INTERRELATIONSHIP OF SOCIOECONOMIC STATUS, FOOD PARENTING PRACTICES, SUGAR-SWEETENED BEVERAGES INTAKE AND PHYSICAL ACTIVITY TOWARDS ANTHROPOMETRIC AND BIOMARKERS PROFILE ON RISK OF OBESITY THROUGH PATH ANALYSIS AMONG IRAQI ADOLESCENTS

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INTERRELATIONSHIP OF SOCIOECONOMIC STATUS, FOOD PARENTING PRACTICES, SUGAR-SWEETENED BEVERAGES INTAKE AND PHYSICAL ACTIVITY TOWARDS ANTHROPOMETRIC AND BIOMARKERS PROFILE ON RISK OF OBESITY THROUGH PATH ANALYSIS AMONG IRAQI ADOLESCENTS

by

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF SYMBOLS

(β_0)	Intercept
(ϵ)	Error Term
(x)	Independent Variable
(y)	Dependent Variable
Δ	Width of the Confidence Interval
<	Less Than
>	More Than
α	Significance Level
β_0	Slope
n	Number
F.	Frequency
χ^2	Chi-Square
f^2	Medium Effect Size
ICC	Intraclass Correlation Coefficient
λ	Factor Loadings
°C	Degrees Celsius
$\bar{d}$	Mean Difference
k	Number of Raters/Repetitions per Subject
p	Proportion of Variable
Power (1 - β)	Statistical Power
r_p	Pearson's Correlation Coefficient
R^2	Coefficient of Determination
SD	Standard Deviation
Z = 1.96	Z-Value When $\alpha = 0.05$
P_0	Minimum Acceptable Reliability (ICC)
P_1	Expected Reliability (ICC)

LIST OF ABBREVIATIONS

AFPQ	Adolescent Food Parenting Questionnaire
AFPQ-a	Adolescent Version of Adolescent Food Parenting Questionnaire
AFPQ-p	Parent Version of Adolescent Food Parenting Questionnaire
AFPQ-A	Adolescent Food Parenting Questionnaire (Arabic version)
AIC	Akaike Information Criterion
ASAQ	Adolescent Sedentary Activity Questionnaire
AVE	Average Variance Extracted
BAZ	Body Mass Index-for-Age Z-Scores
BEVQ	Beverage Intake Questionnaire
BEVQ-A	Beverage Intake Questionnaire (Arabic version)
BIC	Bayesian Information Criterion
BMI	Body Mass Index
BMI z-scores	Body Mass Index-for-Age Z-Scores
BP	Blood Pressure
CCF	Construct Reliability
CFI	Comparative Fit Index
CMIN/DF	Normalized Chi-Square
CR	Construct Reliability
CSELS	Center for Surveillance, Epidemiology, and Laboratory Services
DALYs	Disability-Adjusted Life Years
DHIS	Division of Health Informatics and Surveillance
ECLIA	Electrochemiluminescence Immunoassay
EDTA	Ethylenediaminetetraacetic Acid (commonly for blood sample preservation)

EFA	Exploratory Factor Analysis
EST	Ecological Systems Theory
FBG	Fasting Blood Glucose
FBS	Fasting Blood Sugar
fl oz	Fluid Ounces
FPP	Food Parenting Practices
FVI	Face Validity Index
GNR	Global Nutrition Report
GOD-PAP	Glucose Oxidase-Phenol Amino Phenazone
HDL	High-Density Lipoprotein Cholesterol
HOMA-IR	Homeostasis Model Assessment of Insulin Resistance
I-CVI	Item-Level Content Validity Index
ICC	Intraclass Correlation Coefficient
IOTF	International Obesity Task Force
kcal	Kilocalories
KMO	Kaiser-Meyer-Olkin Measure
LDL	Low-Density Lipoprotein Cholesterol
MI	Model Modification Index
MLM	Robust for Non-Normality
MLR	Maximum Likelihood Estimate
mmHg	Millimeters of Mercury
mmol/L	Millimoles per Liter
MVPA	Moderate to Vigorous Physical Activity
NCD	Non-Communicable Diseases
NNFI	Non-Normed Fit Index
PAQ-C	Physical Activity Questionnaire for Older Children
PAF	Principal Axis Factoring

PCA	Principal Components Analysis
RMSEA	Root Mean Square Error of Approximation
S-CVI/Ave	Scale-Level Content Validity Index (Average)
S-CVI/UA	Scale-Level Content Validity Index (Universal Agreement)
SCT	Social Cognitive Theory
SECA 206	Stadiometer Wall Mounted
SECA 803	Electronic Digital Flat Scale
SES	Socioeconomic Status
SEM	Structural Equation Modeling
SFI/Ave	Scale-Level Face Validity Index
Sig.	Significant
SSB	Sugar-Sweetened Beverage
SPSS	Statistical Package for the Social Sciences
SRMR	Standardized Root Mean Square Residual
TG	Triglycerides
T-Chol	Total Cholesterol
TLI	Tucker-Lewis Index
UNDP	United Nations Development Programme
VIF	Variance Inflation Factor
WHR	Waist-to-Hip Ratio
WHO	World Health Organization
WHtR	Waist-to-Height Ratio

LIST OF APPENDICES

HUBUNGKAIT ANTARA STATUS SOSIOEKONOMI, AMALAN PEMAKANAN IBU BAPA, PENGAMBILAN MINUMAN MANIS BERGULA DAN AKTIVITI FIZIKAL TERHADAP PROFIL ANTROPOMETRIK DAN BIOMARKER RISIKO OBESITI MELALUI ANALISIS LALUAN DALAM KALANGAN REMAJA IRAQ

ABSTRAK

Obesiti dalam kalangan remaja kini menjadi cabaran utama kesihatan awam di Iraq, dengan keadaan pasca-konflik yang unik telah mempercepatkan permasalahan ini melebihi norma serantau. Kadar prevalens yang telah meningkat tiga kali ganda dalam sedekad lalu menunjukkan bahawa remaja Iraq menghadapi masalah obesiti yang dipacu oleh sistem makanan yang terganggu, kekurangan peluang untuk aktiviti fizikal, serta pengaruh kuat keluarga terhadap tabiat pemakanan. Proses perbandaran yang pesat dan pengaruh pemakanan Barat, digabungkan dengan amalan makan beramai-ramai yang tradisional, telah mewujudkan laluan tersendiri ke arah perkembangan obesiti dalam tempoh pembangunan yang kritikal ini. Memahami penentu yang khusus kepada konteks Iraq amat penting untuk merangka intervensi berkesan dalam situasi di mana infrastruktur kesihatan awam masih berhadapan dengan kekangan sumber yang ketara. Kajian ini bertujuan untuk menterjemah dan mengesahkan versi Arab bagi instrumen penilaian amalan keibubapaan makanan (FPP) dan pengambilan minuman bergula (SSBs), serta menentukan tahap tingkah laku sedentari dan aktiviti fizikal sebagai pemboleh ubah bebas. Kajian ini juga meneliti hubungan antara ciri-ciri sosiodemografi dan pemboleh ubah bebas lain dengan ukuran antropometrik (BMI, WHR, WHtR) sebagai hasil dalam kalangan remaja Iraq. Analisis selanjutnya dijalankan untuk menilai pengaruh ukuran antropometrik terhadap pemboleh ubah kardiometabolik seperti profil lipid, tekanan darah, dan kawalan glisemik melalui analisis laluan (path analysis). Kajian ini dilaksanakan dalam dua fasa. Fasa pertama memberi tumpuan kepada penterjemahan dan penyesuaian budaya soal selidik Adolescent Food Parenting Questionnaire (AFPQ) dan Beverage Intake Questionnaire (BEVQ), diikuti oleh penilaian psikometrik termasuk Analisis Faktor Eksploratori (EFA) dan Analisis Faktor Pengesahan (CFA). Analisis pengesahan menunjukkan bahawa kedua-dua soal selidik tersebut mempunyai kebolehpercayaan dan kesahan yang tinggi melalui struktur faktor

yang diterima (EFA/CFA) dan konsistensi dalaman yang kukuh. BEVQ-A menunjukkan kebolehpercayaan tinggi merentasi kategori minuman dengan bias sistematik yang minimum, mengesahkan keberkesanan kedua-dua instrumen dalam menilai tingkah laku pemakanan remaja. Dalam Fasa Kedua, reka bentuk kajian keratan lintang digunakan untuk membangunkan dan menilai model laluan struktur yang mengkaji hubungan antara pemboleh ubah utama kajian. Data dikumpul daripada sampel 506 orang remaja (purata umur = 16.53 tahun, Sisihan Piawai = 0.70) melalui teknik persampelan rawak mudah. Analisis statistik dijalankan menggunakan SPSS versi 26, pakej R lavaan, dan Mplus versi 7.4 bagi memastikan anggaran dan pengesahan model yang kukuh. Model laluan struktur mengenal pasti 45 hubungan yang signifikan antara faktor sosiodemografi, amalan keibubapaan makanan, tingkah laku pemakanan, tingkah laku sedentari, aktiviti fizikal dan ukuran antropometrik dengan tahap kesesuaian model yang memuaskan. Indeks Jisim Tubuh piawai (skor-Z BMI) dan Nisbah Pinggang ke Pinggul (WHR) menunjukkan variasi yang kuat ($R^2 > 0.40$), manakala kalori susu dan kuantiti snek menunjukkan variasi yang lemah ($R^2 < 0.10$). Kajian ini turut mengenal pasti hubungan signifikan antara ukuran antropometrik dan faktor risiko kardiometabolik. Secara khusus, remaja yang mempunyai penglibatan ibu bapa yang lebih tinggi dalam pemilihan makanan dan mengamalkan tabiat pemakanan sihat didapati kurang berisiko untuk mengalami obesiti. Sebaliknya, pengambilan minuman bergula yang tinggi, tingkah laku sedentari yang meningkat dan tahap aktiviti fizikal yang rendah dikaitkan secara positif dengan obesiti dan risiko kardiometabolik, termasuk tekanan darah tinggi dan profil lipid yang tidak menggalakkan. Penemuan ini menekankan keperluan mendesak untuk melaksanakan intervensi pemakanan berasaskan keluarga di Iraq yang bertujuan untuk mewujudkan persekitaran rumah yang lebih sihat serta meningkatkan penglibatan ibu bapa dalam tabiat pemakanan remaja. Di samping itu, galakan aktiviti fizikal di sekolah dan komuniti adalah penting bagi menangani gaya hidup sedentari. Kajian ini juga menggariskan kepentingan pelaksanaan dasar yang disasarkan untuk mengurangkan pengambilan minuman bergula dan mempromosikan alternatif minuman yang lebih sihat. Secara keseluruhan, dapatan ini menyediakan asas kukuh bagi strategi kesihatan awam berasaskan bukti dan pembangunan dasar untuk menangani beban obesiti remaja yang semakin meningkat serta implikasi kesihatan yang berkaitan di Iraq.

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ABSTRACT

Adolescent obesity has emerged as a critical public health challenge in Iraq, where unique post-conflict conditions have accelerated the problem beyond regional norms. With prevalence rates that have tripled over the past decade, Iraqi adolescents face obesity driven by disrupted food systems, limited physical activity opportunities, and strong familial influences on eating behaviors. The country's rapid urbanization and dietary westernization, combined with traditional communal eating practices, create distinct pathways through which obesity develops during this critical developmental period. Understanding these Iraq-specific determinants is essential for creating effective interventions in a setting where public health infrastructure continues to face significant resource constraints. This study aimed to translate and validate Arabic versions of instruments to assess food parenting practices (FPP) and sugar-sweetened beverages (SSBs) and determine the level of sedentary behaviour and physical activity that acted as independent variables. The study further investigated relationships between sociodemographic characteristics and other independent variables with anthropometric measurements (BMI, WHR, WHtR) as an outcome among Iraqi adolescents. The analysis was extended to examine the influence of anthropometric measurements (BMI, WHR, WHtR) with cardiometabolic variables such as lipid profiles, blood pressure, and glycemic control in path analysis. The study was carried out in two phases; phase I emphasized the translation and cultural adaptation of the Adolescent Food Parenting Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ), followed by psychometric evaluations, including Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Validation analyses confirmed both questionnaires' reliability and validity through

acceptable factor structure (EFA/CFA) and strong internal consistency. The BEVQ-A demonstrated high reliability across beverage categories with minimal systematic bias, confirming both instruments' effectiveness for assessing adolescent dietary behaviors. In Phase II, a cross-sectional study design was employed to develop and evaluate a structural path model examining the relationships among key study variables. Data were collected from a sample of 506 adolescents (mean age = 16.53 years, SD = 0.70) using a simple random sampling technique. Statistical analyses were conducted using SPSS version 26, the R package *lavaan*, and Mplus version 7.4 to ensure robust model estimation and validation. The structural path model identified 45 significant relationships among sociodemographic factors, food parenting practices, dietary behaviours, sedentary behaviour, physical activity, and anthropometric measurements, with satisfactory goodness-of-fit. Standardized Body Mass Index (BMI Z-scores) and Waist-to-Hip Ratio (WHR) showed strong variance ($R^2 > 0.40$), while milk calories and snack quantity had weak variance ($R^2 < 0.10$). Additionally, the study identified significant associations between anthropometric measurements and cardiometabolic risk factors. Notably, adolescents with greater parental involvement in food choices and healthier dietary behaviors were less likely to be obese. In contrast, higher consumption of sugar-sweetened beverages (SSBs), increased sedentary behavior, and low levels of physical activity were positively associated with obesity and cardiometabolic risks, including elevated blood pressure and unfavorable lipid profiles. These findings highlight the urgent need for family-centered nutrition interventions in Iraq, aimed at fostering healthier home environments and enhancing parental engagement in adolescents' dietary habits. Additionally, promoting physical activity within schools and communities is critical to counteracting sedentary lifestyles. The study underscores the importance of implementing targeted policies to reduce SSB consumption and promote healthier beverage alternatives. Collectively, these insights offer a strong foundation for evidence-based public health strategies and policy development to address the growing burden of adolescent obesity and its health consequences in Iraq.

CHAPTER 1

INTRODUCTION

1.1 Preview of the Chapter

Chapter One provides an introduction to the study, including its background, significance, rationale, and objectives.

1.2 Study Background.

Over the past four decades, the global prevalence of overweight and obesity has almost tripled, and it is the most significant public health challenges of the twenty-first century (WHO, 2022e). The Centers for Disease Control and Prevention (CDC 2024) reported that between 2017 and March 2020, approximately 19.7% of U.S. children and adolescents were obese, Briefly, approximately 14.7 million youths aged 2–19 years, were classified as obese. Both developed and developing countries continue to exhibit high incidence rates of overweight and obesity. In Iraq, a developing nation, obesity remains a critical public health issue, with a prevalence rate of 32% among children and adolescents as in 2019 (GNRs, 2022c). This rate is on the rise, highlighting the growing concern over obesity in the region.

Research has shown that obesity among Iraqi adolescents is associated with significant health consequences, including dyslipidaemia, hyperglycaemia, and hypertension (Bdair *et al.*, 2020). Additionally, adolescents classified as overweight or obese are often affected by physical inactivity, high levels of sedentary behavior, and poor dietary habits (Kadim *et al.*, 2023; Nwayyir *et al.*, 2023; Shwaish *et al.*, 2023). This alarming trend has drawn attention from researchers who focused on preventing adolescent obesity. Parent do have strong influence toward children's eating behavior, however, lack of studies show the role of coparenting toward eating behavior and examine whether coparenting quality moderates or confounds these

associations (Douglas *et al.*, 2024). Evidence suggests that food parenting practices (FPP) are crucial in shaping the dietary behaviors and weight management of children and adolescents, significantly impacting their psychophysiological health (Vaughn *et al.*, 2016; Koning *et al.*, 2021).

Food Parenting Practices (FPP) refer to the strategies parents use to influence their children's dietary behaviours, including the selection of foods, feeding styles, and modelled eating behaviours (Vaughn *et al.*, 2016; Chen *et al.*, 2021; Mahmood *et al.*, 2021). These practices are context-specific and aim to guide children toward particular eating habits and attitudes (Yee, Lwin, and Ho, 2017; Scaglioni *et al.*, 2018). While much of the research on FPP has focused on parents and their young children, however, there is growing evidence that FPP continues to play a significant role during adolescence is still lacking.

Adolescence is a critical phase marked by significant physical, developmental, and social changes (Sawyer *et al.*, 2012). During this period, individuals are particularly vulnerable to developing overweight, a major public health concern (Kansra, Lakkunarajah, and Jay, 2021; Mahumud *et al.*, 2021). The complex changes occurring during adolescence can substantially influence eating behaviours and overall nutritional status and eventually lead to risk of obesity (Al-Khudairy *et al.*, 2017; Stok *et al.*, 2018; Kim, Kim, and Chung, 2020).

Empirical studies examining the relationship between demographic characteristics such as age, sex, and socioeconomic status (SES) and factors like anthropometric measurements, physical activity, and sugar-sweetened beverage (SSB) consumption in adolescents often rely on direct measures. Many of these studies have found that being female is associated with higher levels of sedentary behaviour (Bahathig *et al.*, 2021), lower physical activity, and increased body weight (Cowley *et*

al., 2021; Mo *et al.*, 2022). This pattern is particularly evident in Iraq and other Middle Eastern contexts, where cultural norms, gender roles, and safety concerns often limit girls' opportunities to engage in outdoor physical activities. Restrictions related to public space access, limited availability of gender-specific sports programs, and societal expectations emphasizing modesty and domestic responsibilities can contribute to increased sedentary time among adolescent girls(Qasem, Al-Hadithi & Al-Tawil, 2019; Kampalath *et al.*, 2023). However, certain research has could not find a significant relationship between SES and obesity, SSB consumption, sedentary behavior, or physical activity (Magnon, Vallet, and Auxiette, 2018).

The rising prevalence of childhood obesity in recent decades underscores the urgent need for obesity stratification to identify individuals at increased risk for cardiometabolic complications (Drozdz *et al.*, 2021; Negrea *et al.*, 2021). Once considered an isolated condition, obesity is now widely recognized as a major contributor to cardiometabolic risk in adolescents, a conclusion supported by a substantial body of literatures (Sommer, and Twig, 2018). Cardiometabolic risk factors include a range of variables that increase the likelihood of developing cardiovascular and metabolic diseases, with lipid profiles, blood pressure, and glycaemic status being the most frequently examined in research.

Identifying individuals at elevated risk for severe obesity and its associated cardiovascular consequences is crucial in both clinical and public health contexts. While numerous studies have examined cardiometabolic risk in childhood within Western populations, a significant research gap persists regarding Iraqi youth (Farrag, Cheskin, and Farag, 2018; Mazidi, Banach, and Kengne, 2019; Bitew *et al.*, 2020).

Despite the extensive body of research on the topic, a significant gap remains in determining the causal pathways through which food parenting practices, dietary

behavior, physical activity, and sedentary behavior interact to influence the risk of overweight and cardiometabolic factors among adolescents. While factors such as peer influence, school environments, media exposure, and broader cultural norms also play critical roles in shaping adolescent eating behaviors, this study intentionally focuses on family dynamics—specifically food parenting practices (FPP)—and sociodemographic characteristics. This narrowed scope was adopted to maintain analytical depth and address the unique cultural context of Iraq, where familial roles are central to dietary habits and lifestyle choices. By employing a path analysis approach, this research models the directional relationships between sociodemographic variables, FPP, dietary behavior, physical activity, sedentary behavior, and anthropometric measurements (BMI, WHR, WHtR). The exclusion of external factors like peer networks or media influence was a deliberate choice to avoid overcomplicating the model and to prioritize investigating modifiable family-level interventions within Iraq's cultural framework. Ultimately, this study seeks to elucidate how obesity, mediated by these familial and sociodemographic variables, impacts cardiometabolic risk factors, providing actionable insights for targeted public health strategies in similar contexts.

1.3 Problem Statement

Obesity is a prevalent issue in developing countries, particularly among children and adolescents (World Obesity Federation, 2019). In Iraq, the escalating prevalence of childhood and adolescent obesity represents a critical public health issue, influenced by a multifaceted array of factors, including family dynamics and Food Parenting Practices (FPP). These practices are instrumental in shaping dietary behaviors that directly impact anthropometric measurements and overall health outcomes (CDC, 2022). However, research specifically addressing how FPP

contribute to the dietary pattern of the adolescents in Iraqi family remains sparse. Cultural, social, and economic factors in Iraq likely play a unique role in shaping parental approaches to food and nutrition (Noor *et al.*, 2020; Jawad, 2021).

The consumption of sugar-sweetened beverages (SSBs) among adolescents is linked to numerous health issues, including obesity, type 2 diabetes, and dental problems (Calcaterra *et al.*, 2023; Hassan, and Othman, 2024). In Iraq, the growing availability and consumption of SSBs among adolescents is particularly concerning given the increasing prevalence of obesity and related health conditions (Agha, and Rasheed, 2021; Hassan, and Othman, 2024). Despite the well-documented risks of excessive SSB intake, research specifically addressing the prevalence, consumption patterns, and determinants of SSB use among Iraqi adolescents remains limited (Alkinani *et al.*, 2022). Moreover, current practices for measuring SSB intake in Iraq are inconsistent and methodologically weak, with most studies relying on general dietary recall or non-standardized food frequency questionnaires that lack detail on beverage types, portion sizes, and frequency of consumption. These instruments are often adapted from international tools without cultural validation or tailoring to the Iraqi context, compromising their reliability and relevance. Furthermore, there is no routine national surveillance system that monitors SSB intake among youth, making it difficult to track trends or inform policy. This highlights an urgent need for a culturally adapted, validated, and standardized assessment tool to accurately capture beverage consumption behaviors. Addressing this gap is essential for understanding the underlying drivers of SSB intake and for designing evidence-based interventions and public health strategies that encourage healthier beverage choices and improve adolescent health outcomes in Iraq.

Low levels of physical activity and high levels of sedentary behavior among adolescents are well-established risk factors for obesity, cardiovascular diseases, and other health complications (Mahumud *et al.*, 2021; Zhu *et al.*, 2021). In Iraq, there is

an increasing concern regarding the growing prevalence of sedentary lifestyles and insufficient physical activity among adolescents (Dawood, 2021; Mahmmod, and Al-Diwan, 2022), which may be contributing to rising rates of obesity and associated health issues (Bdair *et al.*, 2020). To date, fewer than ten peer-reviewed studies have explicitly examined physical inactivity, sedentary behavior, and their cultural or environmental determinants in Iraq, with most focusing narrowly on urban populations (e.g., Baghdad and Basrah) and relying on self-reported data limited (Burahmah, Shanmugam, and Stansfield, 2023; Li, Zhang, and Yan, 2024). For instance, Dawood (2021) identified that only 15% of Iraqi adolescents in Baghdad meet WHO-recommended physical activity levels, attributing this to limited access to safe recreational spaces and cultural restrictions on outdoor activities for girls. Similarly, Mahmmod and Al-Diwan (2022) highlighted that 72% of adolescents in rural Iraq spend over 7 hours daily on screens, exacerbated by poor infrastructure for physical activity. Despite these insights, critical gaps persist: no studies have systematically explored how Iraq's unique cultural norms (e.g., gendered mobility restrictions) or environmental factors (e.g., urban sprawl displacing green spaces) interact to shape sedentary behaviors. This scarcity of localized, multidimensional research hinders the development of targeted public health policies and interventions aimed at promoting physical activity and reducing sedentary time among Iraqi adolescents, both of which are essential for improving long-term health outcomes.

Adolescent obesity is a significant public health concern due to its long-term consequences on health, particularly its influence on anthropometric measurements and metabolic risk factors. Obesity among adolescents is strongly associated with adverse changes in lipid profiles, elevated blood pressure, and impaired glycemic control, which increase the risk of cardiovascular diseases and type 2 diabetes later in life (Abeyratne, Perera, and Fernando, 2020; Caprio, Santoro, and Weiss, 2020; Zucchini *et al.*, 2020; Li, Zhang, and Yan, 2024). In Iraq, the rising prevalence of

adolescent obesity necessitates a deeper understanding of its impact on these critical health markers. However, there is a notable gap in research examining the specific consequences of obesity on lipid profiles, blood pressure, and glycemic parameters among Iraqi adolescents (Farrag, Cheskin, and Farag, 2018; Mazidi, Banach, and Kengne, 2019; Bitew *et al.*, 2020). This lack of localized data limits the ability to develop effective public health strategies and clinical interventions aimed at mitigating the negative health outcomes associated with obesity in this population. Understanding these relationships is crucial for designing preventive measures and treatment protocols that address the metabolic risks posed by adolescent obesity in Iraq.

In summary, the increasing prevalence of obesity among Iraqi adolescents poses a significant public health challenge with critical implications for anthropometric measurements and metabolic health. Despite the key roles of family dynamics, food parenting practices (FPP), sugar-sweetened beverage (SSB) consumption, physical activity, and sedentary behaviors in adolescent health, research within the Iraqi context remains limited. Notably, there is a lack of culturally relevant studies on FPP, SSB consumption, and physical inactivity, as well as validated tools for assessing beverage intake not only among Iraqi adolescents but also across Arabic-speaking countries.

1.4 Significance of the Study

The prevalence of obesity among Iraqi children and adolescents reached 32% in 2019, a rate that continues to rise and mirrors global trends (GNRs, 2022a). This escalating obesity epidemic is closely linked to an increase in metabolic disorders such as insulin resistance, dyslipidemia, and hypertension, which significantly elevate the risk of severe health complications (Abeyratne, Perera, and Fernando, 2020; Caprio, Santoro, and Weiss, 2020; Zucchini *et al.*, 2020; Li, Zhang, and Yan, 2024), adolescent obesity and overweight can lead to non-communicable diseases (NCDs) and metabolic

syndromes, including diabetes, at younger ages. Alarmingly, premature deaths from these conditions are prevalent, with 85% occurring in low- and middle-income countries (CDC, 2021). Long-term morbidity and mortality due to diabetes, heart disease, cancer, and fatty liver are significant concerns (Sahib, Mohsin, and Mutlag, 2021). Furthermore, Iraq's progress towards achieving diet-related NCD targets remains limited, with obesity rates among adults significantly surpassing regional averages. Specifically, 40.1% of women and 26.5% of men in Iraq are living with obesity, compared to the regional averages of 10.3% for women and 7.5% for men. Diabetes affects 20.2% of adult women and 20.3% of adult men in Iraq (GNRs, 2022a). These statistics underscore the urgent need to identify the factors contributing to adolescent obesity in Iraq, where cultural, socioeconomic, lifestyle, and environmental influences may differ markedly from those in other regions.

Environmental factors, such as limited access to safe recreational spaces, urbanization displacing green areas, and the proliferation of energy-dense food outlets, are increasingly recognized as critical drivers of obesity in conflict-affected settings like Iraq (Ofori *et al.*, 2020; Alaa E. Badawi *et al.*, 2021). For instance, a 2022 study in Baghdad found that 68% of neighborhoods lacked parks or sports facilities, correlating with higher adolescent sedentary behavior (Mahmmod & Al-Diwan, 2022). Similarly, urban sprawl and reliance on motorized transport in cities like Basrah have reduced opportunities for active commuting, exacerbating physical inactivity (Dawood, 2021). While this study prioritizes familial and sociodemographic factors due to Iraq’s collectivist culture, future research should explicitly model environmental determinants to inform urban planning and policy interventions. A deeper understanding of these multifaceted determinants is essential for developing targeted interventions that address the specific needs of Iraqi adolescents.

Adolescent obesity is a pressing global issue, with research consistently highlighting its multifaceted etiology, which encompasses sociodemographic factors,

dietary behaviors, physical activity levels, and sedentary lifestyles (Narciso *et al.*, 2020; Mahumud *et al.*, 2021; Zhu *et al.*, 2021). Food parenting practices (FPP) are recognized as critical determinants of children's eating habits and weight outcomes, with substantial evidence indicating that parental influence significantly shapes adolescent dietary behaviors and physical activity levels (Loth *et al.*, 2016; Koning *et al.*, 2021). Additionally, the ecological systems theory of childhood overweight development, proposed by Davison and Birch (2001), posits that the interaction of dietary intake, physical activity, and sedentary behavior child risk factors related to overweight occurs within a broader context of child, family, and community characteristics. In this study, "anthropometric measurements" was used as a comprehensive term to refer to all body composition measurements. However, most existing research focuses on Western contexts, with limited data on how these factors interact in non-Western societies, particularly in Middle Eastern countries like Iraq, where cultural, social, and economic dynamics are distinct (Leandro *et al.*, 2020; Lian *et al.*, 2020; Alaa E. Badawi *et al.*, 2021).

Given the increasing prevalence of obesity among Iraqi adolescents and the unique cultural context in which they live, there is a pressing need to investigate the factors contributing to this public health challenge within this population. The translation and cultural adaptation of the Adolescent Food Parenting Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ) into Arabic are critical steps in providing reliable tools for assessing FPP and dietary intake in Iraqi families. These tools align with Iraq's 2022 National Strategy for Non-Communicable Diseases (NCDs), which emphasizes evidence-based interventions to combat obesity and diabetes (GNRs, 2022a). Validated instruments like the AFPQ and BEVQ are indispensable for monitoring progress toward the strategy's targets, such as reducing adolescent obesity by 15% by 2030. These validated instruments are indispensable for understanding the specific behaviors and practices that impact adolescent health in

Iraq, where existing data are scarce and often lack cultural relevance (Koning, *et al.*, 2021; Liu *et al.*, 2021). Furthermore, this study was examine the direct and indirect associations between sociodemographic characteristics, FPP, dietary behaviors, physical activity, sedentary behavior, and anthropometric measurements among Iraqi adolescents. Findings directly inform Iraq's draft *Action Plan for Adolescent Health (2023)*, which prioritizes school-based nutrition programs and parental education campaigns (MOH, 2022). For instance, the study's insights into sedentary behavior and urban food environments support the plan's proposed policies to limit screen time in schools and regulate junk food marketing near educational institutions.

This analysis is crucial for identifying the underlying mechanisms driving obesity and related health issues in this population, which are likely shaped by a complex interplay of factors that differ from those observed in other regions (Mahumud *et al.*, 2021). By linking familial practices and sociodemographic disparities to actionable policy levers, this study provides a framework for Iraq's Ministry of Health to tailor interventions, such as subsidizing healthy foods in low-income areas or mandating physical education reforms, that address localized drivers of obesity.

1.5 Rationale of the Study

Iraq currently lacks robust, culturally relevant research tools and comprehensive data on adolescent health behaviors, particularly in relation to obesity and its determinants. This study addresses these critical gaps by providing validated instruments and empirical data specific to Iraqi adolescents and, more broadly, to Arabic-speaking populations. While the consumption of sugar-sweetened beverages is prevalent among Iraqi adolescents, no available tool has been developed or validated to assess beverage intake in this demographic. By employing a translated and validated

Arabic version of the questionnaire, this study offers crucial evidence on sugar-sweetened beverage consumption among Iraqi adolescents.

Adolescents' dietary patterns are heavily influenced by the home environment, with parenting playing a pivotal role. Parents, as role models, shape adolescents' dietary habits both at home and in school settings. This study assesses these dynamics, shedding light on the impact of food parenting practices on dietary behaviors and obesity risk.

The significance of this research extends beyond its immediate contribution to public health knowledge in Iraq. It has the potential to guide future health interventions and policies aimed at preventing obesity and fostering healthier lifestyles among Iraqi youth. In the long term, the insights gained from this study will support the development of targeted, culturally appropriate interventions that address the unique challenges faced by Iraqi adolescents.

By determining the associations between health-related behaviors and outcomes, this research provides a foundation for evidence-based strategies to combat obesity and its associated metabolic risks. Ultimately, the findings will contribute to improving the long-term health of the Iraqi population and informing regional efforts to address similar challenges across Arabic-speaking countries.

1.6 Research Questions

1. Are the Arabic versions of the Adolescent Food Parenting Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ) valid to assess food parenting practices and sugar-sweetened beverages consumption among Iraqi adolescents?

2. What is the construct validity of the Arabic version of the Adolescent Food Parenting Questionnaire (AFPQ-A) and the reliability of the Beverage Intake Questionnaire (BEVQ-A) among Iraqi adolescents?
3. What are the levels of food parenting practices (FPP), dietary behaviours, sugar-sweetened beverage (SSB) consumption, physical activity, sedentary behaviour, anthropometric measurements, blood pressure, and biochemical parameters among Iraqi adolescents?
4. What are the direct and indirect path associations between sociodemographic characteristics, food parenting practices (FPP), sugar-sweetened beverage consumption, dietary behaviours, physical activity, sedentary behaviour, and anthropometric measurements among Iraqi adolescents?
5. What are the associations between anthropometric measurements and cardiometabolic risk factors among Iraqi adolescents?

1.7 Research Hypothesis

1. The Arabic versions of the Adolescent Food Parenting Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ) are valid instruments to assess food parenting practices and sugar-sweetened beverage (SSB) consumption among Iraqi adolescents.
2. The Arabic version of the Adolescent Food Parenting Questionnaire (AFPQ-A) demonstrates acceptable construct validity, and the Beverage Intake Questionnaire (BEVQ-A) exhibits reliable measurements among Iraqi adolescents.
3. There are significant direct and indirect path associations between sociodemographic characteristics, food parenting practices (FPP), sugar-

sweetened beverage consumption, dietary behaviours, physical activity, sedentary behaviour, and anthropometric measurements among Iraqi adolescents.

4. There are associations between anthropometric measurements and cardiometabolic risk factors among Iraqi adolescents.

1.8 Research Objectives

1.8.1 General Objectives

The general aim of the study is to examine the structural path association of sociodemographic characteristics, food parenting practices (FPP), dietary behavior, physical activity, sedentary behavior, blood pressure, biomarker profiles and anthropometric measurements among Iraqi adolescents.

1.8.2 Specific Objectives

1. To translate, culturally adapt, and validate the Adolescent Food Parenting Questionnaire (AFPQ) and Beverage Intake Questionnaire (BEVQ) into the Arabic language among Iraqi adolescents.
2. To assess the construct validity of the Arabic version of the Adolescent Food Parenting Questionnaire (AFPQ-A) and assess the reliability of the Beverage Intake Questionnaire (BEVQ-A) among Iraqi adolescents.
3. To identify the levels of food parenting practices (FPP), dietary behaviours, sugar-sweetened beverage (SSB) consumption, physical activity, sedentary behaviour, anthropometric measurements, blood pressure, and biochemical parameters among Iraqi adolescents.
4. To examine the direct and indirect path associations between sociodemographic characteristics, food parenting practices (FPP), sugar-sweetened beverage

consumption, dietary behaviours, physical activity, sedentary behaviour, and anthropometric measurements among Iraqi adolescents.

5. To examine predictors of anthropometric measurements with cardiometabolic risk factors among Iraqi adolescents.

1.9 Research Philosophy

The study design selected, interpretation of findings, and understanding of the world of the researchers are fundamentally influenced by their research philosophy (Ryan, 2018). This philosophy encompasses their basic assumptions and views about reality (Scotland, 2012), knowledge (Polkinghorne, 1989), and research methods (Wright *et al.*, 2016). This study's research philosophy is rooted in positivism, acknowledging the importance of empirical evidence and objective reality in addressing the research questions.

The positivism paradigm, with its focus on objective reality and empirical evidence (Park, Konge, and Artino, 2020), provided a solid foundation for examining health and behavioral patterns among Iraqi adolescents. By concentrating on measurable and observable variables such as food parenting practices, dietary behavior, physical activity, sedentary behavior, blood pressure, and biochemical parameters, positivism facilitated precise quantification and analysis. This approach supported the use of structured surveys, anthropometric measurements, and biochemical analyses, allowing for reliable data collection and statistical analysis to uncover patterns and associations. However, the positivist approach may have overlooked the subjective experiences and cultural contexts that influence these behaviors and health outcomes (Iwelunmor, Newsome, and Airhihenbuwa, 2014). While path analysis elucidated direct and indirect relationships among variables, they might have failed to capture the nuanced, lived experiences of adolescents that

qualitative methods could reveal. Thus, although positivism provided clarity and rigor in examining the relationships between dietary behavior, sociodemographic factors, and health outcomes, it could have been complemented by interpretivist approaches to offer a more comprehensive understanding of adolescent health in Wasit, Iraq.

In summary, the adoption of the positivism paradigms in this study offered a thorough approach to understanding the health and behavioral patterns of Iraqi adolescents. Positivism enabled precise quantification and analysis of measurable variables through structured methods, revealing patterns and associations (Park, Konge, and Artino, 2020). However, its limitations in capturing subjective experiences and cultural contexts highlighted the need for a more holistic perspective. Despite these limitations, the framework provided by positivism was instrumental in ensuring the findings were empirically sound and relevant to the health research context of Iraqi adolescents.

1.10 Operational Definition

1. A path analysis

Path analysis, a component of Structural Equation Modeling (SEM), is employed to examine the relationships and effects among observed variables (Valenzuela, and Ingrid, 2017; Wang, and Wang, 2020). Specifically, it assesses both direct and indirect effects, facilitating the testing and definition of structural models (Sarwono, 2022). In this study, path analysis is operationalized to assess the mediating roles of physical activity, sedentary behavior, and dietary habits in the relationship between sociodemographic characteristics and adolescent parental food behaviors on the risk of obesity, measured through anthropometric assessments.

2. Physical activity

Physical activity was measured using the Physical Activity Questionnaire for Older Children (PAQ-C), a validated nine-item survey assessing exercise habits during

weekdays and weekends in various contexts such as free time, physical education classes, and after-school activities. The PAQ-C, demonstrating good internal consistency (Cronbach's alpha = 0.777), was translated into Arabic with an improved Cronbach's alpha of 0.798. Each item is scored on a Likert scale from 1 (very little physical activity) to 5 (high level of physical activity), and the mean item scores form the PAQ-C total score. This total score categorizes physical activity levels as low, moderate, or high. Additionally, the study employed an equation to convert PAQ-C scores into a continuous measure of moderate to vigorous physical activity (MVPA), providing a comprehensive assessment of participants' activity levels.

3. Sedentary behavior

Sedentary behavior was measured using the Adolescent Sedentary Activity Questionnaire (ASAQ), developed by (Hardy, Booth, and Okely, 2007). The ASAQ, demonstrating test-retest reliability (correlation coefficient = 0.70), assesses daily time spent on 11 sedentary activities categorized into screen time, educational activities, travel and cultural activities, and social activities. Total time spent in each category is summed to calculate the average daily sedentary time for weekdays and weekends. In this study, sedentary behavior was quantified using the continuous score from the ASAQ, translated into Arabic with permission from Bahathig *et al.* (2021).

4. Dietary behavior

Dietary behaviors, for this study, are defined through a structured questionnaire that assesses the frequency and portion sizes of food and beverage consumption. This includes meals such as breakfast, lunch, and dinner, as well as specific items like fruits, vegetables, dairy products, fast food, and carbohydrate beverages. Participants will report their intake over the past week, both during school and outside of school.

5. Sugar-Sweetened Beverages (SSBs)

Sugar-Sweetened Beverages (SSBs) are defined, according to the Dietary Guidelines for Americans (Slavin, 2015), as liquids sweetened with various sugars,

including but not limited to brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, honey, lactose, malt syrup, maltose, molasses, raw sugar, and sucrose. In this study, the consumption of SSBs is assessed using a 7-day dietary recall method applied over the past month. This approach measures the total average daily intake in fluid ounces (fl oz), calories, and grams of SSBs, as well as the consumption of milk and other beverages. The questionnaire, validated and adopted from Hill *et al.* (2017), ensures reliable and accurate estimation of adolescent beverage consumption.

6. Socioeconomic status

Socioeconomic status (SES) was measured using a scale based on four primary variables: occupation, education level, crowding index, and property ownership. The SES Scale, created by Tiwari, Kumar, and Kumar (2005), includes a double-weighted item for parents and considers spouses' education and occupation. SES scores range from 36 to 150, categorized as low (<89), moderate (90-120), and high (121-150). This well-established tool, widely used in prior research, provided a continuous score for SES in this study.

7. Food parenting practices (FPP)

Food parenting practices were assessed using the Adolescent Food Parenting Questionnaire, which examines parents' use of food as a reward (instrumental feeding) or to control emotions (emotional feeding). The study includes two parts: the parent version (AFPQ-p) and the adolescent version (AFPQ-a), both focusing on 16 items across five constructs: autonomy support, coercive control, modeling, healthy structure, and snack structure. Responses are measured on a 5-point Likert scale from “strongly disagree” (1) to “strongly agree” (5). This tool was adapted from Koning *et al.*, (2021).

8. Cardiometabolic Risk Factors

In this study, Cardiometabolic Risk Factors are defined as quantifiable indicators used to assess risks for cardiovascular disease and metabolic disorders, including type 2 diabetes. Blood pressure is measured through systolic and diastolic readings using a calibrated sphygmomanometer. Fasting blood samples, collected after a 12-hour fast, are processed for lipid profile and glucose analysis. The lipid profile, including total cholesterol, triglycerides, HDL, and LDL levels, is analyzed using an enzymatic colorimetric technique, with LDL calculated via the Friedewald formula. Fasting blood glucose is measured enzymatically, and insulin levels are determined through electrochemiluminescence immunoassay (ECLIA). Insulin resistance is assessed using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR), combining fasting insulin and glucose levels. These precise measurements ensure consistency and accuracy in evaluating cardiometabolic risk factors across participants, enabling a comprehensive analysis of their impact on health outcomes.

9. Anthropometric measurements

Anthropometric measurements are the nutritional status assessment. In this study include height, weight, BMI, waist and hip circumferences, WHR, and WHtR. Height is measured to the nearest 0.1 cm using a Stadiometer Wall Mounted (SECA 206) with participants standing straight, barefoot, and looking forward, recording the average of two measurements. Body weight is measured with an Electronic Digital Flat Scale (SECA 803) to the nearest 0.1 kg, with participants barefoot and in light clothing. Weight and height are based on the WHO (2007). BMI is calculated using the WHO's AnthroPlus program. Waist circumference is measured at the midpoint between the lowest ribs and the iliac crest, and hip circumference at the widest part of the buttocks, using an ergonomic tape (SECA 201). WHR is calculated as waist circumference divided by hip circumference, and WHtR as waist circumference divided by height, following WHO guidelines.

10. Adolescents

An adolescent is defined by the World Health Organization (WHO) as a person aged 10 to 19, a stage of growth and development between childhood and adulthood (WHO, 2022a). In this study, adolescents are defined as individuals aged 16 to 18 years, enrolled in governmental and private secondary schools in the Wasit governorate.

1.11 Organization of the Thesis

The thesis is organized into six chapters, which combine translation and validation with innovative path analysis. Chapter 1 introduces the study's background, significance, rationale, and objectives, establishing the foundation for the research. Chapter 2 critically reviews relevant literature, highlighting methodological strengths, and research gaps. Chapter 3 details the methodology, including the study design, data selection, and path modelling approach. Chapters 4 and 5 present and interpret the findings, discussing their implications and limitations. Chapter 6 concludes by synthesizing the results, offering recommendations, and suggesting directions for future research, emphasizing the study's contributions and significance.

1.12 Chapter Summary

This chapter presented an overview of the study's key elements. Definitions of overweight and obesity are provided, contextualizing the study and including the problem statement. These foundational aspects facilitate the establishment of both general and specific objectives. The significance of the study was emphasized through a discussion of its underlying rationale. Operational definitions were presented to ensure clarity of the terms used throughout the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter examines recent literature on adolescent overweight and obesity, focusing on key determinants, contributing factors, theoretical foundations, and highlighting existing research gaps. It concludes by presenting a conceptual framework that aligns with the study's objectives and research questions.

2.2 Conceptualization of Obesity

Obesity, often simply defined as an excessive accumulation of body fat, is a multifaceted condition with significant implications for public health (Kit, Ogden, and Flegal, 2014). It is not merely a state of increased weight but rather a condition characterized by an undesirable positive energy balance, leading to excessive fat storage in adipose tissue (Styne, 2023). This abnormal fat accumulation, particularly when distributed in specific regions of the body, increases the risk of various diseases. The growing prevalence of obesity worldwide, particularly among children and adolescents, necessitates a thorough understanding of its definition, classification, and health implications.

The most widely accepted measure for defining and classifying obesity is the Body Mass Index (BMI), a calculation based on weight and height. In adults, obesity is generally defined as a BMI of 30 kg/m² or greater, with further classifications into three classes based on BMI ranges: Class I (30–34.9 kg/m²), Class II (35–39.9 kg/m²), and Class III (≥40 kg/m²), the latter often termed as severe or extreme obesity (Lynn, and Agrawal, 2023). This classification is crucial as it correlates with increased risks of comorbidities, including cardiovascular diseases, diabetes, and certain cancers.

However, for children and adolescents, defining obesity is more complex due to the ongoing changes in body composition during growth (Kit, Ogden, and Flegal, 2014). Unlike adults, there are no fixed BMI thresholds for children. Instead, obesity is typically defined using BMI percentiles, with a BMI at or above the 95th percentile for age and sex considered obese (WHO, 2000a; Lynn, and Agrawal, 2023). These percentiles are based on reference populations, and different countries may use different growth charts, such as those provided by the Centers for Disease Control and Prevention (CDC) in the United States or the International Obesity Task Force (IOTF). It is important to note that while BMI is a useful tool for population studies and clinical assessments, it does not account for variations in fat distribution, which can significantly affect health risks. For instance, excess abdominal fat, or "android obesity," is more strongly associated with metabolic and cardiovascular diseases than fat distributed more peripherally, as seen in "gynoid obesity"(WHO, 2000a).

In brief, obesity is a complex condition that goes beyond simple weight gain. Its definition involves both the amount and distribution of body fat, with significant variations between adults and children. The use of BMI as a standard measure provides a practical approach to classify and assess obesity, but it is not without limitations, particularly concerning fat distribution and varying health risks. As obesity rates continue to rise globally, particularly among younger populations, it is essential to refine our understanding and definitions of this condition to better address its associated health challenges (Herpertz, Zwaan, and Zipfel, 2024).

2.3 Epidemiology of Obesity in Adolescents

2.3.1 Global Prevalence

Over the past four decades, the prevalence of overweight and obesity has surged globally, nearly tripling in numbers and solidifying its status as one of the most

pressing public health challenges of the 21st century (Malik, and Hu, 2022). In 2022, approximately 390 million children and adolescents aged 5 to 19 were classified as overweight or obese, a stark increase from just 4% in 1975 to 18% in 2016 to over 20% in 2022 (WHO, 2022c). This upward trend has affected both genders, with 18% of girls and 19% of boys being overweight in 2016 (WHO, 2021c). Consequently, about 2.1 billion people worldwide nearly 30% of the global population are now overweight or obese, resulting in significant health, social, and economic burdens (GBD, 2017).

The Global Nutrition Report highlights that between 2000 and 2019, the prevalence of overweight and obesity among children and adolescents aged 5 to 19 years increased significantly, from 10.3% to 20.1%. This rise was observed in both boys and girls (Global Nutrition Report, 2022). In the Western Asia subregion, malnutrition remains a critical issue, with an average of 32.7% of boys and 30.2% of girls aged 5–19 being overweight. Furthermore, 14.4% of boys and 12.7% of girls in this region are classified as obese (GNRs, 2022c). The trends in overweight and obesity in Western Asia are depicted in Figure 2.1.

In the Gulf Countries, the situation is equally alarming. As reported by ALNohair (2014), between 3% to 18% of girls and 5% to 14% of boys are overweight or obese. The prevalence of overweight and obesity among children aged 10 to 19 years has risen by 13% to 23% in the Arab Gulf nations (Alabdulkader, Tuwairqi, and Rao, 2020). Specifically, 14% to 26% of boys and 12% to 20% of girls are now affected by overweight and obesity in these regions.

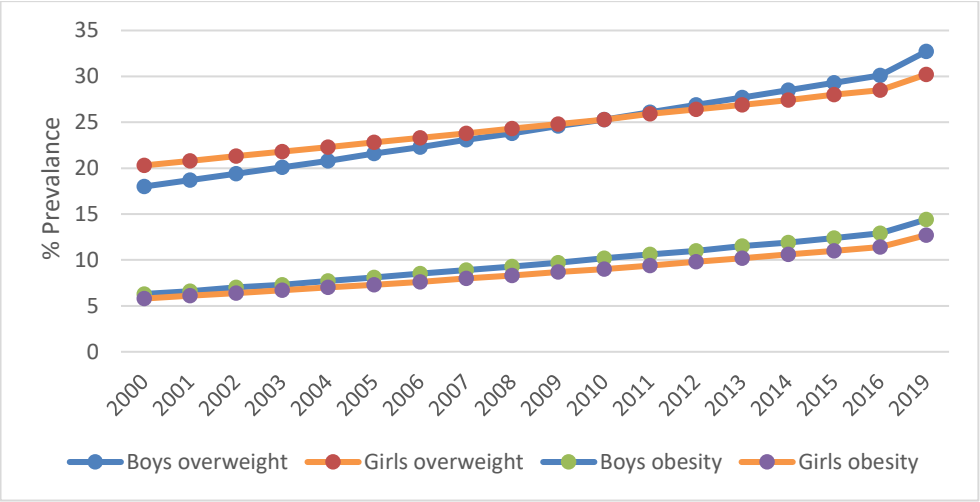


Figure 2.1 Prevalence of Overweight and Obesity Among Children and Adolescents Aged 5–19 in Western Asia

2.3.2 Prevalence in Iraq

In developing countries like Iraq, the rise in obesity and overweight is further exacerbated by reduced physical activity and the consumption of diets high in refined wheat, vegetable oils, caloric sweeteners, and processed foods (Fatemeh Taheri, 2009; Nasreddine *et al.*, 2014; Al-Ani, Al-Hadeethi, and Al-Ani, 2020). In Iraq, malnutrition problem such as overnutrition is a critical concern, with 34.3% of boys and 33.4% of girls aged 5–19 classified as overweight. Additionally, 15.7% of both boys and girls are obese (GNRs, 2022a). The trends in overweight and obesity in Iraq are illustrated in Figure 2.2.

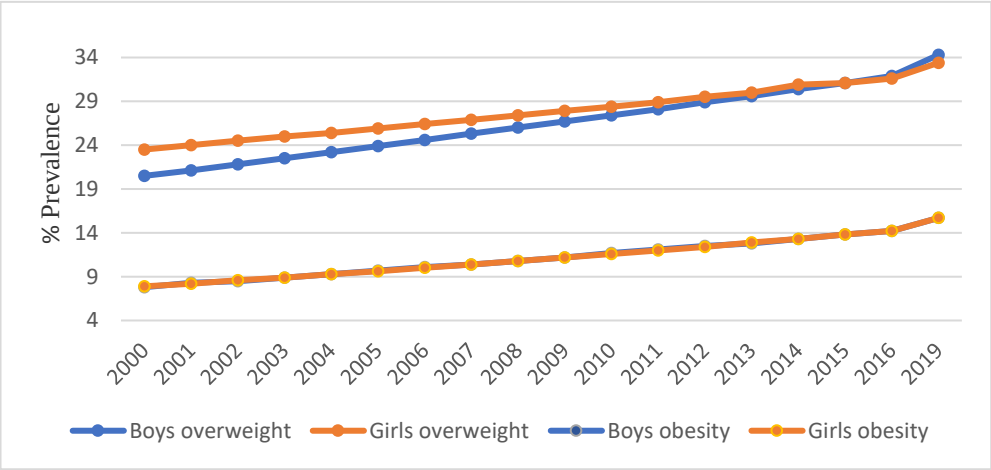


Figure 2.2 Prevalence of Overweight and Obesity Among Iraqi Children and Adolescents Aged 5–19 Years

Table 2.1 provides a summary of studies that have examined obesity prevalence among Iraqi adolescents. However, it is important to note that these studies primarily focus on prevalence without identifying the underlying risk factors contributing to obesity. Consequently, the current study aims to fill this gap by investigating multiple factors associated with obesity among Iraqi adolescents and developing a conceptual framework to better understand and address this public health issue.

Table 2.1 Summary of Studies on Overweight and Obesity Prevalence Among Adolescent Across Iraqi Governorates

City	Year	Age group by years	Total sample	Gender	Obesity or overweight	Reference
Ramadi	2019	13 to 19	1445	B=747 G=698	B=24.49% G=29.22%	(Al-ani, Al-ani, and Al-hadeethi, 2021)
Slemani	2014	13-17	1656	B=838 G=750	B=32.6% G=31%	(Muhammed *et al.*, 2014)
Kirkuk	2013	12-15	537	B=270 G=267	B=24.8% G=19.8%	(Danok, and Ghanim, 2013)
Baghdad	2014	Secondary school age	1254	B=611 G=643	B, and G=44.4%	(Saleh, and Ma´ala, 2015)
Baghdad	2019	15-17	870	B=435 G=435	B=50.8% G=23.9%	(Baghdadi, 2021)
Najaf	2021	12-15	537	B=270 G=267	B, and G=31.8%	(Abbas, Neamat, and Falah, 2021)
Duhook	2017	12-19	200	B=100 G=100	B=50.0% G=42.0%	(Ibrahim et al, 2018)

Note: B= Boys, and G= Girls.

2.4 Determinants of Obesity

Adolescent obesity represents an escalating public health challenge, driven by a complex interrelationship of various factors (Neves *et al.*, 2021; Mangrola *et al.*, 2023; Benton, 2024). Among the critical determinants are dietary intake (Nonguierma *et al.*, 2022), physical activity (Sun *et al.*, 2021), sedentary behavior (Shao, Wang, and Chen, 2020;Mahumud *et al.*, 2021), sociodemographic characteristics (Mohamad *et al.*, 2021), and food parenting practices (FPP) (Anna *et al.*, 2020; Monroe-lord *et al.*,

Criterion Equivalence: ensures that the translated items measure the same constructs as the original. For instance, “Energy, and Sports Drinks, Regular (Red Bull, Gatorade, Powerade)” became “ مشروبات الطاقة والرياضة، العادية (ريد بُل، تايجر، باور هورس، بلو باور)” (Regular Energy, and Sports Drinks: Red Bull, TIGER, Power Horse, Blue Power). Local and popular brands like Tiger and Power Horse were included to ensure respondents could relate to the products. Experts and adolescents provided opinions for these modifications, as confirmed through face validity.

Construct-Concept Equivalence; ensures that the underlying concept being measured is understood similarly in both cultures. For example, “Tea or Coffee, black (no creamer or milk)” was translated to “شاي أو قهوة سادة (بدون مبيض أو حليب)” (Tea or Coffee, black with no creamer or milk) and “Tea or Coffee (w/ milk, and/ or creamer)” was translated to “شاي أو قهوة (مع حليب و / أو مبيض)” maintaining the concept of adding or not adding milk or creamer to tea or coffee. This equivalence was crucial to accurately capturing the same dietary habits in both cultures.

In summary, the translation and cultural adaptation of the BEVQ from English to Arabic (Iraq) involved ensuring that the meaning (semantic), relevance (content), technical details, measurement criteria (criterion), and underlying concepts (construct-concept) were preserved and made culturally appropriate. This thorough approach ensures that the questionnaire remains valid and reliable across different cultural contexts.

4.2.2(b) Content Validity of the BEVQ

The content validity of items in the Arabic Versions of the BEVQ was assessed by four experts, resulting in comprehensive data on various metrics. For the criterion of Relevance, the expert consensus (EC) scores ranged from 3 to 4 across the items, with a mean item content validity index (I-CVI) of 0.94 and a universal agreement (S-CVI/UA) ranging from 0.75 to 1.00. The modified Kappa (κ_m) values were high,

indicating strong agreement among the experts, with values of 1.00 for most items, except for items Q1, Q3, and Q6 which had κ_m values of 0.67. Refer to Table 4.3 for details.

Regarding Clarity, the EC scores varied from 2 to 4, with an overall S-CVI/Ave of 0.90 and a S-CVI/UA between 0.75 and 1.00. The I-CVI values ranged from 0.5 to 1.00, with item Q1 receiving the lowest I-CVI (0.50) and Modified Kappa agreement (0.20), suggesting it might need revision. The probability of chance occurrence (Pc) was generally low, further supporting the validity of these evaluations.

For Simplicity, the EC ratings were consistently high (3 or 4), resulting in an S-CVI/Ave of 0.98 and an S-CVI/UA between 0.92 and 1.00. All items had an I-CVI of 1.00, except for Q1 and Q6, which had an I-CVI of 0.75. The κ_m values were uniformly 1.00, except for Q1 which had a κ_m of 0.67, indicating excellent agreement among experts.

The Ambiguity criterion also showed high EC scores, with an S-CVI/Ave of 0.96 and an S-CVI/UA ranging from 0.92 to 1.00. Most items achieved an I-CVI of 1.00, with only Q1 having a lower I-CVI of 0.5 and a corresponding κ_m of 0.20, suggesting it may require additional refinement based on expert feedback.

In summary, the expert agreement on the content validity of the Arabic BEVQ items is generally high across all criteria. Items identified with lower Modified Kappa agreement and I-CVI values, particularly in Relevance and Clarity, should be reviewed for potential revisions to enhance their validity. The high overall S-CVI/Ave and S-CVI/UA values support the robustness of the Arabic BEVQ, ensuring its content validity is maintained through expert consensus (Table 4.3).

Table 4.3 Expert Agreement (*n*=4) on Content Validity of Items in the Arabic Versions of the BEVQ

Criteria	CVM	Item												S-CVI/Ave	S-CVI/UA
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12		
Relevance	EC	3	4	3	4	4	3	4	4	4	4	4	4	0.94	0.75.1.00
	I-CVI	0.75	1	0.75	1	1	0.75	1	1	1	1	1	1		
	P_c	0.25	0.06	0.25	0.06	0.06	0.25	0.06	0.06	0.06	0.06	0.06	0.06		
	κ_m	0.67	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00		
Clarity	EC	2	4	3	4	4	3	3	4	4	4	4	4	0.90	0.75.1.00
	I-CVI	0.5	1	0.75	1	1	0.75	0.75	1	1	1	1	1		
	P_c	0.38	0.06	0.25	0.06	0.06	0.25	0.25	0.06	0.06	0.06	0.06	0.06		
	κ_m	0.20*	1.00	0.67	1.00	1.00	0.67	0.67	1.00	1.00	1.00	1.00	1.00		
Simplicity	EC	3	4	4	4	4	4	4	4	4	4	4	4	0.98	0.92.1.00
	I-CVI	0.75	1	1	1	1	1	1	1	1	1	1	1		
	P_c	0.25	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
	κ_m	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
Ambiguity	EC	2	4	4	4	4	4	4	4	4	4	4	4	0.96	0.92.1.00
	I-CVI	0.5	1	1	1	1	1	1	1	1	1	1	1		
	P_c	0.38	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06		
	κ_m	0.20*	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
INTP	I-CVI	**Rev.**	App.	**Rev.**	App.	App.	**Rev.**	**Rev.**	App.	App.	App.	App.	App.		
	κ_m	**Gd.**	Exc.	**Gd.**	Exc.	Exc.	**Gd.**	**Gd.**	Exc.	Exc.	Exc.	Exc.	Exc.		

Note: CVM= Content Validity Metrics, EC= Expert Consensus, I-CVI = Item Content Validity Index, P_c = probability of chance occurrence, κ_m = Modified Kappa agreement., S-CVI/Ave = Sum of Content Validity Index/Average (number of items), S-CVI/UA = Sum Content Validity Index/Universal Agreement (Lower, Upper), INTP= Interpretation, App. = Approved, Rev.= Need revision, Exc. = Excellent, Gd. = Good, * = Poor.

4.2.2(c) Face Validity of the BEVQ

Table 4.4 presents the average item face validity index (I-FVI) of the BEVQ-A, evaluated by 30 raters. The I-FVI indicates the proportion of raters who agreed on the face validity of each item. For the majority of the items (Q2 to Q5, Q7 to Q10, and Q12), a perfect agreement was achieved, with all 30 raters in consensus, resulting in an I-FVI of 1.00. Items Q1 and Q6 had a slightly lower agreement with 27 raters in consensus, corresponding to an I-FVI of 0.90. Item Q11 had the lowest agreement among the raters, with 25 in agreement and an I-FVI of 0.83.

The overall face validity of the BEVQ-A items was high, as reflected by the sum of the face validity index/average (S-FVI/Ave) of 0.97. All items were interpreted as approved (App.), indicating that they were deemed face-valid by most of the raters. This high level of agreement suggested that the items of the BEVQ-A were clear and

appropriately capture the constructs they are intended to measure, confirming the instrument's face validity.

Table 4.4 The average item for the face validity index of BEVQ-A from 30 raters

Item	Raters in agreement	I-FVI	INTP
Q1	27	0.90	App.
Q2	30	1.00	App.
Q3	30	1.00	App.
Q4	30	1.00	App.
Q5	30	1.00	App.
Q6	27	0.90	App.
Q7	30	1.00	App.
Q8	30	1.00	App.
Q9	30	1.00	App.
Q10	30	1.00	App.
Q11	25	0.83	App.
Q12	30	1.00	App.
	S-FVI/Ave	0.97	

Note: I-FVI= Item Face Validity Index, S-FVI/Ave= Sum of Face Validity Index/Average (number of items), INTP= Interpretation, App. = Approved.

4.2.3 Construct Validity and Reliability

This section details the methods used to evaluate the construct validity and reliability of two key assessment tools among Iraqi adolescents aged 16 to 18 years. Both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were employed to establish the construct validity of the Adolescent Food Parenting Questionnaire (AFPQ-A). These analyses enabled the identification of the underlying factor structure and confirmation of the theoretical model of the questionnaire. Additionally, the Beverage Intake Questionnaire (BEVQ-A) reliability was determined using the test-retest method, which assessed the stability and consistency of responses over time.

4.2.3(a) Exploratory Factor Analysis

This section presents the results of the Exploratory Factor Analysis (EFA) and internal consistency reliability assessments for two instruments: the Adolescent Food Parenting Questionnaire (AFPQ-A) for parents and the AFPQ-A for adolescents. Initially, the section begins with a preliminary data screening based on the participants'

responses. Following this, the characteristics of the participants and the score distribution for each scale used in Phase I were detailed, accompanied by descriptive statistics. The outcomes of the assumption verification and the EFA analysis were then discussed. Finally, the internal consistency reliability findings are reported after establishing the final EFA models for each scale.

i. Preliminary Data Screening

Missing Data

In this study, each questionnaire item was evaluated to determine the percentage of missing data. No items were deleted because their missing data was less than 5%. One of the most common items with missing data (2.04% of the total) was found during the data review. Since the percentage of missing data was modest, the one missing observation was retained in the data set for further analysis.

Outliers

A boxplot was employed to examine univariate outliers for each numerical variable, including age and questionnaire items (AFPQ-A for both parents and adolescents), (APPENDIX O). Explain a little bit about the box plot, including the anomalies.

Univariate Normality

A histogram was utilized to assess the univariate normality of the numerical variables, including age and questionnaire items. The results indicated a non-normal distribution for both the numerical variables and questionnaire items, as described in APPENDIX P.

ii. Response Rate in EFA study

At the end of the screening process, 140 out of 1,200 participants met the eligibility criteria. All 140 individuals were invited to participate in the exploratory study. Phase I data analysis was based on 98 fully completed questionnaires,

representing a 70% response rate. Despite some dropouts, the data collection successfully achieved the intended sample size of 98 participants.

iii. Socio-Demographic Characteristics of The Study Participants

Table 4.5 presents the sociodemographic characteristics of the exploratory factor analysis participants (*n*=98), describing their age distribution and gender representation among adolescents, as well as the distribution of secondary school attendance. The average age of adolescents was 16.95 years (SD 0.76), with a near-even split between boys (49.0%, *n*=48) and girls (51.0%, *n*=50). Secondary school enrollment was balanced across four schools: Al-Muthanaa (24.5%, n=24), AL-Karama (24.5%, *n*=24), AL-Awayil (25.5%, *n*=25), and AL-Aamara (25.5%, *n*=25). The demographic analysis of parents revealed a mean age of 41.15 years (SD 5.14). Mothers constituted the majority of participants, accounting for 83.7% (n = 82), while fathers represented 16.3% (n = 16). This table provides a comprehensive snapshot of the demographic composition of the study's adolescent participants and their parental characteristics, which is essential for contextualizing subsequent analyses and interpretations.

Table 4.5 Sample distribution according to sociodemographic variables for participants in the study (*n*=98)

Variable			**Mean (SD)**	**F. (%)**
Adolescent	Age (year)		16.95 (0.76)	
	Sex	Boy		48 (49.0)
		Girl		50 (51.0)
	Secondary Schools	Al-Muthanaa		24 (24.5)
		AL-Karama		24 (24.5)
		AL-Awayil		25 (25.5)
		AL-Aamara		25 (25.5)
Parent	Age (year)		41.15 (5.14)	
	Father			16 (16.3)
	Mother			82 (83.7)

The following section presents descriptive statistics for all items in the AFPQ-A for both parent and adolescent versions. The response patterns were described for 16 items in the parent version and 16 items in the adolescent version, with frequencies

and percentages detailed in Table 4.6. The scale's minimum value is one, and the maximum value is five.

Table 4.6 presents descriptive statistics for all 16 items in the AFPQ-A for both parent and adolescent versions with a scale of 1 to 5. The mean score (standard deviation) of the AFPQ-A parent version scale was 52.41 (8.21), with respondents' total scores ranging from 27.00 to 68.00. The mean score (standard deviation) for adolescents was 53.89 (9.16), with total scores ranging from 32.00 to 73.00. The mean (standard deviation) for the autonomy supportive, health structure, corrosive control, snack structure, and modelling scales were 16.60 (2.87), 8.26 (1.78), 13.12 (3.98), 10.28 (3.83), and 8.26 (2.01) for the parent version, and 16.03 (2.97), 7.90 (1.90), 12.29 (4.52), 9.50 (4.12), and 8.17 (2.19) for the adolescent version, respectively. The distribution of scores for each scale was slightly skewed to the left in both versions.

iv. Score Distribution of the Items in the Questionnaire

Table 4.6 Distribution of answer pattern for The Adolescent Food Parenting Questionnaire – parent and adolescent version (*n*=98)

Item No.	Item	Score										Mean (SD)		Median (IQR)	
		Disagree (1)		Slightly disagree (2)		Impartial (3)		Slightly agree (4)		Agree (5)					
		P F (%)	A F (%)	P F (%)	A F (%)	P F (%)	A F (%)	P F (%)	A F (%)	P F (%)	A F (%)	P	A	P	A
1	AS	1(1.0)	1(1.0)	4(4.1)	5(5.1)	15(15.3)	17(17.3)	34(34.7)	39(39.8)	44(44.9)	36(36.7)	4.18(0.91)	4.06(0.91)	4.00(1)	4.00(1)
2	AS	-	2(2.0)	7(7.1)	9(9.2)	18(18.4)	25(25.5)	32(32.7)	31(31.6)	41(41.8)	31(31.6)	4.09(0.94)	3.82(1.04)	4.00(2)	4.00(2)
3	HS	-	2(2.0)	9(9.2)	9(9.2)	14(14.3)	14(16.3)	28(28.6)	30(03.6)	47(48.0)	41(41.8)	3.95(0.98)	4.01(1.07)	4.00(1)	4.00(2)
4	CC	13(13.3)	19(19.4)	21(21.4)	20(20.4)	33(33.5)	27(27.6)	23(23.5)	20(20.4)	8(8.2)	12(12.2)	2.92(1.14)	3.86(1.13)	3.00(2)	4.00(2)
5	AS	1(1.0)	2(2.0)	6(6.1)	7(7.1)	20(20.4)	20(20.4)	24(24.5)	30(30.6)	47(48.0)	39(39.8)	4.12(1.00)	2.86(1.29)	4.00(2)	3.00(2)
6	HS	-	3(3.1)	11(11.2)	12(12.2)	11(11.2)	14(14.3)	29(29.6)	33(33.7)	47(48.0)	36(36.7)	4.14(1.01)	3.99(1.04)	4.00(1)	4.00(2)
7	CC	13(13.3)	24(24.5)	18(18.4)	13(13.3)	19(19.4)	18(18.4)	24(24.5)	22(22.4)	24(24.5)	21(21.4)	3.29(1.37)	3.03(1.48)	3.00(2)	3.00(2)
8	SS	23(23.5)	35(35.7)	50(51.0)	30(30.6)	18.4)	20(20.4)	5(5.1)	8(8.2)	2(2.0)	5(5.1)	2.11(0.98)	2.16(1.15)	2.00(1)	2.00(2)
9	AS	-	1(1.0)	6(6.1)	7(7.1)	15(15.3)	14(14.3)	30(30.6)	29(29.6)	47(48.0)	47(48.0)	4.20(0.91)	4.16(0.99)	4.00(1)	4.00(1)
10	CC	9(9.2)	19(19.4)	18(18.4)	16(16.3)	27(27.6)	24(24.5)	24(24.5)	22(22.4)	20(20.4)	17(17.3)	3.02(1.24)	3.02(1.37)	3.00(2)	3.00(2)
11	Mod	4(4.1)	6(6.1)	7(7.1)	9(9.2)	11(11.2)	12(12.2)	27(27.6)	24(24.5)	49(50)	47(48.0)	4.12(1.12)	3.99(1.23)	4.50(1)	4.00(2)
12	SS	26(26.5)	38(38.8)	29(29.6)	22(22.4)	19(19.4)	18(18.4)	17(17.3)	13(13.3)	7(7.1)	7(7.1)	2.24(1.25)	2.28(1.29)	2.00(2)	2.00(2)
13	SS	18(18.4)	27(27.6)	21(21.4)	21(21.4)	24(24.5)	18(18.4)	27(27.6)	26(26.5)	8(8.2)	6(6.1)	2.86(1.24)	2.62(1.30)	3.00(2)	3.00(3)
14	CC	7(7.1)	10(10.2)	13(13.3)	17(17.3)	19(19.4)	22(22.4)	29(29.6)	24(24.5)	30(30.6)	25(25.5)	3.63(1.24)	3.38(1.31)	4.00(2)	3.00(3)
15	Mod	2(2.0)	4(4.1)	7(7.1)	5(5.1)	14(14.3)	15(15.3)	28(28.6)	19(19.4)	47(48.0)	55(56.1)	4.13(1.04)	4.18(1.12)	4.00(1)	5.00(1)
16	SS	19(19.4)	29(29.6)	23(23.5)	26(26.5)	25(25.5)	23(23.5)	19(19.4)	11(11.2)	12(12.2)	9(9.2)	2.82(1.29)	2.44(1.27)	3.00(2)	2.00(2)

Note: Autonomy Support = item mean AS, Coercive Control = item mean CC, Modelling = item mean Mod., Healthy structure = item mean HS, Snack structure = item mean SS, SD=standard deviation, IQR=interquartile range, P= Parent Version, A=Adolescent Version, F= Frequency.

v. Assumption Checking for EFA

1. Univariate Normality

To assess univariate normality, histograms, and box-and-whisker plots were generated for all items within each scale. The majority of the items exhibited left skewness. The Kolmogorov-Smirnov and Shapiro-Wilk tests for normality indicated that all items had *P*-values below 0.001, suggesting significant deviations from normality. Visual inspection of the data further confirmed a degree of skewness. Additionally, normality was assessed using Kolmogorov-Smirnov tests, Q-Q plots, and extended Q-Q plots, all of which corroborated that none of the items were normally distributed. For more information, refer to APPENDIX P.

2. Positive Definiteness

Principal component analysis was conducted on the sample covariance matrix to verify its positive definiteness. The analysis confirmed that the covariance matrix was positive definite in both versions (APPENDIX Q).

3. Multicollinearity

To assess the presence of multicollinearity, the Squared Multiple Correlation (tolerance) and the Variance Inflation Factor (VIF) were employed. The results indicated no evidence of multicollinearity, as the tolerance values for all items exceeded 0.1, and the VIF values were below 10 (APPENDIX R).

4. Measure of Sampling Adequacy (MSA)

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for both parent and adolescent data sets was found to be 0.709 and 0.663, respectively, indicating that both samples are adequate for factor analysis. Additionally, Bartlett's Test of Sphericity was highly significant for both groups, with approximate chi-square values of 528.95 and 599.52 and degrees of freedom (df) of 120, both yielding *P*-values of 0.000, as shown in Table 4.7. These results suggested that the correlation

matrices for both parent and adolescent data were not identity matrices, thereby confirming the appropriateness of conducting factor analysis.

Table 4.7 KMO and Bartlett's test results AFPQ-A in Both Parent and Adolescent Versions (n=98)

KMO and Bartlett's Test		Parent	Adolescent
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.709	0.663
Bartlett's Test of Sphericity	Approx. Chi-Square	528.95	599.52
	df	120	120
	Sig.	0.000	0.000

vi. Construct Validity and Reliability for EFA study

Subsequently, EFA was conducted using principal axis factoring and Promax rotation. All assumptions were met except for the normality of a few items. According to Costello, and Osborne (2005), Hair *et al.* (2010, 2019), Osborne, Costello, and Kellow (2011), Osborne, (2015), and Kline, (2023), principal axis factoring is robust against non-normal data distributions. Based on the theoretical components of the measures, the number of factors for each measure's EFA model was determined.

Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was conducted on the items, identifying five domains based on the AFP theoretical framework. These domains accounted for a total variance of 69.26% in the parent version and 70.49% in the adolescent version. Table 4.8 presents the eigenvalues and the percentage of variance explained by the extracted factors. The five factors all had eigenvalues greater than 1, indicating their significance. The scree plot is shown in Figure 4.1. The variance values for the five factors in the parent version were 23.52, 15.34, 11.20, 9.33, and 7.88, respectively, while in the adolescent version, they were 25.30, 14.58, 12.98, 8.99, and 7.65, respectively. The identified factors were snack structure, corrosive control, autonomy support, modelling, and healthy structure towards food parent practices.

Table 4.8 Eigenvalues of Factors for AFPQ-A in Both Parent and Adolescent Versions (*n*=98)

Factor	Initial Eigenvalues					
	Total		Percentage of variance		Cumulative percentage	
Version	**P**	**A**	**P**	**A**	**P**	**A**
1	3.76	4.05	23.52	25.30	23.52	25.30
2	2.46	2.33	15.34	14.58	38.86	39.88
3	1.79	2.08	11.20	12.98	50.06	52.85
4	1.49	1.44	9.33	8.99	59.39	61.84
5	1.26	1.23	7.88	7.65	67.26	69.49

Note: P= Parent and A= Adolescent.

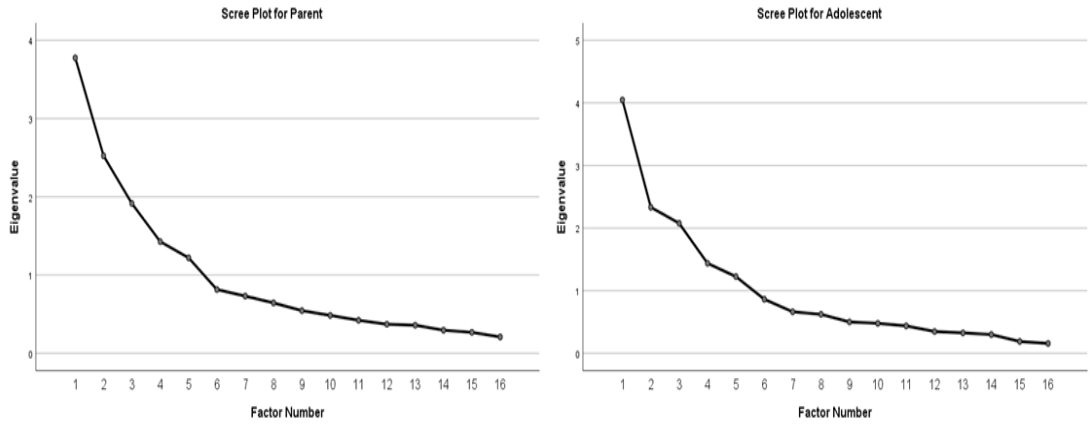


Figure 4.1 Scree Plot AFPQ-A in Both Parent and Adolescent Versions (*n*=98)

Table 4.9 presents the factor loadings and communalities for the Adolescent Food Parenting Questionnaire (AFPQ) items from both parent and adolescent perspectives. All factor loadings and communalities exceed the threshold values of 0.40 and 0.25, respectively, indicating strong and acceptable relationships between items and factors. The factor loadings represent the strength of the relationship between each item and its respective factor. At the same time, the communalities reflect the proportion of each item's variance explained by the extracted factors. The five identified factors are Autonomy Support, Healthy Structure, Coercive Control, Snack Structure, and Modeling.

Table 4.9 Factor Loadings and Communalities in Exploratory Factor Analysis of the Adolescent Food Parenting Questionnaire for Parent and Adolescent Perspectives.

Factor	Item no.	Parent Factor loading	Communalities	Adolescent Factor loading	Communalities
Autonomy Support	1	0.666	0.450	0.593	0.370
	2	0.560	0.359	0.572	0.376
	5	0.687	0.470	0.683	0.456
	9	0.735	0.534	0.708	0.535
Healthy structure	3	0.572	0.321	0.560	0.324
	6	0.786	0.638	0.869	0.752
Coercive Control	4	0.625	0.332	0.678	0.411
	7	0.820	0.711	0.886	0.794
	10	0.725	0.545	0.719	0.636
	14	0.696	0.532	0.764	0.572
Snack structure	8	0.730	0.479	0.739	0.507
	12	0.737	0.575	0.697	0.575
	13	0.749	0.607	0.760	0.611
	16	0.773	0.655	0.802	0.686
Modelling	11	0.723	0.558	0.783	0.604
	15	0.996	0.937	0.942	0.885

Visualization of Loading Plots

Figure 4.2 and Figure 4.3 present a series of loading plots, each representing different comparisons of the Arabic version of the Adolescent Food Parenting Questionnaire (AFPQ) for both parents and adolescents. The plots were arranged in a 2x5 grid, showcasing various factor loadings in rotated factor space. Each subplot (a-j) highlights the relationship between different combinations of factors labelled with Greek letters (e.g., λ).

These loading plots provide a visual representation of the factor structure of the AFPQ-A questionnaire. Each subplot illustrates how specific items load onto different factors, indicating their underlying relationships. Clustering items around specific factors demonstrates the coherence and potential correlations between different items and factors within the questionnaire. The visual differentiation in the loading plots underscores the distinctiveness of the factors being compared, which is crucial for validating the questionnaire's structure and ensuring its reliability and validity in assessing food parenting practices.

Overall, the items within each domain were grouped together, indicating no cross-loading of items to other domains based on the factor loading levels. Notably, the factor plot in rotated factor space depicting the relationship between the factors Autonomy Supportive (λ) and Healthy Structure (λ) (Figure 4.3 (a)) reveals moderate factor loading, particularly for item HS-A3. All factor loadings exceed the threshold value of 0.40. Despite the moderate loading observed for HS-A3, it was considered significant based on discussions with experts and was retained for further reliability analysis.

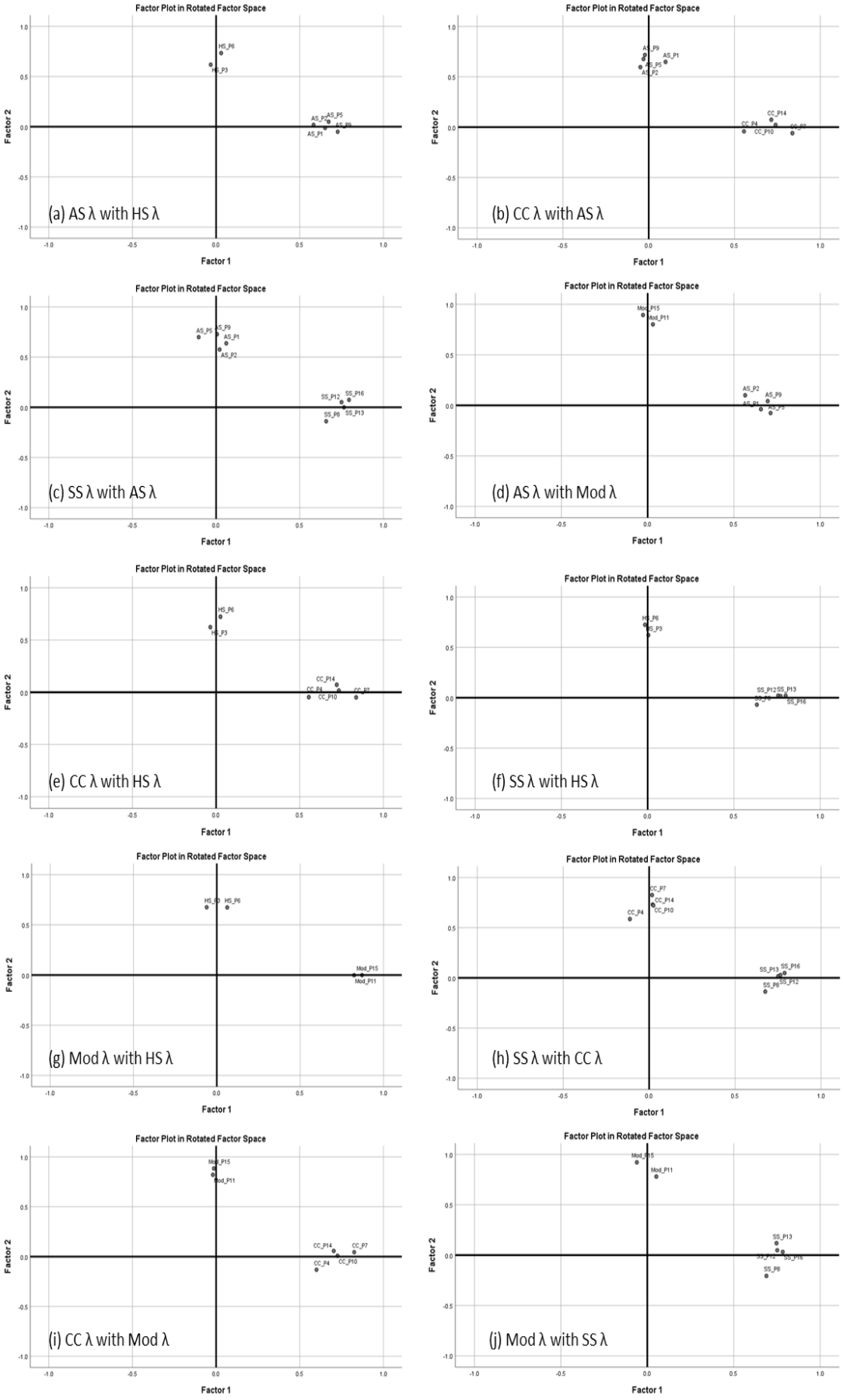


Figure 4.2 Visualization of loading plots for AFPQ-Parents

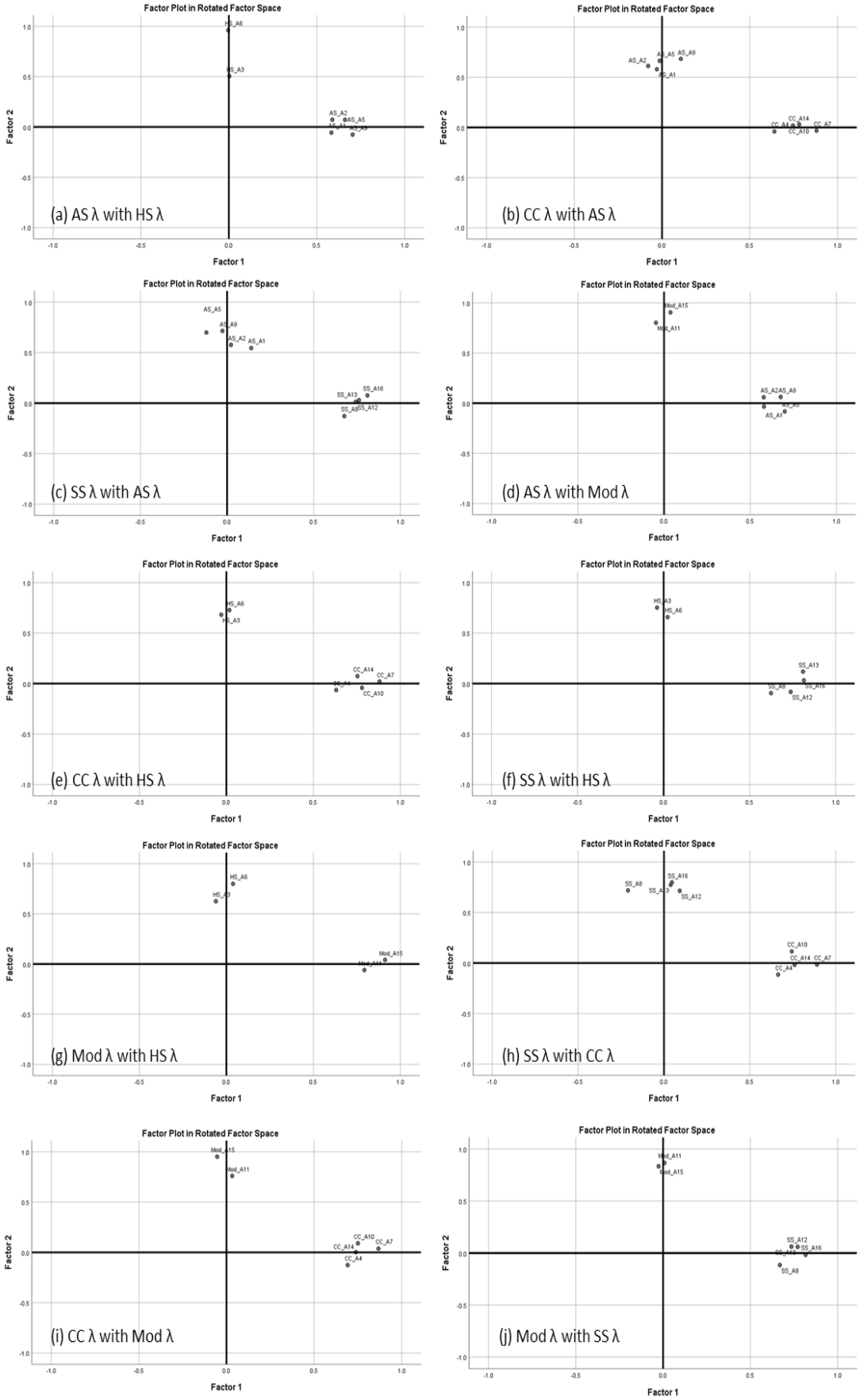


Figure 4.3 Visualization of loading plots for AFPQ- Adolescents

Internal Consistency Reliability

The internal consistency of the Adolescent Food Parenting Questionnaire (AFPQ) was found to be moderate to adequate. The Cronbach's alpha values ranged from 0.621 to 0.834 for the parent version and from 0.662 to 0.845 for the adolescent version, as shown in Table 4.10. Notably, no items were identified for deletion based on these reliability assessments.

Table 4.10 Internal consistency reliability (Cronbach's alpha) of Adolescent Food Parenting Questionnaire among EFA sample

Domain	**Item**	**Corrected item-total correlation**	**Cronbach's alpha if the item deleted**	**Cronbach's alpha**	**Corrected item-total correlation**		**Cronbach's alpha**
		Parent Version			**Adolescent Version**		
Autonomy Support	1	0.546	0.697	0.753	0.485	0.685	0.727
	2	0.502	0.720		0.499	0.678	
	5	0.566	0.686		0.535	0.655	
	9	0.583	0.677		0.551	0.646	
Healthy Structure	3	0.451	-	0.621	0.496	-	0.662
	6	0.451	-		0.496	-	
Coercive Control	4	0.498	0.806	0.803	0.587	0.843	0.845
	7	0.711	0.705		0.772	0.763	
	10	0.636	0.744		0.705	0.795	
	14	0.632	0.747		0.674	0.808	
Snack Structure	8	0.571	0.820	0.826	0.579	0.825	0.834
	12	0.673	0.770		0.669	0.788	
	13	0.687	0.763		0.694	0.776	
	16	0.703	0.756		0.716	0.766	
Modelling	11	0.717	-	0.834	0.719	-	0.834
	15	0.717	-		0.719	-	

4.2.3(b) Confirmatory Factor Analysis

This section presents the findings from the data analysis of the Confirmatory Factor Analysis (CFA) study. It began with preliminary data screening, followed by a detailed account of participants' response rates. Subsequent subsections cover the descriptive statistics for participant characteristics and the score distributions for each scale used in the CFA. The section concludes with the results from the CFA analysis, including assumption checking and model fit evaluations.

i. Preliminary Data Screening

Missing Data

Each item on the questionnaires was analyzed for the percentage of missing data. No items were eliminated, as none exceeded the 5% threshold for missing data. While miner items did have some missing data, the observations were retained for further analysis because the percentage of missing data was very low, ranging from 0.62% to 1.25%.

Outliers

A boxplot analysis was conducted to identify univariate outliers across various numerical variables, including age, anthropometric measures, socioeconomic status, and questionnaire items from both versions of the AFPQ-A (for parents and adolescents), as described in APPENDIX S including several anomalies.

Univariate Normality

Histograms were utilized to assess the univariate normality of numerical variables, including age, height, weight, socioeconomic status, and questionnaire items. The analysis revealed non-normal distributions for several numerical variables and questionnaire items, as detailed in APPENDIX T .

ii. Response Rate in CFA Study

At the conclusion of the screening process, 172 out of 1300 participants met the eligibility criteria for the study. All 172 eligible individuals were invited to participate in the confirmatory study. Phase I data analysis was based on 160 fully completed questionnaires, yielding a response rate of 93.0%. This phase of data collection successfully achieved the target sample size of 150 participants, excluding any dropout considerations.

iii. Socio-Demographic Characteristics of The Study Participants

The study involved 160 adolescents with a mean age of 16.71 years (SD 0.74), nearly equally divided between boys and girls. Participants came from both

governmental and private secondary schools. The study also included their parents, with a mean age of 47.10 years (SD 6.16). The socio-economic status (SES) of the families varied: a minority of fathers (13.8%) held high professional jobs, while the majority (55.0%) were lower professionals or skilled workers. In contrast, most mothers (81.3%) were unskilled workers. Educational attainment showed that 31.9% of fathers and 20.0% of mothers were college graduates. Housing conditions indicated that 51.2% of families owned their homes and household assets. SES scores ranged widely, with 18.8% of families classified as high SES, 46.9% as moderate SES, and 34.4% as low SES, with a mean SES score of 97.32. These results are detailed in Table 4.11.

Table 4.11 Distribution of Participants in the CFA (AFPQ-A) Studies Based on Sociodemographic Variables (*n*=160 for CFA)

Sociodemographic variables			**CFA**	
			F. (%)	
Adolescent	Age (year)	Mean (SD) (Min. - Max.)	16.71 (0.74) (16.0-18.8)	
	Sex	Boy Girl	77 (48.1) 83 (51.9)	
	Secondary school for governmental[1] and private[2]	AL-Mustafaa[1] AL-Ghasaq[1] AL-Zahraa[2] Nur Almujtabaa[2]	43 (26.9) 37 (23.1) 36 (22.5) 44 (27.5)	
Parent	Age (year)	Mean, SD (Min. - Max.)	47.10, 6.16 (34.0-65.0)	
Socio-Economic Status (SES)			Father, F. (%)	Mother, F. (%)
Occupation of parent	High professional, and managerial jobs as doctors, engineers, professors, large employers, directors of business, land owners		22(13.8)	1(0.6)
	Lower professionals, skilled and semiskilled workers as school, teachers, clerical workers, owners of small businesses, military men, and policemen.		88(55.0)	29(18.1)
	Unskilled workers as labourers, farmers casual workers, unemployed, and retired.		50(31.3)	130(81.3)
The educational level of the parent	Illiterate		8(5.0)	22(13.8)
	Read, and write		7(4.4)	13(8.1)
	Primary graduate		42(26.3)	42(26.3)
	intermediate graduate		35(21.9)	29(18.1)
	Secondary graduate		17(10.6)	22(13.80
	College Graduate		51(31.9)	32(20.0)

Table 4.11: Continued

Sociodemographic variables		CFA
		F. (%)
Crowding index	-2 (up to)	100 (62.5)
	- 4 (up to)	48 930.0)
	≥ 4	12 (7.5)
	Mean, SD	1.94, 1.19
	(Min. - Max.)	(0.28-7.50)
Property	Owns a house, a car, and all the household assets.	82 (51.2)
	The house is rented, with or without a car, and most of the household assets	57 (35.6)
	The house is shared, with another family, no car, and some of the household assets	21 (13.1)
Socio-Economic Status (SES)	High (121 – 150)	30 (18.8)
	Moderate (90 - 120)	75 (46.90
	Low (89 -, and less)	55 (34.4)
	Mean, and SD (Min. - Max.)	97.32, 22.46 (46-142)

Note: CFA for Confirmatory Factor Analysis, F. (%) for Frequency (Percentage), SD for Standard Deviation, and (Min. - Max.) for the range from Minimum to Maximum, referring to the mean age of the parent who completed the questionnaire, whether father or mother.

iv. Anthropometric Measurements in CFA Study

Table 4.12 presents the distribution of participants in the Confirmatory Factor Analysis (CFA) study by parental Body Mass Index (BMI) and adolescent BMI z-score for age. The sample size consists of 160 participants. The mean adolescent BMI z-score was 0.66 (SD 1.62), ranging from -3.69 to 4.46. Among the adolescents, 46.9% had a normal weight, 24.4% were overweight, 19.4% were obese, 5.0% were underweight, and 4.4% were severely obese. For the parents, the mean BMI was 29.61 (SD 7.43) for fathers and 28.25 (SD 5.63) for mothers. The distribution among parents indicated that 40.0% of fathers and 43.3% of mothers were overweight, while 37.9% of fathers and 29.7% of mothers fell into the obesity categories (Class I, II, and III).

Table 4.12 Distribution of Participants in the CFA (AFPQ-A) Studies by Parental BMI and Adolescent BMI z-score for Age (*n*=160)

Participant	Categorical	CFA
		F. (%)
Adolescent BMI z-score	Underweight: BMI z-score < -2 SD	8 (5.0)
	Normal weight: BMI z-score ≥ -2 SD and ≤ +1 SD	75 (46.9)
	Overweight: BMI z-score > +1 SD and ≤ +2	39 (24.4)
	Obese: BMI z-score > +2 ≤ +3 SD	31 (19.4)
	Severely Obese: BMI z-score > +3 SD	7 (4.4)
	Mean, SD	0.66, 1.62
	(Min. - Max.)	(-3.69-4.46)
Parental BMI	Underweight: BMI less than 18.5 kg/m²	1(0.7) [f] 1(0.7) [m]
	Normal weight: BMI ranging from 18.5 to 24.9 kg/m²	37(26.2) [f] 31(21.4) [m]
	Overweight: BMI ranging from 25.0 to 29.9 kg/m²	61(43.3) [f] 58(40.0) [m]
	Class I: BMI ranging from 30.0 to 34.9 kg/m²	34(24.1) [f] 34(23.4) [m]
	Class II: BMI ranging from 35.0 to 39.9 kg/m²	4(2.8) [f] 11(7.6) [m]
	Class III (severe obesity): BMI 40.0 kg/m²	4(2.8) [f] 10(6.9) [m]
	Mean, SD	28.25(5.63) [f]
	(Min. - Max.)	29.61(7.43) [m]

Note: BMI= Body Mass Index, CFA= Confirmatory Factor Analysis, SD= Stander Deviation, Min= Minimum, Max= Maximum, Missing values for fathers (f) were 11.9% and for mothers (m) were 9.4% within the study sample.

Table 4.13 displays the distribution of scores across various scales for both the parent and adolescent versions of the AFPQ-A. The mean score (standard deviation) of the AFPQ-A parent version scale was 62.46 (7.15), with respondents' total scores ranging from 38.00 to 78.00. For the adolescent version, the mean score (standard deviation) was 57.24 (98.61), with total scores ranging from 31.00 to 78.00. The mean (standard deviation) for the autonomy supportive, health structure, corrosive control, snack structure, and modelling scales were 18.45 (2.09), 9.26 (1.16), 15.41 (3.79), 10.32 (3.94), and 9.03 (1.44) for the parent version, and 17.32 (2.97), 8.76 (1.49), 14.94 (4.23), 8.79 (3.89), and 8.43 (1.81) for the adolescent version, respectively. The distribution of scores for each scale was slightly skewed to the left in both versions.

v. Score Distribution of the Items in the Questionnaire

Table 4.13 Table Distribution of answer pattern for The Adolescent Food Parenting Questionnaire- Arabic – parent and adolescent version (*n*=160)

Item No.	Item	Score										Mean (SD)		Median (IQR)	
		Disagree (1)		Slightly disagree (2)		Impartial (3)		Slightly agree (4)		Agree (5)					
		P F (%)	A F (%)	P F (%)	A F (%)	P F (%)	A F (%)	P F (%)	A F (%)	P F (%)	A F (%)	P	A	P	A
1	AS	-	3(1.9)	4(2.5)	9(5.6)	3(1.9)	5(3.1)	35(21.9)	58(36.3)	118(73.8)	85(53.1)	4.67(0.64)	4.33(0.92)	5.00(1)	5.00(1)
2	AS	-	3(1.9)	4(2.5)	11(6.9)	8(5.0)	17(10.6)	52(32.5)	53(33.1)	96(60.0)	76(47.5)	4.50(0.70)	4.18(1.00)	5.00(1)	4.00(1)
5	AS	-	2(1.3)	3(1.9)	8(5.0)	5(3.1)	16(10.0)	33(20.6)	35(21.9)	119(74.4)	99(61.9)	4.68(0.63)	4.38(0.94)	5.00(1)	5.00(1)
9	AS		1(0.6)	3(1.9)	8(5.0)	5(3.1)	9(5.6)	44(27.5)	45(28.1)	108(67.5)	97(60.6)	4.61(0.64)	4.43(0.85)	5.00(1)	5.00(1)
3	HS		1(0.6)	3(1.9)	6(3.8)	3(1.9)	10(6.3)	39(24.4)	51(31.9)	115(71.9)	92(57.50	4.66(0.61)	4.42(0.82)	5.00(1)	5.00(1)
6	HS		1(0.6)	5(3.1)	11(6.9)	3(1.9)	12(7.5)	44(27.5)	45(28.1)	108(67.5)	91(56.90	4.59(0.68)	4.34(0.93)	5.00(1)	5.00(1)
4	CC	7(4.4)	14(8.8)	21(13.1)	41(25.6)	21(13.1)	25(15.6)	70(43.8)	46(28.7)	41(25.6)	34(21.3)	3.73(1.11)	3.28(1.29)	4.00(1)	3.50(2)
7	CC	7(4.4)	17(10.6)	24(15.0)	29(18.1)	15(9.4)	24(15.0)	68(42.5)	51(31.9)	46(28.7)	39(24.4)	3.76(1.15)	3.41(1.31)	4.00(1)	4.00(2)
10	CC	5(3.1)	12(7.5)	19(11.9)	34(21.3)	23(14.4)	24(15.0)	69(43.1)	55(34.4)	44(27.5)	35(21.9)	3.80(1.07)	3.42(1.25)	4.00(1)	4.00(2)
14	CC	3(1.9)	5(3.1)	12(7.5)	23(14.4)	15(9.4)	20(12.5)	64(40.0)	59(36.9)	66(41.3)	53(33.1)	4.11(0.98)	3.83(1.13)	4.00(1)	4.00(2)
8	SS	50(31.3)	66(41.3)	80(50.0)	69(43.1)	14(8.8)	17(10.6)	12(7.5)	6(3.8)	4(2.5)	2(1.3)	2(0.96)	1.81(0.86)	2.00(1)	2.00(1)
12	SS	30(18.8)	60(37.5)	54(33.8)	45(28.1)	21(13.1)	21(13.1)	45(28.1)	26(16.3)	10(6.3)	8(5.0)	2.69(1.23)	2.23(1.25)	2.00(1)	2.00(2)
13	SS	18(11.3)	36(22.5)	55(34.4)	51(31.9)	29(18.1)	29(18.1)	46(28.7)	35(21.9)	12(7.5)	9(5.6)	2.87(1.17)	2.56(1.21)	3.00(1)	2.00(2)
16	SS	26(16.3)	53(33.1)	52(32.5)	57(35.6)	28(17.5)	24(15.0)	43(26.9)	18(11.3)	11(6.9)	8(5.0)	2.76(1.21)	2.19(1.16)	3.00(1)	2.00(2)
11	Mod	-	2(1.3)	7(4.4)	15(9.4)	8(5.0)	18(11.3)	51(31.9)	48(30.0)	94(58.8)	77(48.1)	4.45(0.78)	4.14(1.03)	5.00(1)	4.00(1)
15	Mod		3(1.9)	7(4.4)	10(6.3)	6(3.8)	14(8.8)	35(21.9)	44(27.5)	112(70.0)	89(55.6)	4.58(0.76)	4.29(0.99)	5.0(1)	5.00(1)

Note: Autonomy Support = item mean AS, Coercive Control = item mean CC, Modelling = item mean Mod., Healthy structure = item mean HS, Snack structure = item mean SS, SD=standard deviation, IQR=interquartile range. P= Parent Version, A=Adolescent Version, F= Frequency.

vi. Assumption Checking for CFA

Univariate and multivariate assumption checks were conducted prior to the Confirmatory Factor Analysis (CFA) as follows:

Univariate Normality

To assess univariate normality, histograms, and box-and-whisker plots were generated for all items within each scale. The majority of the items exhibited left skewness. The Kolmogorov-Smirnov and Shapiro-Wilk tests for normality indicated that all items had *P*-values below 0.001, suggesting significant deviations from normality. Visual inspection of the data further confirmed a degree of skewness. Additionally, normality was assessed using Kolmogorov-Smirnov tests, Q-Q plots, and extended Q-Q plots, all of which corroborated that none of the items were normally distributed. For more information, refer to APPENDIX T.

Multivariate normality using R-package lavaans

Mardia's tests for multivariate skewness and kurtosis yielded significant *P*-values ($p < 0.001$) across all items, indicating a violation of the assumption of multivariate normality. Furthermore, the Q-Q plot of Mahalanobis distance against chi-square quantiles corroborated this finding, as the data points exhibited substantial deviation from the line representing multivariate normality. Consequently, the Maximum Likelihood Robust (MLR) estimator was employed in place of the Maximum Likelihood (ML) estimator for the subsequent analyses (APPENDIX U).

vii. Measurement Model Analyses (CFA)

As demonstrated in Table 4.14, the Confirmatory Factor Analysis (CFA) of the 16-item, 5-factor Exploratory Factor Analysis (EFA) model indicated that the fit indices for Model-1 were within acceptable thresholds for the parent version. However, for the adolescent version, only the RMSEA (90% CI), CFI, and TLI met

the acceptable criteria. The modification indices (M.I.) and standardized residuals were examined to improve the fit indices. Following discussions with other researchers, model re-specification was undertaken. During this process, a few correlations between item residuals were added. Ultimately, the modified model exhibited generally acceptable fit indices: RMSEA (90% CI) = 0.050 (0.028, 0.069), CFI = 0.964, TLI = 0.953, and SRMR = 0.055, as shown in Table 4.14. For further details on the path diagram, refer to APPENDEX V.

Table 4.14 Summary of The Adolescent Food Parenting Questionnaire model fit indices (*n*=160)

CFA	**RMSEA *P*-Value (90% CI)**		**CFI**		**TLI**		**SRMR**	
Model	**P**	**A**	**P**	**A**	**P**	**A**	**P**	**A**
Model-1	0.044(0.020,0.063)	0.071(0.052,0.089)	0.975	0.936	0.968	0.918	0.054	0.060
Model-2	-	0.050(0.028,0.069)	-	0.964	-	0.953	-	0.055

Note; CFA= Confirmatory Factor Analysis, RMSEA= Relative Mean Squared Error, CI= Confidence Interval, CFI= Comparative Fit Index, TLI= Tucker-Lewis Index, SRMR= Standard Root Mean Square Residual, P= Parent, A= Adolescent.
Model-2 with additional correlated items residual for adolescent version; Q1 with Q2, Q8 with Q13, Q12 with Q16.

viii. Construct Validity for CFA study

The standardized factor loadings exceeding the 0.40 criterion are presented in Table 4.15.Each of the five components exhibited composite reliability (CR) values greater than 0.70, demonstrating satisfactory construct reliability. Although the average variance extracted (AVE) for the adolescent version did not reach the recommended threshold of 0.50 for domains like autonomy supportive and healthy structure, the CR values surpassed the suggested value of 0.60. Consequently, the measurement model's convergent validity is considered adequate.

Table 4.15 Standardized factor loading, AVE, and CR of AFP measurement model (*n*=160)

Item No.	Item	Parent (Model)			Adolescent (Model2)		
		λ	AVE	CR	λ	AVE	CR
1	AS	0.750	0.517	0.811	0.710	0.467	0.723
2	AS	0.750			0.570		
5	AS	0.680			0.770		
9	AS	0.700			0.670		
3	HS	0.950	0.612	0.754	0.710	0.466	0.608
6	HS	0.620			0.620		
4	CC	0.850	0.694	0.904	0.750	0.622	0.867
7	CC	0.900			0.810		
10	CC	0.810			0.790		
14	CC	0.770			0.790		
8	SS	0.550	0.662	0.896	0.730	0.652	0.921
12	SS	0.870			0.850		
13	SS	0.890			0.840		
16	SS	0.890			0.780		
11	Mod	0.750	0.746	0.855	0.740	0.607	0.753
15	Mod	0.970			0.810		

Note: λ=Standardized Factor Loading, AVE= Average Variance Extracted, CR =Construct Reliability, Autonomy Support = item mean AS, Coercive Control = item mean CC, Modelling = item mean Mod., Healthy structure = item mean HS, Snack structure.

The correlation values between the factors ranged from 0.00 to 0.38, all of which were statistically significant, as shown in Table 4.16 the AFPQ-A demonstrated discriminant validity for parents and adolescents, evidenced by correlation values below 0.85 for both versions.

Table 4.16 Discriminant Validity Among Latent Variables of Confirmatory Factor Analysis for the Adolescent Food Parenting Questionnaire (*n*=160)

	Item	1		2		3		4		5	
				P	A	P	A	P	A	P	A
1	AS	1	1	0.09	0.22**	0.23**	0.25**	0.12	0.14	0.24**	0.38**
2	HS			1	1	0.16*	0.14	0.02	0.07	0.11	0.13
3	CC					1	1	0.00	0.10	0.21**	0.23**
4	SS							1	1	0.15	0.05
5	Mod									1	1

Note: Constructs/ Correlation coefficient, r (Spearman's rho), **=statistically significant at p<0.001, *= statistically significant at p<0.05, Autonomy Support = item mean AS, Coercive Control = item mean CC, Modelling = item mean Mod., Healthy structure = item mean HS, Snack structure.

4.2.3(c) Reliability Study for BEVQ

i. Preliminary Data Screening

Missing Data

The percentage of missing data was calculated for each questionnaire item. No items were removed as none exceeded a 5% missing data threshold. Although several items had missing data, the test-retest questionnaires exhibited a very low percentage of missing data (ranging from 1.20% to 3.60%). Therefore, observations with missing data were retained for analysis.

Outliers

A boxplot was used to investigate the univariate outlier for each numerical variable, including age, anthropometric measures, and questionnaire items (BEVQs). (APPENDIX S)

ii. Checking Assumptions for Paired T-test

A histogram was employed to assess the distribution of total milk, total sugar-sweetened beverages, and total beverage scores, ensuring the normality of score differences. As illustrated in APPENDIX W, the normality assumption was met, as the histogram indicated that the differences in scores across all research variables followed a normal distribution.

iii. Response Rate in Intraclass Correlation Coefficient (ICC) Study

During the initial questionnaire of the screening process, 98 out of 160 participants met the eligibility criteria. All 102 individuals were invited to participate in the first test study; however, 15 participants dropped out. Consequently, the ICC data analysis was conducted using 83 fully completed questionnaires, representing a completion rate of 84.6% among those who initially agreed to participate. The respective test-retest participation rates were 60.6% and 85.7%. Despite this, the data collection for this phase did not achieve the intended sample size of 87 participants, excluding the dropout rate.

iv. Socio-Demographic Characteristics of the Study Participants

The study included 83 adolescents with a mean age of 16.72 years (SD = 0.75), ranging from 16.0 to 18.7 years, as detailed in Table 4.17. The sample was nearly evenly divided by gender, with 54.2% boys and 45.8% girls. Participants attended various secondary schools. Socio-economic status (SES) varied, with fathers predominantly holding lower professional or skilled worker positions (47.0%), and mothers mostly being unskilled workers (80.7%). Only 18.1% of fathers were in high professional roles. SES scores indicated that 18.1% of families were classified as high SES, 50.6% as moderate SES, and 31.3% as low SES, with a mean SES score of 99.98 (SD = 20.07), ranging from 57 to 142.

Table 4.17 Distribution of Participants in the ICC (BEVQ-A) Studies Based on Sociodemographic Variables (*n*= 83 for ICC)

Sociodemographic variables			**ICC**	
			F. (%)	
Adolescent	Age (year)	Mean, and SD	16.72, 0.75	
		(Min. - Max.)	(16.0-18.7)	
	Sex	Boy	45 (54.2)	
		Girl	38 (45.8)	
	Secondary school for governmental[1] and private[2]	AL-Mustafaa[1]	26 (31.3)	
		AL-Ghasaq[1]	21 (25.3)	
		AL-Zahraa[2]	20 (24.1)	
		Nur Almujtabaa[2]	16 (19.3)	
Socio-Economic Status (SES)			Father, F. (%)	Mother, F. (%)
Occupation of parent	High professional, and managerial jobs as doctors, engineers, professors, large employers, directors of business, land owners		15(18.1)	-
	Lower Lower professionals, skilled and semiskilled workers as school, teachers, clerical workers, owners of small businesses, military men, and policemen.		39(47.0)	16(19.3)
	Unskilled workers as labourers, farmers casual workers, unemployed, and retired.		29(34.9)	67(80.7)
The educational level of the parent	Illiterate		3(3.6)	10(12.0)
	Read, and write		3(3.6)	3(3.6)
	Primary graduate		23(27.7)	21(25.3)
	intermediate graduate		22(26.5)	16(19.3)
	Secondary graduate		8(9.6)	15(18.1)
	College Graduate		24(28.9)	18(21.7)
Crowding index	< 2 (up to)		59 (71.1)	
	< 4 (up to)		21 (25.3)	
	≥ 4		3 (3.6)	
		Mean, SD	1.77, 1.07	
		(Min. - Max.)	(0.44-7.50)	

Table 4.17: Continued

Sociodemographic variables		ICC
		F. (%)
Property	Owns a house, a car, and all of the household assets.	47 (56.6)
	The house is rented, with or without a car, and most of the household assets	27 (32.5)
	The house is shared, with another family, no car, and some of the household assets	9 (10.8)
Socio-Economic Status (SES)	High (121 – 150)	15 (18.1)
	Moderate (90 - 120)	42 (50.6)
	Low (89 -, and less)	26 (31.3)
	Mean, and SD	99.98, 20.07
	(Min. - Max.)	(57-142)

Note: CFA for Confirmatory Factor Analysis, F. (%) for Frequency (Percentage), SD for Standard Deviation, and (Min. - Max.) for the range from Minimum to Maximum.

v. Anthropometric Measurements in ICC Study

The distribution of participants in the intraclass correlation study (Test-retest) by adolescent BMI z-score for age is shown in Table 4.18. The final sample size comprised 83 participants. The mean adolescent BMI z-score was 0.59 (SD 1.70), with values ranging from -3.75 to 4.03. Within this cohort, 51.8% had normal weight, 22.9% were overweight, 13.3% were obese, 4.8% were underweight, and 7.2% were severely obese.

Table 4.18 Distribution of Participants in the ICC (BEVQ) Studies Based on BMI for age (*n*= 83 for ICC)

Participant	Categorical	CFA
		F. (%)
Adolescent BMI z-score	Underweight: BMI z-score < -2 SD	4 (4.8)
	Normal weight: BMI z-score ≥ -2 SD and ≤ +1 SD	43 (51.8)
	Overweight: BMI z-score > +1 SD and ≤ +2	19 (22.9)
	Obese: BMI z-score > +2 ≤ +3 SD	11 (13.3)
	Severely Obese: BMI z-score > +3 SD	6 (7.2)
	Mean, SD	0.59, 1.70
	(Min. - Max.)	(-3.75 - 4.03)

Note: BMI= Body Mass Index, CFA= Confirmatory Factor Analysis, SD= Stander Deviation, Min= Minimum, Max= Maximum, Missing values for fathers (f) were 11.9% and for mothers (m) were 9.4% within the study sample.

vi. Reliability Measurements for BEVQ-A

To ensure the reliability of the BEVQ-A, five tests were employed: mean differences, intraclass correlation coefficients (ICC), Cronbach's alpha, correlation analyses, and Bland-Altman plots.

Mean Differences Between 1st and 2nd Beverage Questionnaires

The analysis of beverage consumption between the first and second Beverage Questionnaires (BEVQs), as shown in Table 4.19, revealed generally consistent intake patterns across various beverage types for 83 participants. Total beverage intake revealed mean differences of 1.540 fl oz (*P*-value = 0.298), 47.733 gm (*P*-value = 0.286), and 28.567 kcal (*P*-value = 0.058), indicating overall stable consumption patterns. For total sugar-sweetened beverages (SSB), there was a significant increase in grams, with a mean difference of 147.432 gm (*P*-value = 0.007), while changes in fluid ounces (-0.183 fl oz, *P*-value = 0.906) and kilocalories (7.244 kcal, *P*-value = 0.712) were not significant.

Water consumption exhibited a slight mean difference of -0.578 fl oz (95% CI: -1.895, 0.738) and -21.419 gm (95% CI: -58.713, 15.875), with no significant changes ($p > 0.05$). Fresh fruit juice (100%) and sweetened juice beverages showed similar stability, with mean differences of 0.444 fl oz (95% CI: -0.201, 1.089) and -0.465 fl oz (95% CI: -1.387, 0.457), respectively, also indicating no significant changes.

For milk varieties, including whole milk, reduced-fat milk, low-fat milk, and nut milk, the mean differences were negligible and statistically insignificant, such as 0.003 fl oz (95% CI: -0.578, 0.585) for whole milk and 0.041 fl oz (95% CI: -0.622, 0.704) for nut milk. Regular soft drinks and diet or artificially sweetened carbonated drinks also showed minor and non-significant mean differences of 0.801 fl oz (95% CI: -0.622, 2.225) and 0.282 fl oz (95% CI: -0.586, 1.150), respectively.

The consumption of energy and sports drinks, both regular and diet, as well as sweet tea and black tea or coffee, displayed consistent intake patterns with no significant differences between the two questionnaires. For example, regular energy

and sports drinks had a mean difference of 0.220 fl oz (95% CI: -0.696, 1.136), and sweet tea had a mean difference of 0.633 fl oz (95% CI: -0.365, 1.632).

Overall, most beverage types exhibited no significant differences between the first and second BEVQs, reflecting reliable and consistent reporting of beverage intake among participants. The only significant change observed was in the total sugar-sweetened beverages measured in grams.

Table 4.19 Mean differences between 1st and 2nd Beverage Questionnaires (BEVQs) (*n*=83) Variables

Type of beverages		**BEVQ1 Mean (SD)**	**BEVQ2 Mean (SD)**	**[a] Mean Difference (95%, CI)**	**[b]t (df=82)**	***P*-value**
Water	fl oz	24.53 (8.11)	25.11 (7.40)	-0.578 (-1.895,0.738)	-0.874	0.385
	gm	726.82 (240.46)	748.24 (207.711)	-21.419 (-58.713,15.875)	-1.143	0.257
Fresh fruit juice 100%	fl oz	4.77 (5.67)	4.33 (5.67)	0.444 (-0.201,1.089)	1.369	0.175
	kcal	84.36 (100.21)	76.51 (91.83)	7.846 (-3.556,19.250)	1.369	0.175
	gm	147.19 (174.84)	133.50 (160.22)	13.690 (-6.206,33.586)	1.369	0.175
Sweetened Juice Beverage/ local Drink	fl oz	6.46 (6.61)	6.92 (7.63)	-0.465 (-1.387,0.457)	-1.003	0.319
	kcal	92.44 (94.63)	99.09 (109.22)	-6.651 (-19.846,6.540)	-1.003	0.319
	gm	198.33 (203.02)	212.60 (234.34)	-14.270 (-42.573,14.033)	-1.003	0.319
Whole Milk: red cap, Reduced Fat Milk 2%: purple cap, or Chocolate Milk	fl oz	3.31 (3.98)	3.30 (3.77)	0.003 (-0.578,0.585)	0.012	0.991
	kcal	65.50 (78.85)	65.43 (74.74)	0.068 (-11.454,11.590)	0.012	0.991
	gm	100.89 (121.46)	100.37 (120.22)	0.104 (-17.644,17.854)	0.012	0.991
Low Fat 1%: green cap, Fat-Free/Skim Milk: light blue cap, Buttermilk or Soy Milk	fl oz	4.71 (6.41)	4.69 (60.1)	0.344 (-0.508,1.197)	0.803	0.424
	kcal	57.06 (77.58)	52.89 (62.76)	4.165 (-6.155,14.485)	0.803	0.424
	gm	143.74 (195.42)	133.25 (17.35)	10.492 (-15.505,36.490)	0.803	0.424
Nut milk	fl oz	1.16 (4.51)	1.12 (2.49)	0.041 (-0.622,0.704)	0.123	0.902
	kcal	11.40 (44.20)	10.99 (24.45)	0.404 (-6.098,6.907)	0.123	0.902
	gm	35.46 (137.49)	34.20 (76.07)	1.259 (18.966,21.484)	0.123	0.902

Type of beverages		BEVQ1 Mean (SD)	BEVQ2 Mean (SD)	[a] Mean Difference (95%, CI)	[b] t (df=82)	*P*-value
Regular Soft Drinks	fl oz	9.88 (10.15)	9.08 (8.49)	0.801 (-0.622,2.225)	1.119	0.266
	kcal	131.53 (135.12)	119.96 (113.59)	11.569 (-7.254,30.393)	1.223	0.225
	gm	296.69 (304.79)	272.66 (254.70)	24.030 (-18.688,66.75)	1.119	0.266
Regular Energy, and Sports Drinks	fl oz	1.39 (5.63)	1.17 (2.65)	0.220 (-0.696,1.136)	0.478	0.634
	kcal	19.47 (78.95)	16.38 (37.16)	3.084 (-9.746,15.914)	0.478	0.634
	gm	43.18 (175.11)	36.34 (82.41)	6.840 (-21.615,35.296)	0.478	0.634
Diet or Artificially Sweetened Carbonated Drinks, Energy and Sports Drinks	fl oz	2.27 (6.38)	1.99 (4.34)	0.282 (-0.586,1.150)	0.647	0.520
	kcal	0.68 (0.21)	0.59 (1.30)	0.084 (-0.175,0.345)	0.647	0.520
	gm	67.90 (190.35)	59.49 (129.34)	8.411 (-17.462,34.286)	0.647	0.520
Sweet Tea	fl oz	9.66 (9.21)	9.03 (7.05)	0.633 (-0.365,1.632)	1.261	0.211
	kcal	96.70 (92.0.8)	90.36 (70.54)	6.333 (-3.656,16.324)	1.261	0.211
	gm	302.17 (287.74)	282.37 (220.46)	19.793 (-11.427,51.013)	1.261	0.211
Black Tea or Coffee (no creamer or milk)	fl oz	3.07 (5.64)	2.90 (3.57)	0.165 (-0773,1.103)	0.350	0.727
	kcal	10.80 (23.98)	9.71 (16.06)	1.084 (-3.355,5.525)	0.486	0.628
	gm	90.99 (70.54)	86.09 (105.77)	4.890 (-22.890,32.672)	0.350	0.727
Tea or Coffee (with milk, and/ or creamer)	fl oz	2.41 (3.88)	2.37 (3.53)	0.034 (-0.475,0.544)	0.134	0.894
	kcal	22.09 (33.87)	22.22 (35.99)	-0.127 (-5.296,5.042)	-0.049	0.961
	gm	71.18 (114.32)	70.17 (104.27)	1.015 (-14.028,16.059)	0.134	0.894
Total Milk	fl oz	9.19 (9.90)	8.78 (8.94)	0.388 (-0.519,1.297)	0.852	0.397
	kcal	133.97 (134.29)	129.32 (128.20)	4.638 (-7.919,17.195)	0.735	0.465
	gm	280.10 (301.75)	268.24 (272.60)	11.856 (-15.836,39.549)	0.852	0.397
Total sugar-sweetened beverages	fl oz	30.29 (23.25)	30.49 (21.23)	-0.183 (-3.281,2.913)	-0.118	0.906
	kcal	364.48 (276.25)	357.47 (253.91)	7.244 (-31.722,46.211)	0.370	0.712
	gm	951.42	803.99	147.432	2.779	0.007

Table 4.19: Continued

Type of beverages		BEVQ1 Mean (SD)	BEVQ2 Mean (SD)	[a] Mean Difference (95%, CI)	[b]t (df=82)	*P*-value
		(717.81)	(549.00)	(41.887,252.977)		
Total beverages	fl oz	73.48 (36.75)	71.93 (33.82)	1.540 (-1.388,4.469)	1.046	0.298
	kcal	593.43 (411.14)	564.86 (396.80)	28.567 (-1.036,58.170)	1.920	0.058
	gm	2218.99 (1128.32)	2171.25 (1027.68)	47.733 (-40.726,136.193)	1.073	0.286

[a] Mean difference according to a paired sample t-test.
[b]t-statistic., and Sig.= Significant, Kcal= Kilocalories, fl oz= Fluid ounces, gm= Gram.

Intraclass Correlation Coefficients (ICC), Cronbach's alpha, and Correlations Between two BEVQs

The reliability analysis of the Beverage Questionnaires (BEVQs) using Intraclass Correlation Coefficients (ICC), Cronbach's alpha, and Pearson correlations, as presented in Table 4.20, demonstrates varying degrees of reliability across different beverage types. The total consumption of beverages, sugar-sweetened beverages (SSB), and milk across fluid ounces (fl oz), grams (gm), and kilocalories (kcal) demonstrated robust reliability. Total milk consumption, for instance, showed excellent reliability with an ICC of 0.929 (95% CI: 0.892, 0.953) for fluid ounces, 0.963 for grams, and 0.942 (95% CI: 0.911, 0.962) for kilocalories, all indicating strong consistency in reporting. Total sugar-sweetened beverages displayed good reliability with an ICC of 0.799 (95% CI: 0.705, 0.685) for fluid ounces and 0.698 (95% CI: 0.558, 0.797) for grams, accompanied by moderate to strong correlations (r_p = 0.800 and r_p = 0.740, respectively). Overall, the total beverage intake also exhibited excellent reliability with ICCs of 0.903 (95% CI: 0.854, 0.936) for fluid ounces, 0.949 for grams, and 0.905 (95% CI: 0.856, 0.937) for kilocalories, underscoring consistent and dependable reporting across all measures.

Water showed good reliability with ICCs of 0.699 (95% CI: 0.571, 0.794) for fluid ounces and 0.710 (95% CI: 0.586, 0.802) for grams, and moderate to strong correlation with Pearson coefficients of 0.702 and 0.719, respectively. Fresh fruit juice

(100%) exhibited excellent reliability, with ICCs of 0.851 (95% CI: 0.779, 0.901) across all measures (fl oz, kcal, gm) and perfect correlation (r_p = 0.856).

Sweetened juice beverages demonstrated good reliability with ICCs of 0.825 (95% CI: 0.742, 0.883) and perfect correlation (r_p = 0.834). Whole milk and reduced-fat milk also showed good reliability with ICCs of 0.766 (95% CI: 0.660, 0.842) and perfect correlation (r_p = 0.765). Low-fat milk, fat-free/skim milk, buttermilk, and soy milk had ICCs of 0.776 (95% CI: 0.674, 0.849) and perfect correlation (r_p = 0.793).

Nut milk presented moderate reliability with ICCs of 0.655 (95% CI: 0.512, 0.763) and perfect correlation (r_p = 0.770). Regular soft drinks showed good reliability with ICCs of 0.757 (95% CI: 0.648, 0.836) and perfect correlation (r_p = 0.770), while diet or artificially sweetened carbonated drinks demonstrated similar reliability with ICCs of 0.736 (95% CI: 0.620, 0.821) and perfect correlation (r_p = 0.790).

Regular energy and sports drinks showed moderate reliability with ICCs of 0.549 (95% CI: 0.379, 0.683) and moderate to strong correlation (r_p = 0.707). Sweet tea exhibited excellent reliability with ICCs of 0.843 (95% CI: 0.768, 0.896) and perfect correlation (r = 0.875). Black tea or coffee showed moderate reliability with ICCs of 0.588 (95% CI: 0.427, 0.713) for fluid ounces and fair reliability with an ICC of 0.506 (95% CI: 0.326, 0.650) for kilocalories. Tea or coffee with milk or creamer showed good reliability with ICCs of 0.804 (95% CI: 0.712, 0.869) and perfect correlation (r_p = 0.805).

Total milk consumption exhibited excellent reliability with ICCs of 0.929 (95% CI: 0.892, 0.953) and perfect correlation (r_p = 0.933). Total sugar-sweetened beverages showed good reliability with ICCs of 0.799 (95% CI: 0.705, 0.685) for fluid ounces and moderate to strong correlation (r_p = 0.740). Total beverages demonstrated excellent reliability with ICCs of 0.903 (95% CI: 0.854, 0.936) and perfect correlation (r_p = 0.907).

Overall, the BEVQs showed strong reliability for most beverage types, as indicated by high ICCs, Cronbach's alpha values, and Pearson correlations, suggesting consistent and reliable reporting of beverage intake among participants.

Table 4.20: Continued

Table 4.20 Intraclass correlation coefficients (ICC), Cronbach's alpha, and correlations between two BEVQs

Type of beverages		**ICC (95%, CI)[a]**	**α[b]**	**r_p[c]**
Water α	Fl oz	0.699 (0.571,0.794)	0.823	0.702
	gm	0.710 (0.586,0.802)	0.831	0.719
Fresh fruit juice 100%	Fl oz	0.851 (0.779,0.901)	0.920	0.856
	kcal	0.851(0.779,0.901)	0.920	0.856
	gm	0.851 (0.779,0.901)	0.920	0.856
Sweetened Juice Beverage/ local Drink	Fl oz	0.825 (0.742,0.883)	0.902	0.834
	kcal	0.825 (0.742,0.883)	0.902	0.834
	gm	0.825 (0.742,0.883)	0.902	0.834
Whole Milk: red cap, Reduced Fat Milk 2%: purple cap, or Chocolate Milk	Fl oz	0.766 (0.660,0.842)	0.866	0.765
	kcal	0.766 (0.660,0.842)	0.866	0.765
	gm	0.766 (0.660,0.842)	0.866	0.765
Low Fat 1%: green cap, Fat-Free/Skim Milk: light blue cap, Buttermilk or Soy Milk	Fl oz	0.776 (0.674,0.849)	0.874	0.793
	kcal	0.776 (0.674,0.849)	0.874	0.793
	gm	0.776 (0.674,0.849)	0.874	0.793
Nut milk	Fl oz	0.655 (0.512,0.763)	0.790	0.770
	kcal	0.655 (0.512,0.763)	0.790	0.770
	gm	0.655 (0.512,0.763)	0.790	0.770
Regular Soft Drinks	Fl oz	0.757 (0.648,0.836)	0.862	0.770
	kcal	0.760 (0.653,0.838)	0.865	0.773
	gm	0.757 (0.648,0.836)	0.862	0.770
Regular Energy, and Sports Drinks	Fl oz	0.549 (0.379,0.683)	0.709	0.707
	kcal	0.549 (0.379,0.683)	0.709	0.707
	gm	0.549 (0.379,0.683)	0.709	0.707
Diet or Artificially Sweetened Carbonated Drinks, Energy and Sports Drinks	Fl oz	0.736 (0.620,0.821)	0.847	0.790
	kcal	0.736 (0.620,0.821)	0.847	0.790
	gm	0.736 (0.620,0.821)	0.847	0.790
Sweet Tea (with sugar)	Fl oz	0.843 (0.768,0.896)	0.916	0.875
	kcal	0.843 (0.768,0.896)	0.916	0.875
	gm	0.843 (0.768,0.896)	0.916	0.875
Black Tea or Coffee (no creamer or milk)	Fl oz	0.588 (0.427,0.713)	0.739	0.648
	kcal	0.506 (0.326,0.650)	0.670	0.545
	gm	0.588 (0.427,0.713)	0.739	0.643
Tea or Coffee (with milk, and/ or creamer)	Fl oz	0.804 (0.712,0.869)	0.890	0.805
	kcal	0.773 (0.669,0.847)	0.870	0.772
	gm	0.804 (0.712,0.869)	0.890	0.805
Total Milk	Fl oz	0.929 (0.892,0.953)	0.963	0.933
	kcal	0.942 (0.911,0.962)	0.971	0.944
	gm	0.929 (0.893,0.954)	0.963	0.934
Total sugar-sweetened beverages	Fl oz	0.799 (0.705,0.685)	0.887	0.800
	kcal	0.775 (0.673,0.849)	0.872	0.776
	gm	0.698 (0.558,0.797)	0.833	0.740
Total beverages	Fl oz	0.903 (0.854,0.936)	0.949	0.907
	kcal	0.905 (0.856,0.937)	0.950	0.905
	gm	0.903 (0.854,0.936)	0.949	0.907

[a]Intraclass Correlation Coefficient was measured by a model that is two-way mixed and the type is consistency, additionally, the ICC value is based on single measures.
[b]the second reliability test was Cronbach's Alpha, [c]Pearson correlations coefficient

Bland and Altman Plot Statistics for BEVQs

The table indicates that while there are variations in the mean differences and standard deviations across different beverage measurements, the overall mean difference percentages and standard deviation percentages reflect consistent agreement between the test-retest measurements, underscoring the reliability of the BEVQ in assessing beverage consumption, as shown in Table 4.21.

Table 4.21 Bland and Altman plot statistics for BEVQ

Item	LOA	Unit	DM	SD	MDP	SDP
Total milk beverage difference fl oz	Upper Lower	7.76 -8.54	-0.39	4.16	-3.33	94.37
Total milk beverage difference kcal	Upper Lower	108.08 -117.36	-4.64	57.51	0.19	95.10
Total milk beverage gram	Upper Lower	236.72 -260.44	-11.86	126.83	-3.33	94.37
Total sugar-sweetened beverages difference fl oz	Upper Lower	17.57 -19.83	-1.12	9.54	1.17	39.18
Total sugar-sweetened beverages difference kcal	Upper Lower	194.12 -214.37	-10.12	104.21	0.83	40.20
Total sugar-sweetened beverages difference gram	Upper Lower	449.88 -499.16	-24.64	242.10	0.25	44.19
Total beverages difference fl oz	Upper Lower	23.55 -25.63	-1.04	12.54	1.89	25.87
Total beverages difference kcal	Upper Lower	216.02 -259.40	-21.68	121.28	-3.91	30.21
Total beverages difference gram	Upper Lower	707.72 -772.71	-32.49	377.66	1.83	25.81

Note: Kcal= Kilocalories, fl oz= fluid ounces, DM= Difference Mean, SD=Standard Deviation, MDP= Mean Difference Percentage, SDP= Standard Deviation Percentage, LOA= Limit of agreement.

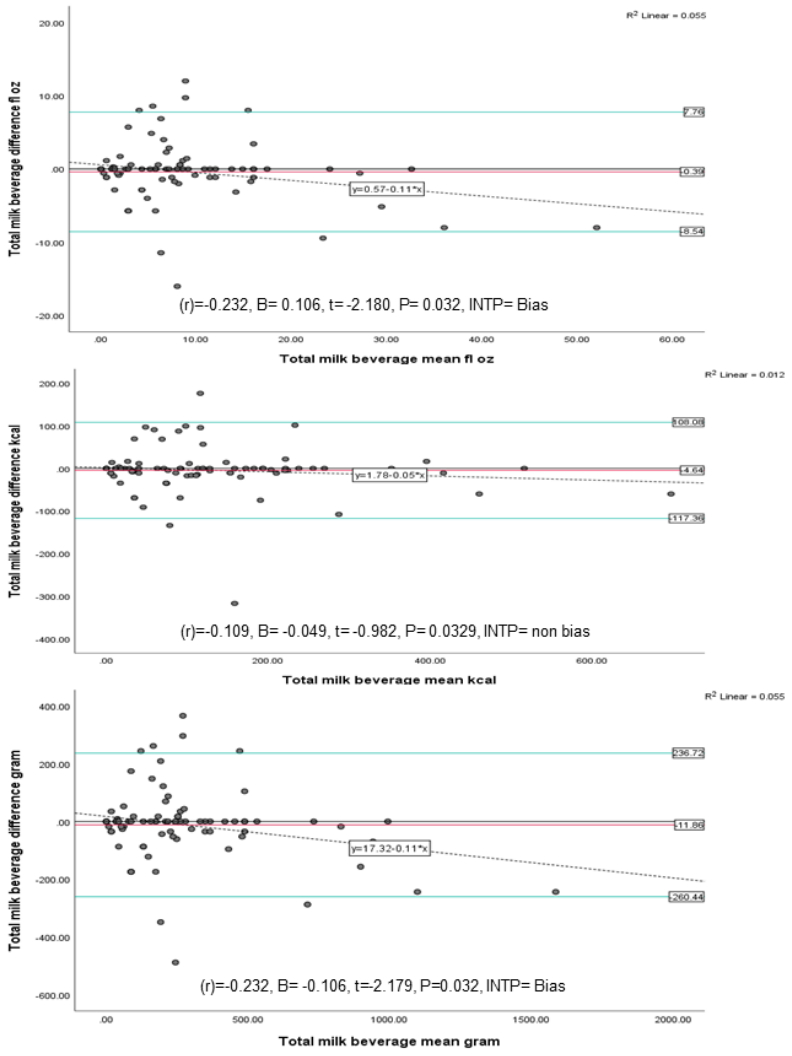


Figure 4.4 Bland-Altman plot test-retest of total milk.

Note: The mean of both measurements is plotted against the difference of both measurements (calculated as first measurement minus second measurement), (r) = Pearson's correlation, B = Unstandardized Coefficients Beta, t = t-value, Probability, INTP= Interpretation.

Figure 4.4 presents Bland-Altman plots evaluating the test-retest reliability of total milk beverage measurements in fluid ounces (fl oz), kilocalories (kcal), and grams (g). The top plot for fluid ounces reveals a small but significant systematic bias (r_p = -0.232, β = 0.106, t = -2.180, *P*-value = 0.032). The middle plot for kilocalories shows a negligible systematic difference (r_p = -0.109, β = -0.049, t = -0.982, *P*-value = 0.329). The bottom plot for grams also indicates a small significant bias (r_p = -0.232, β = -0.106, t = 2.179, *P*-value = 0.032). These findings highlight slight systematic biases in fluid ounces and grams measurements, with negligible bias in kilocalories, reinforcing the reliability of dietary assessments involving milk beverage consumption.

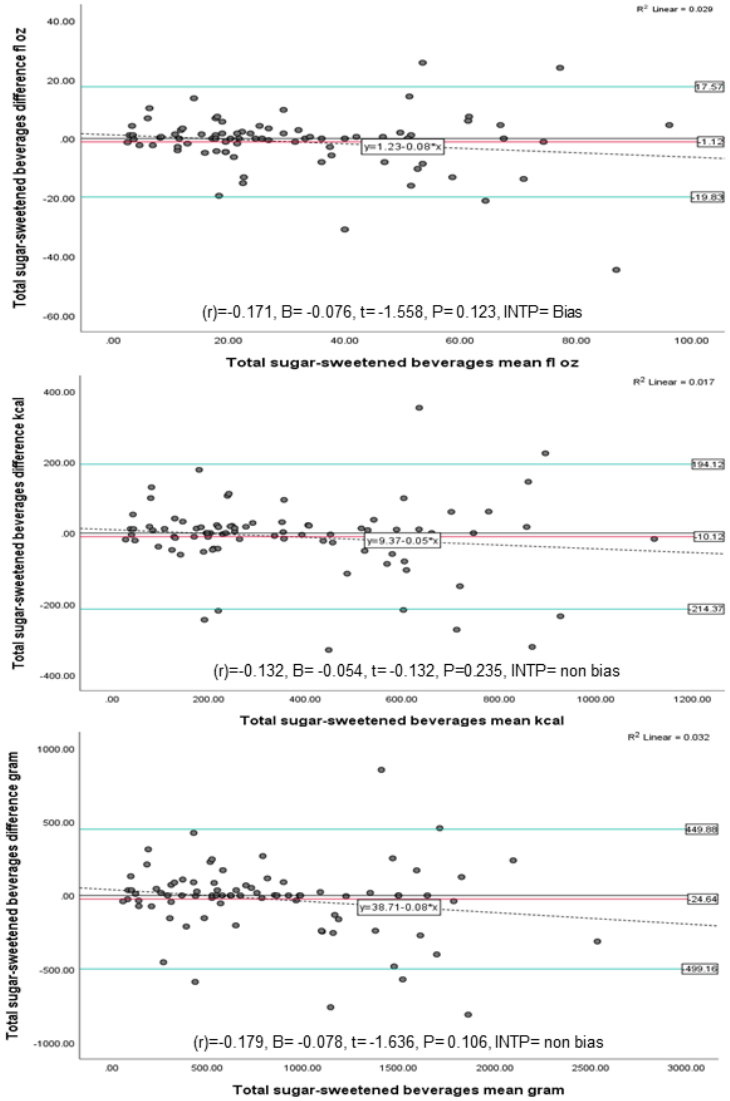


Figure 4.5 Bland-Altman plot test-retest of total sugar-sweetened beverages.

Note: The mean of both measurements is plotted against the difference of both measurements (calculated as first measurement minus second measurement), (r) = Pearson's correlation, B = Unstandardized Coefficients Beta, t = t-value, Probability, INTP= Interpretation.

Figure 4.5 displays Bland-Altman plots assessing the test-retest reliability of total sugar-sweetened beverage measurements. The top plot for fluid ounces shows no significant systematic bias (r_p = -0.171, β = -0.076, t = -1.558, *P*-value = 0.123). The middle plot for kilocalories also reveals no significant systematic difference (r_p = -0.132, β = -0.054, t = -0.132, *P*-value = 0.235). Similarly, the bottom plot for grams indicates no significant bias (r_p = -0.179, β = -0.078, t = -1.636, *P*-value = 0.106). These results suggest that the measurements of total sugar-sweetened beverages across these units exhibit no significant systematic biases, affirming the consistency and reliability of the assessments.

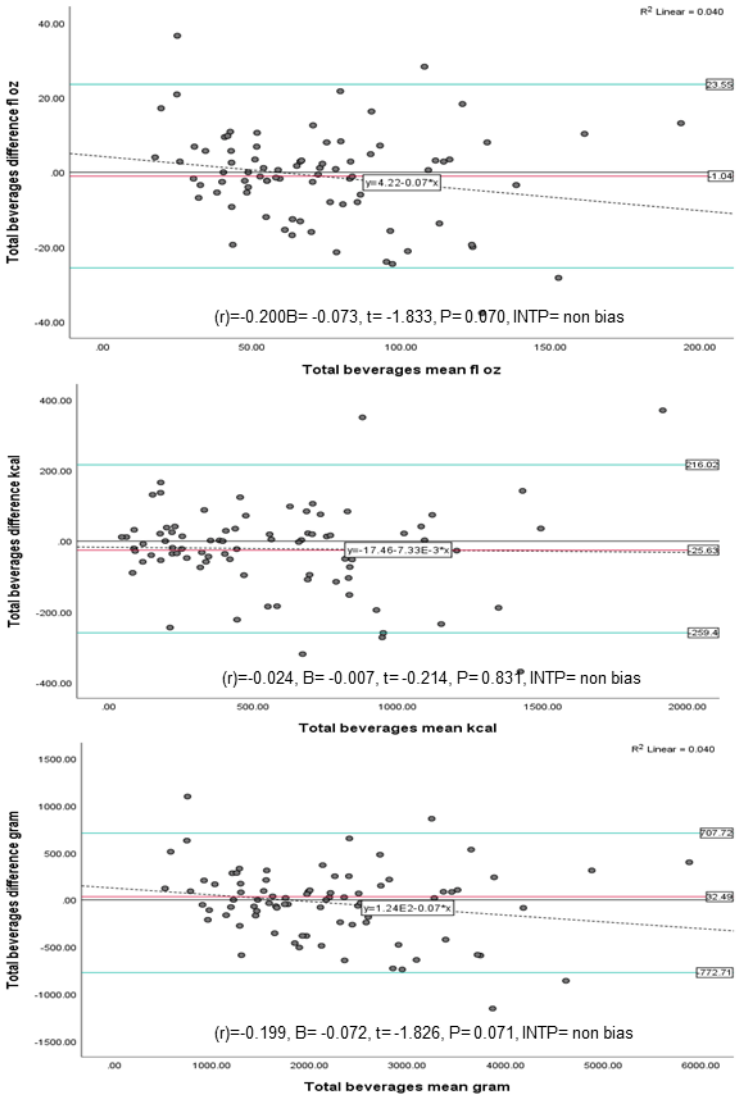


Figure 4.6 Bland-Altman plot test-retest of total beverages.

Note: The mean of both measurements is plotted against the difference of both measurements (calculated as first measurement minus second measurement), (r) = Pearson's correlation, B = Unstandardized Coefficients Beta, t = t-value, Probability, INTP= Interpretation.

Figure 4.6 illustrates Bland-Altman plots assessing the test-retest reliability of total beverage measurements. The top plot for fluid ounces indicates no significant systematic bias (r_p = -0.200, β = -0.073, t = -1.833, *P*-value = 0.070). The middle plot for kilocalories also shows no significant systematic difference (r_p = -0.024, β = -0.007, t = -0.214, *P*-value = 0.831). The bottom plot for grams indicates no significant bias (r_p = -0.199, β = -0.072, t = -1.826, *P*-value = 0.071). These results suggest that the measurements of total beverages across these units exhibit no significant systematic biases, supporting the consistency and reliability of the BEVQ in assessing beverage consumption.

In summary, Bland-Altman plots evaluation showed small but significant systematic biases for milk beverages in fl oz and grams, with negligible bias in kcal, indicating reliable dietary assessments, while sugar-sweetened beverages and total beverages exhibited no significant systematic biases across all units, affirming consistent and reliable measurements.

4.3 Results of the Phase II

The measures involved in this phase included examining the interactions between sociodemographic characteristics and food parenting practices (FPP) with risk factors such as dietary behavior, physical activity, and sedentary behavior, contributing toward overweight and obesity among adolescents. This phase also entailed determining the levels and proportions of these variables, analyzing path associations, developing and validating conceptual frameworks (models) to assess the risk of obesity among Iraqi adolescents based on these measures. The comprehensive analysis aimed to elucidate the complex interplay between these factors, thereby providing a robust basis for understanding the determinants of adolescent obesity within this demographic context.

4.3.1 Socio-demographic characteristics of the study participants

The Table 4.22 provides a comprehensive overview of the sample distribution according to various sociodemographic variables among 506 participants. The mean age of the adolescents was 16.53 years, with a standard deviation of 0.70, and the majority were males (47.8%). The distribution between governmental and private secondary schools is nearly equal, with 49.6% and 50.4%, respectively. Urban residence predominates (89.3%), and the average household income per thousand IQD was 1032.60. Parental data reveals that fathers have a higher representation in professional and managerial occupations (11.7%) compared to mothers (0.4%), who

predominantly occupy unskilled positions (82.0%). Educational attainment shows a disparity, with a higher percentage of fathers being college graduates (15.2%) compared to mothers (10.9%). The crowding index indicates that most families consisted of two people per room (72.9%). Property ownership was relatively low, with only 13.6% owning their homes. Socio-economic Status (SES) categorization reveals that 90.5% of the participants fall into the lower SES bracket, with an overall SES mean score of 88.39, highlighting the socio-economic challenges faced by the majority of the sample population.

Table 4.22 Sample distribution according to sociodemographic variables (SDGVs) for participants in the study (*n*=506)

SDGVs	**Variable**	**Category**	**F. (%)**	**Mean, SD (Min - Max)**
Adolescent	Age (year)			16.53, 0.70 (16.0-18.11)
	Sex	Boy	264 (47.8)	
		Girl	83 (52.2)	
	Secondary school type	Governmental	251 (49.6)	
		Private	255 (50.4)	
	Residence	Urban	452 (89.3)	
		Rural	54 (10.7)	
	Household income per thousand IQD			1032, 601.98 (150 – 3500)
	No. siblings			3.86, 1.82 (0 – 14)
Parent	Age (year)	Father		46.37, 7.17 (35-69)
		Mother		44.10, 5.80 (32-69)

Socio-Economic Status (SES) Scale		Father, F. (%)	Mother, F. (%)
Occupation of parent	High professional, and managerial jobs as doctors, engineers, professors, large employers, directors of business, land owners	59(11.7)	2(0.4)
	Lower professionals, skilled and semiskilled workers as school, teachers, clerical workers, owners of small businesses, military men, and policemen.	276(54.5)	89(17.6)
	Unskilled workers as labourers, farmers casual workers, unemployed, and retired.	171(33.8)	415(82.0)
The educational level of the parent	Illiterate	33(6.5)	78(15.4)
	Read, and write	147(29.1)	167(33.0)
	Primary graduate	119(23.5)	102(20.2)
	intermediate graduate	63(12.5)	67(13.2)

Table 4.22: Continued

SDGVs	Variable	Category	F. (%)	Mean, SD (Min - Max)
	Secondary graduate		67(13.2) 37(7.3)	
	College Graduate		77(15.2) 55(10.9)	
Crowding index		-2 (up to)	369 (72.9)	1.86, 1.14 (0.00-8.00)
		- 4 (up to)	118 (23.3)	
		≥ 4	19 (3.8)	
Property	Owns a house, a car, and all of the household assets.		258 (51.0)	
	The house is rented, with or without a car, and most of the household assets		69 (13.6)	
	The house is shared, with another family, no car, and some of the household assets		179 (35.4)	
Socio-Economic Status (SES)	High (121 – 150)		48 (9.5)	88.39, 21.81 (36-150)
	Moderate (90 - 120)		183 (36.2)	
	Low (89 -, and less)		275 (54.3)	

4.3.2 Distribution of Dietary, Behavioral, and Anthropometric Variables Among Study Participants

The Table 4.23 provides a detailed analysis of various study variables among 506 participants,

4.3.2(a) Food Parenting Practices (FPP)

The study's findings, interpreted in the context of food parenting practices (FPP) as reported by both adolescents and parents, reveal key insights into the dynamics of eating behaviors at home. High scores in both healthy structure (FPP-Adolescent: 4.15; FPP-Parent: 4.50) and autonomy support (FPP-A: 4.08; FPP-P: 4.43) suggest that parents are actively promoting a structured and health-conscious food environment. These findings are supported by questionnaire items such as "My parents educate me about nutrition" and "There are always fruits and vegetables at home," indicating that parents prioritize educating their children about healthy eating and ensure the availability of nutritious foods. The strong alignment between adolescent and parental perceptions in these domains highlights effective parental engagement in fostering positive dietary habits through both education and the creation of a supportive home environment.

In contrast, coercive control scores were lower, particularly in the adolescent reports (FPP-A: 3.39; FPP-P: 3.75). This suggests that while parents enforce some rules related to food consumption, such as "My parents have clear rules about what I can snack on" and "My parents make sure I do not snack just before meals," these controlling behaviors are less prominent compared to their supportive practices. The difference in scores between adolescents and parents may reflect a divergence in how coercive control is perceived, with parents viewing their rules as more positive and necessary than adolescents do.

The low scores in snack structure (FPP-A: 2.19; FPP-P: 2.66) suggest that parental regulation of snacking behaviors is relatively limited. The items "My parents let me snack if I want to" and "My parents have clear rules about what I can snack on" indicate that parents allow more flexibility in snack consumption, which is reflected in the low mean scores in this domain. This lack of structure in snacking behaviors may be an area for improvement, as consistent and clear snack guidelines could contribute to healthier eating patterns among adolescents.

Finally, both adolescents and parents reported high scores in the modelling domain (FPP-A: 4.10; FPP-P: 4.50), which reflects parents' active role in demonstrating healthy eating behaviors. Items such as "My parents consciously eat vegetables or fruits when I'm around" and "My parents try to set a good example when it comes to eating fruits and vegetables" underscore the importance of parental modeling in promoting positive dietary habits. These high scores suggest that parents are successfully reinforcing healthy eating behaviors through their own actions, which is likely contributing to the overall positive dietary practices observed in their children.

In summary, the findings indicate that while parents are highly engaged in supporting healthy eating habits and modeling positive behaviors, there is less emphasis on controlling snack consumption. The differences in perceptions of coercive control between parents and adolescents suggest that greater communication

and consistency around food-related rules may help improve the alignment of parental intentions with adolescent understanding and behavior.

4.3.2(b) Dietary Behavior

The analysis of daily dietary intake patterns among participants reveals distinct variations in the consumption of breakfast, fruits, vegetables, milk products, snacks, and beverages. The mean score for daily breakfast consumption is 2.43 (SD 1.38), indicating that, on average, participants consumed breakfast between "some days" and "most days" over the past month. Fruit intake was slightly lower, with a mean score of 2.24 (SD 1.61), suggesting that participants consumed fruits approximately once or twice daily but not consistently across all days.

Vegetable intake followed a similar pattern, with a mean of 2.16 (SD 1.58), corresponding to moderate consumption, likely between one to two servings per day. Milk and milk product consumption yielded a mean score of 2.00 (SD 1.50), reflecting an average intake close to once per day, though the standard deviation indicates variability in intake across the sample.

Snack food intake presented the highest mean score of 3.14 (SD 1.38), indicating that participants consumed snack foods more frequently, often two to three times daily. This stands in contrast to the lower consumption of carbonated drinks, with a mean score of 2.14 (SD 1.65), and energy drinks, which had the lowest mean of 0.63 (SD 1.15), signifying that energy drinks were consumed infrequently, if at all, by most participants.

Finally, fast food intake averaged 2.17 (SD 1.58), implying that participants consumed fast food on approximately two days per week, although there was considerable variability in fast food consumption patterns. Overall, these results highlight a diet characterized by a moderate intake of essential food groups (fruits, vegetables, milk products) and a higher tendency toward snacking, with limited

consumption of energy drinks and a more frequent intake of carbonated beverages and fast foods.

4.3.2(c) Total Beverage Consumption

The descriptive analysis of total beverage consumption among Iraqi adolescents over the past month reveals distinct patterns across different categories of beverages, particularly milk and sugar-sweetened beverages (SSBs).

The average total milk consumption was 9.11 fl oz (SD 10.20), corresponding to an energy intake of 137.35 kcal (SD 150.59) and a weight of 277.65 grams (SD 311.08). These values indicate relatively low milk intake among the adolescent population, with substantial variability in consumption levels.

In contrast, the average total consumption of sugar-sweetened beverages was markedly higher, amounting to 31.99 fl oz (SD 28.09), providing 378.32 kcal (SD330.35) and 820.92 grams (SD 679.55). The elevated caloric and weight contribution from SSBs highlights a significant source of added sugars in the diet of these adolescents, reflecting a potential area of concern for dietary interventions.

The overall average daily beverage intake, including all types of beverages, was 75.15 fl oz (SD 40.40), contributing 610.80 kcal (SD 450.12) and 2267.52 grams (SD 1224.29). This total reflects a substantial proportion of daily energy intake, underscoring the importance of beverage consumption patterns in the overall dietary profile of adolescents.

These findings suggest that while milk consumption is relatively low, sugar-sweetened beverages constitute a large part of total beverage intake, which could have implications for public health strategies targeting dietary behaviors to reduce the risk of obesity and related metabolic disorders in this population.

4.3.2(d) Physical Activity

The descriptive analysis of physical activity among Iraqi adolescents reveals a mean score of 2.28 (SD 0.89) on the Physical Activity Questionnaire for Children (PAQ-C), which is based on a five-point scale ranging from 1 (low activity) to 5 (high activity). The distribution of physical activity levels indicates that the majority of participants (60.1%, n = 304) exhibited low levels of physical activity, while 32.0% (n = 162) were categorized as having moderate activity. A small proportion (7.9%, n = 40) demonstrated high physical activity levels.

In terms of moderate to vigorous physical activity (MVPA), the mean weekly MVPA was 229.55 minutes (SD 90.77), substantially below the World Health Organization's recommendation of 420 minutes per week. Notably, 97.0% (n = 491) of the participants did not meet the recommended physical activity threshold, while only 3.0% (n = 15) achieved or exceeded the 420-minute guideline.

In conclusion, the data indicates that physical activity levels among Iraqi adolescents are generally low, with a small percentage meeting international guideline for MVPA.

4.3.2(e) Sedentary Behaviors

Based on the methodology using the Adolescent Sedentary Activity Questionnaire (ASAQ), which captures sedentary behavior during weekdays and weekends, the descriptive data reflect that Iraqi adolescents spend significant amounts of time in sedentary activities throughout the week. The ASAQ scores reveal that adolescents are slightly more sedentary on weekends, with a mean score of 465.57 minutes, compared to 457.47 minutes on weekdays. This increase may be due to the lack of structured daily routines, such as school attendance, that limit sedentary behaviors on weekdays. Additionally, the variability in sedentary time, as indicated by the standard deviations, is greater on weekends (SD 70.12), suggesting that weekend

activities differ more widely among individuals. In conclusion, Iraqi adolescents exhibit high levels of sedentary behavior throughout the week.

4.3.2(f) Anthropometric Measurements

The anthropometric measurements of the study participants, consisting of 506 Iraqi adolescents, reveal key insights into their anthropometric measurements and body composition. The mean BMI z-score for the group was 0.66 (±1.61), indicating a general trend toward higher weight categories among the adolescents. A breakdown of BMI z-scores shows that 25 participants (4.9%) were classified as underweight (BMI z-score < -2 SD), while 247 (48.8%) had a normal weight (BMI z-score between -2 SD and ≤ +1 SD). Additionally, 128 adolescents (25.3%) were overweight (BMI z-score > +1 SD and ≤ +2 SD), 72 (14.2%) were classified as obese (BMI z-score > +2 SD and ≤ +3 SD), and 34 participants (6.7%) were severely obese (BMI z-score > +3 SD).

The mean waist circumference (WC) and hip circumference (HC) were 80.39 cm (±15.17) and 96.17 cm (±14.29), respectively. Furthermore, the mean waist-to-height ratio (WHtR) was 0.49 (±0.09), and the mean waist-to-hip ratio (WHR) was 0.83 (±0.08). These anthropometric indices suggest that a notable proportion of the participants may be at risk of central obesity, as indicated by elevated WHtR and WHR values, which are known to be associated with increased cardiometabolic risk.

In conclusion, the anthropometric measurements of the 506 Iraqi adolescents in this study highlight a concerning trend toward overweight and obesity, with over one-third of participants falling into these categories based on BMI z-scores. Additionally, the elevated waist-to-height and waist-to-hip ratios further emphasize the risk of central obesity, a known predictor of cardiometabolic complications.

4.3.2(g) Familial Susceptibility to Gain Weight

The Table 4.23 provides a detailed breakdown of anthropometric measures for 465 parent participants, distinguishing between fathers (f) and mothers (m) based on Body Mass Index (BMI) categories and the number of overweight or obese parents.

The average BMI for fathers (f) was 27.76 kg/m² (SD 4.66), while for mothers (m) it was 29.13 kg/m² (SD 5.49). When categorized by BMI, the distribution for fathers (f) shows 1.2% were underweight (BMI < 18.5 kg/m²), 21.7% had a normal weight (BMI 18.5–24.9 kg/m²), 40.3% were overweight (BMI 25.0–29.9 kg/m²), and 35.4% were obese (BMI ≥ 30.0 kg/m²). Among the obese fathers, 14.0% were classified in Class I obesity (BMI 30.0–34.9 kg/m²), 3.8% in Class II (BMI 35.0–39.9 kg/m²), and 2.0% in Class III, indicating severe obesity (BMI ≥ 40.0 kg/m²).

For mothers (m), 0.8% were underweight, 16.4% had a normal weight, and 35.4% were overweight. Of the obese mothers, 23.5% were in Class I, 6.9% in Class II, and 3.4% in Class III, indicating severe obesity.

Additionally, when considering the number of overweight or obese parents, it was observed that 56.9% of participants had both parents categorized as overweight or obese, 27.3% had one parent overweight or obese, while only 7.7% had neither parent overweight nor obese.

These results emphasize a high prevalence of overweight and obesity among parents, with obesity being particularly common. This could have significant implications for understanding familial risk factors in the development of obesity-related health issues.

Table 4.23 summarizes key health-related behaviors and indicators including parenting practices, diet, activity levels, and physical and biochemical measurements among 506 adolescents.

Study variables	Cutoff point	Mean (SD)	F. (%)
FPP-A			
Autonomy Support		4.08 (0.86)	
Healthy structure		4.15 (0.92)	
Coercive Control		3.39 (0.99)	
Snack structure		2.19 (0.89)	
Modelling		4.10 (1.02)	
FPP-P			
Autonomy Support		4.43 (0.64)	
Healthy structure		4.50 (0.71)	
Coercive Control		3.75 (0.91)	
Snack structure		2.66 (0.91)	
Modelling		4.50 (0.74)	
Dietary behavior			
Breakfast consumption per month		2.43 (1.38)	
Fruit intake per day		2. 24 (1.61)	
Vegetable intake per day		2.16 (1.58)	
Milk/ milk product intake per day		2.00 (1.50)	
Snack food intake per day		3.14 (1.38)	
Carbonated drink consumption per day		2.14 (1.65)	
Energy drink consumption per day		0.63 (1.15)	
Fasting food intake per week		2.17 (1.58)	
Total beverage consumption during last month			
Total Milk	fl oz	9.11 (10.20)	
	kcal	137.35 (150.59)	
	gm	277.65 (311.08)	
Total sugar-sweetened beverages	fl oz	31.99 (28.09)	
	kcal	378.32 (330.35)	
	gm	820.92 (679.55)	
Total average daily of beverages	fl oz	75.15 (40.40)	
	kcal	610.80 (450.12)	
	gm	2267.52 (1224.29)	
Physical activity	PAQ-C	2.28 (0.89)	
	Low		304 (60.1)
	Moderate		162 (32.0)
	High		40 (7.9)
	MVPA	229.55 (90.77)	
	<420 min weekly		491 (97.0)
	≥420 min per week		15 (3.0)
Sedentary behaviors	ASAQ Score Weekdays	457.47 (63.92)	
	ASAQ Score Weekend days	465.57 (70.12)	
Anthropometric measurements			
BMI z-score	BMI z-score	0.66 (1.61)	
	Underweight: BMI z-score < -2 SD		25 (4.9)
	Normal weight: BMI z-score ≥ -2 SD and ≤ +1 SD		247 (48.8)
	Overweight: BMI z-score > +1 SD and ≤ +2		128 (25.3)
	Obese: BMI z-score > +2 ≤ +3 SD		72 (14.2)
	Severely Obese: BMI z-score > +3 SD		34 (6.7)
WC (cm)		80.39 (15.17)	

Table 4.23: Continued

Study variables	Cutoff point	Mean (SD)	F. (%)
HC (cm)		96.17 (14.29)	
WHtR		0.49 (0.09)	
WHR		0.83 (0.08)	
	BMI kg/m²	27.76(4.66)[f] 29.13(5.49)[m]	
	Underweight: BMI less than 18.5 kg/m²		6(1.2)[f] 4(0.8)[m]
	Normal weight: BMI ranging from 18.5 to 24.9 kg/m²		110(21.7)[f] 83(16.4)[m]
BMI parent	Overweight: BMI ranging from 25.0 to 29.9 kg/m²		204(40.3)[f] 179(35.4)[m]
	Class I: BMI ranging from 30.0 to 34.9 kg/m²		71(14.0)[f m] 119(23.5)[m]
	Class II: BMI ranging from 35.0 to 39.9 kg/m²		19(3.8)[f] 35(6.9)[m]
	Class III (severe obesity): BMI 40.0 kg/m²		10(2.0)[f] 17(3.4)[m]
Number of overweight parents	Neither parent was overweight or obese.		39 (7.7)
	One parent was overweight or obese.		138 (27.3)
	Both parents were overweight or obese.		288 (56.9)

Note: Food Parent Practice for Adolescent (FPP-A), Food Parent Practice for Parent (FPP-P), Fluid Ounces (fl oz), Kilocalories (kcal), Grams (gm), Moderate-to-Vigorous Physical Activity (MVPA), Adolescent Sedentary Activity Questionnaire (ASAQ), Body Mass Index (BMI), Waist Circumference (WC) in centimeters, Hip Circumference (HC) in centimeters, Waist-to-Height Ratio (WHtR), and Waist-to-Hip Ratio (WHR). Father (f), and Mother (m).

4.3.3 Path Model Analysis

The study employed a comprehensive approach, utilizing validated measurement scores encompassing various domains, including environmental factors, family characteristics, behavior risk factors, adolescent traits, and anthropometric measurements within its Path analysis. These measurement scales were instrumental as observed variables for the baseline Path analysis, providing a robust foundation for the study's investigations. The scale score measurement addressed a spectrum of environmental factors, ranging from socioeconomic status (SES) and household income (HHI) to living conditions such as the crowding index. Additionally, categorical scales delved into specific areas such as residence type, school environment, and the educational level of both parents. To capture nuances within family dynamics, food practice scales were incorporated, evaluating aspects like autonomy supportiveness, healthy structure, corrosive control, snack structure, and modeling behaviors. Behavior risk factors were rigorously assessed through three distinct scales, including physical activity levels across the previous week, sedentary

behaviors during weekdays and weekends, and dietary habits encompassing both healthy and unhealthy food choices. Furthermore, adolescent characteristics, such as sex, gender, and family predisposition to weight gain (Fa-BMI and Ma-BMI), were meticulously accounted for. The anthropometric measurements measurement scale incorporated indicators like z-BMI for general obesity, WHR for central adiposity, and WHtR for abdominal obesity, ensuring a comprehensive evaluation of cardiovascular risk factors within the framework of the study.

The multivariate normality was examined for the initial Path model by using Mplus. The results of multivariate skewness and kurtosis indicated significant *P*-values ($p<0.001$) (APPENDIX X). Therefore, the assumption of multivariate normality was not met. The MLR estimator was used in the subsequent SEM/Path analyses.

The foundational structural equation model was meticulously constructed in alignment with the comprehensive conceptual framework outlined in Chapter 2. This model intricately integrated a myriad of exogenous and endogenous variables alongside a multitude of observed variables meticulously tested within the Path paradigm. Exogenous variables, serving as the bedrock of independent variables, were meticulously scrutinized alongside endogenous variables, crucial in delineating the intricate web of dependencies akin to those observed in traditional linear regression models, illustrated in Table 4.24. The observed variables, constituting the crux of each domain under examination, were meticulously cataloged and methodically analyzed within the purview of the Path model.

Table 4.24 Classification of Exogenous, Mediator, and Endogenous Variables in the Path Analysis Study

Exogenous Variables	Mediator/Exogenous/ Endogenous Variables
SEX (Sex)	PA (Physical Activity)
AGE (Age)	SB (Sedentary Behavior)
SCHOOL (School)	AS (Autonomy supportive)
RESIDENCE (Residence)	HS (Healthy Structure)
HHI (Household Income)	CC (Corrosive Control)
NUMSIBS (Number of Siblings)	SS (Snack Structure)
CRWDINDX (Crowding Index)	MOD (Modelling)
SES (Socioeconomic Status)	BRKSTFR (Breakfast Frequency)
FATHEDU (Father's Education)	SNACKQTY (Snack Quantity)
MOTHEDU (Mother's Education)	F_VINTAK (Fruit and Vegetable Intake)
FATHOCC (Father's Occupation)	CARBDRNK (Carbonated Drink Consumption)
MOTHOCC (Mother's Occupation)	FASTFOOD (Fast Food Consumption)
FATHBMI (Father's BMI)	SSBCAL (Sugar-Sweetened Beverage Calories)
MOTHBMI (Mother's BMI)	MILKCAL (Milk Calories)
FAMSUS (Familial Susceptibility)	WHTR (Waist-to-Height Ratio)*
	WHR (Waist-to-Hip Ratio)*
	zBMI (Body Mass Index) *

* Endogenous

4.3.3(a) Univariate Associations Between Environmental Factors, Family Characteristics, Behavior Risk Factors, Adolescent Traits, and Anthropometric Measurements

The study hypothesized intricate inter-relationships among demographic characteristics, food parenting practices, and behavioral risk factors (physical activity, sedentary behaviors, and dietary habits) in relation to the anthropometric measurements of adolescent participants. It posited that both demographic characteristics and food parenting practices were not only influence these behaviors but also play a pivotal role in determining the anthropometric measurements of adolescents. Participants who demonstrate a comprehensive understanding of the importance of regular physical activity, moderation in sedentary behaviors, and adherence to healthy dietary habits were presumed to maintain a normal anthropometric measurement. An analysis was conducted using Pearson's correlation coefficient to determine the degree of association between these variables. Most of the study variables had significant associations, according to Table 4.25.

The significant correlation coefficients for physical activity ranged from r_p = −0.38 to 0.73. Negative significant correlations were observed between physical activity and the following variables: sex (r_p=−0.33), school (r_p=−0.38), sugar-sweetened beverage calorie intake (r_p=−0.26), father's BMI (r_p=−0.23), mother's BMI (r_p=−0.20), age (r_p=−0.12), carbonated drink intake (r_p=−0.12), and fast-food consumption (r_p=−0.09). Conversely, positive significant correlations were found with the Physical Activity Questionnaire for Children (PAQ-C) (r_p=0.73), fruit and vegetable intake (r_p=0.24), breakfast frequency (r_p=0.19), and household income (r_p=0.11).

These findings suggested that higher physical activity levels were associated with better dietary habits, including increased fruit and vegetable consumption and more frequent breakfasts, as well as higher household income. In contrast, lower physical activity levels were associated with higher intakes of sugar-sweetened beverages, carbonated drinks, and fast food, and were negatively influenced by factors such as parental BMI and school-related variables.

The significant correlation coefficients for sedentary behavior on weekdays ranged from r_p=0.39 to −0.77. Positive significant correlations were found between sedentary behavior and the following variables: sex (r_p=0.39), age (r_p=0.14), school (r_p=0.28), father's BMI (r_p=0.20), mother's BMI (r_p=0.19), carbonated drink intake (r_p=0.10), fast food consumption (r_p=0.12), sugar-sweetened beverage calorie intake (r_p=0.26), and milk calorie intake (r_p=0.09). Conversely, negative significant correlations were observed with residence (r_p=−0.13), number of siblings (r_p=−0.15), breakfast frequency (r_p=−0.17), fruit and vegetable intake (r_p=−0.20), Physical Education (PE) (r_p=−0.52), and the Physical Activity Questionnaire for Children (PAQ-C) (r_p=−0.77). Additionally, there was a strong positive correlation between sedentary behavior on weekdays and weekends (r_p=0.89).

These findings suggested that higher level of sedentary behavior on weekdays was associated with increased consumption of less healthy dietary options, such as carbonated drinks, fast food, and sugar-sweetened beverages, as well as higher BMI in parents. Conversely, lower sedentary behavior was linked to more frequent breakfasts, greater fruit and vegetable intake, better physical education engagement, and higher overall physical activity, highlighting the interplay between lifestyle choices and sedentary patterns.

Pearson correlation between adolescent food intake at home or eating outside with food parent constructs. As reported by both parents and adolescents, breakfast intake among adolescents showed a positive association with autonomy-supportive parenting (r_p= 0.11 and 0.13) and snack structure (r_p= 0.09 and 0.14). Snack intake among adolescents, as reported by both parents and the adolescents themselves, showed a similar positive association with corrosive control (r_p= 0.12). Conversely, there was a negative association with snack structure (r_p= -0.18 and -0.21). Additionally, adolescents reported a negative association with autonomy-supportive parenting (r_p= -0.12).

Fruit and vegetable intake among adolescents, as reported by both parents and the adolescents themselves, demonstrated several positive associations. Specifically, there was a positive correlation with autonomy-supportive parenting (r_p= 0.20 and 0.22), healthy structure (r_p= 0.24), corrosive control (r_p= 0.14 and 0.12), and modeling behaviors (r_p= 0.22 and 0.20). Additionally, fruit and vegetable intake reported solely by adolescents showed a positive correlation of (r_p= 0.09). As reported by both parents and the adolescents, fast food intake among adolescents had a positive correlation with corrosive control parenting (r_p= 0.32 and 0.26), while a negative correlation with snack structure (r_p= -0.27 and - 0.17). SSB calories among adolescents, as reported by both parents and the adolescents, had a positive correlation with corrosive control parenting (r_p= 0.23 and 0.22), while similarity negatively correlated with snack structure (r_p= -

0.13) for parents and adolescents. Additionally, showed there was a negative correlation between autonomy support with SSB calories for adolescents (r_p= -0.13). Milk calories among adolescents, as reported by both parents and adolescents, had a positive correlation with health structure (r_p= 0.09 and 0.10) and corrosive control (r_p= 0.13 and 0.15).

Significant correlation coefficients exist between various dietary intake items among adolescents, ranging from r_p=−0.11 to r_p=0.65. Adolescents with high breakfast intake showed a positive association with healthy foods, including fruit and vegetable intake (r_p=0.17), and a negative association with unhealthy foods, such as snack quantity and carbonated drinks (r_p=−0.15), fast food (r_p=−0.11), and sugar-sweetened beverage (SSB) calories (r_p=−0.15). The associations between snack quantity and other unhealthy food items were all positive: carbonated drinks (r_p=0.28), fast food (r_p=0.26), and SSB calories (r_p=0.17). Additionally, carbonated drinks had positive correlations with fast food (r_p=0.34), SSB calories (r_p=0.65), and milk calories (r_p=0.23). Fast food intake also positively correlated with SSB calories (r_p=0.34) and milk calories (r_p=0.19). Finally, there was a positive correlation between SSB calories and milk calories (r_p=0.29).

The significant relationships between anthropometric measurements (WHtR) and study variables reveal several key findings: demographic factors such as sex (r_p=−0.13) and residence (r_p=−0.13) exhibit significant negative relationships, indicating their influence on anthropometric measurements. Familial factors like the number of siblings (r_p=−0.19) also show a significant negative relationship, suggesting a potential influence. Positive associations are found between anthropometric measurements and snack quantity (r_p=0.12), carbohydrate drink intake (r_p=0.31), fast food consumption (r_p=0.20), and SSBCal and MilkCal consumption (r_p=0.42 and 0.22). Conversely, a higher intake of fruits and vegetables (r_p=−0.13) correlates with better weight outcomes. Physical activity-related variables, such as Physical Education

(r_p=−0.31) and the Physical Activity Questionnaire for Children (PAQ_C) (r_p=−0.49), show significant negative relationships. In contrast, after-school and weekend sedentary behaviors (r_p=0.48) positively correlate with anthropometric measurements. These findings underscore the multifaceted nature of anthropometric measurements, influenced by a combination of demographic, familial, dietary, and physical activity-related factors.

In the context of anthropometric measurements represented by the Waist-to-Hip Ratio (WHR), several significant relationships with study variables provide valuable insights. Demographic factors such as sex show a strong negative relationship (r_p=−0.26), indicating a gender-related influence on WHR. At the same time, school attendance has a positive relationship (r_p=0.16r = 0.16r_p=0.16), suggesting an impact of the educational environment on WHR. Additionally, the number of siblings (r_p=−0.12) demonstrates a negative relationship with WHR. Familial factors show that parental body mass indexes (r_p=0.25 for fathers and r_p=0.079 for mothers) have positive relationships with WHR, highlighting the role of parental BMI. Dietary factors revealed that snack quantity (r_p=0.10) and SSB calories consumption (r_p=0.24) positively relate to WHR, underscoring the impact of dietary patterns. Milk calories consumption (r_p=0.12) also positively correlates with WHR, indicating its potential influence on body composition. Lifestyle factors such as carbohydrate drink consumption (r_p=0.18) and fast-food consumption (r_p=0.11) show positive relationships with WHR, while physical activity measures such as Physical Education (r_p=−0.16) and the Physical Activity Questionnaire (PAQ_C, r_p=−0.25) exhibit negative relationships, emphasizing the role of physical activity in weight management. Weekend sedentary behavior measures (ASAQWday, r=0.21; ASAQWend, r_p=0.23) demonstrate positive relationships with WHR, highlighting the influence of weekend activities on anthropometric measurements. Overall, these

significant associations illuminate the complex interplay of demographic, lifestyle, and parental factors in shaping WHR and weight outcomes.

Significant relationships with Body Mass Index (zBMI) reveal various influencing factors. Notably, school attendance shows a significant positive relationship (r_p=0.18), suggesting that educational settings may impact adiposity levels, while residence exhibits a significant negative relationship (r_p=−0.20), indicating an influence of residential location on zBMI. Additionally, sex (r=−0.09) and the number of siblings (r_p=−0.18) show significant negative relationships, highlighting gender-related influences and the impact of family size on adiposity. Parental factors, such as Father's BMI (r_p=0.35) and Mother's BMI (r_p=0.22), display significant positive relationships, underscoring the role of parental body mass indexes in adiposity levels. Dietary habits such as breakfast frequency (r_p=−0.12) and fruit and vegetable intake (r_p=−0.10) have significant negative relationships with zBMI, suggesting that higher breakfast frequency and fruit and vegetable intake may be associated with lower adiposity levels. Conversely, snack quantity (r_p=0.14), carbohydrate drink consumption (r=0.28), fast food consumption (r_p=0.20), milk consumption (r_p=0.28), and snack structure and breakfast consumption (r_p=0.42) show significant positive relationships with zBMI, highlighting their potential impact on adiposity. Physical activity-related variables like Physical Education (r_p=−0.30) and the Physical Activity Questionnaire (PAQ_C, r_p=−0.49) demonstrate significant negative relationships with zBMI, indicating the importance of physical activity in managing adiposity. After-school and weekend sedentary behavior measures (ASAQWday and ASAQWend, r_p=0.49 for both) exhibit significant positive relationships, underlining the influence of weekend activities on adiposity. Lastly, the Waist-to-Hip Ratio (WHtR, r_p=0.86) and Waist-to-Hip Ratio (WHR, r_p=0.45) display significant positive relationships with zBMI, emphasizing their correlation with adiposity levels.

Table 4.25 Correlation matrix of the study variables (n=506)

No.	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	33	34	35	36	37	38
1	sex	1.																																				
2	age	.24**	1.																																			
3	school	.01	.12**	1.																																		
4	residence	.01	.04	-.23**	1.																																	
5	NumSibs	.05	.13**	-.08	.17**	1.																																
6	FathEdu	-.12**	-.12**	.12**	-.21**	-.17**	1.																															
7	MothEdu	-.08	-.09*	.14**	-.28**	-.28**	.36**	1.																														
8	FathOcc	.03	-.03	.16**	-.24**	-.08	.41**	.31**	1.																													
9	MothOcc	-.05	-.11*	.08	-.13**	-.25**	.25**	.60**	.16**	1.																												
10	CrwdIndx	.10*	.02	-.04	.20**	.27**	-.22**	-.23**	-.18**	-.15**	1.																											
11	HHI	-.07	-.07	.18**	-.30**	-.19**	.48**	.62**	.61**	.57**	-.29**	1.																										
12	SES	-.10*	-.11*	.17**	-.30**	-.27**	.73**	.75**	.61**	.56**	-.46**	.75**	1.																									
13	FathBMI	-.05	-.08	.18**	-.20**	-.10*	.11*	.06	.08	.06	-.02	.07	.10*	1.																								
14	MothBMI	.03	.02	.15**	-.10*	.02	.05	-.03	.09	-.01	-.03	.02	.02	.30**	1.																							
15	AS_p	.08	-.01	.01	-.04	-.11*	.07	.07	.04	.04	-.06	.01	.10*	-.05	-.07	1.																						
16	HS_p	.10*	.04	-.01	-.07	.	.07	.09*	.09*	.02	-.05	.06	.15**	.	-.04	.34**	1.																					
17	CC_p	.06	-.03	.03	-.08	.	.02	.13**	.04	.07	-.02	.08	.12**	.	-.01	.25**	.25**	1.																				
18	SS_p	.02	-.02	.07	-.09*	-.04	-.02	.02	-.07	.01	-.05	.	.	-.04	.	.29**	.16**	-.01	1.																			
19	Mod_p	.02	-.06	.04	.	.01	.12**	.09	.10*	.06	-.10*	.11*	.16**	.03	.02	.38**	.32**	.25**	.22**	1.																		
20	AS_a	.01	-.05	-.01	.02	-.02	.08	.01	.02	-.01	-.03	-.02	.06	-.07	-.09	.81**	.29**	.25**	.28**	.34**	1.																	
21	HS_a	.04	-.02	-.05	-.02	.04	.09*	.05	.06	.03	-.01	.06	.12**	-.04	-.06	.27**	.80**	.25**	.10*	.29**	.34**	1.															
22	CC_a	.01	-.08	.02	-.05	.02	-.01	.06	.01	.05	-.03	.03	.07	.04	-.03	.20**	.22**	.81**	-.05	.20**	.27**	.21**	1.														
23	SS_a	-.03	-.02	.04	-.09*	.01	.	.06	-.12**	.05	.	.01	.	-.07	-.07	.27**	.15**	.08	.76**	.19**	.29**	.13**	.07	1.													
24	Mod_a	.03	-.04	.09*	.	.02	.15**	.08	.08	.07	-.03	.09	.14**	.	.02	.32**	.25**	.20**	.19**	.76**	.36**	.26**	.22**	.21**	1.												
25	BrkfstFr	-.25**	-.10*	-.03	.19**	.13**	-.14**	-.14**	-.16**	-.08	.05	-.13**	-.17**	-.08	-.15**	.11*	.	.06	.09*	.06	.13**	.03	.07	.14**	.05	1.											
26	SnackQty	-.03	.01	.14**	-.13**	-.10*	.05	.12**	.16**	.08	-.07	.11*	.11*	.05	.01	-.08	-.01	.12**	-.18**	-.03	-.12**	-.08	.12**	-.21**	-.04	-.15**	1.										
27	F_Vintak	-.15**	-.01	-.13**	.08	.	.08	.03	-.03	.02	-.08	-.03	.06	-.04	-.13**	.20**	.24**	.14**	.05	.22**	.22**	.24**	.12**	.09*	.20**	.17**	.04	1.									
28	CarbDmk	-.10*	.02	.05	-.05	-.06	-.02	.10*	.	.04	-.02	.02	.07	.10*	.05	-.08	-.08	.27**	-.18**	-.03	-.10*	-.13**	.22**	-.18**	-.05	-.15**	.28**	-.01	1.								
29	FastFood	-.02	.	.04	-.12**	-.05	.09*	.18**	.14**	.05	-.10*	.13**	.19**	.05	.07	-.09	.04	.32**	-.27**	.03	-.09	.02	.26**	-.17**	.02	-.11*	.26**	.04	.34**	1.							
30	SSBCal	-.09*	.05	.13**	-.09*	-.08	.05	.04	.04	.04	-.04	.03	.09*	.14**	.07	-.06	.	.23**	-.13**	-.03	-.10*	-.04	.22**	-.13**	-.04	-.15**	.17**	-.04	.65**	.33**	1.						
31	MilkCal	-.10*	-.02	.04	-.01	-.03	.08	.02	.07	.	-.03	.05	.06	.06	.08	.02	.09*	.13**	-.02	.	.05	.10*	.15**	.02	.02	.05	.06	.09*	.23**	.19**	.29**	1.					
33	PAQ_C	-.33**	-.12**	-.38**	.08	.11*	.06	.08	.02	.06	-.03	.07	.07	-.23**	-.20**	.03	.	-.08	.	.01	.06	.05	.	.04	.03	.19**	-.06	.24**	-.12**	-.09*	-.26**	-.08	1.				
34	ASAQWday	.39**	.14**	.28**	-.13**	-.15**	-.02	.	.02	.	-.05	.01	.01	.20**	.19**	.02	.05	.06	.02	.01	-.01	-.03	.02	-.03	.01	-.17**	.05	-.20**	.10*	.12**	.26**	.09*	-.77**	1.			
35	ASAQWend	.36**	.13**	.27**	-.08	-.12**	-.04	-.04	.03	-.01	.	-.01	-.02	.20**	.20**	.03	.03	.10*	-.03	.01	.	.	.07	-.07	.02	-.13**	.08	-.21**	.11*	.14**	.26**	.13**	-.74**	.89**	1.		
36	WHtR	-.13**	.05	.19**	-.13**	-.19**	.05	.05	.	.04	-.07	.02	.06	.34**	.20**	-.09*	-.07	.09*	-.09	-.07	-.06	-.04	.09*	-.09*	-.04	-.09	.12**	-.13**	.31**	.20**	.42**	.22**	-.49**	.48**	.48**	1.	
37	WHR	-.26**	.01	.16**	-.09*	-.12**	.07	.06	-.02	.02	-.06	.02	.06	.25**	.08	-.06	-.09*	.05	-.02	-.06	-.03	-.05	.05	.01	-.04	.01	.10*	-.05	.18**	.11*	.24**	.12**	-.25**	.21**	.23**	.69**	1.	
38	zBMI	-.09*	.02	.18**	-.20**	-.18**	.07	.06	.05	.05	-.08	.08	.09*	.35**	.22**	-.09	-.01	.10*	-.10*	-.04	-.07	.03	.08	-.10*	-.04	-.12**	.14**	-.10*	.28**	.20**	.42**	.28**	-.49**	.49**	.49**	.86**	.45**	1.

Note: r_p= Pearson Correlation, **Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

4.3.3(b) Path Model Testing of the Baseline Structural Model

This section examined the associations between environmental and family factors (school, residence, number of siblings, level of education for mother and father). Occupation type of father and mother, crowding index, household income, socioeconomic status, body mass index for father and mother, food parenting practices (autonomy support, healthy structure, corrosive control, snack structure, modeling), behavior risk factors (physical activity, sedentary behaviors on weekdays and weekend, breakfast frequency, snack quantity, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories), adolescent characteristics (sex and age), and anthropometric measurements (waist-to-height ratio, waist-to-hip ratio, Body Mass Index) among all participants. Due to the violation of multivariate normality, the researcher utilized Maximum Likelihood with Robust Standard Errors (MLR) as the estimator for the path analysis. Table 4.26 presents a list of the hypotheses assessed in this study.

Table 4.26 The specific hypotheses of the initial baseline model

No.	Hypotheses
H1a	Sex is significantly related to physical activity.
H1b	Age is significantly related to physical activity.
H1c	School is significantly related to physical activity.
H1d	Residence is significantly related to physical activity.
H1e	The number of siblings is significantly related to physical activity.
H1f	Crowding index is significantly related to physical activity.
H1g	Household income is significantly related to physical activity.
H1h	Socioeconomic status is significantly related to physical activity.
H2a	Sex is significantly related to sedentary behaviors.
H2b	Age is significantly related to sedentary behaviors.
H2c	School is significantly related to sedentary behaviors.
H2d	Residence is significantly related to sedentary behaviors.
H2e	The number of siblings is significantly related to sedentary behaviors.
H2f	Crowding index is significantly related to sedentary behaviors.
H2g	Household income is significantly related to sedentary behaviors.
H2h	Socioeconomic status is significantly related to sedentary behaviors.
H3a	Sex is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H3b	Age is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.

Table 4.26: Continued

No.	Hypotheses
H3c	Residence is significantly related to snack structure.
H3d	The number of siblings is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H3e	Father's education is significantly related to corrosive control.
H3f	Mother's education is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H3g	The father's occupation is significantly related to snack structure.
H3h	Mother's occupation is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H3i	Household income is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H3j	Socioeconomic status is significantly related to healthy structure, corrosive control, and modeling.
H3k	The father's body mass index is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H3l	Mother's body mass index is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.
H4a	Autonomy support is significantly related to breakfast frequency, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, and sugar-sweetened beverage calories.
H4b	Healthy structure is significantly related to fruit and vegetable intake.
H4c	Corrosive control is significantly related to snack quantity, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories.
H4d	Snack structure is significantly related to snack quantity, carbohydrate drink consumption, fast food consumption, and sugar-sweetened beverage calories.
H4e	Modeling is significantly related to fruit and vegetable intake.
H5a	Sex is significantly related to breakfast frequency, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories.
H5b	Age is significantly related to breakfast frequency, snack quantity, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories.
H6a	Sex is significantly related to the waist-to-height ratio.
H6b	Age is significantly related to the waist-to-height ratio.
H6c	Familial susceptibility to gain weight is significantly related to the waist-to-height ratio.
H6d	Physical activity is significantly related to the waist-to-height ratio.
H6e	Sedentary behaviors on weekdays and weekends are significantly related to the waist-to-height ratio.
H6f	Breakfast frequency is significantly related to waist-to-height ratio.
H6g	Snack quantity is significantly related to waist-to-height ratio.
H6h	Fruit and vegetable intake is significantly related to waist-to-height ratio.
H6i	Carbohydrate drink consumption is significantly related to waist-to-height ratio.
H6j	Fast food consumption is significantly related to waist-to-height ratio.
H6k	Sugar-sweetened beverage calories are significantly related to the waist-to-height ratio.
H6l	Milk calories are significantly related to the waist-to-height ratio.
H7a	Sex is significantly related to the waist-to-hip ratio.
H7b	Age is significantly related to waist-to-hip ratio.
H7c	Familial susceptibility to gain weight is significantly related to the waist-to-hip ratio.
H7d	Physical activity is significantly related to the waist-to-hip ratio.
H7e	Sedentary behaviors on weekdays and weekends are significantly related to the waist-to-hip ratio.
H7f	Breakfast frequency is significantly related to waist-to-hip ratio.
H7g	Snack quantity is significantly related to waist-to-hip ratio.
H7h	Fruit and vegetable intake is significantly related to waist-to-hip ratio.
H7i	Carbohydrate drink consumption is significantly related to waist-to-hip ratio.
H7j	Fast food consumption is significantly related to the waist-to-hip ratio.
H7k	Sugar-sweetened beverage calories are significantly related to the waist-to-hip ratio.

Table 4.28: Continued

No.	Hypotheses
H7l	Milk calories are significantly related to the waist-to-hip ratio.
H8a	Sex is significantly related to body mass index.
H8b	Age is significantly related to body mass index.
H8c	Familial susceptibility to gain weight is significantly related to body mass index.
H8d	Physical activity is significantly related to body mass index.
H8e	Sedentary behaviors on weekdays and weekends are significantly related to body mass index.
H8f	Breakfast frequency is significantly related to body mass index.
H8g	Snack quantity is significantly related to body mass index.
H8h	Fruit and vegetable intake is significantly related to body mass index.
H8i	Carbohydrate drink consumption is significantly related to body mass index.
H8j	Fast food consumption is significantly related to body mass index.
H8k	Sugar-sweetened beverage calories are significantly related to body mass index.
H8l	Milk calories are significantly related to body mass index.

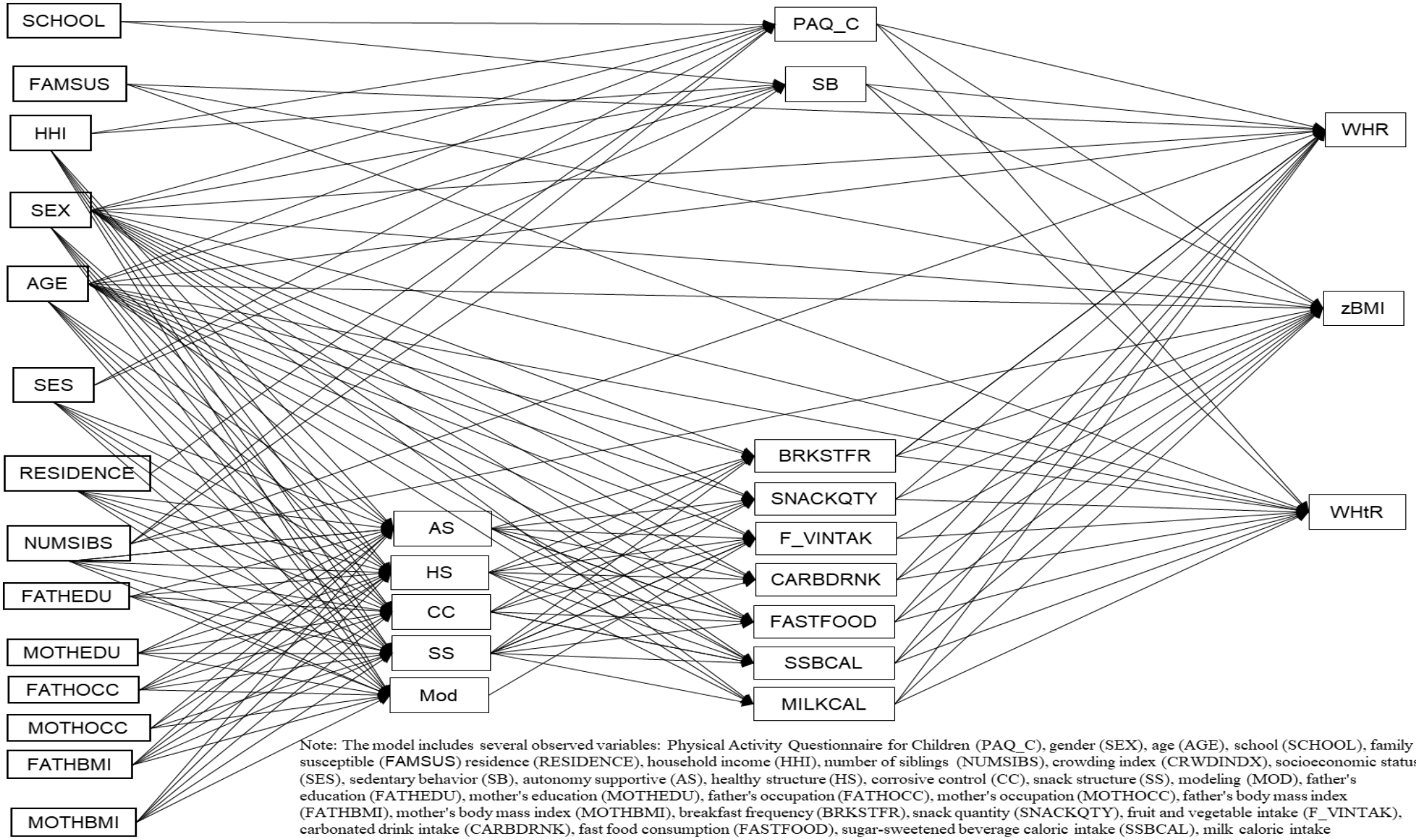
Initial Path Model (Model 1) The initial baseline structural model included all domains within environmental factors, family characteristics, behavior risk factors, adolescent characteristics, and anthropometric measurements, treating all items in these domains as observed variables. According to Hair et al. (2019), previous research indicated that for sample sizes exceeding 250 with observed variables ranging from 12 to 30, acceptable model fit indices are: CFI or TLI > 0.92, SRMR < 0.08, and RMSEA < 0.07. Consequently, as shown in Table 4.27, the model fit indices did not meet the recommended thresholds: RMSEA = 0.085, CFI = 0.817, TLI = 0.660, and SRMR = 0.091. As depicted in Figure 4.7, the initial structural model proposed 151 specific path relationships

the original diagram). Of these paths, 38 were found to be significant, while the remaining hypothesized pathways exhibited non-significant effects.

Table 4.27 Model fit indices of the initial baseline model (Model-1) Model (*n*= 506)

Fit indices	Model 1	Decision	The acceptance level of fitness
RMSEA (90%CI)	0.100 (0.95-0.106)	Unacceptable fit	< 0.080
RMSEA *P*-value	0.000	Unacceptable fit	> 0.050
CFI	0.622	Unacceptable fit	>0.920
TLI	0.366	Unacceptable fit	>0.920
SRMR	0.089	Unacceptable fit	< 0.070

Note: RMSEA =Root mean square error of approximation, RMSEA p value = Probability of RMSEA ≤ 0.05; SRMR = Standardized Root Means Square Residual; TLI = Tucker Lewis Index; CFI = Comparative Fit Index.



Note: The model includes several observed variables: Physical Activity Questionnaire for Children (PAQ_C), gender (SEX), age (AGE), school (SCHOOL), family susceptible (FAMSUS) residence (RESIDENCE), household income (HHI), number of siblings (NUMSIBS), crowding index (CRWDINDX), socioeconomic status (SES), sedentary behavior (SB), autonomy supportive (AS), healthy structure (HS), corrosive control (CC), snack structure (SS), modeling (MOD), father's education (FATHEDU), mother's education (MOTHEDU), father's occupation (FATHOCC), mother's occupation (MOTHOCC), father's body mass index (FATHBMI), mother's body mass index (MOTHBMI), breakfast frequency (BRKSTFR), snack quantity (SNACKQTY), fruit and vegetable intake (F_VINTAK), carbonated drink intake (CARBDRNK), fast food consumption (FASTFOOD), sugar-sweetened beverage caloric intake (SSBCAL), milk caloric intake (MILKCAL), waist-to-height ratio (WHTR), waist-to-hip ratio (WHR), and body Mass index Z score (ZBMI)

Figure 4.7 Initial Path Model (Model 1)

iv. Revised Path Model (Model 2)

Model 2 was respecified by parceling the items in the variables of sedentary behaviour on weekdays and weekends. Subsequently, the average score of the domain was treated as observed variables in the subsequent Path analyses for all models. Table 4.28 shows the results of the goodness of fit test statistics for Model 2 were not within the acceptable range of fit. Further inspection revealed that some path relationships were not significant with fit indices results not reaching the acceptable range. Therefore, removing the insignificant paths was one of the alternatives and required steps to improve the model fit.

Table 4.28 Model fit indices of the initial baseline model (Model-2) Model (*n*= 506)

Fit indices	Model 2	Decision	The acceptance level of fitness
RMSEA (90%CI)	0.93 (0.088-0.099)	Unacceptable fit	< 0.080
RMSEA P-value	0.000	Unacceptable fit	> 0.050
CFI	0.680	Unacceptable fit	>0.920
TLI	0.455	Unacceptable fit	>0.920
SRMR	0.085	Unacceptable fit	< 0.070

Note: RMSEA =Root mean square error of approximation, RMSEA p value = Probability of RMSEA ≤ 0.05; SRMR = Standardized Root Means Square Residual; TLI = Tucker Lewis Index; CFI = Comparative Fit Index.

v. Final Path Model (Model 3)

Further inspection of the model was conducted by going through the results in Modification Indices (M.I) based on the M.I, each path suggested to be added to the model was investigated for theoretical support. The paths were added to the model one at a time and the model was evaluated each time a new path was added. Furthermore, additional path correlations and some error covariances among items were introduced into the model to improve the model fit indices.

However, the fit index of Model 2 still did not reach a reasonable threshold after removing all non-significant paths, so the researchers decided to add six new paths: residence's effects on breakfast frequency, sugar-sweetened beverage calories effects on Fast food consumption, sedentary behavior is the effects of Sugar-sweetened

beverage calories, residence's effects on body mass index, sedentary behavior (SB) correlates to physical activity (PA), and SSB caloric correlates carbohydrate drink frequency(carbdrnk). Furthermore, improving the model fit index values with all of the pathways was significant based on the modification recommendations with full consideration of the theoretical support and empirical findings.

The items with error covariances were investigated for their meaning after discussing them with statisticians and content experts. Figure 4.8 illustrates the modified model after additional paths were added (Model 3). Regarding model fit, Table 4.29 shows that the model goodness-of-fit has been substantially improved. All of the fit indices were within the acceptable range of the recommended fit values, a majority of the fit indices suggested a good fit of model 3 to the observed data.

Table 4.29 Model fit indices of the initial baseline model (Model-3)

Fit indices	Model 3	Decision	The acceptance level of fitness
RMSEA (90%CI)	0.046 (0.037-0.055)	Acceptable fit	< 0.080
RMSEA *P*-value	0.741	Acceptable fit	> 0.050
CFI	0. 955	Acceptable fit	>0.920
TLI	0.925	Acceptable fit	>0.920
SRMR	0.058	Acceptable fit	< 0.070

Note: RMSEA =Root mean square error of approximation, RMSEA p value = Probability of RMSEA ≤ 0.05; SRMR = Standardized Root Means Square Residual; TLI = Tucker Lewis Index; CFI = Comparative Fit Index.

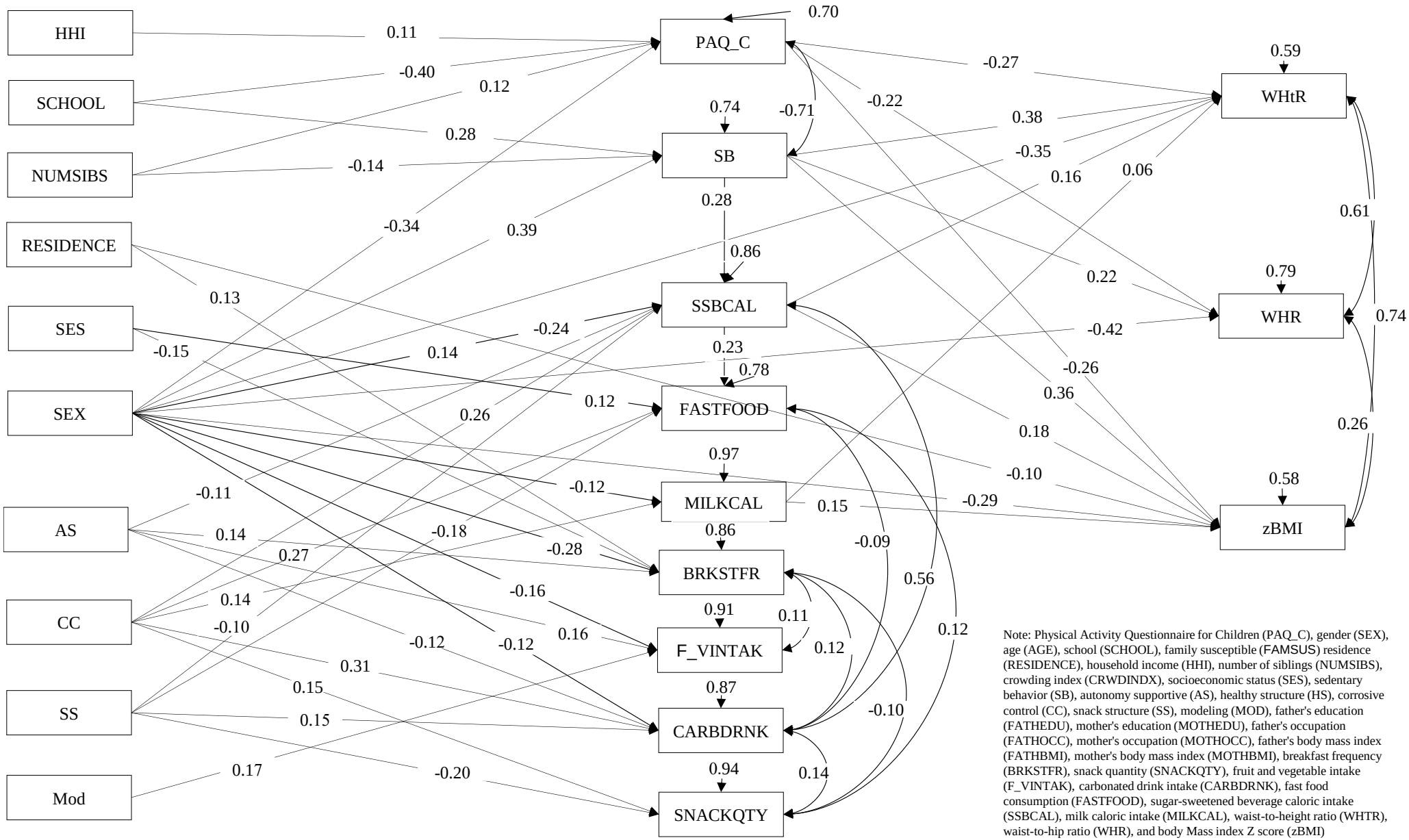


Figure 4.8 Finalized PATH Model (Model 3)

Table 4.30 shows the summary of the findings for model 1 to model 3 based on the fit indices test. There were improvements of all fit indices from the initial model to the final model where at last most of the fit indices achieved the required threshold indicating fit model.

Table 4.30 Summarize the findings of the fitness test for model 1 to model 3 (*n*=506)

Model	RMSEA (90%CI)	RMSEA *P*-value	CFI	TLI	SRMR
Mode 1	0.100 (0.95-0.106)	0.000	0.622	0.366	0.089
Mode 2	0.93 (0.088-0.099)	0.000	0.680	0.455	0.085
Mode 3	0.043 (0.037-0.055)	0.771	0.957	0.927	0.058

Note: RMSEA =Root mean square error of approximation, RMSEA p value = Probability of RMSEA ≤ 0.05; SRMR = standardized Root Means Square Residual; TLI = Tucker Lewis Index; CFI = Comparative Fit Index., Model 1-original model with all observed based on hypothesis, Model 2- model with only significant paths (all insignificant path were removed), Model 3- final model with only significant path (hypothesized and additional path) and additional correlation between residual.

vi. Summary of path analysis and model estimated item reliability

Table 4.31 describes the overall decisions of the hypotheses tested in the path analysis. Out of 71 paths tested in the initial model, only 41 were supported, and 4 additional paths were added. The additional paths added to the model were theoretically related and they were statistically significant. The coefficient of determination (R^2) which explains the amount of the variance explained by the model was identified for the final model. According to Comrey, and Lee, 1992 and Kline (2023), the graded descriptors for the coefficient of determination (R^2) categorize various health and dietary behaviors as follows: Milk Calories, Snack Quantity, and Fruit and Vegetable Intake were rated as poor ($R^2 < 0.10$). Carbonated Drink Consumption, Breakfast Frequency, and Sugar-Sweetened Beverage Calories were considered fair ($R^2 < 0.20$). WHtR, Fast Food Intake, Sedentary Behavior, and Physical Activity were classified as good ($R^2 < 0.30$). Finally, WHR and zBMI were deemed very good ($R^2 < 0.40$).

Table 4.31 Decision for the hypotheses in the final model

No.	Hypotheses	S/NS
H1a	Sex is significantly related to physical activity.	S
H1b	Age is significantly related to physical activity.	NS
H1c	School is significantly related to physical activity.	S
H1d	Residence is significantly related to physical activity.	NS
H1e	The number of siblings is significantly related to physical activity.	S
H1f	Crowding index is significantly related to physical activity.	NS

Table 4.31: continued

No.	Hypotheses	S/NS
H1g	Household income is significantly related to physical activity.	S
H1h	Socioeconomic status is significantly related to physical activity.	NS
H2a	Sex is significantly related to sedentary behaviors.	S
H2b	Age is significantly related to sedentary behaviors.	NS
H2c	School is significantly related to sedentary behaviors.	S
H2d	Residence is significantly related to sedentary behaviors.	NS
H2e	The number of siblings is significantly related to sedentary behaviors.	S
H2f	Crowding index is significantly related to sedentary behaviors.	NS
H2g	Household income is significantly related to sedentary behaviors.	NS
H2h	Socioeconomic status is significantly related to sedentary behaviors.	NS
H3a	Sex is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3b	Age is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3c	Residence is significantly related to snack structure.	NS
H3d	The number of siblings is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3e	Father's education is significantly related to corrosive control.	NS
H3f	Mother's education is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3g	The father's occupation is significantly related to snack structure.	NS
H3h	Mother's occupation is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3i	Household income is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3j	Socioeconomic status is significantly related to healthy structure, corrosive control, and modeling.	NS
H3k	Father's body mass index is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H3l	Mother's body mass index is significantly related to autonomy support, healthy structure, corrosive control, snack structure, and modeling.	NS
H4a	Autonomy support is significantly related to breakfast frequency, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories.	S
H4b	Healthy structure is significantly related to fruit and vegetable intake.	NS
H4c	Corrosive control is significantly related to snack quantity, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories.	S
H4d	Snack structure is significantly related to snack quantity, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories.	S
H4e	Modeling is significantly related to fruit and vegetable intake.	S
H5a	Sex is significantly related to breakfast frequency, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories.	S
H5b	Age is significantly related to breakfast frequency, snack quantity, fruit and vegetable intake, carbohydrate drink consumption, fast food consumption, sugar-sweetened beverage calories, and milk calories.	NS
H6a	Sex is significantly related to waist-to-height ratio.	S
H6b	Age is significantly related to waist-to-height ratio.	NS
H6c	Familial susceptible to again weight is significantly related to waist-to-height ratio.	NS
H6d	Physical activity is significantly related to waist-to-height ratio.	S
H6e	Sedentary behaviors on weekdays and weekends are significantly related to waist-to-height ratio.	S
H6f	Breakfast frequency is significantly related to waist-to-height ratio.	NS
H6g	Snack quantity is significantly related to waist-to-height ratio.	NS
H6h	Fruit and vegetable intake is significantly related to waist-to-height ratio.	NS

Table 4.31: Continued

No.	Hypotheses	S/NS
H6i	Carbohydrate drink consumption is significantly related to waist-to-height ratio.	NS
H6j	Fast food consumption is significantly related to waist-to-height ratio.	NS
H6k	Sugar-sweetened beverage calories are significantly related to waist-to-height ratio.	S
H6l	Milk calories are significantly related to waist-to-height ratio.	S
H7a	Sex is significantly related to waist-to-hip ratio.	S
H7b	Age is significantly related to waist-to-hip ratio.	NS
H7c	Familial susceptible to again weight is significantly related to waist-to-hip ratio.	NS
H7d	Physical activity is significantly related to waist-to-hip ratio.	S
H7e	Sedentary behaviors on weekdays and weekends are significantly related to waist-to-hip ratio.	S
H7f	Breakfast frequency is significantly related to waist-to-hip ratio.	NS
H7g	Snack quantity is significantly related to waist-to-hip ratio.	NS
H7h	Fruit and vegetable intake is significantly related to waist-to-hip ratio.	NS
H7i	Carbohydrate drink consumption is significantly related to waist-to-hip ratio.	NS
H7j	Fast food consumption is significantly related to waist-to-hip ratio.	NS
H7k	Sugar-sweetened beverage calories are significantly related to waist-to-hip ratio.	NS
H7l	Milk calories are significantly related to waist-to-hip ratio.	NS
H8a	Sex is significantly related to body mass index.	S
H8b	Age is significantly related to body mass index.	NS
H8c	Familial susceptible to again weight is significantly related to body mass index.	NS
H8d	Physical activity is significantly related to body mass index.	S
H8e	Sedentary behaviors on weekdays and weekends are significantly related to body mass index.	S
H8f	Breakfast frequency is significantly related to body mass index.	NS
H8g	Snack quantity is significantly related to body mass index.	NS
H8h	Fruit and vegetable intake is significantly related to body mass index.	NS
H8i	Carbohydrate drink consumption is significantly related to body mass index.	NS
H8j	Fast food consumption is significantly related to body mass index.	NS
H8k	Sugar-sweetened beverage calories are significantly related to body mass index.	S
H8l	Milk calories are significantly related to body mass index.	S
Additional hypothesis		S
H9a	Residence is significantly related to Breakfast frequency.	S
H9b	Sugar-sweetened beverage calories are significantly related to Fast food consumption	S
H9c	Sedentary behavior is significantly related to Sugar-sweetened beverage calories	S
H9d	Residence is significantly related to body mass index.	S

Note: S=Supported, NS=Not supported.

Model 3 was considered the final model. All the information on each *P*-value, β (regression coefficient), 95% CI, standard errors for the remaining and added total of up to 6 (hypothesized and additional) significant paths were concluded in Table 4.32. The detailed description for each significant path is summarized below (**Direct effects).**

Table 4.32 Paths relationship of the final model (Direct effects)

H1	Relationship	β (95%CI)	S.E.	CR	*P*-Value
H1a	Physical Activity ← Sex	-0.339 (-0.41, -0.269)	0.036	-9.421	0.000
H1c	Physical Activity ← School	-0.399 (-0.473, -0.326)	0.038	-10.632	0.000
H1e	Physical Activity ← Num. sibs	0.123 (0.044,0.203)	0.041	3.04	0.002
H1g	Physical Activity ← Household income	0.109 (0.046,0.173)	0.032	3.368	0.001
H2a	Sedentary Behavior ← Sex	0.392 (0.327,0.456)	0.033	11.975	0.000
H2c	Sedentary Behavior ← School	0.283 (0.212,0.354)	0.036	7.775	0.000
H2e	Sedentary Behavior ← Num. sibs	-0.138 (-0.224, -0.051)	0.044	-3.124	0.002
H4a	Breakfast Intake ← Autonomy supportive	0.148 (0.058,0.238)	0.046	3.219	0.001
H5a	Breakfast Intake ← Sex	-0.283 (-0.365, -0.2)	0.042	-6.746	0.000
H9e	Breakfast Intake ← SES	-0.147 (-0.235, -0.058)	0.045	-3.243	0.001
H9a	Breakfast Intake ← Residence	0.135 (0.057,0.213)	0.040	3.394	0.001
H4c	Snack Intake ← Corrosive Control	0.152 (0.062,0.242)	0.046	3.31	0.001
H4d	Snack Intake ← Snack Structure	-0.198 (-0.288, -0.109)	0.046	-4.356	0.000
H4a	Fruit and Vegetable Intake ← Autonomy supportive	0.165 (0.081,0.25)	0.043	3.835	0.000
H4e	Fruit and Vegetable Intake ← Modelling	0.164 (0.085,0.242)	0.040	4.078	0.000
H5a	Fruit and Vegetable Intake ← Sex	-0.16 (-0.245, -0.075)	0.044	-3.67	0.000
H4a	Carbonated Drink Consumption ← Autonomy supportive	-0.107 (-0.207, -0.007)	0.051	-2.094	0.036
H4d	Carbonated Drink Consumption ← Snack Structure	-0.152 (-0.239, -0.065)	0.044	-3.43	0.001
H4c	Carbonated Drink Consumption ← Corrosive Control	0.309 (0.23,0.388)	0.040	7.654	0.000
H5a	Carbonated Drink Consumption ← Sex	-0.12 (-0.203, -0.036)	0.043	-2.81	0.005
H4d	Fasting Food Intake ← Snack Structure	-0.208 (-0.286, -0.131)	0.039	-5.283	0.000
H4c	Fasting Food Intake ← Corrosive Control	0.242 (0.158,0.326)	0.043	5.667	0.000
H5a	Fasting Food Intake ← Sex	0.111 (0.031,0.191)	0.041	2.709	0.007
H9b	Fasting Food Intake ← SSB calories	0.229 (0.14,0.318)	0.045	5.053	0.000
H4a	SSB calories ← Autonomy supportive	-0.114 (-0.201, -0.027)	0.044	-2.568	0.010
H4d	SSB calories ← Snack Structure	-0.099 (-0.175, -0.023)	0.039	-2.563	0.010
H4c	SSB calories ← Corrosive Control	0.261 (0.185,0.338)	0.039	6.685	0.000
H5a	SSB calories ← Sex	-0.237 (-0.324, -0.15)	0.044	-5.335	0.000
H9c	SSB calories ← Sedentary Behavior	0.284 (0.21,0.357)	0.038	7.546	0.000
H4c	Milk Calories ← Corrosive Control	0.14 (0.058,0.222)	0.042	3.341	0.001
H5a	Milk Calories ← Sex	-0.121 (-0.21, -0.032)	0.046	-2.654	0.008
H6a	Waist-to-Height Ratio ← Sex	-0.346 (-0.421, -0.271)	0.038	-9.056	0.000
H6d	Waist-to-Height Ratio ← Physical Activity	-0.272 (-0.382, -0.162)	0.056	-4.829	0.000
H6e	Waist-to-Height Ratio ← Sedentary Behavior	0.377 (0.272,0.483)	0.054	7.02	0.000
H6k	Waist-to-Height Ratio ← SSB calories	0.163 (0.107,0.219)	0.028	5.731	0.000
H6l	Waist-to-Height Ratio ← Milk Calories	0.06 (0.001,0.119)	0.030	1.999	0.046
H7a	Waist-to-Hip Ratio ← Sex	-0.423 (-0.502, -0.344)	0.040	-10.445	0.000
H7d	Waist-to-Hip Ratio ← Physical Activity	-0.22 (-0.341, -0.099)	0.062	-3.561	0.000
H7e	Waist-to-Hip Ratio ←Sedentary Behavior	0.215 (0.084,0.347)	0.067	3.216	0.001
H8a	Body Mass Index (z-score) ← Sex	-0.288 (-0.366, -0.21)	0.040	-7.227	0.000
H8d	Body Mass Index (z-score) ← Physical Activity	-0.257 (-0.37, -0.144)	0.058	-4.461	0.000
H8e	Body Mass Index (z-score) ← Sedentary Behavior	0.364 (0.244,0.483)	0.061	5.981	0.000
H8k	Body Mass Index (z-score) ← SSB calories	0.179 (0.116,0.242)	0.032	5.57	0.000
H8l	Body Mass Index (z-score) ← Milk Calories	0.146 (0.085,0.206)	0.031	4.728	0.000
H9d	Body Mass Index (z-score) ← Residence	-0.097 (-0.141, -0.053)	0.022	-4.365	0.000

Note: β = Standardized regression weights of pathways; SE = Standard errors, P = Probabilities value, CI = Confidence Interval, CR = Critical Ratio

The table presents the direct effects of various relationships on the final model, indicated by the standardized regression weights (β), standard errors (SE), critical ratios (CR), and *P*-values. The significant relationships (*P*-value < 0.05) highlight the influence of different factors on physical activity, sedentary behavior, dietary intake, and anthropometric measurements among the participants. For instance, physical activity is negatively influenced by sex (β = -0.339, *P*-value = 0.000) and school (β = -0.399, *P*-value = 0.000). In contrast, household income and the number of siblings positively influence physical activity (β = 0.109, *P*-value = 0.005) and (β = 0.123, *P*-value = 0.002), respectively. Sedentary behaviour is positively significantly associated with sex (β = 0.392, *P*-value = 0.000) and school (β = 0.283, *P*-value = 0.000) and negatively associated considerably with the number of siblings (β = -0.138, *P*-value = 0.002). Dietary habits such as breakfast intake and fruit and vegetable intake are affected by factors like sex, socio-economic status (SES), and autonomy supportive environments. Notably, carbonated drink consumption is significantly associated with snack structure (β = -0.152, *P*-value = 0.000) and corrosive control (β = 0.309, *P*-value = 0.000).

The table further details the direct effects of various factors on anthropometric measurements, providing insight into how behaviors and environmental influences impact physical health outcomes such as waist-to-height ratio, waist-to-hip ratio, and body mass index (BMI) z-scores. For example, waist-to-height ratio is negatively affected by physical activity (β = -0.157, *P*-value = 0.000) and positively influenced by sedentary behavior (β = 0.125, *P*-value = 0.000), underscoring the detrimental impact of inactivity on body fat distribution. Similarly, waist-to-hip ratio shows a significant negative relationship with physical activity (β = -0.166, *P*-value = 0.000) and a positive relationship with sedentary behavior (β = 0.215, *P*-value = 0.000). The body mass index (BMI) z-scores reveal a strong negative association with physical activity (β = -0.257,

P-value = 0.000) and a positive association with sedentary behavior (β = 0.182, *P*-value = 0.000), highlighting how increased physical activity correlates with lower BMI z-scores, while higher sedentary behavior is linked to higher BMI z-scores. Additionally, BMI z-scores are significantly affected by SSB calories (β = 0.265, *P*-value = 0.000) and milk calories (β = 0.146, *P*-value = 0.000), indicating that higher consumption of sugar-sweetened beverages and milk correlates with higher BMI z-scores.

The data on BMI z-scores also emphasize the significant role of residence (β = 0.097, *P*-value = 0.000), suggesting that environmental factors related to where participants live influence their body weight and overall health. These findings highlight the intricate relationships between lifestyle behaviors, dietary intake, and physical health, providing a nuanced understanding of the determinants of obesity and other anthropometric outcomes.

The Table 4.33 delineates the specific indirect, total, and indirect effects of various predictor variables on anthropometric measurements, as mediated by physical activity, sedentary behaviors, and dietary habits. The analysis reveals significant paths through which adolescent characteristics, demographic factors, and societal characteristics influence anthropometric measurements. For instance, sex impacts WHtR via sugar-sweetened beverage calories (SSBCAL), sedentary behavior (SB), milk calories (MILKCAL), and physical activity (PA), with notable indirect effects (β = 0.212, *P*-value = 0.000). The total effect of sex on WHtR is significant (β = -0.134, *P*-value = 0.003), indicating a robust relationship mediated through these pathways. Similarly, sex influences WHR and zBMI through SB and PA, with significant total effects of β = -0.264 (*P*-value = 0.000) and β = -0.099 (*P*-value = 0.032), respectively.

Table 4.33 standardized specific indirect, total effect, and total indirect effect.

Predictor Variable		Specific indirect				Total effect				Total indirect effect			
		β	S.E.	CR	*P*-value	β	S.E.	CR	*P-value*	β	S.E.	CR	*P*-value
Adolescent characteristics → MAs													
Effects from sex to WHtR	via					-0.134	0.044	-3.019	0.003	0.212	0.030	6.980	0.000
	SSBCAL	-0.039	0.010	-3.827	0.000								
	SB	0.148	0.026	5.795	0.000								
	MILKCAL	-0.007	0.005	-1.585	0.113								
	PA	0.092	0.022	4.142	0.000								
	SB→ SSBCAL	0.018	0.005	3.795	0.000								
Effects from sex to WHR	via					-0.264	0.038	-6.93	0.000	0.159	0.023	6.877	0.000
	SB	0.084	0.027	3.132	0.002								
	PA	0.075	0.023	3.226	0.001								
Effects from sex to zBMI	via					-0.099	0.046	-2.14	0.032	0.189	0.033	5.741	0.000
	SSBCAL	-0.042	0.011	-3.793	0.000								
	SB	0.142	0.028	5.159	0.000								
	MILKCAL	-0.018	0.008	-2.34	0.019								
	PA	0.087	0.022	4.014	0.000								
	SB→ SSBCAL	0.02	0.005	3.847	0.000								
Demographic and societal characteristics → MAs													
Effects from school type to WHtR	via					0.229	0.027	8.378	0.000	0.229	0.027	8.378	0.000
	SB	0.107	0.019	5.534	0.000								
	PA	0.109	0.025	4.349	0.000								
	SB→ SSBCAL	0.013	0.003	3.851	0.000								
Effects from school type to WHR	via					0.149	0.023	6.425	0.000	0.149	0.023	6.425	0.000
	SB	0.061	0.02	3.125	0.002								
	PA	0.088	0.027	3.255	0.001								
Effects from school type to zBMI	via												
	SB	0.103	0.021	4.974	0.000	0.22	0.026	8.441	0.000	0.22	0.026	8.441	0.000
	PA	0.103	0.025	4.157	0.000								
	SB→ SSBCAL	0.014	0.004	3.85	0.000								
Effects from HHI to WHtR	via					-0.03	0.011	-2.693	0.007	-0.03	0.011	-2.693	0.007
	PA	-0.03	0.011	-2.693	0.007								
Effects from HHI to WHR	via					-0.024	0.01	-2.368	0.018	-0.024	0.01	-2.368	0.018
	PA	-0.024	0.01	-2.368	0.018								
Effects from HHI to zBMI	via					-0.028	0.01	-2.75	0.006	-0.028	0.01	-2.75	0.006
	PA	-0.028	0.01	-2.75	0.006								

Table 4.33: Continued

Predictor Variable		Specific indirect				Total effect				Total indirect effect			
		β	S.E.	CR	*P*-value	β	S.E.	CR	*P-value*	β	S.E.	CR	*P*-value
Effects from no. of siblings to WHtR						-0.092	0.028	-3.33	0.001	-0.092	0.028	-3.330	0.001
	SB	-0.052	0.018	-2.917	0.004								
	PA	-0.034	0.013	-2.541	0.011								
SB→	SSBCAL	-0.006	0.002	-2.63	0.009								
Effects from no. of siblings to WHR	via					-0.057	0.018	-3.142	0.002	-0.057	0.018	-3.142	0.002
	SB	-0.03	0.013	-2.235	0.025								
	PA	-0.027	0.012	-2.358	0.018								
Effects from no. of siblings to zBMI	via					-0.089	0.027	-3.333	0.001	-0.089	0.027	-3.333	0.001
	SB	-0.05	0.017	-2.941	0.003								
	PA	-0.032	0.013	-2.507	0.012								
SB→	SSBCAL	-0.007	0.003	-2.633	0.008								
Food parenting behaviors → MAs													
Effects from AS to WHtR	via					-0.019	0.008	-2.392	0.017	-0.019	0.008	-2.392	0.017
	SSBCAL	-0.019	0.008	-2.392	0.017								
Effects from AS to zBMI	via					-0.02	0.009	-2.308	0.021	-0.02	0.009	-2.308	0.021
	SSBCAL	-0.02	0.009	-2.308	0.021								
Effects from CC to WHtR	via					0.051	0.01	5.028	0.000	0.051	0.01	5.028	0.000
	SSBCAL	0.043	0.009	4.558	0.000								
	MILKCAL	0.008	0.005	1.843	0.065								
Effects from CC to zBMI	via					0.067	0.013	5.273	0.000	0.067	0.013	5.273	0.000
	SSBCAL	0.047	0.01	4.45	0.000								
	MILKCAL	0.02	0.007	2.893	0.004								
Effects from SS to WHtR	via					-0.016	0.007	-2.19	0.029	-0.016	0.007	-2.19	0.029
	SSBCAL	-0.016	0.007	-2.19	0.029								
Effects from SS to zBMI	via					-0.018	0.008	-2.19	0.029	-0.018	0.008	-2.19	0.029
	SSBCAL	-0.018	0.008	-2.19	0.029								
Adolescent behaviors → MAs													
Effects from SB to WHtR	via					0.424	0.053	7.94	0.000	0.046	0.011	4.310	0.000
	SSBCAL	0.046	0.011	4.31	0.000								
Effects from SB to zBMI	via					0.414	0.06	6.962	0.000	0.051	0.012	4.325	0.000
	SSBCAL	0.051	0.012	4.325	0.000								

Note: MAs = anthropometric measurements, β = Standardized regression weights of pathways; SE = Standard errors, P = Probabilities value, CI = Confidence Interval, CR = Critical Ratio, Note: The model includes several variables: Physical Activity (PA), gender (SEX), age (AGE), school (SCHOOL), residence (RESIDENCE), household income (HHI), number of siblings (no. of siblings) socioeconomic status (SES), sedentary behavior (SB), autonomy-supportive (AS), corrosive control (CC), snack structure (SS), sugar-sweetened beverage caloric intake (SSBCAL), milk caloric intake (MILKCAL), waist-to-height ratio (WHTR), waist-to-hip ratio (WHR), and body mass index z score(zBMI)

Demographic and societal characteristics, particularly school type, show significant indirect effects on WHR and zBMI through SB and PA, with the total effects being β = 0.229 (*P*-value = 0.000) and β = 0.22 (*P*-value = 0.000), respectively. The paths highlight the critical role of school type in shaping physical activity and sedentary behaviors, which in turn affect anthropometric measurements. Additionally, household income (HHI) impacts WHR and WHR via PA, with notable indirect effects (β = -0.03, *P*-value = 0.007) and (β = -0.024, *P*-value = 0.018). The data underscores the multifaceted nature of anthropometric measurements determinants, illustrating how behavioral, environmental, and socio-economic factors intertwine to influence anthropometric outcomes. The significant indirect paths elucidate the mechanisms through which these variables exert their effects, providing valuable insights for targeted interventions aimed at improving adolescent health outcomes. The predictor variables include physical activity (PA), sedentary behavior (SB), autonomy-supportive (AS), coercive control (CC), and snack structure (SS), with mediating variables such as sugar-sweetened beverage caloric intake (SSBCAL) and milk caloric intake (MILKCAL). For example, the number of siblings shows significant negative total indirect effects on WHR (β = -0.092, *P*-value = 0.001) and zBMI (β = -0.089, *P*-value = 0.001) through PA and SB. Similarly, food parenting behaviors from AS and CC have significant indirect effects on anthropometric measurements through SSBCAL and MILKCAL, with total effects being β = 0.051 (*P*-value = 0.000) for CC to WHR and β = 0.067 (*P*-value = 0.000) for CC to zBMI. Adolescent behaviors also show substantial total effects on WHR (β = 0.424, *P*-value = 0.000) and zBMI (β = 0.414, *P*-value = 0.000) through SSBCAL, with total indirect effects of β = 0.046 (*P*-value = 0.000) and β = 0.051 (*P*-value = 0.000), respectively. These findings highlight the complex interplay between family dynamics, dietary behaviors, and adolescent weight outcomes, with significant pathways demonstrating the mediating role of specific caloric intake sources, as evidenced by *P*-values below 0.05 across multiple relationships.

vii. Participant Characteristics (Cardiometabolic Tests)

A total of 506 respondents who participated in Phase I study were invited into the Phase II study to fulfilled the fifth objective of the study: elucidating the consequences of obesity on adolescent anthropometric measurements and its subsequent influence on cardiometabolic risk factors. Ultimately, 96 participants provided consent for blood sample taking, representing 19% of the eligible participants.

Table 4.34 presents the sample distribution by sociodemographic variables (SDGVs) among the participants in the Cardiometabolic Testing Study (n=96). The participants had a mean age of 16.74 years (SD = 0.73), with ages ranging from 16 to 18 years. The gender distribution was relatively balanced, with 43 boys (44.8%) and 53 girls (55.2%).

Regarding educational background, a significant majority of participants attended private secondary schools (72 participants, 75.5%), while the remainder were enrolled in governmental schools (24 participants, 25.0%). Most participants resided in urban areas (92 participants, 95.4%), with only 4 (4.2%) living in rural settings.

Household income showed considerable variation, with an average income of 1,060.22 thousand IQD (SD 680.76), ranging from 250 to 3,000 thousand IQD. The number of siblings per participant varied widely, with a mean of 3.92 siblings (SD 2.01), ranging from 0 to 14.

In terms of socio-economic status (SES), the parental occupation of participants varied significantly. Among fathers, 15.6% were engaged in high professional and managerial roles, while 49.0% were lower professionals or skilled workers, and 35.4% were unskilled workers. Among mothers, none were in high professional roles, with the majority being unskilled workers (82.3%).

Table 4.34 Sample Distribution by Sociodemographic Variables (SDGVs) Among Participants in the Cardiometabolic Testing Study (n=96)

SDGVs	Variable	Category	F. (%)	Mean, SD (Min - Max)
Adolescent	Age (year)			16.74, 0.73 (16.0-18.11)
	Sex	Boy	43 (44.8)	
		Girl	53 (55.2)	
	Secondary school type	Governmental	24 (25.0)	
		Private	72 (75.5)	
Family and environment variables	Residence	Urban	92 (95.4)	
		Rural	4 (4.2)	
	Household income per thousand IQD			1060.22, 680.76 (250 – 3000)
	No. siblings			3.92, 2.01 (0 – 14)

Socio-Economic Status (SES) Scale		Father, F. (%)	Mother, F. (%)	
Occupation of parent	High professional, and managerial jobs as doctors, engineers, professors, large employers, directors of business, land owners	15(15.6)	0(0.0)	
	Lower professionals, skilled and semiskilled workers as school, teachers, clerical workers, owners of small businesses, military men, and policemen.	47(49.0)	17(17.7)	
	Unskilled workers as laborers, farmers casual workers, unemployed, and retired.	34(35.4)	79(82.3	
The educational level of the parent	Illiterate	6(6.3)	17(1.7)	
	Read, and write	26(27.1)	25(25.0)	
	Primary graduate	25(26.0)	23(24.0)	
	intermediate graduate	7(7.3)	16(16.7)	
	Secondary graduate	16(16.7)	2(2.1)	
	College Graduate	16(16.7)	13(13.5)	
Crowding index	-2 (up to)	57 (59.4)		1.98, 1.03 (0.44-6.00)
	- 4 (up to)	30 (31.3)		
	≥ 4	3 (3.1)		
Property	Owns a house, a car, and all of the household assets.	57 (59.4)		
	The house is rented, with or without a car, and most of the household assets	9 (9.4)		
	The house is shared, with another family, no car, and some of the household assets	30 (31.3)		
Socio-Economic Status (SES)	High (121 – 150)	14 (14.6)		91.47, 22.99 (49-142)
	Moderate (90 - 120)	31 (32.3)		
	Low (89 -, and less)	51 (53.1)		

The educational level of parents also varied, with 16.7% of fathers and 13.5% of mothers being college graduates. However, a significant proportion of mothers were illiterate (17.7%) or had only completed primary education (24.0%).

The crowding index revealed that the majority of participants (59.4%) lived in less crowded households (up to 2 persons per room), while 31.3% lived in moderately crowded conditions (up to 4 persons per room). Additionally, 59.4% of participants' families owned a house, a car, and all household assets, while 31.3% lived in shared housing with fewer assets.

Finally, the overall socio-economic status of participants revealed that more than half of the participants (53.1%) fell into the low SES category, while 32.3% had moderate SES, and 14.6% were classified as having high SES. The mean SES score was 91.47 (SD = 22.99), with a range from 49 to 142.

viii. Cardiometabolic Characteristics and Anthropometric Measurements of Participants

The analysis presented in Table 4.35 provides examination of the cardiometabolic and anthropometric measurements measures among the study participants (n = 96), offering a comprehensive overview of key health indicators within this cross-sectional study.

The assessment of blood pressure reveals that the participants had a mean systolic blood pressure of 115.84 mmHg (SD 9.06) and a mean diastolic blood pressure of 69.23 mmHg (SD 7.42). These values suggest that, on average, the participants-maintained blood pressure levels within the normal range, which is crucial for reducing the risk of cardiovascular diseases.

Biochemical profiles further elucidate the metabolic health of the participants. The mean triglyceride level was recorded at 80.87 mg/dl (SD 21.58), and the mean total cholesterol level was 138.52 mg/dl (SD 16.45). Additionally, the High-Density Lipoprotein (HDL) mean was 42.78 mg/dl (SD 8.12), while Low-Density Lipoprotein

(LDL) averaged 79.58 mg/dl (SD 17.24). These lipid profile measurements provide critical insights into the participants' cardiovascular risk, with values largely indicating a favorable lipid status among the majority.

The glycemic indices, which include fasting blood sugar (FBS) and serum insulin levels, reveal a mean FBS of 4.06 mmol/L (SD 0.55) and a mean serum insulin level of 21.59 µU/mL (SD 4.30). The Homeostatic Model Assessment of Insulin Resistance (HOMA IR) yielded a mean value of 3.94 (SD 1.14), reflecting varied degrees of insulin resistance across the cohort. These findings are instrumental in understanding the prevalence of metabolic syndrome and the risk of developing type 2 diabetes among the participants.

Anthropometric measurements were also a focal point of the study, with the Body Mass Index (BMI) z-score providing a nuanced understanding of anthropometric measurements relative to age and sex. The mean BMI z-score was 1.01 (SD 1.51), with the distribution indicating that 2.1% of participants were underweight, 43.8% had a normal weight, 27.1% were overweight, 17.7% were classified as obese, and 9.4% were severely obese. These statistics underscore the significant variation in anthropometric measurements within the study group, highlighting areas for targeted intervention.

Lastly, the Waist-to-Height Ratio (WHtR) and Waist-to-Hip Ratio (WHR) provide additional insights into central adiposity, with mean values of 0.51 (SD 0.09) and 0.85 (SD 0.10), respectively. These ratios are critical indicators of abdominal obesity, which is closely associated with increased cardiometabolic risk.

Overall, the data presented in Table 4.35 offer a detailed snapshot of the cardiometabolic and anthropometric measurements among participants, emphasizing the importance of these measures in predicting health outcomes and guiding future interventions.

Table 4.35 Mean and Standard Deviation of Cardiometabolic and Anthropometric Measurements Measures Among Study Participants (*n*=96)

Study variables	Cutoff point	Mean (SD)	F. (%)
Blood pressure	Systolic B.p (mmHg)	115.84(9.06)	
	Diastolic B.p (mmHg)	69.23 (7.42)	
Biochemical profiles	Triglycerides (mg/dl)	80.87 (21.58)	
	Total Cholesterol (mg/dl)	138.52 (16.45)	
	HDL (mg/dl)	42.78 (8.12)	
	LDL (mg/dl)	79.58 (17.24)	
Glycaemic indices	FBS (mmol/L)	4.06 (0.55)	
	Serum Insulin (µU/mL)	21.59 (4.30)	
	HOMA IR	3.94 (1.14)	
Anthropometric measurements			
BMI z-score	BMI z-score	1.01 (1.51)	
	Underweight: BMI z-score < -2 SD		2 (2.1)
	Normal weight: BMI z-score ≥ -2 SD and ≤ +1 SD		42 (43.8)
	Overweight: BMI z-score > +1 SD and ≤ +2		26 (27.1)
	Obese: BMI z-score > +2 ≤ +3 SD		17 (17.7)
	Severely Obese: BMI z-score > +3 SD		9 (9.4)
WHtR		0.51 (0.09)	
WHR		0.85 (0.10)	

Note: Fasting Blood Sugar (FBS), High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), Homeostatic Model Assessment of Insulin Resistance (HOMA IR), Body Mass Index (BMI), Waist-to-Height Ratio (WHtR), Waist-to-Hip Ratio (WHR), millimeters of mercury (mmHg), milligrams per deciliter (mg/dl), millimoles per liter (mmol/L), and micro-units per milliliter (µU/mL).

ix. Simple Linear Regression Analysis

Table 4.36 presents a detailed analysis of the relationship between cardiometabolic variables and anthropometric measurements indicators among the study participants, using simple linear regression models. These results reveal important insights into how different anthropometric measurements are Waist-to-Height Ratio (WHtR), Waist-to-Hip Ratio (WHR), and BMI z-score correlate with various cardiometabolic outcomes, providing significant implications for understanding the health risks associated with obesity.

The analysis indicates a robust positive association between systolic blood pressure and all three anthropometric measurements indicators. Specifically, WHtR (Model 1) demonstrated a strong correlation with systolic blood pressure ($\beta = 0.430$, 95% CI [0.341, 0.520], $p < 0.001$), with a *P*-value indicating a highly significant association ($p < 0.01$). This finding suggests that central obesity, as measured by

WHtR, is a significant predictor of elevated systolic blood pressure, highlighting the importance of addressing central adiposity in adolescent populations. Similarly, the BMI z-score (Model 3) showed an even stronger association ($\beta = 2.413$, 95% CI [1.944, 2.883], $p < 0.001$), also highly significant ($p < 0.01$), indicating that overall body fatness is a critical determinant of higher systolic blood pressure levels. The significant positive correlation between WHR (Model 2) and systolic blood pressure further supports the role of fat distribution in influencing cardiovascular risk factors.

For diastolic blood pressure, WHtR (Model 4) also emerged as a significant predictor ($\beta = 0.247$, 95% CI [0.171, 0.324], $p < 0.001$), with a highly significant association ($p < 0.01$), suggesting that increased central adiposity is associated with higher diastolic pressure. The BMI z-score (Model 6) similarly predicted diastolic pressure ($\beta = 1.412$, 95% CI [1.008, 1.817], $p < 0.001$), reinforcing the role of overall obesity in elevating both systolic and diastolic blood pressures. The association for WHR (Model 5) ($\beta = 0.101$, 95% CI [0.020, 0.183], $p = 0.015$) was significant ($p < 0.05$), suggesting that fat distribution also plays a role in predicting diastolic pressure, albeit less strongly than other measures of central and overall adiposity.

In terms of lipid profiles, triglyceride levels were significantly associated with all three anthropometric measurements indicators. WHtR (Model 7) had a notable positive relationship with triglyceride levels ($\beta = 1.144$, 95% CI [0.757, 1.530], $p < 0.001$), which was highly significant ($p < 0.01$). This suggests that as central obesity increases, triglyceride levels rise, indicating a higher risk of dyslipidemia among those with greater central fat accumulation. The BMI z-score (Model 9) also showed a significant impact on triglyceride levels ($\beta = 7.302$, 95% CI [4.791, 9.814], $p < 0.001$), again highly significant ($p < 0.01$), implying that adolescents with higher overall body fat are at greater risk for elevated triglycerides, a known risk factor for cardiovascular disease.

The associations with total cholesterol were less pronounced. WHtR (Model 11) showed a borderline significant result (β = 0.341, 95% CI [0.001, 0.681], p = 0.052), with a *P*-value slightly above 0.05, while WHR (Model 12) did not reach significance (β = 0.259, 95% CI [-0.040, 0.559], p = 0.089). The BMI z-score (Model 13) also showed a non-significant relationship with total cholesterol (β = 1.572, 95% CI [-0.652, 3.797], *P*-value = 0.164), indicating that total cholesterol levels may not be as closely linked to these specific anthropometric measurements measures as other cardiometabolic markers.

In contrast, HDL levels showed significant inverse associations with all three anthropometric measurements indicators. The BMI z-score (Model 16) had a strong inverse relationship with HDL (β = -2.653, 95% CI [-3.609, -1.696], *P*-value < 0.001), which was highly significant (p < 0.01), and WHtR (Model 14) also showed a significant inverse association (β = -0.370, 95% CI [-0.522, -0.218], *P*-value < 0.001), also highly significant (*P*-value < 0.01). These findings suggest that as obesity increases, protective HDL levels decrease, elevating cardiovascular risk.

For LDL, significant positive associations were observed with BMI z-score (Model 19, β = 3.120, 95% CI [0.874, 5.366], *P*-value = 0.007), with the association being highly significant (p < 0.01), and WHtR (Model 17, β = 0.536, 95% CI [0.192, 0.880], *P*-value = 0.003), which was also highly significant (p < 0.01). These findings suggest that as BMI z-score and WHtR increase, LDL levels rise, which is consistent with the known role of LDL in cardiovascular risk. WHR (Model 18) showed a significant but weaker relationship with LDL (β = 0.351, 95% CI [0.043, 0.659], *P*-value = 0.026), indicating a significant association (p < 0.05), implying that WHR might be somewhat influential in predicting LDL levels.

Fasting Blood Sugar (FBS) levels demonstrated significant positive associations with both WHtR (Model 20, β = 0.016, 95% CI [0.005, 0.027], *P*-value = 0.005) and WHR (Model 21, β = 0.015, 95% CI [0.005, 0.025], *P*-value = 0.003), both

of which were highly significant ($p < 0.01$), suggesting that higher central obesity is associated with increased FBS levels. The BMI z-score (Model 22) also showed a significant relationship with FBS ($\beta = 0.087$, 95% CI [0.014, 0.160], *P*-value = 0.019), with a *P*-value indicating significance (*P*-value < 0.05), indicating that overall obesity contributes to elevated FBS levels, although to a lesser extent compared to central adiposity.

The analysis reveals that insulin hormone levels are significantly and positively associated with all three anthropometric measurements indicators, emphasizing the critical role of both central and overall adiposity in metabolic health. The Waist-to-Height Ratio (WHtR) demonstrated a highly significant association ($\beta = 0.144$, 95% CI [0.059, 0.229], *P*-value < 0.001) with insulin levels, indicating that central obesity substantially contributes to elevated insulin, a precursor to insulin resistance. Similarly, the BMI z-score showed a robust positive relationship ($\beta = 0.952$, 95% CI [0.403, 1.501], *P*-value < 0.001), underscoring the impact of overall body fatness on insulin hormone levels and highlighting the risk of metabolic disorders associated with general obesity. The Waist-to-Hip Ratio (WHR) also exhibited a significant association ($\beta = 0.129$, 95% CI [0.055, 0.203], $p < 0.001$), further supporting the role of fat distribution in influencing insulin levels. These findings underscore the importance of addressing both central and overall obesity in clinical interventions to mitigate the risk of insulin resistance and related metabolic complications, particularly in adolescent populations.

Regarding HOMA IR, a measure of insulin resistance, significant positive relationships were found with all three anthropometric measurements indicators. The BMI z-score (Model 28) was a significant predictor of HOMA IR ($\beta = 0.278$, 95% CI [0.138, 0.422], *P*-value < 0.001), with a highly significant association (*P*-value < 0.01). Similarly, WHR (Model 27, $\beta = 0.037$, 95% CI [0.018, 0.057], $p < 0.001$) and WHtR (Model 26, $\beta = 0.045$, 95% CI [0.023, 0.067], *P*-value < 0.001) also showed

highly significant associations ($p < 0.01$), highlighting the role of both central and overall obesity in exacerbating insulin resistance. These findings underscore the crucial role of body fat distribution and overall adiposity in the development of insulin resistance, a significant risk factor for type 2 diabetes and other metabolic disorders.

The analysis presented in Table 4.36 provides a comprehensive examination of the relationships between cardiometabolic variables and various anthropometric measurements indicators namely, Waist-to-Height Ratio (WHtR), Waist-to-Hip Ratio (WHR), and BMI z-score among the study participants. Utilizing simple linear regression, the study constructed path models, as depicted in Figure 4.9 (Initial Model) and Figure 4.10 (Final Models), which include only the significant pathways (*P*-value < 0.01).

The results demonstrate a strong positive relationship between zBMI and systolic blood pressure ($\beta = 2.413$, 95% CI [1.944 to 2.883], *P*-value < 0.001) and diastolic blood pressure ($\beta = 1.412$, 95% CI [0.008 to 1.817], *P*-value < 0.001), indicating that as zBMI increases, both systolic and diastolic blood pressures significantly rise. WHtR also contributes notably to the increase in systolic blood pressure ($\beta = 0.430$, 95% CI [0.341 to 0.520], *P*-value < 0.001) and diastolic blood pressure ($\beta = 0.247$, 95% CI [0.171 to 0.324], *P*-value < 0.001), albeit to a lesser extent than zBMI. The WHR shows a moderate but significant effect on both systolic and diastolic blood pressures.

For lipid parameters, zBMI is a significant predictor of triglycerides (TG) ($\beta = 7.302$, 95% CI [4.791 to 9.814], *P*-value < 0.001) and low-density lipoprotein (LDL) ($\beta = 3.120$, 95% CI [0.874 to 5.366], *P*-value = 0.007), suggesting that higher zBMI is associated with elevated TG and LDL levels. WHtR also significantly predicts increased TG ($\beta = 1.144$, 95% CI [0.757 to 1.530], *P*-value < 0.001) and LDL ($\beta = 0.536$, 95% CI [0.192 to 0.880], $p = 0.003$). Interestingly, zBMI is negatively associated with HDL levels ($\beta = -2.653$, 95% CI [-3.609 to -1.696], *P*-value < 0.001),

indicating that higher zBMI leads to lower HDL, a pattern also observed with WHtR and WHR, though to a lesser degree.

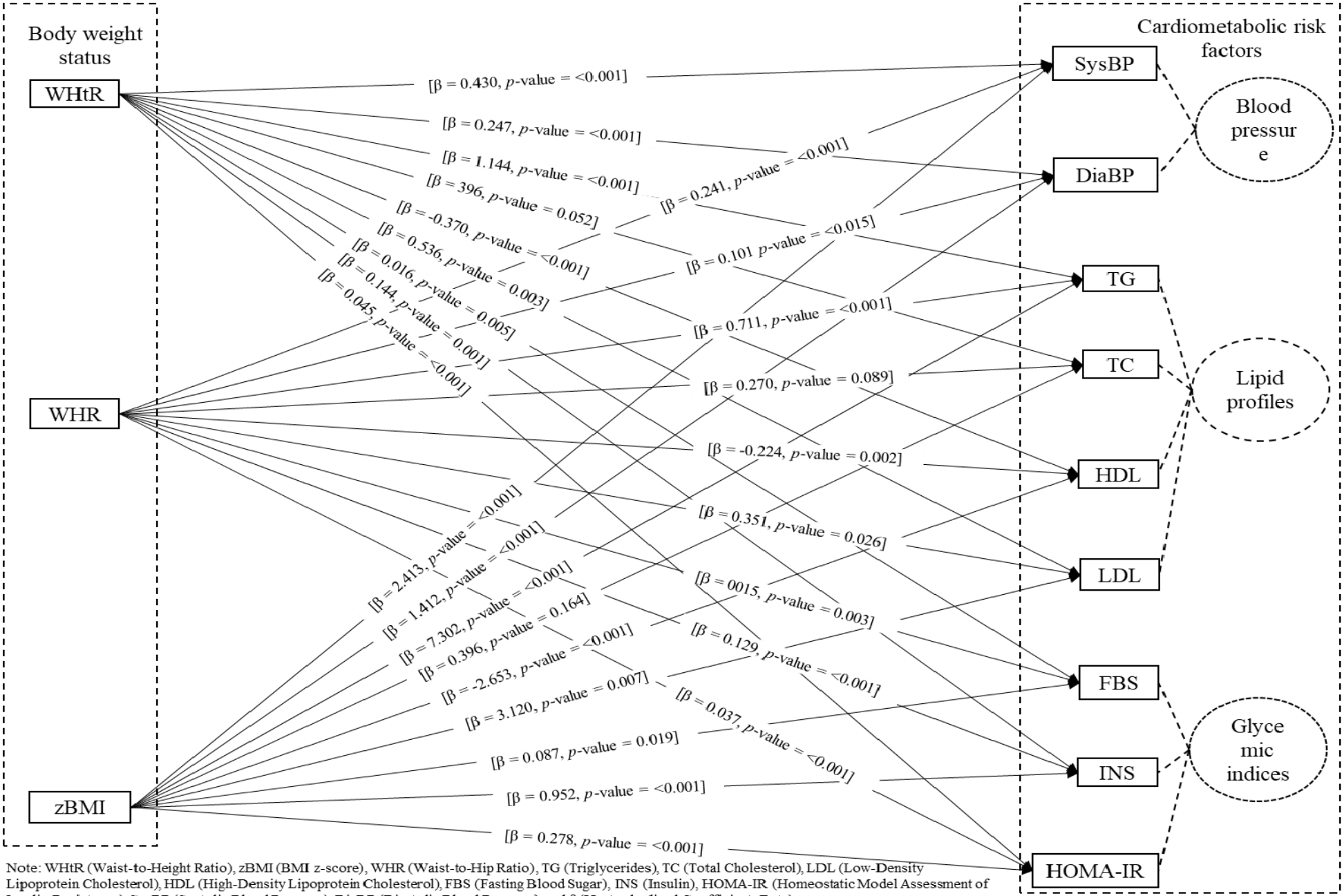
Regarding fasting blood sugar (FBS), zBMI again emerges as a significant predictor (β = 0.087, 95% CI [0.014 to 0.160], *P*-value = 0.019), indicating a direct relationship between higher zBMI and elevated FBS levels. Both WHtR and WHR also show significant associations with FBS and insulin hormone levels, with zBMI having the strongest effect on insulin hormone levels (β = 0.952, 95% CI [0.403 to 1.501], *P*-value < 0.001) and HOMA IR (β = 0.278, 95% CI [0.138 to 0.422], *P*-value < 0.001).

Overall, the results suggest that zBMI is the most potent predictor across the majority of cardiometabolic outcomes, particularly for systolic and diastolic blood pressures, triglycerides, LDL, and insulin resistance. The WHtR and WHR also contribute significantly, albeit to a lesser degree, highlighting their importance as predictors of cardiometabolic risk factors in this adolescent population. The consistent significance of these anthropometric measurement's variables across various cardiometabolic outcomes underscores the critical role of body composition and fat distribution in influencing the cardiometabolic health of adolescents. This information is essential for developing targeted interventions aimed at mitigating these risks in youth populations.

Table 4.36 Simple Linear Regression Analysis for Cardiometabolic Variables on Anthropometric Measurements

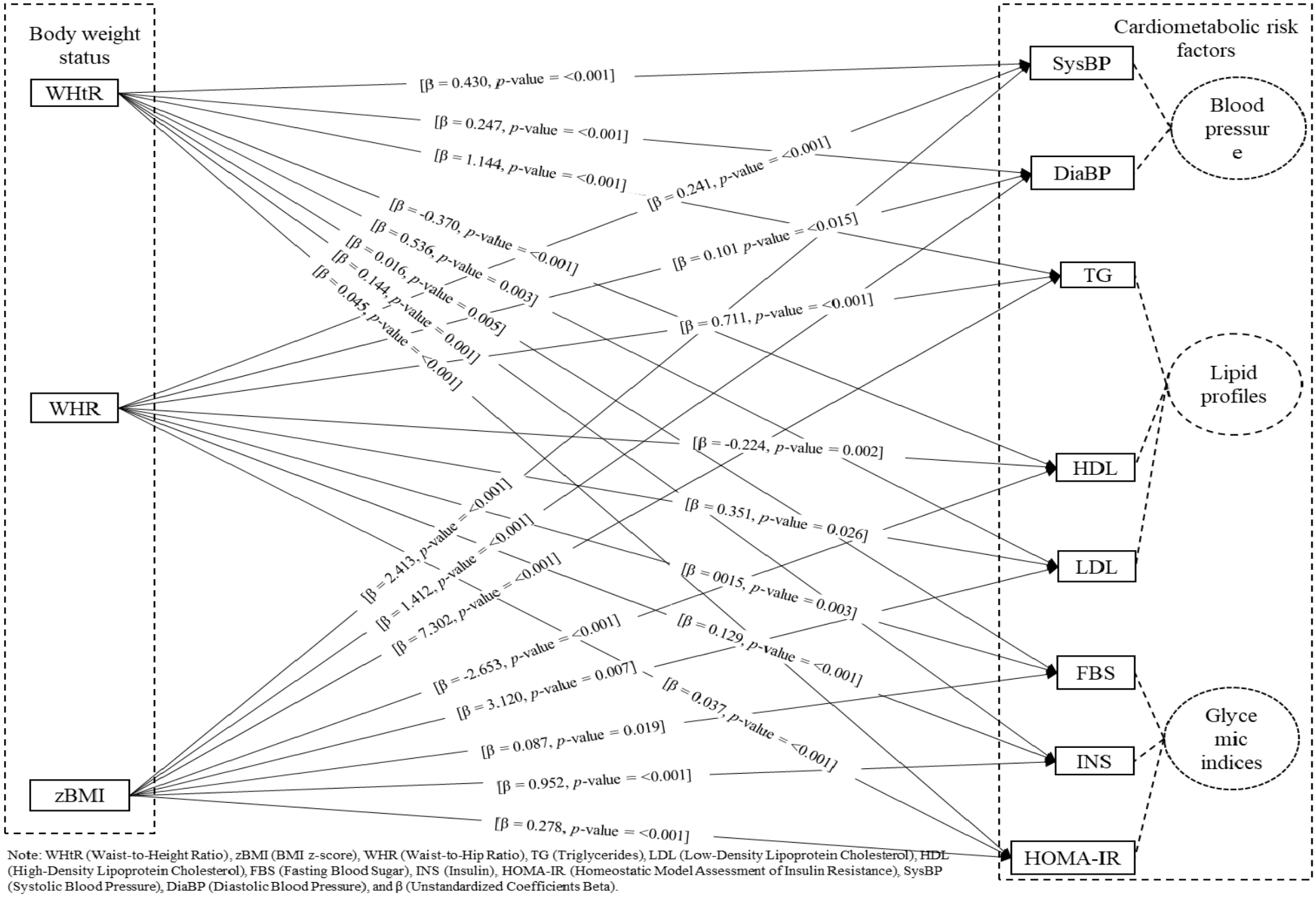
M	PV.	DV.	β (95% CI)	S.E.	t-value	*P*-value
1	WHtR →	Sys. B.p	0.430 (0.341 to 0.520)	0.045	9.483	**<0.001**
2	WHR →	Sys. B.p	0.241 (0.143 to 0.339)	0.050	4.844	**<0.001**
3	zBMI →	Sys. B.p	2.413 (1.944 to 2.883)	0.239	10.094	**<0.001**
4	WHtR →	Dia. B.p	0.247 (0.171 to 0.324)	0.039	6.361	**<0.001**
5	WHR →	Dia. B.p	0.101 (0.020 to 0.183)	0.042	2.436	**0.015**
6	zBMI →	Dia. B.p	1.412 (0.008 to 1.817)	0.206	6.865	**<0.001**
7	WHtR →	TG	1.144 (0.757 to 1.530)	0.195	5.878	**<0.001**
8	WHR →	TG	0.711 (0.343 to 1.079)	0.185	3.837	**<0.001**
9	zBMI →	TG	7.302 (4.791 to 9.814)	1.265	5.773	**<0.001**
11	WHtR →	TC	0.341 0.001 to 0.681)	0.780	1.951	0.052
12	WHR →	TC	0.259 (-0.040 to 0.559)	0.151	0.174	0.089
13	zBMI →	TC	1.572 (-0.652 to 3.797)	1.120	1.403	0.164
14	WHtR →	HDL	-0.370 (-0.522 to -0.218)	0.077	-4.826	**<0.001**
15	WHR →	HDL	-0.224 (-0.366 to -0.082)	0.071	-3.140	**0.002**
16	zBMI →	HDL	-2.653 (-3.609 to -1.696)	0.482	-5.507	**<0.001**
17	WHtR →	LDL	0.536 (0.192 to 0.880)	0.173	3.096	**0.003**
18	WHR →	LDL	0.351 (0.043to 0.659)	0.155	2.266	**0.026**
19	zBMI →	LDL	3.120 (0.874 to 5.366)	1.131	2.758	**0.007**
20	WHtR →	FBS (mmol/L)	0.016 (0.005 to 0.027)	0.006	2.847	**0.005**
21	WHR →	FBS (mmol/L)	0.015 (0.005 to 0.025)	0.005	3.107	**0.003**
22	zBMI →	FBS (mmol/L)	0.087 (0.014 to 0.160)	0.037	2.380	**0.019**
23	WHtR →	Insulin hormone	0.144 (0.059 to 0.229)	0.043	3.352	**0.001**
24	WHR →	Insulin hormone	0.129 (0.055 to 0.203)	0.037	3.443	**<0.001**
25	zBMI →	Insulin hormone	0.952 (0.403 to 1.501)	0.277	3.442	**<0.001**
26	WHtR →	HOMA IR	0.045 (0.023 to 0.067)	0.011	4.017	**<0.001**
27	WHR →	HOMA IR	0.037 (0.018 to 0.057)	0.010	3.781	**<0.001**
28	zBMI →	HOMA IR	0.278 (0.138 to 0.422)	0.073	3.838	**<0.001**

Note: Model (M), Predictor Variable (PV), Dependent Variable (DV), Unstandardized Beta Coefficient with 99% Confidence Interval (β [99% CI]), Standard Error (SE), Adjusted R-squared (Adj. R^2), and Fasting Blood Sugar (FBS), Triglycerides (TG), Total Cholesterol (TC), High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), Homeostatic Model Assessment of Insulin Resistance (HOMA IR), Body Mass Index (BMI), Waist-to-Height Ratio (WHtR), Waist-to-Hip Ratio (WHR), millimeters of mercury (mmHg), milligrams per deciliter (mg/dl), millimoles per liter (mmol/L), and micro-units per milliliter (µU/mL).



Note: WHtR (Waist-to-Height Ratio), zBMI (BMI z-score), WHR (Waist-to-Hip Ratio), TG (Triglycerides), TC (Total Cholesterol), LDL (Low-Density Lipoprotein Cholesterol), HDL (High-Density Lipoprotein Cholesterol), FBS (Fasting Blood Sugar), INS (Insulin), HOMA-IR (Homeostatic Model Assessment of Insulin Resistance), SysBP (Systolic Blood Pressure), DiaBP (Diastolic Blood Pressure), and β (Unstandardized Coefficients Beta).

Figure 4.9 Initial Simple Linear Regression Analysis



Note: WHtR (Waist-to-Height Ratio), zBMI (BMI z-score), WHR (Waist-to-Hip Ratio), TG (Triglycerides), LDL (Low-Density Lipoprotein Cholesterol), HDL (High-Density Lipoprotein Cholesterol), FBS (Fasting Blood Sugar), INS (Insulin), HOMA-IR (Homeostatic Model Assessment of Insulin Resistance), SysBP (Systolic Blood Pressure), DiaBP (Diastolic Blood Pressure), and β (Unstandardized Coefficients Beta).

Figure 4.10 Final Simple Linear Regression Analysis

4.4 Chapter Summary

This chapter critically examines the findings and objectives of each phase. In Phase I, the translation of the English questionnaire adhered to a standard procedure, followed by rigorous content validity by experts, face validity, and pre-testing. The results indicated that the translated AFPQ-A and BEVQ-A were sufficiently prepared for construct validity testing, with EFA applied to AFPQ-A and internal consistency reliability assessed for BEVQ-A. The EFA results confirmed the theoretical soundness of the extracted factors and items. Validation analysis using CFA revealed that the scales measuring all related variables achieved acceptable fit indices (CFI, RMSEA, SRMR, and TLI). The reliability of the BEVQ-A was further supported by five tests, which showed strong reliability across most beverage types, evidenced by high ICCs, Cronbach's alpha values, and Pearson correlations. Bland-Altman plots identified small but significant systematic biases for milk beverages in fl oz and grams, negligible bias in kcal, and no significant systematic biases for sugar-sweetened beverages and total beverages across all units, reinforcing the consistency and reliability of dietary assessments. Collectively, these exploratory, confirmatory, and internal consistency reliability studies provided robust evidence of the validity and reliability of the measurement tools for assessing food parenting practices and beverage intake among adolescents.

Moreover, in Phase II, the final measurement model was applied for structural path analysis to investigate the inter-relationships among key variables. This analysis uncovered forty-five significant path relationships within the model, demonstrating a good fit across all fit indices. The analysis also revealed variance explanations categorized as follows: poor for milk calories, snack quantity, and fruit and vegetable intake; fair for carbonated drink consumption, breakfast frequency, and sugar-sweetened beverage calories; good for waist-to-height ratio (WHtR), fast food intake, sedentary behavior, and physical activity; and very good for waist-to-hip ratio (WHR) and body mass index Z score (zBMI) .

CHAPTER 5 DISCUSSION

5.1 Introduction

This chapter presents the study findings in alignment with the study objectives across the two phases. Phase I was aimed to assess the validity and reliability of the Arabic versions of the Adolescent Food Parenting Practices Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ). Phase II was aimed to identify the direct and indirect pathways linking sociodemographic characteristics, food parenting practices (FPP), sugar sweetened beverages (SSBs) consumption, dietary behaviors, physical activity, sedentary behavior, and anthropometric measurements among Iraqi adolescents. Additionally, it sought to examine the influence of anthropometric measurements (BMI, WHR, and WHtR) on cardiometabolic risk factors in this population.

5.2 Translation, Cultural Adaptation, and Validation of Arabic-Version Questionnaires

5.2.1 Adolescent Food Parenting Practices Questionnaire (AFPQ)

This study followed the translation guidelines recommended by Wild *et al.* (2005) and reviewed by experts to ensure clarity and accuracy in the Arabic version of the questionnaire (Matsumoto, and Vijver, 2011). It is the first known pilot study to translate and adapt a tool measuring adolescent food parenting practices in Iraq. The Arabic version showed satisfactory content and face validity, making it useful for assessing food parenting behaviors and sugary drink consumption. With Arabic being the fifth most spoken language globally and officially recognized in 22 countries, the questionnaire holds strong potential for broader application (Istizada, 2024).

The process of cross-cultural adaptation involves not only translation but also culturally appropriate adjustments for a new context (Matsumoto, and Vijver, 2011; Tran, Nguyen, and Chan, 2017). Despite the extensive geographical diversity of Iraq, the Arabic language exhibits a wide range of accents, slang, and subtleties. During this research, challenges faced by researchers include in finding accurate Arabic equivalents for terms like "a small snack as comfort" during the reconciliation process. Consequently, the study included both the Arabic term "كالتعتيمة" and the English term "like a bite-sized treat" in item Q14 through consensus among the panel committee and the researcher. Such translation efforts often encounter difficulties when languages lack direct equivalents, potentially resulting in divergent interpretations (Tran, Nguyen, and Chan, 2017). This highlights the growing importance of cross-cultural research translation within the field of health research.

The cognitive interviews revealed that most parents and adolescents understood the questions, though they suggested changes to the questionnaire's structure, wording, and use of examples. In particular, they emphasized the need for clearer examples for items related to coercive control (Q7p and Q7a). The study found several items—specifically 2, 4, 6, and 11—to be confusing, prompting revisions in sentence structure and added context. Examples like "having healthy meals together" or "offering fruit during study time" were included to make the items more relatable. These findings highlight the importance of simplifying assessment tools and tailoring them for audiences with limited education or literacy before using them in diverse cultural contexts.

This study confirms that the AFPQ-A has good, clear, simple, and essential content validity based on relevance, clarity, simplicity, and ambiguity. To prove the accuracy of the translation and suitability for the target audience from a cultural perspective, the assessment items provide a holistic perspective of content validity. The translated version needs to be culturally appropriate, with an acceptable content

validity index (I-CVI/Ave of 0.90 or higher according to Polit, Beck, and Owen, 2007, and 0.80 according to Saiful, and Yusoff, (2019), and reached the same communicative effect as the original. According to this study, the AFPQ-A showed strong content validity for the Iraqi population, with an I-CVI/Ave of 0.95 and an I-CVI/UA of 0.81. The kappa statistic revealed that the majority of items had values of 1.00, significantly supporting the CVI results and indicating a level of agreement beyond chance. To improve clarity and eliminate ambiguity, items Q2p, Q2a, Q3a, Q9p, Q9a, and Q14p were revised.

Face validation verified that respondents understood the questions. The questionnaire was simple, easy to read, and uncomplicated, resulting in no tension or unanswered questions. The face validation index (FVI) for clarity and comprehension of the current questionnaire among parents and their adolescents ranged from 0.80 to 1.00 (I-FVI), with an S-FVI/Ave of 0.95 and 0.94, respectively. Many researchers recommend that an item face validation index (I-FVI) value above 0.80 and an S-FVI/Ave value above 0.90 are acceptable for inter-rater agreement in questionnaires (Nurma *et al.*, 2017; Saiful, and Yusoff, 2019b).

Language and cultural adaptation were common issues in the English-to-Arabic translation (Husni, and Newman, 2015; Mubarak, 2017). A few English terms were mistranslated into Arabic, leading to different words for the similar concept. Additionally, some Arabic terminology was not suitable for translation. The expert group also rejected a few participant suggestions because they would fundamentally alter the main questions.

Lastly, the study supports the use of the AFPQ-A to measure adolescent food parenting behaviors in Iraqi adolescents, despite the limitations highlighted earlier. The AFPQ-A offers additional advantages for the clinical evaluation of adolescent obesity, including reduced burden costs, applicability to a wide sample population, and rapid assessment in nearby facilities (Koning, Gevers, *et al.*, 2021; Koning, Vink, *et*

al., 2021). The study suggests further investigation into the relationships, development, and associated health effects in young children. Childhood obesity and food parenting are well-known public health issues linked to numerous negative health outcomes.

These studies will help improve public health, especially in Iraq, by addressing the rising epidemics of childhood obesity and nutritional disorders. Healthy eating habits among adolescents are associated with better health outcomes, including increased parental support for autonomy and health structure, while unhealthy eating habits are linked to less coercive control and poor snack structure (Koning *et al.*, 2021). This study has the potential to be a useful indicator of food parenting behaviors, provide evidence of risks, and facilitate earlier population-level intervention through more relevant and focused programs, given its primary focus on young children.

5.2.2 Beverage Intake Questionnaire (BEVQ)

This study documented the successful translation and validation of the Beverage Intake Questionnaire (BEVQ) for Iraq. The translation process followed all forms of equivalence translation which includes; semantic, content, technical, criterion, and conceptual. National references for beverages were included including local advertising brands, unit measures, and logo names. Evaluation by experts showed that content validity was adequately high, although several items such as Q1 and Q6 had lower agreement scores and therefore required some adjustments. Most items achieved unanimous agreement, strong validity for face validity. Overall, the Arabic BEVQ has been found to adequately address the requirements of validity and reliability concerning beverage consumption studies in Iraq.

The process of translating and culturally adapting the Beverage Questionnaire (BEVQ) from English to Arabic (Iraq) effectively ensured semantic, content, technical, criterion, and construct-concept equivalence. These findings align with

existing literature on questionnaire adaptation, which emphasizes the importance of maintaining these forms of equivalence (Andrechuk *et al.*, 2019; Jomori *et al.*, 2021). The high content validity and face validity achieved in this study are consistent with previous studies that report similar validity indices for well-validated instruments (Saiful, and Yusoff, 2019a, 2019b; Saiful *et al.*, 2021). Differences in specific items, like Q1 and Q6, suggest potential cultural nuances or translation ambiguities, which have also been noted in other dietary assessment adaptations (Livingstone *et al.*, 2023). By including culturally familiar drinks and local brands, this study reinforces the importance of cultural relevance, a key factor in accurate dietary assessments (Tayyem *et al.*, 2020, 2021). The validated Arabic BEVQ provides a reliable tool for cross-cultural research and public health interventions in Iraq, contributing significantly to the field by facilitating accurate beverage consumption assessment in Arabic-speaking populations. Future studies could focus on refining problematic items and exploring regional differences to further enhance the tool's applicability.

Two studies have addressed the development and translation of beverage intake questionnaires for the Saudi Arabian population. The first study (Aldhirgham *et al.*, 2023), had several limitations. The questionnaire, adapted from prior research, lacked a comprehensive content validity process, which may have compromised its cultural relevance. The study was based on a small sample of adults, limiting the generalizability of the results. Moreover, it did not account for total beverage intake, sugar-sweetened beverages (SSBs), or milk consumption based on caloric intake, restricting the scope of the findings. The focus on a specific age group further constrained the ability to apply the results to the broader population. Future research should employ larger, more diverse samples and include validated beverage categories that account for caloric intake. The second study (Islam *et al.*, 2020), which involved translating an existing questionnaire, also faced significant limitations. Notably, the translation process lacked a formal validation procedure to ensure semantic, content,

technical, criterion, and construct equivalence. This absence raised concerns about the consistency and reliability of the translated items. Additionally, no expert-driven content validation index was utilized to confirm the relevance and appropriateness of the questionnaire items for the target population. Without these crucial validation steps, the accuracy and cultural adaptability of the translated questionnaire in assessing beverage consumption remain uncertain.

The processes of adaptation of the Beverage Intake Questionnaire (BEVQ) faced multiple barriers relating to maintenance of validity – both face and content validity in the Iraqi context. Considerable work was done to ensure multiple forms of equivalence: semantic, content, technical, and construct; however, the differences in beverage consumption between the West and Iraq posed challenges. Take for example the fact that American students tend to consume a wide variety of drinks including water, milk, and sugary beverages (Miller *et al.*, 2017), while Iraqis are more likely to prefer tea, coffee, and more recently, bottled water and soft drinks (Hassan, and Othman, 2024). Some efforts were made to address face validity, like incorporating local drinks such as tamarind juice into the survey with professionals' input and validation through face validity (Wild et al., 2005).

Content validity, evaluated by a panel of four experts, was reasonably good, although some elements such as Q1 and Q6 showed lower agreement and require further refinement (Polit, and Beck, 2006). Despite face validity receiving favorable marks, it is widely recognized as a subjective indicator based on expert and participant perceptions of clarity and fit within the culture (Saiful, and Yusoff, 2019b; Amir, and Mohamad, 2021). This subjectivity risks ignoring important cultural factors which may lead to misconceptions (Boateng *et al.*, 2018). Ethnographic, cultural, and anthropological critiques suggest the absence of a deeper understanding of cultures results in constructs being imposed on diverse people, ideas which are inherently rooted in monolithic, colonial belief systems. Thus, sufficient face validity does not

ensure the absence of adaptation, high validity culturally relevant changes (Ares, 2018; Saiful, and Yusoff, 2019b; Broesch *et al.*, 2020).

The research notes the successful cultural adaptation, translation and validation of the Beverage Intake Questionnaire (BEVQ) into Arabic for Iraqi adolescents. The instrument had adequate semantic, content and technical equivalence which indicates it is valid for measuring sugar and milk beverage intake among the youth, bilingual parents, and guardians. This is vital to help address the problem of obesity exacerbated by high beverage consumption (Bleich, and Vercammen, 2018; Amin, 2019; Alkinani *et al.*, 2022; Jakobsen, Brader, and Bruun, 2023). Despite exhibiting acceptable face and content validity, the Arabic BEVQ still has some items that require refinement to adapt to the culture better. Further inquiry should focus on improving the questionnaire, other variables that shape beverage consumption patterns, and leveraging technology for data collection.

5.3 Construct Validity and Reliability of Arabic-Translated Questionnaires

Currently, there are limited tools available for assessing food parenting practices (FPP) among adolescents and their parents (Hoteit *et al.*, 2023), with the majority of existing literature relying primarily on parent-reported data (De-Jongh González *et al.*, 2021; Gomes *et al.*, 2021; Pérez *et al.*, 2022). This study filled the gap for culturally responsive frameworks by validating the Arab versions of the Adolescent Food Parenting Questionnaire for Parents (AFPQ-p) and for Adolescents (AFPQ-a). The BEVQ was found appropriate for monitoring beverage consumption among adolescents (Hill *et al.*, 2017). The BEVQ translation and adaptation performed in this study for the Iraqi adolescents was found to be reliable, consistent, and culturally appropriate. The Arabic BEVQ was found to have significant content and face validity, although some items require further refinement. Overall, the tool serves to reliably estimate beverage consumption for Arabic speakers and aids in public health research

and intervention evaluation relevant to Iraq. There is still work to be done to achieve the appropriate cultural relevance that will allow for improved generalizability in future studies.

5.3.1 Exploratory Factor Analysis of Adolescent Food Parent Questionnaire (AFPQ)

The construct validation of the Adolescent Food Parenting Questionnaire for Adolescents (AFPQ-A) commenced with an Exploratory Factor Analysis (EFA), despite the original English version being previously validated by Koning *et al.* (2021). This approach was chosen because the researcher anticipated that the factor structure of the AFPQ-A might differ when applied to Arabic-speaking populations, necessitating an exploratory approach to validation. The decision to fix the number of factors in the EFA was informed by prior research and recommendations from Hair *et al.* (2010, 2019) and Finch (2023).

The results of this study identified five distinct domains within the AFPQ, namely Snack Structure, Coercive Control, Autonomy Support, Modeling, and Healthy Structure. These domains were well-supported by high factor loadings, all of which exceeded the commonly accepted threshold of 0.40, and communalities greater than 0.25, signifying strong relationships between the items and their respective factors. This confirms the validity of the AFPQ-A in effectively capturing key dimensions of food parenting practices. These findings are consistent with established research on food parenting, which has identified similar domains. For instance, studies by Vaughn *et al.* (2016) and van Nee *et al.* (2021) emphasize the importance of structure and autonomy support in promoting healthy eating behaviors among adolescents, while Mahmood *et al.* (2021) highlight the roles of modeling and control as significant predictors of dietary habits.

The explained variance of the parent version was 69.26% and 70.49% for the adolescent version—and as with many other psychometric studies assessing food parenting tools, this indicates a strong factor structure. Principal axis factoring employing Promax rotation supports the meaning of these factors for food-related parenting, particularly with Arabic adolescent populations.

For reliability, the internal consistency of the AFPQ-A yielded a moderate to good score, with Cronbach's alpha between 0.621 and 0.834 for the parent version, and from 0.662 to 0.845 for the adolescent version. These findings point to acceptable fidelity for both versions, suggesting that no items would need to be discarded to enhance reliability. According to Taber (2018), alpha values over 0.70 tend to be deemed acceptable, and values below.

The internal consistency findings of this study align with those reported in the literature. For example, Mosli (2020) found Cronbach's alpha values between 0.49 and 0.88 when assessing feeding behaviors among Saudi mothers, indicating moderate to good reliability. Similarly, Itani *et al.* (2017) observed alpha values between 0.75 and 0.83 when validating an Arabic version of eating behavior questionnaires for Lebanese adolescents, further supporting the reliability of such instruments in Arabic-speaking populations.

Such reliability benchmarks were also cited by other researchers. Horst and Sleddens (2018) found that the alpha values for the different feeding instruments used was between 0.65 and 0.92, and Koning *et al.* (2021) cited a range of 0.74 to 0.85. Vaughn *et al.* (2018) also reported similar scoring, citing a range of 0.62-0.93. These findings reinforce the perception of AFPQ as a reliable measure of food parenting practices, specifically for Arabic speaking teenagers, and underscores its transcultural significance.

5.3.2 Confirmatory Factor Analysis of Adolescent Food Parent Questionnaire (AFPQ)

The measurement model analysis and construct validation of the AFPQ-A began with CFA. This method was selected to confirm whether the factor structure of the AFPQ-A observed in a prior study could be replicated or if any variations would emerge in a slightly larger study sample. The use of CFA was essential for validating the factor structure and ensuring the applicability of the questionnaire across different adolescent populations.

The data indicate that the Confirmatory Factor Analysis (CFA) results for the parent version of the Adolescent Food Parenting Questionnaire (AFPQ-A) achieved satisfactory fit indices. In contrast, the adolescent version required model re-specification to meet the established criteria for RMSEA, CFI, and TLI. The findings support the theory that model modifications, such as correlating item residuals, can significantly enhance fit indices, as evidenced by the improved values in the modified model (e.g., RMSEA = 0.050, CFI = 0.964, SRMR = 0.055), consistent with guidelines from Brown (2015), Hair *et al.* (2019), and Kline (2023).

The analysis reveals strong factor loadings above 0.40 and composite reliability (CR) values exceeding 0.70, confirming robust construct reliability in accordance with Hair (2019). While some domains of the adolescent version did not meet the average variance extracted (AVE) threshold of 0.50, the CR values above 0.60 suggest adequate convergent validity, as supported by the criteria from Tseng, Dörnyei, and Schmitt (2006) and Hair *et al.* (2010).

Additionally, the study demonstrates significant correlations between factors, ranging from 0.00 to 0.38, and confirms discriminant validity for both the parent and adolescent versions. The correlation values remain below the 0.85 threshold, aligning with Kline (2023) standards for acceptable discriminant validity.

The CFA findings of this study align with those of previous research on the psychometric validation of food parenting questionnaires, particularly in Arabic-speaking populations. Similar to studies by Iman Almarhoon *et al.* (2018) and El-Kassas *et al.* (2024)**,** which also reported moderate to good reliability in Arabic versions of food parenting instruments; the current research demonstrates acceptable fit indices and construct reliability for the parent version of the AFPQ-A. Both studies observed the need for model re-specifications, particularly in adapting Western-developed instruments to Arabic cultural contexts. This underscores the challenges of cultural adaptation and the importance of modifying models to ensure that they capture the nuances of food parenting practices in diverse populations.

While previous studies, such as Vaughn *et al.* (2018) and Koning *et al.* (2021), reported similar factor loadings and composite reliability values for food parenting instruments; the slight deviation in average variance extracted (AVE) values in the adolescent version of the AFPQ-A could be attributed to cultural differences or variations in how adolescents perceive and respond to parenting practices. For instance, the lower AVE values in domains like autonomy support and healthy structure might reflect cultural influences in Arab societies, where parental authority is more emphasized compared to Western cultures, potentially affecting adolescents' perception of autonomy in food-related decisions.

The validation of the AFPQ-A underscores its accuracy and justifies use with Arabic populations while considering densely silent literature on food parenting, providing a much-needed insight. Even though some model modifications such as correlating item residuals were needed to improve fit, this is a testament to the intricacy of adolescent food choices within this culture and the need for contextual validation (satisfactory CR values, factor correlations, etc. noted). A lower AVE with autonomy support and healthy structure indicates that these explanations might have different

cultural meanings, warranting further investigation. These results highlight consideration for cultural factors when developing psychometric tests.

5.3.3 Stability of the Beverage Intake Questionnaire (BEVQ)

This study evaluated the reliability of the BEVQ-A among Iraqi adolescents using five key tests: mean differences, ICC, Cronbach's alpha, correlation analysis, and Bland-Altman plots. Results showed consistent beverage intake between the two administrations, with only minor differences across most drink categories. This stability is likely due to the short one-month interval and the study being conducted during summer, when hot weather encourages steady hydration habits (especially water and juice) among adolescents (Stelmach-Mardas *et al.* 2017). These findings are in line with Xiaoyu *et al.* (2023), who noted that limited variation in beverage intake over time often reflects survey conditions rather than real changes in behavior.

The stability of total beverage intake was further supported by the lack of significant mean differences in fluid ounces, grams, or kilocalories, indicating consistent dietary habits and reliable self-reporting. Previous studies, including those by Abutbul Vered *et al.* (2022) and Vanderlee *et al.* (2018), reinforce the reliability of web-based beverage intake questionnaires in tracking stable consumption patterns over time. Moreover, the consistent intake across different beverage categories, such as water, milk, fruit juice, and soft drinks, aligns with findings from Hedrick *et al.* (2013) and Hill *et al.* (2017), who similarly reported minimal variation in beverage consumption over time.

However, a notable increase in sugar-sweetened beverage (SSB) consumption measured in grams was observed, despite no significant changes in fluid ounces or kilocalories. This could reflect a shift towards beverages with higher sugar content but lower overall caloric density. Studies by Fausnacht *et al.* (2020) and Aldhirgham *et al.* (2023) suggest that SSB consumption may be influenced by seasonal availability,

marketing, and shifts in individual preferences. Stelmach-Mardas *et al.* (2017) further highlight seasonal variations in dietary intake, which may explain the increase in SSB consumption during specific times of the year.

The study demonstrated strong reliability across most beverage categories, as confirmed by high ICCs, Cronbach's alpha, and Pearson correlations. Total milk consumption, for instance, showed excellent reliability across fluid ounces, grams, and kilocalories, consistent with Nanri *et al.* (2022), who reported high test-retest reliability in beverage intake questionnaires. Similarly, water and fresh fruit juice intake were reliably measured, underscoring the robustness of the BEVQ-A in capturing stable beverage consumption patterns. Gosadi *et al.* (2017) emphasized the importance of reliability in dietary assessment tools, particularly in diverse cultural contexts like Iraq.

Bland-Altman plot analysis confirmed minimal systematic biases across most beverage categories, further validating the reliability of the BEVQ-A. The slight, yet statistically significant biases observed for milk in fluid ounces and grams, while kilocalories remained unaffected, are in line with findings from Fausnacht *et al.* (2020), who also noted minor discrepancies in specific beverage categories but reported overall strong agreement and minimal bias in total beverage intake. These results, much like those from Fausnacht et al. (2020), suggest that while minor variations in certain beverages may occur, they do not compromise the overall validity of the questionnaire.

Similar the findings in this study, Rogerson *et al.* (2023) noted very little bias in water and other beverages using the Workplace Beverage Intake Questionnaire, adding to the credibility of such instruments for assessing habitual consumption. In the same context, De Cock *et al.* (2017) and Zalaket *et al.* (2019) reported some specific, albeit small, category-specific biases, yet underscored that beverage intake questionnaires are, by and large, valid. This study demonstrated low systematic bias for categories like milk, providing support for adolescents's BEVQ-A reliability.

Hedrick *et al.* (2013) noted that rapid beverage screeners like the BEVQ-A are particularly useful for monitoring high-use items, including sugar-sweetened beverages (SSBs), a finding this study also supported. The BEVQ-A is, using Bland-Altman analysis and supporting literature, a valid low-bias measure of total beverages and SSBs consumed. Social biases of over reporting, recall bias, or presenting one's self in a more favorable light still exist, but the small inaccuracies observed here align with those highlighted in previous literature, such as Zalaket *et al.* (2019). The arguments made by De Cock *et al.* (2017) and Rogerson *et al.* (2023) regarding the limited adaptable scope due to the sample's age and window of participation are noteworthy. More studies are needed to verify the BEVQ-A across different groups and to study the effects of beverage consumption, especially of SSBs, on health over an extended period of time. Such longitudinal work looking at seasonal or geography driven trends in particular beverage consumption may enrich the understanding of the relationship between diet and health. Study showed that the BEVQ-A is a valid instrument for tracking beverage consumption among adolescents, and its further use in dietary monitoring research will enhance the knowledge of patterns of beverage consumption and their effects on public health.

5.4 Identifying the Distribution of Dietary, Behavioral, and Anthropometric Variables Among Study Participants

5.4.1 Food Parenting Practices (FPP)

The research looked into five food parenting practices (FPPs): healthy structure, autonomy support, coercive control, snack structure, and modeling, to analyze their impact on adolescents' eating behaviors in Iraq. Parents are key determinants in the adoption of healthy diets, and considering the views of both the adolescent and the parent sheds light on how these practices function within a

particular culture. **Autonomy Support** proved to be one of the highest scored practices which suggested that a lot of parents in Iraq allow their children to exercise choice in what food options they want to make selections from. This is consistent with some findings in Western studies, like the study which claimed that autonomy-supportive parenting fostered more healthful eating and less emotional eating among adolescents (Roselinde, Kleef, and Trijp, 2021). Contrastingly, much of the Arab literature reports higher levels of controlling parenting (Al-Hammad, 2018 in Saudi Arabia). It is possible that the autonomy support scores in this study signify a shift in culture towards modern health promotion influences in Iraq. **Healthy structure** received the highest ratings overall. Enhanced dietary habits at home were accompanied by the regular presence of fruits and vegetables, along with routine meal times. This corresponds with research done in the Netherlands (Koning *et al.*, 2021) and Kuwait (Zafar, and Alkazemi, 2022), which highlighted how a systematically organized food environment improves eating patterns despite modern adversity such as hectic lifestyles and fast food availability. However, differences in perceptions concerning **coercive control** revealed a gap. Parents self-reported greater application of food rules than what adolescents acknowledged. Even if well-meaning, forms of control believed to be coercive, such as forcing children to eat, have been shown to result in disordered eating habits or the rejection of healthy foods (Vaughn *et al.* 2016; Smith *et al.* 2020). In the Arab setting, this kind of control is thought to stem from a body image concern narrative (Sharaf *et al.*, 2021) and tends to undermine adolescents' autonomy. **Snack structure** scored lowest, indicating a lack of control parents exercised over their adolescents' snacking. Evidence suggests this lack of structure results in the development of poor dietary habits as is the case in other parts of the world (Gibson *et al.*, 2020) and in Morocco (El-Ammari *et al.*, 2020), where adolescents are known to snack indiscriminately on unhealthy foods without supervision. However, structured snacking, reported in studies from Lebanon and Syria, can help reduce intake of sugary

and processed snacks (Jamaluddine *et al.*, 2022). **Modeling** behaviors scored high, showing that many parents actively demonstrate healthy eating by consuming fruits and vegetables in front of their children. Parental modeling is a strong influence across cultures, with evidence from China (Fu *et al.*, 2021), Jordan, and Lebanon (Dalky *et al.*, 2017; Said, Gubbels, and Kremers, 2020) supporting its positive impact. In Arab cultures, where family meals are common, modeling may be especially powerful. Overall, the findings suggest that Iraqi parents are combining structure, autonomy support, and modeling to promote healthy eating, while also navigating the challenges of coercive control and snack regulation. These insights can guide public health strategies in the Arab region by encouraging parents to support autonomy, provide structured food environments, and model healthy habits, while reducing excessive control that may hinder long-term dietary improvements.

5.4.2 Dietary Behavior

The eating habits of Iraqi teenagers noted in this study are in alignment with local and global shifts in the diet that the world is adopting. Similar to worldwide trends, the adolescents reported low intake of fruits, vegetables, and breakfast, but a higher consumption of snacking and sugary foods (Wrottesley *et al.*, 2023). Skipping breakfast appeared to be a norm and aligns with MENA findings about the association of this practice with obesity, poor dietary habits, lower academic achievement, and globally negative academic outcomes (Aldwairji, 2019; Harris, Carins, and Rundle-Thiele, 2021; Peña-jorquera *et al.*, 2021). It is reasonable to assume that these habits are shaped by sociocultural and economic context of Iraq. The low consumption of fruits and vegetables is in alignment with WHO's assertion that most adolescents do not meet the recommended number of servings per age group (WHO, 2023b). This trend has been associated with the increase in obesity and non communicable diseases

(Kerkadi *et al.*, 2021;Zeidan *et al.*, 2023), possibly due to inadequate availability of fresh fruits and vegetables in conjunction with greater reliance on processed food.

As seen in other countries in the MENA region, snack food consumption was high and adolescents tended to forgo meals for energy-dense and low-nutrient snacks (Ferreira *et al.*, 2020; Kerkadi *et al.*, 2021). Iraqi studies confirm these trends and relate them to increased obesity and metabolic risks (Saleh, and Ma´ala, 2015; Ibrahim, Hadithi, and Ismail, 2020). Likewise, the consumption of sugary beverages was moderately high and consistent with regional consumption patterns (Daradkeh *et al.*, 2018; Alfawaz *et al.*, 2021), contributing to diabetes and excess weight (Bawadi *et al.*, 2019; Amer, and Kateeb, 2021; Damiri *et al.*, 2021). The region is also witnessing a growing obesity epidemic. Consumption of fast food, although moderate, demonstrates increasing adoption of Western diets in Iraq, as is also reported in Libya and Saudi Arabia (Alhyas, El Kashef, and AlGhaferi, 2016; Al Khars *et al.*, 2020; Aonso-Diego, Krotter, and García-Pérez, 2024). Worryingly, milk consumption was low as compared to high-income countries suggesting a nutrient shortfall needed for growth due to inadequate milk fortification and health campaigns (Fraschetti *et al.*, 2022; Khammas, and Mohammed, 2020). Milk dessearted attention which could be attributed to cultural preferences and marketing (Brittin, and Obeidat, 2021; Kucharczuk, Oliver, and Dowdell, 2022; Tsochantaridou *et al.*, 2023). Fast food intake was moderate but reflects the broader dietary transition across the Arab world, where processed and convenience foods are becoming more common. This shift has been tied to increased obesity and NCDs among youth (Younis, and Eljamay, 2019; Mumena *et al.*, 2022; Saleh, and Ma´ala, 2015; Lian *et al.*, 2020). In summary, the dietary behaviors of Iraqi adolescents reflect a nutritional transition seen globally and regionally. These patterns; marked by low consumption of healthy foods and high intake of processed items, highlight the urgent need for culturally tailored public health strategies to improve adolescent nutrition and prevent diet-related diseases in Iraq.

5.4.3 Sugar-Sweetened Beverages (SSBs)

The present findings offer critical insights into the beverage consumption patterns of Iraqi adolescents, revealing significant dietary concerns that may pose long-term health risks, particularly when compared with trends observed in high-income countries. A prominent observation is the low **intake of milk** among Iraqi adolescents, raising concerns about potential deficiencies in essential nutrients such as calcium, protein, and vitamin D key elements required during adolescence for supporting bone growth, muscle development, and overall health. By contrast, adolescents in high-income countries generally have higher milk consumption, largely driven by greater access to fortified dairy products and robust public health campaigns emphasizing the importance of nutrient-rich diets (Fraschetti *et al.*, 2022). In Iraq, the inadequate consumption of milk may reflect cultural and socioeconomic factors, similar to those seen in other Middle Eastern countries where milk is not traditionally prioritized in the diet (Khammas, and Mohammed, 2020). Cultural preferences, particularly in Arab communities, often favor traditional beverages like tea and sugar-sweetened drinks over milk and yogurt, relegating dairy products to a secondary role (Brittin, and Obeidat, 2021). Furthermore, peer influence and marketing pressures often steer adolescents toward sweeter, more intensely flavored options like sodas and energy drinks, further reducing milk intake (Kucharczuk, Oliver, and Dowdell, 2022; Tsochantaridou *et al.*, 2023).

The findings also reveal a significantly higher consumption of **sugar-sweetened beverages (SSBs)** among Iraqi adolescents, a trend that mirrors patterns seen in many high-income countries but has become the focus of aggressive public health interventions in those settings. SSBs, including sodas, energy drinks, and sweetened juices, contribute a substantial proportion of daily caloric intake, offering little nutritional value while delivering excessive amounts of added sugars. This high

intake of added sugars is closely linked to increased risks of obesity, insulin resistance, type 2 diabetes, and cardiovascular diseases (Daradkeh *et al.*, 2018; Bawadi *et al.*, 2019; Amer, and Kateeb, 2021; Damiri *et al.*, 2021). In high-income countries such as the United States and the United Kingdom, policy interventions such as sugar taxes and public health campaigns have led to significant reductions in SSB consumption (Itria *et al.*, 2021; Andreyeva *et al.*, 2022). Conversely, in Iraq and other low- and middle-income countries (LMICs), SSB consumption continues to rise, driven by aggressive marketing, easy access, and limited regulatory measures (Agha, and Rasheed, 2021). Similar trends have been reported in countries like the Jourden and Saudi Arabia, where high SSB consumption is contributing to increasing rates of obesity among adolescents (Bawadi *et al.*, 2019; Azzeh, and Hamouh, 2022).

Adolescents' consumption of SSBs is influenced by a variety of factors, including psychological, cultural, and environmental drivers. In many Arab countries, cultural norms emphasizing hospitality often lead to SSBs being a staple at social gatherings, thereby normalizing their consumption (Benajiba, and Eldib, 2018; Benajiba, Bernstein, and Aboul-Enein, 2020). Peer influence, marketing, and ease of access also play critical roles in driving SSB consumption, with adolescents often opting for heavily flavored and inexpensive drinks over healthier alternatives (Pamarta, Suminah, and Sumardiyono, 2022). The role of parents is also significant; studies have shown that if SSBs are readily available in the home, adolescents are more likely to adopt these unhealthy consumption patterns (Koning *et al.*, 2021). In contrast, high-income countries have seen a shift toward healthier beverage choices such as flavored water and low-sugar drinks, a result of enhanced public health awareness and regulatory actions (Popkin *et al.*, 2021).

The predominance of calorie-dense, nutrient-poor beverages like SSBs in the overall beverage intake of Iraqi adolescents is alarming. These consumption patterns, if left unchecked, could contribute to a significant increase in long-term health risks,

such as obesity, type 2 diabetes, and cardiovascular diseases, issues that are already becoming more prevalent in other regions with similar dietary habits (Amer, and Kateeb, 2021; Damiri *et al.*, 2021). In high-income countries, public health strategies, including education campaigns, policy interventions, and product reformulation, have successfully reduced the intake of unhealthy beverages (Itria *et al.*, 2021). For instance, Mexico's national sugar tax on sugary drinks resulted in a 19% reduction in SSB consumption within 6 years, highlighting the potential effectiveness of similar policies in Iraq (Salgado Hernández, and Ng, 2021).

From a public health perspective, the findings emphasize the urgent need for targeted interventions to address beverage consumption patterns among Iraqi adolescents, particularly when compared to the progress made in high-income countries. The implementation of education campaigns, school-based programs, and policy measures like taxation on sugary drinks, combined with the promotion of healthier alternatives such as milk and water, could significantly reduce the consumption of SSBs and mitigate associated health risks. Tailored strategies that consider the unique cultural, economic, and environmental factors influencing beverage choices in Iraq could yield considerable public health benefits and improve the long-term health outcomes of the adolescent population.

In conclusion, these findings underscore critical dietary concerns regarding the low consumption of milk and the high intake of sugar-sweetened beverages among Iraqi adolescents. Compared to high-income countries, where public health interventions have made substantial progress in reducing unhealthy beverage consumption, Iraq faces distinct cultural and socioeconomic challenges. Addressing these issues through comprehensive public health strategies could play a crucial role in improving adolescent health outcomes and reducing the risk of obesity and related metabolic disorders.

5.4.4 Physical Activity

One of the primary objectives of this study was to assess physical activity levels among Iraqi adolescents. The findings indicate that the majority of Iraqi adolescents have low physical activity levels, with only a small percentage meeting the recommended levels of moderate to vigorous physical activity (MVPA) as outlined by global health guidelines. This trend mirrors global patterns in adolescent populations but is further intensified in Iraq due to distinct cultural and environmental factors.

The study contributes to adolescent health research by identifying key sociocultural, environmental, and technological barriers to physical activity among Iraqi adolescents. By encompassing both urban and rural contexts, it addresses a research gap in conflict-affected regions, emphasizing the impact of gender norms, safety concerns, and screen time on sedentary behavior. These findings provide a foundation for targeted interventions aimed at improving physical activity in similar settings.

Globally, low physical activity levels among adolescents are a well-recognized issue. According to the World Health Organization (WHO), over 80% of adolescents worldwide do not meet the recommended 60 minutes of daily MVPA (WHO, 2024). Specifically, in Iraq, the prevalence of physical inactivity stands at 80% for boys and 91% for girls aged 11–17 years (WHO, 2022b). Similar trends have been observed in countries like the United States, the United Kingdom, and Australia, where sedentary lifestyles among adolescents are on the rise due to increased screen-based activities, academic pressures, and changes in leisure behavior (Guthold *et al.*, 2020). However, in Iraq, unique sociocultural, infrastructural, and security-related barriers make the issue even more pronounced.

Culturally, Iraq exhibits similarities with other Arabic countries, where traditional norms often discourage female participation in outdoor activities. Sharara *et al.* (2019) reported that gender norms significantly influence physical activity behaviors among female adolescents in Arab countries. Compared to global trends where boys and girls face more similar barriers, the gender gap in physical activity is more pronounced in Iraq and other Middle Eastern countries, primarily due to conservative views on modesty and public participation in sports. Similar patterns have been observed in countries like Saudi Arabia, where cultural expectations and limited opportunities for girls significantly reduce their physical activity levels (Agha, and Rasheed, 2021; Bahathig *et al.*, 2021).

Infrastructural and environmental challenges further contribute to the lower physical activity levels among Iraqi adolescents compared to their global counterparts. While inadequate urban planning and limited recreational spaces are global concerns, these issues are particularly acute in conflict-affected areas such as Iraq. Mahmmod, and Al-Diwan (2022) highlighted that the lack of accessible and safe recreational facilities is a prevalent issue in the Arab region, exacerbated by Iraq's political instability. Similar trends have been documented in other conflict zones, such as Syria, where security concerns restrict outdoor mobility and access to physical activity resources (Kampalath *et al.*, 2023).

The influence of technology on adolescent physical activity is another factor affecting both global and regional populations. Studies across different regions, including the US, Europe, and Asia, have documented how increased screen time, driven by smartphone use, gaming, and social media, reduces time spent on physical activities (Guthold *et al.*, 2020). Almaqhawi and Albarqi (2022) identified a similar trend in Arab countries, where adolescents increasingly engage with digital devices, mirroring global behaviors but facing additional barriers from conflict and socioeconomic factors that further limit outdoor activities.

Moreover, Iraq's education system, which often deprioritizes physical education (PE), exacerbates the problem. Globally, PE programs are crucial in promoting physical activity, but many countries, particularly those affected by conflict or with limited resources, struggle to implement comprehensive PE curricula (WHO, 2018a) Due to ongoing security challenges and underfunded educational infrastructure, Iraq offers even fewer opportunities for school-based physical activity, unlike countries with more robust school programs that can compensate for reduced out-of-school physical activity.

Socioeconomic factors, including parental influence, also significantly impact physical activity levels. While global research indicates that lower socioeconomic status (SES) correlates with limited access to physical activity resources, this is especially pronounced in Iraq, where families facing economic challenges may prioritize academic success over physical fitness. Study by Qasem, Al-Hadithi and Al-Tawil (2019) emphasize that limited financial resources hinder access to gyms, sports programs, and safe play areas, a finding consistent with other low- and middle-income countries where physical activity is often considered a luxury rather than a necessity.

To address the observed low levels of physical activity among Iraqi adolescents, several practical interventions are recommended. Public health campaigns tailored to encourage active lifestyles, especially among girls, are essential to overcome sociocultural barriers. Schools should prioritize physical education programs to ensure that adolescents in both urban and rural settings have regular opportunities for exercise. Additionally, enhancing access to safe recreational facilities, particularly in conflict-affected areas, is crucial. Encouraging parental guidance to limit screen time and promoting active alternatives to digital entertainment can also be effective strategies.

This study's strengths lie in its comprehensive assessment of physical activity levels among both urban and rural Iraqi adolescents, utilizing validated tools and

capturing a broad range of sociodemographic, cultural, and environmental factors. Including rural populations enhances the generalizability of the findings and offers unique insights into the impact of sociocultural norms and conflict across different settings. However, the study's limitations include its cross-sectional design, which limits causal inference, and its reliance on self-reported data, which may introduce recall bias.

For future research, path analysis could be utilized to investigate predictors of low physical activity among adolescents, exploring the direct and indirect influences of factors such as gender, socioeconomic status, technology use, and cultural norms. Longitudinal studies are also recommended to better understand the causal relationships and long-term effects of these factors on physical activity levels. Further research should evaluate the effectiveness of school-based and community interventions in promoting sustained physical activity among Iraqi adolescents.

In conclusion, compared to global trends, Iraq's distinct sociocultural, economic, and conflict-related barriers result in significantly lower physical activity levels among its adolescent population. Addressing these challenges requires not only improving physical infrastructure and safety but also transforming cultural attitudes toward physical activity, particularly for girls, and incorporating more comprehensive physical education programs in schools. Tailored public health initiatives, combined with efforts to reduce screen time and promote active lifestyles, are essential to counteract the sedentary trends observed in this population.

5.4.5 Sedentary Behavior

The objective of this study also included assessing sedentary behavior among Iraqi adolescents. The findings reveal high levels of sedentary behavior in this population, with a notable increase in sedentary time during weekends. These results align with global patterns, where adolescent sedentary behaviors have become

increasingly prevalent. Internationally, adolescents spend considerable time engaged in sedentary activities, particularly screen-based entertainment, a key contributor to physical inactivity. . Ahrensberg *et al.* (2023) reported a global median sedentary time of 7.5 hours per day among children and adolescents, with screen time playing a central role as sedentary behavior increases from early childhood through adolescence.

Although data on sedentary behavior among Iraqi adolescents remain limited (Alanazi *et al.*, 2021; Burahmah, Shanmugam, and Stansfield, 2023), a study conducted a decade ago in northern Iraq indicated that 82% of boys and 64% of girls exceeded two hours of daily screen time (Musaiger, Al-Mufty, and Al-Hazzaa, 2014). The findings of the current study are consistent with these patterns, reinforcing the global trend of reduced physical activity among youth and rising sedentary behaviors in Iraq.

Comparative studies from other Arab countries reveal similar trends in sedentary behavior. In Saudi Arabia, adolescents are reported to spend over eight hours per day engaged in sedentary activities, primarily screen time (Evenson *et al.*, 2023). Likewise, research in Oman demonstrated that most adolescents spend significant time on screens, both for educational purposes and leisure, with a strong link between sedentary behavior and unhealthy dietary habits (AL-Mahrouqi, 2019). The findings of the current study are comparable, suggesting shared socio-cultural and environmental influences on adolescent health behaviors across the region.

One of the primary drivers of sedentary behavior in Iraq and other Arab countries is the increasing prevalence of screen-based leisure activities. The widespread use of smartphones, social media, and digital entertainment has transformed how adolescents spend their free time, replacing physical activities with screen-based behavior. Similar findings have been reported in Qatar and Jordan, where adolescents report spending more time on screens than participating in physical activity (Al-Thani *et al.*, 2018; Al-Domi *et al.*, 2020).

Environmental and urbanization factors also play a significant role in shaping sedentary behavior in Iraq and across the Arab region. Rapid urbanization has led to a decline in safe, accessible recreational spaces, limiting adolescents' opportunities for outdoor activities. Studies in Egypt and Lebanon have reported similar challenges, where adolescents in urban areas face difficulties accessing recreational spaces due to overcrowding, inadequate infrastructure, and safety concerns (Burahmah, Shanmugam, and Stansfield, 2023). This is reflective of the situation in Iraq, where urban adolescents encounter comparable barriers, driving them toward more sedentary activities at home.

Family dynamics and socio-economic factors further contribute to sedentary behaviors. Across many Arab countries, families emphasize academic achievement, often resulting in the normalization of sedentary behaviors as adolescents dedicate more time to educational activities at the expense of physical activity. This has been observed in Saudi Arabia, where adolescents report spending considerable time on academic tasks, with limited opportunities for physical exercise (Alasqah, Mahmud, East, and Usher, 2021). In Iraq, similar socio-economic and cultural factors likely contribute to the high levels of sedentary behavior observed in this study, where educational priorities and restricted access to physical activity resources drive adolescents toward sedentary lifestyles.

In conclusion, the sedentary behavior patterns observed among Iraqi adolescents are consistent with both global and regional trends. The rise in screen-based entertainment, the lack of accessible spaces for physical activity, and socio-economic and family dynamics are key contributors. These findings underscore the urgent need for public health interventions to reduce sedentary behavior and promote active lifestyles among adolescents, both in Iraq and across the region. Given the common challenges faced by Arab countries, a regional approach to intervention design that considers the cultural and environmental contexts may prove beneficial.

5.4.6 Anthropometric Measurements

This study assessed anthropometric measures among Iraqi adolescents and uncovered a concerning trend in body composition. A substantial proportion of participants were classified as overweight or obese based on BMI z-scores. Additionally, waist and hip measurements, along with waist-to-height and waist-to-hip ratios, indicated a high prevalence of central obesity, an established risk factor for cardiometabolic conditions like diabetes and cardiovascular disease. These findings point to an urgent need for causal research to explore the drivers behind this growing issue and to inform targeted interventions.

Globally, adolescent obesity has risen sharply over recent decades. The World Health Organization (WHO) reported that From 1990 to 2022, the percentage of children and adolescents aged 5–19 years living with obesity increased four-fold from 2% to 8% globally (WHO, 2023a). In high-income countries, such as the United States, obesity affects approximately more than twenty percent of adolescents; several studies confirm that (Sharma *et al.*, 2019; Y. Wang *et al.*, 2021; Pinhas-Hamiel *et al.*, 2022; Tsoi *et al.*, 2022), while nearly one-third of adolescents in the United Kingdom fall into the overweight or obese categories. In developing countries, obesity rates have also surged; for example, adolescent obesity in China rose from 1.2% in 1985 to 23.4% in 2019 and 32.7% in 2030. The prevalence alone will increase from 9.6% in 2019 to 15.1% in 2030 (YH *et al.*, 2023).

In Iraq, recent studies have confirmed the rising prevalence of adolescent overweight and obesity, consistent with global trends. A study conducted in Baghdad reported that 29.4% of adolescents were classified as overweight, while 17.4% were categorized as obese (Ali *et al.*, 2024). Similarly, research from northern Iraq identified 17.7% of adolescents as overweight and 33.7% as obese (Salih, Ali, and Ahmed, 2023). In southern Iraq, another study found that 20.6% of adolescents were

overweight, with 22.6% classified as obese (Shwaish *et al.*, 2023). These findings parallel those in other Arab countries, such as Saudi Arabia, where 33.6% of adolescents were found to be overweight, and 20.5% were categorized as obese (Alshaikh *et al.*, 2023). The increasing rates of obesity among Iraqi adolescents reflect broader regional patterns, driven by factors such as urbanization, shifts toward energy-dense diets, and increasingly sedentary lifestyles.

In Iraq, studies corroborate these global trends. A study conducted in Baghdad revealed that 29.4% of adolescents were overweight, with 17.4% classified as obese (Ali *et al.*, 2024). Similarly, research in northern Iraq found that 17.7% of adolescents were overweight, and 33.7% were obese (Salih, Ali, and Ahmed, 2023). also, research in southern Iraq found 20.6% of adolescents were overweight, and 22.6% were obese (Shwaish *et al.*, 2023). These statistics align with findings from other Arab countries, such as Saudi Arabia, where adolescents are categorized as 33.6% were overweight and 20.5% were obese (Alshaikh *et al.*, 2023). The increasing prevalence of obesity among Iraqi adolescents mirrors regional patterns attributed to urbanization, dietary shifts, and sedentary lifestyles.

The rising rates of overweight and obesity among adolescents have become a pressing public health issue, affecting both developed and developing countries, albeit with differing rates and contributing factors. In developed nations, such as the United States, the National Health and Nutrition Examination Survey (NHANES) reported a 21.2% obesity prevalence among adolescents aged 12–19 between 2017 and 2020 (Ogden *et al.*, 2021). In the United Kingdom, the Health Survey for England (2020) indicated that 20% of adolescents were classified as obese, with an additional 14% considered overweight. These trends can be largely attributed to increased consumption of calorie-dense processed foods, reduced physical activity, and sedentary behaviors associated with screen time (Bandurek *et al.*, 2020; Liberali *et al.*, 2021; Barnabé *et al.*, 2023).

Conversely, developing countries are witnessing an alarming rise in adolescent obesity rates, often exacerbated by rapid urbanization and nutrition transitions. In the Middle East, a study by Alenazi *et al.* (2023) found that nearly 23% of Saudi adolescents were either overweight or obese. Similarly, in Jordan, Abdullatif *et al.* (2022) reported that 41% of adolescents fell into these categories, highlighting the accelerated pace of the obesity epidemic in the region.

The driving factors behind these trends in developing nations are multifaceted and closely linked to the rapid transition from traditional diets to Western-style diets that are high in fats, sugars, and processed foods. Additionally, urbanization has led to reduced physical activity levels, as opportunities for outdoor activities have diminished (Ali *et al.*, 2024). Economic growth has also affected food availability and affordability, further promoting unhealthy dietary behaviors.

In Latin America, the prevalence of adolescent overweight and obesity is also rising. A study conducted in Brazil in 2019 reported that 20.5% of adolescents were classified as overweight, with 8.4% falling into the obese category (Pelegrini *et al.*, 2021). Similarly, Southeast Asia is witnessing alarming rates of childhood obesity. In Malaysia, recent data indicate that the prevalence of overweight and obesity among children ranges from 23.8% to 58.0%, marking a significant increase over the past few decades (Zakaria *et al.*, 2022).

Despite high obesity rates in both developed and developing countries, the nature of the issue varies significantly. Developed nations often see stabilization in obesity rates as public health initiatives such as sugar taxation and promoting healthy eating in schools are implemented more aggressively. In contrast, many developing countries continue to face the dual burden of malnutrition, where undernutrition and obesity coexist, largely due to rapid urbanization and lifestyle shifts.

The data indicates that, while obesity is a global concern, developing nations are experiencing a more rapid increase in adolescent obesity rates compared to their

developed counterparts (Popkin, Corvalan, and Grummer-Strawn, 2020). This rapid rise is particularly alarming as healthcare systems in many developing countries are ill-equipped to manage the long-term consequences of adolescent obesity, which include type 2 diabetes, hypertension, and cardiovascular diseases.

These findings align with global trends of increasing adolescent obesity, especially in developing regions. For example, a study in the United States by Tsoi *et al.* (2022) noted a consistent rise in obesity rates among adolescents over the past decade, mirroring similar concerns in Europe, where the Health Survey for England (2020) reported an alarming increase in central obesity among children and adolescents. This global trend emphasizes the multifactorial nature of adolescent obesity, with various contributing factors including sedentary lifestyles and high-calorie diets.

In summary, the prevalence of overweight and obesity among adolescents in Iraq is shaped by various dietary, behavioral, and socio-economic factors that reflect broader global patterns. Addressing this pressing public health issue requires comprehensive strategies tailored to the unique cultural and environmental contexts of these adolescents.

5.5 Path Analysis Model

The objective of Phase II was to develop a comprehensive path model that explains the interrelationships between sociodemographic characteristics, food parenting practices (FPP), dietary behaviour, physical activity, sedentary behaviour, and anthropometric measurements among Iraqi adolescents. This model also aimed to elucidate the consequences of obesity on anthropometric measurements and its subsequent influence on cardiometabolic risk factors. Initially, the structural model did not exhibit an acceptable fit, necessitating model re-specification. This process

involved parcelling items, removing insignificant paths, and incorporating potential pathways as suggested by modification indices (MI).

The final measurement models were integrated with other study variables in the path analysis to evaluate the complex interrelationships. The refined path model revealed 41 significant pathways across the study variables, with the addition of four newly identified paths. The final model demonstrated an improved fit, fulfilling all criteria for model adequacy. The goodness-of-fit indices confirmed the validity of the structural model, indicating strong model performance. Specifically, the explained variance for waist-to-hip ratio (WHR) and zBMI was substantial ($R^2 > 0.40$), suggesting a robust model. The final hypothesized model adequately accounted for the variance of the included variables. All potential associations were thoroughly analyzed, and the magnitude of the estimated effects, based on the coefficients' values, was carefully compared across pathways.

5.5.1 Direct Effects in the Pathways of the Final Model

This study examined factors influencing physical activity and sedentary behavior among 506 Iraqi adolescents. Results showed that sex, school type, household income, and family size were significantly associated with these behaviors, reflecting global patterns. Physical activity was lower among girls and private school students, likely due to cultural norms that limit girls' participation in sports, consistent with trends reported in the U.S. and Europe (Guthold *et al.*, 2020; Shao, and Zhou, 2023). Similarly, Duffey *et al.* (2021) reported that girls in conservative societies face more barriers to physical activity, reinforcing the challenges faced by female adolescents in Iraq. Additionally, private school students, particularly in conservative societies like Iraq, displayed reduced physical activity due to academic pressures that prioritize scholastic achievement over extracurricular activities. Similar findings were reported by Tribby *et al.* (2020) and Joshi-Reddy *et al.* (2020), who highlighted that

structured curricula in private schools often limit time for physical education, reflecting trends in countries like India and Iraq.

Household income emerged as a critical determinant, with adolescents from lower-income families reporting less physical activity, a trend echoed in studies from Australia and the U.S. (Kemp *et al.*, 2021; Alliott *et al.*, 2022). This is primarily due to barriers such as limited access to recreational facilities and concerns about safety. These challenges are particularly pronounced in Iraq, where public health initiatives aimed at mitigating such barriers remain largely absent.

The data revealed that adolescents with more siblings tended to be more physically active, likely due to greater opportunities for shared play and interaction. This trend is consistent with studies from Australia and Spain, which found similar links between larger family size and increased physical activity (Kemp *et al.*, 2021; LeCroy *et al.*, 2024).

In contrast, higher levels of sedentary behavior were more prevalent among adolescent girls, private school students, and those from smaller families. These findings mirror global trends, where adolescent girls often engage more in sedentary behaviors due to cultural and psychological barriers (Brazo-Sayavera *et al.*, 2021). In Iraq, societal expectations further limit girls' physical activity, promoting a sedentary lifestyle (Al-ani, Al-ani, and Al-hadeethi, 2021; Mahmmod, and Al-Diwan, 2022). Private school students also exhibited increased sedentary behavior, as these institutions often prioritize academic performance over physical education, a trend observed in both regional and global contexts (Al-hazzaa, 2018; Shiekuma, 2021). Furthermore, adolescents from smaller families, who often have greater access to technology, were more likely to engage in screen-based activities, reducing opportunities for physical interaction (Tian, and von Cramon-Taubadel, 2020).

In the Arab region, similar patterns were observed. Studies in Saudi Arabia (Aliss *et al.*, 2020; Aljehani *et al.*, 2022) and Jordan (Alshammari *et al.*, 2022) reported

lower physical activity levels among girls and adolescents from lower-income families, reflecting the challenges identified in Iraqi adolescents. Similarly, study conducted in Arab countries, including Saudi Arabia have reported that girls, particularly in conservative societies, face greater restrictions on outdoor physical activity, which can contribute to increased sedentary behavior (Evenson *et al.*, 2023). Additionally, research in Saudi Arabia (Elkhodary, and Farsi, 2018) highlighted the reduced opportunities for physical activity among private school students, further supporting the findings from Iraq.

Although limited research exists on these topics in Iraq, existing studies corroborate these findings. Musaiger, Al-Mufty and Al-Hazzaa (2014) reported lower physical activity levels among girls in urban Iraqi settings, while Agha and Rasheed (2021) highlighted the barriers faced by lower-income adolescents in accessing recreational facilities. (Dawood, 2021) noted the restrictive schedules in private schools in Baghdad, emphasizing academic performance over physical activities.

This study found that boys had less healthy eating habits than girls, skipping breakfast more often, eating fewer fruits and vegetables, and consuming more sugary drinks and milk-based calories. These findings align with global and regional trends, where boys typically show lower fruit and vegetable intake (Darfour-Oduro *et al.*, 2019) and higher consumption of sugary beverages (Sim *et al.*, 2019). Regionally, studies from the Middle East, including Iraq and neighboring countries, have similarly reported that boys are more likely to consume energy-dense foods and beverages (Al-Jawaldeh, Taktouk, and Nasreddine, 2020).

In contrast, girls in this study also reported a higher consumption of fast food. This pattern has also been observed in other populations. A study conducted in Jourdon, for example, found that adolescent girls showed a preference for fast food despite a generally better adherence to healthy dietary practices, such as lower consumption of sugary beverages compared to boys (Allehdan *et al.*, 2017). This

behavior may be influenced by societal factors, including marketing strategies targeting young females and the increased accessibility of fast food, particularly in urban areas (Saghaiana, and Mohammadi, 2018; Amerah *et al.*, 2023).

The finding that boys are more likely to skip breakfast aligns with global trends. Studies consistently show that boys often neglect breakfast due to factors such as lack of time, late waking, and a lower priority placed on nutrition. Globally, research by Yaguchi-Tanaka, and Tabuchi (2021) and Wang *et al.* (2023) has highlighted this pattern, noting the association with poor dietary quality and weight gain. Regionally, Said, and Shaab Alibrahim (2022), Al-Hazzaa *et al.* (2020) and Alazawii and Hamood (2019) observed similar trends in Saudi Arabia and Iraq, where boys frequently replaced breakfast with fast food and sugary beverages, contributing to unhealthy dietary patterns.

The association between higher socioeconomic status (SES) and urban living with increased breakfast skipping among adolescents is an emerging global concern. Research indicates that adolescents from higher SES backgrounds are more likely to forgo meals, particularly breakfast, in favor of energy-dense snacks and fast food (Silva *et al.*, 2022). Similar trends have been observed in studies from Palestine and Sudan, where adolescents residing in urban areas demonstrated a higher likelihood of skipping breakfast (Musaiger, Nabag, and Al-Mannai, 2016; Badrasawi, Anabtawi, and Al-Zain, 2021). This behavior in urban settings may be attributed to the fast-paced lifestyle and the wider availability of fast-food options, further contributing to the prevalence of breakfast skipping.

The study found that higher parental autonomy support and modeling were linked to greater fruit and vegetable intake among adolescents. This aligns with past research showing that when parents guide but allow teens to make their own food choices, it encourages healthier eating (Koning *et al.*, 2021; Liu *et al.*, 2021). This pattern holds true in the Arab context as well. A studies in Lebanon and Kuwait found

that adolescents with parents who modeled healthy eating behaviors were more likely to consume fruits and vegetables regularly (Said, Gubbels, and Kremers, 2020; Zafar, and Alkazemi, 2022).

Conversely, adolescents with low autonomy support demonstrated a greater intake of carbonated drinks and SSBs, contributing to a higher caloric intake from these sources. These findings are consistent with research indicating that less supportive parenting styles may lead to unhealthy food choices among adolescents (Zhang *et al.*, 2019; Liu *et al.*, 2021; Hampshire, Mahoney, and Davis, 2022). Low autonomy support often results in greater reliance on unhealthy, convenient foods, such as sugary beverages and fast food, which are widely available and inexpensive (Vaughn *et al.*, 2016; Koning, Vink, *et al.*, 2021).

The study also identified that participants with higher levels of Corrosive Control exhibited increased consumption of carbonated drinks, fast food, SSBs, and milk-based calories. Corrosive Control refers to highly controlling, restrictive parenting behaviors, which have been linked to rebellious or oppositional eating patterns in adolescents (Hampshire, Mahoney, and Davis, 2022; Wang *et al.*, 2022). Global studies have consistently shown that overly controlling parental behaviors often backfire, leading adolescents to seek out forbidden or unhealthy foods (Mahmood *et al.*, 2021). In the Middle East, a similar association has been observed, where adolescents subjected to restrictive food environments may compensate by consuming unhealthy foods when unsupervised (Westbury *et al.*, 2021; Nield, 2024).

Adherence to Snack Structure, characterized by the establishment of regular snack times and limits on unhealthy snacks, was associated with reduced consumption of carbonated drinks, fast food, and SSBs. This finding resonates with research indicating that structured meal and snack times promote healthier dietary habits by discouraging impulsive or emotional eating (Melo *et al.*, 2020; Almoraie *et al.*, 2021; Mingay *et al.*, 2022). Structured eating patterns have been associated with better

weight management and reduced intake of calorie-dense foods, particularly in adolescence (Barros *et al.*, 2021; Kunset *et al.*, 2023).

Additionally, the positive association between higher consumption of SSBs, fast food, and elevated sedentary behavior suggests that unhealthy dietary patterns are closely linked to more sedentary lifestyles in this population. This finding supports a large body of global evidence that demonstrates a strong correlation between poor dietary habits and physical inactivity (Afrin *et al.*, 2021; Miranda *et al.*, 2021). Adolescents who consume higher quantities of fast food and sugary beverages are often more likely to engage in sedentary activities, such as screen time (Ashdown-Franks *et al.*, 2019; Li *et al.*, 2020). A studies from Jordan and Saudia Arabia reported a similar trend, where adolescents with higher SSB consumption and fast food intake also showed higher levels of sedentary behavior (Al-Domi *et al.*, 2020; Alghadir, Iqbal, and Gabr, 2021).

Boys in this study showed higher obesity indicators such as WHtR, WHR, and BMI z scores compared to girls. Greater physical activity was linked to lower obesity, while more sedentary time and higher intake of sugary drinks and milk calories were associated with increased obesity, especially in urban settings. These results are consistent with regional and international studies reporting higher obesity rates among boys in countries like Saudi Arabia, Egypt, and others in the Middle East (Hamed *et al.*, 2019; Rey-Lopez *et al.*, 2019; Abd El-aty *et al.*, 2020; Al Jawaldeha *et al.*, 2020; Said, and Shaab Alibrahim, 2022; Alenazi *et al.*, 2023). This trend is also observed in global contexts, where adolescent boys tend to have higher BMI and central obesity rates, particularly in Western countries such as the U.S. (Nagata *et al.*, 2019; Y. Wang *et al.*, 2021). These findings can be attributed to biological differences in fat distribution, as boys are more prone to visceral fat accumulation, which is strongly associated with central obesity and higher cardiometabolic risks (Goluch-Koniuszy, and Kuchlewska, 2018). Cultural norms in Arab countries also contribute, as boys are

often allowed greater dietary freedom, leading to higher caloric intake and increased likelihood of obesity (Cathaoir, 2018; Al-Domi *et al.*, 2020).

The negative association between physical activity and obesity indices, alongside the positive association of sedentary behavior with obesity, is consistent with research from both global and regional studies. In Gulf countries like Saudi Arabia and the UAE, lower physical activity levels have been linked to increased obesity rates among adolescents (Abduelkarem *et al.*, 2020; Baniissa *et al.*, 2020; Abedelmalek *et al.*, 2022). Globally, studies highlight that physical activity serves as a protective factor against central obesity, while sedentary behaviors, including screen time, are associated with weight gain and metabolic risk factors (Canabrava *et al.*, 2019; Liberali *et al.*, 2021; Verswijveren *et al.*, 2021). In Iraq and similar Arab nations, urbanization and modern lifestyle changes have significantly increased sedentary activities, particularly among boys, who are more likely to engage in screen-based entertainment. This shift is exacerbated by cultural preferences for indoor activities and limited access to public recreational facilities, as well as the region's hot climate, which discourages outdoor physical activity (Musaiger, Al-Mufty, and Al-Hazzaa, 2014; Wang *et al.*, 2020).

The finding of a positive association between sugar-sweetened beverages (SSB) and milk calories with WHtR and BMI z-scores was supported by numerous studies from both Arab countries and the global literature. Research from Saudi Arabia, Kuwait, and Jordan similarly shows that high consumption of SSBs is directly linked to increased obesity among adolescents (Stamataki *et al.*, 2020; Alqaoud *et al.*, 2021; AlFaris *et al.*, 2022; Azzeh, and Hamouh, 2022; Alhareky *et al.*, 2023). In Western countries, high-calorie beverages, including sugary drinks and flavored milk, contribute significantly to weight gain and central obesity in adolescents (Jakobsen, Brader, and Bruun, 2023). In Iraq, the widespread availability of SSBs and flavored milk, combined with aggressive marketing, likely plays a role in their high

consumption among adolescents, leading to higher caloric intake and fat deposition (Amin, 2019).

Furthermore, the study indicates that adolescents living in urban areas are more likely to exhibit higher BMI z-scores, suggesting a stronger association with obesity. This observation mirrors findings from Sudan, Egypt, and Saudi Arabia, where urban adolescents show higher obesity rates due to increased access to fast food, processed foods, and more sedentary lifestyles (Musaiger, Nabag, and Al-mannai, 2016; Talat, and El Shahat, 2016; Alfadda, and Masood, 2019). Urbanization has led to significant dietary shifts toward energy-dense, nutrient-poor foods, particularly in cities, where adolescents have greater exposure to unhealthy food environments. In contrast, rural areas often maintain more traditional diets and higher levels of physical activity, which contribute to lower obesity rates (Nurwanti *et al.*, 2019; Casari *et al.*, 2022).

Globally, Urban adolescents in middle-income countries face higher obesity rates due to urbanization (Caleyachetty *et al.*, 2018; Guo *et al.*, 2019). However, In Arab countries, including Iraq, this trend is worsened by specific sociocultural factors like poor diet, sedentary habits, and fast-paced urban growth. While these patterns reflect global findings, they also point to unique regional challenges. This study highlights the need for targeted public health efforts, especially in urban areas, to reduce sugary drink intake, encourage physical activity, and foster healthier environments (WHO, 2016).

5.5.2 Indirect Effects in the Pathways of the Final Model

This study found that among Iraqi adolescents, increased sugar-sweetened beverage (SSB) consumption and sedentary behavior are key factors influencing body measurements, with boys being more affected than girls. This gender difference is consistent with both global and regional studies, which highlight how boys and girls differ in physical activity, diet, and metabolism during adolescence.

Globally, boys tend to consume more SSBs than girls, leading to higher calorie intake and a greater risk of weight gain. For example, Korean research showed that boys drink significantly more SSBs than girls, contributing to higher BMI and obesity risk (Sim *et al.*, 2019). Boys' preference for sugary drinks and greater exposure to marketing (Sadeghirad *et al.*, 2018). combined with more time spent in sedentary activities like gaming or watching TV (Ashdown-Franks *et al.*, 2019; Li *et al.*, 2020), creates a pattern that promotes weight gain through excess calorie intake and low energy expenditure.

Regionally, studies conducted in Arab countries reinforce the notion that boys are at a greater risk of weight gain due to these unhealthy behaviors. In Kuwait, Alqaoud *et al.* (2021) found that boys exhibited higher screen time and SSB consumption than girls, leading to a heightened likelihood of obesity. Similarly, research in Saudia Arabia showed that male adolescents were more inclined to consume SSBs and fast food, resulting in a higher BMI compared to their female counterparts (Alghadir, Iqbal, and Gabr, 2021). These findings reflect cultural contexts in many Arab nations, where boys typically enjoy more freedom to engage in social activities outside the home, including visits to fast-food outlets, while girls face more restrictions on movement and outdoor activities. Consequently, boys have greater opportunities to consume SSBs and engage in sedentary pastimes, increasing their risk of weight gain.

Sociocultural factors also play a pivotal role in shaping the dietary and activity patterns of Iraqi adolescents. Rapid urbanization and globalization in Iraq, akin to many Arab countries, have led to a shift toward sedentary lifestyles and increased consumption of Westernized diets, characterized by higher SSB and fast-food intake (Naja *et al.*, 2018; Salem *et al.*, 2022). Boys, in particular, may be more susceptible to these shifts due to greater social freedoms and access to food outlets. The rise in screen-based activities, including video gaming and social media use, correlates with

increased SSB consumption and decreased physical activity, both of which contribute to weight gain (Schröder *et al.*, 2021). The interaction of these factors disproportionately affects boys, exacerbating the gender gap in obesity risk.

The study reveals a notable but often overlooked link between school type and body measurements among Iraqi adolescents. Those in private schools were more prone to weight gain than their peers in governorate schools, largely due to higher levels of physical inactivity and sedentary behavior. This suggests that school environment, lifestyle, and socioeconomic status interact in complex ways to shape adolescent health, especially regarding obesity.

Global research supports this pattern, showing that school settings greatly influence physical activity and sedentary habits. Adolescents in private, often urban, schools, typically from higher socioeconomic backgrounds, may have greater access to unhealthy foods and spend more time on sedentary activities like screen use, both risk factors for higher BMI (Said, and Shaab Alibrahim, 2022). In contrast, students in public schools may be more physically active, benefiting from structured routines and relying more on active transport such as walking or cycling.

These findings echo global trends, including in France, where sedentary behavior and socioeconomic status have been linked to adolescent weight gain. Omorou *et al.* (2020) found that teens from wealthier families often engage in more sedentary leisure time, raising their risk of obesity. Similarly, adolescents in private schools, typically from higher-income backgrounds, may have more access to screen-based entertainment and less encouragement for physical activity in school settings.

This pattern is also seen across the Arab world. Said and Shaab Alibrahim (2022) reported that private school students in Saudi Arabia were more likely to spend excessive time on screens and had higher rates of overweight and obesity compared to their public school peers. They also noted that private schools offered fewer physical education and sports opportunities.

In Iraq, similar social dynamics may be at play. Students in private schools, often from affluent families, may have less exposure to physical education and greater access to unhealthy food both at school and home. This aligns with findings from the Eastern Mediterranean region, where higher socioeconomic status is linked to greater consumption of fast food and sugary drinks (Al-Jawaldeh, Taktouk, and Nasreddine, 2020).

Transportation habits also contribute. Private school students are more often driven to school, reducing daily physical activity, while those in governorate schools may walk or use public transport. Al-Nuaim, and Safi, (2023) identified car reliance as a key factor associated with higher BMI in Saudi adolescents. Moreover, lifestyle differences matter. Private school students may face greater academic pressure, leading to longer study hours and less time for physical activity, a trend supported by global research (Sánchez-Miguel *et al.*, 2022).

This study suggests that Iraqi adolescents' anthropometric measurements are indirectly influenced by higher household income, mainly through its effect on physical activity levels. Adolescents from wealthier families often have greater access to gyms, sports clubs, and organized activities, which can promote physical health. They may also benefit from healthier food options (Scholes, and Mindell, 2021). However, the relationship is not straightforward. Affluent environments also tend to provide more access to screen-based entertainment, which can lead to increased sedentary behavior. This paradox means that while higher income can support healthier lifestyles, it may also encourage habits that negatively impact physical health (Mello *et al.*, 2021). International studies reflect this complexity. In high-income countries, higher socioeconomic status often correlates with lower adolescent obesity rates, due to better access to healthy food and safe spaces for exercise (Langøy *et al.*, 2019; Claassen *et al.*, 2020; Heidelberger, and Smith, 2018). Yet in some Arab countries, the trend can be reversed. In places like Saudi Arabia and Jordan, higher-

income families sometimes see higher adolescent obesity rates, driven by sedentary lifestyles and increased consumption of processed foods and sugary drinks (Alazzeh *et al.*, 2018; Okour *et al.*, 2019).

The findings of this study indicate that decrease anthropometric measurements among Iraqi adolescents is indirectly influenced by the number of siblings, which is mediated by higher levels of physical activity and reduced sedentary behaviors. This relationship aligns with global studies showing that adolescents with more siblings are less likely to be overweight or obese (Park, and Cormier, 2019). For instance, research in the United States revealed that children with multiple siblings engage more frequently in active play and are less likely to partake in sedentary activities, such as watching television or playing video games (Kracht, and Sisson, 2019). Several factors contribute to this trend; larger families often have limited disposable income, which can reduce access to calorie-dense foods. Additionally, sibling interactions foster active play, thereby decreasing the time spent on sedentary pursuits. This pattern is consistent with the cultural context of Iraq and the broader Arab world, where familial interactions and responsibilities play a central role in daily life. In larger families, adolescents may engage more frequently in physical tasks and shared activities, further mitigating sedentary behaviors and promoting higher levels of physical activity (Alazzeh *et al.*, 2018; Aljayyousi *et al.*, 2019).

The study's findings support the established relationship between physical activity and sedentary behaviors in influencing adolescent anthropometric measurements. Globally, research indicates that physical activity has protective effects against obesity, while sedentary behaviors, particularly excessive screen time, are linked to weight gain (Gualdi-Russo *et al.*, 2021). Iraqi adolescents from larger families may have enhanced opportunities for physical activities due to sibling interactions and shared responsibilities, leading to fewer chances for sedentary behaviors such as prolonged screen time. In contrast, adolescents from smaller families

may be more prone to sedentary behaviors due to limited opportunities for active social play, increasing their risk of weight gain (Bohn *et al.*, 2022). Research conducted in Saudi Arabia corroborates these findings, revealing that adolescents from larger families exhibit lower obesity rates, likely due to increased levels of physical activity and reduced screen time (Alazzeh *et al.*, 2018). Similarly, in Kuwait, family structure significantly influenced adolescents' lifestyle choices, with larger families shaping physical activity levels and sedentary behaviors that ultimately affected anthropometric measurements (Zafar, and Alkazemi, 2022).

The findings of this study highlight a clear link between sedentary behavior and higher BMI among Iraqi adolescents, with sugar-sweetened beverage (SSB) intake playing a key mediating role. Adolescents who spend more time sitting, especially during screen-based activities, tend to consume more calorie-rich, sugary drinks, which contributes to weight gain. This pattern mirrors global trends. These patterns reflect global trends, as evidenced by a meta-analysis indicating that extended sedentary activities, such as screen time, are associated with unhealthy dietary patterns, including higher consumption of fast food, snacks, and SSBs, all of which directly influence BMI (Barnabé *et al.*, 2023). In high-income countries, similar trends are observed, where sedentary adolescents tend to consume greater amounts of SSBs and energy-dense foods, promoting weight gain and elevating cardiometabolic risks (Ra, and Huyen, 2024). For instance, a Malaysia and China studies by Gan *et al.* (2019) and Yu *et al.* (2023) found a strong correlation between television viewing, increased SSB consumption, and higher BMI among adolescents. UK study further corroborate this, indicating that adolescents with high screen time are more likely to consume sugary drinks and engage in poor dietary habits, contributing to increased adiposity (Thomas *et al.*, 2019).

Regionally, the current findings resonate with research from Arab countries, where rising sedentary lifestyles and high SSB consumption among adolescents mirror

global patterns. In Saudi Arabia, a study identified that adolescents with extensive screen time had higher obesity rates driven by increased SSB consumption (Al-Hazzaa, 2019). In Kuwait, Alqaoud *et al.* (2021) found that frequent SSB consumption among sedentary children significantly contributed to higher BMI levels. In the context of Iraqi adolescents, these regional studies suggest that the Westernization of dietary patterns, resulting from urbanization and increased access to fast food and sugary beverages, may explain the significant relationship observed between sedentary behavior, SSB intake, and BMI.

These findings highlight the need for focused public health efforts to reduce sedentary lifestyles and sugary drink (SSB) consumption among adolescents in Iraq and across the Arab region. Encouraging physical activity, limiting screen time, and raising awareness about the health risks of SSBs are key strategies to combat rising obesity rates. Policy tools, like the SSB taxes implemented in Mexico and the U.K., could also help reduce intake and improve health markers (Salgado Hernández, and Ng, 2021). Future studies should explore how prolonged sedentary behavior and high SSB intake affect adolescent cardiometabolic health over time, especially through long-term, follow-up research in Arab countries.

5.5.3 Association of Anthropometric Measurements with Cardiometabolic Risk Factors

The study demonstrates that zBMI is the most potent predictor of cardiometabolic outcomes, including systolic and diastolic blood pressures, triglycerides, low-density lipoprotein (LDL), and insulin resistance among Iraqi adolescents. This finding is consistent with global research, where zBMI and BMI are widely recognized as strong markers of adiposity and predictors of adverse cardiometabolic profiles in children and adolescents (Jones *et al.*, 2019; Li, 2020; Roberge *et al.*, 2021). Studies conducted in Western populations, such as those in the

United States and Europe, similarly link higher BMI to increased risks of hypertension, dyslipidemia, and insulin resistance (Xiao *et al.*, 2021; Tan *et al.*, 2023). zBMI's ability to predict these outcomes is largely due to its close association with overall adiposity, particularly in terms of excess fat, which drives insulin resistance, lipid abnormalities, and elevated blood pressure (Araújo *et al.*, 2018; Wu *et al.*, 2020). Excess adipose tissue, especially visceral fat, releases inflammatory cytokines like interleukin-6 and tumor necrosis factor-alpha, which promote insulin resistance and dyslipidemia, providing a clear mechanism for zBMI's predictive strength.

While zBMI emerged as the strongest predictor, the study also showed that WHtR and WHR were associated with cardiometabolic risk, though to a lesser extent. This supports findings from global and regional research, where measures of central obesity, such as WHtR and WHR, are often better indicators of visceral fat and cardiometabolic risk than BMI alone (Haregu *et al.*, 2020). In Arab countries like Saudi Arabia, Syria, and Egypt, WHtR has been highlighted as a key predictor of metabolic syndrome among adolescents (Zaki *et al.*, 2015; Al-Bachir, and Bakir, 2018; Alowfi *et al.*, 2021). These measures are valuable because they reflect abdominal fat distribution, particularly visceral fat, which is closely linked to insulin resistance, high blood pressure, and dyslipidemia (Kusters *et al.*, 2017). Unlike BMI, which reflects general body fat, WHtR and WHR provide more specific insight into central obesity, enhancing their predictive value for cardiometabolic risk.

The association of zBMI, WHtR, and WHR with cardiometabolic risk factors such as blood pressure, triglycerides, LDL, and insulin resistance highlights the critical importance of addressing obesity in adolescence to prevent future cardiovascular diseases and type 2 diabetes (Sardinha *et al.*, 2017). Adolescents with higher levels of adiposity, particularly central adiposity, are at increased risk of developing metabolic syndrome, which can have long-term consequences on their health (Werneck *et al.*, 2017). The strong associations observed between these obesity indices and blood

pressure, for example, can be explained by the relationship between excess adiposity and vascular dysfunction, where increased fat leads to vascular stiffness and elevated blood pressure (Pucci *et al.*, 2023). The link between obesity and insulin resistance is well-established, with adipose tissue dysfunction contributing to altered insulin signaling and increased triglyceride levels (Ahmed, Sultana, and Greene, 2021; Kunz *et al.*, 2021).

These findings are consistent with research across the Arab world, where rising rates of adolescent obesity have been linked to increased prevalence of cardiometabolic risk factors. For instance, a study in Saudi Arabia, Jordan, Palestine, and Kuwait, found that WHtR and BMI were significant predictors of hypertension and insulin resistance among adolescents (Davidsson *et al.*, 2021; Ejheisheh *et al.*, 2021; El-Ashker *et al.*, 2021; Al Hourani, and Alkhatib, 2022). In Saudi Arabia and Alger, both BMI and WHR have been associated with elevated blood pressure and lipid abnormalities, similar to the findings in Iraqi adolescents (Milyani, and Al-Agha, 2019; Alowfi *et al.*, 2021). These parallels between Iraq and other Arab countries can be attributed to shared dietary patterns, sedentary lifestyles, and cultural norms that contribute to high obesity rates and related cardiometabolic diseases. The adoption of Westernized diets, rich in processed foods, combined with low levels of physical activity, has exacerbated the prevalence of obesity and its associated health risks among adolescents in the region (Naja *et al.*, 2018; Salem *et al.*, 2022).

In conclusion, this study shows that zBMI is the strongest predictor of cardiometabolic risk among Iraqi adolescents, with WHtR and WHR also playing important roles. These results align with both global and regional research, emphasizing how body composition and fat distribution impact cardiometabolic health. The consistent influence of these measures across various outcomes highlights the urgent need for targeted strategies to address adolescent obesity. Culturally tailored

approaches that focus on diet, physical activity, and central fat reduction are crucial to tackling obesity-related health risks in Iraq and the broader Arab region.

5.6 Methodological Issues and Study Parameters

5.6.1 Generalizability of the Study Findings

The incorporation of a cross-sectional design in this study is justified by its strengths in enhancing the generalizability of findings. This design facilitates the collection of data from a diverse sample of Iraqi adolescents at a single point in time, capturing various health behaviors and dietary practices across demographic groups, thus improving the applicability of results to the broader adolescent population in Iraq (Plichta, and Kelvin, 2013). The efficiency of this design allows simultaneous data gathering from multiple participants, which is essential for obtaining a representative sample (Creswell, and Creswell, 2019).

Additionally, this design enables exploration of associations among sociodemographic factors, food parenting practices, dietary behaviors, and obesity risk, strengthening the relevance of findings to broader contexts and informing public health initiatives (Plichta, and Kelvin, 2013; Spector, 2019). The results can serve as a foundation for future research, including longitudinal studies or targeted interventions, thereby contributing to a comprehensive understanding of adolescent health trends over time (Wang, and Cheng, 2020). Furthermore, the adaptability of the design allows researchers to tailor methodologies to the cultural context of Iraqi adolescents, ensuring the results are applicable to similar populations across varied settings (Hua *et al.*, 2019).

The study utilized simple random sampling, ensuring that every school in the population had an equal chance of selection, which mitigates biases and allows generalization of findings to the broader adolescent population in Wasit Governorate

(Latpate *et al.*, 2021). This straightforward implementation enhances data collection efficiency and provides a robust foundation for statistical analyses, increasing the validity of the research findings (Cui *et al.*, 2023). The selection of schools also ensures representation from various socioeconomic backgrounds, enriching the study.

The exclusion criteria were designed to enhance the reliability and validity of the findings. Adolescents not living with their parents were excluded to reflect the impact of parental involvement on health behaviors, as those living independently may lack consistent guidance (Koning *et al.*, 2021). Excluding adolescents with uncontrolled hyperactivity or inattention prevents distortion of dietary behaviors and questionnaire responses, which could compromise data integrity (Del-Ponte *et al.*, 2019). Additionally, adolescents with Diabetes Mellitus were excluded due to the unique dietary management required, which could confound the study results (Zakarneh, Khial, and Tayyem, 2023). These criteria ensure that the sample accurately represents adolescents influenced by normative food parenting practices.

The focus on adolescents aged 16 to 18 years aligns with a critical developmental stage marked by significant changes in dietary behaviors and food-related decision-making. This age group is particularly relevant for examining health behaviors, as it encompasses increased independence in food choices influenced by both parental practices and social factors (Ziegler *et al.*, 2021). This age range corresponds with the WHO classification of adolescence, supporting the exploration of behavioral factors that influence health during this period (WHO, 2022a). The Body Mass Index (BMI) of participants was categorized based on WHO Growth Reference for children and adolescents aged 5-19 years, ensuring accurate representation of health dynamics.

In total, the study included 124 participants for pretest, face validity, and content validity assessments, with 98 and 160 participants completing the exploratory and confirmatory factor analyses, respectively. In Phase II, 506 participants completed

the full questionnaire, with 96 individuals providing blood samples for cardiometabolic analysis. This comprehensive participant engagement ensures robust and reliable findings regarding adolescent health behaviors and practices.

5.6.2 The Sample Size of Study Participants

The sample size for each specific objective was calculated based on established methodological guidelines. For the Exploratory Factor Analysis (EFA), a total of 98 participants were included, which was deemed sufficient. This sample size was estimated following the rule of thumb suggested by Costello and, and Osborne (2005), who recommended multiplying the number of items by a factor of 5 to 10. Therefore, the 98 participants utilized in the EFA phase were considered appropriate for the purposes of this study.

In contrast, the sample size for the Confirmatory Factor Analysis (CFA) was slightly less than the pre-estimated requirement, with 160 participants taking part. The recommended sample size for CFA was derived based on the guidelines provided by Arifin (2023)and Kim (2005), who emphasized the importance of sample size in relation to the Comparative Fit Index (CFI) for advanced model testing. However, Muthén and Muthén (2002) indicated that a minimum sample size of 150 participants is acceptable for CFA. Given that 160 participants were included in this stage, the sample size was still considered adequate and within acceptable limits based on Muthén and Muthén's recommendation.

For the Intraclass Correlation Coefficient (ICC), the required sample size, after accounting for a 10% dropout rate, was calculated to be 102 participants. However, only 83 participants were available for this analysis. Despite the reduced sample size, the reliability power was calculated at 0.80, with a minimum acceptable ICC of 0.60, which was still deemed acceptable for this study.

In the case of Path Analysis, the sample size achieved was 506 participants, which provided an expected statistical power of 80%. This sample size meets the recommendations of Cohen (1988) and Wang *et al.* (2019) for ensuring sufficient power in path analysis, thereby affirming the adequacy of the sample size for this objective.

In conclusion, while some variations in sample size existed between the study phases, the overall sample sizes were consistent with established methodological standards and were considered sufficient to ensure the reliability and validity of the findings.

5.6.3 The Response Rate of the Study

The study's response rates varied according to the type of data collection, reflecting the overall engagement of participants across different study phases. The response rates for Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were 70% and 93%, respectively, indicating strong participant involvement in these crucial analytical stages. For Intraclass Correlation Coefficient (ICC) assessment, a response rate of 84% was achieved, while Path Analysis had an 80% response rate. These high response rates are consistent with acceptable standards in survey-based and clinical research, as noted by Costello and, and Osborne (2005) and Kline (2023), who emphasized that response rates above 60% are typically sufficient for factor analyses. The strong response rates in these phases support the robustness of the study's findings, ensuring that the factor structures and reliability estimates are generalizable to the broader adolescent population.

The 19% response rate for cardiometabolic tests, however, was notably lower. This is not unusual, as more invasive procedures, such as blood tests, often result in reduced participation due to logistical challenges and participant discomfort, as observed by Neelakantan *et al.* (2023). Although the lower response rate may

introduce selection bias, it is important to recognize that the more comprehensive data collection components, such as EFA, CFA, ICC, and Path Analysis, maintained higher response rates. This discrepancy suggests that the generalization of cardiometabolic test findings should be approached cautiously, while the broader conclusions of the study remain robust.

The variation in response rates, ranging from 70% to 93%, across most data collection phases, aligns with response rates observed in similar research contexts. According to Hendra and Hill (2019), high response rates minimize non-response bias, enhancing the external validity and generalizability of study findings. While the low response rate for cardiometabolic tests reflects common challenges in participation for invasive procedures, the high engagement in the primary study phases reinforces the overall reliability of the conclusions drawn from the factor analyses, reliability assessments, and path analyses. These findings suggest that, despite the challenges with certain data collection methods, the study's design and execution effectively captured a representative sample, ensuring that the results are applicable to the target population.

5.6.4 Debate on Theoretical Framework

The present study applied an **Ecological Systems Theory** (Davison, and Birch, 2001), which offers a robust framework for understanding the multilevel determinants of adolescent overweight and obesity (OW/OB). This theory conceptualizes obesity as an outcome influenced by the interaction of individual, familial, and environmental factors. The findings of the study substantiate this framework by demonstrating the significant impact of child characteristics, parenting styles, and environmental contexts on adolescent anthropometric outcomes. For instance, child-specific factors, such as sex and familial susceptibility to weight gain, were shown to moderate dietary behaviors, physical activity, and sedentary behaviour. Parenting styles, including

autonomy support and coercive control, emerged as critical determinants of adolescents' dietary patterns and activity levels. Autonomy-supportive practices promoted healthier dietary behaviors, consistent with findings from (Roselinde, Kleef, and Trijp, 2021), who highlighted the role of parenting in shaping health-related outcomes. In contrast, coercive control was associated with increased consumption of sugar-sweetened beverages and unhealthy snacks, contributing to higher BMI z-scores. These findings align with Vaughn *et al.* (2016) work, which emphasized the influence of food parenting practices on children's weight-related behaviours.

Environmental factors, such as socioeconomic status and school environment, were also found to significantly shape adolescents' physical activity and dietary behaviours, further supporting the assumptions of the ecological framework. For example, the type of school attended was a determinant of both physical activity and sedentary behaviour, echoing evidence from Bronfenbrenner (1979) ecological theory, which posits that microsystem-level influences, such as schools, play a pivotal role in individual behaviour. Similarly, socioeconomic status influenced dietary intake, with higher income levels linked to healthier food choices, corroborating studies by Al-Jawaldeh, Taktouk, and Nasreddine (2020) that associate socioeconomic disparities with health behaviours. The interaction between these environmental and familial factors underscores the interconnected nature of influences described in the ecological model.

The study findings further emphasize familial susceptibility to weight gain, a key component within the ecological framework. The high prevalence of overweight and obesity among parents, particularly severe obesity, reflects the significant role of familial genetic and environmental contributions to adolescent weight outcomes. This intergenerational pattern of obesity aligns with prior research, including Wardle *et al.* (2008), Wu *et al.* (2018), and Bouchard (2021), which estimate obesity heritability at 40% to 70%. Additionally, environmental factors, such as shared family dietary

practices and physical activity habits, exacerbate genetic predispositions, consistent with Tavalire *et al.* (2020) findings on gene-environment interactions. Regionally, studies in the Arab context, such as those by Mattoo and colleagues (2020) and Salem and colleagues (2022), have identified similar trends, linking familial dietary habits and cultural norms to high obesity rates. These findings reinforce the ecological framework by demonstrating that familial and environmental influences operate synergistically to shape adolescent health behaviours and outcomes.

The results of the study provide compelling evidence supporting the **Ecological Systems Theory**, highlighting the interplay between individual behaviours, parenting practices, and broader environmental factors. Parenting styles directly influence adolescents' food preferences, dietary habits, and physical activity, which, in turn, significantly impact anthropometric measures such as BMI z-scores and waist-to-hip ratios. Moreover, familial predisposition to weight gain underscores the genetic and behavioural transmission of obesity across generations. By integrating these multilevel influences, this study affirms the relevance of ecological models in obesity research and supports the adoption of family-centered, contextually tailored interventions for effective prevention strategies. Future research should explore the specific mechanisms underlying these interactions, including culturally sensitive approaches to family-based interventions, as recommended by Alenazi and colleagues (2023). Addressing obesity in adolescents requires a holistic perspective that integrates genetic, familial, and environmental dimensions, as emphasized in the theoretical foundation of this study.

5.7 Strengths and Limitations of the Study

5.7.1 Strength of the Study

This study exhibits multiple strengths, beginning with its rigorous methodological framework. The research incorporates positivist paradigms, enabling a comprehensive approach to investigating the research questions. Positivism, which focuses on measurable variables, allowed for the precise quantification of food parenting practices, dietary behaviors, and health outcomes among Iraqi adolescents, Also, positivism acknowledged the complexity of observations and the need for continual reassessment (Fischer, 1998; Ryan, 2018). The integration of both paradigms ensured that the findings were empirically robust and contextually relevant, especially in a culturally specific population such as Iraq (Park, Konge, and Artino, 2020).

A key strength of the study lies in its translation and cultural adaptation of two established questionnaires the Adolescent Food Parenting Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ) into Arabic. The translation-back-translation process, guided by Wild *et al.* (2005) principles of good practice, ensured that the questionnaires were culturally and linguistically adapted to accurately reflect food parenting behaviors and beverage intake in the Iraqi context. This meticulous process involved multiple stages of validation, including content, face, and construct validity checks, thereby enhancing the reliability and validity of the instruments (Lynn, 1986; Polit, and Beck, 2006).

The statistical analysis applied in this study, including Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), was another methodological strength. These analyses ensured that the constructs of the AFPQ and BEVQ were accurately captured, and the internal consistency of the tools was confirmed through Cronbach's alpha, a widely accepted measure of reliability (Hair *et al.*, 2019). These rigorous statistical methods strengthen the credibility of the findings

by demonstrating that the instruments were valid and reliable in measuring adolescent food parenting practices and beverage intake in Iraq.

Moreover, the study employed path analysis, a robust statistical technique that enabled the exploration of both direct and indirect relationships among multiple variables. Path analysis is particularly valuable for testing complex hypotheses and theories, such as the Ecological Systems Theory, which postulates that adolescent behaviors are influenced by interactions between various environmental and social systems, such as family, school, and community (Bronfenbrenner, 1979). By using path analysis, the study was able to examine how sociodemographic factors, food parenting practices, and adolescent health outcomes were interrelated. The ability to identify mediating variables and model causal pathways added depth to the theoretical framework and provided a more holistic understanding of adolescent dietary behaviors (Kline, 2023).

Another significant strength of the study was its sample design and data collection methods. A random sampling technique was used to select schools and participants from both governmental and private secondary schools in Kut City, ensuring a high level of representativeness and minimizing selection bias (Howel, 2016). Additionally, proportional stratified sampling was employed to account for key demographic characteristics such as school type and gender, ensuring the sample mirrored the broader population of Iraqi adolescents. The study also included the administration of the AFPQ to both adolescents and their parents, providing multi-informant data. This approach enriched the findings by offering insights from both perspectives and enabled the comparison of parent-reported and adolescent-reported behaviors (Gevers *et al.*, 2014; Vaughn *et al.*, 2016).

Furthermore, the adequate sample size for statistical analyses, such as EFA and CFA, was another strength. The study followed well-established guidelines for determining sample size, ensuring that the data were sufficiently powered to detect

significant relationships (Gorsuch, 1983; Kline, 2023). Additionally, the sample size was adjusted to account for potential dropout rates, preserving the integrity of the findings even in cases of participant attrition (Costello, and Osborne, 2005).

In terms of data collection, the study utilized a combination of methods, including face-to-face interviews, test-retest reliability, and validated instruments with cultural sensitivity. The face-to-face administration of the questionnaires, particularly with parents, ensured high participation rates and accurate data collection, while the use of test-retest methods for the BEVQ confirmed the stability of the responses over time (Hill *et al.*, 2017). The triangulation of data from multiple sources, including self-reported questionnaires, anthropometric measurements, and biochemical data, provided a comprehensive understanding of adolescent health and behavior, further enhancing the reliability of the findings (Polit, and Beck, 2006).

Finally, the study adhered to high ethical standards. Informed consent was obtained from both adolescents and their parents, and ethical approval was granted by the appropriate institutional review boards. The cultural sensitivity in the administration of the questionnaires, along with the ethical protocols followed, strengthened the study’s credibility and ensured respect for the participants' autonomy and rights (Barrow, Brannan, and Khandhar, 2022).

In conclusion, the study's methodological rigor, including its robust sample design, data collection procedures, and comprehensive statistical analysis, ensured that the findings were reliable, valid, and applicable to the broader adolescent population in Iraq. These strengths contribute to the study's potential impact on future public health policies aimed at improving adolescent dietary behaviors in the Middle East.

5.7.2 Limitations of the Study

This study was rigorously designed, yet several limitations and delimitations influenced its scope, findings, and generalizability. Understanding these factors

provides a more comprehensive context for interpreting the results and considering areas for future research.

One significant limitation was the difficulty in collecting biological data, particularly blood samples. Although some parents granted permission for their adolescents to donate blood for biochemical analysis, a notable number of participants dropped out during data collection due to fear or anxiety about the procedure. This reduced the availability of objective health measures, such as biomarkers, which would have provided critical insights into the physiological effects of dietary behaviors. The inability to collect sufficient blood samples limited the study's ability to correlate reported behaviors with actual health outcomes, thereby reducing the depth of the analysis (Chen *et al.*, 2019).

Budgetary limitations also constrained the use of advanced laboratory equipment and other biochemical analyses, restricting the data to available measures rather than more objective health indicators. Additionally, logistical challenges and the geographical focus on Wasit Governorate, Iraq, restricted the inclusion of adolescents from more diverse regions, particularly rural areas. This focus limits the external validity of the findings and raises concerns about their generalizability to the broader adolescent population of Iraq (Cosentino, and Maiorano, 2021).

The decision to focus exclusively on adolescents aged 16–18 years further shaped the scope of the study. While this age group was selected as it represents a critical developmental period, it excluded younger and older age groups, whose dietary behaviors might differ significantly. Adolescents in this life stage may exhibit unique dietary patterns that limit the applicability of the findings to the full spectrum of adolescent health behaviours.

The limitation of the study also reflect practical considerations, such as limiting the research to a specific age group and region to ensure manageability within the available resources. While this approach provided meaningful insights into dietary

behaviours during a key developmental stage, the narrow focus must be considered when interpreting the findings.

In conclusion, while the study provides valuable insights into adolescent dietary behaviours in Iraq, limitations such as the difficulty in collecting biological samples, regional focus, and age-group specificity must be acknowledged. Future research could address these issues by including broader geographic regions, other age groups, and employing longitudinal designs to capture changes in dietary behaviours over time.

5.8 Chapter Summary

This chapter provided a comprehensive discussion of the methods and results, addressing the research objectives across the two phases of the study. In Phase I, the study successfully translated and validated the Adolescent Food Parenting Practices Questionnaire (AFPQ) and Beverage Intake Questionnaire (BEVQ) into Arabic for the Iraqi adolescent population, ensuring their cultural relevance. Phase II explored the relationships between sociodemographic factors, food parenting practices, dietary behaviors, physical activity, sedentary behavior, and anthropometric measurements, with particular attention to the impact of obesity on cardiometabolic risk factors.

The discussion compared the study's findings with existing literature, offering insights into the unique health behaviors and challenges faced by Iraqi adolescents. The study also highlighted the methodological challenges and limitations encountered, such as the lower response rate for cardiometabolic testing. Despite these limitations, the findings contribute valuable insights into adolescent health in Iraq.

CHAPTER 6

CONCLUSION AND FUTURE RECOMMENDATIONS

6.1 Introduction

This chapter provides a conclusion of the main findings of the study, presents recommendations for future research, and discusses the contributions of the study to the field of adolescent health, particularly in the context of Iraq.

6.2 Conclusion

This study successfully identified the complex relationships between sociodemographic factors, food parenting practices (FPP), dietary behaviours, sugar-sweetened beverage (SSB) consumption, physical activity, sedentary behaviour, and anthropometric measurements among Iraqi adolescents, as well as the impact of obesity on cardiometabolic risk factors. Employing a cross-sectional design and culturally adapted, validated instruments namely, the Arabic versions of the Adolescent Food Parenting Questionnaire (AFPQ-A) and the Beverage Intake Questionnaire (BEVQ-A) the study significantly contributes to understanding adolescent obesity and nutrition-related behaviours in this population. This study is among the first to validate the AFPQ and BEVQ in Arabic and apply a path model to adolescent obesity in Iraq, thus filling a gap in culturally relevant health behavior research in the region.

The findings demonstrated that the Arabic versions of the AFPQ-A and BEVQ-A questionnaires are both valid and reliable for assessing food parenting practices and beverage intake among Iraqi adolescents. This has been confirmed through exploratory factor analysis (EFA) and Cronbach's alpha values. Additionally, confirmatory factor analysis (CFA) and construct reliability further validated their reliability. The Arabic version of the BEVQ-A demonstrated stability over two time points, as evidenced by test-retest reliability using the Intraclass Correlation Coefficient (ICC) and Bland-Altman plot analysis.

The findings confirmed that food parenting practices (FPP) significantly influence adolescent dietary behaviours. Adolescents whose parents implemented restrictive or controlling food practices were more likely to exhibit unhealthy eating patterns, such as a preference for sugary drinks and high-calorie snacks. In contrast, adolescents whose parents encouraged healthier eating through support and guidance were more likely to follow balanced diets, which in turn were associated with healthier anthropometric measurements. These findings align with existing literature that highlighted the role of parenting in shaping adolescent dietary habits.

Additionally, sociodemographic factors such as family size, household income, and urban versus rural living environments played a significant role in shaping adolescent health outcomes. Adolescents from larger families or those with more siblings demonstrated higher levels of physical activity and lower levels of sedentary behavior, suggesting that family dynamics in larger households may encourage more active lifestyles. In contrast, adolescents from urban areas exhibited higher levels of sedentary behavior and were more likely to have higher BMI z-scores, possibly due to greater exposure to sedentary entertainment options and increased access to unhealthy food choices. These findings reflect notable lifestyle differences, with adolescents in rural areas potentially engaging in more outdoor physical activities and following healthier, traditional diets, while those in urban environments may face higher risks of sedentary behavior and unhealthy dietary patterns.

The study also explored the relationship between physical activity and sedentary behavior with adolescent anthropometric measurements. Adolescents who engaged in regular physical activity were more likely to maintain a healthy weight, while those who spent more time in sedentary activities, such as watching television or using electronic devices, were more likely to be overweight or obese. The findings support global evidence on the role of physical activity in combating obesity and

underscore the need for public health initiatives that promote active lifestyles among adolescents.

A significant finding of the study was the direct relationship between obesity and cardiometabolic risk factors. Adolescents who were classified as overweight or obese showed higher incidences of elevated blood pressure, abnormal lipid profiles (such as high cholesterol levels), and impaired glycaemic control. These results are particularly alarming, as they suggested that obesity in adolescence can lead to early onset of cardiovascular diseases, type 2 diabetes, and other chronic health conditions. The study adds to the growing body of evidence that highlights the urgent need to address obesity at a young age to prevent long-term health complications.

Furthermore, the structural model developed in the study provided a clear framework for understanding the interplay between the different variables. The model showed both direct and indirect effects of food parenting practices and sociodemographic factors on anthropometric measurements, with dietary behaviors acting as a mediating variable. This comprehensive model serves as a valuable resource for future research and intervention planning, highlighting the various pathways that shape adolescent health behaviours and outcomes.

These findings provide empirical support for the application of the Ecological Systems Theory in adolescent obesity research in the Middle Eastern context. They also highlight key intervention points at the family and community levels that could guide culturally appropriate obesity prevention strategies. The study's hypotheses were generally supported by the findings, with the research objective effectively addressed within the Ecological Systems Theory framework. The confirmed hypothesis—that adolescent overweight and obesity are influenced by individual, familial, and environmental factors—aligned with the study's aim to examine direct and indirect path associations. Individual factors (e.g., sex), familial influences (e.g., FPP and parental weight), and environmental contexts (e.g., SES and school type) all

played interconnected roles in shaping adolescents' behaviors and anthropometric outcomes.

Overall, the findings of this study contribute significantly to the understanding of adolescent health in Iraq, a region where research on obesity and its related risk factors is limited. By providing empirical evidence on the role of parenting, socioeconomic factors, and lifestyle behaviors in shaping adolescent obesity and related health risks, this study offers a foundation for developing targeted public health interventions. These interventions could focus on promoting healthier food environments at home, encouraging physical activity, and addressing the broader social determinants of health to reduce the growing burden of adolescent obesity and its associated health risks in Iraq.

In conclusion, the findings indicate that addressing obesity and its risk factors in adolescence requires a multi-faceted approach in particular nutrition education for children and adolescent that considers not only individual behaviours but also the family environment and school environment. These findings align with international evidence on the determinants of adolescent health and emphasize the need for culturally tailored interventions in Iraq to improve adolescent health outcomes and prevent future chronic diseases.

6.3 Recommendations for Future Research

Based on the limitations identified in this study, several avenues for future research are recommended to enhance the understanding of adolescent dietary behaviors, food parenting practices, and health outcomes, particularly in Iraq.

A significant limitation of this study was the difficulty in collecting biological data, especially blood samples, due to the parental consent issue. Future research should explore strategies to improve participation in biochemical assessments. This could include educational campaigns to inform parents and adolescents about the importance of such data for understanding health outcomes, as well as investigating

less invasive alternatives, such as saliva sampling or non-invasive glucose monitoring, to increase participation and provide objective health indicators.

The cross-sectional design of this study limited the ability to observe changes over time or establish causal relationships. Future studies should adopt longitudinal designs to track how food parenting practices, dietary behaviors, and physical activity evolve during critical developmental periods. Longitudinal data would also provide insights into the long-term effects of adolescent dietary habits on anthropometric measurements and cardiometabolic health, offering a clearer understanding of the progression of obesity and related health risks into adulthood. Furthermore, it is important to include nutrition education syllabus in the school curriculum in Iraq as adolescents spent most of their time in school.

This study was limited to adolescents in Wasit Governorate, which restricted the generalizability of its findings. Future research should aim to include a more geographically diverse sample, representing both urban and rural areas across Iraq, to capture a wider range of dietary behaviors behaviours including sugar sweetened beverages (SSBs) intake and food parenting practices. Additionally, expanding the sample to include different age groups, such as younger adolescents (ages 12-15) and older adolescents (ages 19-21), would offer a more comprehensive picture of how health behaviors evolve across adolescence.

While this study examined food parenting practices, dietary behaviours, and sugar sweetened beverages (SSBs) intake, further research is needed to explore the broader cultural and social factors that influence these behaviors. Understanding how family traditions, peer influence, and social norms shape food choices and physical activity levels in Iraqi adolescents would provide critical insights for developing culturally sensitive interventions through qualitative study. Additionally, exploring the role of media and advertising in shaping dietary behaviours would be an important area for future study.

Future research should identify potential gender differences in how adolescents respond to food parenting practices, dietary behaviors, and physical activity. Investigating whether boys and girls experience different health outcomes based on these practices would allow for the development of gender-specific health interventions, ensuring that both male and female adolescents receive appropriate support for maintaining healthy lifestyles.

Future research should assess the effectiveness of policy-level interventions to improve adolescent health, including school nutrition programs, taxation on sugary drinks, and restrictions on unhealthy food advertising. Evaluating these policies across urban and rural areas would provide insights for implementing strategies to reduce obesity and enhance adolescent health in Iraq. Additionally, integrating physical education and promoting sports activities in schools, alongside initiatives to reduce screen time and encourage active breaks, could enhance physical activity levels. Future studies should examine the impact of these interventions on reducing sedentary behaviors and associated health risks.

Finally, Future research should employ longitudinal designs and multigroup structural equation modeling (SEM) to explore causal pathways and compare findings across diverse subgroups (e.g., urban vs. rural), while also investigating parental dietary behavior as a potential mediator or moderator, and testing measurement invariance to strengthen the validity and applicability of findings.

6.4 Contributions of the Study

The contributions of this study are multi-faceted and offer significant advancements in understanding adolescent health, particularly within the context of Iraqi adolescents.

First, the study contributes to theoretical development by translating and culturally adapting the Adolescent Food Parenting Questionnaire (AFPQ) and Beverage Intake Questionnaire (BEVQ) into Arabic, providing validated tools to

assess food parenting practices and dietary behaviors in Iraq. This study is among the first to validate the AFPQ and BEVQ in Arabic and apply a path model to adolescent obesity in Iraq, thus filling a gap in culturally relevant health behavior research in the region.

Second, the study develops a structural model that explains the relationships among sociodemographic characteristics, food parenting practices, dietary behaviors, physical activity, sedentary behavior, and anthropometric measurements in Iraqi adolescents. This model highlights both direct and indirect pathways influencing obesity and provides a comprehensive framework applicable to future studies in similar cultural contexts.

Third, the study demonstrates that the proposed structural model offers superior Goodness-of-Fit indices compared to alternative models, confirming its effectiveness in explaining the complex relationships between the studied variables. This validated model is a robust tool for understanding the factors contributing to adolescent obesity in Iraq and can be used to inform public health interventions.

Additionally, the research highlights the association of anthropometric measurements with cardiometabolic risk factors among Iraqi adolescents, examining how anthropometric measurements correlates with lipid profiles, blood pressure, and glycemic control. This contribution offers valuable insights into the long-term health risks associated with adolescent obesity and the need for targeted interventions to mitigate these risks.

Finally, as the first study of its kind in Iraq, it provides critical insights for policy makers and public health organizations. The findings offer a deeper understanding of adolescent obesity and related health behaviors, which can guide the development of targeted interventions to improve nutrition, physical activity, and overall health outcomes in Iraqi adolescents, with potential implications for broader public health strategies in similar regions.

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APPENDICES

APPENDIX A: Evidence of Communication (Permission to Use AFPQ)

Re: Collection tool (Development and preliminary validation of the Adolescent Food Parenting Questionnaire: Parent and adolescent version)

Koning, M. (Maaike) <maaike.koning@ru.nl>
Sun 6/12/2022 4:20 PM

To:Al Kinani Abbas Ali <abbas.phn@student.usm.my>
Cc:Vink, J.M. (Jacqueline) <jacqueline.vink@ru.nl>;Eisinga, R.N. (Rob) <rob.eisinga@ru.nl>;Larsen, J.K. (Junilla) <junilla.larsen@ru.nl>

1 attachments (605 KB)
1-s2.0-S0195666321005250-main-2.pdf;

Dear Abbas AL-Kinani,

Thank you for your email.

I am sorry but the nature of your request is unclear to me (share the share?) . I can send you the published article in which we describe the steps undertaken and the methods used, see attachment. I hope you find this helpful.

Kind regards,

Maaike Koning

From: Al Kinani Abbas Ali <abbas.phn@student.usm.my>
Sent: 12 June 2022 15:08
To: Koning, M. (Maaike) <maaike.koning@ru.nl>; Vink, J.M. (Jacqueline) <jacqueline.vink@ru.nl>; n.notten@windesheim.nl <n.notten@windesheim.nl>; Eisinga, R.N. (Rob) <rob.eisinga@ru.nl>; Larsen, J.K. (Junilla) <junilla.larsen@ru.nl>
Subject: Collection tool (Development and preliminary validation of the Adolescent Food Parenting Questionnaire: Parent and adolescent version)

Dear Dr.Maaike koning
Dear Dr.J. Vink
Dear Dr.N. Notten
Dear Dr. R. Eisinga
Dear Dr. J. Larsen

My name is Abbas Ali A. AL-Kinani, . Student at university of science Malaysia (USM) in PH.D program public health epidemiology. My research interest focuses on "food parenting practices in adolescents" came across your interesting article published in 2021, '.Development and preliminary validation of the Adolescent Food Parenting
Questionnaire: Parent and adolescent version. I would be grateful if you could share the share with me for the purposes of our study and we would not share this with any other parties.

Abbas AL-Kinani
Ph.D student in Public Health (Nutrition) filed at College of Medicine/ USM

APPENDIX B: Evidence of communication (permission to use BEVQ)

FW: Questionnaire Tool

Valisa Hedrick <vrespres@vt.edu>
Mon 1/3/2022 8:36 PM

To:Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>

3 attachments (1 MB)
Kids BEVQ Updated 3_22pdf; Kids BEVQ Updated Excel Scoring Template 5-5-17.xlsx; Kids Scoring Instruction for Updated Beverage Intake Questionnaire 5_15_17.docx;

My apologies for the delay in my response.
Please see attached BEVQ-15 scoring instructions and Excel template to help with scoring. I am attaching the updated version.
Best, Valisa Hedrick

From: Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>
Sent: Thursday, December 23, 2021 5:48 PM
To: Davy, Brenda <bdavy@vt.edu>; cate93@vt.edu <cate93@vt.edu>
Subject: Quesonnaire Tool

Dear Dr. Catelyn E. Hill

My name is Abbas Ali A. AL-Kinani, . Student at university of science Malaysia (USM) in PH.D program public health epidemiology. My research interest focuses on "assess of Consumption of Sugar-Sweetened Beverages Among Adolescents" came across your interesting theis published year 2016 ' Validity and Reliability of the BEVQ-15 in Children and Adolescents '. I would be grateful if you could share with me for the purposes of our study and we would not share this with any other parties.

Thanking you in advance.

Best wishes,

Abbas AL-Kinani
Ph.D student in Public Health (Nutrition) filed at College of Medicine/ USM

APPENDIX C: JEPEM's approval

Jawatankuasa Etika
Penyelidikan Manusia USM (JEPeM)

Human Research Ethics Committee USM (HREC)

Universiti Sains Malaysia
Kampus Kesihatan
16150 Kubang Kerian, Kelantan, Malaysia.
Tel. : +609 - 767 3000/2354/2362
Fax. : + 609 - 767 2351
Email : jepem@usm.my
Laman Web : www.jepem.kk.usm.my
www.usm.my

16th July 2023

Mr. Abbas Ali Abdulhasan Al-Kinani
Department of Community Medicine
School of Medical Sciences
Universiti Sains Malaysia
16150 Kubang Kerian, Kelantan.

JEPeM Code : USM/JEPeM/KK/23030276
Protocol Title: A Path Analysis of the Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.

Dear Mr.,

We wish to inform you that your study protocol has been reviewed and is hereby granted approval for implementation by the Jawatankuasa Etika Penyelidikan Manusia Universiti Sains Malaysia (JEPeM-USM). Your study has been assigned study protocol code **USM/JEPeM/KK/23030276**, which should be used for all communications to JEPeM-USM in relation to this study. This ethical approval is valid from **16th July 2023** until **15th July 2024.**

Study Site: Iraq.

The following researchers are also involved in this study:
1. Assoc. Prof. Dr. Rohana Abdul Jalil
2. Assoc. Prof. Dr. Wan Muhamad Amir W Ahmad
3. Dr. Ruhaya Hasan

The following documents have been approved for use in the study.
1. Research Proposal

In addition to the abovementioned documents, the following technical documents were included in the review on which this approval was based:
1. Participant Information Sheet and Consent Form (English version) – Phase I
2. Participant Information Sheet and Consent Form (Arabic version) – Phase I
3. Participant Information Sheet and Consent Form (English version) – Phase II
4. Participant Information Sheet and Consent Form (Arabic version) – Phase II
5. Questionnaires

The list of JEPeM-USM members present during the full board meeting reviewing your protocol is attached.

While the study is in progress, we request you to submit to us the following documents:
1. Application for renewal of ethical approval 45 days before the expiration date of this approval through submission of **JEPeM-USM FORM 3(B) 2022: Continuing Review Application Form.**
2. Any changes in the protocol, especially those that may adversely affect the safety of the participants during the conduct of the trial including changes in personnel, must be submitted or reported using **JEPeM-USM FORM 3(A) 2022: Study Protocol Amendment Submission Form.**
3. Revisions in the informed consent form using the **JEPeM-USM FORM 3(A) 2022: Study Protocol Amendment Submission Form.**

JEPeM
JAWATANKUASA ETIKA PENYELIDIKAN MANUSIA

4. Reports of adverse events including from other study sites (national, international) using the **JEPeM-USM FORM 3(G) 2022: Adverse Events Report.**
5. Notice of early termination of the study and reasons for such using **JEPeM-USM FORM 3(E) 2022.**
6. Any event which may have ethical significance.
7. Any information which is needed by the JEPeM-USM to do ongoing review.
8. Notice of time of completion of the study using **JEPeM-USM FORM 3(C) 2022: Final Report Form.**

Please note that forms may be downloaded from the JEPeM-USM website: **www.jepem.kk.usm.my**

JEPeM-USM is in compliance with the Declaration of Helsinki, International Conference on Harmonization (ICH) Guidelines, Good Clinical Practice (GCP) Standards, Council for International Organizations of Medical Sciences (CIOMS) Guidelines, World Health Organization (WHO) Standards and Operational Guidance for Ethics Review of Health-Related Research and Surveying and Evaluating Ethical Review Practices, EC/IRB Standard Operating Procedures (SOPs), and Local Regulations and Standards in Ethical Review.

Thank you.

"MALAYSIA MADANI"

"BERKHIDMAT UNTUK NEGARA"

Sincerely,

ASSOC. PROF. DR. NAZRI MUSTAFFA
Deputy Chairperson
Jawatankuasa Etika Penyelidikan (Manusia) JEPeM
Universiti Sains Malaysia

Jawatankuasa Etika
Penyelidikan Manusia USM (JEPeM)

Human Research Ethics Committee USM (HREC)

Universiti Sains Malaysia
Kampus Kesihatan
16150 Kubang Kerian, Kelantan, Malaysia.
Tel. : +609 - 767 3000/2354/2362
Fax. : + 609 - 767 2351
Email : jepem@usm.my
Laman Web : www.jepem.kk.usm.my
www.usm.my

Date of meeting : 7th March 2023
Venue : Through WEBEX Application
Time : 9.00 a.m – 2.00 p.m
Meeting No : 580

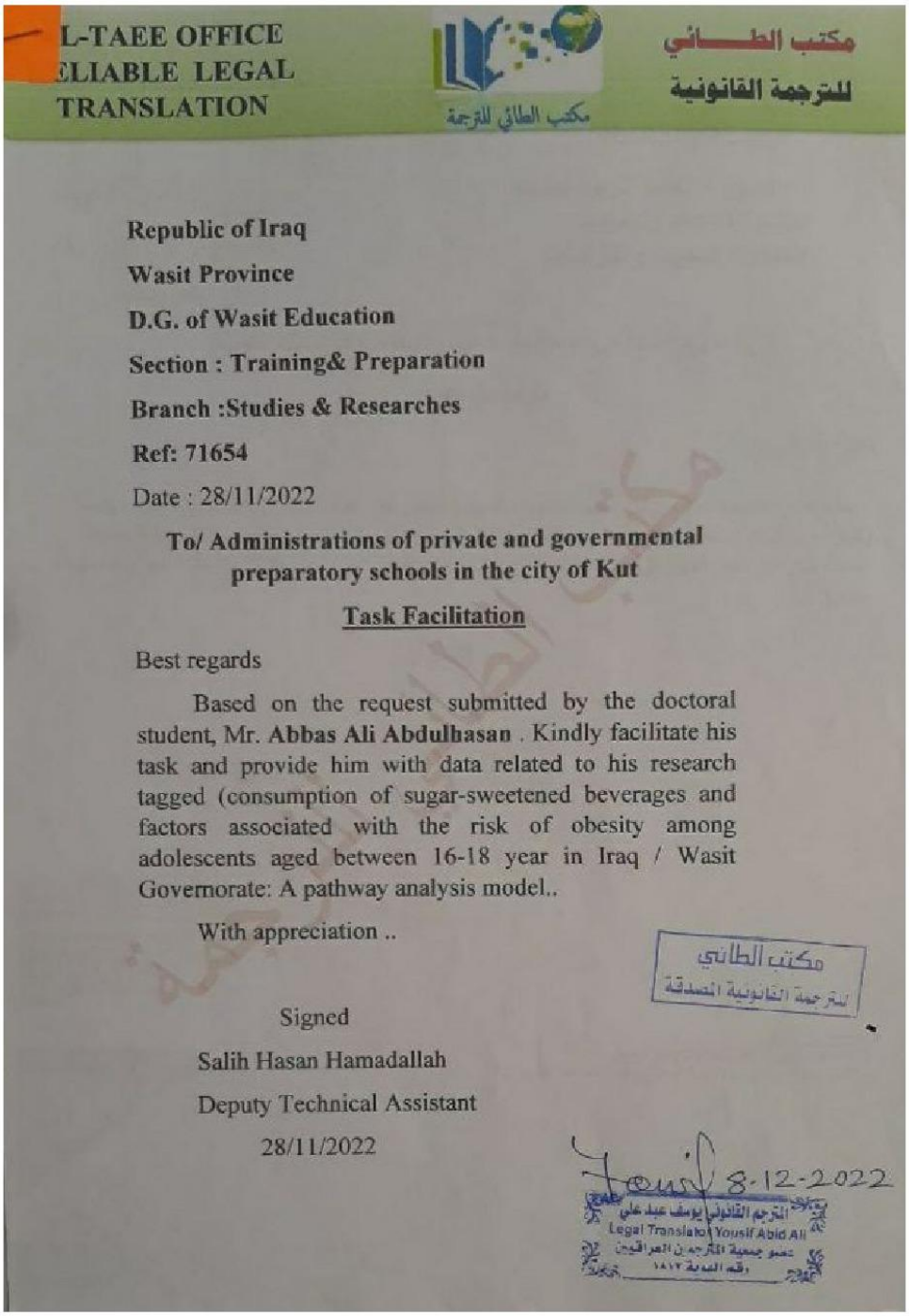
Members of Committee of the Jawatankuasa Etika Penyelidikan (Manusia), JEPeM Universiti Sains Malaysia who reviewed the protocol/documents are as follows:

Member (Title and Name)		Occupation (Designation)	Male/ Female (M/F)	Tick (✓) present during review process
Deputy Chairperson: Assoc. Prof. Dr. Nazri Mustaffa @ Mohamed		Deputy Chairperson of Jawatankuasa Etika Penyelidikan (Manusia), JEPeM USM	M	✓ **(Deputy Chairperson)**
Member Secretary: Assoc. Prof. Dr. Wong Kah Keng		Member Secretary of Jawatankuasa Etika Penyelidikan (Manusia), JEPeM USM	M	✓ **(Member Secretary)**
Secretary: Mr. Mohd Bazlan Hafidz Mukrim		Senior Science Officer	M	✓
Secretariat: Miss Siti Fatihah Ariffin		Research Officer	F	✓
Members:				
1.	Dr. Azlina Yusuf	Lecturer, School of Health Sciences	F	✓
2.	Prof. Dato' Dr. Jafri Malin Abdullah	Lecturer, School of Medical Sciences	M	✓
3.	Dr. Michael Wong Pak Kai	Lecturer, School of Medical Sciences	M	✓
4.	Assoc. Prof. Dr. Garry Kuan Pei Ern	Lecturer, School of Health Sciences	M	✓
5.	Dr. Saedah Ali	Scientific, Non Institutional Member	F	✓
6.	Dr. Surianti Sukeri	Lecturer, School of Medical Sciences	F	✓
7.	Madam Zawiah Abu Bakar	Community Representatives	F	✓
8.	Dr. Surini Yusoff	Lecturer, School of Medical Sciences	F	✓
9.	Prof. Dr. Hamid Jan Jan Mohamed	Lecturer, School of Health Sciences	M	✓
10.	Prof. Dr. Oleksandr Krasilshchikov	Scientific, Non Institutional Member	M	✓

Jawatankuasa Etika Penyelidikan (Manusia), JEPeM-USM is in compliance with the Declaration of Helsinki, International Conference on Harmonization (ICH) Guidelines, Good Clinical Practice (GCP) Standards, Council for International Organizations of Medical Sciences (CIOMS) Guidelines, World Health Organization (WHO) Standards and Operational Guidance for Ethics Review of Health-Related Research and Surveying and Evaluating Ethical Review Practices, EC/IRB Standard Operating Procedures (SOPs), and Local Regulations and Standards in Ethical Review.

ASSOC. PROF. DR. NAZRI MUSTAFFA
Deputy Chairperson
Jawatankuasa Etika Penyelidikan (Manusia), JEPeM
Universiti Sains Malaysia

APPENDIX D: Approval from the General Directorate of Wasit Education



L-TAEE OFFICE
ELIABLE LEGAL
TRANSLATION

مكتب الطائي للترجمة

مكتب الطـــائي
للترجمة القانونية

Republic of Iraq

Wasit Province

D.G. of Wasit Education

Section : Training& Preparation

Branch :Studies & Researches

Ref: 71654

Date : 28/11/2022

To/ Administrations of private and governmental preparatory schools in the city of Kut

Task Facilitation

Best regards

Based on the request submitted by the doctoral student, Mr. **Abbas Ali Abdulhasan** . Kindly facilitate his task and provide him with data related to his research tagged (consumption of sugar-sweetened beverages and factors associated with the risk of obesity among adolescents aged between 16-18 year in Iraq / Wasit Governorate: A pathway analysis model..

With appreciation ..

مكتب الطائي
للترجمة القانونية المصدقة

Signed

Salih Hasan Hamadallah

Deputy Technical Assistant

28/11/2022

8-12-2022

المترجم القانوني يوسف عبد علي
Legal Translator Yousif Abid Ali
عضو جمعية المترجمين العراقيين
رقم العضوية ١٨١٢

جمهورية العراق
ديوان محافظة واسط

HE REPUBLIC OF IRAQ
WASIT PROVINCE

المديرية العامة لتربية واسط
القسم / الإعداد والتدريب
الشعبة / البحوث والدراسات

العدد : ٧١٦٠٤
التاريخ : ٢٠٢٢/١١/٢٨

واسط ... اعمار واستثمار
٢٠٢٠-٢٠٢٥

إلى / ادارات المدارس الاعدادية الاهلية والحكومية في مدينة الكوت

م/ تسهيل مهمة

تحية طيبة ...

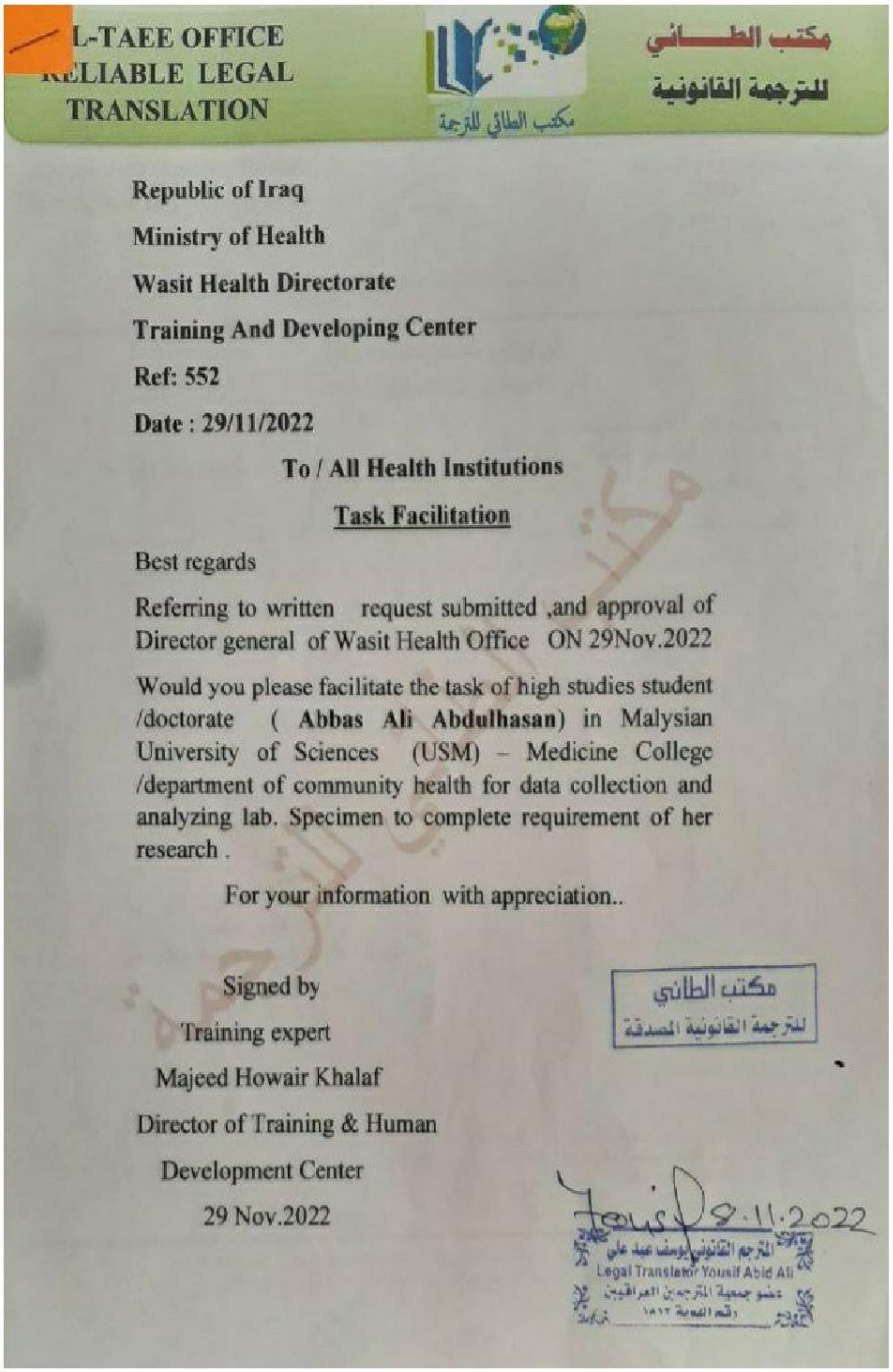
بناءا على الطلب المقدم من قبل طالب الدكتوراه السيد (عباس علي عبد الحسن) للتفضل بتسهيل مهمته وتزويده ببيانات الخاصة بحثه الموسوم (استهلاك المشروبات المحلاة بالسكر والعوامل المرتبطة بمخاطر السمنة بين المراهقين الذين تتراوح اعمارهم بين ١٦- ١٨ سنة في العراق / محافظة واسط : نموذج تحليل مسار) ..

.. مع التقدير..

صالح حسن حمد الله
المعاون الفني /وكالة
٢٠٢٢/١١/٢٨

نسخه منه إلى//
*المعاون الفني /للتفضل بالاطلاع مع التقدير..
*قسم الاعداد والتدريب / شعبة البحوث والدراسات مع التقدير ..

APPENDIX E: Approval from Ministry of health



L-TAEE OFFICE
RELIABLE LEGAL
TRANSLATION

مكتب الطائي للترجمة

مكتب الطـــائي
للترجمة القانونية

Republic of Iraq

Ministry of Health

Wasit Health Directorate

Training And Developing Center

Ref: 552

Date : 29/11/2022

To / All Health Institutions

Task Facilitation

Best regards

Referring to written request submitted ,and approval of Director general of Wasit Health Office ON 29Nov.2022

Would you please facilitate the task of high studies student /doctorate (**Abbas Ali Abdulhasan**) in Malysian University of Sciences (USM) – Medicine College /department of community health for data collection and analyzing lab. Specimen to complete requirement of her research .

For your information with appreciation..

مكتب الطاني
للترجمة القانونية المصدقة

Signed by

Training expert

Majeed Howair Khalaf

Director of Training & Human

Development Center

29 Nov.2022

8.11.2022

المترجم القانوني يوسف عبد علي
Legal Translator Yousif Abid Ali
عضو جمعية المترجمين العراقيين
رقم العضوية ١٨١٢

وزارة الصحه
دائرة صحة واسط
مركز التدريب والتنمية البشرية
شعبة ادارة المعرفة والبحوث
العدد // ٥٥٢
التاريخ /٩/ ١١/ ٢٠٢٢

جمهورية العراق

Republic of Iraq
Ministry of Health
Directorate Wasit of Health
raining and developing center

(محمد نبينا اقام دولة العدل والتسامح)

الى // المؤسسات الصحية كافة
الموضوع // تسهيل مهمة

يهديكم مركزنا أطيب التحيات ...

اشارة الى الطلب الخطي المقدم وموافقة السيد مدير عام دائرة صحة واسط بتاريخ٢٩/ ١١/ ٢٠٢٢

للتفضل بتسهيل مهمة طالبة الدراسات العليا/ الدكتوراه(عباس علي عبد الحسن) في جامعة العلوم الماليزية USM كلية الطب /قسم صحة مجتمع / لغرض جمع البيانات وتحليل العينات المختبرية لاستكمال متطلبات بحثه

للتفضل بالاطلاع.....مع الاحترام.

مجيد هوير خلف
مدير مركز التدريب والتنمية البشرية
٩/ ١١/ ٢٠٢٢

نسخة منه الى :-
- مكتب المدير العام / للتفضل بالاطلاع ..... مع الاحترام
- مركز التدريب والتنمية البشرية مع الاوليات كافة
- التوثيق (لضبارة البحوث)

الكمبانية:- رشا كامل

البريد الالكتروني لمركز التدريب والتنمية البشرية Email :trs wassit@yahoo.com
مركز التدريب والتنمية البشرية / بناية مركز طيبة النموذجي التدريبي / الطابق الثاني

APPENDIX F: Table of Translation and Back Translation of the AFPQ.

Item No.	Parent Version	Adolescent Version	Domain
01	(O) I educate my child about nutrition, for example, talking about healthy and unhealthy food. (A) انا أقوم بتثقيف طفلي حول التغذية، على سبيل المثال الحديث عن الطعام الصحي وغير الصحي. (B) I educate my child about nutrition, for example, talking about healthy and unhealthy food.	(O) My parents educate me about nutrition, for example, talking about healthy and unhealthy food. (A) يعلمني والداي عن التغذية، على سبيل المثال الحديث عن الطعام الصحي وغير الصحي. (B) My parents educate me about nutrition, for example talking about healthy and unhealthy food.	AS
02	(O) I explain why I have specific rules about eating to my child. (A) انا أشرح لطفلي لماذا لدي قواعد معينة بشأن تناول الطعام، مثل **تناولنا وجبات صحية معًا وتجنبنا الأطعمة غير الصحية.** (B) I explain to my child why I have specific rules about eating, **such as having healthy meals together and avoiding unhealthy foods.**	(O) My parents explain why they have specific rules about eating to me. (A) يشرح لي والداي سبب وجود قواعد معينة حول تناول الطعام ، **مثل تناول وجبات صحية معًا وتجنب الأطعمة غير الصحية.** (B) My parents explain **to me** why they have specific rules about eating**, such as having healthy meals together and avoiding unhealthy foods**	AS
03	(O) There are always fruit and vegetables at home for my children to eat. (A) هناك دائمًا فواكه وخضروات في المنزل ليأكلها أطفالي. (B) There are always fruit and vegetables at home for my children to eat.	(O) There are always fruit and vegetables at home for me to eat. (A) لدي دائمًا فواكه وخضروات لأتناولها في المنزل. (B) **I always have fruits and veggies to eat at home.**	HS
04	(O) I sometimes give my child something to eat as a distraction. (A) أحيانًا أعطي طفلي شيئًا ليأكله لإلهاءه، **مثل إعطائه قطعة من الفاكهة أثناء دراسته ليستريح ويتركز بشكل أفضل.** (B) Sometimes I give my child something to eat to distract them, **like giving them a piece of fruit while they are studying to help them rest and focus better.**	(O) My parents sometimes give me something to eat as a distraction. (A) أحيانًا يعطيني والدي شيئًا لآكله لإلهائي، **مثل إعطائي قطعة من الفاكهة أثناء دراستي لأستريح وأركز بشكل أفضل.** (B) Sometimes my parent gives me something to eat to distract me, **like giving me a piece of fruit while I am studying to help me rest and focus better.**	CC
05	(O) I give my child feedback related to their eating habits, for example, if my child eats too quickly or doesn't eat enough vegetables. (A) انا أقدم لطفلي ملاحظات تتعلق بعاداته الغذائية، على سبيل المثال إذا كان طفلي يأكل بسرعة كبيرة أو لا يأكل ما يكفي من الخضار. (B) I give my child feedback related to their eating habits. For example, if my child eats too quickly or doesn't eat enough vegetables.	(O) My parents give me feedback related to my eating habits, for example, if I eat too quickly or don't eat enough vegetables. (A) يقدم لي والداي ملاحظات تتعلق بعاداتي في الأكل ، على سبيل المثال إذا أكلت بسرعة كبيرة أو لم أتناول ما يكفي من الخضار. (B) My parents gave me feedback related to my eating habits. For example, if I eat too quickly or don't eat enough vegetables.	AS
06	(O) At home, my child can quickly eat vegetables as they are part of our daily meals. (A) في المنزل, يمكن لطفلي أن يأكل الخضروات بسهولة لأنها جزء من وجباتنا اليومية ، **مثل تناوله للسلطة التي تُقدم مع الوجبة الرئيسية.** (B) At home, my child can **easily** eat vegetables because they are part of our daily	(O) At home, I can quickly eat vegetables as they are part of our daily meals. (A) في المنزل يمكنني أكل الخضروات بسهولة لأنها جزء من وجباتنا اليومية، **مثل السلطة التي تقدم مع كل وجبة رئيسية.** (B) At home, I can **easily** eat vegetables because they are part of our	HS

Item No.	Parent Version	Adolescent Version	Domain
	meals, **like when they have salad served with the main meal.**	daily meals, **like the salad served with every main meal.**	
07	(O) I sometimes give my child something to eat as a reward. (A) أحيانًا أعطي طفلي شيئًا ليأكله كمكافأة، **مثل قطعة من الكعك بعد إنهاء واجباته المدرسية.** (B) Sometimes I give my child something to eat as a reward, **like a piece of cake after he / his finishes his school assignments.**	(O) My parents sometimes give me something to eat as a reward. (A) يعطيني والداي أحيانًا شيئًا ما آكله كمكافأة، **مثل قطعة من الكعك بعد إنهاء واجباتي المدرسية.** (B) My parents sometimes give me something to eat as a reward, **like a piece of cake after finishing my school assignments.**	CC
08	(O) I let my children snack if he/she wants to. (A) أنا أسمح لطفلي بتناول وجبة خفيفة إذا أراد ذلك. (B) I let my child snack if they want to.	(O) My parents let me snack if I want to. (A) سمح لي والداي بوجبة خفيفة إذا أردت ذلك. (B) My parents let me snack if I want to.	SS*
09	(O) I discuss why it is important to eat fruit and vegetables with my child. (A) انا أناقش مع طفلي سبب أهمية تناول الفاكهة والخضروات. (B) I discuss **with my child** why it is important to eat fruit and vegetables.	(O) My parents discuss why it is important to eat fruit and vegetables with me. (A) يناقش والداي معي سبب أهمية تناول الفاكهة والخضروات. (B) My parents discuss **with me** why it is important to eat fruit and vegetables.	AS
10	(O) I sometimes give my child something to eat when they do something right, for example, when doing homework. (A) أنا أحيانًا أعطي طفلي شيئًا ليأكله عندما يفعل شيئًا صحيحًا، على سبيل المثال عند أداء الواجب المنزلي. (B) I sometimes give my child something to eat when he/she does something right, for example when doing homework.	(O) My parents sometimes give me something to eat when I do something right. For example, when doing my homework. (A) يعطيني والداي أحيانًا شيئًا لآكله عندما أفعل شيئًا صحيحًا. على سبيل المثال عند القيام بواجبي المنزلي. (B) My parents sometimes give me something to eat when I do something right. For example, when doing my homework.	CC
11	(O) I consciously eat vegetables or fruit when my child is around. (A) انا أتناول الخضار أو الفاكهة بوعي عندما يكون طفلي بالقرب مني. **مثل تناولي السلطة الطازجة أو الفواكه الموسمية في وجبة العشاء.** (B) I consciously eat vegetables or fruits when my child is around, **such as having fresh salad or seasonal fruits during dinner**.	(O) My parents consciously eat vegetables or fruit when I am around. (A) والداي يأكلان الخضار أو الفاكهة بوعي عندما أكون في الجوار ، **مثل تناولهما السلطة الطازجة أو الفواكه الموسمية في وجبة العشاء.** (B) My parents consciously eat vegetables or fruits when I'm around, **like having fresh salad or seasonal fruits during dinner.**	Mod
12	(O) I have clear rules about what my children can snack on, for example, one biscuit after school. (A) أنا لدي قواعد واضحة حول ما يمكن لأولادي تناوله كوجبة خفيفة على سبيل المثال قطعة بسكويت واحدة بعد المدرسة. (B) I have clear rules about what my children can snack on for example 1 biscuit after school.	(O) My parents have clear rules about what I can snack on, for example, one biscuit after school. (A) لدى والديّ قواعد واضحة حول ما يمكنني تناوله كوجبة خفيفة على سبيل المثال قطعة واحدة من البسكويت بعد المدرسة. (B) My parents have clear rules about what I can snack on for example 1 biscuit after school.	SS
13	(O) I make sure my child does not snack just before meals. (A) أنا أتأكد من أن طفلي لا يتناول وجبة خفيفة قبل الوجبات الرئسية مباشرة.	(O) My parents make sure I do not snack just before meals. (A) يتأكد والداي من أنني لا أتناول وجبة خفيفة قبل الوجبات الرئسية مباشرة.	SS

Item No.	Parent Version	Adolescent Version	Domain
	(B) I make sure my child does not snack just before meals.	(B) My parents make sure I do not snack just before meals.	
14	(O) I sometimes give my child a small snack as comfort. (A) أنا أحيانًا أعطي طفلي وجبة خفيفة صغيرة **كالتعتيمة**. (B) I sometimes give my child a small snack, like **a bite-sized treat.**	(O) My parents sometimes give me a small snack as comfort. (A) يقدم لي والداي أحيانًا وجبة خفيفة صغيرة **كالتعتيمة**. (B) My parents sometimes give me a small snack like **a bite-sized treat.**	CC
15	(O) I try to consciously set a good example when it comes to eating fruit and vegetables. (A) أنا أحاول أن أكون بوعي قدوة حسنة عندما يتعلق الأمر بتناول الفاكهة والخضروات. (B) I try to consciously set a good example when it comes to eating fruit and vegetables.	(O) My parents try to consciously set a good example when it comes to eating fruit and vegetables. (A) يحاول والداي أن يكونا قدوة حسنة بوعي عندما يتعلق الأمر بتناول الفاكهة والخضروات. (B) My parents try to consciously set a good example when it comes to eating fruit and vegetables.	Mod
16	(O) I have rules about when my child is allowed to eat snacks and how much. (A) أنا لدي قواعد حول متى يسمح لطفلي بتناول الوجبات الخفيفة ومقدارها. (B) I have rules about when my child is allowed to eat snacks and how much.	(O) My parents have rules about when I am allowed to eat snacks and how much. (A) لدى والديّ قواعد بشأن الوقت الذي يُسمح لي فيه بتناول الوجبات الخفيفة ومقدارها. (B) My parents have rules about when I am allowed to eat snacks and how much.	SS

Note: O = Original English version item, A = Arabic version item, B = Back-translated English version item, Autonomy Support = AS (دعم الاستقلال), Healthy Structure = HS (الهيكل الصحي), Coercive Control = CC (التحكم القسري), Snack Structure = SS (هيكل الوجبات الخفيفة), Modelling = Mod (النمذجة), *Reversed item.

APPENDIX G: Table of Translation and Back Translation of the BEVQ.

Item No.	Beverage Questionnaire (BEVQ)
Title	(O) Kids Beverage Questionnaire (BEVQ) (A) استبيان مشروبات الأطفال (B) **Children's** Beverage Questionnaire [(a)]
Instructions	(O) "For the past month, please indicate your intake for each beverage type by marking an "X" in the bubble for "how often" and " how much each time". 1. Indicate how often you drank the following beverages; for example, if you drank five glasses of water per week, mark 4-6 times per week. 2. Indicate the approximate amount of beverage you drank each time; for example, if you drank 1 cup of water each time, mark 1 cup under "how much each time". If XXX is applicable, indicate the specific type of beverage by marking an "X" in the bubble by the one used (i.e., type of nut milk). 3. When trying to estimate your intake throughout the day (i.e., water), think about the total amount you drink. For example, three times per day and 20 fl oz each time = 60 XXX fl oz per day. If you consume more than 60 fl oz per day, select "1 time per day" and write the TOTAL daily amount in the last column. 4. Do not count beverages used in cooking or other preparations, such as milk in cereal. 5. Count milk/creamer added to tea and coffee in the tea or coffee with creamer beverage category, NOT in the milk categories; this includes non-dairy creamer. Please XXX indicates the type of creamer (flavoured, plain, or sugar-free) and sweetener used by marking an "X" in the bubble by the one used, if applicable." (A) "خلال الشهر الماضي ، يرجى الإشارة إلى كمية لكل نوع المشروبات عن طريق وضع علامة على "x" في الدائرة ل "كم مرة"" و "كم في كل مرة". 1. حدد عدد المرات التي شربت فيها المشروبات التالية ، على سبيل المثال ، إذا شربت 5 أكواب من الماء أسبوعيا ، ضع علامة 4-6 مرات في الأسبوع. 2. حدد الكمية التقريبية للمشروبات التي شربتها في كل مرة ، على سبيل المثال ، إذا شربت 1 كوب من الماء في كل مرة ، ضع علامة 1 كوب تحت "كم في كل مرة". إذا XXX ينطبق ، تشير إلى نوع معين من المشروبات عن طريق وضع علامة على "X" في دائرة من قبل واحد المستخدمة (أي نوع من الحليب الجوز). 3. عند محاولة تقدير تناولك على مدار اليوم ، (أي الماء) فكر في الكمية الإجمالية التي تشربها. على سبيل المثال ، 3 مرات في اليوم و 20 أونصة سائلة (ما يعادل 591 ملليلترًا) من سائلة في كل مرة = 60 XXX أونصة سائلة (ما يعادل 1774 ملليلترًا) من السائل يوميًا. إذا كنت تستهلك أكثر من 60 أونصة سائلة (ما يعادل 1774 ملليلترًا) من السوائل يوميًا، فحدد "1 مرة في اليوم" واكتب إجمالي المبلغ اليومي في العمود الأخير. 4. لا تحسب المشروبات المستخدمة في الطهي أو المستحضرات الأخرى ، مثل الحليب في الحبوب. 5. احسب الحليب / الكشطه المضافة إلى الشاي والقهوة في فئة الشاي أو القهوة مع المشروبات الكشطه ، وليس في فئات الحليب ؛ وهذا يشمل الكشطه غير الألبان. يرجى XXX الإشارة إلى نوع من كريمر (النكهة ، عادي أو خالية من السكر) والمحليات المستخدمة عن طريق وضع علامة على "X" في الدائرة من قبل واحد المستخدمة ، إذا كان ذلك ممكنا." (B) "**Over** the past month, please indicate the amount for each beverage type by marking **the** "X" in the circle for "how many times" and " how much each time".[(a)] 1. Indicate how many times you drank the following beverages; for example, if you drink five glasses of water **a** week, mark 4-6 times per week.

2. Indicate the approximate amount of beverage you drank at a time; for example, if you drank one glass of water each time, Mark 1 glass under "how many each time". If XXX **applies**, indicate the specific type of beverage by marking **the** "X" in the **circle** by the one used (i.e. type of nut milk).
3. When trying to estimate your intake throughout the day (i.e. water), think about the total amount you drink. For example, three times per day and 20 fl oz (equal to 591 **milliliters**) of liquid each time = 60 XXX fl oz (equal to 1774 **milliliters**) of liquid per day. If you consume more than 60 fl oz (equal to 1774 **milliliters**) of liquid per day, select "1 time per day" and write the TOTAL daily amount in the last column. [a]
4. Do not count beverages used in cooking or other preparations, such as milk in cereals.
5. **Calculate the** milk/creamer added to tea and coffee in **the category of tea or coffee with creamer drinks and** not in the **categories of milk**; this includes non-dairy creamer. Please XXX indicates the type of Creamer (flavoured, plain or sugar-free) and sweetener used by marking the "X" in the circle by the one used, if applicable."

	How often (mark one)							How much each time (mark one)					
(O)	Never or less than 1 time per week (go to next beverage)	1 time per week	2-3 times per week	4-6 times per week	1 time per day	2+ times per day	3+ times per day	Less than 6 fl oz (¾ cup)	8 fl oz (1 cup)	12 fl oz (1½ cups)	16 fl oz (2 cups)	20 fl oz (2½ cups)	> 20 fl oz (specify TOTAL daily amount)

كم في كل مرة (علامة واحدة)						كم مرة (علامة واحدة)							
اكثرمن 592 ملتر(حدد إجمالي المبلغ اليومي)	**592 ملتر(2 و 1/2 كوب)**	**473 ملتر(2 كوب)**	**355 ملتر(1 و 1/2 كوب)**	**237 ملتر(1 كوب)**	**اقل من 177 ملتر(3/4 كوب)**	**خلال اليوم**			**خلال الاسبوع**			أبدا أو أقل من 1 مرة في الأسبوع اذهب إلى) المشروب (التالي	(A)
						3 + مرات	2 + مرات	مرة 1	4-6 مرات	2-3 مرات	1مرة		

	How many times (mark one)							How much each time (mark one)					
		Per week [b]			**Per day** [b]								
(B)	Never or less than 1 time a week (go to the next beverage)	1 time	2-3 times	4-6 times	1 time	+ 2 times	+ 3 times	**Less than 177 ML (3/4 Cup)**	**237 ML (1 cup)**	**355 ML (1 and 1/2 cups)**	**473 ML (2 cups)**	**592 ML (2 and 2/1 cups)**	**More than 592 ML(specify the total daily amount)**

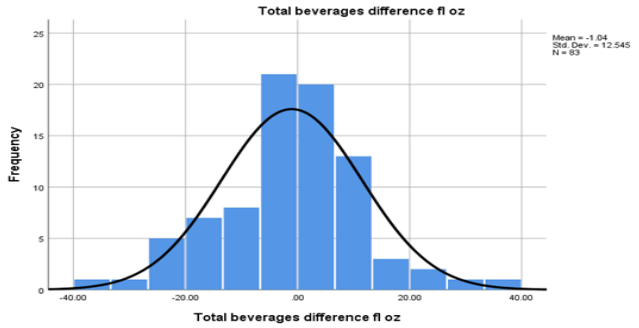
Continued for Table of Translation and Back Translation of the BEVQ.

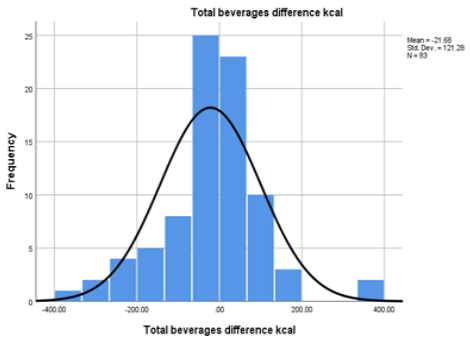
Item No.	Beverage Questionnaire (BEVQ)
01	(O) Water or unsweetened sparkling water (A) الماء (B) **Water** (b, andc)
02	(O) 100% Fruit Juice. (A) عصير فواكه طازج 100%. (B) **Fresh** fruit juice 100%.(a)
03	(O) Sweetened Juice Beverage/Drink (Fruit punch, juice cocktail, Sunny Delight, Capri Sun). (A) مشروب عصير محلى / مشروب محلى: شربت، عصير تمر هندي، وشربت الزبيب. (B) Sweetened Juice Beverage/ **local** Drink: **Sherbet, Tamarind Juice, Shirbat Zabib).** (b, andc)
04	(O) Whole Milk: red cap, Reduced Fat Milk 2%: purple cap, or Chocolate Milk. (A) الحليب كامل الدسم: غطاء أحمر ، حليب قليل الدسم 2٪: غطاء أرجواني ، أو حليب شوكولاتة. (B)Whole milk: red cap, **low**-fat milk 2%: Purple Cap, or chocolate milk.
05	(O) Low Fat 1%: green cap, Fat-Free/Skim Milk: light blue cap, Buttermilk or Soy Milk. (A) قليل الدسم 1٪: غطاء أخضر ، حليب خالي من الدسم / خالي الدسم: كوب أزرق فاتح ، لبن أو حليب الصويا. (B) Low-fat 1%: green cap, Fat-Free/Skim Milk: light blue cup, **yogurt or soy milk**.(a)
06	(O) Nut Milk (almond, cashew, coconut) o Flavored, Original, or Plain o Unsweetened (A) حليب الجوز (اللوز ، الكاجو ، جوز الهند) o منكه أو أصلي أو عادي o غير محلى (B) Nut milk (almond, cashew, coconut) o Flavored, original, or Plain o Unsweetened
07	(O) Soft Drinks, Regular (A) المشروبات الغازية العادية (B) **Regular** Soft Drinks (a)
08	(O) Energy, and Sports Drinks, Regular (Red Bull, Gatorade, Powerade) (A) مشروبات الطاقة والرياضة، العادية (ريد بُل، تايجر، باور هورس، بلو باور). (B) **Regular** Energy, and Sports Drinks (Red Bull, **TIGER, Power Horse, Blue Power**). (b, andc)
09	(O) Diet or Artificially Sweetened Soft Drinks, Energy, and Sports Drinks (Diet Coke, Crystal Light, artificially sweetened sparkling water, Sugar-Free or Total Zero Red Bull, Powerade Zero). (A) الدايت أو المشروبات الغازية المحلاة صناعيا، ومشروبات الطاقة والرياضة (بيبسي دايت، ريد بُل زيرو سكر، باور هورس زيرو سكر). (B) Diet or Artificially Sweetened **Carbonated** Drinks, Energy and Sports Drinks) **Pepsi diet, Red Bull ZERO SUGAR, Power Horse zero sugar).** (b, andc)
10	(O) Sweet Tea (with sugar) (A) شاي حلو (بالسكر) (B) Sweet Tea (with sugar)
11	(O) Tea or Coffee, black (no creamer or milk) o Sugar

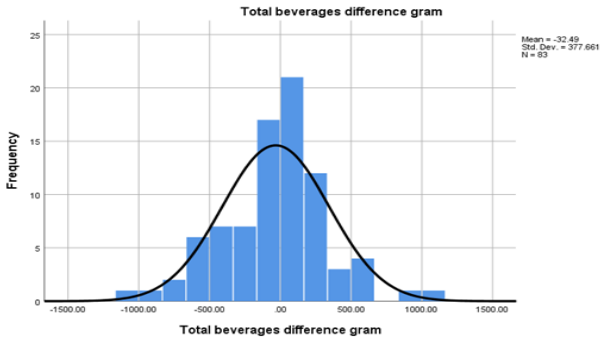
	o Artificial Sweetener o N/A	
	(A) شاي أو قهوة سادة (بدون مبيض أو حليب) o السكر o التحلية الاصطناعية o غير متاح (B) Black Tea or Coffee (no creamer or milk) o Sugar o Artificial Sweetener o N/A	
12	(O) Tea or Coffee (w/ milk, and/ or creamer) o Sugar o Artificial Sweetener o N/A Milk, and/ or creamer o Milk o Half, and Half or Cream o N/A Creamer: o Flav. o plain o Sugar-Free.	(A) شاي أو قهوة (مع حليب و / أو مبيض) o السكر o التحلية الاصطناعية o غير متاح حليب و / أو مبيض o الحليب o نصف ونصف أو كريم o غير متاح كريمر: o منكة o سادة o خالي من السكر (B) Tea or Coffee (with milk, and/ or creamer) o Sugar o Artificial Sweetener o N/A Milk, and/ or creamer o Milk o Half, and Half or Cream o N/A Creamer: o Flav. o plain o Sugar-Free.

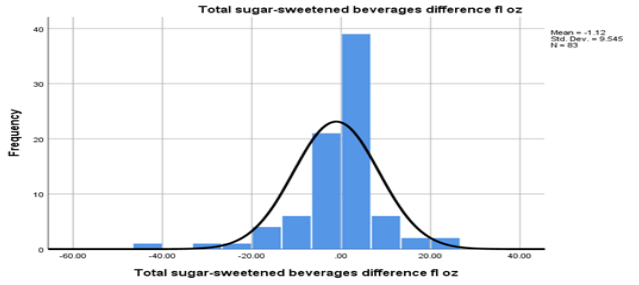
Note: O = Original English version item, A = Arabic version item, B = Back-translated English version item. a = translator modification, b = experts' modification, c = adolescent modification.

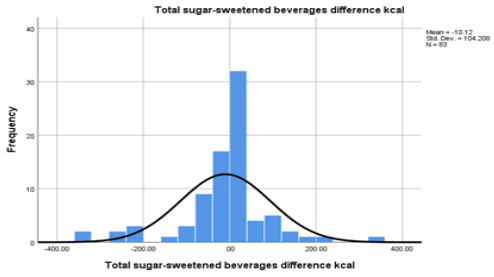
APPENDIX H: Normality Assumption checking for paired t test (BEVQ)

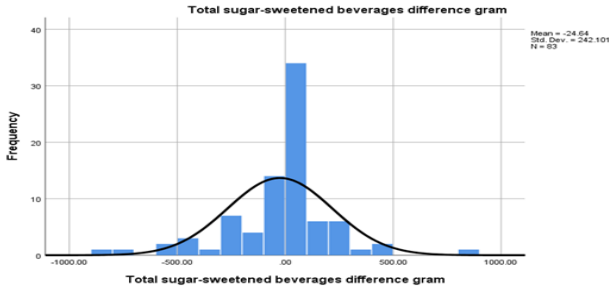


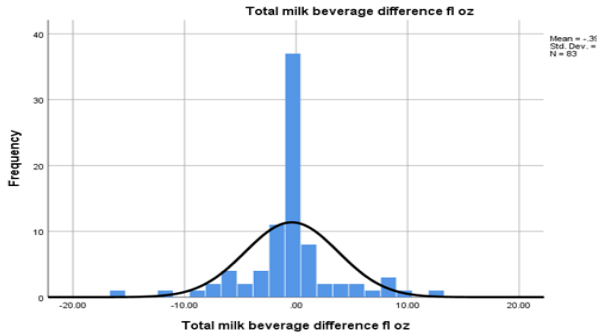


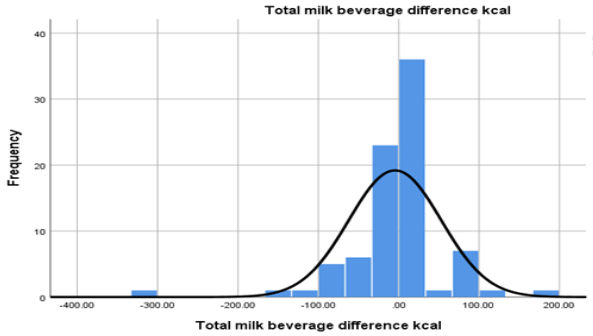


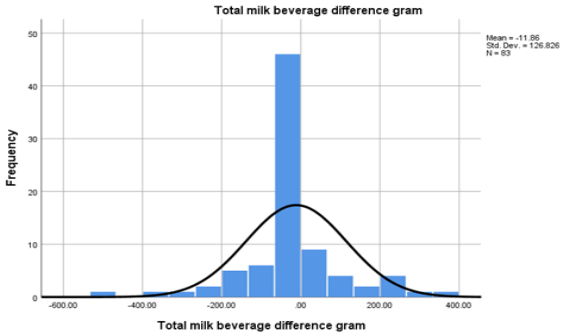












APPENDIX I : Table of Socio-Economic Status (SES) Scale

Item	Score		Description
	Male	Female	
Occupation of Father (Double)	25	25	Skilled professional or senior managerial occupations (e.g. company manager, dentist, engineer, high-level administrative official, IT professional, judge, lawyer, pharmacist, university lecturer, veterinarian)
	17	17	Skilled manual and non-manual occupations (e.g. clerk, customer services employee, nurse, technician − electrical or mechanical technician). Associate professional occupations (e.g. accountant, actor, athlete, commissioned military and police officer, journalist, medical assistant, cleric, teacher, translator)
	9	9	Unskilled manual occupations (e.g. cleaner, gardener, housekeeper, labourer, shoe mender, street vendor). Semi-skilled manual occupations (e.g. baker, barber, blacksmith, builder, butcher, carpenter, cook, driver, farmer, fitter, goldsmith, midwife, plumber, policeman, soldier, shop owner, tailor)
Level of Edu. (Double)	0	0	Illiterate
	5	5	Read, and write
	10	10	Primary graduate
	15	15	intermediate graduate
	20	20	Secondary graduate
	25	25	College Graduate
Crowding index (Single)	25		-2 (up to)
	17		- 4 (up to)
	9		≥ 4
Property (Single)	25		Owns a house, a car, and all of the household assets.
	17		The house is rented, with or without a car, and most of the household assets.
	9		The house is shared with another family, no car and some of the household assets.

APPENDIX J : Questionnaire for Phase II (English Version)

Serial No. 001 Date of the interview: / / (dd/mm/yy)

Section A: Sociodemographic Variables

1. Gender: Boy ☐ Girl ☐
2. Date of birth: ...../ ..... /..... Day/month/year
3. School name: .....
4. School type: Governmental ☐ Private ☐
5. Family residence: Urban ☐ Rural ☐
6. Housing condition: Rent ☐ Owner ☐ Share ☐
7. Number of family members (living together): ……..
8. Number of rooms in the house: ☐ Except for the bathroom and kitchen
9. Total monthly income: ..... Iraqi Dinar
10. Do your family have a car: ☐ No ☐ Yes
11. Number of siblings ……
12. Educational level (father) ☐ 0. My mom 1 . Primary school graduate or can read and write Intermediate graduate .2
13. Educational level (mother): ☐ High school .3 graduate Institute graduate .4 Bachelor's degree .5 graduate Master's .6 graduate PhD graduate .7
14. Father's occupation: …….
15. Mother's occupation:……

Section B1: The Adolescent Food Parenting Questionnaire

Please read the following statements and check the boxes that are most relevant to your parent's eating behavior at home.						
No.	Adolescent Version	Disagree	Slightly disagree	Impartial	Slightly agree	Agree
01	My parents educate me about nutrition, for example, talking about healthy and unhealthy food.					
02	My parents explain to me why they have specific rules about eating, such as having healthy meals together and avoiding unhealthy foods					
03	I always have fruits and veggies to eat at home.					
04	Sometimes my parent gives me something to eat to distract me, like giving me a piece of fruit while I am studying to help me rest and focus better.					
05	My parents gave me feedback related to my eating habits. For example, if I eat too quickly or don’t eat enough vegetables.					
06	At home, I can easily eat vegetables because they are part of our daily meals, like the salad served with every main meal.					
07	My parents sometimes give me something to eat as a reward, like a piece of cake after finishing my school assignments.					
08	My parents let me snack if I want to.					
09	My parents discuss with me why it is important to eat fruit and vegetables.					
10	My parents sometimes give me something to eat when I do something right. For example, when doing my homework.					
11	My parents consciously eat vegetables or fruits when I'm around, like having fresh salad or seasonal fruits during dinner.					
12	My parents have clear rules about what I can snack on for example 1 biscuit after school.					
13	My parents make sure I do not snack just before meals.					
14	My parents sometimes give me a small snack like a bite-sized treat.					
15	My parents try to consciously set a good example when it comes to eating fruit and vegetables.					
16	My parents have rules about when I am allowed to eat snacks and how much.					

Section C: Adolescent dietary behaviors

1. **During the past 30 days, how often did you eat breakfast?**
   0. Never.
   1. Rarely.
   2. Some days.
   3. Most days.
   4. Everyday.
2. **What is the main reason you do not eat breakfast?**
   1. I always eat breakfast.
   2. I do not have time for breakfast.
   3. I do not feel hungry.
   4. There is not always prepared breakfast meal in my home.
3. **How many days do you eat lunch during the week?**
   0. Never.
   1. One day.
   2. Two days.
   3. Three days.
   4. Four days.
   5. Five days and more.
4. **How many days do you eat dinner during the week?**
   0. Never.
   1. One day.
   2. Two days.
   3. Three days.
   4. Four days.
   5. Five days and more.
5. **How many snacks (e.g. fatayer, sandwich, chips, etc.) do you usually have per day?**
   0. Never.
   1. I eat snacks, but not daily.
   2. One.
   3. Two.
   4. Three.
   5. Four.
   6. More than four times.
6. **How many times do you eat fruits per day?**
   0. Never.
   1. I eat fruits, but not daily.
   2. One.
   3. Two.
   4. Three.
   5. Four.
   6. More than four times.
7. **How many times do you eat vegetables (e.g. salad, vegetable stew, molokhiya, etc.) per day?**
   0. Never.
   1. I eat vegetables, but not daily.
   2. One.
   3. Two.
   4. Three.

5. Four.
6. More than four times.

8. How many times do you drink carbonated beverages (e.g. Pepsi, Coke, 7-Up, Miranda, etc.) per day?

0. Never.
1. I drink carbonated beverages, but not daily.
2. One.
3. Two.
4. Three.
5. Four.
6. More than four times.

9. How many times do you drink energy drinks (e.g. Red Bull, Power Horse, etc.) per day?

0. Never.
1. I drink energy drinks, but not daily.
2. One.
3. Two.
4. Three.
5. Four.
6. More than four times.

10. How many times do you consume milk or milk products (e.g. yogurt, cheese, labnah, etc.) per day?

0. Never.
1. I consume milk products, but not daily.
2. One.
3. Two.
4. Three.
5. Four.
6. More than four times.

11. During the past 7 days, on how many days did you eat fast food (e.g. burger, shawarma, pizza, etc.) from a fast food restaurant such as Mac, KFC, Herfy, Albaik etc.?

0. Never.
1. 1 day.
2. 2 days.
3. 3 days.
4. 4 days.
5. 5 days.
6. 6 days.
7. Daily.

12. During the past 30 days, did you eat less food, fewer calories, or foods low in fat to lose weight?

1) Yes.

2) No.

13. During your school years, were you taught in any of your classes the benefits of healthy eating such as the benefits of eating fruits, vegetables and milk or milk products?

1) Yes.
2) No.

14. **During your school years, were you taught in any of your classes the health risks of eating fast food from restaurants?**

    1) Yes.
    2) No.

15. **During your school years, were you taught in any of your classes the health risks of drinking carbonated beverages?**

    1) Yes.
    2) No.

16. **During your school years, were you taught in any of your classes the health risks of drinking energy drinks?**

    1) Yes.
    2) No.

17. **Do you think students need more health education regarding healthy diet?**

    1) Yes.
    2) No.

Section D: Children's Beverage Questionnaire

"Over the past month, please indicate the amount for each beverage type by marking the "X" in the circle for "how many times" and " how much each time".(a)

1 .Indicate how many times you drank the following beverages; for example, if you drink five glasses of water a week, mark 4-6 times per week.

2 .Indicate the approximate amount of beverage you drank at a time; for example, if you drank one glass of water each time, Mark 1 glass under "how many each time". If XXX applies, indicate the specific type of beverage by marking the "X" in the circle by the one used (i.e. type of nut milk).

3 .When trying to estimate your intake throughout the day (i.e. water), think about the total amount you drink. For example, three times per day and 20 fl oz (equal to 591 milliliters) of liquid each time = 60 XXX fl oz (equal to 1774 milliliters) of liquid per day. If you consume more than 60 fl oz (equal to 1774 milliliters) of liquid per day, select "1 time per day" and write the TOTAL daily amount in the last column. (a)

4 .Do not count beverages used in cooking or other preparations, such as milk in cereals.

5 .Calculate the milk/creamer added to tea and coffee in the category of tea or coffee with creamer drinks and not in the categories of milk; this includes non-dairy creamer. Please XXX indicates the type of Creamer (flavoured, plain or sugar-free) and sweetener used by marking the "X" in the circle by the one used, if applicable".

Type of drink	How many times (check one)							How much each time (tick one)					
		during the week			During the day								
	Never or less than 1 time	1	2-3	4-6	1	2+	3+	(cup ¾)	(cup 1)	(and ½ cup 1)	(cups 2)	(and ½ cup 2)	Select) (quantity below
water													
fresh fruit juice %100.													
Sweetened Juice Beverage/ local Drink: Sherbet, Tamarind Juice, Shirbat Zabib).													
Whole milk: red cap, low-fat milk 2%: Purple Cap, or chocolate milk.													
Low-fat 1%: green cap, Fat-Free/Skim Milk: light blue cup, yogurt or soy milk.													
Nut milk (almond, cashew, coconut) o Flavored, original, or Plain o Unsweetened													
Regular soft drinks													
Regular Energy, and Sports Drinks (Red Bull, TIGER, Power Horse, Blue Power).													
Diet or Artificially Sweetened Carbonated Drinks, Energy and Sports Drinks) Pepsi diet, Red Bull ZERO SUGAR, Power Horse zero sugar).													
Sweet tea (with sugar)													
Tea or coffee, black (no creamer or milk) Osugar OArtificial sweetener O N/A													
Tea or Coffee (with milk, and/ or creamer) o Sugar o Artificial Sweetener o N/A Milk, and/ or creamer o Milk o Half, and Half or Cream o N/A Creamer: o Flav. o plain o Sugar-Free.													
Rather													

Section E: Physical activity

We are trying to find out your physical activity level from the last 7 days (in the last week). This includes sports ,that make you sweat or make your legs feel tired, or games that make you breathe hard, such as jumping, running .climbing, and others

to remember:

a There are no right or wrong answers - this is not a test
b Please answer all questions as truthfully and accurately as you can

How often					Questions
More than 7 times	**6-5 times**	**4-3 times**	**2-1 times**	**no**	**1. Physical activity in your free time: Have you done any of the following activities in the past 7 days (last week)? If yes, how often? (Select only .(one option**
					a Jumping rope
					b Tag game
					c Chairs game
					d Dancing in ways
					e Pull the rope
					f Snowshoeing
					g Walking for exercise
					h Hide and seek
					i Jogging or running
					j Fitness exercises
					k Swimming
					l Dance
					m soccer
					n basketball
					o volleyball
					p bike
					q .....:Other
					r .....:Other

2. During the past seven days, during physical activity classes, how many times did you engage in high-intensity physical activity (playing vigorously, running, jumping, throwing)? (Check just one.)

a I do not do sports activity
b Very difficult
c sometimes
d Very often
e always

3.During the past seven days, what did you do most of your time resting? (Check only one).

a I sat (talking, reading, doing my homework)
b I stood or walked around the place
c I ran or played very little
d I ran Or played a little
e I ran I played strong most of the time

4. During the past seven days, what did you usually do at lunch (besides eating lunch) (Check only (one.

a I sat (talking, reading, doing my homework)
b I stood or walked around the place
c I ran or played very little
d I ran I played a little
e I ran I played it Power most of the time

5. During the past seven days, on how many days did you exercise, dance, or play and were very active right after school (check only one).

a nothing
b Once last week
c or 3 times in the last week
d times in the last week
e times in the last week 5

6. During the past seven days, how many times did you exercise, dance, or play games in which you were very active in the evening? (check only one)

a. nothing
b. Once last week
c. Or 3 times in the last week
d. Or 5 last week
e. or 7 times in the last week 6

7.During the past weekend, how many times did you exercise, dance or play games and7. were very active? (check only one)

a. except one thing
b. time 1
c. times 3 -
d. times 5 -
e. times or more 6

8. Which of the following best describes the past seven days for you? Read all five statements before deciding on the one answer that best describes you

a. I spent all or most of my free time doing activities that involved little physical effort
b. :Sometimes (1-2 times in the last week) I did physical activities in my free time (eg (played sports, ran, swam, rode a bike, did fitness exercises
c. Often (3-4 times in the past week) I do physical activities in my free time
d. Often (5-6 times in the last week) I do physical activities in my spare time
e. Very often (7 or more times in the past week) I engage in physical activities in my free time

9. Determine the number of times you engaged in physical activity, such as (exercise ,games dancing, or any other physical activity) during the past week.

Very often	mostly	middle	a little	no	week days
					Sunday
					Monday
					Tuesday
					Wednesday
					Thursday
					Friday
					Saturday

10. Have you been sick in the past week, or has something prevented you from doin your normal physical activities? (tick one)

- ○ Yes
- ○ no

If yes, what He blocked you?

....

Section F: Sedentary behaviours

Now, some questions about sedentary activities
Generally, you have about 8 hours of free time before and after school, some of which is spent sitting and you . may be able to do multiple activities at the same time (such as playing with smartphones in front of the TV)

. So please estimate the amount of time spent on each activity by the total time spent doing the activities
Think about a typical school week, and write down how long you spend doing the following activities before and .after school each day. Leave the space blank if you don't do this activity

Activities/time duration	Sunday			Monday			Tuesday			Wednesday			Thursday		
	minutes		hour	minutes		hour	minutes		hour	minutes		hour	minutes		hour
Watching TV															
Watch videos/DVDs (DVD)															
Use the computer for fun															
Play on your smartphone or iPad															
Play computer or video games ,Nintendo) ,Xbox ,PlayStation (Wii															
Using the computer to do homework															
Doing homework without using a computer															
Reading for pleasure															
the study															
Travel (car/bus/train)															
Practicing crafts or hobbies															
Chat with friends / on the phone / relax															
Play/play a musical instrument															

Generally, you have about 16 hours of free time before and after school, some of which is spent sitting and you may be able to do multiple activities at the same time (such as playing with . (smartphones in front of the TV

So please estimate the amount of time spent on each activity by the total time spent doing the activities
Think about a typical school week, and write down how long you spend doing the following activities .before and after school each day. Leave the space blank if you do not do this activity

Activities/time duration	Friday			Saturday		
	minutes		hour	minutes		hour
Watching TV						
Watch videos/DVDs						
Use the computer for fun						
Play on your smartphone or iPad						
,Play computer or video games (Nintendo, Xbox (PlayStation, Wii						
Using the computer to do homework						
Doing homework without using a computer						
Reading for fun						
the study						
Travel (car/bus/train)						
Practicing crafts or hobbies						
Chat mode with friends / on the phone / relax						
Play/play a musical instrument						
Going to the mosque to perform prayers						

Section I: Anthropometric measurements

	Adolescent	**Father**	**Mother**
Weight (kg)			
Height (cm)			
Waist circumference (cm)			
Hip circumference (cm)			

Section H: Biochemical profile tests

Systolic Blood Pressure (BP) mmHg =
Diastolic Blood Pressure (BP) mmHg =
Fasting Blood Sugar (FBS) mmol/L =
Cholesterol mg/dl =
Triglycerides mg/dl =
Low-Density Lipoprotein (LDL) mg/dl =
Very Low-Density Lipoprotein (VLDL) mg/dl =
High-Density Lipoprotein (HDL) mg/dl =
Fasting Serum Insulin (mU /L) =
Homeostatic Model Assessment of Insulin Resistance (HOMA-IR) =

mmHg = millimeters of mercury, mg/dl = milligram per deciliter,
mmol/L (millimoles per liter), and mU /L (milliunits per liter)

This is the end of the questionnaire, thank you for participating.

Section B2: The Adolescent Food Parenting Questionnaire

Participant: Father ☐ Mother ☐ Serial No. of adolescent: 001

Age: ……..

Anthropometric measurements for parent:

Weight	height	
……. KG	…….cm	Father
……. KG	…….cm	Mother

Please read the following statements and check the boxes that are most relevant to your child's eating behavior at home.

No.	Parent version	Disagree	Slightly disagree	Impartial	Slightly agree	Agree
01	I educate my child about nutrition, for example, talking about healthy and unhealthy food.					
02	I explain to my child why I have specific rules about eating, such as having healthy meals together and avoiding unhealthy foods.					
03	There are always fruit and vegetables at home for my children to eat.					
04	Sometimes I give my child something to eat to distract them, like giving them a piece of fruit while they are studying to help them rest and focus better.					
05	I give my child feedback related to their eating habits. For example, if my child eats too quickly or doesn't eat enough vegetables.					
06	At home, my child can easily eat vegetables because they are part of our daily meals, like when they have salad served with the main meal.					
07	Sometimes I give my child something to eat as a reward, like a piece of cake after he / his finishes his school assignments.					
08	I let my child snack if they want to.					
09	I discuss with my child why it is important to eat fruit and vegetables.					
10	I sometimes give my child something to eat when he/she does something right, for example when doing homework.					
11	I consciously eat vegetables or fruits when my child is around, such as having fresh salad or seasonal fruits during dinner.					
12	I have clear rules about what my children can snack on for example 1 biscuit after school.					
13	I make sure my child does not snack just before meals.					
14	I sometimes give my child a small snack, like a bite-sized treat.					
15	I try to consciously set a good example when it comes to eating fruit and vegetables.					
16	I have rules about when my child is allowed to eat snacks and how much.					

APPENDIX K : Questionnaire for Phase II (Arabic Version)

رقم الاستبانة: تاريخ المقابلة:

القسم أ: الخصائص الاجتماعية الديموغرافية

16. الجنس: ☐ ذكر ☐ أنثى

17. تاريخ الميلاد: ...../ ..... /..... يوم / شهر /سنة

18. اسم المدرسة: .....

19. نوع المدرسة: ☐ حكومية ☐ خاصة

20. محل إقامة عائلي: ☐ حضري ☐ ريفي

21. حالة السكن: ☐ إيجار ☐ خاص ☐ مشترك

22. عدد أفراد الأسرة (يعيشون معًا): ……..

23. عدد الغرف في المنزل: ☐ عدا الحمام والمطبخ

24. اجمالي الدخل الشهري: ..... دينار عراقي

25. هل تملكون سيارة: كلا نعم : العدد ..... النوع .....

26. عدد الأشقاء: ……

27. المستوى التعليمي (الأب): ☐
1. امي
2. خريج ابتدائي او يقراءة ويكتب
3. خريج متوسط
4. خريج اعدادية
5. خريج معهد
6. خريج خريج بكالوريوس
7. خريج ماستر
8. خريج دكتوراه

28. المستوى التعليمي (الأم): ☐

29. مهنة الأب:……

30. مهنة الأم:……

القسم ب1 : استبيان تربية غذاء المراهقين

يرجى قراءة العبارات التالية وتحديد المربعات الأكثر ملاءمة لسلوك والديك في تناول الطعام في المنزل.						
ت	نسخة المراهق	لا اوافق	لا اوافق نوعا ما	محايد	اوافق نوعا ما	اوافق
1	يعلمني والداي عن التغذية، على سبيل المثال الحديث عن الطعام الصحي وغير الصحي.					
2	يشرح لي والداي سبب وجود قواعد معينة حول تناول الطعام ، مثل تناول وجبات صحية معًا وتجنب الأطعمة غير الصحية.					
3	لدي دائمًا فواكه وخضروات لأتناولها في المنزل.					
4	أحيانًا يعطيني والدي شيئًا لآكله لإلهائي، مثل إعطائي قطعة من الفاكهة أثناء دراستي لأستريح وأركز بشكل أفضل.					
5	يقدم لي والداي ملاحظات تتعلق بعاداتي في الأكل ، على سبيل المثال إذا أكلت بسرعة كبيرة أو لم أتناول ما يكفي من الخضار.					
6	في المنزل يمكنني أكل الخضروات بسهولة لأنها جزء من وجباتنا اليومية، مثل السلطة التي تقدم مع كل وجبة رئيسية.					
7	يعطيني والداي أحيانًا شيئًا ما آكله كمكافأة، مثل قطعة من الكعك بعد إنهاء واجباتي المدرسية.					
8	سمح لي والداي بوجبة خفيفة إذا أردت ذلك.					
9	يناقش والداي معي سبب أهمية تناول الفاكهة والخضروات.					
10	يعطيني والداي أحيانًا شيئًا لآكله عندما أفعل شيئًا صحيحًا. على سبيل المثال عند القيام بواجبي المنزلي.					
11	والداي يأكلان الخضار أو الفاكهة بوعي عندما أكون في الجوار ، مثل تناولهما السلطة الطازجة أو الفواكه الموسمية في وجبة العشاء.					
12	لدى والديّ قواعد واضحة حول ما يمكنني تناوله كوجبة خفيفة على سبيل المثال قطعة واحدة من البسكويت بعد المدرسة.					
13	يتأكد والداي من أنني لا أتناول وجبة خفيفة قبل الوجبات الرئسية مباشرة.					
14	يقدم لي والداي أحيانًا وجبة خفيفة صغيرة كالتعتيمة.					
15	يحاول والداي أن يكونا قدوة حسنة بوعي عندما يتعلق الأمر بتناول الفاكهة والخضروات.					
16	لدى والديّ قواعد بشأن الوقت الذي يُسمح لي فيه بتناول الوجبات الخفيفة ومقدارها.					

القسم ت : سلوكيات طعام المراهق

1. **خلال الثلاثين يومًا الماضية ، كم مرة تناولت وجبة الإفطار؟**
   A. .أبداً
   B. .نادرًا
   C. .بعض أيام
   D. .أغلب الأيام
   E. .كل يوم
2. **ما هو السبب الرئيسي لعدم تناول الفطور؟**
   A. .انا دائما اكل الفطور
   B. .ليس لدي وقت لتناول الإفطار
   C. .لا أشعر بالجوع
   D. .لا توجد دائمًا وجبة إفطار معدة في منزلي
3. **كم يوما تأكل الغداء خلال الأسبوع؟**
   A. .أبداً
   B. .يوم واحد
   C. .يومان
   D. .ثلاثة ايام
   E. .أربعة أيام
   F. .خمسة أيام وأكثر
4. **كم يوما تأكل العشاء خلال الأسبوع؟**
   A. .أبداً
   B. .يوم واحد
   C. .يومان
   D. .ثلاثة ايام
   E. .أربعة أيام
   F. .خمسة أيام وأكثر
5. **كم عدد الوجبات الخفيفة(مثل□ ، الفطائر□ ، الساندويتش□الشيبس, □الكيك, □البطاطة المقلات ,□الاسي كريم, □الحلويات / الحلوى ..... إلخ)التي تتناولها عادة في اليوم؟**
   A. .أبداً
   B. .واحد
   C. .اثنين
   D. .ثلاثة
   E. .أربعة
   F. .أكثر من أربع مرات
   G. .أنا آكل وجبات خفيفة ، لكن ليس يوميًا
6. **كم يوما تأكل المكسرات (الفستق, الحوز, الوز, البندق, تافستق المختلط) خلال الأسبوع؟**
   A. .أبداً
   B. .واحد
   C. .اثنين
   D. .ثلاثة
   E. .أربعة
   F. .أكثر من أربع مرات
   G. أنا آكلالمكسرات.لكن ليس يوميًا ،

7. كم مرة تأكل الفاكهة يوميا؟

H. .أبداً
I. .واحد
J. .اثنين
K. .ثلاثة
L. .أربعة
M. .أكثر من أربع مرات
N. .أنا آكل الفاكهة ، لكن ليس يوميًا

8.) كم مرة تأكل الخضار(، مثل السلطة ، الملوخية.....إلخ)في اليوم؟

A. .أبداً
B. .واحد
C. .اثنين
D. .ثلاثة
E. .أربعة
F. .أكثر من أربع مرات
G. .أنا آكل الخضار ، لكن ليس يوميًا

9.) كم مرة تشرب المشروبات الغازية(، مثل بيبسي ، كوكاكولا ، سفن أب ، ميراندا ..... إلخ)يوميًا؟

A. .أبداً
B. .واحد
C. .اثنين
D. .ثلاثة
E. .أربعة
F. .أكثر من أربع مرات
G. .أنا أشرب المشروبات الغازية ، لكن ليس يوميًا

10. كم مرة تشرب مشروبات الطاقة (مثلا .....) يوميًا؟

A. .أبداً
B. .واحد
C. .اثنين
D. .ثلاثة
E. .أربعة
F. .أكثر من أربع مرات
G. .أنا أشرب مشروبات الطاقة ، لكن ليس يوميًا

11. كم مرة تستهلك الحليب أو منتجات الألبان(مثل الزبادي والجبن واللبنة وما إلى ذلك)في اليوم؟

A. .أبداً
B. .واحد
C. .اثنين
D. .ثلاثة
E. .أربعة
F. .أكثر من أربع مرات
G. .أنا أستهلك منتجات الألبان ، لكن ليس بشكل يومي

12. **خلال السبعة أيام الماضية ، كم عدد الأيام التي تناولت فيها وجبات سريعة(مثل البرجر والشاورما والبيتزا.....) وما إلى ذلك**

A. .أبداً
B. .يوم 1
C. .أيام 2
D. .أيام 3
E. .أيام 4
F. .ايام 5
G. .أيام 6
H. .يوميًا

13. **خلال الثلاثين يومًا الماضية ، هل تناولت طعامًا أقل ، أو سعرات حرارية أقل ، أو أطعمة منخفضة الدهون لإنقاص الوزن؟**

A. .نعم
B. .لا

14. **خلال سنوات دراستك ، هل علمت في أي من فصولك فوائد الأكل الصحي مثل فوائد تناول الفاكهة والخضروات والحليب أو منتجات الألبان؟**

A. .نعم
B. .لا

15. **خلال سنوات دراستك ، هل علمت في أي من فصولك المخاطر الصحية لتناول الوجبات السريعة من المطاعم؟**

A. .نعم
B. .لا

16. **خلال سنوات دراستك ، هل علمت في أي من فصولك المخاطر الصحية لشرب المشروبات الغازية؟**

A. .نعم
B. .لا

17. **خلال سنوات دراستك ، هل علمت في أي من فصولك المخاطر الصحية لشرب مشروبات الطاقة؟**

A. .نعم
B. .لا

18. **هل تعتقد أن الطلاب بحاجة إلى مزيد من التثقيف الصحي فيما يتعلق بالنظام الغذائي الصحي؟**

A.نعم

B.لا

القسم ث: استبيان تناول المشروبات (BEQV)

استبيان مشروبات الأطفال

"خلال الشهر الماضي ، يرجى الإشارة إلى كمية لكل نوع المشروبات عن طريق وضع علامة على ""x"" في الدائرة ل ""كم مرة"" و ""كم في كل مرة."""

1 .حدد عدد المرات التي شربت فيها المشروبات التالية ، على سبيل المثال ، إذا شربت 5 أكواب من الماء أسبوعيا ، ضع علامة 4-6 مرات في الأسبوع.
2 .حدد الكمية التقريبية للمشروبات التي شربتها في كل مرة ، على سبيل المثال ، إذا شربت 1 كوب من الماء في كل مرة ، ضع علامة 1 كوب تحت ""كم في كل مرة"". إذا XXX ينطبق ، تشير إلى نوع معين من المشروبات عن طريق وضع علامة على "X" في دائرة من قبل واحد المستخدمة (أي نوع من الحليب الجوز).
3 .عند محاولة تقدير تناولك على مدار اليوم ، (أي الماء) فكر في الكمية الإجمالية التي تشربها. على سبيل المثال ، 3 مرات في اليوم و 20 أونصة سائلة (ما يعادل 591 ملليلترًا) من سائلة في كل مرة = XXX 60 أونصة سائلة (ما يعادل 1774 ملليلترًا) من السائل يوميًا. إذا كنت تستهلك أكثر من 60 أونصة سائلة (ما يعادل 1774 ملليلترًا) من السوائل يوميًا، فحدد "1 مرة في اليوم" واكتب إجمالي المبلغ اليومي في العمود الأخير.
4 .لا تحسب المشروبات المستخدمة في الطهي أو المستحضرات الأخرى ، مثل الحليب في الحبوب.
5. احسب الحليب / الكشطه المضافة إلى الشاي والقهوة في فنة الشاي أو القهوة مع المشروبات الكشطه ، وليس في فنات الحليب ؛ وهذا يشمل الكشطه غير الألبان. يرجى XXX الإشارة إلى نوع من كريمر (النكهة ، عادي أو خالية من السكر) والمحليات المستخدمة عن طريق وضع علامة على "X" في الدائرة من قبل واحد المستخدمة ، إذا كان ذلك ممكنا."

نوع المشروب	كم مرة (ضع علامة واحدة)							كم في كل مرة (ضع علامة واحدة)						
	أبدًا أو أقل من 1	خلال الاسبوع			خلال اليوم			(¾ كوب)	(1 كوب)	(1 و½ كوب)	(2 كوب)	(2 و½ كوب)	(حدد الكمية أدناه)
		1	2-3	4-6	1	2+	3+						
الماء													
عصير فواكه طازج 100.%													
مشروب عصير محلى / مشروب محلى: شربت، عصير تمر هندي، وشربت الزبيب.													
الحليب كامل الدسم: غطاء أحمر، حليب قليل الدسم 2٪: غطاء بنفسجي أو حليب بالشوكولاتة													
قليل الدسم 1٪: غطاء أخضر ، حليب خالي من الدسم / خالي الدسم: كوب أزرق فاتح ، لبن أو حليب الصويا.													
حليب البندق (لوز، كاجو ، جوز الهند) □منكو ، أصلي ، أو سادة □غير محلى													
المشروبات الغازية العادية													
مشروبات الطاقة والرياضة، العادية (ريد بُل، .تايجر، باور هورس، بلو باور)													
الدايت أو المشروبات الغازية المحلاة صناعيا، ومشروبات الطاقة والرياضة (بيبسي دايت، .ريد بُل زيرو سكر، باور هورس زيرو سكر)													
شاي حلو (بالسكر)													
شاي أو قهوة، أسود (بدون مقشدة أو حليب) O سكر O مُحلي صناعي O غير متوفر													
الشاي أو القهوة (مع الحليب و / أو المبيض) O سكر O محليات غير طبيعية O غير متاح **الحليب و / أو المبيض** O حليب O نصف ونصف أو كريمة O غير متاح **كريمر :** O منكو O سادة O خالي من الس													
احرى													

القسم ج: **استبيان النشاط البدني**

نحن نحاول معرفة مستوى نشاطك البدني من آخر 7 أيام (في الأسبوع الأخير). وهذا يشمل الرياضة التي تجعلك تعرق أو تجعل ساقيك يشعران بالتعب ، أو الألعاب التي تجعلك تتنفس بصعوبة ، مثل القفز ، الجري ، التسلق ، وغيرها.

تذكّر:

أ. لا توجد إجابات صحيحة أو خاطئة - هذا ليس اختبارًا.

ب. يرجى الإجابة على جميع الأسئلة بصدق ودقة بقدر ما تستطيع.

الأسئلة	**عدد المرات**				
1- النشاط البدني في وقت فراغك: هل قمت بأي من الأنشطة التالية في الـ 7 أيام الماضية (الأسبوع الماضي)؟ إذا كان الجواب نعم، كم مرة؟ (حدد اختيار واحد فقط).	**لا**	**2-1 مرات**	**4-3 مرات**	**6-5 مرات**	**أكثر من 7 مرات**
أ. نط الحبل					
ب. لعبة العلامة					
ج. لعبة الكراسي					
د. الرقص بالطرق					
ه. سحب الحبل					
و. التزلج بأحذية التزلج					
ز. المشي لممارسة الرياضة					
ح. الغميضة					
ط. الركض أو الجري					
ي. تمارين لياقة بدنية					
ك. السباحة					
ل. الرقص					
م. كرة القدم					
ن. كرة السلة					
س. الكرة الطائرة					
ع. الدراجة الهوائية					
ف. أخرى:.....					
ص. أخرى:.....					

2. خلال الأيام السبعة الماضية ، خلال فصول النشاط البدنية ، كم مرة مارست فيه نشاطاً بدنياً مرتفع الشدة (اللعب بقوة ، الجري ، القفز ، الرمي)؟ (تحقق من واحد فقط.)

أ. لا أقوم بنشاط رياضي
ب. بصعوبة جداً
ج. بعض الأحيان
د. غالباً جدً
ه. دائماً

3. خلال الأيام السبعة الماضية ، ماذا فعلت في معظم الوقت الراحة ؟ (تحقق من واحد فقط):

أ. جلست (أتحدث، أقرأ ، أقوم بواجباتي المدرسية)
ب. وقفت أو مشيت حول المكان
ج. ركضت أو لعبت قليلاً جداً
د. ركضت أولعبت قليلا
ه. ركضت أولعبتبقوة في معظم الوقت

4. خلال الأيام السبعة الماضية ، ماذا كنت تفعل عادة عند الغداء (إلى جانب تناول الغداء)؟ (تحقق من واحد فقط).

أ. جلست (أتحدث، أقرأ ، أقوم بواجباتي المدرسية)
ب. وقفت أو مشيت حول المكان
ج. ركضت أو لعبت قليلاً جداً
د. ركضت أولعبت قليلاً
ه. ركضت أولعبتب قوة في معظم الوقت

5- خلال الأيام السبعة الماضية ، كم يوم قمت فيه بممارسة الرياضة أو الرقص أو اللعبو كنت فيها نشيطًا للغاية بعد المدرسة مباشرة (تحقق من واحد فقط).

أ. لا شيء
ب. مرة واحدة في الأسبوع الماضي
ج. 2 أو 3 مرات في الأسبوع الماضي
د. 4 مرات في الأسبوع الماضي
ه. هـ. 5 مرات في الأسبوع الماضي

6- خلال الأيام السبعة الماضية، كم عدد المرات التي قمت فيها بالرياضة ، أو الرقص ، أو ممارسة الألعاب التي كنت فيها نشيطًا للغاية في فترة المساء؟ (تحقق من واحد فقط)

أ. لا شيء
ب. مرة واحدة في الأسبوع الماضي
ج. أو 3 مرات في الأسبوع الماضي
د. أو 5 الأسبوع الماضي
ه. 6 أو 7 مرات في الأسبوع الماضي

7- خلال عطلة نهاية الأسبوع الماضي ، كم مرة قمت فيها بممارسة الرياضة أو الرقص أو ممارسة الألعاب و كنت نشيطًا للغاية؟ (تحقق من واحد فقط)

أ. أ.لا شيء
ب. 1 مرة
ت. 2 - 3 مرات
ث. 4 - 5 مرات
ج. 6 مرات أو أكثر

8. أي مما يلي يصف لك أفضل شيْ خلال الأيام السبعة الماضية ؟ اقرأ جميع العبارات الخمس قبل أن تقرر الإجابة الوحيدة التي تصفك

أ. لقد قضيت كل أو معظم وقت فراغي في القيام بأنشطة تشمل جهد بدني قليل.
ب. أحيانا (1-2 مرات في الأسبوع الماضي) قمت بأنشطة بدنية في وقت الفراغ(على سبيل المثال: لعبت الرياضة ، جريت ، سبحت ، ركبت الدراجة ، تمارين اللياقة البدنية)
ج. غالباً (3 - 4 مرات في الأسبوع الماضي) أقومبأنشطة بدنية في وقت الفراغ
د. في كثير من الأحيان (5 - 6 مرات في الأسبوع الماضي) أقومبأنشطةبدنية في وقت الفراغ
ه. غالباً جداً (7 مرات أو أكثر في الأسبوع الماضي) أقومبأنشطةبدنية في وقت الفراغ

9. حدد عدد المرات التي مارست فيها النشاط البدني مثال (ممارسة الرياضة ، الألعاب ، الرقص ، أو أي نشاط بدني آخر) خلال أيام الأسبوع الماضي.

أيام الأسبوع	لا	قليلا	متوسط	غالباً	غالباً جداً
الأحد					
الاثنين					
الثلاثاء					
الأربعاء					
الخميس					
الجمعة					
السبت					

10. هل كنت مريضا في الأسبوع الماضي ، أو منعك شيء ما من القيام بأنشطتك البدنية الطبيعية؟ (ضع علامة على واحدة)

○ نعم

○ لا

إذا كان الجواب نعم ، ما الذي منعك؟

.....

القسم ح: **الأنشطة المستقرة**

الآن ، بعض الأسئلة حول الأنشطة المتصفة بكثرة الجلوس
عموما ، لديك حوالي 8 ساعات من وقت الفراغ قبل وبعد المدرسة ، بعضها يقضى في الجلوس وقد يمكنك القيام بأنشطة متعددة في نفس الوقت (مثل اللعب بالهواتف الذكية أمام التلفزيون).

لذا يرجى تقدير مقدار الوقت الذي تم إنفاقه على كل نشاط من خلال إجمالي الوقت المستغرق في القيام بالأنشطة.
فكر في أسبوع مدرسي عادي ، واكتب المدة التي تقضيها في القيام بالأنشطة التالية قبل وبعد المدرسة كل يوم ، اترك المكان فارغا إذا لم تقم بهذا النشاط.

الأنشطة / المدة الزمنية	**الأحد**			**الاثنين**			**الثلاثاء**			**الأربعاء**			**الخميس**		
	دقائق		**ساعة**	**دقائق**		**ساعة**	**دقائق**		**ساعة**	**دقائق**		**ساعة**	**دقائق**		**ساعة**
مشاهدة التليفزيون															
مشاهدة أشرطة الفيديو / أقراص الفيديو الرقمية (دي في دي)															
استخدام الكمبيوتر للمتعة															
اللعب على الهاتف الذكي أوالأيباد															
لعب ألعاب الكمبيوتر أو الفيديو (نانتندو ، إكسبوكس، بلايستيشن، ويي)															
استخدام الكمبيوتر في أداء الواجب المنزلي															
أداء الواجبات المنزلية بدون استخدام الكمبيوتر															
القراءة للمتعة															
الدراسة															
السفر (سيارة / حافلة / قطار)															
ممارسة الحرف أو الهوايات															
الدردشة مع الأصدقاء / على الهاتف / الاسترخاء															
لعب / العزف على آلة موسيقية															

عموما، لديك حوالي 16 ساعات من وقت الفراغ قبل وبعد المدرسة، وبعضها يقضى في الجلوس وقد يمكنك القيام بأنشطة متعددة في نفس الوقت (مثل اللعب بالهواتف الذكية أمام التلفزيون).

لذا يرجى تقدير مقدار الوقت الذي تم إنفاقه على كل نشاط من خلال إجمالي الوقت المستغرق في القيام بالأنشطة
فكر في أسبوع مدرسي عادي ، واكتب المدة التي تقضيها في القيام بالأنشطة التالية قبل وبعد المدرسة كل يوم، اترك المكان فارغا إذا لم تقم بهذا النشاط.

الأنشطة / المدة الزمنية	الجمعة			السبت		
	دقائق		ساعة	دقائق		ساعة
مشاهدة التليفزيون						
مشاهدة أشرطة الفيديو / أقراص الفيديو الرقمية(دي في دي)						
استخدام الكمبيوتر للمتعة						
اللعب على الهاتف الذكي أو الأيباد						
لعب ألعاب الكمبيوتر أو الفيديو (نينتندو، إكسبوكس، بلايستيشن، ويي)						
استخدام الكمبيوتر في أداء الواجب المنزلي						
أداء الواجبات المنزلية بدون استخدام الكمبيوتر						
القراءة للمتعة						
الدراسة						
السفر (سيارة / حافلة / قطار)						
ممارسة الحرف أو الهوايات						
وضع الدردشة مع الأصدقاء / على الهاتف / الاسترخاء						
لعب / العزف على آلة موسيقية						
الذهاب إلى المسجد لأداء الصلاة						

القسم خ: المقايس الجسمانية

	Adolescent	**Father**	**Mother**
Weight (kg)			
Height (cm)			
Waist circumference (cm)			
Hip circumference (cm)			

القسم د: الفحوصات المختبرية

Systolic Blood Pressure (B.P) mmHg =
Diastolic Blood Pressure (B.P) mmHg =
Fasting Blood Sugar (FBS) mmol/L =
Cholesterol mg/dl =
Triglycerides mg/dl =
Low-Density Lipoprotein (LDL) mg/dl =
Very Low-Density Lipoprotein (VLDL) mg/dl =
High-Density Lipoprotein (HDL) mg/dl =
Fasting Serum Insulin (mU/L) =
Homeostatic Model Assessment of Insulin Resistance (HOMA-IR) =

mmHg = millimeters of mercury, mg/dl = milligram per deciliter,
mmol/L (millimoles per liter), and mU/L (milliunits per liter)

This is the end of the questionnaire, thank you for participating.

القسم ب 2: استبيان تربية غذاء للابوين

المشارك: الاب ..... الام ..... رقم الاستبانة الطالب :.....

ولي الامر	الطول	الوزن
الاب	سم	كم
الام	سم	كم

العمر: .....

يرجى قراءة العبارات التالية وتحديد المربعات الأكثر ملاءمة لسلوك طفلك في تناول الطعام في المنزل.

ت	نسخة الوالدين	لا اوافق	لا اوافق نوعا ما	محايد	اوافق نوعا ما	اوافق
1	انا أقوم بتثقيف طفلي حول التغذية، على سبيل المثال الحديث عن الطعام الصحي وغير الصحي.					
2	انا أشرح لطفلي لماذا لدي قواعد معينة بشأن تناول الطعام، مثل تناولنا وجبات صحية معًا وتجنبنا الأطعمة غير الصحية.					
3	هناك دائمًا فواكه وخضروات في المنزل ليأكلها أطفالي.					
4	أحيانًا أعطي طفلي شيئًا ليأكله لإلهاءه، مثل إعطائه قطعة من الفاكهة أثناء دراسته ليستريح ويتركز بشكل أفضل.					
5	انا أقدم لطفلي ملاحظات تتعلق بعاداته الغذائية، على سبيل المثال إذا كان طفلي يأكل بسرعة كبيرة أو لا يأكل ما يكفي من الخضار.					
6	في المنزل, يمكن لطفلي أن يأكل الخضروات بسهولة لأنها جزء من وجباتنا اليومية ، مثل تناوله للسلطة التي تُقدم مع الوجبة الرئيسية.					
7	أحيانًا أعطي طفلي شيئًا ليأكله كمكافأة، مثل قطعة من الكعك بعد إنهاء واجباته المدرسية.					
8	أنا أسمح لطفلي بتناول وجبة خفيفة إذا أراد ذلك.					
9	انا أناقش مع طفلي سبب أهمية تناول الفاكهة والخضروات.					
10	أنا أحيانًا أعطي طفلي شيئًا ليأكله عندما يفعل شيئًا صحيحًا، على سبيل المثال عند أداء الواجب المنزلي.					
11	انا أتناول الخضار أو الفاكهة بوعي عندما يكون طفلي بالقرب مني, مثل تناولي السلطة الطازجة أو الفواكه الموسمية في وجبة العشاء.					
12	أنا لدي قواعد واضحة حول ما يمكن لأولادي تناوله كوجبة خفيفة على سبيل المثال قطعة بسكويت واحدة بعد المدرسة.					
13	أنا أتأكد من أن طفلي لا يتناول وجبة خفيفة قبل الوجبات مباشرة.					
14	أنا أحيانًا أعطي طفلي وجبة خفيفة صغيرة كالتعتيمة.					
15	أنا أحاول أن أكون بوعي قدوة حسنة عندما يتعلق الأمر بتناول الفاكهة والخضروات.					
16	أنا لدي قواعد حول متى يسمح لطفلي بتناول الوجبات الخفيفة ومقدارها.					

APPENDIX L: Evidence of communication (permission to use dietary behavior)

Re: questionnaire tool

Ibrahim A <i.alasqah@gmail.com>
Thu 1/26/2023 11:45 PM
To:Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>

1 attachments (84 KB)
Final Survey.pdf;

Dear Dr Abbas
Assalam alaykum, please find attached the survey we used in our studies which three categories one of for dietary behaviour.

Regards

Ibrahim

On Thu, 26 Jan 2023 at 12:42 pm, Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my> wrote:

> Dear Dr. Ibrahim Alasqah
> My name is Abbas Ali A. AL-Kinani, . Student at the university of science Malaysia (USM) in the PhD program in public health epidemiology. My research interest focuses on "Adolescent Food Behaviour," I came across your interesting article published in 2021,' Dietary Behavior of Adolescents in the Qassim Region, Saudi Arabia: A Comparison between Cities with and without the Healthy Cities Program. I would be grateful if you agreed to use your questionnaire tool for our study, and we would not share this with any other parties.
>
> Best regards
>
> Abbas Alkinani

APPENDIX M Evidence of communication (permission to use physical activity and sedentary behaviors)

إعادة توجيه: Questionnaire Tool (Arabic Version)

عبير باحاذق <abeer-ahmad-b@hotmail.com>
Thu 2/2/2023 6:35 AM
To:Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>

In our research, this questionnaire is considered for physical activity and sedentary behavior variables. You are welcome to contact us if you have other variables

and would like to obtain the Arabic version

With Regards,
Abeer Bahathig

من: Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>
تم الإرسال: 10/رجب/1444 05:09 م
إلى: عبير باحاذق <abeer-ahmad-b@hotmail.com>
الموضوع: Re: Questionnaire Tool (Arabic Version)

Alkumalsalam
Thank so much dear Dr. Abeer Bahathig
I wish you all the best in your scientific career.

jazakum allah khayran

From: عبير باحاذق <abeer-ahmad-b@hotmail.com>
Sent: Wednesday, February 1, 2023 9:45:50 PM
To: Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>
Subject: إعادة توجيه: Questionnaire Tool (Arabic Virtion)

Al Salam Alikom Warahmatu Allah Wabarakatuh

The required questionnaire is attached

With best wishes for success, please do not hesitate to contact me if you have any questions

With Regards,
Abeer Bahathig

من: Al Kinani Abbas Ali Abdulhasan <abbas.phn@student.usm.my>
تم الإرسال: 08/رجب/1444 06:58 م
إلى: abeer-ahmad-b@hotmail.com <abeer-ahmad-b@hotmail.com>; n_husna@upm.edu.my <n_husna@upm.edu.my>; hazizi@upm.edu.my <hazizi@upm.edu.my>; norbaizura@upm.edu.my <<norbaizura@upm.edu.my>; Mahaaessam82@gmail.com <Mahaaessam82@gmail.com
نسخة: <rohanajalil@usm.my <rohanajalil@usm.my>
الموضوع: Questionnaire Tool (Arabic Virtion)

Dear Dr. Abeer Ahmad Bahathig
My name is Abbas Ali A. AL-Kinani, student at the University of Science Malaysia (USM) in the PhD program in public health epidemiology. My research interest focuses on "Physical Activity and Sedentary Behavior Among Iraqi Adolescents" I came across your interesting article published in 2021,' Relationship between Physical Activity, Sedentary Behavior, and Anthropometric Measurements among Saudi Female Adolescents: A Cross-Sectional Study. I would be grateful if you

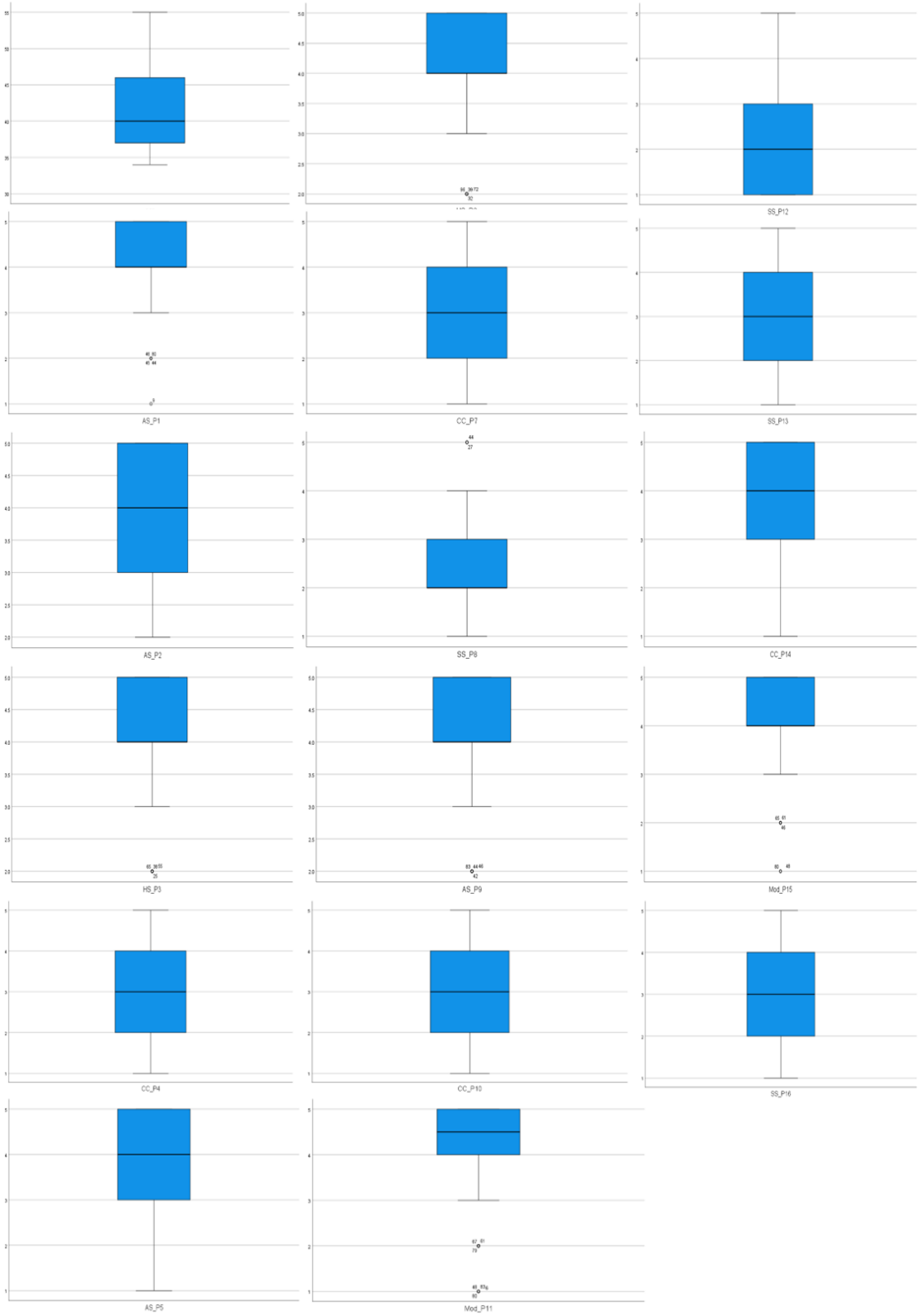
APPENDIX N: Table Sample Size Calculation for Objective 3 in Phase II Based on Single Proportion and Mean Estimation

Variable	Source	P	N	N+10 %
Adolescent dietary behaviour				
a. The proportion of daily dietary item consumption:				
Breakfast	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.48[b]	384	**427**
		0.36[g]	355	395
	(Kareem, and Abdul, 2015)	0.15[b]	196	218
		0.22[g]	264	294
	(Thabit, and Mohammed, 2012)	0.20[b, andg]	246	274
Vegetables	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.46[b]	282	425
		0.62[g]	363	404
Fruits	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.24[b]	281	313
		0.46[g]	282	425
	(Kareem, and Abdul, 2015)	0.17[b]	217	242
		0.31[g]	329	366
Milk	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.37[b]	359	399
		0.35[g]	350	389
b. The proportion of dietary consumption ranges from 3/ weekly to daily.				
Sugar-sweetened drinks consumption	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.67[b]	340	378
		0.60[g]	369	410
	(Thabit, and Mohammed, 2012)	0.27[b, andg]	303	337
Fast food consumption	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.37[b]	359	399
		0.25[g]	289	322
	(Kareem, and Abdul, 2015)	0.12[b]	163	182
		0.05[g]	73	82
	(Thabit, and Mohammed, 2012)	0.22[b, andg]	264	294
French fries/potato chips consumption	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.51[b]	384	**427**
		0.65[g]	350	389
	(Thabit, and Mohammed, 2012)	0.36[b, andg]	355	395
Energy drinks consumption	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.06[b]	87	97
		0.03[g]	45	50
Physical activity level				
Physical inactivity	(Shwaish *et al.*, 2023)	0.43[b, andg]	377	419
	(Mahmmod, and Al-Diwan, 2022)	0.65[b]	350	389
		0.92[g]	110	123
	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.30[b]	323	323
		0.69[g]	329	366
	(Hassan, and Ma'ala, 2013)	0.87[b, andg]	174	194
	(World Health Organization, 2012)	0.75[b]	289	322
		0.86[g]	186	207
	(Wahid, 2012)	0.75[g]	289	322
	(Thabit, and Mohammed, 2012)	0.46[b, andg]	382	425
Sedentary behaviour				
Sedentary behaviour	(Musaiger, Al-Mufty, and Al-Hazzaa, 2014)	0.82[b]	227	253
		0.64[g]	355	395
	(Shwaish *et al.*, 2023)	0.80[b, andg]	246	274
	(Al-jaff, 2016)	0.76[b, andg]	281	313
BMI				
Overweight	(WHO, 2022c)	38.1 [b]	363	404
		41.6 [g]	374	416
Obesity		14.9 [b]	195	217
		22.2 [g]	266	296
Overweight	(Shwaish *et al.*, 2023)	0.21[b, andg]	255	284
Obesity		0.23[b, andg]	273	304

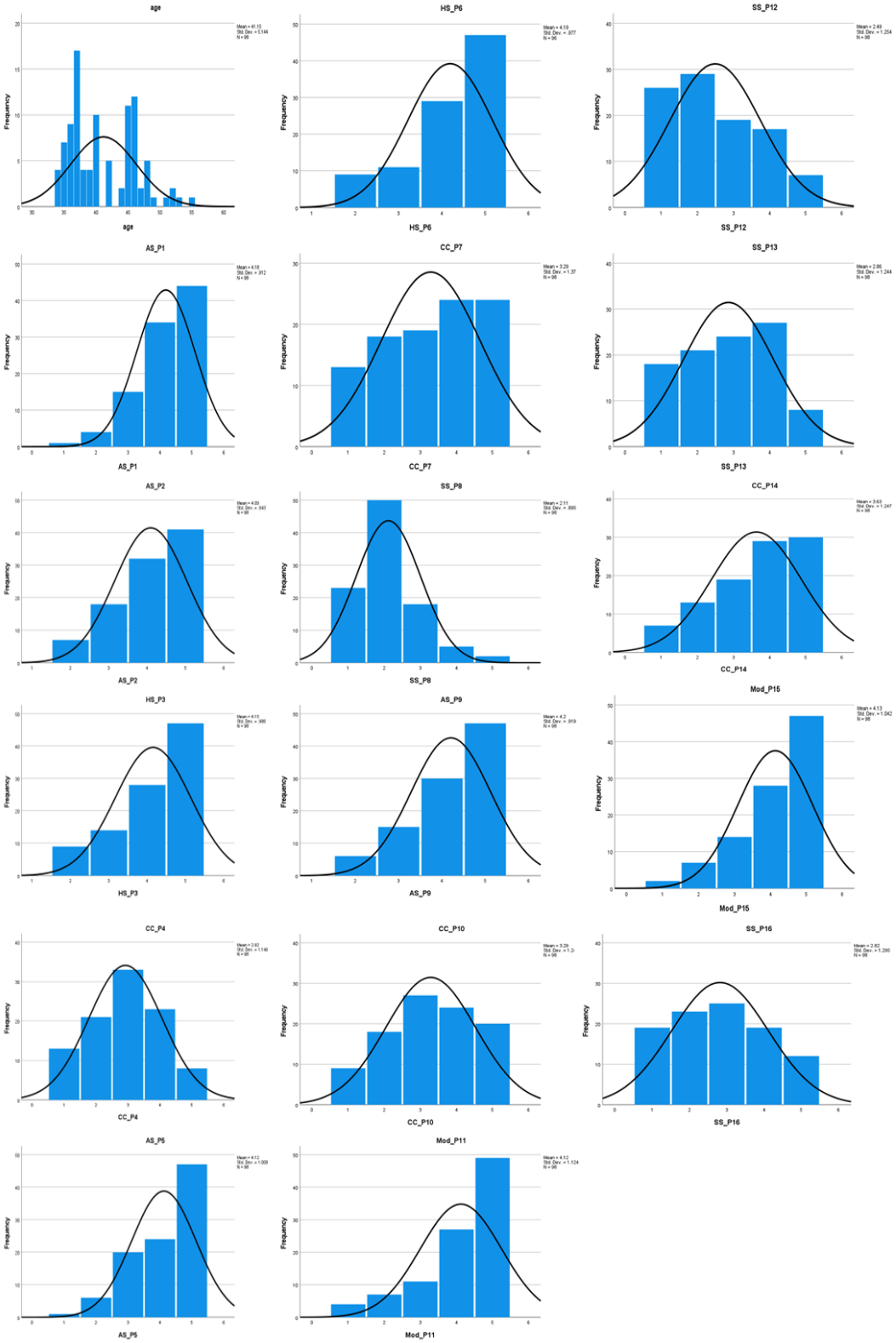
Variable	Source	P	N	N+10 %
Overweight and obesity	(Abbas, Neamat, and Falah, 2021)	0.32[b, andg]	334	367
	(Al-ani, Al-ani, and Al-hadeethi, 2021)	0.24[b]	281	309
		0.29[g]	317	349
	(Baghdadi, 2021)	0.51[b]	384	422
		0.24[g]	281	309
Hypertriton				
Systolic BP	(Qadir, and M. Weli, 2023)	0.05[b, andg]	73	82
Diastolic BP		0.08[b, andg]	114	127
Biochemical parameters [c]				
TC (mg/dl)	(Waheed *et al.*, 2020)	8.56 [d]	16	18
TG (mg/dl)		5.07 [d]	16	18
LDL-C (mg/dl)		4.21 [d]	16	18
HDL-C (mg/dl)		3.61 [d]	16	18
FBG (mg/dl)		4.46 [d]	16	18
Insulin (µU/ml)	(Tahir *et al.*, 2021)	2.50[d]	16	18

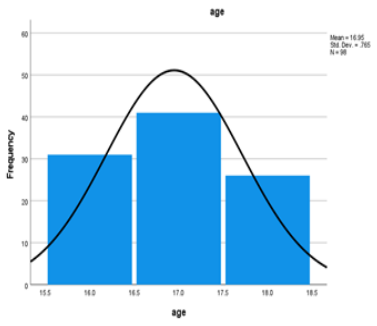
Note; P=Proportion, *n*= Number B=Boy, G=Girl, c= single mean, d= standard deviation.

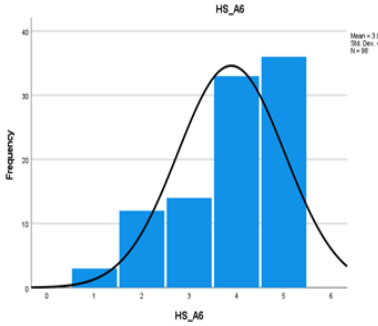
APPENDIX O: Outlier Detection for Exploratory Factor Analysis Using Boxplot Screening

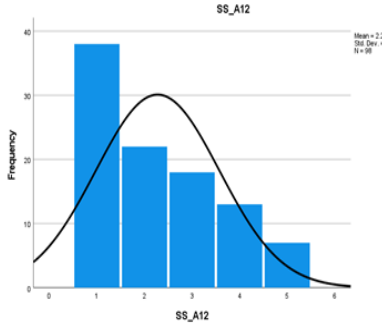


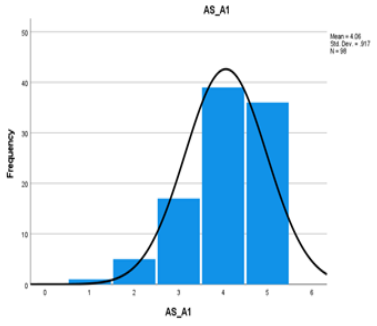
APPENDIX P: Univariate Normality for Exploratory Factor Analysis Using Histogram Screening

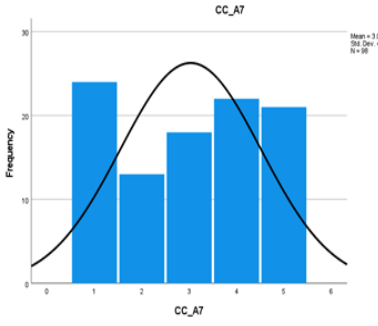


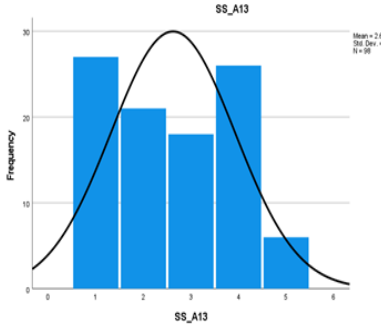

age
Mean = 16.95
Std. Dev. = .765
N = 98
Frequency
age

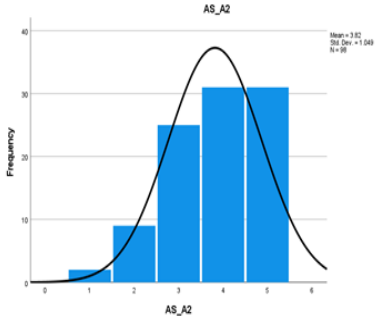

HS_A6
Mean = 3.89
Std. Dev. = 1.13
N = 98
Frequency
HS_A6

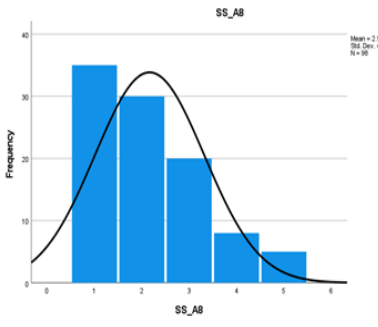

SS_A12
Mean = 2.28
Std. Dev. = 1.299
N = 98
Frequency
SS_A12

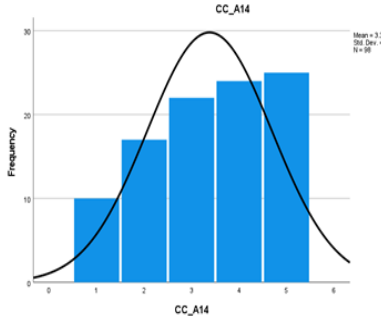

AS_A1
Mean = 4.06
Std. Dev. = .917
N = 98
Frequency
AS_A1

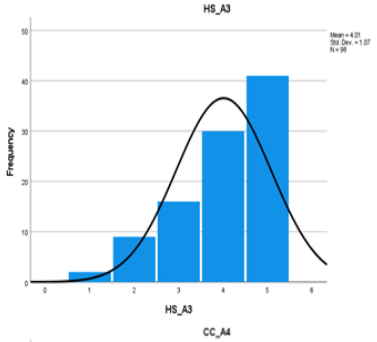

CC_A7
Mean = 3.03
Std. Dev. = 1.488
N = 98
Frequency
CC_A7

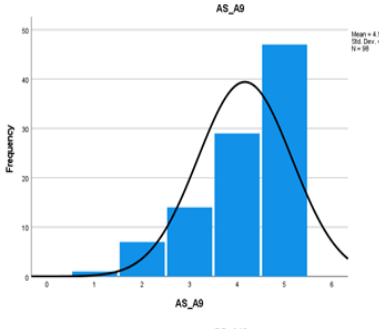

SS_A13
Mean = 2.62
Std. Dev. = 1.304
N = 98
Frequency
SS_A13

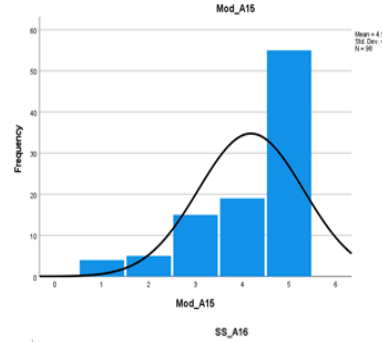

AS_A2
Mean = 3.82
Std. Dev. = 1.049
N = 98
Frequency
AS_A2

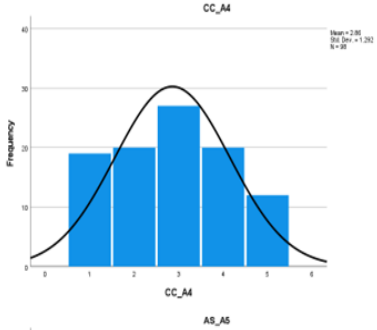

SS_A8
Mean = 2.16
Std. Dev. = 1.155
N = 98
Frequency
SS_A8

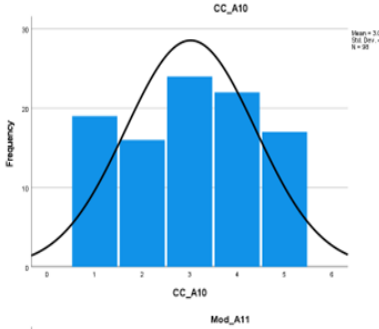

CC_A14
Mean = 3.38
Std. Dev. = 1.312
N = 98
Frequency
CC_A14

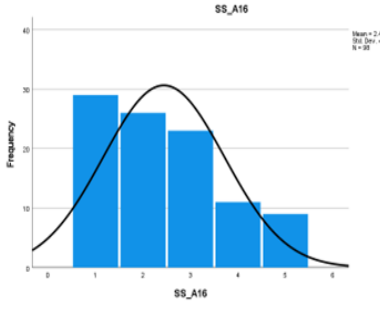

HS_A3
Mean = 4.01
Std. Dev. = 1.07
N = 98
Frequency
HS_A3

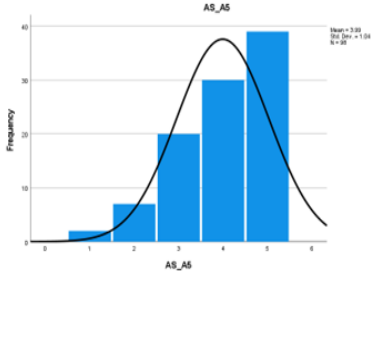

AS_A9
Mean = 4.16
Std. Dev. = .992
N = 98
Frequency
AS_A9

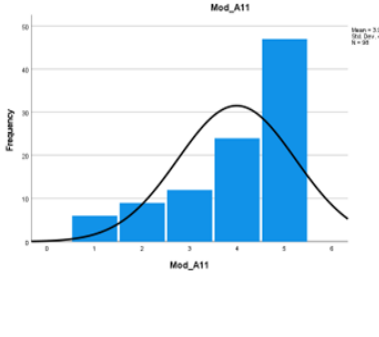

Mod_A15
Mean = 4.18
Std. Dev. = 1.125
N = 98
Frequency
Mod_A15


CC_A4
Mean = 2.86
Std. Dev. = 1.292
N = 98
Frequency
CC_A4


CC_A10
Mean = 3.02
Std. Dev. = 1.37
N = 98
Frequency
CC_A10


SS_A16
Mean = 2.44
Std. Dev. = 1.277
N = 98
Frequency
SS_A16


AS_A5
Mean = 3.99
Std. Dev. = 1.04
N = 98
Frequency
AS_A5


Mod_A11
Mean = 3.99
Std. Dev. = 1.239
N = 98
Frequency
Mod_A11

APPENDIX Q: Positive definiteness checking in both versions

Total Variance Explained for Parents

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.647	24.311	24.311	3.647	24.311	24.311
2	2.328	15.518	39.829	2.328	15.518	39.829
3	1.918	12.787	52.616	1.918	12.787	52.616
4	1.347	8.978	61.594	1.347	8.978	61.594
5	1.178	7.853	69.448	1.178	7.853	69.448
6	.816	5.442	74.889			
7	.662	4.413	79.303			
8	.640	4.267	83.570			
9	.506	3.374	86.943			
10	.434	2.894	89.837			
11	.374	2.494	92.331			
12	.365	2.436	94.767			
13	.301	2.006	96.773			
14	.276	1.843	98.616			
15	.208	1.384	100.000			

Extraction Method: Principal Component Analysis.

Total Variance Explained for Adolescents

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.047	25.295	25.295	4.047	25.295	25.295
2	2.333	14.581	39.876	2.333	14.581	39.876
3	2.076	12.977	52.853	2.076	12.977	52.853
4	1.438	8.985	61.838	1.438	8.985	61.838
5	1.225	7.654	69.492	1.225	7.654	69.492
6	.863	5.396	74.888			
7	.662	4.139	79.028			
8	.622	3.886	82.913			
9	.500	3.127	86.041			
10	.478	2.988	89.029			
11	.438	2.736	91.765			
12	.347	2.171	93.936			
13	.326	2.036	95.972			
14	.299	1.870	97.842			
15	.188	1.177	99.019			
16	.157	.981	100.000			

Extraction Method: Principal Component Analysis.

APPENDIX R: Multicollinearity checking

Table of Correlation Matrix: Parent Version

No.	Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	AS_P1	1															
2	AS_P2	.448**	1.00														
3	HS_P3	0.12	0.13	1.00													
4	CC_P4	0.04	-0.01	-0.03	1.00												
5	AS_P5	.413**	.379**	0.16	0.04	1.00											
6	HS_P6	.205*	.202*	.451**	-0.03	.265**	1.00										
7	CC_P7	0.06	-0.05	-0.03	.501**	0.06	-0.02	1.00									
8	SS_P8	0.03	0.05	-0.01	0.09	-0.04	-0.08	0.13	1.00								
9	AS_P9	.435**	.383**	0.15	-0.04	.540**	0.17	-0.03	-0.12	1.00							
10	CC_P10	.199*	0.00	-0.04	.357**	-0.04	0.07	.617**	0.05	0.06	1.00						
11	Mod_P11	0.17	.233*	0.08	0.03	0.11	0.16	.238*	-0.01	0.18	0.19	1.00					
12	SS_P12	0.16	0.14	-0.06	0.11	0.05	0.09	.260**	.520**	0.13	.220*	.235*	1.00				
13	SS_P13	0.09	0.04	0.04	0.04	0.01	-0.01	.284**	.440**	0.16	.267**	.227*	.588**	1.00			
14	CC_P14	0.14	0.06	0.03	.405**	0.02	0.07	.569**	0.04	0.13	.560**	0.18	.228*	.238*	1.00		
15	Mod_P15	0.07	.208*	0.06	0.04	0.09	0.19	.248*	-0.12	.230*	0.17	.717**	0.10	0.20	.260**	1.00	
16	SS_P16	.212*	0.12	0.07	0.07	0.02	-0.03	.262**	.507**	0.19	.276**	0.14	.570**	.649**	.322**	0.15	1.00
Collin	Tolerance	0.618	0.681	0.729	0.688	0.565	0.662	0.415	0.552	0.53	0.496	0.429	0.467	0.464	0.529	0.403	0.419
Stats.	VIF	1.617	1.469	1.372	1.454	1.769	1.511	2.408	1.813	1.886	2.016	2.333	2.144	2.154	1.89	2.479	2.384

Note: Collin Stats.= Collinearity Statistics, VIF= Variance Inflation Factor

**. Correlation is significant at the 0.01 level (2-tailed),*. Correlation is significant at the 0.05 level (2-tailed).

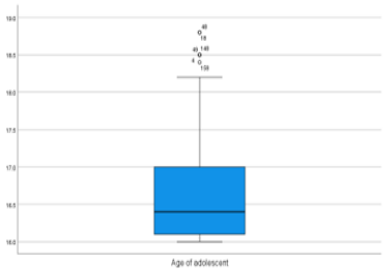
Table of Correlation Matrix: Adolescent Version

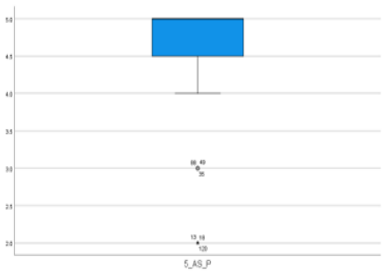
No.	Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	AS_A1	1.00															
2	AS_A2	.451**	1.00														
3	HS_A3	0.03	0.04	1.00													
4	HS_A6	0.02	0.18	.496**	1.00												
5	CC_A4	0.09	0.00	-0.08	-0.10	1.00											
6	AS_A5	.325**	.367**	0.05	0.19	0.00	1.00										
7	CC_A7	0.00	0.00	-0.07	-0.02	.576**	0.13	1.00									
8	SS_A8	0.15	0.06	-0.14	-0.13	0.04	-0.07	-0.02	1.00								
9	AS_A9	.363**	.356**	0.09	-0.01	0.08	.541**	0.14	-0.11	1.00							
10	CC_A10	0.09	0.01	-0.11	-0.06	.497**	0.09	.677**	0.13	.202*	1.00						
11	Mod_A11	0.14	0.18	0.03	0.06	0.15	0.10	.330**	0.04	0.19	.292**	1.00					
12	SS_A12	0.17	0.08	-.202*	-0.06	0.17	-0.01	.273**	.499**	0.16	.333**	.252*	1.00				
13	SS_A13	0.12	0.07	-0.03	0.02	0.00	0.07	.330**	.466**	0.14	.299**	0.18	.598**	1.00			
14	CC_A14	0.04	0.05	-0.02	0.02	.458**	0.03	.654**	-0.05	.222*	.598**	0.18	.247*	.235*	1.00		
15	Mod_A15	0.14	.265**	0.03	.211*	0.06	0.17	.274**	0.01	.324**	.319**	.719**	0.13	.202*	.260**	1.00	
16	SS_A16	.267**	0.15	-0.08	-0.05	0.11	0.04	.259*	.531**	0.13	.331**	0.13	.579**	.658**	.263**	0.14	1.00
Collin	Tolerance	0.671	0.669	0.635	0.57	0.541	0.555	0.311	0.52	0.467	0.433	0.388	0.433	0.406	0.462	0.346	0.43
Stats	VIF	1.49	1.495	1.575	1.754	1.848	1.801	3.216	1.925	2.142	2.311	2.58	2.312	2.466	2.167	2.89	2.323

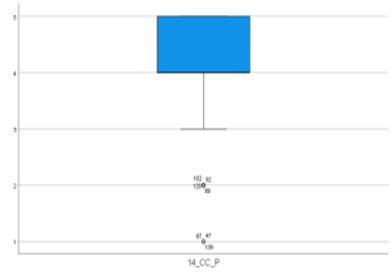
Note: Collin Stats.= Collinearity Statistics, VIF= Variance Inflation Factor

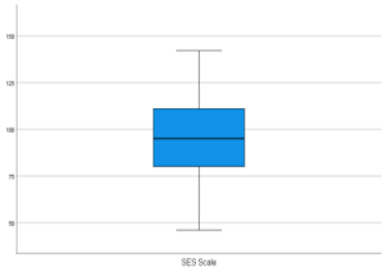
**. Correlation is significant at the 0.01 level (2-tailed),*. Correlation is significant at the 0.05 level (2-tailed).

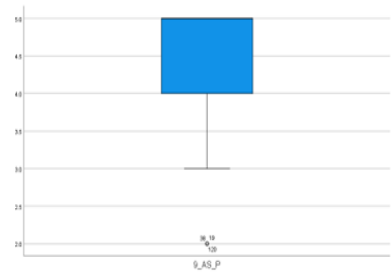
APPENDIX S: Outlier Detection for Confirmatory Factor Analysis Using Boxplot Screening

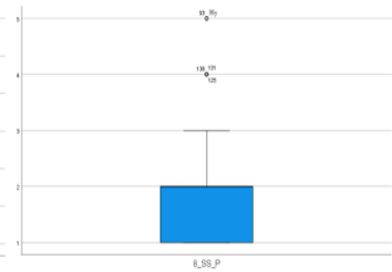

Age of adolescent

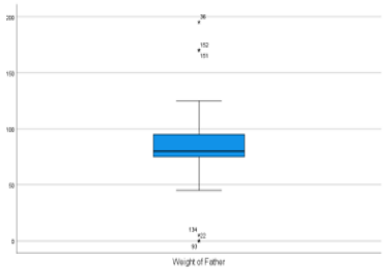

5_AS_P

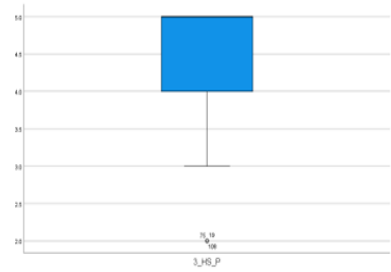

14_CC_P

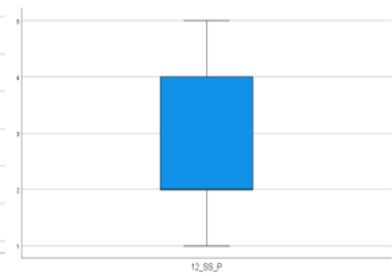

SES Scale

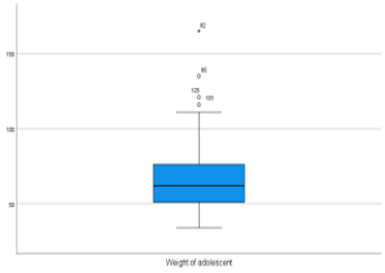

9_AS_P

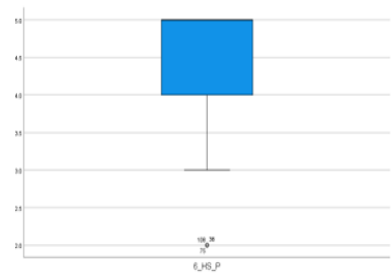

8_SS_P

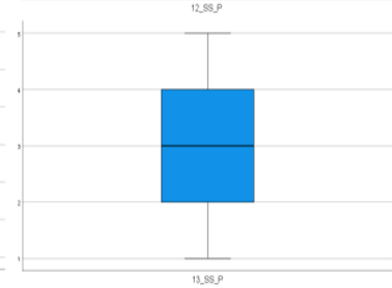

Weight of Father

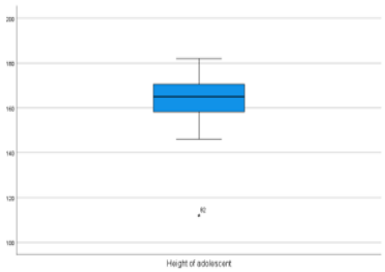

3_HS_P

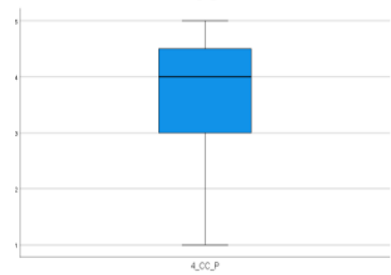

12_SS_P

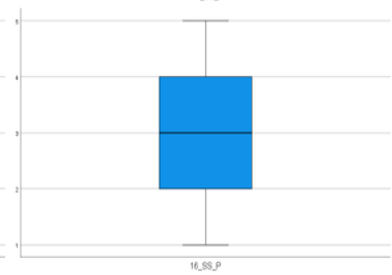

Weight of adolescent

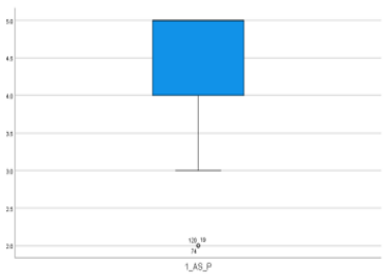

6_HS_P


13_SS_P


Height of adolescent


4_CC_P


16_SS_P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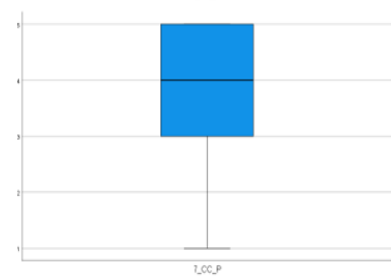
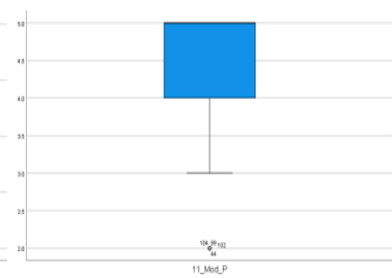
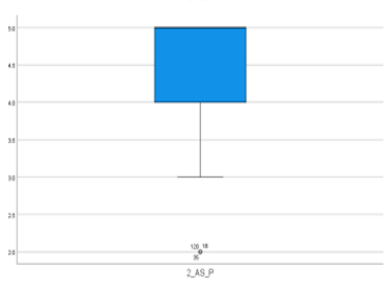
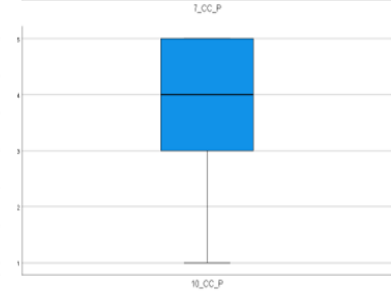
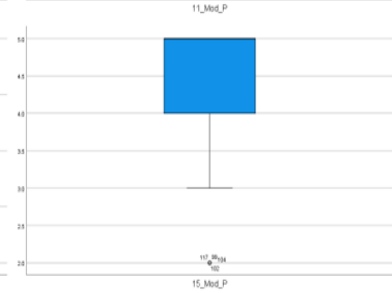

7_CC_P

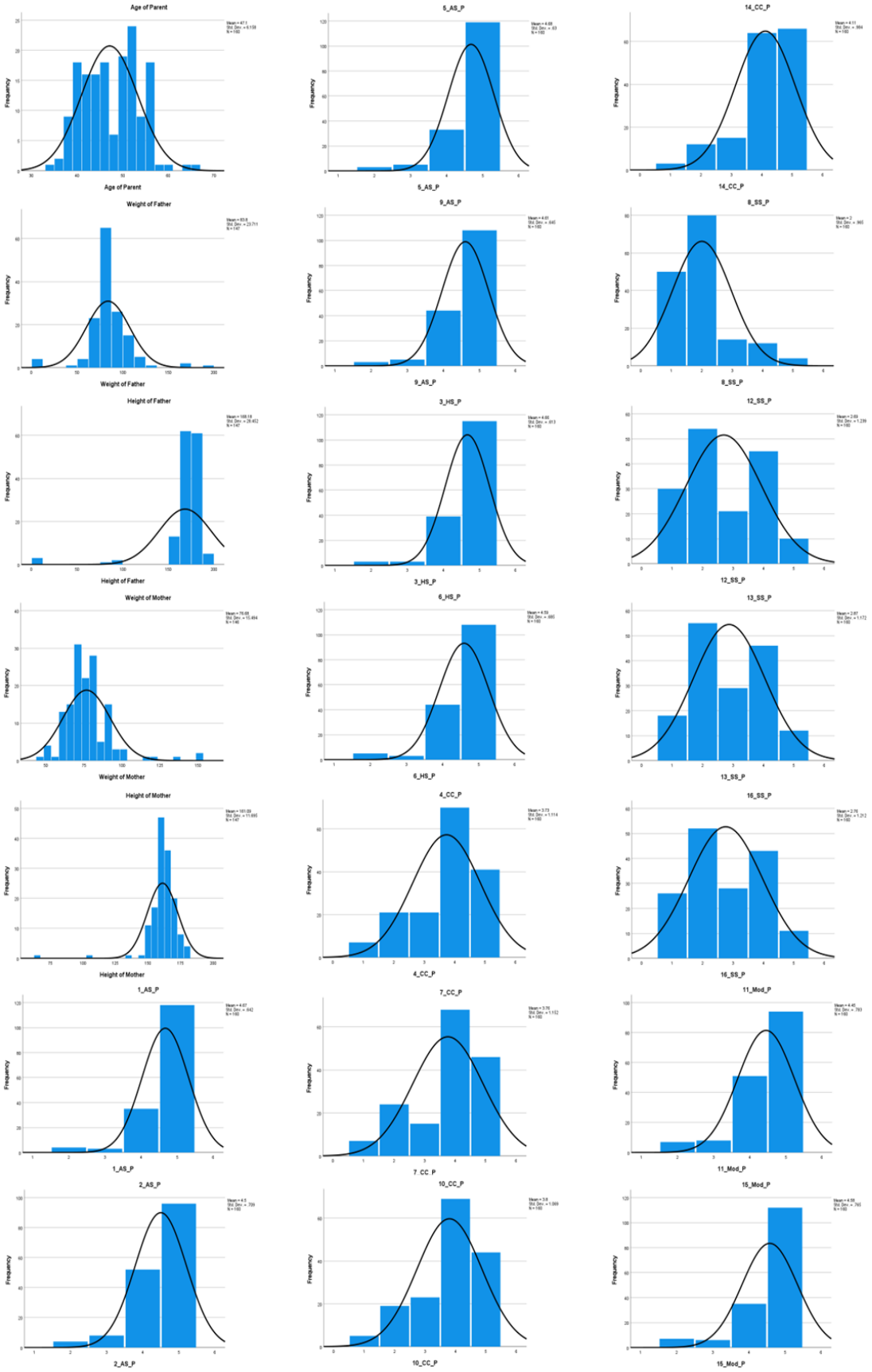

11_Mod_P

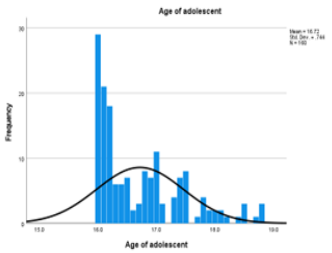

2_AS_P

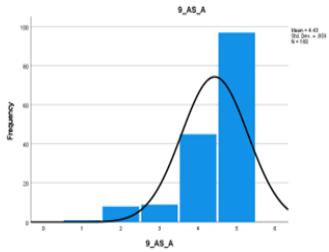

10_CC_P

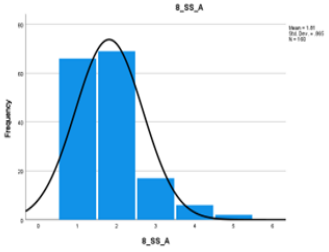

15_Mod_P

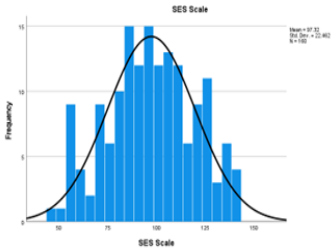
APPENDIX T: Univariate Normality for Confirmatory Factor Analysis Using Histogram Screening

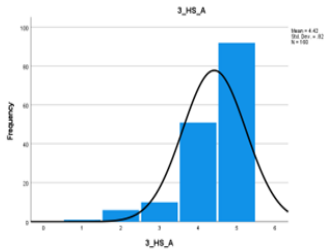


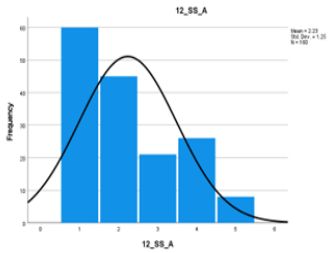

Age of adolescent
Frequency
Age of adolescent

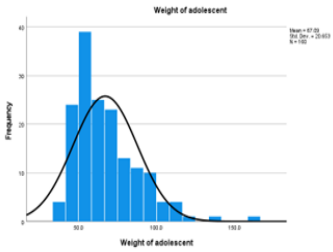

9_AS_A
Frequency
9_AS_A

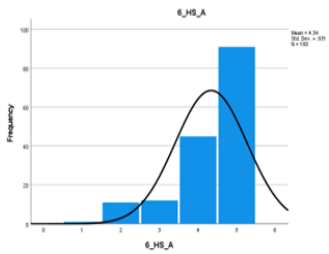

8_SS_A
Frequency
8_SS_A

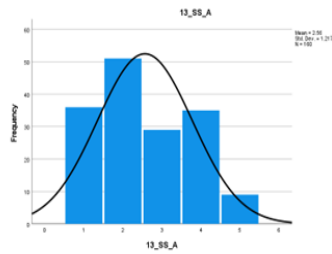

SES Scale
Frequency
SES Scale

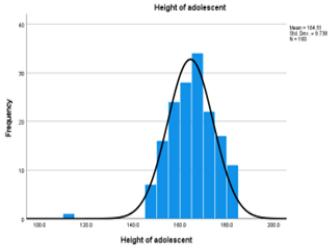

3_HS_A
Frequency
3_HS_A

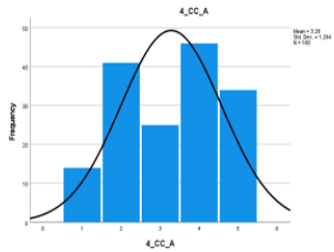

12_SS_A
Frequency
12_SS_A

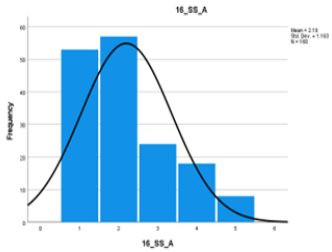

Weight of adolescent
Frequency
Weight of adolescent

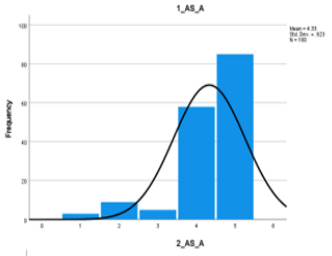

6_HS_A
Frequency
6_HS_A

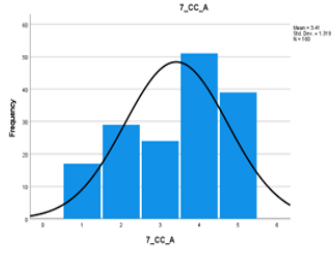

13_SS_A
Frequency
13_SS_A

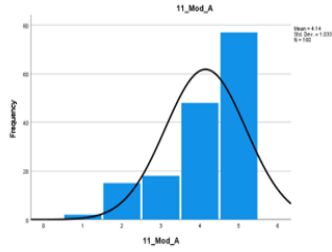

Height of adolescent
Frequency
Height of adolescent

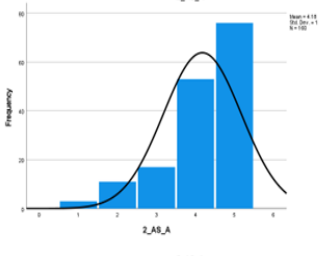

4_CC_A
Frequency
4_CC_A

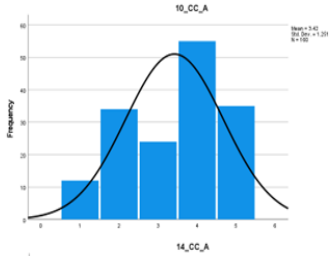

16_SS_A
Frequency
16_SS_A

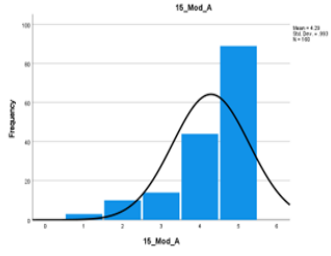

1_AS_A
Frequency
2_AS_A

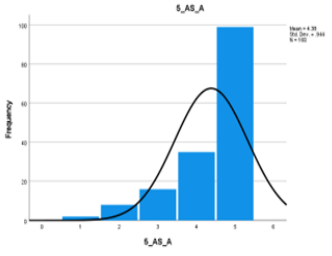

7_CC_A
Frequency
7_CC_A

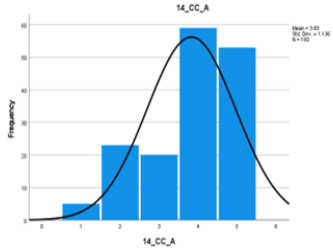

11_Mod_A
Frequency
11_Mod_A


Frequency
2_AS_A


10_CC_A
Frequency
10_CC_A


15_Mod_A
Frequency
15_Mod_A

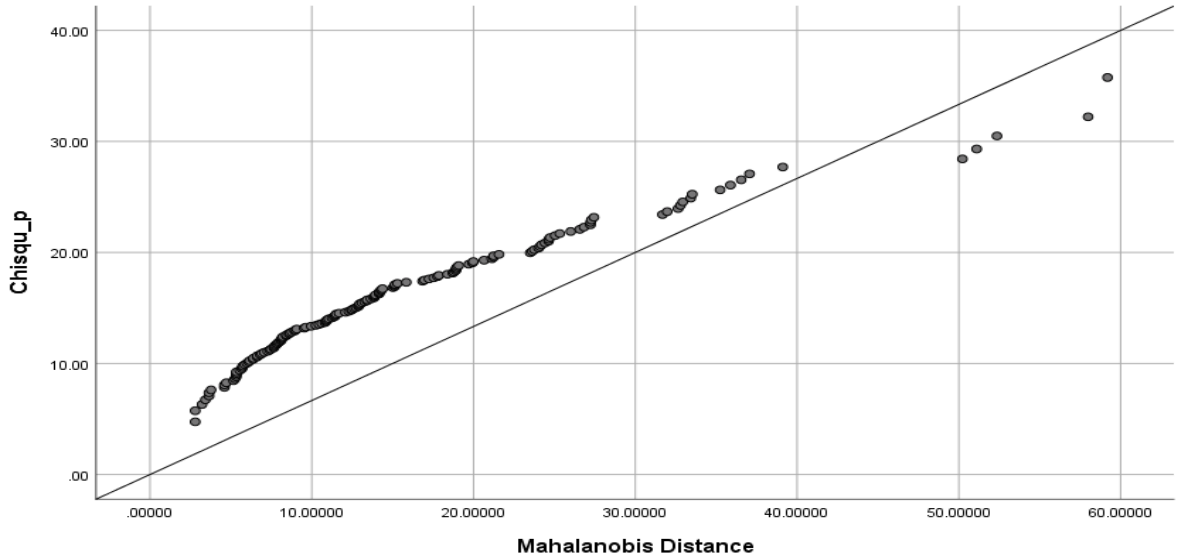

5_AS_A
Frequency
5_AS_A


14_CC_A
Frequency
14_CC_A

APPENDIX U: Multivariate normality for Confirmatory Factor Analysis Using Histogram Screening

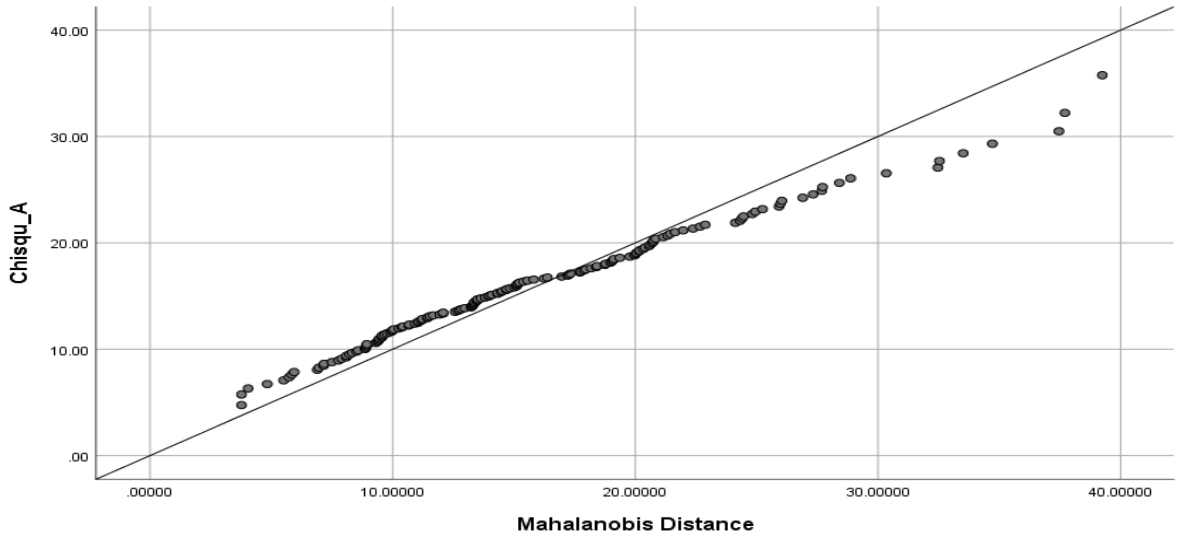
For parents

```
mardia tests of multivariate skew and kurtosis
Use describe(x) the to get univariate tests
n.obs = 160   num.vars =  16
b1p =  86.49   skew =  2306.32  with probability  <=  3.3e-142
 small sample skew =  2354.72  with probability <=  4.7e-149
b2p =  372.3   kurtosis =  22.22  with probability <=  0
```



For adolescents

```
Mardia tests of multivariate skew and kurtosis
Use describe(x) the to get univariate tests
n.obs = 160   num.vars =  16
b1p =  54.06   skew =  1441.66  with probability  <=  2.5e-37
 small sample skew =  1471.91  with probability <=  3e-40
b2p =  305.72   kurtosis =  4.67  with probability <=  3e-06
```



APPENDIX V: Path Diagram of the Final Model of the AFPQ-A

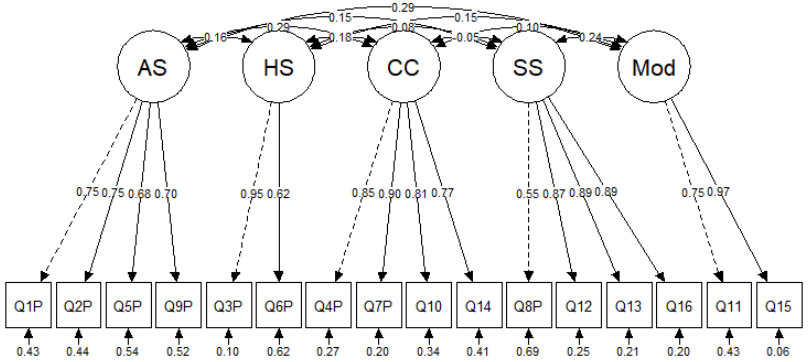


Figure of Final Model of AFPQ-A for parents with five-factor.

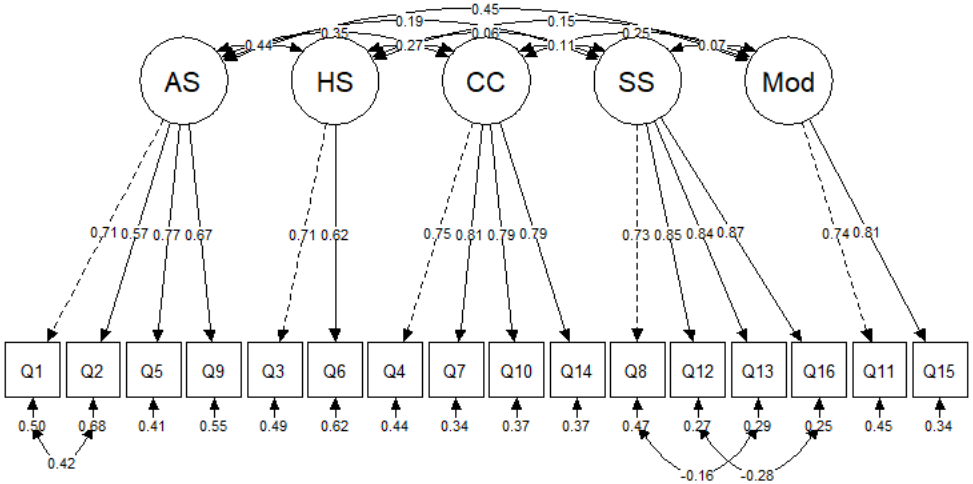
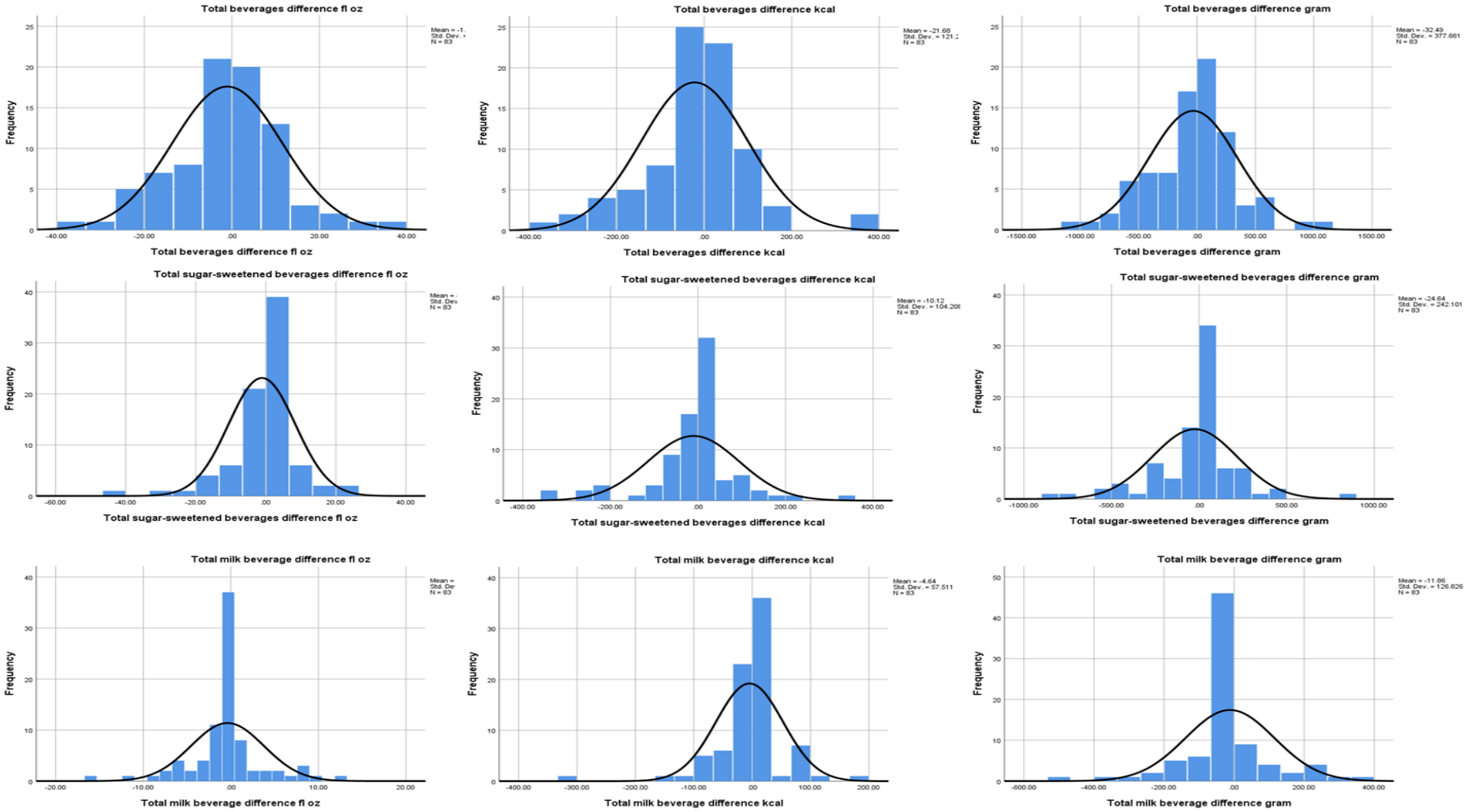


Figure of Final model of AFPQ-A for adolescents with five factors.

APPENDIX W: Checking Assumptions for Paired T-test



APPENDIX X Normality Tests for Univariate and Multivariate Skewness and Kurtosis of Path Analysis

UNIVARIATE SKEW AND KURTOSIS TESTS OF FIT

Variable	Sample Value	Mean	Standard Deviation	P-Value
TWO-SIDED UNIVARIATE SKEW TESTS OF FIT				
BRKSTFR	-0.202	0.010	0.117	0.0200
SNACKQTY	0.230	0.004	0.108	0.0600
F_VINTAK	0.705	0.008	0.110	0.0000
CARBDRNK	1.201	-0.002	0.106	0.0000
FASTFOOD	0.634	0.005	0.122	0.0000
SSBCAL	1.981	-0.010	0.105	0.0000
SB	-1.095	0.002	0.110	0.0000
MILKCAL	1.976	0.003	0.110	0.0000
PAQ_C	0.588	-0.012	0.108	0.0000
WHTR	0.810	-0.006	0.119	0.0000
WHR	0.245	0.005	0.118	0.0400
BAZ	-0.115	-0.005	0.123	0.4000
AS	-1.437	-0.009	0.116	0.0000
HS	-1.276	0.005	0.117	0.0000
CC	-0.548	-0.002	0.117	0.0000
SS	0.473	0.000	0.126	0.0000
MOD	-1.272	-0.003	0.118	0.0000
TWO-SIDED UNIVARIATE KURTOSIS TESTS OF FIT				
BRKSTFR	-1.331	-0.037	0.225	0.0000
SNACKQTY	-1.076	-0.037	0.200	0.0000
F_VINTAK	0.116	-0.007	0.223	0.5300
CARBDRNK	1.583	-0.046	0.234	0.0000
FASTFOOD	0.222	-0.018	0.230	0.2400
SSBCAL	5.786	-0.038	0.228	0.0000
SB	1.150	-0.098	0.196	0.0000
MILKCAL	4.993	-0.040	0.236	0.0000
PAQ_C	-0.498	-0.098	0.202	0.0000
WHTR	0.831	-0.042	0.226	0.0100
WHR	4.254	-0.034	0.208	0.0000
BAZ	-0.497	-0.016	0.219	0.0100
AS	2.120	-0.036	0.235	0.0000
HS	0.992	-0.022	0.205	0.0000
CC	-0.377	-0.015	0.221	0.0800
SS	-0.569	-0.034	0.226	0.0000
MOD	0.935	-0.028	0.210	0.0000

Multivariate Using Mardia's Multivariate

TECHNICAL 13 OUTPUT

SKEW AND KURTOSIS TESTS OF MODEL FIT

TWO-SIDED MULTIVARIATE SKEW TEST OF FIT

Sample Value	40.588
Mean	12.974
Standard Deviation	0.648
P-Value	0.0000

TWO-SIDED MULTIVARIATE KURTOSIS TEST OF FIT

Sample Value	377.132
Mean	321.182
Standard Deviation	2.450
P-Value	0.0000

APPENDIX Y: Monte Carlo Simulation for Sample Size Determination for path Analysis MODEL:

```
PAQ_C ON SEX AGE SCHOOL RESIDENCE HHI NUMSIBS CRWDINDX SES;
SB ON SEX AGE SCHOOL RESIDENCE HHI NUMSIBS CRWDINDX SES;
AS ON SEX AGE RESIDENCE HHI NUMSIBS FATHEDU MOTHEDU FATHOCC MOTHOCC SES FATHBMI
MOTHBMI;
HS ON SEX AGE RESIDENCE HHI NUMSIBS FATHEDU MOTHEDU FATHOCC MOTHOCC SES FATHBMI
MOTHBMI;
CC ON SEX AGE RESIDENCE HHI NUMSIBS FATHEDU MOTHEDU FATHOCC MOTHOCC SES FATHBMI
MOTHBMI;
SS ON SEX AGE RESIDENCE HHI NUMSIBS FATHEDU MOTHEDU FATHOCC MOTHOCC SES FATHBMI
MOTHBMI;
MOD ON SEX AGE RESIDENCE HHI NUMSIBS FATHEDU MOTHEDU FATHOCC MOTHOCC SES FATHBMI
MOTHBMI;
BRKSTFR ON AS HS SS CC MOD SEX AGE;
SNACKQTY ON AS HS SS CC MOD SEX AGE;
F_VINTAK ON AS HS SS CC MOD SEX AGE;
CARBDRNK ON AS HS SS CC MOD SEX AGE;
FASTFOOD ON AS HS SS CC MOD SEX AGE;
SSBCAL ON AS HS SS CC MOD SEX AGE;
MILKCAL ON AS HS SS CC MOD SEX AGE;
WHTR ON SEX FAMSUS AGE PAQ_C SB BRKSTFR SNACKQTY F_VINTAK CARBDRNK FASTFOOD SSBCAL
MILKCAL;
WHR ON SEX FAMSUS AGE PAQ_C SB BRKSTFR SNACKQTY F_VINTAK CARBDRNK FASTFOOD SSBCAL
MILKCAL;
BAZ ON SEX FAMSUS AGE PAQ_C SB BRKSTFR SNACKQTY F_VINTAK CARBDRNK FASTFOOD SSBCAL
MILKCAL;
OUTPUT:
TECH9;  ! Request detailed information on parameter estimates and standard errors
```

APPENDIX Z: Path Diagram for Initial Path Model (Model 1)

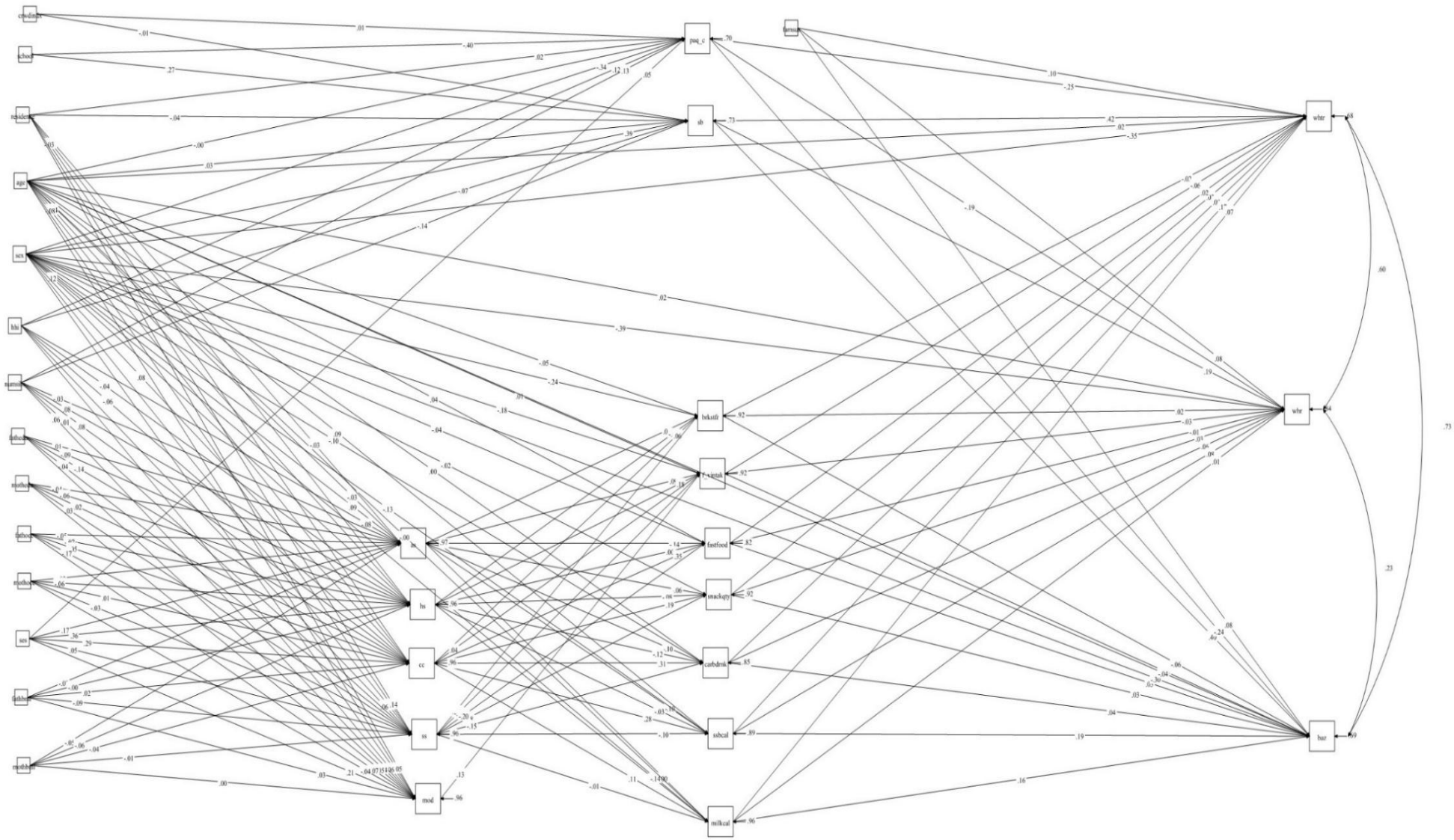
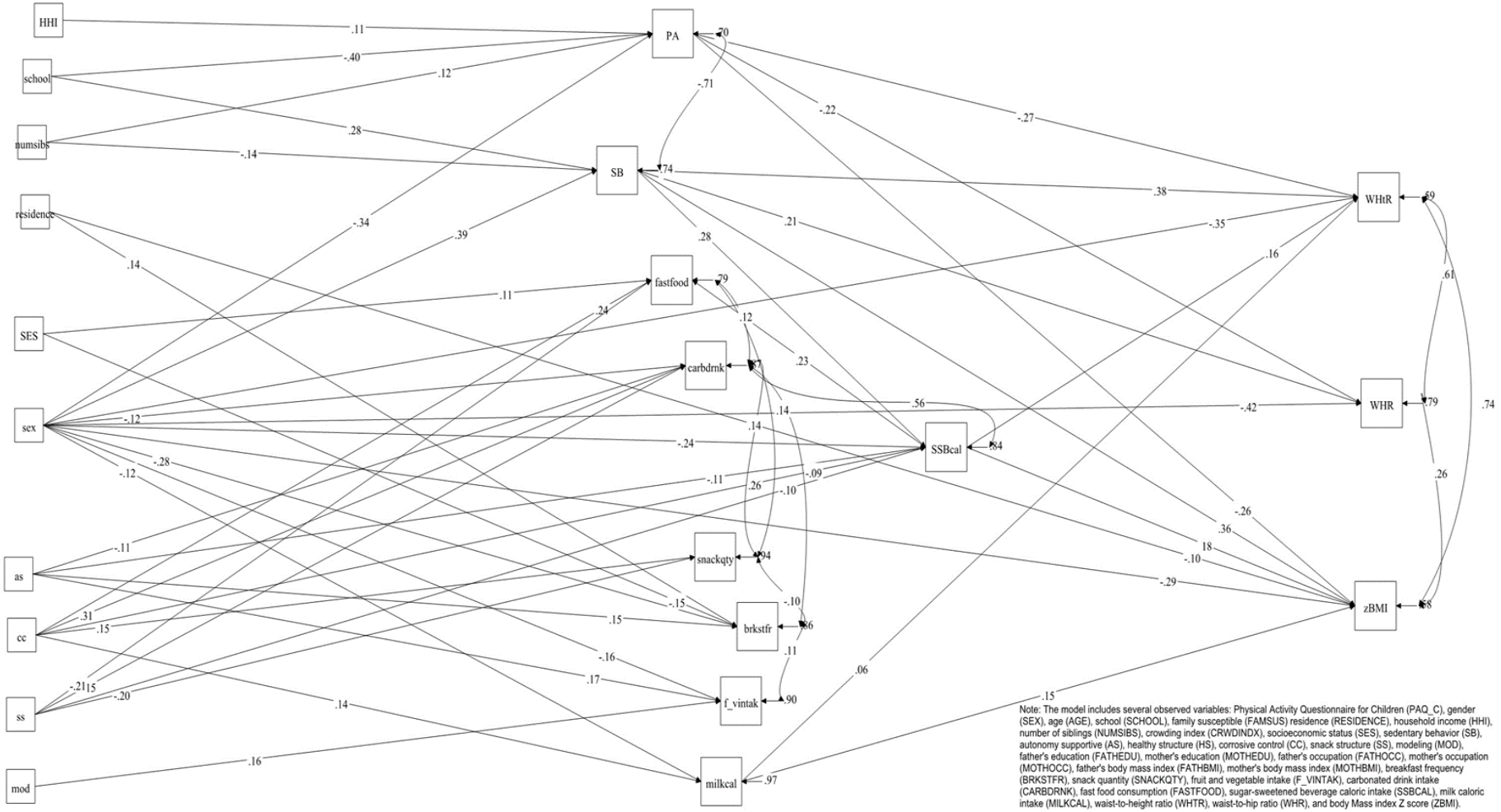


Figure of Initial Path Model (Model 1)

Note: The model includes several variables: Physical Activity Questionnaire for Children (PAQ_C), gender (SEX), age (AGE), school (SCHOOL), residence (RESIDENCE), household income (HHI), number of siblings (NUMSIBS), crowding index (CRWDINDX), socioeconomic status (SES), sedentary behavior (SB), autonomy supportive (AS), healthy structure (HS), corrosive control (CC), snack structure (SS), modeling (MOD), father's

education (FATHEDU), mother's education (MOTHEDU), father's occupation (FATHOCC), mother's occupation (MOTHOCC), father's body mass index (FATHBMI), mother's body mass index (MOTHBMI), breakfast frequency (BRKSTFR), snack quantity (SNACKQTY), fruit and vegetable intake (F_VINTAK), carbonated drink intake (CARBDRNK), fast food consumption (FASTFOOD), sugar-sweetened beverage caloric intake (SSBCAL), milk caloric intake (MILKCAL), waist-to-height ratio (WHTR), waist-to-hip ratio (WHR), and body Mass index (BAZ)

APPENDIX AA: Final Path Model (Original)



APPENDIX BB: Participant Information Sheet and Consent Form (English Version, and Arabic)

JAWATANKUASA ETIKA PENYELIDIKAN (MANUSIA) – JEPeM USM
UNIVERSITI SAINS MALAYSIA

TEMPLATE BORANG MAKLUMAT DAN KEIZINAN PESERTA
TEMPLATE OF PARTICIPANT INFORMATION SHEET AND CONSENT FORM

A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.

(RESEARCH PROJECT)

INFORMATION FORMS

AND

PARTICIPANT CONSENT FORM

PhD RESEARCH PROJECT

RESEARCH INFORMATION

Research Title: **A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.**

Phase-I Study: **To culturally translate, validate, and reliability the Beverage Intake Questionnaire (BEVQ-15) and Adolescent Food Parenting Questionnaire (AFPQ) into the Arabic language.**

Name of Main Researcher: Abbas Ali A. AL-Kinani
Name of co-Researcher: Main supervisor: Assoc. Prof. Dr. Rohana Abdul Jalil
Co-supervisor: Dr. Ruhaya Hasan
Co-supervisor: Assoc. Prof. Dr. Wan Muhamad Amir
Supervisor Filed: Assoc. Prof. Dr. Saad Abid Al-badri

INTRODUCTION

Parents play a pivotal role in shaping children's eating behaviors, food consumption, body weight, and weight gain (Loth et al., 2016; Koning et al., 2021). They act as providers, role models, and regulators within the food environment, influencing it through their food parenting practices (FPP) (Vaughn et al., 2016). FPP encompasses the strategies and actions parents use to guide their children's eating behaviors and teach them how to navigate various food-related situations (Vaughn et al., 2016). While most research on FPP focuses on younger children, its relevance during adolescence remains significant. Adolescence, a period marked by rapid physical, developmental, and social changes, is a critical time for establishing eating habits and addressing the risk of overweight and related public health concerns (Ogden et al., 2016; Koning et al., 2021).

This study aims to culturally translate and validate the Adolescent Food Parenting Questionnaire (AFPQ) and Beverage Intake Questionnaire (BEVQ-15) into Arabic for use among Iraqi adolescents aged 16 to 19 years. Additionally, it seeks to determine the construct validity and reliability of these tools in this population.

Participation in this study involves a commitment of approximately 30 minutes. The study plans to recruit up to 108 participants. If you agree to participate, you will receive a copy of this information for your records.

PURPOSE OF THE STUDY

1. To culturally translate and validate the Adolescent Food Parenting Questionnaire (AFPQ) and Beverage Intake Questionnaire (BEVQ-15) into the Arabic language among Iraqi adolescent aged 16 to 19 years old.
2. To determine the construct validity and reliability of the Adolescent Food Parenting Questionnaire (AFPQ) and Beverage Intake Questionnaire (BEVQ-15) among Iraqi adolescent aged 16 to 19 years old.

PARTICIPANTS CRITERIA

Inclusion criteria:

- Adolescents aged 16 to 19 years old at the period of study.
- Parents who permit their adolescent to participate and they themselves (parent & adolsecent) gave consent to participate in the study.
- Adolescent who living together with their parents.

Exclusion criteria:

- Adolescent who does not live together with their parents during the study period.

STUDY PROCEDURES

This study will be conducted in Iraq following institutional ethical approval and will consist of two phases. Phase I focuses on the translation and validation of the Adolescent Food Parenting Questionnaire (AFPQ) and the Beverage Intake Questionnaire (BEVQ-15). Participants will include adolescents aged 16 to 19 years and their parents from secondary schools in Wasit Province, with informed consent obtained prior to participation. The AFPQ comprises 16 items representing five domains: Autonomy Support (questions 1, 2, 5, 9), Coercive Control (questions 4, 7, 10, 14), Modeling (questions 11, 15), Healthy Structure (questions 3, 6), and Snack Structure (questions 8, 12, 13, 16). Responses are recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), and the domains are identical for both adolescents and parents. The BEVQ-15 estimates daily beverage intake in fluid ounces and calories, calculating totals based on the frequency and quantity of 15 beverage types, including sugar-sweetened beverages (SSBs). Nutritional values are derived from food composition tables, and SSB intake is determined by summing the consumption of sugary drinks like soft drinks, energy drinks, and sweetened teas. Additional socio-demographic data will be collected through Arabic-language questionnaires during face-to-face interviews conducted separately with each adolescent and parent. Participants may seek clarification on any terms or phrases during the interview.

RISKS

Participation in this study poses no risks beyond the normal daily experiences of participants. Non-invasive and non-experimental methods, including structured questionnaires and interviews, will be used. Personal identities will remain confidential throughout the study and its subsequent publication. Participant privacy will be strictly safeguarded.

PARTICIPATION IN THE STUDY

Participants will need to sign a permission form to enroll. Participation is entirely voluntary, and individuals may withdraw at any time without providing a reason. A decision to withdraw or decline participation will not affect the adolescent's right to attend school or their educational status.

POSSIBLE BENEFITS [Benefit to Individual, Community, University]

You won't be charged anything for completing the questionnaire in its entirety.The results of this experiment will probably help with existing efforts at the local, state, and international levels to better prevent and control obesity.

QUESTIONS

If you have any question about this study or your rights, please contact;

Abbas Ali A. AL-Kinani
Public Health Epidemiology
School of Medical Science
USM Health Campus
Contact No. 07714362119
Email: abbas.phn@sudent.usm.my, abbasalkinani09@gmail.com

If you have any questions regarding the Ethical Approval or any issue / problem related to this study, please contact;

Mr. Mohd Bazlan Hafidz Mukrim
Secretary of Human Research Ethics Committee USM
Division of Research & Innovation (R&I)
USM Health Campus
Tel. No. : 09-767 2354 / 09-767 2362
Email : bazlan@usm.my

OR

Miss Nor Amira Khurshid Ahmed
Secretariat of Human Research Ethics Committee USM
Research Creativity & Management Office (RCMO)
USM Main Campus, Penang
Tel. No. : 04-6536537
Email : noramira@usm.my

CONFIDENTIALITY

Your information will be kept confidential by the researchers and will not be made publicly available unless disclosure is required by law.

Data obtained from this study that does not identify you individually will be published for knowledge purposes.

Your original records may be reviewed by the researcher, the Ethical Review Board for this study, and regulatory authorities for the purpose of verifying the study procedures and/or data. Your information may be held and processed on a computer. Only research team members are authorized to access your information.

By signing this consent form, you authorize the record review, information storage and data process described above.

_____
Signature of Research Subject or Legal Representative

To be entered into the study, you or a legal representative must sign and date the signature page [ATTACHMENT S and ATTACHMENT P]

Subject Information and Consent Form
(Signature Page)

Research Title:	**A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.** **Phase-I: Translation, Validation and Reliability Questionnaires (BEVQ-15) and (AFPQ)**
Researcher's Name:	**Abbas Ali A. AL-Kinani** **Assoc. Prof. Dr. Rohana Abdul Jalil** **Dr. Ruhaya Hasan** **Assoc. Prof. Dr. Wan Muhamad Amir** **Assoc. Prof. Dr. Saad Abid Al-badri**

To become a part this study, you or your legal representative must sign this page. By signing this page, I am confirming the following:

- I have read all of the information in this Patient Information and Consent Form **including any information regarding the risk in this study** and I have had time to think about it.
- All of my questions have been answered to my satisfaction.
- I voluntarily agree to be part of this research study, to follow the study procedures, and to provide necessary information to the doctor, nurses, or other staff members, as requested.
- I may freely choose to stop being a part of this study at anytime.
- I have received a copy of this Participant Information and Consent Form to keep for myself.

Parents/Guardian Name	**Parents/guardian I/C number**
Patient's Name and I/C Number	**Parents/Guardian Signature**
Signature of Participant or Legal Representative	**Date** (dd/MM/yy)
Adolescent Name	**Adolescent Signature**
Name of Individual Conducting Consent Discussion	
Signature of Individual Conducting Consent Discussion	**Date** (dd/MM/yy)
Name & Signature of Witness	**Date** (dd/MM/yy)

Note: i) All participants who are involved in this study will not be covered by insurance.

ATTACHMENT P

Participant's Material Publication Consent Form
Signature Page

Research Title: **A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.**
Phase-I: Translation, Validation and Reliability Questionnaires (BEVQ-15) and (AFPQ)

Researcher's Name: ***Abbas Ali A. AL-Kinani***
Assoc. Prof. Dr. Rohana Abdul Jalil
Dr. Ruhaya Hasan
Assoc. Prof. Dr. Wan Muhamad Amir
Assoc. Prof. Dr. Saad Abid Al-badri

To become a part this study, you or your legal representative must sign this page.

By signing this page, I am confirming the following:

- I understood that my name will not appear on the materials published and there have been efforts to make sure that the privacy of my name is kept confidential although the confidentiality is not completely guaranteed due to unexpected circumstances.
- I have read the materials or general description of what the material contains and reviewed all photographs and figures in which I am included that could be published.
- I have been offered the opportunity to read the manuscript and to see all materials in which I am included but have waived my right to do so.
- All the published materials will be shared among the medical practitioners, scientists and journalist worldwide.
- The materials will also be used in local publications, book publications and accessed by many local and international doctors worldwide.
- I hereby agree and allow the materials to be used in other publications required by other publishers with these conditions:
- The materials will not be used as advertisement purposes nor as packaging materials.
- The materials will not be used out of contex – i.e.: Sample pictures will not be used in an article which is unrelated subject to the picture.

Parents/Guardian Name	**Parents/guardian I/C number**
Patient's Name and I/C Number	**Parents/Guardian Signature**
Signature of Participant or Legal Representative	**Date** (dd/MM/yy)
Adolescent Name	**Adolescent Signature**
Name and Signature of Individual Conducting Consent Discussion	**Date** (dd/MM/yy)

Note: i) All participants who are involved in this study will not be covered by insurance.

Information Sheet (Arabic Version)

معلومات البحث

عنوان البحث: **تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.**

المرحلة الأولى: استبيانات الترجمة والتحقق والموثوقية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني

الأستاذ المساعد الدكتورة روحانا عبد الجليل

الدكتورة رقية حسن

الأستاذ المساعد الدكتور وان محمود أمير
الأستاذ المساعد الدكتور سعد فرحان البدري

مقدمة

يؤثر الآباء بشكل كبير على كيفية تناول الأطفال ، ومقدار الطعام الذي يأكلونه ، ومقدار الوزن الذي لديهم ، ومقدار الوزن الذي يكتسبونه (لوث وآخرون ، 2016 ؛ كونينج وآخرون ، 2021). إنهم يعملون كمقدمين ونماذج يحتذى بها ومنظمين للبيئة الغذائية ويؤثرون عليها من خلال كيفية تعاملهم مع التربية الغذائية **(Vaughn et al. ، 2016 FPP) (FPP) .** هي إجراءات يتخذها الآباء حول الطعام والأكل لتعليم أطفالهم كيفية التصرف في المواقف المختلفة **(Vaughn et al. ، 2016 .(**تم إجراء معظم الدراسات حول **FPP** مع الأطفال وأولياء أمورهم. ومع ذلك ، قد يكون **FPP** ضروريًا أيضًا خلال فترة المراهقة. المراهقة هي فترة التطور والتحول السريع. تعتبر المراهقة فترة معرضة بشكل خاص لظهور زيادة الوزن ، وهي مصدر قلق شديد على الصحة العامة بسبب آثار التغيرات الجسدية والنمائية والاجتماعية على عادات الأكل والصحة التغذوية.**(Ogden et al. ، 2016؛ Koning et al.).**

المشاركة الطوعية في هذه الدراسة مطلوبة من المشاركين. يهدف هذا البحث إلى ترجمة استبيان تناول المشروبات **(BEVQ-15)**واستبيان الأبوة والأمومة الغذائية للمراهقين **(AFPQ)** والتحقق من صحته إلى اللغة العربية. علاوة على ذلك ، لمعرفة العلاقة بين ممارسات الأبوة والأمومة الغذائية للمراهقين وتناول الطعام الصحي وغير الصحي للمراهقين تجاه مؤشر كتلة الجسم للمراهقين. بالإضافة إلى تقدير نسبة استهلاك المشروبات المحلاة بالسكر بين المراهقين العراقيين في مدينة واسط.

من المهم أن تقرأ وتفهم معلومات البحث هذه قبل الموافقة على المشاركة في هذه الدراسة. ستتلقى نسخة من هذا النموذج للاحتفاظ بها في سجلاتك إذا وافقت على المشاركة.

من المتوقع أن تستغرق مشاركتك في هذه الدراسة نصف ساعة. تشير التقديرات إلى أن هذه الدراسة تشمل ما يصل إلى 108 مشاركًا.

الغرض من الدراسة

1 .الغرض من هذا للترجمة الثقافية والتحقق من صحة استبيان تناول المشروبات **(BEVQ-15)** واستبيان الوالدية الغذائية للمراهقين **(AFPQ)** إلى اللغة العربية. أيضًا لتحديد صلاحية وموثوقية النسخة العربية من استبيان تناول المشروبات **(BEVQ-15)**واستبيان الأبوة والأمومة للمراهقين.**(AFPQ)**
2. التعرف على العلاقة بين ممارسات الأبوة والأمومة الغذائية للمراهقين مع تناول طعام المراهقين الصحي وغير الصحي تجاه مؤشر كتلة الجسم للمراهقين.

معايير المشاركين

معايير الاشتمال:
•المراهقون وأولياء أمورهم الذين تتراوح أعمارهم بين 16 و 19 عامًا في فترة الدراسة

معايير الاستبعاد:
•الآباء غير القادرين على التواصل بسبب الإصابة بالمرض

إجراءات الدراسة

سيتم إجراء هذه الدراسة في العراق بعد أخذ خطاب الموافقة الأخلاقية المؤسسية. ستتم هذه الدراسة على مرحلتين. في المرحلة الأولى ، ستكون هناك ترجمة والتحقق من صحة دراسة الاستبيانات. المراهقون وأولياء أمورهم من سن 16 إلى 19 سنة في المدارس الثانوية بولاية واسط. في البداية ، سيتم أخذ الموافقة المسبقة من المشارك. احتوى استبيان وكالة فرانس

برس على 16 سؤالاً ، يمثل كل منها واحداً من المجالات الخمسة. يتكون مجال دعم الاستقلالية من أربعة أسئلة ، وهي 1 و 2 و 5 و 9. يشتمل مجال التحكم القسري أيضًا على أربعة أسئلة ، والتي كانت أسئلة 4 و 7 و 10 و 14. ويتكون مجال النمذجة من سؤالين فقط: الأسئلة 11 و 15. أيضًا ، يتكون مجال البنية الصحية من السؤالين 3 و 6 فقط. أشارت الأسئلة الأربعة المتبقية ، والتي تتضمن الأسئلة 8 و 12 و 13 و 16 ، إلى مجال بنية الوجبات الخفيفة. كما يتم توفير ملخص لجميع مجالات المراهقين ، والتي هي نفسها الخاصة بالآباء. ردا على كل سؤال ، يمكن للمستجيبين تقديم درجة من 1 (لا أوافق بشدة) إلى 5 (أوافق بشدة) على مقياس ليكرت المكون من 5 نقاط (الدرجة 5). **BEVQ-15** عبارة عن استبيان لتناول المشروبات يقدر متوسط المدخول اليومي (بالسعرات الحرارية والأوقية السائلة) لـ 15 نوعًا من المشروبات ، بالإضافة إلى العدد الإجمالي للمشروبات المحلاة بالسكر (**SSB**) والعدد الإجمالي للمشروبات **BEVQ** الجديدة -15 يحسب كمية المشروبات اليومية في أوقية السوائل بضرب عدد مشروبات المشروبات اليومية ("كم مرة") في متوسط الكمية المستهلكة في كل جلسة ("كم في كل مرة"). تم حساب جميع أنواع المشروبات المختلفة من السعرات الحرارية وعدد الجرام (لكل أونصة سائلة) باستخدام جداول مكونات الطعام. تم حساب إجمالي استهلاك **SSB** من خلال إضافة العديد من أنواع المشروبات السكرية التي يستهلكها الناس (مشروبات / مشروبات العصائر المحلاة ، المشروبات الغازية العادية ، مشروبات الطاقة والرياضات العادية ، الشاي المحلى ، و / أو مبيض القهوة). ستتم مقابلة المشاركين باستخدام استمارة جمع البيانات على البيانات الاجتماعية والديموغرافية ، نسخة استبيان باللغة العربية. سيُسمح للمشاركين بسؤال المحاور أثناء المقابلة عما إذا كان هناك أي مصطلح أو عبارة لا يمكنهم فهمها. سيتم إجراء المقابلة وجهًا لوجه لكل من الوالدين والمراهق على حدة.

المخاطر

لن يتسبب كل ما سبق في أي ألم أو إزعاج أو تجارب عكسية تتجاوز ما قد تتعرض له أثناء إجراء جمع الدم المعتاد.

المشاركة في الدراسة

ستحتاج إلى توقيع نموذج إذن إذا قبلت المشاركة في الدراسة. ومع ذلك ، يمكنك الانسحاب في أي لحظة ودون إبداء أسباب. لن يتأثر حق ابنك المراهق في التسجيل في هذه المدرسة بقرار الانسحاب أو اختيار عدم المشاركة في أي وقت.

الفوائد المحتملة

لن يتم تحصيل أي رسوم منك مقابل إكمال الاستبيان بالكامل ، ومن المحتمل أن تساعد نتائج هذه التجربة في الجهود الحالية على المستوى المحلي ومستوى الولاية والمستوى الدولي لتحسين الوقاية من السمنة ومكافحتها.

أسئلة

إذا كان لديك أي سؤال حول هذه الدراسة أو حقوقك ، يرجى الاتصال ؛

عباس علي عبدالحسن الكناني
وبائيات الصحة العامة
كلية العلوم الطبية
الحرم الصحي/ جامعة العلوم ماليزيا
>رقم الاتصال 07714362119
البريد الإلكتروني : abbasalkinani09@gmail.com & abbas.phn@sudent.usm.my

إذا كان لديك أي أسئلة بخصوص الموافقة الأخلاقية أو أي قضية / مشكلة تتعلق بهذه الدراسة ، يرجى الاتصال ؛

السيد محمد بزلان حافظ مكريم
سكرتير لجنة أخلاقيات البحث البشريUSM
قسم البحث والابتكار(R&I)
الحرم الجامعي الصحي USM
رقم الهاتف : 09-767 2354 / 09-767 2362
البريد الإلكتروني: bazlan@usm.my
أو

الأنسة ولا أميرة خورشيد أحمد
سكرتارية لجنة أخلاقيات البحث البشري USM
مكتب الإبداع البحثي والإدارة(RCMO)
الحرم الجامعي الرئيسي USM ، بينانغ
رقم الهاتف: 04-6536537
بريد إلكتروني: noramira@usm.my

سرية

سيتمكن محققو الدراسة فقط من الوصول إلى السجلات ، والمحقق الرئيسي هو المسؤول عن الحفاظ على السرية التامة لأي معلومات يتم جمعها عنك وعن مشاركك البالغ أثناء عملية البحث. أي شيء يمكن استخدامه لتحديد هويتك ، مع حذف اسمك وعنوانك.

عينة / تخزين البيانات وسحبها من الدراسة

سيتم تخزين أي عينات دم أو أنسجة تم الحصول عليها خلال هذه الدراسة وتحليلها فقط لأغراض هذه الدراسة لفترة لا تتجاوز 3 سنوات وسيتم تدميرها بعد الانتهاء من الدراسة .ومع ذلك ، إذا وافقت على السماح لنا بالاحتفاظ بعينات الأنسجة أو الدم للدراسات المستقبلية بعد اكتمال هذا المشروع ، فسيُطلب منك التوقيع في الجزء المناسب من نموذج الموافقة أدناه .سيتم تدمير العينة البيولوجية الخاصة بك وسيتم حذف بياناتك عندما تسحب من الدراسة .

توقيع ولي الامر أو الممثل القانوني _____.

التوقيعات

للاشتراك في الدراسة ، يجب عليك أنت أو الممثل القانوني التوقيع على صفحة التوقيع وتاريخها.

[ATTACHMENT S and ATTACHMENT P]

معلومات الموضوع واستمارة الموافقة
(صفحة التوقيع)

عنوان البحث: الخبرة تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.

المرحلة الأولى: استبيانات الترجمة والتحقق والموثوقية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني
الأستاذ المساعد الدكتورة روحانا عبد الجليل
الدكتورة رقية حسن
الأستاذ المساعد الدكتور وان محمود أمير
الأستاذ المساعد الدكتور سعد فرحان البدري

لكي تصبح جزءا من هذه الدراسة ، يجب عليك أنت أو ممثلك القانوني التوقيع على هذه الصفحة.
بتوقيعي على هذه الصفحة ، أؤكد ما يلي:

- لقد قرأت جميع المعلومات الواردة في نموذج الموافقة ومعلومات المريض بما في ذلك أي معلومات تتعلق بالمخاطر في هذه الدراسة وكان لدي الوقت للتفكير في الأمر.
- تمت الإجابة على جميع أسئلتي بما يرضي.
- أوافق طواعية على أن أكون جزءا من هذه الدراسة البحثية ، وأن أتبع إجراءات الدراسة ، وأن أقدم المعلومات اللازمة للطبيب ، أو الممرضات ، أو غيرهم من الموظفين ، حسب الطلب.
- قد أختار بحرية التوقف عن المشاركة في هذه الدراسة في أي وقت.
- لقد تلقيت نسخة من معلومات المشارك واستمارة الموافقة لأحتفظ بها لنفسي.

اسم ولي الامر او الابوين	**رقم هوية ولي الامر او الابوي**
توقيع المشارك أو الممثل القانوني	**التاريخ (يوم / شهر / سنة)**
اسم المراهق	**توقيع المراهق**
توقيع الفرد إجراء مناقشة الموافقة	**التاريخ (اليوم / الشهر / السنة)**
اسم وتوقيع الشاهد	**التاريخ (يوم / شهر / سنة)**

.ملاحظة: 1) لن يغطي التأمين جميع المشاركين الذين يشاركون في هذه الدراسة

نموذج الموافقة على النشر المادي للمشارك
صفحة التوقيع

عنوان البحث: تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.

الأولى دراسة: دراسة مقطعية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني
اسم الباحث المشارك: الأستاذ المساعد الدكتورة روحانا عبد الجليل
الدكتورة رقية حسن
الأستاذ المساعد الدكتور وان محمود أمير

لكي تصبح جزءا من هذه الدراسة ، يجب عليك أنت أو ممثلك القانوني التوقيع على هذه الصفحة:
بتوقيعي على هذه الصفحة ، أؤكد ما يلي

- لقد فهمت أن اسمي لن يظهر على المواد المنشورة وكانت هناك جهود للتأكد من الحفاظ على سرية خصوصية اسمي على الرغم من أن السرية ليست مضمونة تمامًا بسبب ظروف غير متوقعة.
- لقد قرأت المواد أو الوصف العام لما تحتويه المادة وراجعت جميع الصور والأشكال التي تضمنتها والتي يمكن نشرها.
- لقد أتيحت لي الفرصة لقراءة المخطوطة والاطلاع على جميع المواد التي تم تضمينها فيها ولكني تنازلت عن حقي في القيام بذلك.
- سيتم مشاركة جميع المواد المنشورة بين الممارسين الطبيين والعلماء والصحفيين في جميع أنحاء العالم.
- سيتم استخدام المواد أيضًا في المطبوعات المحلية ومنشورات الكتب ويمكن الوصول إليها من قبل العديد من الأطباء المحليين والدوليين في جميع أنحاء العالم.
- أوافق بموجب هذا وأسمح باستخدام المواد في المنشورات الأخرى التي يطلبها الناشرون الآخرون وفقًا للشروط التالية:
- لن يتم استخدام المواد كأغراض إعلانية ولا كمواد تغليف.
- لن يتم استخدام المواد خارج النطاق - على سبيل المثال: لن يتم استخدام عينات من الصور في مقالة لا علاقة لها بالموضوع بالصورة.

اسم ولي الامر او الابوين	**رقم هوية ولي الامر او الابوي**
توقيع المشارك أو الممثل القانوني	**التاريخ (يوم / شهر / سنة)**
اسم المراهق	**توقيع المراهق**
توقيع الفرد **إجراء مناقشة الموافقة**	**التاريخ (اليوم / الشهر / السنة)**

.ملاحظة: 1) لن يغطي التأمين جميع المشاركين الذين يشاركون في هذه الدراسة

RESEARCH INFORMATION

Research Title: **A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.**

Phase-II Study: **A cross sectional study**

Name of Main Researcher: Abbas Ali A. AL-Kinani
Name of co-Researcher: Main supervisor: Assoc. Prof. Dr. Rohana Abdul Jalil
Co-supervisor: Dr. Ruhaya Hasan
Co-supervisor: Assoc. Prof. Dr. Wan Muhamad Amir
Supervisor Filed: Assoc. Prof. Dr. Saad Abid Al-badri

INTRODUCTION

Globally, the prevalence of overweight and obesity has nearly tripled over the past four decades, making them among the most pressing public health challenges of the 21st century (WHO, 2022c). Non-communicable diseases (NCDs), often linked to obesity, account for 74% of global deaths annually, or 41 million people (CDC, 2021). Obesity, one of the primary metabolic risk factors, contributes to NCDs through metabolic changes and is classified as a form of overnutrition, encompassing excessive nutrient intake, nutrient imbalances, and poor nutrient utilization (Haron, 2020; WHO, 2021c). In Western Asia, including Iraq, obesity affects 39.5% of women and 27.2% of men, with rates among Iraqi children and adolescents rising to 32% in 2019 (Global Nutrition Reports, 2022a). Predictions indicate that two in ten Iraqi children aged 10–19 may be obese by 2030, highlighting an urgent need for interventions (World Obesity Federation, 2019).

Obesity is influenced by numerous factors, including dietary patterns, physical activity levels, and social determinants of health (CDC, 2022b). Among adolescents, additional contributors include high blood pressure (Dong et al., 2019), hyperglycemia (AlZaabi, 2018), and dyslipidemia (Jung & Yoo, 2018), which increase the risk of cardiovascular disease (WHO, 2008). In Iraq, obesity among adults also exceeds regional averages, with 40.1% of women and 26.5% of men affected, alongside rising diabetes rates of approximately 20% in both genders (Global Nutrition Reports, 2022a). Given these trends, addressing adolescent obesity in Iraq requires urgent action at the policy level, focusing on risk factors and tailored interventions.

This study aims to develop a model of obesity risk among Iraqi adolescents based on parental food behaviors, adolescent dietary habits, sugar-sweetened beverage consumption, physical activity levels, and sociodemographic factors, incorporating biochemical testing to assess obesity risks. Additionally, the study seeks to determine the prevalence of obesity among adolescents in Wasit City.

Participation is voluntary, with the study estimated to involve 387 participants. Each participant will be asked to commit approximately 30 minutes, and a copy of this information will be provided for their records upon agreement to participate.

PURPOSE OF THE STUDY

1. To determine the proportion of obesity among Iraqi adolescents aged 16 to 19 years old in Wasit, Iraq
2. To determine the path association between sociodemographic characteristics, food parenting practices (FPP), dietary behavior, consumption of sugar-sweetened beverages (SSBs), and level of physical activity and sedentary Behavior with the risk of obesity among Iraqi adolescents.
3. To develop and validate conceptual framework (models) of the risk of obesity among Iraqi adolescents based on sociodemographic characteristics, food parenting practices (FPP), dietary behavior, consumption of sugar-sweetened beverages (SSBs), and level of physical activity and sedentary Behavior that attribute to both anthropometric and biochemical parameters toward the risk of obesity among adolescent aged 16 to 19 years old in Wasit, Iraq.

PARTICIPANTS CRITERIA

Inclusion criteria:

- Adolescents aged 16 to 19 years old at the period of study
- Parents who permit their adolescent to participate and they themselves (parents and adolescent) gave consent to participate in the study.
- Adolescent who living together with their parents.

Exclusion criteria:

- Parents who do not consent for their adolescents to participate in this study.
- Adolescent who do not live together with their parents during the study period.
- Female adolescent who are pregnant during the study period.

STUDY PROCEDURES

This study will be conducted at Iraq after taking the institutional ethical approval letter. This study will be done in two phases. In Phase-II, cross sectional study will be done by using a path analysis model to asses the risk of obesity among Iraqi adolescents. Subjects of age 16 - 19 years who have already been recruited in phase–I will be invited to participate in phase-II study. The interview will be conducted face-to-face with each parent and adolescent separately. It will take approximately one hour to complete the interview, but subjects can finish it at any time; they will not be forced to complete it. The participants will have an excellent opportunity to undergo thorough anthropometric measurements and blood pressure measurements. The first questionnaire is for parents, while the second is for adolescents. Blood work will be done to determine an adolescent's lipid levels, blood sugar levels, and insulin resistance.

RISKS

Everything mentioned above won't make you feel any worse than you already do. Non-experimental research methods were used here, including a structured questionnaire and interview. There were invasive techniques applied in this study. Participating in this study carries minimum risk, and neither the process of conducting it nor the publication of the results will involve any kind of disclosure of your identity. We respect your privacy and won't share anything with anyone.

REPORTING HEALTH EXPERIENCES.

Please contact, at any time, the following researcher if you experience any health problem either directly or indirectly related to this study.

Abbas Ali A. AL-Kinani at +9647714362119

PARTICIPATION IN THE STUDY

A permission form will need to be signed if you accept to take part in the study. You may, however, withdraw at any moment and without providing a reason. Your adolescent's right to enroll in this school will not be impacted by a decision to withdraw or choose not to participate at any point.

POSSIBLE BENEFITS [Benefit to Individual, Community, University]

You won't be charged anything for completing the questionnaire in its entirety.The results of this experiment will probably help with existing efforts at the local, state, and international levels to better prevent and control obesity.

QUESTIONS

If you have any question about this study or your rights, please contact;

Abbas Ali A. AL-Kinani
Public Health Epidemiology
School of Medical Science
USM Health Campus

If you have any questions regarding the Ethical Approval or any issue / problem related to this study, please contact;

Mr. Mohd Bazlan Hafidz Mukrim
Secretary of Human Research Ethics Committee USM
Division of Research & Innovation (R&I)
USM Health Campus

OR

Miss Nor Amira Khurshid Ahmed
Secretariat of Human Research Ethics Committee USM
Research Creativity & Management Office (RCMO)
USM Main Campus, Penang

CONFIDENTIALITY

Your information will be kept confidential by the researchers and will not be made publicly available unless disclosure is required by law.

Data obtained from this study that does not identify you individually will be published for knowledge purposes.

Your original records may be reviewed by the researcher, the Ethical Review Board for this study, and regulatory authorities for the purpose of verifying the study procedures and/or data. Your information may be held and processed on a computer. Only research team members are authorized to access your information.

By signing this consent form, you authorize the record review, information storage and data process described above.

_____
Signature of Research Subject or Legal Representative

To be entered into the study, you or a legal representative must sign and date the signature page [ATTACHMENT S, ATTACHMENT G and ATTACHMENT P]

Subject Information and Consent Form (Signature Page)

Research Title: **A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents. Phase-II: A cross sectional study**

Researcher's Name: **Abbas Ali A. AL-Kinani**
Assoc. Prof. Dr. Rohana Abdul Jalil
Dr. Ruhaya Hasan
Assoc. Prof. Dr. Wan Muhamad Amir
Assoc. Prof. Dr. Saad Abid Al-badri

To become a part this study, you or your legal representative must sign this page. By signing this page, I am confirming the following:

- I have read all of the information in this Patient Information and Consent Form **including any information regarding the risk in this study** and I have had time to think about it.
- All of my questions have been answered to my satisfaction.
- I voluntarily agree to be part of this research study, to follow the study procedures, and to provide necessary information to the doctor, nurses, or other staff members, as requested.
- I may freely choose to stop being a part of this study at anytime.
- I have received a copy of this Participant Information and Consent Form to keep for myself.

Parents/Guardian Name	**Parents/guardian I/C number**
Patient's Name and I/C Number	**Parents/Guardian Signature**
Signature of Participant or Legal Representative	**Date** (dd/MM/yy)
Adolescent Name	**Adolescent Signature**
Name of Individual Conducting Consent Discussion	
Signature of Individual Conducting Consent Discussion	**Date** (dd/MM/yy)
Name & Signature of Witness	**Date** (dd/MM/yy)

Note: i) All participants who are involved in this study will not be covered by insurance.

Participant's Material Publication Consent Form
Signature Page

Research Title: **A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.**
Phase-II: A cross sectional study

Researcher's Name: ***Abbas Ali A. AL-Kinani***
Assoc. Prof. Dr. Rohana Abdul Jalil
Dr. Ruhaya Hasan
Assoc. Prof. Dr. Wan Muhamad Amir
Assoc. Prof. Dr. Saad Abid Al-badri

To become a part this study, you or your legal representative must sign this page.

By signing this page, I am confirming the following:

- I understood that my name will not appear on the materials published and there have been efforts to make sure that the privacy of my name is kept confidential although the confidentiality is not completely guaranteed due to unexpected circumstances
.
- I have read the materials or general description of what the material contains and reviewed all photographs and figures in which I am included that could be published.
- I have been offered the opportunity to read the manuscript and to see all materials in which I am included but have waived my right to do so.
- All the published materials will be shared among the medical practitioners, scientists and journalist worldwide.
- The materials will also be used in local publications, book publications and accessed by many local and international doctors worldwide.
- I hereby agree and allow the materials to be used in other publications required by other publishers with these conditions:
- The materials will not be used as advertisement purposes nor as packaging materials.
- The materials will not be used out of contex – i.e.: Sample pictures will not be used in an article which is unrelated subject to the picture.

Parents/Guardian Name	**Parents/guardian I/C number**
Patient's Name and I/C Number	**Parents/Guardian Signature**
Signature of Participant or Legal Representative	**Date** (dd/MM/yy)
Adolescent Name	**Adolescent Signature**
Name and Signature of Individual Conducting Consent Discussion	**Date** (dd/MM/yy)

Note: i) All participants who are involved in this study will not be covered by insurance.

ATTACHMENT G

Subject Information and Consent Form
(Signature Page – Genetic Sample)

Research Title: **A Path Analysis of The Food Parenting Practices (FPP), Dietary Behaviour, Sugar-Sweetened Beverages Intake (SSBs) and Physical Activity Towards Anthropometric and Biomarkers Profile on Risk of Obesity Among Iraqi Adolescents.**
Phase-II: A cross sectional study

Researcher's Name: ***Abbas Ali A. AL-Kinani***
Assoc. Prof. Dr. Rohana Abdul Jalil
Dr. Ruhaya Hasan
Assoc. Prof. Dr. Wan Muhamad Amir
Assoc. Prof. Dr. Saad Abid Al-badri

To become a part this study, you or your legal representative must sign this page. By signing this page, I am confirming the following:

- I have read all of the information in this Patient Information and Consent Form **including any information regarding the risk in this study** and I have had time to think about it.
- All of my questions have been answered to my satisfaction.
- I voluntarily agree to be part of this research study, to follow the study procedures, and to provide necessary information to the doctor, nurses, or other staff members, as requested.
- I may freely choose to stop being a part of this study at anytime.
- I have received a copy of this Participant Information and Consent Form to keep for myself.

Parents/Guardian Name	**Parents/guardian I/C number**
Patient's Name and I/C Number	**Parents/Guardian Signature**
Signature of Participant or Legal Representative	**Date** (dd/MM/yy)
Adolescent Name	**Adolescent Signature**
Name of Individual Conducting Consent Discussion	
Signature of Individual Conducting Consent Discussion	**Date** (dd/MM/yy)
Name & Signature of Witness	**Date** (dd/MM/yy)

Note: i) All participants who are involved in this study will not be covered by insurance.
ii) Excess samples from this research will not be used for other reasons and will be destroyed with the consent from the Human Research Ethics Committee, USM.

Information Sheet (Arabic Version)

معلومات البحث

عنوان البحث: **تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.**

المرحلة الثانية :دراسة مقطعية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني

الأستاذ المساعد الدكتورة روحانا عبد الجليل

الدكتورة رقية حسن

الأستاذ المساعد الدكتور وان محمود أمير
الأستاذ المساعد الدكتور سعد فرحان البدري

مقدمة

تضاعف الوزن الزائد والسمنة ثلاث مرات تقريبًا على مستوى العالم في العقود الأربعة الماضية ، مما يجعلهما أحد أكثر تحديات الصحة العامة الخطيرة التي لم يتم حلها في القرن الحادي والعشرين (منظمة الصحة العالمية ، 2022 ج). بالإضافة إلى ذلك ، تقتل الأمراض غير المعدية 41 مليون شخص سنويًا ، وهو ما يمثل 74٪ من جميع الوفيات في جميع أنحاء العالم **(CDC**، 2021 **.(**تعد زيادة الوزن أو السمنة من بين عوامل الخطر الأيضية الأربعة الأكثر أهمية ، والتي تساهم في التغيرات الأيضية التي تزيد من خطر الإصابة بالأمراض غير المعدية (منظمة الصحة العالمية ، 2022 هـ). زيادة الوزن والسمنة هي أنواع الإفراط في التغذية التي تؤثر على الأطفال والمراهقين. وتنقسم هذه إلى سوء التغذية ، والأمراض ، والإفراط في تناول المغذيات ، وعدم توازن العناصر الغذائية الأساسية ، وسوء استخدام المغذيات**Haron)** ، 2020؛ **WHO**، 2021 **.(a**يعاني السكان البالغون في منطقة غرب آسيا الفرعية أيضًا من سوء التغذية: فمتوسط 39.5٪ من النساء و 27.2٪ من الرجال يعانون من السمنة**Global Nutrition Reports)** ، 2022 **.(c**وفي الوقت نفسه ، كان معدل انتشار السمنة قريبًا من 32٪ بين الأطفال والمراهقين في العراق في عام 2019 ، وهي آخذة في الازدياد **(Global Nutrition Reports**، 2022 **.(c**السمنة مرض معقد عندما يزن الشخص أكثر مما هو صحي بالنسبة لطوله. تؤثر السمنة على البالغين والأطفال بطرق مختلفة. يمكن أن تساهم عدة عوامل في زيادة وزن الجسم ، مثل أنماط الأكل ومستويات النشاط البدني والمحددات الاجتماعية للصحة **CDC)** ، 2022 **.(**أيضًا ، هناك العديد من العوامل الأخرى التي تساهم في زيادة وزن المراهقين ، مثل ارتفاع ضغط الدم **.Dong et al)** ، 2019 **(**، وارتفاع السكر في الدم **AlZaabi)** ، 2018 **(** ، وخلل شحميات الدم **Jung & Yoo)** ، 2018 **(**، مما يزيد من مخاطر الإصابة بأمراض القلب والأوعية الدموية (منظمة الصحة العالمية ، 2008). ومع ذلك ، في العراق ، وهو بلد نام ، لا تزال السمنة مشكلة كبيرة في الصحة العامة (تقارير التغذية العالمية ، 2022 أ). تعد زيادة الوزن والسمنة من أكثر أشكال سوء التغذية انتشارًا بين المراهقين في العراق مقارنة بالنحافة (وزارة الصحة ووزارة المالية ومنظمة الصحة العالمية ، 2015 ؛ تقارير التغذية العالمية ، 2022 أ). وفقًا للاتحاد العالمي للسمنة ، سيكون طفلان من كل عشرة أطفال تتراوح أعمارهم بين 10 و 19 عامًا مصابين بالسمنة في عام 2030 (الاتحاد العالمي للسمنة ، 2019). لم يحرز العراق الكثير من التقدم نحو أهدافه المتعلقة بالأمراض غير المعدية المتعلقة بالنظام الغذائي. لم تحرز الدولة أي تقدم تجاه السمنة ، وتشير التقديرات إلى أن 40.1٪ من النساء البالغات و 26.5٪ من الرجال البالغين (18 عامًا فأكثر) يعانون من السمنة. في حين بلغت نسبة السمنة 15.7٪ بين الأطفال والمراهقين. إن عدد البدناء في العراق أعلى من متوسط المنطقة وهو 10.3٪ للنساء و 7.5٪ للرجال. في الوقت نفسه ، يعتقد حوالي 20.2٪ من النساء البالغات و 20.3٪ من الرجال البالغين مصابون بمرض السكري (تقارير التغذية العالمية ، 2022 أ). لذلك ، لا بد من اتخاذ إجراءات سريعة لمعالجة هذه المشكلة على مستويات صنع السياسات والتنفيذ من خلال التحديد المناسب لعوامل الخطر التي تسبب السمنة لدى المراهقين.

المشاركون مدعوون للمشاركة طواعية في هذا البحث. يعمل هذا البحث على تطوير نموذج لخطر السمنة بين المراهقين العراقيين بناءً على السلوك الغذائي للوالدين المراهقين ، والسلوك الغذائي للمراهقين ، واستهلاك المشروبات المحلاة بالسكر ، ومستوى النشاط البدني ، والخصائص الاجتماعية الديموغرافية التي تنسب الاختبار الكيميائي الحيوي إلى خطر السمنة. . .. علاوة على تحديد نسبة السمنة بين المراهقين العراقيين في مدينة واسط.

من المهم أن تقرأ وتفهم معلومات البحث هذه قبل الموافقة على المشاركة في هذه الدراسة. ستتلقى نسخة من هذا النموذج للاحتفاظ بسجلاتك إذا وافقت على المشاركة.

من المتوقع أن تستغرق مشاركتك في هذه الدراسة 30 دقيقة. تشير التقديرات إلى أن هذه الدراسة تشمل ما يصل إلى 387 مشاركًا.

الغرض من الدراسة

1 .تحديد نسبة السمنة بين المراهقين العراقيين في مدينة واسط.
2 .لتحديد ارتباط المسار بين السلوك الغذائي الأبوي للمراهقين ، والسلوك الغذائي للمراهقين ، واستهلاك المشروبات المحلاة بالسكر ، ومستوى النشاط البدني ، والخصائص الاجتماعية والديموغرافية مع خطر السمنة بين المراهقين العراقيين.

3 - تطوير نموذج لخطر السمنة بين المراهقين العراقيين على أساس السلوك الغذائي للوالدين المراهقين ، والسلوك الغذائي للمراهقين ، واستهلاك المشروبات المحلاة بالسكر ، ومستوى النشاط البدني ، والخصائص الاجتماعية الديموغرافية التي تنسب الاختبار الكيميائي الحيوي إلى خطر السمنة.
4. التعرف على العلاقة بين ممارسات الأبوة والأمومة الغذائية للمراهقين مع تناول طعام المراهقين الصحي وغير الصحي تجاه مؤشر كتلة الجسم للمراهقين.

معايير المشاركين

معايير الاشتمال:
•المراهقون وأولياء أمورهم الذين تتراوح أعمارهم بين 16 و 19 عامًا في فترة الدراسة

معايير الاستبعاد:
- الآباء غير القادرين على التواصل بسبب الإصابة بالمرض
- الآباء الذين لا يوافقون على مشاركة أبنائهم المراهقين في هذه الدراسة.
- المراهقون المتسربون من المدرسة.
- المراهقة الحامل.

إجراءات الدراسة

سيتم إجراء هذه الدراسة في العراق بعد أخذ خطاب الموافقة الأخلاقية المؤسسية. ستتم هذه الدراسة على مرحلتين. في المرحلة الثانية ، سيتم إجراء دراسة مقطعية باستخدام نموذج تحليل المسار لتقييم مخاطر السمنة بين المراهقين العراقيين. الأشخاص الذين تتراوح أعمارهم بين 15 و 19 عامًا والذين تم تعيينهم بالفعل في المرحلة الأولى - ستتم دعوتهم للمشاركة في دراسة المرحلة الثانية. سيتم إجراء المقابلة وجهًا لوجه مع كل والد ومراهق على حدة. سيستغرق إكمال المقابلة حوالي ساعة ، ولكن يمكن للموضوعات إنهاءها في أي وقت ؛ لن يجبروا على إكماله. ستتاح للمشاركين فرصة ممتازة للخضوع لقياسات أنثروبومترية شاملة وقياسات ضغط الدم. الاستبيان الأول للآباء والثاني للمراهقين. سيتم عمل الدم لتحديد مستويات الدهون لدى المراهق ومستويات السكر في الدم ومقاومة الأنسولين.

المخاطر

لن يتسبب كل ما سبق في أي ألم أو إزعاج أو تجارب عكسية تتجاوز ما قد تتعرض له أثناء إجراء جمع الدم المعتاد.

المشاركة في الدراسة

ستحتاج إلى توقيع نموذج إذن إذا قبلت المشاركة في الدراسة. ومع ذلك ، يمكنك الانسحاب في أي لحظة ودون إبداء أسباب. لن يتأثر حق ابنك المراهق في التسجيل في هذه المدرسة بقرار الانسحاب أو اختيار عدم المشاركة في أي وقت.

الفوائد المحتملة

لن يتم تحصيل أي رسوم منك مقابل إكمال الاستبيان بالكامل ، ومن المحتمل أن تساعد نتائج هذه التجربة في الجهود الحالية على المستوى المحلي ومستوى الولاية والمستوى الدولي لتحسين الوقاية من السمنة ومكافحتها.

أسئلة

إذا كان لديك أي سؤال حول هذه الدراسة أو حقوقك ، يرجى الاتصال ؛

عباس علي عبدالحسن الكناني
وبائيات الصحة العامة
كلية العلوم الطبية
الحرم الصحي/ جامعة العلوم ماليزيا
>رقم الاتصال 07714362119
البريد الإلكتروني : abbasalkinani09@gmail.com & abbas.phn@sudent.usm.my

إذا كان لديك أي أسئلة بخصوص الموافقة الأخلاقية أو أي قضية / مشكلة تتعلق بهذه الدراسة ، يرجى الاتصال ؛

السيد محمد بزلان حافظ مكريم
سكرتير لجنة أخلاقيات البحث البشريUSM
قسم البحث والابتكار(R&I)
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أو

الأنسة ولا أميرة خورشيد أحمد
سكرتارية لجنة أخلاقيات البحث البشري USM
مكتب الإبداع البحثي والإدارة(RCMO)
الحرم الجامعي الرئيسي USM ، بينانغ
رقم الهاتف: 04-6536537
بريد إلكتروني: noramira@usm.my

سرية

سيتمكن محققو الدراسة فقط من الوصول إلى السجلات ، والمحقق الرئيسي هو المسؤول عن الحفاظ على السرية التامة لأي معلومات يتم جمعها عنك وعن مشاركك البالغ أثناء عملية البحث. أي شيء يمكن استخدامه لتحديد هويتك ، مع حذف اسمك وعنوانك.

عينة / تخزين البيانات وسحبها من الدراسة

سيتم تخزين أي عينات دم أو أنسجة تم الحصول عليها خلال هذه الدراسة وتحليلها فقط لأغراض هذه الدراسة لفترة لا تتجاوز 3 سنوات وسيتم تدميرها بعد الانتهاء من الدراسة .ومع ذلك ، إذا وافقت على السماح لنا بالاحتفاظ بعينات الأنسجة أو الدم للدراسات المستقبلية بعد اكتمال هذا المشروع ، فسيُطلب منك التوقيع في الجزء المناسب من نموذج الموافقة أدناه .سيتم تدمير العينة البيولوجية الخاصة بك وسيتم حذف بياناتك عندما تسحب من الدراسة .

توقيع ولي الامر أو الممثل القانوني _____.

التوقيعات

للاشتراك في الدراسة ، يجب عليك أنت أو الممثل القانوني التوقيع على صفحة التوقيع وتاريخها.

[ATTACHMENT S and ATTACHMENT P and ATTACHMENT G]

معلومات الموضوع واستمارة الموافقة
(صفحة التوقيع)

عنوان البحث: الخبرة تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.

المرحلة الثانية: دراسة مقطعية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني
الأستاذ المساعد الدكتورة روحانا عبد الجليل
الدكتورة رقية حسن
الأستاذ المساعد الدكتور وان محمود أمير
الأستاذ المساعد الدكتور سعد فرحان البدري

لكي تصبح جزءا من هذه الدراسة ، يجب عليك أنت أو ممثلك القانوني التوقيع على هذه الصفحة.
بتوقيعي على هذه الصفحة ، أؤكد ما يلي:

- لقد قرأت جميع المعلومات الواردة في نموذج الموافقة ومعلومات المريض بما في ذلك أي معلومات تتعلق بالمخاطر في هذه الدراسة وكان لدي الوقت للتفكير في الأمر.
- تمت الإجابة على جميع أسئلتي بما يرضي.
- أوافق طواعية على أن أكون جزءا من هذه الدراسة البحثية ، وأن أتبع إجراءات الدراسة ، وأن أقدم المعلومات اللازمة للطبيب ، أو الممرضات ، أو غيرهم من الموظفين ، حسب الطلب.
- قد أختار بحرية التوقف عن المشاركة في هذه الدراسة في أي وقت.
- لقد تلقيت نسخة من معلومات المشارك واستمارة الموافقة لأحتفظ بها لنفسي.

اسم ولي الامر او الابوين	**رقم هوية ولي الامر او الابوي**
توقيع المشارك أو الممثل القانوني	**التاريخ (يوم / شهر / سنة)**
اسم المراهق	**توقيع المراهق**
توقيع الفرد إجراء مناقشة الموافقة	**التاريخ (اليوم / الشهر / السنة)**
اسم وتوقيع الشاهد	**التاريخ (يوم / شهر / سنة)**

.ملاحظة: 1) لن يغطي التأمين جميع المشاركين الذين يشاركون في هذه الدراسة

ATTACHMENT P الموافقة ص

نموذج الموافقة على النشر المادي للمشارك
صفحة التوقيع

عنوان البحث: تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.

المرحلة الثانية: دراسة مقطعية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني
اسم الباحث المشارك: الأستاذ المساعد الدكتورة روحانا عبد الجليل
الدكتورة رقية حسن
الأستاذ المساعد الدكتور وان محمود أمير
الأستاذ المساعد الدكتور سعد فرحان البدري

لكي تصبح جزءا من هذه الدراسة ، يجب عليك أنت أو ممثلك القانوني التوقيع على هذه الصفحة:
بتوقيعي على هذه الصفحة ، أؤكد ما يلي

- لقد فهمت أن اسمي لن يظهر على المواد المنشورة وكانت هناك جهود للتأكد من الحفاظ على سرية خصوصية اسمي على الرغم من أن السرية ليست مضمونة تمامًا بسبب ظروف غير متوقعة.
- لقد قرأت المواد أو الوصف العام لما تحتويه المادة وراجعت جميع الصور والأشكال التي تضمنتها والتي يمكن نشرها.
- لقد أتيحت لي الفرصة لقراءة المخطوطة والاطلاع على جميع المواد التي تم تضمينها فيها ولكني تنازلت عن حقي في القيام بذلك.
- سيتم مشاركة جميع المواد المنشورة بين الممارسين الطبيين والعلماء والصحفيين في جميع أنحاء العالم.
- سيتم استخدام المواد أيضًا في المطبوعات المحلية ومنشورات الكتب ويمكن الوصول إليها من قبل العديد من الأطباء المحليين والدوليين في جميع أنحاء العالم.
- أوافق بموجب هذا وأسمح باستخدام المواد في المنشورات الأخرى التي يطلبها الناشرون الآخرون وفقًا للشروط التالية:
- لن يتم استخدام المواد كأغراض إعلانية ولا كمواد تغليف.
- لن يتم استخدام المواد خارج النطاق - على سبيل المثال: لن يتم استخدام عينات من الصور في مقالة لا علاقة لها بالموضوع بالصورة.

اسم ولي الامر او الابوين _____ **رقم هوية ولي الامر او الابوي** _____

توقيع المشارك أو الممثل القانوني _____ **التاريخ (يوم / شهر / سنة)** _____

اسم المراهق _____ **توقيع المراهق** _____

توقيع الفرد
إجراء مناقشة الموافقة _____ **التاريخ (اليوم / الشهر / السنة)** _____

.ملاحظة: 1) لن يغطي التأمين جميع المشاركين الذين يشاركون في هذه الدراسة

ATTACHMENT G مرفق ج

معلومات الموضوع واستمارة الموافقة
(صفحة التوقيع)

عنوان البحث: الخبرة تحليل مسار السلوك الغذائي للوالدين والمراهقين ، تناول المشروبات المحلاة بالسكر، النشاط البدني نحو قياس الأنثروبومترية والمؤشرات الحيوية حول مخاطر السمنة بين المراهقين العراقيين.

المرحلة الثانية: دراسة مقطعية

الباحث الرئيسي والشريك: عباس علي عبدالحسن الكناني
الأستاذ المساعد الدكتورة روحانا عبد الجليل
الدكتورة رقية حسن
الأستاذ المساعد الدكتور وان محمود أمير
الأستاذ المساعد الدكتور سعد فرحان البدري

لكي تصبح جزءا من هذه الدراسة ، يجب عليك أنت أو ممثلك القانوني التوقيع على هذه الصفحة. بتوقيعي على هذه الصفحة ، أؤكد ما يلي:

لقد قرأت جميع المعلومات الواردة في نموذج الموافقة ومعلومات المريض بما في ذلك أي معلومات تتعلق بالمخاطر في هذه الدراسة وكان لدي الوقت للتفكير في الأمر.
تمت الإجابة على جميع أسئلتي بما يرضي.
_ أوافق طواعية على أن أكون جزءا من هذه الدراسة البحثية ، وأن أتبع إجراءات الدراسة ، وأن أقدم المعلومات اللازمة إلى الطبيب أو الممرضات أو غيرهم من الموظفين ، حسب الطلب.
_ قد أختار بحرية التوقف عن المشاركة في هذه الدراسة في أي وقت.
_ لقد تلقيت نسخة من معلومات المشارك واستمارة الموافقة لأحتفظ بها لنفسي.

اسم ولي الامر او الابوين	**رقم هوية ولي الامر او الابوي**
توقيع المشارك أو الممثل القانوني	**التاريخ (يوم / شهر / سنة)**
اسم المراهق	**توقيع المراهق**
توقيع الفرد إجراء مناقشة الموافقة	**التاريخ (اليوم / الشهر / السنة)**
اسم وتوقيع الشاهد	**التاريخ (يوم / شهر / سنة)**

ملحوظة: 1) لن يغطي التأمين جميع المشاركين المشاركين في هذه الدراسة.
ب) لن يتم استخدام العينات الزائدة من هذا البحث لأسباب أخرى وسيتم تدميرها بموافقة لجنة أخلاقيات البحث البشري ، .USM

LIST OF PUBLICATIONS

Two published articles

Alkinani, A., Rohana, A. J., Hasan, R., Muhamad, W., Ahmad, A. W., and Al-badri, S. A. (2024b) Translation, Cultural Adaptation, and Validation of the Arab Version of the Adolescent Food Parenting Questionnaire (AFPQ) in Kut City, Iraq., 1–12.

Alkinani, A., Rohana, A. J., Hasan, R., Muhamad, W., Ahmad, A. W., and Al-badri, S. A. (2024c) Translation and Validation of a Culturally Adapted Arabic Version of the Beverage Intake Questionnaire (BEVQ)., 16(10).

Two articles " under review"

Validation of the Arabic Version of the Adolescent Food Parenting Questionnaire (AFPQ-A): A Factor Analysis (Public Health Nutrition Journal "Q2" WOS).

Evaluating the Reproducibility of a Beverage Intake Questionnaire for Caloric Estimation Among Adolescents in Iraq (Journal of Taibah University Medical Sciences "Q3" WOS).

Four articles " to be submitted"

Evaluating the Reproducibility of Sugar-Sweetened Beverages, Milk and Its Association with BMI Among Iraqi Adolescents.

Path Analysis of Sociodemographic Influences on Weight Status: Mediating Roles of Physical Activity and Sedentary Behavior.

Examining Relationships Between Food Parenting Practices, Dietary Behaviors, and Weight Status Using SEM.

Predictive Factors for Increased Cardiometabolic Risk Among Iraqi Adolescents.

Presentations:

Alkinani, A., Rohana, A. J., Hasan, R., Muhamad, W., Ahmad, A. W., and Al-badri, S. A. (2022) The relationship between Sugar-Sweetened Beverages and obesity between children and adolescents in Eastern Mediterranean Region: systematic review. in the 1st international, and 14 national conferrnce on innovations in health sciences, Shahid Beheshti University of medical sciences, school of public health, andsafety, 3. Available at: https://en.ihsc.bsbmu.ir/index.php/posters/.

Alkinani, A., Rohana, A. J., Hasan, R., Muhamad, W., Ahmad, A. W., and Al-badri, S. A. (2024a) Translating, Culturally Adapting, and Validating the Adolescent Food Parenting Questionnaire for Arabic-Speaking Youth in Kut, Iraq (Ages 16-18). in 8th AMDI-UNAIR International Postgraduate Research, and Innovation Colloquium (AUPC2024) T01, 80.

Alkinani, A., Rohana, A. J., Hasan, R., Muhamad, W., Ahmad, A. W., and Al-badri, S. A. (2024d) Validation of the Arabic Version of the Adolescent food Parenting Questionnaire: A Comprehensive Factor Analysis. in the 6th International Scientific Conference for Health and Medical Specialties, 212.

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Exercising the Function of the Director
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Has Participated The 6th International Scientific Conference of Medical and Health Specialties

1 - 2 / December / 2024

For presenting his research entitled:

Validation of the Arabic Version of the Adolescent food Parenting Questionnaire: A Comprehensive Factor Analysis

Prof. Dr. Lateef E. Alwan
Chairman of Organizing Committee

Prof. Dr. Wadhah Amer Hatem
President of (M.T.U)