

**DIETARY DIVERSITY ASSESSMENT OF FOOD MENUS OFFERED  
IN SCHOOL CANTEEN FROM URBAN AND RURAL PRIMARY  
SCHOOLS IN KELANTAN**

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UNIVERSITI SAINS MALAYSIA**

**2025**

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IN SCHOOL CANTEEN FROM URBAN AND RURAL PRIMARY  
SCHOOLS IN KELANTAN**

**By**

**NUR ALYA NASUHA BINTI MOHD RIDUAN**

**DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF  
REQUIREMENTS FOR THE DEGREE OF BACHELOR OF HEALTH  
SCIENCE NUTRITION (HONOUR) JANUARY 2026**

## **CERTIFICATE**

This is to certify that the dissertation entitled “Dietary Diversity Assessment of Food Menus Offered in School Canteen from Urban and Rural Primary Schools in Kelantan” is the bona fide record of research work done by Nur Alya Nasuha binti Mohd Riduan with matric number 162530 during the period from March 2025 to February 2026 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 Nutrition (Honours).

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Signature

.....

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## **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.

Signature

.....

Nur Alya Nasuha binti Mohd Riduan

Date: 8 February 2026

## **Acknowledgment**

First and foremost, I would like to express my deepest gratitude to Almighty God for granting me the strength, patience and perseverance to complete this thesis successfully.

I am sincerely thankful to my supervisor, Prof Madya Dr Foo Leng Huat, for his invaluable guidance, constructive feedback and continuous encouragement throughout the course of this research. Their expertise and support have been instrumental in shaping this study.

I would also like to extend my heartfelt thanks to the headmasters, teachers, and canteen operators of the school involved in this study for their cooperation and assistance during the data collection process. Without their support, this research would not have been possible.

A special thanks are due to my friend especially Nur Aina Nasuha and colleagues who have offered encouragement, shared knowledge and provided moral support throughout this journey. Finally, I am forever indebted to my parents and family for their unconditional love, prayers and unwavering support. Their encouragement has been my greatest source of strength and motivation.

To all who have contributed in one way or another, I extend my sincere appreciation.

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## **Abstrak**

Kepelbagaian diet merupakan penentu bagi kecukupan nutrisi dan perkembangan kanak-kanak. Kantin sekolah memainkan peranan utama dalam membentuk tabiat pemakanan, namun banyak menu yang ditawarkan masih terhad dari segi variasi. Kajian ini dijalankan untuk menilai skor kepelbagaian diet (Dietary Diversity Score) bagi menu sarapan pagi yang disediakan di kantin sekolah rendah di kawasan bandar dan luar bandar di Kelantan, Malaysia. Reka bentuk kajian ini adalah keratan rentas melibatkan enam buah sekolah (tiga bandar dan tiga luar bandar). Menu yang disediakan di kantin sekolah diperhatikan selama lima hari berturut-turut dan DDS dikira berdasarkan kehadiran lapan kumpulan makanan iaitu karbohidrat, protein, sayur-sayuran, buah-buahan, produk tenusu, lemak dan minyak, gula dan makanan manis serta kekacang.

Hasil kajian menunjukkan bahawa sekolah bandar secara umum mencapai DDS yang lebih tinggi berbanding sekolah luar bandar, yang lebih bergantung kepada makanan berasaskan karbohidrat dengan penyertaan buah-buahan dan produk tenusu yang terhad. Secara keseluruhan, kebanyakan menu berada dalam kategori kepelbagaian sederhana, menandakan kekurangan kumpulan makanan yang kaya dengan mikronutrien. Dapatan ini menekankan perbezaan kualiti menu antara sekolah bandar dan luar bandar serta keperluan untuk perancangan diet yang lebih baik.

Kesimpulannya, kajian ini membuktikan bahawa menu kantin sekolah di Kelantan masih kurang kepelbagaian, yang berpotensi menyumbang kepada kekurangan nutrisi dalam kalangan murid sekolah rendah. Pengukuhan dasar pemakanan, kepelbagaian menu, dan pendidikan pemakanan disyorkan bagi meningkatkan kualiti persekitaran makanan di sekolah serta menyokong pertumbuhan, pembelajaran, dan kesihatan jangka panjang kanak-kanak.

## **Abstract**

Dietary diversity is a critical determinant of nutritional adequacy and child development. School canteens play a central role in shaping dietary habits, yet many menus remain limited in variety. This study aimed to assess the dietary diversity score (DDS) of breakfast menus offered in primary school canteens across urban and rural districts in Kelantan, Malaysia. A cross-sectional design was employed, involving six schools (three urban, three rural). All menus that sold in school canteen were observed over five consecutive days, and DDS was calculated based on the presence of eight food groups: carbohydrates, proteins, vegetables, fruits, dairy products, fats and oils, sugar and sweets, and legumes.

Findings revealed that urban schools generally achieved higher DDS compared to rural schools, which relied heavily on carbohydrate-rich meals with limited inclusion of fruits and dairy products. Overall, most menus fell within the moderate diversity category, indicating insufficient representation of nutrient-dense food groups. These results highlight disparities in menu quality between urban and rural schools and underscore the need for improved dietary planning

In conclusion, the study demonstrates that school canteen menus in Kelantan lack adequate diversity, potentially contributing to nutritional inadequacies among school-aged children. Strengthening nutrition policies, diversifying menus, and promoting nutrition education are recommended to enhance the quality of school food environments and support children's growth, learning, and long-term health.

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 Healthy Diet in Children**

A balance and healthy diet play a main role in growth and development of children especially for school-aged children. School-aged children need to eat five healthy food groups which are vegetables and legumes, fruits, cereal and grains, dairy product and meat and fish (Raising Children Network, 2021). Healthy fruits are important for children aged 7 to 13 years because it can support growth, development and learning. Each food groups has a different nutrient that body need to work properly. Healthy diet act to protect children from easily getting disease in life like heart disease, diabetes and hypertension. According to Ministry of Health, the number of serving for five food groups is increase as well as the age increase. For example, children aged 7-9 years require 4- servings of cereal and grains, 2 servings of fruits, 3 servings of vegetables, 1 serving for meat/poultry/pish and 2 serving of dairy product or milk. For children ages 10-12 years, it required 6-7 servings of cereal and grains, 3 servings of vegetables and slightly more protein and dairy (Ministry of Health Malaysia, 2013). Healthy diets are not only focusing on main meals a day, but it can also obtain from having a snacking. Example of healthy snacking food are yogurt and vegetable stick. During snacking, usually children tend to eat ultra processed food, salty and sugary foods. To avoid that, parents need to prepare the healthy food like apple, watermelon and yogurt in fridge to train them eat that.

Healthy diet is crucial in school-age children. During adolescence, the adoption of adequate dietary and exercise habits can protect against obesity and prevent chronic diseases, such as diabetes mellitus, heart disease or stroke (Guevara

et al 2020). Proper nutrition during childhood especially school-aged children is essential for growth and development. During age of 7-12 years old, the nutrients like protein, calcium and vitamins are significant to build strong muscle, bone and tissue. If the children lack essential nutrient, they may have high risk to be stunting and delayed development. Next, it also gives a positive impact to cognitive function. As we know, a brilliant student usually has a good cognitive function. By having a healthy diet like vitamin and mineral, student will have higher brain function which lead them to perform the best in academically. In addition, reduce risk of chronic disease is one of the important for school-aged children for having a healthy diet. In early childhood, it is a good time to train children choose the best dietary pattern for their life. This is because it will give an impact for them in future. Choosing a healthy diet will reduce potential of develop chronic disease like diabetes mellitus and obesity. According to Chua et al. (2024), prevalence of obesity for 5 to 12 years old was 13.0%.

Common nutritional issues and concerns in school-age children nowadays are malnutrition, obesity and overweight. Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy or nutrients (World Health Organization, 2024). It means poor nutrition and can refer to undernutrition and overnutrition. Undernutrition is not getting enough nutrients while overnutrition is getting more nutrients than needed NHS (2023). Obesity is a chronic complex disease defined by excessive fat deposits that can impair health (World Health Organization, 2025). Obesity can be classified by Body Mass Index (BMI) which  $30\text{kg/m}^2$  and above. Overweight is a weight over and above what is required or allowed. It can classify by using Body Mass Index (BMI) which  $25\text{kg/m}^2$  to  $29\text{kg/m}^2$ . These nutritional issues mostly derived from consuming poor healthy diet like sweet beverages and ultra processed food. Ultra processed foods have higher calorie that body uses for activities

like walking and organ functions. But the extra calories that not used has been stored as a fat in body. The fat can build up under the skin that led to weight gain. As we know, processed food has high glycaemic index (GI). High glycaemic index causes a quick rise in blood sugar but quick drop too. So that, it can easily risk getting health problem if consuming it too much.

In school canteens, they provide a breakfast menu in early morning around 7am and also main meal around 10.15am which is during recess session. Breakfast is crucial for people because it will give an initial energy needed to start performing a daily activity. For school children, breakfast will help to support concentration and enhance academic performance. However, school canteen usually has served the food with limited variety nutrition. It will influence to student's dietary habits negatively. Dietary diversity Score (DDS) is used to measure diet quality that assesses the frequency of food consumption from various food categories over a specific period, indicating nutritional adequacy and variety, which is essential for overall health, especially in children (Jafari et al., 2019). The major problem related to poor nutrition among school students is the double burden of malnutrition, which includes stunting and thinness (undernutrition), and overnutrition like overweight and obesity. Having these condition is leading to increased health risks, lower academic performance, and greater susceptibility to infectious diseases Estecha Querol et al. (2021).

Hence, the aims of the present study will be formulated to assess the dietary diversity score of menus that offered in school canteens for all day in Kelantan. Dietary diversity is an important aspect of nutrition, especially for children and adolescents who are in their growing phase. A balanced and diverse diet helps promote good health, support learning, and reduce the risk of nutrition-related diseases. Dietary Diversity Score (DDS) is only focusing on breakfast menu that has been provided in

school canteen. There is no human involving but relying on the observation and analysing menu.

## **1.2 Problem Statement**

The development of the children is mostly dependent on their dietary pattern especially during school sessions. As we know, having a balanced diet will help to improve cognitive functions and learning abilities. Not just that, it also improves concentration in class due to having a full energy during breakfast. The Malaysian Health and Adolescents Longitudinal Research Team (MyHeART) study among Malaysian adolescents suggested that students who live in rural areas consumed more sugar, cholesterol and energy in their dietary intake than their peers in urban schools (Abdul Majid et al., 2016). It is shown that people that stay in rural area more tend to consume unhealthy diet than people stay in urban. One of the reasons is in rural rea, they lack variety healthy diet that make it hard to find in market. So, all people especially parents and school need to pay an attention about their diet by providing a meal to students in the morning especially to the student that not having breakfast in home.

Despite efforts to improve school meals, many canteen menus still lack variety and fail to meet dietary recommendations. Limited diversity can lead to micronutrient deficiencies, poor eating habits, and long-term health issues. So, assessing the quality and variety of food is essential. Dietary Diversity Score (DDS) is assessment tool in nutrition research to evaluate the dietary diversity among school children. This study is important to evaluate the diversity score for breakfast menu that provided in school canteen.

### **1.3 Research Questions**

- 1.3.1** What types of breakfast foods are offered in the selected school canteen over 5 days observation?
- 1.3.2** What is the Dietary Diversity Score (DDS) for each school's breakfast menu?
- 1.3.3** Which food groups are most commonly available for menu in school canteen?

### **1.4 Research Objectives**

#### **1.4.1 General objectives**

To assess the dietary diversity score of breakfast menus served at school canteens in primary school of Kelantan.

#### **1.4.2 Specific objectives**

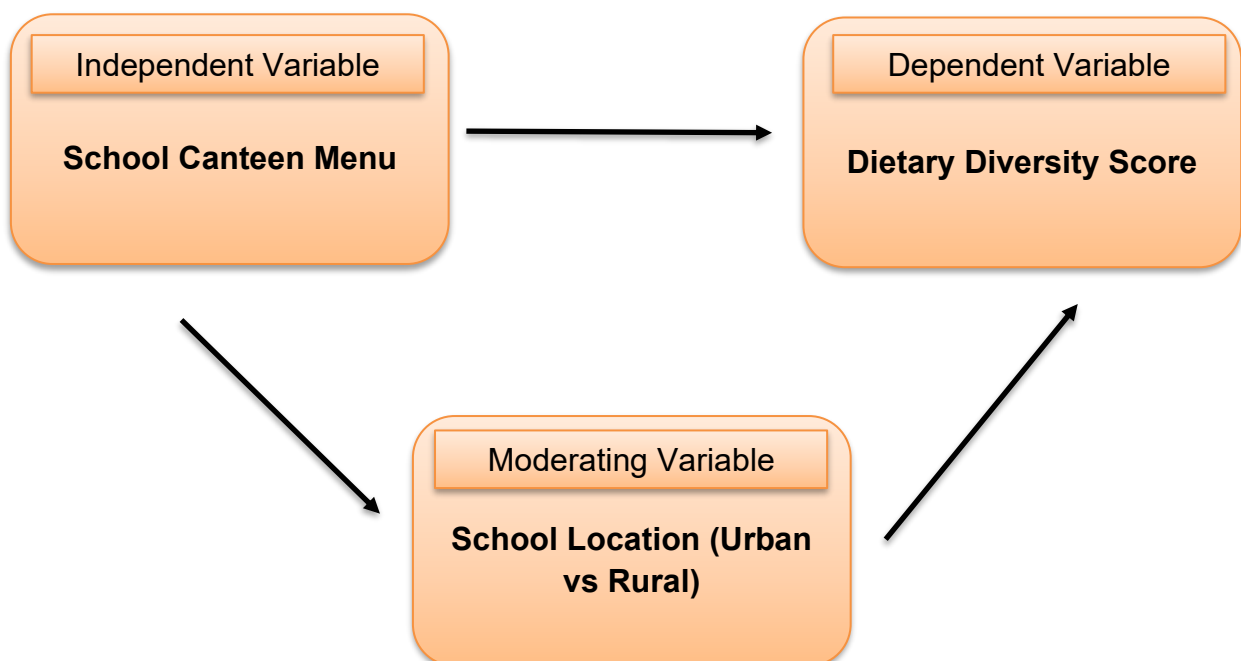
- i. To identify the types of food groups included in breakfast menus of selected school canteens over 5 days.
- ii. To calculate the Dietary Diversity Score (DDS) of breakfast menus for each breakfast menu.
- iii. To identify the most frequently available food groups in school canteen breakfast menu.

## 1.5 Research Hypothesis

### 1.5.1 Null hypothesis

There is no significant difference in the dietary diversity score of breakfast menu served at school canteens in primary school of Kelantan.

## 1.6 Conceptual Framework



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Previous Study**

There are some previous studies that assess the dietary diversity in school children especially in the context of meal that has been served in school. Dietary diversity has been widely used as a proxy indicator of diet quality and nutritional adequacy among children (Kennedy et al., 2013; Jafari et al., 2019). Numerous international and local studies have demonstrated that low dietary diversity among school-aged children is associated with poor nutritional status, inadequate micronutrient intake, and adverse health outcomes. Previous studies have applied Dietary Diversity Score (DDS) to evaluate eating patterns either through dietary recalls, food frequency questionnaires, or observation of food availability in schools.

In low- and middle-income countries, school-aged children often experience limited dietary diversity due to socioeconomic constraints, food availability, and environmental factors. In Plateau Central Region, the primary school children do not have a good dietary practice. Thus, 13.4% of students have a low DDS indicate insufficient intake of varied food groups and average in 48.9%, versus 37.7% high DDS (Ouedraogo et al., 2024). This finding highlights the persistent issue of monotonous diets dominated by staple foods with limited inclusion of fruits, vegetables, and animal-source foods.

In Malaysia, similar concern has been reported. A total of 36.4% of children consumed cereal/grains diversely while fruits were not diversely consumed by 96.4% of them (Devindran et al., 2022). This data has been recorded by previous research that conducted in Negeri Sembilan. Most of them that has low dietary diversity score

contribute to has low weight status. It highlighting inadequate micronutrient exposure among Malaysian school children. Children with lower DDS were more likely to have underweight or abnormal weight status, suggesting that dietary diversity plays an important role in maintaining healthy growth.

Despite the growing body of evidence, most previous studies have focused on individual dietary intake using 24-hour dietary recall or self-reported data. There is limited research that evaluates dietary diversity based on food menus provided by school canteens, particularly in the Malaysian context. This highlights the need for studies that assess the dietary diversity of foods offered in school environments as school canteens significantly influence children's daily food consumption.

## **2.2 Overview Dietary Diversity**

Dietary Diversity (DD) is known as the quantity of various food groups or food ingested over a specific time period (Agbo et al., 2025). Based on Food and Agriculture Organization (FAO) 2013, dietary diversity refers to the number of different food groups consumed over a specific reference period and is recognised as a core indicator of diet quality. Dietary diversity is important in nutrition because it is required to meet the energy requirements and other necessary nutrients. Dietary Diversity is related to the increases of nutrient adequacy of diet (Kennedy et al., 2013). A diversified diet is particularly important for children, as it supports optimal growth, cognitive development and immune function.

Dietary Diversity Score (DDS) is a quantitative measure used to access dietary diversity and has been widely applied in nutrition surveillance and research among children and adolescents (Jafari et al., 2019; Agbo et al., 2025). It is calculated by counting

the number of food groups consumed within a given time frame regardless of portion size.

According to Guidelines, there are 12 food groups involve which are cereals, white tubers and roots, vegetables, fruits, meat, eggs, fish and other seafood, legumes, nuts and seeds, milk and milk product, oils and fats, sweets and spices, condiments and beverages. In the context of school canteen and school-aged children, DDS is often modified to reflect commonly available foods. In this study, the food groups involve are carbohydrate, protein, vegetables, fruits, dairy products, fats and oil, sugar and sweet foods and legumes. This is because the food groups involve is suitable with children and food served in school canteen as it captures the main sources of energy and nutrients typically offered during breakfast.

DDS has a several advantages as an assessment tool. It is simple, cost-effective and does not require complex nutrient analysis. Furthermore, it is suitable for observational studies where directly dietary intake data from individuals is not collected. However, DDS does not account for portion size or food quantity and therefore should be interpreted as an indicator of diet quality rather than total nutrient intake.

### **2.3 Importance of Menus in school canteen for School Children**

School canteen is food service outlet that located within school compound. The role of school canteen is providing meals and beverage to staff and student during school sessions. School canteen usually start operation in early morning before academic session and assembly begin. They will provide menu like cereal and grains as known as breakfast. Breakfast is the first and often considered the most vital meal

of the day, provides energy and nutrients, after an overnight fast (Monzani et al., 2019). Unfortunately, many children skip breakfast, a habit that reportedly becomes more common as they grow older (Gong et al., 2021). Skip breakfast will give a negative impact to health especially school children. One of the examples is leading to poor diet quality and increased morbidity during adulthood. Poor diet quality is because of not have sufficient amount of nutrient that can disturb the organ functioning well. In addition, it can also lead to lack of focus in academic session. The Southeast Asian Nutrition Surveys I (SEANUTS I) demonstrated that 33.2% of Malaysian children aged 2–12 years did not consume breakfast daily, and those with breakfast skipping behaviour had lower micronutrient intakes (Chong, Wu, Noor Hafizah, Bragt, & Poh, 2016). In UK, the 2007 Australian National Children's Nutrition and Physical Activity Survey was used to explore breakfast skipping among 4487 children aged 2–16 years (Sincovich et al., 2022). During recess hour, school canteen provides a main meal and beverages like white rice with poultry and also snack. School canteens play a vital role to promote healthy eating and improve nutritional quality and diversity to school children.

## **2.4 Research Gaps**

While several studies have been explored on nutritional status in children, there is few has focused on the use of dietary diversity score as an indicator of diet quality in school. Some assessments have been made of food availability in school canteen, but the detailed analysis of the nutritional quality and diversity of menu is limited. Existing research tend to focus on nutritional status, obesity prevalence or dietary intake patterns rather than the quality and diversity of school food environments. However, most of the study are more focusing on dietary recall 24 hours of students

which are subject to recall bias and reporting bias. There is limited research about dietary diversity focusing on food directly that provided by school canteen.

There is also limited research that applies dietary diversity score (DDS) without involving human participants, relying solely on menu observation and food classification. This approach can provide an objective assessment of food availability and reduce ethical and logistical challenges associated with human data collection.

On the other hand, it also lacks comparative data on dietary diversity of menus in school canteen between urban and rural areas. Differences in food availability, socioeconomic factors and infrastructure may influence menu diversity. Yet, this aspect has not been adequately explored.

Therefore, this study aims to address these gaps by assessing the Dietary Diversity Score (DDS) of breakfast menus offered in primary school canteens in urban and rural areas of Kelantan. The findings are expected to contribute to existing knowledge and support efforts to improve the nutritional quality of school food environment.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Research design**

The research design for this study was a cross-sectional study. This is because the data was obtained for a specific period which was five days in each school by using stimulated menu data in school canteen. In addition, it did not involve human participants. So that, there was no follow-up, intervention or personal data collection involved. The aimed for this study was to determine the dietary diversity level of menu breakfast that has been served in school for children.

#### **3.2 Study area**

This study was conducted at state of Kelantan in Malaysia. According to the Ministry of Education, there were 413 primary schools in Kelantan which included Sekolah Kebangsaan (SK), Sekolah Jenis Kebangsaan Cina (SJKC) and Sekolah Jenis Kebangsaan Tamil (SJKT). Kelantan consists of 10 districts. Each of the district has a different sociodemographic characteristics like urban and rural classification. According to Sedia et al. (2019), urban is the area that has been reported and has a resident more than 10,000 peoples. The area can also be classified as an urban if the resident is less than 10,000 peoples but 60% is not involved in agriculture activities. Rural was identify as the resident is less than 10,000 people in area. According to Ministry of Housing and Local Government (2025), urban and rural can be distinguished based on the respective local authorities. District councils were focusing on rural based while municipal council were focusing on urban area. For this study, 2

districts were chosen to represent the diversity. The selected district were Kota Bharu and Bachok. A total of 6 schools which 3 schools from each district were included in the study. Kota Bharu has been chosen because it was the only one district that categorized as urban. For rural area, Bachok has been chosen because of the place was quite near to my place. To collected the data for five days, Bachok was the best place to conduct the research study because it can go there easily.

### **3.3 Study population**

This study did not involve students because the observation only conducted on the menu breakfast in school canteen. This study only focuses only on breakfast menu. Study population was referred to selected food and beverages that offered in primary school canteen.

### **3.4 Subject criteria**

#### **3.4.1 Inclusion Criteria**

- i. Sekolah Kebangsaan has been selected
- ii. Breakfast menus from selected school canteens during weekdays.

#### **3.4.2 Exclusion Criteria**

- i. School has less than 300 students

### **3.5 Sample size estimation**

This study did not require formal sample size estimation as it did not involve human participants or probabilistic sampling. Sample size was determined by the number of available menus approximately 20 to 30 breakfast menus for each school.

### **3.6 Sampling method and subject recruitment**

According to the Ministry of Education, there were 413 primary schools in Kelantan which included Sekolah Kebangsaan (SK), Sekolah Jenis Kebangsaan Cina (SJKC) and Sekolah Jenis Kebangsaan Tamil (SJKT). There were 15 primary schools from SJKC and a school from SJKT. Based on the inclusion criteria, only SK was involved due to the majority of schools that have in Kelantan. However, any school with an enrolment of fewer than 300 students will be excluded from the sampling and will be replaced by another school to fulfil the inclusion criteria. In Kelantan, there were 10 districts that has different sociodemographic which was rural and urban area. A district, Kota Bharu categorized as urban and the other nine categorized as rural area. From all districts, only two districts were selected which were Kota Bharu and Bachok by using random sampling method.

There were 92 schools in Kota Bharu and 34 schools in Bachok. Based on the two districts, each of that was choose 3 schools. So, the total of school that include in this research was 6 schools. In Bachok, there was one school that has been rejected due to the school only have 277 students. In my opinion, school that has a smaller number of students normally do not have variety of food in their canteens. This can make it hard to assess the real variety of food that offered to students. By selecting

school with more than 300 students, the study can get more reliable data and can help to make a better comparison between different schools. In line with the objective of this study, the school was not eligible to join it. So that, I reselected to complete list of three school in Bachok. The school were selected by using simple random sampling. To sum up, there were 6 out of 400 schools that has different sociodemographic that has been involved in this study. School A, School B and School C were referred to school located in Kota Bharu while School X, School Y and School Z refer to school located in Bachok.

### **3.7 Operational definition**

#### **a. Dietary Diversity Score**

Dietary diversity score (DDS) is an indicator for assessing nutritional adequacy, reflecting the variety of foods consumed. It can be used over a specific period , for this study was on breakfast menu in school canteen. In this study, DDS was calculated based on the presence or absence standard food group. List of food groups that will be assess are carbohydrate, protein, vegetables, fruits, dairy products, fats and oil, sugar and sweet foods and legumes. These 8 food groups were adapted based on common food that found in school canteen .

### **3.8 Data collection method**

The process of data was started by getting permission from the school principal of each selected school. The period for data collection was undergo from October 2025 until November 2025.

First and foremost, I obtained the food menu that has been served by school canteen to students for each six selected schools. Direct observation of food items serves at the canteen during breakfast hours which approximately 7:00am and 10:15am. At 10:15am was recess hour for student in primary school. There was also some school that served food to the student for three times which during the recess hour. Usually the school that provided three times for recess hours in urban area due to the high number of students in that school. The duration for one school to collect data was conducting for five consecutive days. This is because in five days, it can capture a full of range of menus item served in school canteen. It is important because school canteen often change a menu from day to day. By observing twice per week, it has high chance to might miss some food groups that only served in the specific days. By collecting data in five days, it allows for a complete and accurate assessment of the dietary diversity score directly reduce a bias in choose menu.

Every meal provided has recorded for assessment dietary diversity score including name of food and beverages. After that, all the food items were categorized into respective food groups to evaluate the score. Then, the score for meals in school has been compared with the other school to determine whether which type of food group usually contain or unavailable. In addition, it can also help to choose which school has served high dietary diversity to their students. The students will get variety nutrient as the dietary also has a lot of nutrients in one meal. As a prove, photographic documentation also used for visual reference, and it help in food classification.

### 3.9 Study flowchart

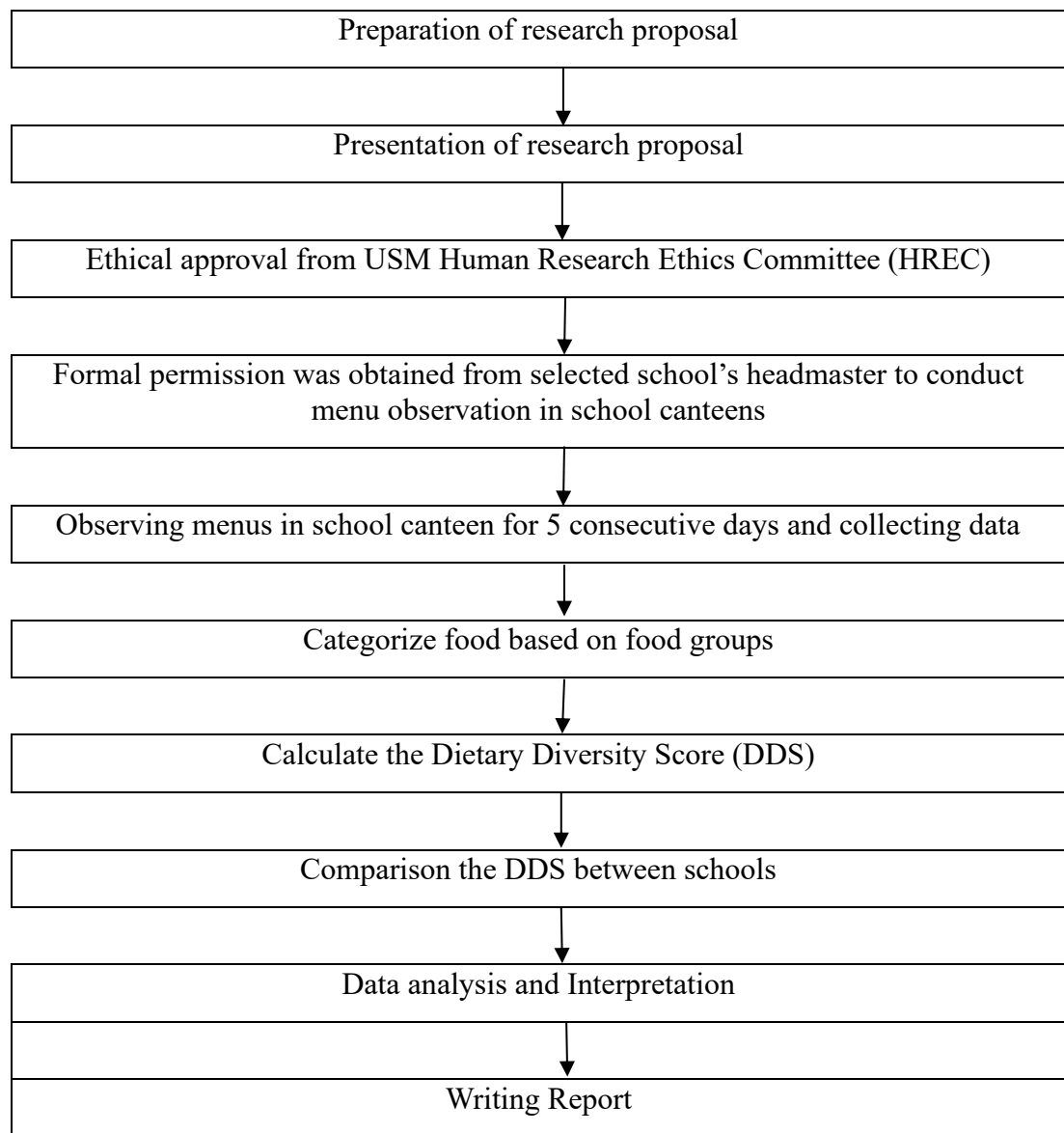


**Diagram 3.9 Study Flowchart**

### **3.10 Data analysis**

Data that has been collected will be entered into Microsoft Excel and SPSS Version 22 for calculating the Dietary Diversity Score (DDS). DDS was calculate based on the number of food groups that present in menus at each school canteen. A score '1' will be given to each food group even at least one food items from a food group is present. But it the food absent score '0' will be given. The total of Dietary Diversity Score (DDS) from each type of food are then summed up. Based on the food groups are 8 group, the DDS score will be 0-2 is low diversity, 3-4 is moderate diversity and 5-8 is high diversity. To be clearly, Nasi Lemak with Milo is and an example. For this food, it will get point for food group carbohydrate due to the rice, protein because of eggs, fruits because of cucumber, fats refer to the coconut milk that mix with rice and sugar due to the Milo. So that, the total of dietary diversity score for Nasi lemak with Milo is 5. After analysing all the menu, we need to determine the categorising of dietary diversity level. For the example menu, the dietary diversity level is moderate.

### **3.11 Validity and Reliability**

The validity and reliability of this study were strengthened through the use of a systematic menu observation approach and standardised dietary diversity assessment methods.

Validity refers to the extent to which a study accurately measures the concept it intends to access. In this study, content validity was achieved by using the Dietary Diversity Score (DDS) as an indicator of diet quality, which has been shown to be strongly associated with micronutrients adequacy among children (Nguyen et al., 2020; Zhao et al., 2021). These studies support the use of DDS as a valid proxy for evaluating overall diet quality in school-aged populations.

Direct observation of school canteen breakfast menus was employed instead of self-reported dietary intake. This approach enhanced validity by minimising recall bias and reporting errors commonly associated with dietary assessment methods (Workicho et al., 2021). In addition, data collection was conducted over five consecutive school days to capture day-to-day variation in menu offerings, thereby improving the representativeness of the observed food environment (Tamiru et al., 2021).

Photographic documentation was used as a supporting reference during data collection to ensure accurate identification and classification of food items. This methodological triangulation further strengthened the validity of the dietary diversity assessment.

Reliability refers to the consistency and reproducibility of study findings. Reliability in this study was ensured through the use of a standardised observation procedure and consistent food group classification across all selected school canteens. The DDS was calculated using the same predefined scoring criteria for every menu observed, allowing for consistent application of the method throughout the study period.

Previous study has demonstrated that dietary diversity indicators provide stable and reliable measures of diet quality when applied using uniform assessment procedures (Workicho et al., 2021). As this study did not involve human participants, respondent-related bias and inter-individual variability were eliminated, further enhancing the reliability of the findings.

## CHAPTER FOUR

### RESULT

#### 4.1 Comparison of Dietary Diversity Score from Each Schools

**Table 4.1: Comparison of DDS derived from each food groups based on school and geographic areas**

|                                  | Urban                                                                                        |                                                                                   |                                                                                                                                                                                                    | Rural                                       |                                                                 |                 |
|----------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------|-----------------|
|                                  | School 1                                                                                     | School 2                                                                          | School 3                                                                                                                                                                                           | School 1                                    | School 2                                                        | School 3        |
| NOODLE/PASTA BASED COOKED DISHES | Bihun sup<br>Kueyteow sup<br>Makaroni goreng<br>Mi Goreng<br>Kueyteow Goreng<br>Laksa penang | Kueyteow goreng<br>Meehun goreng<br>Pasta carbonara<br>Maggi goreng<br>Mee goreng | maggi goreng<br>bihun sup<br>kueh teow sup<br>mi sup<br>maggisup<br>spagethi carbonara<br>macaroni carbonara<br>macaroni bolognese<br>bihun tomyam<br>kueh teow tomyam<br>mi tomyam<br>maggitomyam | Meehun goreng<br>Meehun sup<br>Kueyteow sup | Makaroni Goreng<br>Mi Goreng<br>Kueyteow Goreng<br>Bihun Goreng |                 |
| RICE-BASED COOKED DISHES         | Nasi ayam pedas<br>Nasi ayam kari                                                            | Nasi ayam gulai<br>Nasi lemak                                                     | Nasi putih ayam<br>korea<br>Nasi lemak                                                                                                                                                             | Nasi ayam gulai<br>Nasi ayam masak pedas    | Nasi Ayam Masak Merah                                           | Nasi ayam gulai |

|                       |                         |                                                                                                                                                                                                                                                      |                                                                                                                             |                       |                      |                                                        |
|-----------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|--------------------------------------------------------|
|                       |                         | Nasi<br>ayam<br>kicap<br>Nasi sup<br>ayam                                                                                                                                                                                                            | Nasi<br>ayam<br>buttermilk<br>Nasi<br>ayam<br>masak<br>merah<br>Nasi<br>ayam<br>berempah<br>Nasi<br>ayam<br>chicken<br>chop | Nasi<br>ayam<br>kicap | Nasi<br>Ayam<br>Kari |                                                        |
| BREAD TYPE<br>PRODUCT | Roti<br>sosej<br>goreng | Massimo<br>cream<br>roll<br>chocolate<br>Massimo<br>cream<br>roll corn<br>Massimo<br>chiffon<br>classic<br>Massimo<br>chiffon<br>chocolate<br>Massimo<br>chiffon<br>pandan<br>coconut<br>Massimo<br>chiffon<br>cheese<br>Massimo<br>chiffon<br>mocha | Roti<br>gulung<br>Roti jem<br>strawberry<br>Roti jem<br>coklat<br>Roti<br>sardine<br>roti<br>oblong                         | Roti<br>sosej         | Egg<br>sandwich      |                                                        |
| OTHERS                |                         | Nestle<br>honeystars<br>Nestle<br>kokocrunch                                                                                                                                                                                                         | Nestle<br>kokocrunch +<br>susu                                                                                              |                       |                      | Nestle<br>kokocrunch<br>Nestle<br>kokocrunch<br>cookie |

|                                         |                          |                          |                                                                             |                                                         |                                   |                  |
|-----------------------------------------|--------------------------|--------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------|------------------|
|                                         |                          |                          |                                                                             |                                                         |                                   | Nestle<br>Trix   |
| SWEET<br>PASTRIES                       | Puddin<br>g<br>karamel   |                          |                                                                             | Donut<br>coklat<br>Waffle<br>coklat<br>Waffle<br>peanut |                                   |                  |
| TRADITIONA<br>L LOCAL<br>DESSERTS       |                          |                          | Jagung<br>susu<br>pau<br>kacang<br>merah                                    |                                                         |                                   | Popis            |
| POTATO<br>FRIES                         | Wedges<br>cheese         | Wedges<br>cheese         |                                                                             | Potato<br>fries                                         |                                   | Cheezy<br>wedges |
| FRIED<br>CHICKEN<br>STRIPS/POPC<br>ORN  |                          |                          | Ayam<br>popcorn<br>cheese<br>Chicken<br>tenders<br>Ayam<br>popcorn<br>korea |                                                         |                                   |                  |
| BURGERS                                 | Burger<br>ayam<br>crispy | Burger<br>ayam<br>crispy | Burger<br>ayam<br>crispy                                                    | Burger                                                  | Homema<br>de<br>Chicken<br>Burger |                  |
| WRAPS                                   | Chicke<br>n Wrap         |                          |                                                                             | Wrap<br>ayam                                            |                                   |                  |
| SAUSAGE                                 | Fried<br>beef<br>patty   |                          |                                                                             |                                                         |                                   |                  |
| FRIED FISH<br>CRACKER                   | Keropo<br>k Lekor        | Keropok<br>Lekor         | Keropok<br>Lekor                                                            | Kerop<br>ok<br>Lekor                                    | Keropok<br>Lekor                  | Keropok<br>Lekor |
| FRIED<br>SAVOURY<br>FILLING<br>FRITTERS | Enoki<br>Goreng          |                          | Enoki<br>Goreng                                                             |                                                         | Cucur<br>Udang                    |                  |
| SPRING<br>ROLLS                         |                          |                          |                                                                             |                                                         | Popia<br>Goreng                   |                  |
| FRIED FISH<br>BALLS                     |                          |                          |                                                                             | Fish<br>balls                                           |                                   |                  |
| FRIED CRAB<br>FLAVOURED                 |                          |                          |                                                                             | Imitati<br>on<br>crab                                   |                                   |                  |

|                              |                                                   |                            |          |                                                                          |                                                               |                                                                                                                                                         |
|------------------------------|---------------------------------------------------|----------------------------|----------|--------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| CHICKEN-BASED FOOD           | Chicken chop<br>Ayam Celup Tepung<br>Ayam gunting | Ayam Korea<br>Chicken Chop | Ayam kfc | Chicken chop<br>Ayam goreng cheese<br>Ayam goreng tepung<br>Ayam gunting | Ayam Gunting<br>Ayam Celup tepung<br>Ayam Celup tepung cheese | Ayam goreng tepung                                                                                                                                      |
| PRE-PACKAGED FLAVOURED DRINK |                                                   |                            |          |                                                                          |                                                               | Calciyum Strawberry<br>Calciyum Grapes<br>Calciyum Vanilla<br>Calciyum Mango<br>Vitagen Grapes<br>Vitagen Original<br>Vitagen Oranges<br>Vitagen Apples |

|                             |                |                              |                          |                |                                         |                           |
|-----------------------------|----------------|------------------------------|--------------------------|----------------|-----------------------------------------|---------------------------|
| PRE-PACKAGED FLAVOURED MILK |                | F&N Magnolia chocolate milk  |                          |                |                                         |                           |
| PRE-PACKAGED PLAIN MILK     |                | F&N Magnolia full cream milk |                          |                |                                         |                           |
| FRUITS                      |                | Guava                        | tembikai                 |                | Guava                                   |                           |
| VEGETABLES                  |                |                              | vietnam roll             |                |                                         |                           |
| EGG-BASED DISHES            | Telur Goreng   |                              |                          |                |                                         |                           |
| BEVERAGES                   | Milo Teh lemon | Milo                         | milo oren bandung cincau | Air Myvic Oren | Chocolate Mango Blackcurrant Strawberry | air sirap Air coklat Vico |

Table 4.1 summarises the types of breakfast food and beverage items available in urban and rural school canteens across multiple food categories. Overall, the findings show that a wide range of cooked foods, fried snacks, processed items, and beverages were available, with urban schools demonstrating greater menu diversity compared to rural schools.

For fried fish crackers, keropok lekor was consistently available across both urban and rural schools, making it one of the most common snack items observed. Similarly, fried savoury filling fritters such as enoki goreng and cucur udang were present in both locations, although urban schools offered a wider selection of fritter types. Spring rolls (popia goreng), fried fish balls, and imitation crab products were observed less frequently and were mainly available in selected schools only.