

**THE EFFECTS OF PSYCHOSOCIAL FACTORS IN
PHYSICAL ACTIVITY PROMOTION AMONG
OVERWEIGHT AND OBESE ADOLESCENT IN
YUNNAN PROVINCE, CHINA USING YOUTH
PHYSICAL ACTIVITY PROMOTION MODEL**

HAN MINGXUE

UNIVERSITI SAINS MALAYSIA

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by

HAN MINGXUE

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LIST OF ABBREVIATIONS

AMOS	Analysis of Moment Structures
AVE	Average Variance Extracted
BMI	Body Mass Index
CPAC-C	Chinese version of the Children's Physical Activity Correlates Scale
CAPA	Children's Attraction to Physical Activity
CFI	Comparative Fit Index
CR	Composite Reliability
CFA	Confirmatory Factor Analysis
FI	Family Influence
GSES	General Self-Efficacy Scale
GFI	Goodness-of-Fit Index
ML	Maximum Likelihood
MI	Modification Index
MGA	Multi-group Analysis
NFI	Normed Fit Index
OSA	Obstructive Sleep Apnea
PS	Parental Socialization
PI	Peer Influence
PC	Perceived competence
PA	Physical Activity
PACES	Physical Activity Enjoyment Scale PACES
PAQ-A	Physical Activity Questionnaire for Adolescents
PE	physical education PE
RCT	Randomized Controlled Trial
RMANOVA	Repeated Measures Analysis of Variance
RMSEA	Root Mean Square Error of Approximation
SSSPH-SC	The Simplified Chinese version of the Social Support Scale for Physical Activity
SD	Standard Deviation
SRMR	Standardized Root Mean Square Residual
SPSS	Statistical Package for the Social Sciences
TLI	Tucker-Lewis Index

VIF	Variance Inflation Factor
YPAP	Youth Physical Activity Promotion model
WHO	World Health Organization

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**KESAN FAKTOR PSIKOSOSIAL DALAM PROMOSI AKTIVITI
FIZIKAL DALAM KALANGAN REMAJA BERLEBIHAN BERAT BADAN
DAN OBES DI WILAYAH YUNNAN, CHINA MENGGUNAKAN MODEL
PROMOSI AKTIVITI FIZIKAL REMAJA**

ABSTRAK

Kegemukan remaja merupakan masalah kesihatan awam yang semakin meningkat di China, dengan kekurangan aktiviti fizikal sebagai penyumbang utama. Faktor psikososial memainkan peranan penting dalam membentuk tingkah laku aktiviti fizikal remaja, namun kajian yang memfokuskan kepada golongan remaja yang berlebihan berat badan dan obes di rantau ini adalah terhad. Kajian ini menggunakan Model Promosi Aktiviti Fizikal Belia (YPAP) untuk meneroka pengaruh faktor psikososial terhadap aktiviti fizikal dalam kalangan remaja yang berlebihan berat badan dan obes di China. Program intervensi, yang menggabungkan strategi aktiviti fizikal berasaskan keluarga dan sekolah, telah direka untuk menilai kesannya terhadap tahap aktiviti fizikal remaja di Zhaotong, Yunnan. Kajian ini dijalankan dalam dua fasa. Fasa 1 ialah kajian keratan lintang melibatkan seramai 1,500 remaja berusia 12 hingga 15 tahun yang melengkapkan beberapa soal selidik mengenai aktiviti fizikal dan faktor psikososial. Analisis statistik Structural Equation Modelling digunakan untuk menilai hubungan antara pembolehubah, dengan model akhir menunjukkan kesesuaian data yang baik ($\chi^2/df = 2.22$, CFI = 0.98, GFI = 0.95, RMSEA = 0.03, SRMR = 0.07, NFI = 0.96, TLI = 0.98). Dapatan menunjukkan hubungan positif yang signifikan antara pengaruh keluarga, pengaruh rakan sebaya, persepsi kecekapan, keseronokan, efikasi sendiri, dan tahap aktiviti fizikal ($p < 0.05$); namun, hubungan keluarga dan persepsi kecekapan tidak signifikan ($\beta = 0.019$, $p > 0.05$), dan analisis

perantaraan juga menunjukkan kesan tidak signifikan ($\beta = 0.002$, $p = 0.566$). Selain itu, faktor psikososial dalam model YPAP berbeza mengikut BMI dan tahap gred. Fasa 2 menggunakan reka bentuk kawalan rawak dengan 96 peserta yang dibahagikan secara rawak kepada kumpulan intervensi dan kawalan. Intervensi dilaksanakan selama lapan minggu dengan tiga sesi setiap minggu, dan kesan interaksi adalah signifikan bagi pengaruh keluarga, pengaruh rakan sebaya, keseronokan, efikasi sendiri, dan aktiviti fizikal ($p < 0.05$), di mana kumpulan intervensi mencatat skor lebih tinggi berbanding kumpulan kawalan. Walau bagaimanapun, kesan interaksi terhadap persepsi kecekapan tidak signifikan ($p = 0.077$). Kajian ini menunjukkan hubungan signifikan antara faktor psikososial dan aktiviti fizikal dalam kalangan remaja berlebihan berat badan dan obes di China, di mana efikasi sendiri, pengaruh keluarga, pengaruh rakan sebaya, dan keseronokan dikenal pasti sebagai faktor penting dalam mempromosikan aktiviti fizikal. Intervensi berasaskan YPAP terbukti berkesan dalam meningkatkan tahap aktiviti fizikal, dan penyelidikan masa depan disarankan untuk mengkaji pembolehubah perantara serta menyesuaikan strategi intervensi mengikut perbezaan BMI dan tahap gred untuk meningkatkan keberkesanan.

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PHYSICAL ACTIVITY PROMOTION MODEL**

ABSTRACT

Adolescent obesity is a growing public health issue in China, with insufficient physical activity (PA) as a major contributor. Psychosocial factors play a crucial role in shaping children's PA behaviors, but research focusing on overweight and obese adolescents in this region is limited. This study employs the Youth Physical Activity Promotion Model (YPAP) to explore the influence of psychosocial factors on PA among overweight and obese adolescent in China. An intervention program combining family and school-based PA strategies was designed to assess its effect on PA levels in adolescent in Zhaotong, Yunnan. The study was conducted in two phases. Phase 1 was a cross-sectional study involving 1,500 adolescents aged 12 to 15 who completed several questionnaires on PA and psychosocial factors. Structural equation modelling was used to analyse the relationships between the variables. The final model fit the data well ($\chi^2/df = 2.22$, CFI = 0.98, GFI = 0.95, RMSEA = 0.03, SRMR = 0.07, NFI = 0.96, TLI = 0.98). The results revealed significant positive relationships between family influence (FI), peer influence (PI), perceived competence (PC), enjoyment, self-efficacy, and PA levels ($p < 0.05$). However, the path coefficient from FI to PC was non-significant ($\beta = 0.019$, $p > 0.05$), and mediation analysis showed that the pathway from FI to PA through PC was also non-significant (effect = 0.002, $p = 0.566$). Additionally, psychosocial factors in the YPAP model displayed variations across different BMI and grade-level groups. Phase 2 involved a randomized controlled trial

with 96 participants, who were randomly assigned to an intervention or a control group. The intervention lasted eight weeks, with three sessions per week. The interaction effects were significant for FI, PI, enjoyment, self-efficacy, and PA ($p < 0.05$), with the intervention group showing significantly higher scores than the control group. However, the interaction effect on PC was not significant ($p = 0.077$). This study highlights significant associations between psychosocial factors and PA among overweight and obese adolescent in China. Self-efficacy, FI, PI, and enjoyment are crucial factors in promoting PA. The YPAP-based intervention is effective in increasing PA levels. Future research should explore mediating or moderating variables and adjust intervention strategies based on BMI and grade-level differences to enhance effectiveness.

CHAPTER 1

INTRODUCTION

1.1 Background and Scope of the Study

Obesity among adolescents ranks as one of the most pressing public health challenges of the 21st century. As of 2022, more than 159 million children and adolescents worldwide were considered obese, a figure that has grown significantly since 1990 (Phelps et al., 2024). The latest data from the World Health Organization (WHO) show that the global obesity rate among children and adolescents aged 5 to 19 rose from 1.94% in 1990 to 8.24% in 2022 (WHO, 2024). According to the projections by the World Obesity Federation, the number of obese children and adolescents could reach approximately 400 million by 2035 (WOF, 2023). Globally, at least every country has reported cases of child and adolescent obesity, and the number is constantly increasing (Coronado-Ferrer et al., 2022). Overall, the rising prevalence of childhood and adolescent obesity worldwide is a cause for serious concern, underscoring the urgent need for countries to implement effective health interventions and policies to curb the ongoing rise in obesity rates.

The prevalence of overweight and obesity among Chinese children and adolescents aged 7-18 has continued to rise, increasing from 5.3% in 1995 to 24.2% in 2019 (Luo & Song, 2022). According to the Report on Nutrition and Chronic Diseases of Chinese Residents (2020), the prevalence among those aged 6-17 was 19.0% in 2020, meaning that approximately one in five children and adolescents were overweight or obese (National Health Commission of the People's Republic of China, 2021). Without effective intervention, this rate is projected to exceed 31.8% by 2030 (Agency, 2025). Therefore, overweight and obesity among children and adolescents have become a national health priority in China (Dong et al., 2023).

Insufficient physical activity (PA) is a key contributor to obesity (Silveira et al., 2022; Yuksel et al., 2020), increasing the risk of various health issues, such as cardiovascular diseases (Carbone et al., 2019), type 2 diabetes, chronic respiratory conditions, and musculoskeletal issues (Yee et al., 2023). Research also indicates that obesity can result in psychological issues such as low self-esteem, anxiety, and depression (Moradi et al., 2021; Rodriguez-Ayllon et al., 2018; Sagar & Gupta, 2018). Weight problems often lead to social exclusion and discrimination, exacerbating psychological disorders and perpetuating a negative cycle where psychological and physical health problems worsen each other (Puhl et al., 2020). Social psychological stress and body image issues may hinder children and adolescents from engaging in active physical activities, further aggravating obesity and physical inactivity (Hamer et al., 2023).

Consistent engagement in PA is essential for the healthy growth and development of children and adolescents (Brooks et al., 2021). Numerous studies have emphasized the vital role of PA in preventing childhood obesity (Zaki et al., 2023; Porri et al., 2024). For example, a community-based PA intervention in Nanjing, China, significantly increased students' PA levels, prevented obesity, reduced the number of new overweight/obesity cases, and notably increased the proportion of previously overweight/obese students who returned to a normal weight (Wang et al., 2018). A 2019 systematic review on exercise therapy for obese children indicated that appropriate physical activities, such as resistance training and endurance exercises, can significantly improve the BMI of overweight and obese children (Jung et al., 2019). In addition to obesity prevention, PA can reduce the incidence of type II diabetes, promote mental health, and provide other health-related benefits (Posadzki et al., 2020). However, in China, only 34.1% of children and adolescents meet the recommended

daily levels of moderate to vigorous PA (Chen et al., 2020). Therefore, increasing children's participation in PA and addressing the rising trend of childhood and adolescent obesity have become critical issues that urgently need to be addressed.

The PA behavior of adolescents is influenced by multiple factors. The Social Ecological Model (SEM) provides a framework to explain this complexity. According to SEM, determinants of PA include individual-level factors (e.g., motivation, self-efficacy), social-level factors (e.g., family support, peer influence), environmental-level factors (e.g., community facilities, accessibility of sports venues), and policy-level factors (e.g., national health policies and school physical education curriculum arrangements) (Hu et al., 2021). Among these factors, the interaction between individual psychological factors (e.g., motivation, self-efficacy) and social support systems (e.g., family, peers), collectively referred to as 'socio-psychological variables' are central to promoting PA behaviours among children and adolescents (Garcia et al., 2016; Martins et al., 2021). Newson and Abayomi (2024) highlighted that in the context of childhood obesity, psychosocial factors significantly influence children's perceptions, attitudes, and behaviours regarding PA and diet.

However, the mechanisms by which psychosocial factors influence childhood overweight or obesity require further investigation (Veloso et al., 2012). Therefore, it is necessary to explore the complex relationships between these variables further and deconstruct the mechanisms by which psychosocial factors affect weight management and interventions. In this regard, the Youth Physical Activity Promotion (YPAP) model provides a theoretical framework that may help explain the interaction between these psychosocial variables and PA (Welk, 1999).

The YPAP model comprises four categories of psychosocial influencing factors: predisposing, reinforcing, enabling, and demographic factors. Predisposing factors are personal attributes that increase the likelihood of regular participation in PA, such as self-efficacy, perceived competence, enjoyment, beliefs, and attitudes. Reinforcing factors refer to social influences that encourage PA, including family, peers, and coaches. Enabling factors are environmental or biological conditions that facilitate PA, such as access to equipment and facilities, safety, physical skills, fitness, and body composition. While these factors do not directly determine PA participation, they provide the essential foundation for engaging in such activities.

Furthermore, demographic factors, such as age, gender, race/culture, and socioeconomic status, shape the patterns and preferences for participation. This model not only helps deepen the understanding of adolescents' motivations and barriers to physical exercise but also provides strong theoretical support for intervention strategies to promote PA and a healthy lifestyle.

Therefore, this study employed the YPAP model to explore the relationship between PA and psychosocial factors (such as family influence, peer influence, Self-efficacy, Enjoyment, and perceived competence) among urban adolescents in China. Moreover, based on these psychosocial factors, the present researcher then developed intervention strategies targeting overweight and obese adolescents in Zhaotong City, Yunnan Province and support the promotion and dissemination of healthy lifestyles in the region.

1.2 Problem Statement

The rising rates of adolescents overweight and obesity have emerged as a critical global public health concern, prompting growing awareness of their

detrimental effects on both physical health and mental well-being (Haththotuwa et al., 2020). In China, this trend aligns with global patterns. According to existing research and recent cross-sectional studies conducted in China, the rates of overweight and obesity in children and adolescents are continuously rising, particularly among children aged 6-11 (Zhou et al., 2022). Dong et al. (2023) projected that the overweight and obesity rate among Chinese children and adolescents aged 7-18 will increase from 23.4% in 2019 to 32.7% in 2030. Despite various public health interventions aimed at promoting PA, the rates of childhood overweight and obesity continue to increase (Chen et al., 2020). Engaging in PA is essential in managing and preventing childhood obesity (Eichner-Seitz et al., 2023). However, understanding the complex relationship among the various factors influencing PA behavior remains challenging.

Qiu et al. (2021) suggest that psychosocial factors, including self-efficacy, attitudes, family and peer influences, and perceived competence, are critical in determining children's participation in PA. However, research on the relationship between psychosocial factors and PA among children and adolescents in China has primarily focused on developed regions (Feng et al., 2024; Liu et al., 2023). For example, a study by Zhang et al. (2021) in Wuhan, Hubei, found that friend support, social norms, barriers to PA, intrinsic motivation, self-efficacy, and the availability of nearby facilities and PA resources significantly influenced adolescents' PA levels. Similarly, Wang et al. (2017) found that among children in Beijing, parental support and role modelling played a significant role in increasing children's engagement in moderate to vigorous PA, with fathers serving as the most influential role models. In addition, Chen et al. (2017), in their research on children in Fuzhou, found that self-efficacy and enjoyment of PA mediated the relationship between peer support and PA.

Yunnan Province is China's most populous region for ethnic minorities. Over 90% of its area is covered by mountains, and it is an underdeveloped area where children's participation in PA is deeply influenced by its unique socio-cultural and economic environment. A review of the existing literature reveals that research on factors influencing PA among children and adolescents in Yunnan Province has primarily focused on factors such as maintaining interest in sports, sports environments, PA behavior, and exercise commitment, with relatively little research on other psychosocial factors (Li et al., 2016; Tong et al., 2023). For example, Huang (2022) emphasized that the sports environment and expectations from schools and families are key factors influencing the sports learning interest of middle school students in Kunming. Ran (2024) argued that reasonable community planning helps enhance extracurricular physical activity among children in Kunming. Han et al. (2024) suggested that creating a supportive environment and promoting exercise commitment effectively improve PA behaviours among children in Zhaotong.

However, it remains unclear whether psychosocial factors such as self-efficacy, family influence, peer influence, perceived competence, and enjoyment of PA are significantly associated with PA among adolescents aged 12 to 15 years in Zhaotong City, Yunnan Province. Strengthening these factors may increase adolescents' engagement in PA. Further research is needed to address this gap, provide theoretical support for developing targeted and effective PA interventions, and ultimately promote the healthy development and overall well-being of adolescents in Zhaotong City, Yunnan Province.

The YPAP model has been widely applied due to its effectiveness in explaining and promoting adolescent PA behavior. It comprehensively explains the motivation

for adolescent PA behavior through multiple dimensions, including predisposing, enabling, and reinforcing factors. Numerous empirical studies have supported the validity of this framework. For example, a study conducted among primary school children in Portugal found that enjoyment was directly related to PA, while parental influence indirectly affected activity levels through self-efficacy (Seabra et al., 2013). In addition, the YPAP model has demonstrated good adaptability across different cultural contexts, implying that its core constructs can effectively explain adolescent PA behavior in various cultures (Silva et al., 2012). In summary, the YPAP model, with its scientific foundation, applicability, and strong cross-cultural explanatory power, has become an important theoretical tool for studying and promoting adolescent PA behavior.

However, Cai et al. (2019) noted that empirical studies on the YPAP model in China are scarce and primarily theoretical and that the model's proposed factors and underlying mechanisms require further improvement. Cai suggested that domestic scholars should build upon the strengths of the YPAP model while addressing its shortcomings, promoting localised research to develop a theoretical system more suited to Chinese children and adolescents. Therefore, based on the current state of the literature, this study adopts the YPAP model as its theoretical framework and uses cross-sectional surveys and randomized controlled trials to test its applicability and explore cross-cultural differences in China.

This study uses the Children's Physical Activity Correlates (CPAC) scale to measure the perceived competence of Chinese adolescents. Since the scale originates from a Western cultural context (Welk et al., 2006), it may not accurately capture Chinese children's cultural differences and psychosocial characteristics in PA. Brislin

(1970) pointed out that translating cross-cultural scales requires linguistic conversion and cultural adaptability to avoid measurement bias. Therefore, this study employed translation, back-translation, and localised validation to ensure the reliability and validity of the CPAC scale in the Chinese context. This process enables the scale to effectively measure Chinese children's perceived competence and related psychosocial factors in PA, reducing errors caused by cultural differences and providing better support for examining the connection between psychosocial factors and children's engagement in PA.

In summary, this study aimed to determine the relationship between key psychosocial factors in the YPAP model and PA in Chinese children and adolescents and to design interventions to validate the model's applicability in China. The study results are expected to provide guidelines for improving exercise participation in overweight and obese children.

1.3 Research Question(s)

1. What is the validity and reliability of the Chinese version of the Children's Physical Activity Correlates Scale (CPAC-C) among adolescents in Zhaotong, Yunnan Province, China?

2. What are the levels of family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity within the YPAP model among adolescents aged 12-15 years in Zhaotong, Yunnan Province, China?

3. Is there a relationship between family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity among adolescents in Zhaotong, Yunnan Province, China?

4. Are there differences in the relationships between family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity among adolescents across different BMI groups (underweight, normal weight, overweight, and obese) and different grade levels (Grades 7, 8, and 9)?

5. Can physical activity intervention strategies based on the YPAP model enhance family influence, peer influence, self-efficacy, enjoyment, and perceived competence, and thereby promote physical activity participation among overweight and obese adolescents in Zhaotong, Yunnan Province, China?

1.4 Research Objective

The main goal of this study is to apply the Youth Physical Activity Promotion (YPAP) model to overweight and obese adolescents in Zhaotong City, Yunnan Province, China. The study evaluates the model's applicability and effectiveness in predicting physical activity in this group, based on evidence from the literature. Where appropriate, the model is refined to improve its relevance in the local context. The research also develops intervention programmes grounded in the YPAP framework to encourage active participation and improve health outcomes.

1.4.1 Specific Objectives

1. To determine the validity and reliability of the Chinese version of the Children's Physical Activity Correlates Scale (CPAC-C) among adolescents in Zhaotong, Yunnan Province, China.

2. To assess the levels of family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity within the YPAP model among adolescents aged 12-15 years in Zhaotong, Yunnan Province, China.

3. To determine the relationship between family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity in the YPAP model among adolescents in Zhaotong, Yunnan Province, China.

4. To determine the differences in the relationships among family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity within the YPAP model across different BMI groups (underweight, normal weight, overweight, and obese) and different grade levels (Grades 7, 8, and 9) among adolescents in Zhaotong, Yunnan Province, China.

5. To determine the effectiveness of YPAP model-based intervention strategies in promoting family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity among overweight and obese adolescents in Zhaotong, Yunnan Province, China.

1.5 Research Hypotheses

As this study adopts a quantitative research design, both research objectives and hypotheses are included to ensure clarity and testability. In addition to the objectives in Section 1.4, this section presents specific hypotheses to guide the data analysis. The objectives outline the overall aims of the study, while the hypotheses provide clear and testable statements, linking the study framework with statistical analyses to verify the proposed relationships. The specific hypotheses are as follows:

Hypothesis 1

Null hypothesis (H_{01}): The Chinese version of the Children's Physical Activity Correlates Scale (CPAC-C) does not demonstrate adequate reliability and validity when applied to Chinese adolescents in Zhaotong, Yunnan Province, China.

Alternative hypothesis (HA₁): The Chinese version of the Children's Physical Activity Correlates Scale (CPAC-C) demonstrates adequate reliability and validity when applied to Chinese adolescents in Zhaotong, Yunnan Province, China.

Hypothesis 2

Null hypothesis (H0₂): There are no significant relationships between family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity in the YPAP model among adolescents in Zhaotong, Yunnan Province, China.

Alternative hypothesis (HA₂): There are significant relationships between family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity in the YPAP model among adolescents in Zhaotong, Yunnan Province, China.

Hypothesis 3

Null hypothesis (H0₃): There are no significant differences in the relationships among family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity within the YPAP model across different BMI groups (underweight, normal weight, overweight, and obese) and different grade levels (Grades 7, 8, and 9) among adolescents in Zhaotong, Yunnan Province, China.

Alternative hypothesis (HA₃): There are significant differences in the relationships among family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity within the YPAP model across different BMI groups (underweight, normal weight, overweight, and obese) and different grade levels (Grades 7, 8, and 9) among adolescents in Zhaotong, Yunnan Province, China.

Hypothesis 4

Null hypothesis (H0₄): The YPAP-based intervention does not lead to significant improvements in family influence, peer influence, self-efficacy, enjoyment, perceived competence, or physical activity among overweight and obese adolescents in Zhaotong, Yunnan Province, China.

Alternative hypothesis (HA₄): The YPAP-based intervention leads to significant improvements in family influence, peer influence, self-efficacy, enjoyment, perceived competence, and physical activity among overweight and obese adolescents in Zhaotong, Yunnan Province, China.

1.6 Research Significance

This study primarily investigates the relationship between specific psychological and social components within the YPAP framework and the involvement in exercise among adolescents in Zhaotong, China. Additionally, it evaluates the applicability of this model in the Chinese cultural context. Although the YPAP framework has been widely used as a theoretical foundation for predicting PA patterns among young individuals in Western countries, empirical research within the Chinese cultural setting remains limited. Therefore, this research aims to empirically validate the model in China, filling the gap in cross-cultural research and offering significant theoretical and practical implications.

By identifying key psychosocial factors that influenced PA among adolescents in Zhaotong, such as self-efficacy, family influence, peer influence, enjoyment, and perceived competence, this study provided empirical evidence for schools and health promotion programs. It helped formulate more targeted interventions to encourage

adolescents to engage in PA actively. This has significant implications for improving the physical and mental health of adolescents in Zhaotong, reducing obesity rates, and promoting the development of healthy behaviours.

In addition, the research findings provided a reference for cross-cultural comparative studies in other regions of China, expanding the application of the YPAP model in different regional cultural contexts. This also offered theoretical support for the design of health interventions for adolescents in China, demonstrating practical value.

1.7 Conceptual Definitions

Table 1.1 Conceptual Definitions

Term	Conceptual Definitions
Physical activity (PA)	Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure (Caspersen et al., 1985). Physical activity can be structured and planned exercises (such as running, swimming, playing basketball, etc.) or natural activities in daily life (such as walking, doing household chores, climbing stairs, etc.).
Self-efficacy	Perceived self-efficacy involves belief in their capability to plan and perform the necessary actions to achieve specific goals. It represents confidence in one's ability to influence motivation, behavior, and social surroundings (Bandura, 1993).
Social support	Social support is defined as the assistance individuals receive from others, including emotional support (such as empathy and care), informational support (such as advice and information), instrumental support (such as practical help), and appraisal support (such as feedback and affirmation) (House, 1983). This study focuses primarily on parental and peer support. The YPAP model is also referred to as parental influence (FI) and peer influence (PI).

Table 1.1 Continued

Term	Conceptual Definitions
Enjoyment	Enjoyment is seen as a component of intrinsic motivation, where individuals engage in an activity for the inherent satisfaction and pleasure derived from the activity rather than for some separable consequence (Deci & Ryan, 2013). Sport enjoyment is defined as a positive affective response to the sports experience that reflects generalized feelings such as pleasure, liking, and fun (Scanlan & Simons, 1992).
Perceived of competence	Perceived competence is defined as an individual's subjective assessment or belief in their ability to perform tasks in specific domains(Harter, 1982a). Perceived competence, as an important component of children's self-concept, significantly influences their emotional states, self-confidence, and behavioral choices, and their level. Directly relates to individuals' responses when facing challenging tasks.
Mediator variable	A mediating variable is defined as a variable that functions as a mediator when it accounts for the relation between the independent variable and the dependent variable (Baron & Kenny, 1986). In other words, a mediating variable transmits the effect of an independent variable on a dependent variable(MacKinnon, 2012). Based on the YPAP model, this study hypothesizes the mediating role of self-efficacy, enjoyment, and perceptions of competence in the relationship between family influence or peer influence and PA.
Moderating variable	A moderating variable is “Qualitative (e.g., sex, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable (Baron & Kenny, 1986). In this study, BMI and grade level are treated as moderating variables, as they are expected to influence the direction and/or strength of the relationship between the independent and dependent variables.
Structural equation modelling (SEM)	It is a statistical technique used to test hypotheses in the analysis of structural theories. It aims to identify causal relationships among multiple variables. The method considers observed and unobserved variables and examines their underlying relationships. Byrne (2013) described SEM as a procedure that supports aspects of theory by identifying causal means that create observations on numerous variables.

1.8 Summary

This chapter reviewed global and Chinese trends in adolescent overweight and obesity, their negative health effects, and the benefits of PA. It situated the study within both contexts, clarified the problem, and outlined the research questions, hypotheses, significance, and objectives. It highlighted a gap in research on psychosocial factors influencing PA among adolescents in Zhaotong, Yunnan, within the Chinese cultural context. This study addressed the gap by testing the YPAP model in China, providing insights into its suitability for promoting PA among Chinese adolescents.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed adolescent overweight and obesity, emphasising the role of PA in promoting physical, psychological, and social well-being. It outlined global and Chinese trends, with a focus on Yunnan Province, and introduced the YPAP model, assessing its applicability and potential to increase PA among adolescents with overweight and obesity. It also examined key psychosocial determinants, their definitions, development, and influence on adolescent PA participation, establishing a strong theoretical basis for understanding how these factors encourage PA engagement in young people.

2.2 Global and Local Status and Impact of Adolescent Obesity

Adolescent obesity had become a major global public health problem. It threatened both physical and mental health and had long-term effects on social development. In recent decades, its prevalence had continued to rise in developed countries and had grown rapidly in developing countries. Reviewing the trends, health risks, and regional differences in adolescent obesity from global and local perspectives provided a theoretical basis for developing targeted intervention strategies.

2.2.1 Global Status of Adolescent Obesity

The increasing global prevalence of adolescents obesity has raised widespread concern, making the trend particularly alarming (Mohajan & Mohajan, 2023). adolescents obesity contributes to multiple health complications and elevates the risk of chronic diseases in adulthood, presenting a major public health concern (Lozano et al., 2025). There is evidence that shows millions of children under five suffer from

overweight and obesity globally. Although it is particularly prevalent in high-income countries, obesity rates are also steeply becoming more prevalent in developing nations, especially in rapidly urbanizing areas (Xie et al., 2024).

A 2019 global study estimated that around 330 million children and adolescents aged 5 to 19 were categorized as overweight or obese (Di Cesare et al., 2019). In addition, Noubiap et al. (2022) found that, despite a slowdown in obesity rates in high-income countries, obesity rates among children and adolescents continue to increase globally, especially in low- and middle-income countries.

According to a global study published in the Lancet in March 2024, around 159 million young individuals worldwide (65 million girls and 94 million boys) were affected by obesity in 2022, compared to just 31 million in 1990. This shows that the global rate of obesity among youth has more than quadrupled from 1990 to 2022: for girls, it increased from 1.7% to 6.9%, and for boys, from 2.1% to 9.3% (Phelps et al., 2024). The World Obesity Federation (WOF) predicts that obesity among adolescent is increasing at the highest rate among all age groups. Between 2020 and 2035, the global prevalence of obesity in boys is expected to double from 10% to 20%, while for girls, it is projected to rise from 8% to 18% (WOF, 2023).

In conclusion, the global rise in adolescent obesity is significant. It involves multiple and complex factors that need to be addressed collectively through policy adjustments, educational interventions, and community action on a global scale.

2.2.2 Overweight and Obesity in Chinese Adolescents

With China's rapid socioeconomic development over the past two decades, the prevalence of overweight and obesity among both adults and children has become increasingly severe. The Report on the Nutrition and Chronic Disease Status of Chinese

Residents (2020) indicates that more than half of Chinese adults are affected by overweight and obesity. Among youth aged 6 to 17, the prevalence of excessive weight and obesity is nearly 20%, while for children under 6 years old, the rate is 10. Dong et al. (2023) projected that excessive weight and obesity among Chinese youth aged 7-18 will rise from 23.4% in 2019 to 32.7% by 2030.

Obesity in China varies significantly by region (Li et al., 2022). Evidence suggests that childhood obesity rates are usually higher in the eastern coastal regions than in the central and western regions (Zhu et al., 2020). For example, childhood obesity rates in Beijing and Shanghai are generally higher than in Western provinces such as Yunnan and Guizhou (Guo et al., 2021). This regional disparity is closely related to economic development, dietary habits, and lifestyle practices in different areas. In the eastern regions, where the economy is more developed, and urbanization is rapid, children have greater access to high-calorie fast foods and snacks (Gu et al., 2022).

In rural areas, although obesity rates are relatively low, there has been an upward trend in recent years. As the economy develops and living standards improve (Wang et al., 2021). This indicates that the obesity issue is not limited to urban areas but is also spreading to rural regions. Dong et al. (2019) examined the patterns of excessive weight and obesity prevalence between rural and urban youth in China from 2010 to 2014. They revealed that although the obesity rate in rural areas was relatively low, the obesity rate among rural children in some eastern provinces had exceeded that of urban children since 2014.

Overall, adolescent obesity in China is on a significant upward trend, with noticeable differences across various regions and populations. Addressing this challenge requires a comprehensive approach, including improvements in PA and the

effective implementation of policies and education to control adolescent obesity and promote overall health.

2.2.3 Obesity and Physical Inactivity in Yunnan Province

Yunnan Province, located in southwestern China at the intersection of the Tibetan Plateau and the Yunnan-Guizhou Plateau, features highly diverse terrain ranging from the 6,740-meter-high Kawagebo Peak to the 76.4-meter Red River Basin. Its landscape includes mountains, valleys, plains, and basins. The region's diverse climate conditions have fostered abundant natural resources, unique biodiversity, and a rich cultural heritage of 56 ethnic minorities. This distinctive geographical and cultural background has profoundly influenced the lifestyles and health of adolescents in the region. This distinctive geographical and cultural background shapes various aspects of adolescents' lifestyles, including their PA patterns. In recent years, growing social attention has been directed toward the issues of physical inactivity and excessive weight among youth in Yunnan Province (Yang et al., 2022; Yang et al., 2023; Yunnan Provincial Government, 2023).

According to the study by Deng et al. (2022), 39.6% of students in Yunnan Province engaged in one hour of PAPA daily and exercised at least three days per week, with significant differences in participation rates between urban and rural regions. Specifically, rural children and adolescents had lower participation in extracurricular physical activities due to a lack of structured exercise goals and limited activity options. Their free time was primarily spent on homework and household chores, with the remaining time mainly devoted to playing games (Li et al., 2016b). Although urban students were more engaged in extracurricular sports, studies indicate that overall PA levels among youth in Yunnan remain well below the WHO's recommendation of at

least 60 minutes of moderate to vigorous PA daily (Huang, 2022; Li et al., 2023; Ran, 2024).

Based on the unique geographical environment and economic conditions of Yunnan Province, the prevalence of overweight and obese adolescent in Yunnan is classified as being at a low epidemic level in the regional classification table for the prevalence of overweight and obese adolescent in China (See Table 2.1) (YPSB, 2020). Yang et al. (2023) surveyed 2016 to 2017 using stratified cluster sampling, selecting 3,463 children and adolescents aged 6-17 from 65 primary and secondary schools across 13 counties in Yunnan Province. The sample included 2,098 primary school students, 762 middle school students, and 603 high school students, with 1,368 students from urban areas and 2,095 from rural areas. Among youth aged 6-17, the rates of overweight and obesity were 8.43% (292/3,463) and 6.01% (208/3,463) respectively. Children and adolescents in urban students attending non-boarding schools had a higher likelihood of being overweight or obese.

Wang et al. (2017) reported that between 2016 and 2017, the prevalence of overweight and obesity among children and adolescents aged 6–17 in Yunnan Province was lower than the national student survey findings from 2014, which recorded rates of 12.1% and 7.3%, respectively. The prevalence in Yunnan was also lower than that reported in Jiangsu Province (17.8% and 13.8%) (Zhang et al., 2019), Henan Province (22.8% and 19.5%), and Guizhou Province (11.5% and 7.2%) (Zhang et al., 2021), but higher than the rates observed in Chongqing Municipality (4.46% and 3.78%) (Chen et al., 2020). Additionally, Wei et al. (2016) found that obesity prevalence in Yunnan exceeded the 2014 provincial rate of 4.31%, while the prevalence of overweight was lower than the 2014 estimate of 8.51%.

The combined rate of overweight and obesity among adolescent in Yunnan Province remains relatively low; significant regional variations and increasing trends have emerged in recent years. A study by Zhang et al. (2024) reported that among 1,126 grade 1-3 children in Yunnan Province, the overweight rate was 5.7%, the obesity rate was 5.3%, and boys exhibited higher overweight rates than girls. Chang et al. (2018) surveyed 7,200 Han ethnicity students aged 7-18 in Kunming, Dali, and Honghe Prefectures, reporting an overweight rate of 13.6% and an obesity rate of 4.6%. Shen et al. (2020) found that the overweight and obesity rates among 14,624 children aged 0-6 in Yunnan Province were 13.6% and 4.6%, respectively. Gong et al. (2020) further analysed data from Yunnan Province spanning 1990-2016 and found that in 2016, the overweight and obesity rates for children aged 1-4 were 7.20% and 4.22%, respectively. Projections indicate these rates will rise to 8.32% and 8 % by 2025, with the overall rate increasing from 11.42% to 16.32%, highlighting a significant growth trend.

Overall, the PA levels of adolescent in Yunnan Province are insufficient. A recent study shows that the proportion of students who exercise for at least one hour per day and at least three days per week was found to be 39.6%, which is relatively low to moderate (Deng et al., 2022). Although the obesity rate remains lower than the national average, it has shown an increasing trend in recent years. Therefore, comprehensive intervention measures are essential to enhance PA levels, lower overweight and obesity rates, and improve overall health.

Table 2.1 Regional Patterns and Prevalence of Adolescent Overweight and Obesity in China

Prevalence level classification	Provinces
Low Prevalence Classification (8)	Guangxi; Hainan; Yunnan; Qinghai; Guangdong; Tibet; Guizhou; Sichuan
Medium Prevalence Classification (11)	Hunan; Gansu; Zhejiang; Fujian; Xinjiang; Hubei; Anhui; Ningxia; Henan; Jiangxi; Chongqing
High Prevalence Classification (12)	Shaanxi; Beijing; Jilin; Tianjin; Shanxi; Shanghai; Inner Mongolia; Liaoning; Heilongjiang; Jiangsu; Shandong; Hebei

2.3 Impact of Obesity on Adolescents' Health

Obesity impacts more than just children's weight; it significantly harms their overall health and quality of life (Lister et al., 2023). The correlation between excessive body weight and metabolic disorders has become a growing focus in recent research. Research shows that an obese child faces a heightened risk of type 2 diabetes, and elevated risk is due to insulin resistance caused by obesity, which disrupts the normal function of insulin (Ahmed et al., 2021). In obese children, insulin sensitivity is significantly reduced, directly increasing the incidence of prediabetes and type 2 diabetes (Oranika et al., 2023). Additionally, diabetes not only leads to long-term blood sugar control issues but also triggers severe complications such as cardiovascular disease, kidney disease, and retinopathy (Wu et al., 2022).

Obesity is also closely related to hypertension. Research indicates that obese children are at an increased risk of hypertension due to the additional burden on blood circulation caused by excess fatty tissue in their bodies (Welsh et al., 2024). High blood pressure, if not effectively controlled, heightens the probability of developing cardiovascular disease and stroke (Fuchs & Whelton, 2020). Obese adolescent often have impaired arterial endothelial function, an early marker of atherosclerosis (Jeong et

al., 2022). Atherosclerosis can lead to impaired blood circulation, elevating the likelihood of heart attacks and strokes.

Dyslipidaemia is also a severe problem in obese adolescent. Studies have shown that obesity is strongly associated with high cholesterol and triglyceride levels, further increasing cardiovascular disease risk (Figueiredo et al., 2022; Sadiq et al., 2022; Stadler & Marsche, 2020). High cholesterol levels can lead to atherosclerosis, while high triglyceride levels can cause health problems such as pancreatitis (Hernandez et al., 2021).

Obesity also significantly impacts the respiratory system. Obese children are more prone to developing obstructive sleep apnea (OSA), a condition characterized by the narrowing and obstruction of the upper airway due to excess body weight. Recent studies have shown that the incidence of OSA is substantially elevated in obese adolescent compared to their normal-weight peers (Andersen et al., 2019; Jat & Rajeev, 2023; Su et al., 2016). OSA can lead to decreased sleep quality, affecting daily activities and overall health. Additionally, obesity may be associated with increased asthma symptoms (Bantulà et al., 2021). Asthma attacks and severity are strongly associated with weight gain, and obesity may make asthma symptoms more difficult to control (Mangova et al., 2020).

There is also growing concern about the adverse effects of obesity on bones and joints. Being overweight increases the joint burden, especially the knees, increasing the risk of joint pain and osteoarthritis (Kulkarni et al., 2016). Obese adolescent have a significantly higher incidence of knee pain than normal-weight children (Cao et al., 2022). Long-term weight burden may also affect bone density and increase the risk of fractures (Miedany et al., 2024).

The influence of obesity on the mental well-being of adolescents is also important. Parvez et al. (2020) and Puhl and Latner (2007) found that adolescent with obesity often face psychological challenges, such as social isolation, low self-esteem, and anxiety. Obese adolescent also have a higher risk of depression and anxiety disorders (Brandreth et al., 2024). They may be ridiculed or excluded in social situations, which further harms their self-esteem and social skills (Thedinga et al., 2021). In addition, Hu et al. (2021) reported that overweight and obese adolescent are less willing to take part in PA. These problems can affect academic performance and may also harm future life and career development (Agnafors et al., 2021; McCabe et al., 2024).

The impact of obesity on adolescent' health is multifaceted and profound, encompassing metabolic diseases, cardiovascular issues, respiratory conditions, skeletal and joint problems, and psychological health concerns. Comprehensive measures are necessary to effectively mitigate the health risks linked to adolescent obesity. These include improving dietary habits, increasing PA, enhancing health education, and implementing early interventions. Such strategies can slow the progression of obesity and improve overall health outcomes for children.

2.4 Effects of Physical Activity on Adolescents' Health

Physical activity was vital for adolescent' physical, mental, and social health. Regular participation supported growth, strengthened the heart, improved motor skills, and reduced chronic disease risk. It also boosted mood, eased anxiety, and encouraged social interaction. Evidence-based guidelines advised on activity frequency, intensity, and duration, helping parents, educators, and policymakers promote active lifestyles.