

**THE ASSOCIATION BETWEEN KNOWLEDGE, ATTITUDE,
PRACTICE (KAP) ON SODIUM AND DIET QUALITY
AMONG HYPERTENSIVE PATIENTS IN HOSPITAL
UNIVERSITI SAINS MALAYSIA (HPUSM)**

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By

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LIST OF ABBREVIATION

KAP: Knowledge, Attitude, and Practice

HPUSM: Hospital Pakar Universiti Sains Malaysia

NHMS: National Health and Morbidity Survey

M-HEI: Malaysian Healthy Eating Index

S-MHEI: Standardised Malaysian Healthy Eating Index

WHO: World Health Organization

IPH: Institute for Public Health

DDC: Daily Dietary Cost

MyCoSS: Malaysian Community Salt Study

KPP: Klinik Pakar Perubatan

NHBLI: National Heart, Lung, and Blood Institute

DQI: Diet Quality Index

MDS: Mediterranean Diet Score

FVS: Food Variety Score

DDS: Diet Diversity Score

MUAC: Mid-Upper Arm Circumference

RNI: Recommended Nutrient Intake

KRK: Klinik Rawatan Keluarga

IQR: Interquartile Range

SPSS: Statistical Package for the Social Sciences

DHQ: Diet History Questionnaire

HTN : Hypertension

**HUBUNGKAIT ANTARA PENGETAHUAN, TINGKAH LAKU,
AMALAN TERHADAP SODIUM AND KUALITI DIET
DALAM KALANGAN PESAKIT DARAH TINGGI DI HOSPITAL
PAKAR UNIVERSITI SAINS MALAYSIA (HPUSM)**

ABSTRAK

Satu daripada tiga orang dewasa di Malaysia menghidap hipertensi. Tahap pengetahuan, sikap, amalan (KAP) terhadap sodium memainkan peranan penting dalam menentukan kualiti diet yang berupaya mengawal tekanan darah pesakit. Oleh itu, kajian keratan rentas ini dijalankan untuk menentukan hubungan antara KAP sodium terhadap pengambilan natrium dengan kualiti diet dalam kalangan pesakit hipertensi di HPUSM. Seramai 180 peserta dengan median umur 64 tahun, majoriti berumur (63.9% berumur lebih dari 60 tahun). Majoriti daripada peserta merupakan perempuan (57.2%), berbangsa Melayu (42.8%), berpendapatan bawah RM2000 (58.4%), dan tidak bekerja (52.8%). Hasil kajian menunjukkan majoriti peserta mempunyai pengetahuan yang lemah (47.8%), sikap yang positif (53.3%), namun amalan yang tidak mencukupi (88.9%). Manakala kualiti diet pada tahap sederhana (70%) dan perlu penambahbaikan kerana tiada peserta yang mencapai tahap kualiti diet yang baik. Terdapat hubungan signifikan sederhana ($r = 0.335, p < 0.001$) antara domain pengetahuan dan sikap, hubungan signifikan lemah antara pengetahuan dan amalan ($r = 0.169, p = 0.012$), dan hubungan signifikan sederhana antara sikap dan amalan ($r = 0.395, p < 0.001$). Namun tiada hubungan yang signifikan antara domain KAP sodium dengan kualiti diet pengambilan serta pengambilan sodium ($p > 0.05$). Namun median skor diet kualiti dalam kalangan peserta yang mempunyai pengetahuan baik adalah lebih tinggi (56.100, IQR 31.3) berbanding kumpulan sederhana (51.350, IQR 55.3) ($p = 0.025$).

Kesimpulannya, walaupun majoriti peserta mempunyai sikap yang positif, tahap pengetahuan dan amalan berkaitan natrium masih lemah dan ini mempengaruhi kualiti diet mereka. Justeru, program intervensi berasaskan peningkatan pengetahuan dan amalan amat diperlukan bagi menterjemahkan sikap positif pesakit kepada kualiti diet yang lebih baik.

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ABSTRACT

One in three adults in Malaysia suffers from hypertension. Knowledge, attitudes, and practices (KAP) on sodium play a crucial role in determining diet quality, which in turn helps manage patients' blood pressure. Therefore, this cross-sectional study was conducted to determine the relationship between Knowledge, Attitude, and Practice (KAP) towards sodium intake and dietary quality among hypertensive patients at HPUSM. A total of 180 participants with median age 64 years (63.9% age more than 60). Majority were female (57.2%), Malay (42.8%), earning below RM2000 (58.4%), and unemployed (52.8%). The results showed that the majority of participants had poor knowledge (47.8%), positive attitude (53.3%), inadequate practice (88.9%). Meanwhile diet quality were moderate (70%) and requires improvement, as no participants achieved a good level of diet quality. There was a moderate significant correlation ($r = 0.335$, $p < 0.001$) between the knowledge and attitude domains, a weak significant correlation between knowledge and practice ($r = 0.169$, $p = 0.012$), and a moderate significant correlation between attitude and practice ($r = 0.395$, $p < 0.001$). However, no significant correlation was found between the sodium KAP domains and overall diet quality or sodium intake ($p > 0.05$). Nonetheless, the median diet quality score among participants with good knowledge was significantly higher (56.100, IQR 31.3) compared to those in the moderate knowledge group (51.350, IQR 55.3) ($p = 0.025$). In conclusion, although the majority of participants exhibited a positive attitude,

their level of knowledge and practice regarding sodium remains poor, thereby influencing their diet quality. Therefore, intervention programs focusing on enhancing knowledge and practice are essential to translate patients' positive attitudes into better diet quality.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Hypertension is a condition where systolic blood pressure values 130 mmHg or more and/or diastolic blood pressure of more than 80 mmHg (Iqbal & Jamal, 2023). National Health and Morbidity Surveys (NHMS) in 2023 show that one in three adults (29.2%) in Malaysia has hypertension (Institute for Public Health *et al.*, 2024). 17.3% of them know that they have hypertension, while 11.9% of them do not know they have hypertension. The biggest proportion of those who do not know were within the ages of 18 to 39 years old. The prevalence of prehypertension and hypertension involving 7585 Malaysian adults was 40.7% and 38.0%, respectively (Ismail *et al.*, 2023).

Sodium has been widely used in various foods in Malaysia. In a study by Ali *et al.* (2019), the study found that energy contributions of ultra-processed groups were 24%, while the values for sodium and added sugar contribution of ultra-processed group were 26% and 63% respectively. Despite that, grains like rice or noodles, sauces, poultry products, and seafood also contribute the most sodium in meals (Mahat *et al.*, 2017). Rice and noodles are considered staple foods in Asia, especially in Malaysia. In a study conducted by Cheong *et al.* (2021), almost three-quarters of subjects consumed dietary sodium more than 2000 mg in a day, but only 14.9% of them perceived that they consumed too much salt. The global mean intake of adults is double the recommendations for adults, which is the recommendation of less than 5g per day of sodium or approximately one teaspoon (World Health Organization, 2026).

The risk factors for developing hypertension are divided into modifiable and non-modifiable risk factors. The modifiable risk factors include diet, physical activity, alcohol consumption and tobacco smoking, and obesity or overweight (Mohammed Nawi *et al.*, 2021). In contrast, non-modifiable risk factors include family history of hypertension, age more than 65 years old, and the presence of other comorbidities, including diabetes and chronic kidney disease (Kaddumukasa *et al.*, 2017). KAP on sodium is generally associated with diet quality, as a higher KAP score expected to be associated with lower sodium intake, lower intake of ultra-processed foods, and higher intake of fruits and vegetables. However, there are still limited studies that have proven whether high KAP will result in overall good diet quality.

A recent study of diet quality among community-dwelling older adults in an urban district in Kuala Lumpur, the results showed that wholegrain cereals, legumes, and sugar-rich foods were listed as the top three non-adherence food groups among the subjects (Nohan *et al.*, 2020). Meanwhile, cereal products and tubers, vegetables, and high-fat protein foods are the food groups that were highly adhered to among the subjects. Hence, research on KAP on sodium and diet quality is crucial to be conducted to give insight into whether there is an association between KAP on sodium and diet quality.

1.2 Problem Statement

Hypertension is a major cause of premature death worldwide, which affects over a billion people (WHO, 2019). Despite recommendations from the Ministry of Health, findings from a study showed that the majority of participants exceeded the recommendations (Cheong *et al.*, 2021).

Most studies focus on the research of KAP on sodium and dietary salt intake, as seen by research conducted by Cheong *et al.* (2021) KAP on sodium among Malaysian adults, and Jarrar *et al.* (2024) KAP on sodium and assessment of dietary salt and fat intake among University of Sharjah students. Some studies examined KAP on sodium and blood pressure, such as those conducted by Haron *et al.* (2021) among Malay elderly. Despite that, there are still a few studies that focus on KAP on sodium and diet quality, especially in Malaysia.

A study in Johor among Chinese adults (N = 90) conducted by Pang *et al.* (2022) aimed to determine KAP on salt and its relationship with blood pressure. The majority of participants have overall good knowledge regarding sodium, a positive attitude, but inadequate practice of healthy salt intake. From this study, it can be concluded that having a moderate level of knowledge and a positive attitude among subjects did not affect their daily practice of controlling salt (Pang *et al.*, 2022). A study by Cheong *et al.* (2021) conducted among Malay elderly showed the majority of subjects had a positive attitude towards healthy salt intake, but poor to fair knowledge and practice on healthy salt intake. The contradictory findings indicated that KAP patterns are not same across different populations, and high knowledge or positive attitude did not guarantee a good practice. So,

this study aimed to provide further evidence to clarify the inconsistencies and determine the relationship between each domain.

Few studies address diet quality among hypertensive patients, including how diet quality is associated with KAP sodium among hypertensive patients. A study in Canada (N=1147) suggests that nutrition knowledge is a significant correlate of diet quality (Carbonneau *et al.*, 2021). According to Spronk *et al.* (2014) as cited by Carbonneau *et al.* (2021), the association between nutrition knowledge and diet quality in the general population has received limited attention. This was explained by only three out of the twenty-nine studies that used nutrition knowledge and dietary intake assessments that were both valid. Interventions aiming at increasing nutrition knowledge may be a promising approach to improve diet quality, especially in some subgroups of the population (Carbonneau *et al.*, 2021).

Therefore, this study aimed to determine the association between the level of KAP on sodium and diet quality status among hypertensive patients at Hospital Universiti Sains Malaysia (HPUSM). Addressing this critical gap study will provide insight into whether strengthening KAP on Sodium is closely related to healthy diet quality among hypertensive patients, which may facilitate health improvement and potentially reduce the prevalence of hypertension in Malaysia.

1.3 Objectives

General Objective

To determine the level and association between KAP on sodium, and diet quality among hypertensive patients at HPUSM.

Specific Objectives

1. To determine the level of KAP on sodium among hypertensive patients at HPUSM.
2. To determine the level of diet quality status among hypertensive patients at HPUSM.
3. To determine the association between KAP on sodium and diet quality among patients at HPUSM.

1.4 Research Hypothesis

Null hypothesis: There is no association between the level of KAP on sodium and the level of diet quality among patients at HPUSM.

Alternative hypothesis: There is an association between the level of KAP on sodium and the level of diet quality among patients at HPUSM.

1.5 Research Questions

1. What is the level of KAP on sodium among hypertensive patients at HPUSM?
2. What is the diet quality status among hypertensive patients at HPUSM?
3. Is there any association between the level of KAP on sodium with diet quality status among patients at HPUSM?

1.6 Significance of Study

This study holds significant value in addressing the gap in KAP on sodium and diet quality among hypertensive patients at HPUSM. Many studies regarding sodium have been conducted, but still, few studies focus on the relationship between KAP on sodium and diet quality. Diet quality differs from diet intake or meal pattern as it is a diverse, balanced, and healthy diet that provides energy and all essential nutrients for growth and a healthy life (International Atomic Energy Agency, 2016). It measures the overall pattern on individual's food intake based on 11 food components whether the food intake meet the serving recommendation from the Malaysian Dietary Guidelines (MDG). The score given is based on the number of serving that have meet the guidelines.

One study was conducted at HPUSM, Kelantan, which involved 120 hypertensive patients. This study aims to determine the relationship between KAP on sodium and salt intake. The study conducted by Abd Khadir (2024) revealed that the majority of patients have a fair to poor score of KAP on sodium, which was unsatisfying. This study only assessed KAP on sodium and salt intake, without comprehensively taking consideration

about overall diet quality of participants. Another cross-sectional study was conducted at the Felda residence in Terengganu. About 94 hypertensive participants were recruited. All participants have good knowledge and attitude levels, but a poor level of practice towards salt intake (Che Wan Mansor *et al.*, 2021). Gaining insight into the level of KAP on sodium for hypertensive patients in Kelantan is crucial to receive an idea about the trends of the KAP level for this population. From these studies, KAP on sodium is still not in a satisfactory state. Thus, assessing KAP on sodium provides a broader perspective on the actual KAP levels among hypertensive patients at HPUSM, ensuring a reliable understanding of their dietary habits.

Moreover, gaining an understanding of the level of KAP on sodium will help clinicians plan specific interventions for the patients, so patients will improve their diet quality and improve their overall quality of life. Determining the level of KAP will also help clinicians to specifically identify which areas are lacking, so actions can be planned to improve that level. The level of KAP regarding hypertension in hypertensive patients plays a significant role in controlling modifiable risk factors and reducing burden through assessing the gaps and improving awareness and perception. Good knowledge of hypertension is associated with higher rates of blood pressure control, medication adherence, as well as decreasing morbidity and mortality (Machaalani *et al.*, 2022).

Poor KAP on sodium and poor diet quality are modifiable risk factors. As they are modifiable risk factors, action can be taken to overcome the problem. Actions such as the enforcement of lifestyle modification and strengthening of knowledge will be a part of comprehensive care for hypertension management. This study will also fill the gaps in the

literature by providing specific and recent data regarding KAP on sodium and the diet quality of hypertensive patients in Malaysia. As there are few studies regarding KAP on sodium and diet quality that have been done, this study will become an evidence-based study for future advancement of research about the hypertensive population.

This study provides practical insights into how KAP shape diet quality and salt intake. For dietitians, it helps tailor better and personalized nutrition advice instead of generic interventions. This study offers real data to build more effective community health programs in the policymakers' fields. Most importantly, understanding these eating habits will support sodium reduction efforts, which make it easier to guide the public toward healthier and encourage to choose low salt food to prevent hypertension.

1.7 Conceptual Framework

The conceptual framework illustrates shows the relationship between KAP on sodium and diet quality. Sociodemographic factors could affect KAP on sodium and diet quality. Age, gender, ethnicity, education level, household income, and marital status could affect KAP on sodium. Age could affect KAP, as seen in a study showed knowledge of salt among the majority of the elderly in Bangi ranged from poor to moderate (Haron *et al.*, 2021). Besides that, from a study conducted among undergraduate students (N=107), female students showed a higher number of having good nutrition knowledge (Yusni *et al.*, 2023).

Marital status affects diet quality, as shown in a study among Orang Asli women, a poor diet was associated with women being either single, divorced, or widowed (Chong *et al.*, 2019). A study by Ramadas *et al.* (2021) showed that women have better diet quality

than men. Higher daily dietary cost (DDC) is associated with better diet quality (Pondor *et al.*, 2017). Evidence from a study conducted by Nohan *et al.* (2020), among dwelling elderly in urban districts, stated that Chinese and Indians have a higher proportion of good diet quality compared to Malays. This explains why the Chinese often value foods as a core eccentricity of a healthy lifestyle, hence a higher prevalence of a good diet quality index. From this study, those who attained higher education were found to have a better diet quality.

Diet quality is affected by other factors such as smoking status and comorbidities. In a cross-sectional study in China (Haq *et al.*, 2019), it was found that smoking was associated with an independent negative association with diet quality, showing that people who smoke tend to have poorer diet quality. A study by Wen *et al.* (2026) in China has found that the intention to reduce salt intake was higher among middle-aged and older hypertensive patients aged 45 years or older (70.8%), with patients who had a family history of hypertension showing significantly higher mean salt reduction intention.

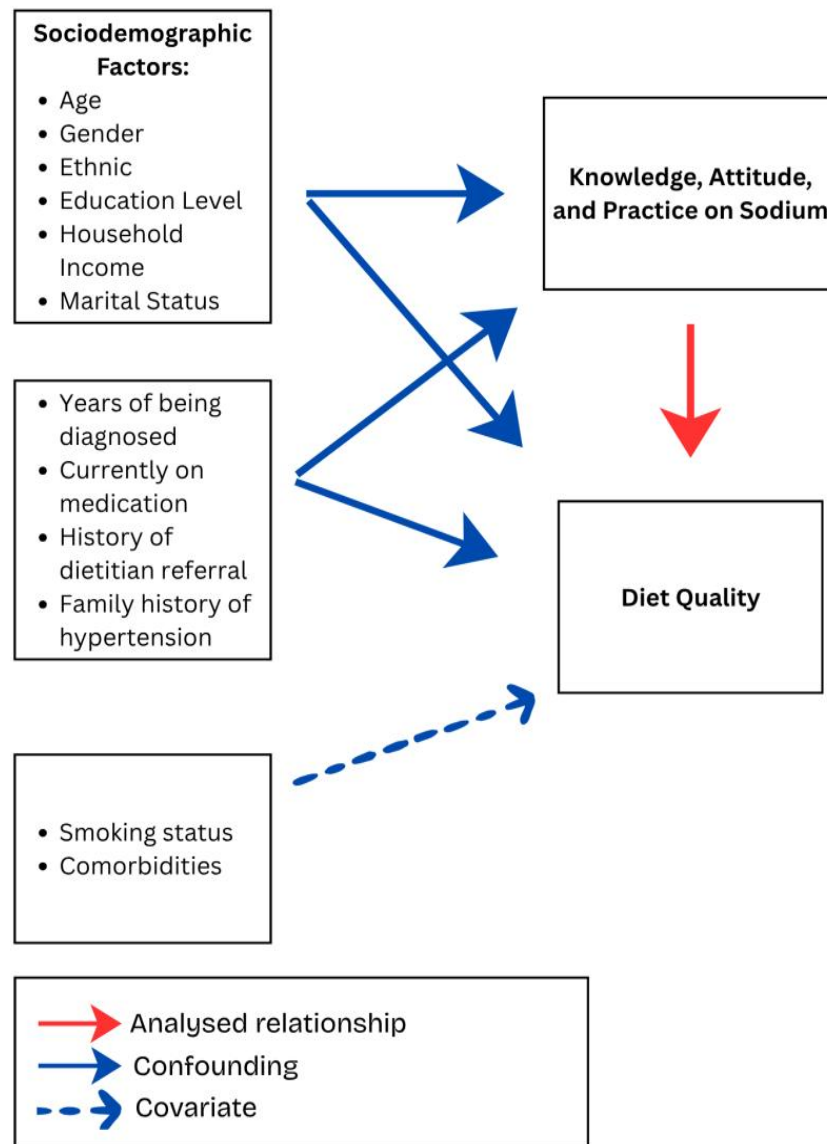


Figure 1.7 Conceptual Framework

CHAPTER 2

LITERATURE REVIEW

2.1 Hypertension

A recent National Health and Morbidity survey from the Institute for Public Health (2023) involving Malaysian adults shows that the prevalence of hypertension was 29.2%, with the prevalence of known hypertension at 17.3% and raised blood pressure among those not known to have hypertension at 11.9%. Another study from the Malaysian Community Salt Study (MyCoSS) stated that the prevalence of hypertension among Malaysian adults was 49.39% from 1047 respondents (Zaki *et al.*, 2021). Respondents with higher age and higher BMI were seen as more likely to be hypertensive compared to respondents with a normal weight. In a cross-sectional study done in Malaysia among adolescents (N=273), the prevalence of hypertension was found to be 24.5%, with the prevalence highest among Malays, followed by Indians and Chinese.

Risk factors can be classified as non-modifiable, which cannot be controlled, while modifiable risk factors can be controlled. Age is an example of a non-modifiable factor. Increasing age, blood vessels naturally thicken and stiffen over time (National Heart, Lung, and Blood Institute, 2024). Another risk factor includes family history and genetics. Many genes are linked to small increases in high blood pressure risk (NHBLI, 2024). Some people have a high sensitivity to salt in their diet, which plays a role in their blood pressure levels.

Modifiable factors that may increase the risk of high blood pressure include eating unhealthy foods, drinking too much alcohol or caffeine, not getting enough physical activity, not getting enough good quality sleep, experiencing high-stress situations, and the use of substances such as cocaine (NHBLI, 2024). Lifestyle changes can help lower high blood pressure. Example lifestyle changes include eating healthy, losing weight, being physically active, and quitting tobacco (WHO, 2023).

Uncontrolled blood pressure could lead to heart attack, stroke, heart failure, kidney disease, vision loss, sexual dysfunction, heart disease, angina, and atherosclerosis (American Heart Association, 2024). Hypertension is particularly challenging because it is an asymptomatic, silent killer and often remains hidden until caught during monitoring or evidence in a hypertension-associated disease such as heart failure or stroke (World Heart Federation, 2023).

2.2 Knowledge, attitude, and practice (KAP) on sodium

The KAP Questionnaire can identify knowledge of sodium and how far the implementation of that knowledge is in real life. A KAP survey is meant to be a representative survey of a target population, it aims to elicit what is known (knowledge), believed (attitude), and done (practiced) in the context of the topic of interest (Andrade *et al.*, 2021). The KAP on sodium questionnaire was first adapted from the World Health Organization by the Institute of Public Health. Now, KAP on sodium questionnaires have been used widely in research to investigate patients' KAP on sodium.

A study involving 1440 respondents aims to investigate knowledge, perception, and practice related to sodium intake among Malaysian adults. This study shows that there is no association between knowledge, perception, and practice with excessive dietary sodium intake among Malaysian adults, findings from the Malaysian Community Salt Study (MyCoSS) (Cheong *et al.*, 2021). The reason behind this was because even though most participants reported to consume salt in the 'right amount', it clearly reveals that majority were not aware of their actual consumption and recommended amount to avoid health problems. From this study, most Malaysian adults have been reported to consume high dietary sodium despite claiming to know about the negative effects of high salt intake. A possible explanation for this is that most respondents perceived their sodium intake to be the right amount, while not being aware of the actual consumption and the recommended amount to avoid health problems. This results in excessive intake of sodium in the daily diet. Although the majority of subjects had a positive attitude towards healthy salt intake, they had poor to fair knowledge and poor practice on healthy salt intake (Cheong *et al.*, 2021).

In research studies conducted by Chia *et al.* (2025) among Malaysian adults around Klang Valley and five other states, participants of different ethnicities display significant differences in the KAP on the sodium domain. It is stated that Indians generally exhibit better KAP which include reading salt labels and using spices in meals. Although overall, participants of this study were aware of the relationship between high salt intake and its impact on health, almost two-thirds of participants believed that consuming more water could mitigate the adverse effects of a high salt diet. A related study among Chinese adults in Johor (N = 90) was conducted to determine KAP on salt intake and its relationship with

blood pressure. Results from this study indicated that the practice of healthy salt intake among most Chinese in the study is still inadequate, with less than 10% of subjects avoiding adding salt when cooking and checking the salt content on the food labels.

A cross-sectional study conducted at Universiti Sultan Zainal Abidin (UNiSZA) among health sciences students (Ahmad *et al.*, 2020) revealed that there is no association between KAP sodium and dietary sodium intake observed. In this study, half of the participants (54%) reported that they thought there were no guidelines for salt intake in Malaysia. 75.1% of participants knew that high blood pressure is a serious health problem, but not many knew that high salt intake may lead to high blood pressure and other non-communicable diseases (Ahmad *et al.*, 2020). In a cross-sectional study conducted by Yusni *et al.* (2023) involving 107 undergraduate students in Universiti Sains Malaysia (USM), the majority of students can be categorized into good nutrition knowledge and a good attitude. However, the practice of healthy eating among undergraduate students in USM Kubang Kerian was poor. The nutrition knowledge score was higher in women and in participants with either higher education or income level (Carbonneau *et al.*, 2021). Female students showed a higher number of having good nutrition knowledge compared to male students (Yusni *et al.*, 2023).

2.3 Diet Quality

Diet quality refers to the extent to which an individual's diet conforms to the principles of being balanced, healthy, diversified, and providing the essential nutrients needed for a healthy life (Ramadas *et al.*, 2021). It measures the food intake serving with the reference from Malaysian Dietary Guidelines. The four most used tools to assess diet

quality are the Healthy Eating Index (HEI), the Healthy Diet Indicator (HDI), the Diet Quality Index (DQI), and the Mediterranean Diet Score (MDS). The majority of tools used is the Malaysia Healthy Eating Index (M-HEI) as seen in studies of the Malaysian adult population (Jailani *et al.*, 2021) and (Pondor *et al.*, 2017), multi-ethnic population (Ramadas *et al.*, 2021), and among aboriginal women in Malaysia (Chong *et al.*, 2019). This indicates the widespread use of these tools among researchers in Malaysia. However, these tools have a weakness in that they are limited to the use of indices to only certain energy requirements included in the Malaysian Dietary Guidelines 2010 (Jailani *et al.*, 2021). Despite that, the Diet Quality Index (DQI) is also used as a tool in determining diet quality among community-dwelling older adults in urban districts in Kuala Lumpur (Nohan *et al.*, 2020). Malaysian Dietary Guidelines and Malaysian Food Pyramid were applied in devising the diet quality index.

A scoping review of evidence involving the diet quality of Malaysians across the lifespan has found that overall diet quality was poor in all age groups studied (Ramadas *et al.*, 2021). It has been found that one study of urban Malaysian communities reported a high prevalence of low to medium Food Variety Score (FVS) concurrent with high Diet Diversity Score (DDS). This is most likely due to consistently purchasing familiar yet cheaper foods. It has been reported that the diet quality of adult urban Malaysians needs improvement. Higher education, maternal years of schooling, being female, not working, and higher household income have been consistently associated with better diet quality among adults and older adults (Ramadas *et al.*, 2021).

Another study reveals that 55% of urban women need improvement in their diet quality, with Indian women having the lowest HEI score (Karupaiah *et al.*, 2012). This was

followed by Orang Asli women with even lower scores (Chong *et al.*, 2019). Men and women aged 60 years and above with poor diet quality were reported to have significant associations with age, ethnicity, low educational attainment, low financial income, hypertension, low skeletal muscle, high body fat, high visceral fat, high waist circumference, low mid-upper arm circumference (MUAC), and low handgrip strength (Nohan *et al.*, 2020).

A cross-sectional study among Malaysian adults involving 450 healthy participants showed that higher daily dietary cost (DDC) is associated with higher scores of M-HEI (Pondor *et al.*, 2017). From this study, it is generally accepted that higher socio-economic position has consistently been associated with better diet quality. Another study reveals that Nutrition and Dietetics students (N = 132) significantly score better in diet quality and nutrition knowledge than non-Nutrition and Dietetics students (Lee *et al.*, 2023). This could be due to the implementation of knowledge regarding diet in daily life. A study on 523 American undergraduates showed that eating self-regulation was positively correlated with fruit and vegetable intakes, but negatively correlated with sweet intakes (Ling & Zahry, 2021). Findings reveal that students consumed sweets and soft drinks about once every other day, and fruits/vegetables about two times per day. Therefore, focusing on cultivating college students' eating self-regulation skills to improve their dietary intake (Ling & Zahry, 2021).

The Dietary Approach to Stop Hypertension (DASH) diet is recognized as an effective dietary intervention to reduce blood pressure (Filippou *et al.*, 2020). . The DASH dietary approach restricts saturated fat and cholesterol consumption, encourage the intake of fruits, vegetables, whole grain, lean proteins, and low-fat dairy products while reducing

sodium, sugary beverages and processed foods (Onwuzo *et al.*, 2023). A study conducted by Filippou *et al.* (2020) revealed that the adoption of the DASH diet was accompanied by significant blood pressure reduction in adults with or without hypertension. Better diet quality may reflect greater adherence to the principle of the DASH diet. The DASH score has been widely used to assess diet quality. For instance, a study by Konikowska *et al.* (2023) reported that a higher DASH score was positively correlated with high-density lipoprotein cholesterol, and negatively correlated with triglyceride concentration and waist circumference. Therefore, participants with higher diet quality scores are expected to demonstrate dietary patterns that consistent with DASH recommendations.

2.4 KAP on Sodium and Diet Quality

There is limited study that studied on KAP on sodium and diet quality in Malaysia. A study in Canada (N =1147) involving adults from the province of Quebec (Carbonneau *et al.*, 2021) suggests that nutrition knowledge is a significant correlate of diet quality. The findings highlight that nutrition knowledge is a significant correlate of diet quality, and the association is a stronger influence on healthy eating among individuals with a lower level of education and those living without children. Overall, the nutrition knowledge score was higher in women and in participants with either higher education or income level (Carbonneau *et al.*, 2021). As subjects with low education tend to have lower diet quality, an intervention aiming to increase nutrition knowledge could contribute to healthier dietary patterns.

A study conducted among University of Sharjah students (N =401) with the aims to determine the KAP salt level and fat intake (Cheikh Ismail *et al.*, 2019). Results from the

questionnaire pointed out that university students' knowledge related to salt and sodium was relatively low, and a lesser percentage of students considered implementing practices to reduce salt in their diet. Results on 24-hour dietary recall presented a high percentage of students exceeding the recommendations of total fat, saturated fats, trans fat, and sodium. Subjects identified as older age, female, and studying health-related majors were associated with higher salt-related knowledge scores.

A cross-sectional study involving groups of residents in the UAE aims to measure urinary sodium and potassium with KAP sodium. (Jarrar *et al.*, 2024). A sample of 190 healthy individuals recruited reported that females significantly had higher scores for food-related knowledge compared with males. Both genders are classified as fair for health-related knowledge. The percentage of energy from carbohydrate, protein, and fat was within the Recommended Nutrient Intake (RNI). The results from this study conducted by Jarrar *et al.* (2024) showed that there is a very high sodium intake with low potassium intake within the population of the UAE. These findings from Jarrar *et al.* (2024) highlighted the need for educational and public awareness programmes that focus on staple foods, processed foods, drinks, and other foods (Jarrar *et al.*, 2024).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Study Design

This study utilized a quantitative and cross-sectional design. This approach provided a rapid and cost-effective means of collecting data at a single point in time, thereby minimizing the institutional and personal burden on patients. This study was purely observational and did not alter or evaluate ongoing clinical treatments.

3.2 Study Location

The study was conducted among inpatients and outpatient clinics within Hospital Pakar Universiti Sains Malaysia (HPUSM), which included, Klinik Rawatan Keluarga (KRK), Klinik Pakar Perubatan (KPP), Klinik Dietetik, Klinik Warga USM, and the Inpatient ward of Orthopaedic (*Wad 4 Utara & Selatan*), Medical ward (*Wad 7 Utara & Selatan*) of HPUSM, Kubang Kerian, Kelantan were chosen as research sites. HPUSM was chosen as this hospital was ideal for conducting research and convenient for data collection.

3.3 Target Population

The target population comprised hypertensive patients who sought treatment at HPUSM and fulfilled all established inclusion and exclusion criteria.

3.4 Selection Criteria

3.4.1 Inclusion Criteria

- Hypertensive patients aged ≥ 18 years old with or without other controlled chronic comorbidities (eg., type 2 diabetes mellitus, hyperlipidemia)
- Agreed to participate in this study

3.4.2 Exclusion Criteria

- Pregnant, post-partum, or lactating women
- Individuals diagnosed with psychiatric illnesses
- Patients with severe, debilitating medical conditions (e.g., active cancer, chronic gastrointestinal disorders, or those who were completely bedridden)

3.5 Sample Size Calculation

Objective 1: To determine the level of knowledge, attitude, practice (KAP) on sodium among hypertensive patients at Hospital Pakar Universiti Sains Malaysia.

Using the formula of:

$$n = \left(\frac{Z}{\Delta}\right)^2 p (1-p)$$

Confidence level of 95%, Z-score will be 1.96, with precision 0.08 and prevalence taken from Haron *et al.* (2021).

i) Knowledge

$$n = \left(\frac{1.96}{0.08}\right)^2 (0.22) (1-0.22)$$

$$= 103 \text{ subjects}$$

Considering a 20% non-response rate, the sample size is

$$\begin{aligned}\text{Sample size} &= 103 + (20\% \times 103) \\ &= 103 + 21 \\ &= 124 \text{ subjects}\end{aligned}$$

ii) Attitude

$$\begin{aligned}n &= \left(\frac{1.96}{0.08}\right)^2 (0.75) (1-0.75) \\ &= 112 \text{ subjects}\end{aligned}$$

Considering a 20% non-response rate, the sample size is

$$\begin{aligned}\text{Sample size} &= 112 + (20\% \times 112) \\ &= 112 + 23 \\ &= 135 \text{ subjects}\end{aligned}$$

iii) Practice

$$\begin{aligned}n &= \left(\frac{1.96}{0.08}\right)^2 (0.17) (1-0.17) \\ &= 85 \text{ subjects}\end{aligned}$$

Considering a 20% non-response rate, the sample size is

$$\text{Sample size} = 85 + (20\% \times 85)$$

$$= 85 + 17$$

$$= 102 \text{ subjects}$$

Objective 2: To determine the level of diet quality status among Hypertensive patients at Hospital Pakar Universiti Sains Malaysia.

Confidence level of 95%, Z-score will be 1.96, with precision 0.08 and prevalence of good diet quality, taken from Feng *et al* (2023), is 89.7%.

$$n = \left(\frac{1.96}{0.08}\right)^2 (0.89) (1-0.89)$$

$$= 58.7 \sim 59 \text{ subjects}$$

Considering a 20% non-response rate, the sample size is

$$\text{Sample size} = 59 + (20\% \times 59)$$

$$= 59 + 12$$

$$= 71 \text{ subjects}$$

Objective 3: To determine the association between the level of knowledge, attitude and practice (KAP) on sodium and the level of diet quality among patients at Hospital Pakar Universiti Sains Malaysia.

Using formula one proportion,

Confidence level of 95%, Z-score will be 1.96, with precision 0.08, the prevalence of hypertension is 49.39%, taken from the Malaysian Community Salt Study (MyCoSS)

$$n = \left(\frac{1.96}{0.08}\right)^2 (0.49) (1-0.49)$$

$$= 150 \text{ subjects}$$

Considering a 20% non-response rate, the sample size is

$$\text{Sample size} = 150 + (20\% \times 150)$$

$$= 150 + 30$$

$$= 180 \text{ subjects}$$

Therefore, the total number of subjects that were recruited is 180.

3.6 Sampling Method

Subjects were selected using convenience sampling. Convenience sampling was defined as a process of data collection from population that is close at hand and easily accessible to researcher (Rahi, 2017). According to Golzar *et al.* (2022), convenience sampling is a non-probability sampling technique commonly used in both quantitative and qualitative research. This sampling used with consideration of all recruited individuals conformed strictly to the inclusion and exclusion criteria. The questionnaire was completed within 15 to 20 minutes with the assistance of a researcher due to the patient's health, time limitation and age factor.

3.7 Study Instruments

A self-administered instrument was adopted and adjusted from the original questionnaire developed by the Institute for Public Health (MySalt 2015) (IPH, 2016) for the KAP section. The instrument was structured into specific subsections:

- **Part A: Sociodemographic Information:** age, gender, ethnicity, marital status, education level, household income, and employment status to evaluate potential confounding variables.
- **Part B: Clinical and Health-Related Information:** Documented clinical background, including the years of being diagnosed with hypertension, taking medication, family history of hypertension, comorbidity, history of dietitian referrals, and smoking status.
- **Part C: Knowledge, Attitude, and Practice (KAP) on Sodium:** The KAP questionnaire was adapted from the WHO. This 8-item section evaluated behavioral components. The English version of the questionnaire was translated into the Malaysian-Malay language by two independent translator and validated using back translation. The initial translation was then independently back-translated to English version. Discrepancies were resolved, and content validity of the questions was checked with expert panel consensus, and then pre-tested among adults (IPH, 2019).
 - *Knowledge (2 items):* Evaluated awareness of health complications linked to high salt intake via categorical "Yes/No" responses.
 - *Attitude (2 items):* Assessed perceptions of the importance of salt reduction using scale-based responses.