ASSESSMENT OF NUTRIENT PROFILE OF SCHOOL MEAL PROGRAM IN PRIMARY SCHOOL IN KOTA BHARU, KELANTAN

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ASSESSMENT OF NUTRIENT PROFILE OF SCHOOL MEAL PROGRAM IN PRIMARY SCHOOL IN KOTA BHARU, KELANTAN

by

ABDUL THAQIF BIN IBRAHIM

Dissertation submitted in partial fulfillment

of the requirements for the degree

of Bachelor of Health Science (Honours) (Dietetics)

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CERTIFICATE

This is to certify that the dissertation entitled ASSESSMENT OF NUTRIENT PROFILE OF SCHOOL MEAL PROGRAM IN PRIMARY SCHOOL IN KOTA BHARU, KELANTAN is the bona fide record of research work done by Mr. ABDUL THAQIF BIN IBRAHIM during the period from April 2024 to May 2024 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Bachelor of Health Science (Honours) (Dietetics).

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

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ABSTRAK

Kajian ini menggunakan kaedah pensampelan bukan kebarangkalian (non-probability sampling method, khususnya teknik pensampelan mudah (convenience sampling). Empat buah sekolah dibawah Rancangan Makanan Tambahan (RMT) telah dipilih secara rawak daripada 92 buah sekolah yang memenuhi kriteria inklusi. Empat buah sekolah rendah yang telah dipilih untuk kajian ini yang menunjukkan corak pemakanan yang berbeza di Kota Bharu, Kelantan. Semua contoh makanan selama sepuluh hari persekolahana telah dianalisa kandungan kalori, protein, karbohidrat, lemak, serat, kalsium, zat besi, dan folat (Vitamin B-9). Kebanyakan makanan yang disediakan berasaskan Makanan berasaskan nasi seperti bubur nasi, nasi ayam, nasi goreng Cina, nasi goreng kampung, nasi kari ayam, nasi lemak, dan nasi ayam paprik. Jumlah julat kandungan kalori, protein, karbohidrat, dan lemak per hidangan untuk setiap sekolah ialah 320-484 kcal, 13-22 g, 34-75.1 g, dan 9-13.3 g. Makanan yang disediakan dibawah Rancangan Makanan Tambahan mengandungi jumlah tenaga dan karbihidrate yang tinggi manakala kandungan protein yang rendah. Jumlah tenaga, protein, karbohidrate, dan lemak per hidangan untuk sarapan pagi ialah 300-400 kcal, 25-40 g, 45-60 g, dan kurang daripada 20 g untuk lemak yang disarankan. Intervensi pemakanan yang disarankan kepada sekolah ialah meningkatkan pengambilan kalsium dan serat makanan, kerana kandungan nutrien tidak mencukupi dalam makanan yang disedaikan. Jumlah tenaga, karbohidrat, dan lemak perlu dikurangkan terutamanya dalam hidangan yang tinggi kalori dan lemak dan mencadangkan untuk memperbanyak pilihan makanan dengan menambah lebih banyak buah-buahan, sayur-sayuran, dan bijirin penuh di kantin sekolah, untuk mencapai makronutrien yang seimbang dengan protein tanpa lemak, karbohidrat kompleks, dan lemak sihat. Makanan yang tinggi gula dan lemak hendaklah disajikan dengan lebih

jarang bagi membantu pengawalan pengambilan kalori dan meningkatkan gaya pemakanan yang lebih sihat.

ABSTRACT

The study used a non-probability sampling method, specifically convenience sampling techniques. Four schools with the school meal program were chosen at random from the 92 that met the inclusion criteria. The four primary schools selected for this study, which demonstrated different dietary patterns, are located in Kota Bharu, Kelantan. All food samples over ten school days were analyzed for calorie, protein, carbohydrate, fat, fiber, calcium, iron, and folate (Vitamin B-9) content. Most of the meals provided were rice-based, such as rice porridge, chicken rice, Chinese fried rice, villager's fried rice, chicken curry rice, coconut milk rice, and paprika rice. The range of calories, protein, carbohydrates, and fat per serving for each school was 320-484 kcal, 13-22 g, 34-75.1 g, and 9-13.3 g. The meals provided under the Rancangan Makanan Tambahan (RMT) contained high amounts of energy and carbohydrates but low protein content. The recommended amounts of energy, protein, carbohydrates, and fat per serving for breakfast were 300-400 kcal, 25-40 g, 45-60 g, and less than 20 g for fat. The targeted nutritional intervention recommends schools enhance calcium and dietary fibre intake, as these nutrients were frequently deficient in the assessed meals, while decreasing total energy, carbohydrate, and fat, particularly in high-calorie and fatty dishes. Diversifying meal options by including more fruits, vegetables, and whole grains are suggested for school canteens, as ensures balanced macronutrient distribution with lean proteins, complex carbohydrates, and healthy fats. High-sugar and high-fat foods should be served less frequently to help control calorie intake and promote healthier eating habits.

CHAPTER ONE

INTRODUCTION

1.0 Background of Study

The global prevalence of overweight and obesity in children was rising, including in Malaysia (De Bont *et al*., 2020; Roberto *et al*., 2015). For instance, in Spain, approximately 41% of children aged between 6 and 9 years were overweight/obese in 2015, the second highest prevalence in Europe. This prevalence was alarming given that childhood and adolescent obesity was associated with later-life health consequences, including adult overweight/obesity and cardiovascular, musculoskeletal, and endocrine diseases (De Bont *et al*., 2020; Mado, 2021). Obesity was regarded as a defining health issue and was recognized as the most common form of malnutrition, increasing the incidence of obesity-related complications and the global disease burden (Claire Wang *et al*., 2011). The etiology of obesity, on the other hand, was likely multifactorial but was poorly understood. It was widely assumed that genes and environment played a role in the occurrence and progression of obesity (Casazza *et al*., 2015). According to a recent study, energy imbalance could cause obesity via hypothalamic regulation, and dietary habits were closely related to energy balance (Obri & Claret, 2019). It was well established that breakfast was the most important meal of the day; however, the use of breakfast was defined differently across different studies (Feeley *et al*., 2012). A first meal to be consumed a day before or at the beginning of the activity within 2 hours of waking up, usually no later than 10 am, had a calorie content of 20% to 35% of the total daily energy requirement and/or any food or beverage consumption between 5 and 9 am.

The patterns of dietary behavior among populations across the lifespan, including school-aged children, had changed dramatically over the past 40 years with the changes in life rhythm (Almoraie *et al*., 2021). Typically, breakfast, lunch, and dinner meals were difficult to distinguish because meal skipping, particularly breakfast skipping, had become more common among school-age children, adolescents, and working adults (Jeong, 2019; X. Ma *et al*., 2020). Breakfast skipping had recently become a contentious public health issue for school-age children, adolescents, and working adults (Monzani *et al*., 2019a, 2019b). Many people believed that skipping breakfast could help them lose weight. However, this behavior might have increased the prevalence of obesity and obesity-related complications (Telleria-Aramburu & Arroyo-Izaga, 2022), and eating breakfast on an ongoing basis might have successfully decreased the risk of obesity (Ober *et al*., 2021).

Based on the nationwide survey of the National Health & Morbidity Survey (NHMS) among children and adolescents aged 5 to 17 years in 2019, the prevalence of overweight and obesity had increased from 15.1% in 2011 to 29.8% in 2019 (Institute for Public Health, 2020). This finding emphasized the dramatic rise in the prevalence of childhood obesity in Malaysia, with implications for later-life psychosocial and cardiometabolic health. A poor diet was well-documented as one of the major determinants of an increased risk of malnutrition in school-aged children, ranging from underweight to obesity (Driessen *et al*., 2014; Rodriguez-Martinez *et al*., 2020).

In order to achieve the Sustainable Development Goals, it was important to recognize the role of prevention and health promotion in reducing the prevalence and burden of diseases (WHO, 2018). Therefore, designing an effective healthy lifestyle program interconnected with the education programs in primary schools could improve health literacy needed to prevent this public health concern among primary school children. Previous studies reported that Malaysian primary school children were at increased risk of poor dietary behaviors, including breakfast skipping, low fruit and vegetable intakes, unhealthy snacking behaviors, and low physical activity, which might have affected their nutritional status and exposed them to malnutrition, lower cognitive performance, and poor quality of life. There was a need for a holistic nutrition intervention program that promoted healthy eating and active living for all primary school children so that they could have a healthy lifestyle, good nutritional status, better cognitive performance, and good quality of life (Teo *et al*., 2019).

Therefore, in Malaysia, school feeding addressed these issues while also benefiting children's health, education, and social development. Furthermore, it lowered household food expenses while increasing disposable income, which was especially important for low-income households. Procurement for school feeding programs, if well designed and implemented, had the potential to transform local food agriculture and increase the incomes of smallholder farmers.

Annually, governments in both developed and developing nations, as well as international organizations including the World Food Programme (WFP), spent millions of dollars on school meal programs, which provided food to students. Program designs differed, and

food distribution modalities ranged from on-site morning meals to take-home food rations, depending on various factors such as infrastructure constraints. When schools lacked proper kitchen facilities, for instance, providing pre-packaged fortified snacks was recommended. The most well-known school meal program in Malaysia was the Rancangan Makanan Tambahan (RMT), which provided free meals to primary school students from low-income families. Other programs, in addition to RMT, included the parent-funded Program Hidangan Berkhasiat di Sekolah (HiTS). Despite their prevalence, little was known about why they were necessary, how they were implemented, and how effective they had been. Furthermore, recent discussions in Malaysia centered on expanding school feeding from a targeted program to a universal one.

1.2 Problem Statement

It was generally agreed that breakfast consumption was considered the most vital meal of the day for all generations (Spence, 2017). Breakfast intake in children and adolescents was regarded as an important way to encourage and promote the achievement of optimal nutritional well-being during their critical growing years when they were still in the growing and developing process. Eating breakfast was important for everyone, especially for children and adolescents, because breakfast improved cognition, possibly due to the immediate cognitive impact of breakfast consumption. According to a recent study, eating grain/rice for breakfast 6-7 days per week increased average verbal, performance, and full-scale IQ scores compared to rare grain/rice intake (J. Liu *et al*., 2021). These findings corroborated existing studies suggesting that breakfasts high in complex carbohydrates improved cognitive performance throughout the morning (Peña-Jorquera *et al*., 2021). On the other hand, long-term regular breakfast consumption was associated with increased verbal and full IQ scores (J. Liu *et al*., 2021). Previous longitudinal studies on the effects of school breakfast programs found that breakfast consumption was positively associated with educational outcomes, improved memory, and improved concentration (Adolphus *et al*., 2015; Lundqvist *et al*., 2019).

Breakfast skipping was a common problem among school-aged children. A recent systematic review reporting on the prevalence of breakfast skipping among children and adolescents from 33 countries (n = 285,626, aged 2-18 years) concluded that most studies reported between 10-30% of young people skipped breakfast (Monzani *et al*., 2019a, 2019b). Commonly reported reasons for breakfast skipping among children and adolescents included a lack of time, enjoyment of breakfast, feelings of hunger in the morning, and weight control (Mullan *et al*., 2014). Evidence suggested that breakfast

skipping was most prevalent among females, older children, and adolescents (Monzani *et al*., 2019a, 2019b). A nationwide survey conducted between 2010 and 2011 found that 9.8% and 11.8% of children aged 6 months to 12 years old were overweight and obese respectively, while the 2012 Malaysia School-Based Nutrition Survey (MSNS) reported that 14.6% and 12.3% of children aged 10-17 years were overweight or obese respectively (Tee *et al*., 2018a, 2018b).

The quality of breakfast in children was important because regular consumption of nutritious cereal-based breakfast helped children perform in a variety of tasks. Growing children's brains received enough energy from glucose metabolism to support cognitive behavior in terms of memory, concentration, and mathematical problem-solving (Arora, 2022).

1.3 Significance of the study

Research conducted shows that breakfast consumption was fundamental to the health and development of adolescents (Nurul-Fadhilah *et al*., 2013). A study carried out proved that regular breakfast consumption increased satiety, prevented weight gain, and subsequently reduced the likelihood of childhood obesity (Tee *et al*., 2018b). Although breakfast intake contributed a lot of benefits worldwide, people still skipped breakfast and showed unhealthy eating practices, especially children and adolescents (Affinita *et al*., 2013). In Malaysia, studies found that breakfast was the most frequently skipped meal among school children and adolescents (Foong Ming *et al*., 2006). Therefore, the school meal program in Malaysia was developed, such as the Rancangan Makanan Tambahan (RMT), which gave free meals to primary school students from low-income households. Aside from RMT, other programs included the parent-funded Program Hidangan Berkhasiat di Sekolah (HiTS).

The school meal program was developed to avoid hunger, affecting development and learning. As children entered their schooling period, they gained more autonomy in deciding what they ate, especially while they were at school. This contributed to their dietary habits and ultimately, their health status (UNICEF, GAIN 2019; UNICEF, 2019). Additionally, the daily energy intake at breakfast was essential for concentration and participation in school (UNICEF, 2019). For hungry students, learning became more difficult because they had skipped breakfast and were encouraged to eat by purchasing food in or outside schools, but there might have been little to no healthy options. For instance, ultra-processed foods and sugar-sweetened beverages were easily sold to children in these settings. Hence, it might not have been surprising that some children who did not eat breakfast had higher Body Mass Index (BMI) than their peers who did

since the former tended to eat more snacks high in calories but low in other nutrients (Utter *et al*., 2007).

The existence of a school meal program aimed to overcome poor diets and nutritional status (Pokorney *et al*., 2019). Statistics on children's nutritional outcomes gave much cause for concern. Undernutrition affected how children grew and developed and was associated with impaired cognitive function, higher school absenteeism, and poor school performance (UNICEF, 2019). Adolescents were especially vulnerable to undernutrition, in part because rapid growth demanded good nutrition. In 2017, 8.2% of school-going children aged 10 to 17 years were stunted, i.e., too short for their age. As a direct consequence of the nutrient profile, the study was conducted to assess nutrient intake and serving sizes based on the nutrient profiling system of the school meal program in primary schools in Kota Bharu, Kelantan, and was compared to the recommended menu from the Malaysian Food-based dietary guidelines. The nutrient profiling was also used to assess the nutritional quality of foods, improve the nutritional quality of diets, and differentiate between nutrient intakes and serving sizes among the selected primary schools. Additionally, the nutritional assessment of breakfast was carried out in primary schools in Kota Bharu to evaluate based on nutritional profiles to ensure overall compliance with dietary recommendations. Considerable changes on the supply side, such as an increase in fruit and vegetable portions and a reduction in salt and fat in the breakfast, were implemented to align with the desired nutritional standards.

1.4 Research Question

i. What was the nutrient profile of the School Meal Program in primary schools in Kota Bharu, Kelantan?

ii. What was the nutrient profile model used in the assessment of the School Meal Program in primary schools in Kota Bharu, Kelantan?

iii. Was there any association between nutrient intake and serving size based on the nutrient profile in the assessment of the School Meal Program in primary schools in Kota Bharu, Kelantan?

1.5 Research Objectives

1.5.1 General Objectives

To evaluate the nutritional profile of school meal programs according to nutrient intake and serving size, which were offered and consumed in primary schools in Kota Bharu, Kelantan.

1.5.2 Specific Objectives

i. To analyse the meals selected by the schools through the School Meal Program in primary schools in Kota Bharu, Kelantan.

ii. To analyse the nutrient contents in each menu offered by the selected schools, and compare with the RNI Malaysia.

iii. To identify the association between nutrient intake and serving size based on the nutrient profile in the assessment of the School Meal Program in primary schools in Kota Bharu, Kelantan.

1.6 Research Hypothesis

Null Hypothesis (H0):

There was no significant association between nutrient intake and serving size based on the nutrient profile in the assessment of the School Meal Program in primary schools in Kota Bharu, Kelantan.

Alternative Hypothesis (H1):

There was a significant association between nutrient intake and serving size based on the nutrient profile in the assessment of the School Meal Program in primary schools in Kota Bharu, Kelantan.

CHAPTER TWO

LITERATURE REVIEW

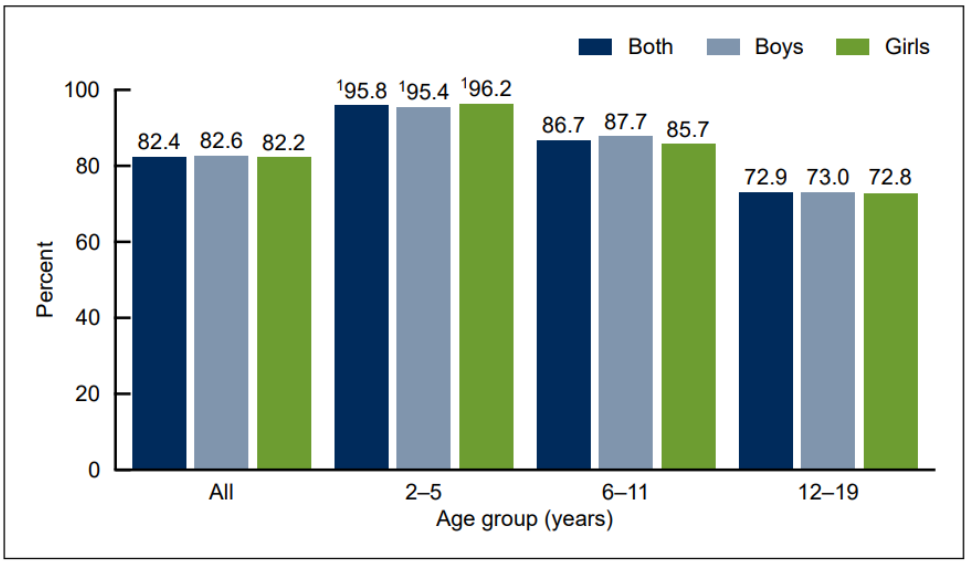
2.1 School Meal Program

Every year, governments in developed and developing countries, along with international organizations such as the World Food Programme (WFP), spent millions on school feeding programs, i.e., the provision of food to school children. Program designs varied, and food distribution modalities ranged from on-site morning meals to take-home food rations, depending on several factors including infrastructure constraints, among other things. For example, providing packed fortified snacks was recommended when schools lacked proper kitchen facilities. In Malaysia, the best-known school feeding program was the Rancangan Makanan Tambahan (RMT), which gave free meals to primary school students from low-income households. Aside from RMT, other programs included the parent-funded Program Hidangan Berkhasiat di Sekolah (HiTS). Despite the ubiquity of these programs, little was known about why they were needed, how they were implemented, and how effective they had been. Furthermore, recent discussions centered on expanding school feeding from a targeted program to a universal one in Malaysia (Khalidi, J. R., & Gen, T. Z., 2020).

2.2 Impact Breakfast Intake Among Children

The American Academy of Pediatrics recommended that children and adolescents consume breakfast for healthier body weights, improved nutrition, better memory, better test scores, and better attention spans (Terry *et al*., 2015). In 2015–2018, 82.4% of

children and adolescents aged 2–19 years consumed breakfast on a given day, and no difference was observed by sex (Figure 1). Breakfast consumption declined with age. Almost 96% (95.8%) of children aged 2-5 years consumed breakfast, compared with 86.7% of children aged 6–11 years, and less than three-quarters of adolescents (72.9%) aged 12–19 years. The same pattern was observed in both boys and girls, with no differences observed by sex for any age group.



[1]Significant decreasing linear trend with age.
NOTES: Percentages are based on reporting "breakfast" or "desayuno" as the eating occasion for a food or beverage during the in-person 24-hour dietary recall. Access data table for Figure 1 at: https://www.cdc.gov/nchs/data/databriefs/db386-tables-508.pdf#1.
SOURCE: National Center for Health Statistics, National Health and Nutrition Examination Survey, 2015–2018.

Figure 1: Percentages of children and adolescents aged 2-19 years consuming breakfast on a given day, by sex and age: United States, 2015-2018

2.3 Nutrient Composition of School Meal

According to a Preventive Medicine study in 2014, nutrient analyses of meal program menus were performed using menus available in the school meal program to ensure adherence to USDA nutrition standards. The nutrients analyzed included total fat, food energy (kilocalories or "kcal"), carbohydrates, dietary fiber, protein, iron, calcium, and folate (Cummings *et al*., 2014).

2.4 Assessment of Nutrient Profiling in a Meal

Nutrient profiling was defined as "the science of classifying or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health." It was used for deciding the healthiness of foods in a variety of situations (Rito *et al*., 2019). Nutrient profiling provided a means of differentiating between foods and non-alcoholic beverages (henceforth "foods") that were more likely to be part of a healthy diet from those that were less likely (notably those foods that might contribute to excess consumption of energy, saturated fats, trans fats, sugar, or salt). Therefore, it was used to improve the overall nutritional quality of diets. Eat Mediterranean—a program for eliminating dietary inequalities in schools (EM) was developed to address these and other issues in Portugal in 2016. EM was a community-based intervention that followed the public health intervention strategy recommended by the WHO and incorporated in the Portuguese National Health Plan (Rito *et al*., 2019). The program's goal was to reduce nutritional inequalities in school children through the promotion of Mediterranean Diet principles, including a healthy and complete breakfast. This study aimed to evaluate the quality, frequency, and content of breakfast meals of children and participants of the EM program and to evaluate the healthiness of one of the most frequent breakfast food items, RTECs, according to the WHO/Euro-NP (WHO, Regional Office for Europe nutrient profile model, 2015).

2.5 Conceptual Framework

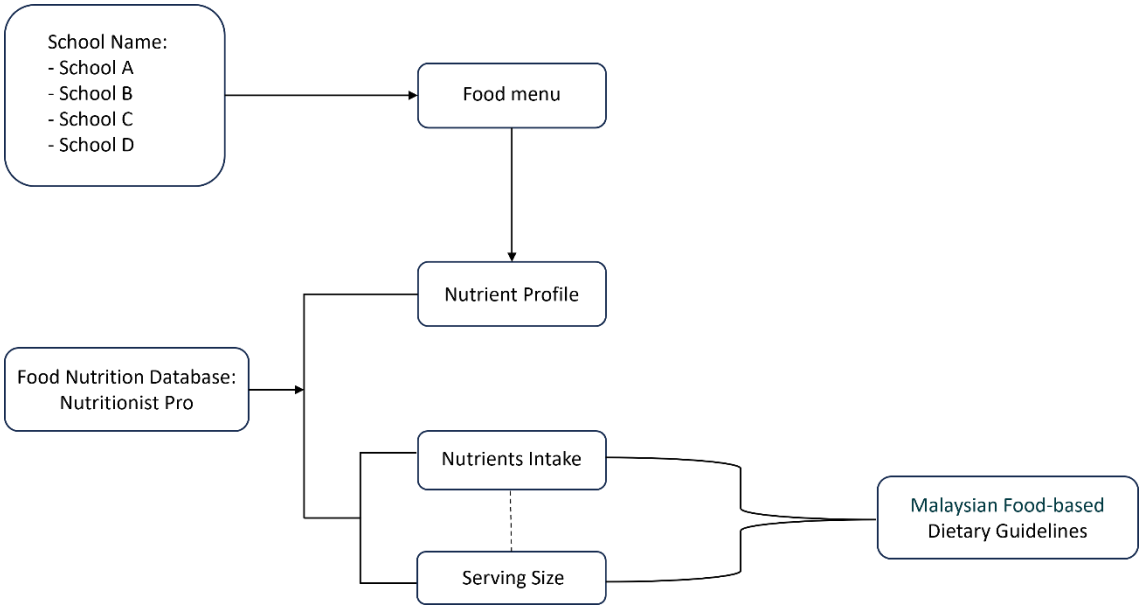


Figure 2: Conceptual work of study

Figure 2 describes the conceptual framework showing that the food menu was obtained from five randomly selected schools in Kota Bharu, Kelantan. Then, the nutrient profile was assessed based on the nutrient intake and serving size for Schools A, B, C, and D. This nutritional analysis was performed using the Nutritionist Pro software. The software used the USDA food nutrient database to analyze the food items on the menu; the database was continually updated to align with the dietary recommendations. The nutrient intake and serving size in all food menus for all selected schools were compared to the Malaysian Food-based Dietary Guidelines. The comparison was performed to determine whether or not the entire food menu in each school followed the meal recommendations.

CHAPTER THREE

Methodology

3.1 Research Design

The study's research design was a cross-sectional study aimed at investigating the relationship between nutrient intake and serving size based on the nutrient profile in the assessment of the School Meal Programme in primary schools in Kota Bharu, Kelantan. The study focused only on the food menu offered in the school meal programme. A cross-sectional study was conducted for this study, which used a comprehensive approach. This study focused on primary schools involved in the school meal programme in Kota Bharu, Kelantan. The sample selection process involved the use of a representative sample obtained through convenience sampling techniques.

3.2 Study Location

There were 399 Sekolah Kebangsaan primary schools in the state of Kelantan, and 92 primary schools in the PPD of Kota Bharu were chosen as a subset which are four schools of interested study areas. This location was chosen because Kota Bharu, one of the most populous cities in Kelantan, was very useful in generalizing the state's population. The proximity of USM Kubang Kerian to the targeted primary schools helped to speed up and reduce the cost of data collection activities. Researchers were able to navigate the selected schools conveniently, fostering more seamless interaction with school administrators, and teachers. This study was conducted specifically at different schools within Kota Bharu based on the chosen subset.

3.3 Study Population

This study did not involve students because the observation was only conducted on the RMT menu.

3.4 Study Criteria

3.4.1 Inclusion Criteria

i. Government primary schools in Kota Bharu that implement the Rancangan Makanan Tambahan (RMT).
ii. School with the teacher that cooperates to answer the questions regarding satisfaction towards the School Meal Program.

3.4.2 Exclusion Criteria

This exclusion is not related to this study, because there was no direct involvement of students in the data collection.

3.5 Sample Size Estimation

According to the list of primary schools from the statistical database provided by the State Education Department (JPN) in Kelantan, there were four school districts (n = 92) that were randomly selected from the sample involved in the school meal program. Therefore, the numbers chosen from 1 to 4 were used as convenience sampling method targets in this study.

3.6 Sampling Method and Subject Recruitment

This research used a non-probability sampling method to utilize the sample by employing convenience sampling techniques. The objective was to draw a representative sample from the total of 92 primary schools in the Kota Bharu district, Kelantan, which offered the school meal program. This investigation aimed to compare the food menu offered by the school meal programs with the Malaysian Food-based Dietary Guidelines based on nutrient intake and serving size. The study began by obtaining the complete list of public primary schools in Kota Bharu, Kelantan, from the Ministry of Education Malaysia's website, which was used as the sampling frame. There were 92 public schools in the Kota Bharu district, and only four schools were randomly selected that met the inclusion criteria before they were finally selected to be a subset of interested schools. Otherwise, another set of schools was reselected.

Before beginning the analysis, we had to obtain the food menu and nutritional information from the four selected schools (Schools A, B, C, and D), and all the school meals offered to the students were analyzed. The analysis of nutrient composition was based on nutrient profiling, which was applied in this study to categorize the food menu by evaluating the quantity of nutrient intake and serving size from the food menu offered by the school meal program. After that, each menu from each school was compared with the recommended menu from the Malaysian Food-based Dietary Guidelines to see if there were any differences. This nutritional analysis was performed using the Nutritionist Pro software, which uses the USDA food nutrient database to analyze the food items on the menu. The database is continually updated to align with dietary recommendations. Fifty menus from the five schools were analyzed based on nutrient components and serving size and compared with the recommended menu using Nutritionist Pro Software. Each

school could only select 10 menus from the 20 menus listed in the Food Supply Agreement, with another 10 menus used in rotation over two weeks. Each menu was assessed based on two main components: nutrient profile or nutrient content and serving size.

3.7 Operational Definition

1) Nutrient Profile

- The science of classifying or ranking foods, can be used for deciding the healthiness of foods (Rito *et al*., 2019).

2) Food Nutrition Database

- Nutritionist Pro is able to create labels for a few regions – USA, Canada, UK/EU, China/HK. For these labels, the government allows the food and food service industry to use an ingredient database and software to calculate recipe data and food labels (Nutritionist ProTM | FAQs., 2022).

3) Nutrient intake and serving size

- Large food PSs may be associated with positive energy and nutrient intake (Flieh *et al*., 2023).

4) School supplementary meal:

- A meal provided to students and sometimes teachers at a school, typically in the middle or beginning of the school day (Definitions for school meal, 2021).

3.8 Data Collection Method

The process of data collection began once permission was granted by the school principal of each selected school. The period for data collection was estimated to be from April 2024 until June 2024.

Prior to starting our analysis, we had to obtain the food menu and nutritional data from each of the four chosen schools (Schools A, B, C, and D). Every school meal provided to students was examined. Therefore, the nutrient composition analysis was predicated on nutrient profiling, which was utilized in this study as a technique to classify the food menu by assessing the amount of nutrient intake and serving size from the menu provided by the Rancangan Makanan Tambahan (RMT). Subsequently, every school's menu was compared to the Malaysian Food-based Dietary Guideline, which served as the recommended menu, to determine whether any differences existed. The Nutritionist Pro program was used to carry out this nutritional analysis. The USDA food nutrient database, which was updated regularly to comply with dietary recommendations, was used by the software to analyze the food items on the menu. The Nutritionist Pro software was used to analyze 20 menus from the four schools, taking into account serving sizes and nutrient components. The recommended menu was compared with the menus, as each school was only allowed to accept 10 menus out of the 20 listed in the Food Supply Agreement. Consequently, ten more menus were rotated over the course of two more weeks. Next, each menu was evaluated using two primary criteria: serving size and nutrient profile, also known as nutrient content.

3.9 Flowchart of Study

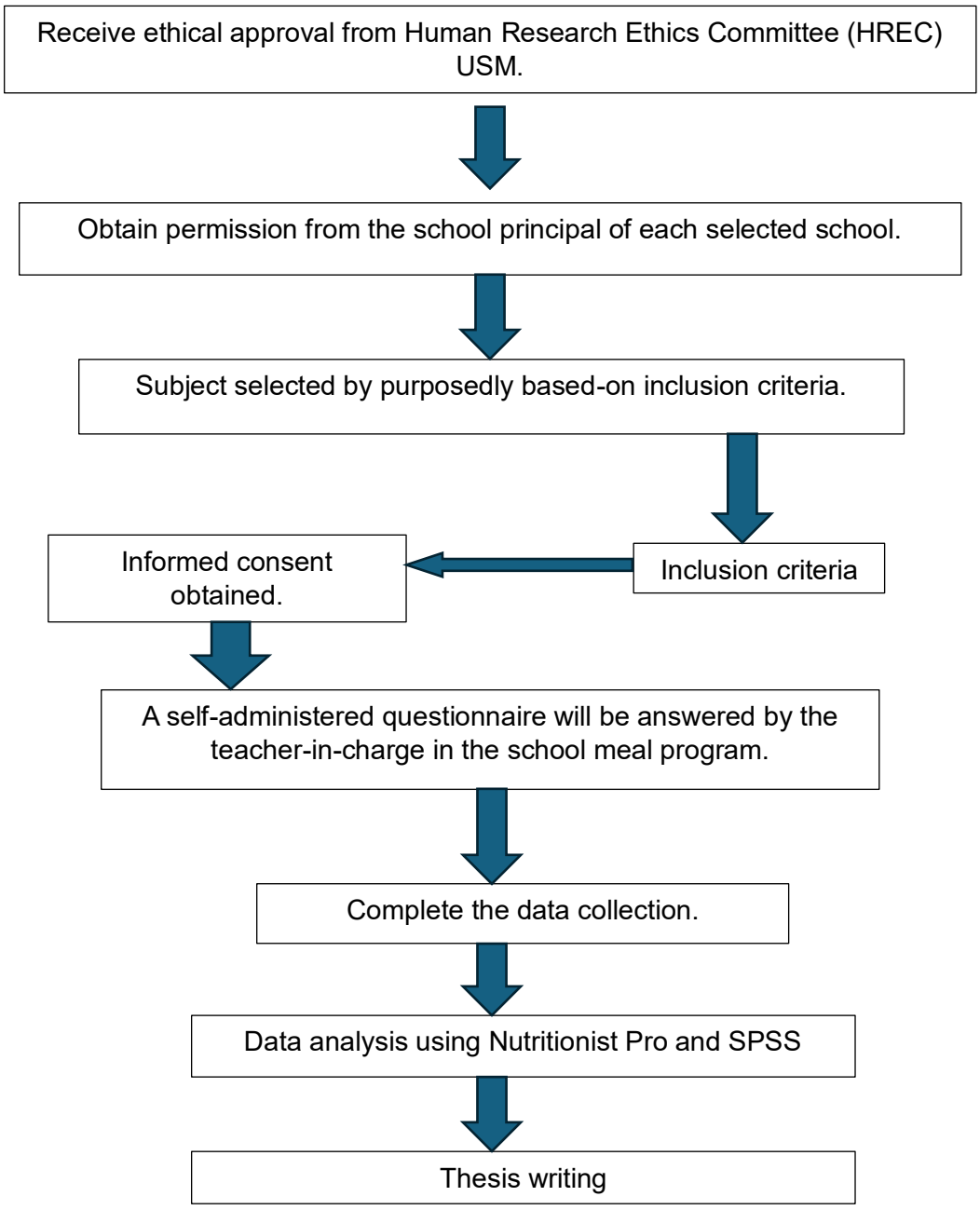


Figure 3: Study Flowchart

3.10 Data Analysis

The analysis of the collected data was conducted using Nutritionist Pro software. All ingredients for each meal were entered into the software to generate the total number of nutrients contained in each meal. The data represented all nutrients present for each selected school. After that, the data was entered into the Excel sheet and IBM SPSS Statistic 27 application to generate the frequency of meals selected by each school based on the food groups. Additionally, the average change in kilocalories per meal for breakfast and the number of servings was calculated and used to estimate the net calories (kcal) offered in Rancangan Makanan Tambahan (RMT).

CHAPTER FOUR

RESULTS

4.1 General characteristic of the schools in the study

The clustered bar chart shown in Figure 4 shows the percentage of male and female students in four schools that involve in the program of Rancangan Makanan Tambahan (RMT). The schools are SK. Peringat, SK. Wakaf Stan, SK. Seribong, SK. Kubang Kerian 2.

Overall, the percentage of male and female students is fairly balanced across the four schools. The highest percentage of female students is 19.82% in SK. Seribong, and the lowest is 9.22% in SK. Peringat. The highest percentage of male students is 18.28% in SK. Seribong, and the lowest is 9.83% in SK. Peringat.

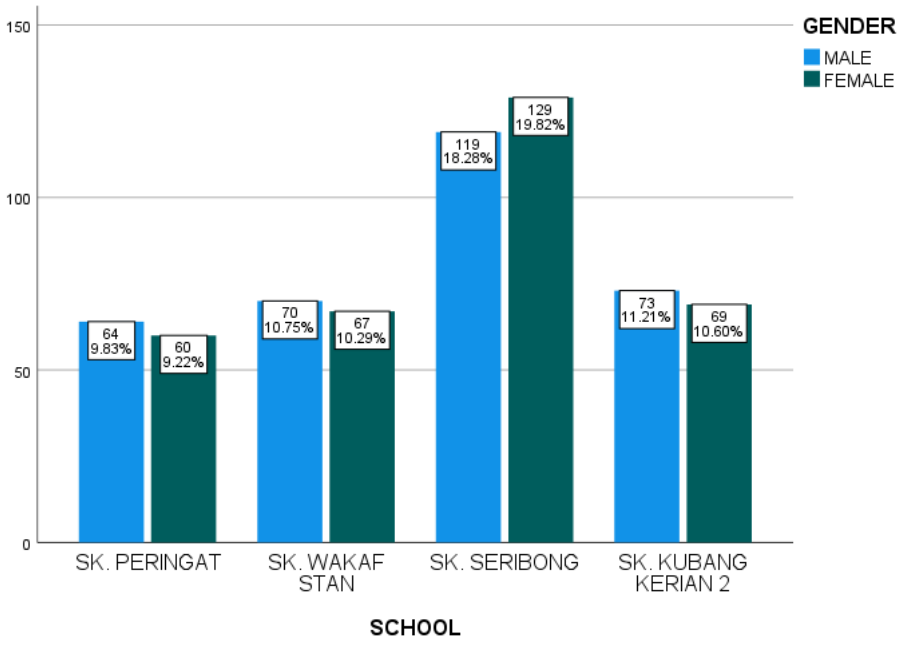


Figure 4: the percentage of male and female students in four schools

A comparison of each group of mean intakes for selected nutrients based on each school is then presented and compared to the Recommended Nutrients Intakes (RNIs) for Malaysia (Mognard *et al*., 2023).