OSTEOPOROSIS KNOWLEDGE, HEALTH BELIEFS, AND CALCIUM INTAKE AMONG MALAYSIAN CHINESE ADULTS IN KAMPAR, PERAK

By

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ABSTRACT

OSTEOPOROSIS KNOWLEDGE, HEALTH BELIEFS, AND CALCIUM INTAKE AMONG MALAYSIAN CHINESE ADULTS IN KAMPAR, PERAK

Thean Hui Ru

Osteoporosis is a major health concern, characterized by low bone density and fragile bones. The Chinese population has the highest prevalence of hip fractures in Malaysia. Hence, the study investigated the relationship between osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak. A cross-sectional study was conducted using convenience sampling among 205 Malaysian Chinese individuals aged 18–64 in Kampar. Participants completed a questionnaire that collected their sociodemographic data, osteoporosis knowledge, health beliefs, and calcium intake. The data were analysed using SPSS version 20, applying Chi-square and Spearman's correlation tests. Firstly, the participants had a low osteoporosis knowledge level, with an average OPAAT score of 6.84 ± 2.92. In terms of health beliefs, Chinese adults in Kampar displayed low perceived susceptibility (14.87 ± 5.00), moderate perceived seriousness (17.81 ± 5.20), high perceived benefits (22.73 ± 3.75), moderate perceived barriers to calcium intake (15.61 ± 4.15), and high health motivation (21.26 ± 3.84). The average daily calcium intake was 530 ± 353.2 mg/day, with only 12.0% of participants meeting the recommended intake of 1000 mg/day or more. Significant associations were found between calcium

intake and both osteoporosis knowledge ($p = 0.045$) and health motivation ($p = 0.021$). Furthermore, osteoporosis knowledge was significantly correlated with nearly all health belief categories. All health belief categories were correlated with each other, with the strongest correlation between perceived seriousness and health motivation ($\rho = 0.304$). Additionally, calcium intake was found to be correlated with age ($\rho = 0.181$), osteoporosis knowledge ($\rho = 0.141$), perceived benefits ($\rho = 0.177$), perceived barriers ($\rho = -0.240$), and health motivation ($\rho = 0.176$). These findings highlight the crucial need to prioritize raising awareness and strengthening health motivation in osteoporosis prevention programs targeted at the Malaysian Chinese population.

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DECLARATION

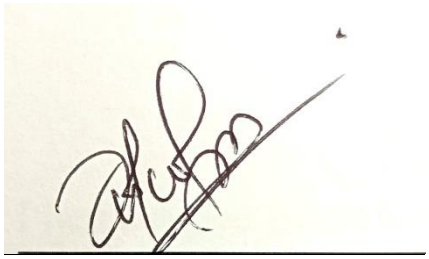
I hereby declare that this final year project report is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

Thean Hui Ru

APPROVAL SHEET

This final year project report entitled "**OSTEOPOROSIS KNOWLEDGE, HEALTH BELIEFS, AND CALCIUM INTAKE AMONG MALAYSIAN CHINESE ADULTS IN KAMPAR, PERAK**" was prepared by THEAN HUI RU and submitted as partial fulfilment of the requirements for the degree of Bachelor of Science (Hons) Dietetics at Universiti Tunku Abdul Rahman.

Approved by:



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PERMISSION SHEET

It is hereby certified that **THEAN HUI RU** (ID No: **20ADB05149**) has completed this final year project report entitled "OSTEOPOROSIS KNOWLEDGE, HEALTH BELIEFS, AND CALCIUM INTAKE AMONG MALAYSIAN CHINESE ADULTS IN KAMPAR, PERAK" under the supervision of Ms Nurul Aimi binti AB Kadir from the Department of Allied Health Science, Faculty of Science.

I hereby give permission to the University to upload the softcopy of my final year project in pdf format into the UTAR Institutional Repository, which may be made accessible to the UTAR community and public.

Yours truly,

(THEAN HUI RU)

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LIST OF ABBREVIATIONS

NOF	National Osteoporosis Foundation
RNI	Recommended Nutrition Intake
KAP	Knowledge, Attitude and Practice
NIH	National Institute of Health
DEXA	Dual-energy X-ray absorptiometry
BMD	Bone mineral density
BMI	Body Mass Index
PTH	Parathyroid hormone
TNFα	Tumour necrosis factor α
OPAAT	Osteoporosis Prevention and Awareness Tool
OKT	Osteoporosis Knowledge Test and
OKAT	Osteoporosis Knowledge Assessment Tool
OHBS	Osteoporosis Health Belief Scale
USM	Universiti Sains Malaysia
FFQ	Food frequency questionnaires
UMT	Universiti Malaysia Terengganu
UTAR	Universiti Tunku Abdul Rahman
SPSS	Statistical Package for the Social Science
SD	Standard deviations
AIDS	Acquired immunodeficiency syndrome
HBM	Health Belief Model
QUS	Quantitative Ultrasound
IPAQ	International Physical Activity Questionnaire

CHAPTER 1

INTRODUCTION

1.1 Research Background

Osteoporosis is a major public health issue around the world, especially within Asia (Yap et al., 2019). It can be identified by low bone density, degradation of bone tissues or porous bone which are linked with an increased risk of fracture (Yap et al., 2019). The National Osteoporosis Foundation (NOF) considers osteoporosis to be a silent disorder because most people are unaware of consistent declines in bone mass and it has no symptoms or clinical appearance until a fracture happens. Osteoporosis commonly affects hip, wrist and spine. Hip fracture cases are expected to rise by 3.55 times in Malaysia between 2018 and 2050, with the greatest increase in the Asian region (Cheung et al., 2018). According to Lee and Khir (2007), the Chinese population in Malaysia aged over 50 has the highest incidence of hip fractures. Besides, osteoporosis is frequently associated with the stereotype that only elderly women are affected (Khan et al., 2014). However, the truth is that osteoporosis can strike at any age and gender. Adults, men, premenopausal women, and even children can develop osteoporosis as a result of certain medications, disease, or lifestyle choices (Khan et al., 2014).

Following that, calcium is an essential mineral that is widely known for its important role in human bone health. Calcium is important for building and providing the bone strength and structure. Inadequate calcium intake

consumption can trigger bone resorption in order to sustain the calcium level in extracellular fluid, resulting in diminished bone mass (Zamzuri et al., 2019). Hence, calcium deficiency will result in brittle bone and bone fracture. According to the Recommended Nutrition Intake (RNI) 2017, Malaysian adults should consume 1000mg of calcium per day. However, Lee and Muda (2019) reported that Malaysian adults aged between 20 to 65 years only consumed 490mg of calcium per day.

Furthermore, the level of osteoporosis knowledge and health belief in Malaysian adults may be one of the factors influencing their calcium intake (Chiang, Husni, and Jamal, 2020). This is because the perceptions and knowledge of individuals can motivate them to take osteoporosis preventive actions such as sufficient calcium consumption. However, research on the associations between these two factors and calcium intake among Malaysian Chinese adults over is scarce. As a result, this study was carried out in Kampar, Perak, to explore the associations and correlations between osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults aged 18 to 64.

1.2 Problem Statements

Numerous studies regarding osteoporosis have been carried out in Malaysia. However, one significant issue identified from the previous research is the lack of osteoporosis studies among middle-aged Malaysian adults. This is due to the fact that most osteoporosis research focuses on specific groups, such as postmenopausal women, the elderly, or university students (Ramli, Rahman, and

Haque, 2018; Chee et al., 2010; Amin and Mukti, 2017). Additionally, studies assessing osteoporosis knowledge among university students often do not include daily calcium consumption (Khan et al., 2014; Amin and Mukti, 2017; Elnaem et al., 2017; Ramli, Rahman, and Haque, 2018).

Moreover, many Malaysian studies on osteoporosis focus on knowledge, attitude, and practice (KAP) assessments (Khan et al., 2014; Lim, Ali, and Yusof, 2017; Al-Naggar et al., 2019). However, general KAP surveys cannot provide a detailed analysis of factors related to osteoporosis compared to studies that specifically examine practices such as daily calcium intake. For example, KAP questionnaires typically ask how often calcium-rich foods are consumed, ranging from "never" to "every day," rather than measuring the actual number of servings consumed daily or total daily calcium intake (Khan et al., 2014; Ramli, Rahman, and Haque, 2018; Al-Naggar et al., 2019).

Furthermore, research on calcium consumption primarily targets older adults and does not explore the relationship between calcium intake, health beliefs, and osteoporosis knowledge (Zamzuri et al., 2019; Nohan et al., 2020; Lim et al., 2022). Therefore, more comprehensive studies addressing these gaps are required to better understand and prevent osteoporosis in a broader population, including middle-aged Malaysians.

1.3 Purpose Statement

This research aims to evaluate the level of knowledge and health beliefs about osteoporosis, as well as the amount of calcium intake, among Malaysian adults aged 18 to 64 years in Kampar, Perak. This study seeks to investigate their awareness and daily calcium intake levels. By evaluating the current level of knowledge and health beliefs about osteoporosis, the study aims to identify gaps and misconceptions about osteoporosis that may exist among Malaysian Chinese adults in Kampar, Perak. Understanding these aspects is important because osteoporosis is a major public health concern that can have serious consequences if not managed properly.

1.4 Research Objectives

1.4.1 General Objective

1. To investigate the relationship and association between osteoporosis knowledge, health beliefs, and daily calcium intake among Malaysian Chinese adults in Kampar, Perak.

1.4.2 Specific Objectives

1. To explore the level of osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak.
2. To investigate the association between osteoporosis knowledge and calcium intake among Malaysian Chinese adults in Kampar, Perak.

3. To investigate the association between osteoporosis health beliefs and calcium intake among Malaysian Chinese adults in Kampar, Perak.
4. To determine the relationship between age, osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak.

1.5 Research Questions

1. What is the level of osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak?
2. Is there an association between osteoporosis knowledge and calcium intake among Malaysian Chinese adults in Kampar, Perak?
3. Is there an association between osteoporosis health beliefs and calcium intake among Malaysian Chinese adults in Kampar, Perak?
4. What is the relationship between age, osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak?

1.6 Research Hypothesis

1. Malaysian Chinese adults in Kampar, Perak have a moderate level of osteoporosis knowledge and health beliefs.
2. The calcium intake among Malaysian Chinese adults in Kampar, Perak is inadequate.

3. There is a significant positive association between osteoporosis knowledge and calcium intake among Malaysian Chinese adults in Kampar, Perak.
4. There is a significant association between osteoporosis health beliefs and calcium intake among Malaysian Chinese adults in Kampar, Perak.
5. There is a significant correlation between age, osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak.

1.7 Conceptual Framework

In this study, osteoporosis knowledge and health beliefs were identified as key factors influencing daily calcium intake among Malaysian Chinese adults in Kampar, Perak. This is due to the fact that individuals with a higher level of knowledge about osteoporosis are more likely to recognize the risks associated with the condition (Chan et al., 2019b). Hence, this awareness often makes them feel that they are at a higher risk of developing osteoporosis themselves.

As a result, these individuals are more motivated to take preventive measures to minimize their risk. A significant step they are likely to take is to ensure they consume sufficient calcium daily, as calcium is vital for maintaining strong bones and overall bone health. Hence, meeting the daily recommended calcium intake helps in preventing osteoporosis and improving bone strength.

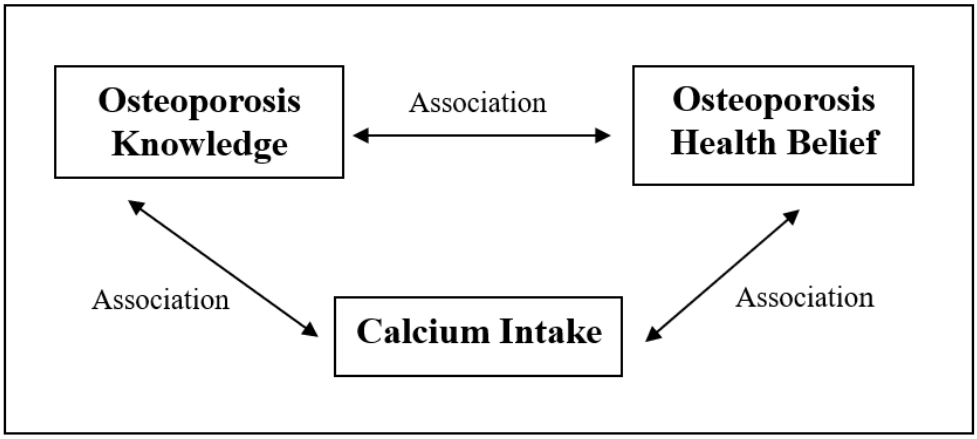


Figure 1.1: Conceptual framework for the association between osteoporosis knowledge, osteoporosis health beliefs, and calcium intake.

1.8 Significance of Study

Firstly, this study aims to provide comprehensive information about the relationship between osteoporosis knowledge, health beliefs, and calcium intake among Chinese adults in Kampar, Perak. Besides, this research can also provide data on the current calcium intake among Chinese adults aged 18 to 64 in Kampar, Perak, identifying potential deficiencies or adequacies. As a result, the study can serve as a foundation for developing health education and intervention programs aimed at enhancing bone health and preventing osteoporosis among Chinese adults in Kampar. Besides, the intervention programs can be tailored to be more effective by understanding the specific cultural context and needs of this population through this study. Furthermore, the study will play a crucial role in educating individuals with evidence-based information about osteoporosis and emphasizing the importance of calcium intake for osteoporosis prevention and overall quality of life. Additionally, the study will provide insights into osteoporosis knowledge and health beliefs among middle-aged participants, addressing a gap in current osteoporosis research.

CHAPTER 2

LITERATURE REVIEW

2.1 Osteoporosis

Osteoporosis is a bone condition marked by weakened bone strength, which heightens the likelihood of fractures (Ministry of Health Malaysia, 2022). Bone strength is a combination of bone density and bone quality. Bone density, measured in g/cm² or g/cm³, is influenced by peak bone mass and the extent of bone loss (Ministry of Health Malaysia, 2022). Bone quality encompasses the bone's structure, remodelling process, damage accumulation, and mineralisation. Osteoporosis occurs when there is an imbalance between bone formation and bone resorption (Pouresmaeili et al., 2018). When bone resorption outpaces bone formation, more bone is broken down than is replaced, leading to a decrease in bone density and mass. Standard tests for diagnosing osteoporosis include dual-energy X-ray absorptiometry (DEXA), which measures bone mineral density (BMD) at the femoral neck, total hip, or lumbar spine. BMD results are provided as either a T-score or Z-score (Ministry of Health Malaysia, 2022). A T-score of -2.5 or lower indicates osteoporosis. (Ministry of Health Malaysia, 2022). The Arthritis Foundation of Malaysia stated that over one million Malaysians are at risk of having osteoporosis (Khan et al., 2014).

2.2 The Risk Factors of Osteoporosis

The risk factors for osteoporosis can be divided into modifiable or non-modifiable. Modifiable risk factors include those that can be modified and improved, such as low consumption of calcium and vitamin D, excessive consumption of carbonated beverages, a Body Mass Index (BMI) below 19 kg/m^2, and a sedentary lifestyle; while non-modifiable risk factors include family background, menopause issue, and aging (Amin and Mukti, 2017).

2.2.1 Nutritional Deficiency, Sun Exposure and Sedentary Lifestyle

Osteoporosis is strongly linked to lifestyle factors such as physical activity and dietary intake of nutrients such as calcium and Vitamin D (Suriawati et al., 2016). Calcium is essential for optimal bone development, and adequate calcium intake is vital for achieving maximum peak bone mass, which helps lower the risk of developing osteoporosis later in life (Suriawati et al., 2016). As a result, insufficient calcium intake in adulthood increases the risk of low bone density, fractures, osteoporosis, and falls. A study conducted by Ibrahim, Nabil, and Ghaleb (2019) discovered that osteoporosis patients consumed significantly less calcium, primarily from milk and dairy products. Vitamin D is also essential for calcium and phosphorus absorption, reducing parathyroid hormone (PTH) production, and increasing bone mass density (Min, Yoo, and Choi, 2021). Actually, Vitamin D can be easily obtained through sun exposure. However, a study conducted by Ibrahim, Nabil, and Ghaleb (2019) revealed that 74% of osteoporosis patients had sun exposure for only 5 minutes or less, three to four times per week. People with sedentary lifestyles tend to have low sun exposure because they are less likely to be involved in outdoor activities that increase

sunlight exposure. Furthermore, exercise promotes bone health by enhancing skeletal growth and bone strength (Ibrahim, Nabil, and Ghaleb, 2019). As a result, Lin et al. (2023) found that individuals with sedentary lifestyles tend to have low bone density.

2.2.2 Age and Gender

The study conducted by Ibrahim, Nabil, and Ghaleb (2019) revealed that 76% of the patients with osteoporosis were women at or above 50 years of age. According to the International Osteoporosis Foundation, around 20% of men and 33% of women over the age of 50 will suffer an osteoporosis-related fracture at some point in their lives (Ibrahim, Nabil, and Ghaleb, 2019). This is because the bone mass starts losing when people reach the age of 40 and above, resulting in a high risk of bone fractures. However, women will lose bone density more rapidly than male, especially during the first 5 to 10 years after menopause due to oestrogen deficiency. Besides, men have 12-13% higher bone mass than women. Individuals with higher bone mass have a greater reserve of bone mineral content (Pouresmaeili et al., 2018). As bone density naturally decreases with age, those with initially higher bone mass have more to lose before reaching the critical threshold for osteoporosis. As a result, the hip fracture rate in women is approximately 2 times more than in men (Pouresmaeili et al., 2018).

2.2.3 Body Mass Index (BMI)

A study conducted in the US by Ibrahim, Nabil, and Ghaleb (2019) found that osteoporosis patients have significantly lower BMI compared to individuals without osteoporosis, with 72% of the osteoporosis patients having a BMI of less than 25 kg/m². Similarly, a study conducted by Chiu et al. (2024) in Taiwan revealed that underweight individuals had a significantly higher risk of developing osteoporosis compared to those of normal weight. This is because individuals with higher body weight place more mechanical stress on their bones, which helps maintain bone density (Chiu et al., 2024). Conversely, those with low BMI exert less mechanical load and muscle stress on their bones, leading to lower peak bone mass and increased bone loss. Additionally, low body fat can results in lower leptin levels, reducing osteoblast proliferation, mineralization, and collagen synthesis, while increasing bone resorption (Chiu et al., 2024).

2.2.4 Alcohol Consumption

According to Cheraghi et al. (2019), individuals who drank 1 to 2 alcoholic beverages per day were 1.34 times more likely to develop osteoporosis, whereas those who consumed 2 or more drinks daily had a 1.63 times greater risk of the disease. This is because heavy alcohol consumption impairs the absorption of essential nutrients for bone health, such as calcium, vitamin D, magnesium, and phosphorus. Hence, decreased levels of circulating serum calcium may contribute to weakened bones and an increased risk of osteoporosis. Additionally, chronic heavy drinking results in hormone deficiencies in both men and women. Frequent alcohol consumption in men leads to reduced testosterone levels, which

decreases osteoblast production and hinders bone formation (Godos et al., 2022). In women, excessive alcohol intake lowers oestrogen production, causing rapid bone degradation (Godos et al., 2022). Therefore, it is recommended that men limit alcohol intake to less than 2 servings per day and women to less than 1 serving per day to promote bone health.

2.2.5 Cigarette Smoking

A previous study conducted by Ibrahim, Nabil, and Ghaleb (2019) reported that 54% of osteoporosis patients were current smokers. Cigarette smoking is considered as one of the major modifiable risk factors for osteoporosis. This is because smoking affects bone tissue negatively by increasing oxidative stress in the body (Al-Bashaireh et al., 2018). Hence, high levels of free radicals accelerate bone resorption, the process of breaking down bone. Additionally, smokers tend to have higher glucocorticoid levels, which can disrupt bone metabolism by altering the activities of osteoblasts and osteoclasts, and impairing calcium absorption indirectly (Al-Bashaireh et al., 2018). Besides, nicotine causes the elevated tumour necrosis factor α (TNFα) production, reducing bone formation by osteoblasts and increasing bone resorption by osteoclasts (Ibrahim, Nabil, and Ghaleb, 2019). Additionally, nicotine also affects the intestinal calcium absorption, which lowers the effectiveness of dietary calcium intake (Ibrahim, Nabil, and Ghaleb, 2019). As a result, smokers exhibit lower bone mass density in the radius and femoral neck compared to non-smokers (Pouresmaeili et al., 2018).

2.3 Factors Contributing to High Prevalence of Osteoporosis Among the Chinese Population in Malaysia

Firstly, low calcium intake is a significant factor contributing to the high risk of osteoporosis among the Chinese population, as calcium is vital for bone mass and density production. Recent studies have shown the calcium intake among the Chinese population was below the recommended daily intake of 1000 mg (Chee et al., 2010; Yap et al., 2019; Lim et al., 2022). For instance, Yap et al. (2019) found that the Chinese population consumed only 362.3 mg of calcium per day. This result can be supported by another study done by Chan et al. (2019b) which reported that a majority of middle-aged and elderly Chinese individuals in Klang Valley, Malaysia did not consume dairy products (68.9%) or calcium supplements (82.2%) frequently.

Additionally, a study conducted by Lim et al. (2022) highlighted that Chinese older adults have significantly lower BMI and BMD compared to the Malay and Indian older adults, even though their BMI and BMD are still within the normal range. A lower BMI is associated with lower BMD, thereby increasing the risk of osteoporosis and bone fractures (Lim et al., 2022). This can be supported by previous research by Chan et al. (2014), which showed that the Chinese population had lower BMD and a higher incidence of bone fractures compared to other ethnic groups.

Furthermore, a study by Tam et al. (2016) assessing physical activity levels among Malaysian adults concluded that the Chinese population is the least physically active ethnic group, with the lowest participation in moderate or

vigorous physical activities. A sedentary lifestyle with low physical activity is a risk factor for osteoporosis due to reduced bone density (Lin et al., 2023). This is further supported by a study conducted by Chan et al. (2014), which revealed that individuals with less than 30 minutes of daily physical activity had lower hip BMD compared to those engaging in 30 minutes or more of daily physical activity.

2.4 The Prevalence of Osteoporosis Among Gender

Some of the studies regarding osteoporosis knowledge, health beliefs, and calcium intake are only targeted at females (Kim et al., 2013; Azhar and Jaafar, 2020; Pinar and Pinar, 2020; Embong and Yew, 2021). This is because several studies have shown that females are more likely to be diagnosed with osteoporosis than males, particularly during the postmenopausal period in later life (Azhar and Jaafar, 2020; Subramaniam et al., 2019). Besides, there are 51.8% of urban Malaysian women are being diagnosed with osteoporosis around the age of menopause (Khan et al., 2014). This is due to the fact that females will experience some natural life events that primarily affect their bone status, such as menstruation, being pregnancy, breastfeeding, and menopause. For example, the oestrogen level in the female body will decrease after menopause, resulting in rapid bone loss (Elnaem et al., 2017; Ramli, Rahman and Haque, 2018). This is because oestrogen deficiency changes the mineral and cellular matrix of bone tissue, increasing bone resorption while reducing bone formation in the body (Embong and Yew, 2021). Hence, this can lead to compromised bone microarchitecture and strength, increasing the chances of developing

osteoporosis among females (Embong and Yew, 2021). Following that, the National Osteoporosis Foundation (NOF) also stated that women have thinner bones than men which boosts the chance of getting porous bones (Azhar and Jaafar, 2020)

2.5 Osteoporosis Knowledge and Health Beliefs

2.5.1 The Definition of Osteoporosis Knowledge and Health Beliefs

There are few factors that may contribute to an increase in osteoporosis prevalence, including inadequate levels of literacy and a lack of understanding of osteoporosis risk and negative impacts (Amin and Mukti, 2017). Therefore, the level of osteoporosis knowledge is a crucial factor in fostering preventative behaviours against osteoporosis among Malaysian adults (Toh et al., 2015). Osteoporosis knowledge encompasses an understanding and awareness of the condition, including the importance of physical activity, sufficient calcium and vitamin D intake, fall prevention, and osteoporosis screening (Toh et al., 2015). Hence, there are many tools available in the previous Malaysian studies to evaluate the level of osteoporosis knowledge among the participants, such as the Osteoporosis Prevention and Awareness Tool (OPAAT), Osteoporosis Knowledge Test (OKT) and Osteoporosis Knowledge Assessment Tool (OKAT) (Elnaem et al., 2017; Ramli, Rahman and Haque, 2018; Chin et al., 2022).

Osteoporosis health belief refers to the understanding of one's vulnerability to osteoporosis and the awareness of the advantages of engaging in preventative measures, such as regular exercise and adequate calcium intake (Kim et al., 2013). Therefore, models like the Osteoporosis Health Belief Scale (OHBS)

have been created on 2013 to assess health beliefs related to osteoporosis. These models evaluate factors such as perceived susceptibility, seriousness of the condition, benefits and barriers to calcium intake, benefits and barriers to exercise, and overall health motivation in relation to osteoporosis. Adopting positive lifestyle changes can decrease the occurrence of osteoporosis in Malaysia. Therefore, it is crucial to understand individuals' health beliefs and attitudes towards osteoporosis to facilitate these positive changes (Soleymanian et al., 2014).

2.5.2 The Level of Osteoporosis Knowledge and Health Beliefs Among Malaysian Adults

According to numerous studies, Malaysian adults generally possessed a moderate level of osteoporosis knowledge (Lim, Ali and Yusof, 2017; Chan et al., 2019a; Chan et al., 2019b; Al-Naggar et al., 2019). The majority of Malaysian adults (above 82%) were aware that osteoporosis can cause weak and fragile bones, increasing the risk of bone fractures (Khan et al., 2014; Chan et al., 2019a; Chan et al., 2019b; Embong and Yew, 2021). Besides, there are 73.8% of the participants know that a lack of milk and dairy products is one of the risk factors of osteoporosis (Khan et al., 2014). However, there is still room for improvement in osteoporosis knowledge among Malaysians. According to a study by Lim, Ali and Yusof (2017), only 12.5% of Malaysian adults demonstrated a high level of osteoporosis knowledge, with the majority scoring low. This finding can be supported by another cross-sectional study conducted by Amin and Mukti (2017), which revealed that only 6.8% of students had good

knowledge of osteoporosis, while 79.4% of students exhibited poor knowledge of the subject.

2.5.3 The Level of Osteoporosis Knowledge Between Gender

Previous studies conducted at Malaysian universities revealed that female students had a higher level of osteoporosis knowledge than male students (Khan et al., 2014; Ramli, Rahman, and Haque, 2018). This finding is consistent with a cross-sectional study conducted by Lim, Ali, and Yusof (2017), which found that women had higher osteoporosis level scores than men among adults aged 21 to 50 in Kuala Lumpur. In addition, this finding also can be supported by another cross-sectional study conducted by Embong and Yew (2021) at Hospital Universiti Sains Malaysia (USM) on hospitalised women aged 45 to 55 which found that 40.5% of women had adequate knowledge of osteoporosis. Following that, a study conducted by Chan et al. (2019b) which targeted Malaysians more than 40 years old also revealed that women (75.91%) had higher level of general osteoporosis knowledge than men (69.24%).

2.5.4 The Level of Osteoporosis Health Beliefs Among Malaysian Adults

There were limited studies that mainly focused on the assessment of the osteoporosis health beliefs among Malaysians. Hence, some health beliefs components can be found in the KAP studies regarding osteoporosis. The cross-sectional studies conducted by Ramli, Rahman and Haque (2018), Chan et al. (2019a), and Chan et al. (2019b) determined that Malaysian adults held moderate to high levels of health beliefs about osteoporosis. Following that, a study by

Ramli, Rahman and Haque (2018) showed that 67% of the participants did not believe that they had a high chance of developing osteoporosis and 43.4% of them had weak bones. However, more than half of the participants (63.2%) think that osteoporosis is scary (Ramli, Rahman and Haque, 2018). In addition, a KAP study conducted by Lim, Ali and Yusof (2017) mentioned that most of the adults aged 21 to 50 years old are unaware that sufficient calcium consumption is one of the best ways to prevent osteoporosis. Besides, the study participants aged 19 to 47 years old had a low perception of the seriousness of osteoporosis compared to cancer and diabetes (Khan et al., 2014).

2.6 The Calcium Intake Among Malaysian Adults

Calcium intake is one of the important factors that promote bone health. Currently, the osteoporosis studies that included calcium intake among middle-aged Malaysian adults are very limited, as most of the studies targeted only the elderly and university students (Zamzuri et al., 2019; Yap et al., 2019; Azhar and Jaafar, 2020; Lim et al., 2022). In previous studies, several tools have been used to assess calcium intake among participants, including semi-quantitative food frequency questionnaires (FFQ), one-day food records, and 3-day diet recalls (Lim, Ali, and Yusof, 2017; Lim et al., 2022; Azhar and Jaafar, 2020; Yap et al., 2019).

However, most of the studies that assess calcium intake among Malaysian adults show that Malaysian adults have inadequate calcium consumption, which is below 600 mg/day. For example, a study that targeted young female adults aged

19 to 25 years old showed an intake of 377.93 (±179.08) mg/day, which is lower than the recommended intake according to RNI (2017) (Azhar and Jaafar, 2020). The findings of this study is parallel with a previous study conducted by Yap et al. (2019), which showed the average calcium intake by students at Universiti Malaysia Terengganu (UMT) was 348.3 mg/day. Furthermore, calcium intake among free-living Chinese post-menopausal women in Kuala Lumpur was 497 (±233) mg/day, while 14% of them were able to reach the recommended calcium intake with the additional intake of calcium supplements (Chee et al., 2010). A study by Lee and Wan Muda (2019) reported that the calcium intake among Malaysians aged between 20 to 65 years old was 490.3 mg/day. According to previous studies, milk was the major source of calcium intake among Malaysian adults (Azhar and Jaafar, 2020; Lim et al., 2022).

2.7 The Relationship Between Osteoporosis Knowledge, Health Beliefs and Calcium Intake

A cross-sectional study by Lim, Ali, and Yusof (2017) found a significant correlation ($\rho = 0.348$, $p < 0.0001$) between osteoporosis knowledge and attitudes. Research indicates that insufficient knowledge about osteoporosis may be linked to lower calcium intake and less effective lifestyle practices. Additionally, a study by Chan et al. (2019b) supported this connection, demonstrating a significant correlation between osteoporosis knowledge, health beliefs, and osteoprotective practices ($p < 0.05$). For instance, Chan et al. (2019b) found a positive correlation between osteoporosis knowledge and the perceived benefits of calcium intake ($r = 0.151$, $p \leq 0.001$).

CHAPTER 3

MATERIALS AND METHODS

3.1 Study Design

This cross-sectional study was conducted from December 2023 to August 2024 in Kampar, Perak. A cross-sectional study is an observational study that evaluates data from a population at a specific point in time (Wang and Cheng, 2020). It is appropriate to use in this study because it can estimate the prevalence and investigate the association between multiple exposures and outcomes in a population (Wang and Cheng, 2020). Furthermore, cross-sectional studies are simple to conduct, inexpensive, and time-efficient. A questionnaire is a common data collection method in cross-sectional studies.

3.2 Ethical Approval

Prior to the commencement of the study, an ethical approval from the UTAR Ethics committee (approval code: Re: U/SERC/78-252/2024) was obtained (Appendix A). Participants were informed about the purpose of the study as well as the personal data protection notice. All information obtained was kept strictly confidential and would not be disclosed to the public or any other unauthorised personnel. The data was handled and analysed solely by the researcher and supervisor who conducted the research. Their participation was entirely voluntary, their consent was obtained prior to data collection. Participants could withdraw from the study at any time.

3.3 Sample Recruitment

3.3.1 Target Population

The target population of this study was Malaysian Chinese adults aged 18 to 64 living in Kampar, Perak. Participants were recruited from various locations in Kampar, including Universiti Tunku Abdul Rahman (UTAR), Westlake home, market, restaurants, and grocery stores such as Lotus's and Econsave.

3.3.2 Sampling Method

Convenience sampling, a non-probability sampling method, was implemented in this study to recruit participants in Kampar. Convenience sampling is a popular type of sampling in population research because it is inexpensive, time-saving, and simple (Stratton, 2021). Hence, the participants were chosen based on their availability and willingness to participate in the study.

3.3.3 Sample Size Calculation

The sample size was calculated based on the formula by Cochran (1977).

$$n = \frac{Z^2 pq}{e^2}$$

where,

n = estimated sample size

Z = z-value corresponding to the confidence level

p = expected prevalence or proportion of the population

q = 1 - p

e = margin of error

According to Yeap et al. (2020), the prevalence of osteoporosis cases in Malaysia was 14.0%. Hence, with a 95% confidence level and a 5% margin of error, the value of Z, p, q, and e were calculated as shown in Table 3.1 below.

Table 3.1: The calculated value for sample size estimation.

Confidence level (Z)	95% (Z=1.96)
p	0.14
q (1-p)	0.86
Margin of error (E)	5% (0.05)

Therefore, the estimated sample size for this study was calculated as below:

$$n = \frac{(Z_\alpha)^2 p(1-p)}{E^2}$$

$$= \frac{(1.96)^2(0.14)(1-0.14)}{0.05^2}$$

$$= 185.01$$

$$\approx 185$$

With an additional 10% for the non-response rate,

$$n = 185 + (185 \times 0.1)$$

$$= 203.5$$

$$\approx 204 \text{ participants}$$

3.3.4 Inclusion and Exclusion Criteria

Inclusion criteria refer to the specific characteristics or features that participants must have to be eligible for the study. These criteria help to ensure that the study population is consistent, reliable, uniform, and objective (Garg, 2016). Besides, exclusion criteria identify factors or characteristics that would prevent individuals from participating in the study (Garg, 2016), as these factors could potentially confound the outcome parameters, thereby affecting the validity and reliability of the study's findings (Garg, 2016). Table 3.2 summarised the inclusion and exclusion criteria for this study.

Table 3.2: Inclusion and exclusion criteria of this study.

Inclusion criteria	Exclusion criteria
• Malaysian Chinese citizens. • Aged 18 – 64. • Reside in Kampar, Perak.	• Individuals with specific dietary restrictions (e.g. vegan) • Pregnant women

3.4 Research Questionnaires

A research questionnaire is designed as a data collection tool, consisting of a series of questions or items to gather data from the target sample (Ranganathan and Caduff, 2023). This method is recognized as a cost-effective way to quickly collect a large amount of data (Ranganathan and Caduff, 2023). The questionnaires used in this study were self-reported. The questionnaires were distributed physically and took participants approximately 10 to 15 minutes to complete. It consisted of four sections:

1. **Section A:** Sociodemographic Information
2. **Section B:** Osteoporosis Prevention and Awareness Tool (OPAAT) Questions
3. **Section C:** Osteoporosis Health Belief Scale (OHBS) Questions
4. **Section D:** 30-Item Food Frequency Questionnaire (FFQ)

This structure ensured that the questionnaire comprehensively addressed all relevant aspects of the study, allowing for a thorough analysis of osteoporosis knowledge, health beliefs, and calcium intake among the target population. The questionnaire used is attached in Appendix B. All the questions were derived from previous research studies related to the topic. Additionally, a pilot study was conducted to validate the modified questions in Sections B and C.

3.4.1 Pilot Study

A pilot study is a small-scale preliminary study that evaluates different components of procedures in preparation for a larger and more comprehensive research (Lowe, 2019). Generally, researchers utilize pilot studies in order to assess the suitability of their intended methods and procedures (Lowe, 2019). Hence, a pilot study was conducted to measure the reliability of the particular modified questionnaire in Section B and Section C. For Section B, 15 out of the 30 questions were taken from the original OPAAT questions, considering the potential for response fatigue due to the lengthy questionnaire. Other than that, the questions from some categories such as benefits of exercise and barriers to

exercise which unrelated to the research were removed from the original OHBS questions in Section C (Kim et al., 2013). As a result, 30 out of 42 questions were included in Section C of the questionnaire in this study to evaluate the osteoporosis health beliefs among the participants.

After that, 10% of the estimated sample size which is 20 participants were included in the pilot study from 18th February to 25th February 2024. Then, the collected data was analysed to test the reliability and consistency of the modified questions on Sections B and C through SPSS version 20 software. Cronbach's alpha coefficient was used to assess the internal consistency of the modified OPAAT and OHBS questions. As a result, the selected 15 questions from the original OPAAT questions demonstrated relatively fair and acceptable internal reliability and consistency with a Cronbach's alpha value of 0.709 by referring toTable 3.3 below. At the same time, the 30 questions from the original OHBS questions demonstrated a relatively good internal reliability and consistency with a Cronbach's alpha value of 0.838.

Table 3.3: The internal reliability and consistency level based on the Cronbach's alpha value.

Cronbach's alpha value	Internal Reliability and Consistency
>0.9	Excellent
>0.8	Good
> 0.7	Acceptable
> 0.6	Questionable
> 0.5	Poor
<0.5	Unacceptable

Source: (Toh et al., 2015)

3.4.2 Section A: Sociodemographic Information

A total of nine questions were included in this section. The personal information such as name, age, gender, educational level, monthly income, and smoking status was asked in this section. In this section, participants were also asked about their personal and family history of osteoporosis. At the same time, this section also tried to obtain the source of knowledge of the participants by providing the options of newspapers, books, online website, friends, family members, or social media.

3.4.3 Section B: Osteoporosis Prevention and Awareness Tool (OPAAT) Questions

The purpose of this section was to assess the osteoporosis knowledge level of the participants. Therefore, 15 out of 30 questions were taken from original OPAAT questions which included osteoporosis in general, consequences of untreated osteoporosis, and ways to prevent osteoporosis. OPAAT was developed by Toh et al. (2015) and it was considered as a reliable and valid tool to determine the level of knowledge regarding osteoporosis among participants in Malaysia with the range of 0.29 – 0.756 of Cronbach's alpha. Besides, there were some recent studies used OPAAT to assess osteoporosis knowledge among Malaysian adults (Chan et al., 2019a; Chan et al., 2019b; Chin et al., 2022).

In this section, a total of 15 close-ended questions were being included with three options "True", "False", and "I don't know." There was only one correct answer for each question and "I don't know" was considered as wrong answer.

Then, the correct answer will be given one mark for each question and the total mark will be calculated. As a result, the osteoporosis knowledge level was determined and classified according to Chan et al. (2019a) score as low (7 and less than), moderate (8-10), and high (11-15).

3.4.4 Section C: Osteoporosis Health Belief Scale (OHBS) Questions

In this section, OHBS questions were used to assess the osteoporosis health belief among the participants. OHBS was a common method that used by some recent studies in Malaysia to evaluate osteoporosis health belief (Chan et al., 2019a; Chan et al., 2019b; Chin et al., 2022). There were 30 questions taken from the original OHBS in 5 categories: Q1-Q6: susceptibility; Q7-Q12: seriousness; Q13-Q18: benefits of calcium intake; Q19-Q24: barriers to calcium intake; Q25-Q30: health motivation. Then, a 5-point Likert Scale in OHBS was scored as 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree) with a possible range of 6 to 30 for each category (Kim et al., 2013). According to the study conducted by Chan et al. (2019a), the belief score will be summed up and classified into low (6 -15), moderate (16-20), and high (21-30). Higher OHBS scores show a more favourable attitude toward bone health among the participants (Chin et al., 2022)

3.4.5 Section D: 30-Item Food Frequency Questionnaire (FFQ)

In this section, a semi-quantitative food frequency questionnaire (FFQ) developed by Cheou (2021) was used to assess the calcium intake of the participants. According to Cheou (2021), the FFQ was created by referring to various sources, including the Malaysia Atlas of Food Exchanges and Portion Sizes, the Malaysian Food Composition Database, and the Nutrient Composition of Malaysian Food via Nutritionist ProTM. Besides, the developed FFQ underwent a pilot study and demonstrated acceptable validity and reliability, with a Cronbach's alpha of 0.778 and a Pearson's correlation coefficient of 0.716 (Cheou, 2021).

The FFQ consisted of 30 common food and beverages item in Malaysia which high in calcium and can be divided into 6 food groups, including “dairy products”, “fish, poultry and meat”, “soy and soy products”, “fruits and vegetables”, “cereals and cereal products”, and “others.” Table 3.4 shows the food items included in the FFQ and the calcium content in one serving size for each food.

Table 3.4: FFQ food item lists, serving size and calcium content (mg).

Food item	Food/ beverages items	Serving size	Calcium contents (mg)
	Dairy products		
1	Milk	1 glass (250ml)	273.1
2	Yogurt	1 cup	317.5
3	Cheese	¼ cup	103.0
4	Milk powder	4 dessert spoons	338.0
5	Malted milk drink	3 dessert spoons	170.0
6	Ice cream	½ cup	92.2
	Fish, poultry and meat		
7	Egg	1 whole	34.9
8	Canned sardines	1 serving	167.4
9	Anchovies	1/3 cup	60.0
10	Poultry and meat	3 oz	14.7
11	Fish	3 oz	19.2
12	Shellfish	3 oz	51.0
	Soy and soy products		
13	Tofu	1 piece	105.0
14	Chickpea/ Yellow dhal	¼ cup	5.7
15	Tempeh	1 piece	9.7
16	Unsweetened soy milk	1 glass (250ml)	45.4
	Fruits and vegetables		
17	Apple/ pear	1 whole	8.28
18	Orange	1 whole	57.4
19	Pineapple	1 slice	34.1
20	Cauliflower/ broccoli	1 cup	36.3
21	Dark green vegetables	½ cup	52.5
22	Carrot	½ cup	19.4
	Cereal and cereal products		
23	Potatoes, sweet potatoes, taro	1 whole	16.5
24	Bread	1 slice	11.2
25	Rice	¼ plate	3.2
26	Noodles	½ cup	5.5
27	Oats	½ cup	7.7
	Others		
28	Fast food (hamburger/ cheese burger)	1 item	85.3
29	Coffee and tea	1 cup	4.7
30	Calcium supplement		

Source: Cheou (2021)

In this section, the participants had to recall and choose the option to indicate the most relevant frequency of consuming the particular food in the past month from a 10-point scale ("Never", "1 serving per month or less", "2 – 3 servings per month", "1 – 2 servings per week", "3 – 4 servings per week", "5 – 6 servings per week", "1 serving per day", "2 – 3 servings per day", "4 – 5 servings per day", and "6 or more servings per day"). For example, if a respondent consumed 3 glasses of milk every week in the past month, the option "3-4 servings per week" was chosen. Additionally, a picture of each food item with its corresponding serving size was provided (as shown in Figure 3.1 below) to minimize misunderstandings or incorrect assumptions about portion sizes among participants, leading to more precise dietary data.

Food items		Frequency of intake (based on number of servings)	
DAIRY PRODUCTS			
Dairy milk (all types, include milk in coffee, tea and cereal) 1 serving = 1 glass (250ml)		o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Figure 3.1: The sample question in Section D to assess the calcium intake of the participants.

Following that, the answers provided by each respondent in the FFQ were collected and presented in the table form in Microsoft Excel 2016. Then, the mean frequency of each food item consumption was calculated by referring to Table 3.5 below:

Table 3.5: The mean of the frequency of the food item consumption based on the options in the FFQ.

The frequency of the food item consumption	Mean of the frequency of the food item consumption
Never	0 time per month
1 serving per month or less	0.5 times per month
2 - 3 servings per month	2.5 times per month
1 - 2 servings per week	1.5 times per week
3 - 4 servings per week	3.5 times per week
5 - 6 servings per week	5.5 times per week
1 serving per day	1 time per day
2 – 3 servings per day	2.5 times per day
4 – 5 servings per day	4.5 times per day
6 or more servings per day	6.5 times per day

The conversion factor (times per day) was calculated as below:

Daily = Mean of the frequency of the food item consumption

Weekly = Mean of the frequency of the food item consumption /7

Monthly = Mean of the frequency of the food item consumption /30

Then, the total daily calcium intake was calculated by using the formula below:

Calcium intake of a food item

= The conversion factor (times/ day) x Calcium content of food item (mg)

Total calcium intake

= Total sum of calcium intake from 30 food items (mg/day)

3.5 Data Collection

The final questionnaire was created in Microsoft Word and then printed out. The questionnaires, along with informed consent forms, were physically distributed

to participants in the Kampar area. The data collection period spanned from May 2024 to July 2024. During this period, a total of 213 responses were collected.

3.6 Data Analysis

After the data collection was completed, results from the questionnaire were all cleaned and coded using Excel and IBM Statistical Package for the Social Science (SPSS) version 20 for tabulation and analysis. During this period, some responses had been eliminated due to unclear or incomplete responses. In addition, the extreme values of the daily amount of total calcium intake were also removed. As a result, 205 out of the 213 participants were included in the final analysis of this study, which meets the minimum sample size requirement. For descriptive statistics, categorical data were reported as frequencies and percentages, while continuous data were expressed as means and standard deviations (SD).

3.6.1 Kolmogorov-Smirnov test

The Kolmogorov-Smirnov test was used to assess the normality of the collected data the sample size in this study. The test result was considered a normal distribution if the p-value was greater than 0.05. As a result, the collected data in this study was considered not normally distributed as the p-value was less than 0.05. Therefore, non-parametric tests were used to analyze the data. For each test, a p-value below 0.05 was considered statistically significant.

3.6.2 Chi-Square Test

The Chi-square test used to determine the significant association between two categorical variables. In this study, it was used to assess the association between calcium intake level with the level of osteoporosis knowledge and health beliefs.

3.6.3 Spearman's Correlation Coefficient

Spearman's correlation is a non-parametric method used to assess the strength and direction of the linear relationship between two continuous variables. In this study, it was employed to examine the linear relationships between osteoporosis knowledge (OPAAT scores), osteoporosis health beliefs, and calcium intake among Malaysian Chinese adults in Kampar. The Spearman's correlation coefficient ranges from -1 to 1; a value of +1 signifies a strong positive linear relationship, -1 denotes a strong negative linear relationship, and zero indicates no linear relationship. The strength of the correlation coefficient is further interpreted according to Table 3.6 below.

Table 3.6: The interpretation of data based on the correlation coefficient value.

Correlation coefficient	Interpretation
0.00-0.10	Negligible correlation
0.10-0.39	Weak correlation
0.40-0.69	Moderate correlation
0.70-0.89	Strong correlation
0.90-1.00	Very strong correlation

Source: (Schober, Boer and Schwarte, 2018)

3.7 Flowchart of Research Activities

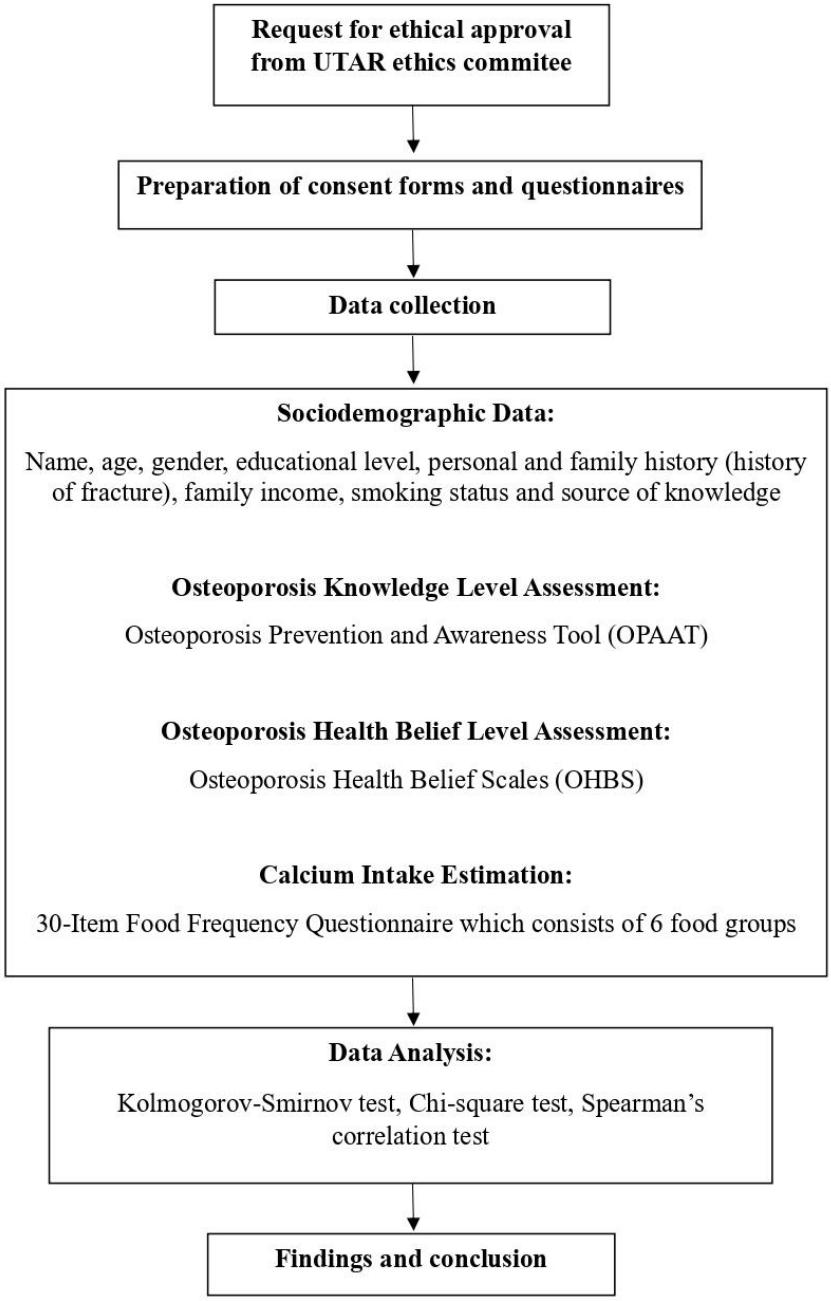


Figure 3.2: Flow chart of research activities on the association and relationship between osteoporosis knowledge, osteoporosis health belief and calcium intake.

CHAPTER 4

RESULTS

4.1 Background Information

A total of 213 questionnaires were collected from Kampar residents. However, some were excluded due to not meeting the inclusion criteria or contained unclear or incomplete responses. Additionally, participants who reported extreme values for daily calcium intake were also removed from this study. As a result, 205 out of the initial 213 participants were included in the final analysis, meeting the minimum sample size requirement for the study.

4.2 Sociodemographic Characteristics of the Participants

The study sample consisted of a diverse group of participants with varying ages, genders, educational backgrounds, and monthly income. Hence, Table 4.1 presented the sociodemographic information of the 205 participants for this study. The sample included 93 male and 112 female participants, ranging in age from 18 to 64 years. The largest age group was 31-40 years (32.7%), while the smallest was the 51-64 age group (18.0%). Participants' educational backgrounds varied widely, with the most common qualification being a Bachelor's degree, held by 36.1% of participants. Additionally, 26.8% of participants had qualifications below a diploma, 13.7% of participants had a diploma, and a smaller percentage had advanced degrees, including a Master's

(7.8%) and a PhD (11.7%). Besides, a minority (3.9%) of the participants had completed a Foundation program.

Regarding income, nearly half of the participants (45.9%) earned less than RM 2,500 per month, while 27.3% reported income between RM 2,500 and RM 4,999, indicating that the majority of the sample fell within the lower income brackets. Besides, majority of the participants didn't experience bone fracture or osteoporosis (93.7%), nor a family history of bone fracture and osteoporosis (87.3%). Furthermore, only 4.9% of participants were smokers as smoking is one of the risk factors for osteoporosis. Table 4.1 also showed that the primary sources of knowledge for the participants were social media (68.3%) and online websites (57.1%), followed by books or magazines (37.2%). Only 58 (28.3%) of the participants identified the profession as their source of information. In conclusion, the sociodemographic analysis suggests that the sample is predominantly lower to middle-income, well-educated, with a limited personal or family history of osteoporosis, where social media and online platforms play a significant role in their knowledge acquisition.

Table 4.1: Sociodemographic characteristics of the participants (n=205).

Characteristics	n (%)		
	Male (n=93)	Female (n=112)	Total (n= 205)
Age			
18 - 30	27 (13.2)	33 (16.1)	60 (26.8)
31 - 40	32 (15.6)	35 (17.1)	67 (32.7)
41 - 50	18 (8.8)	23 (11.2)	41 (20.0)
51 – 64	16 (7.8)	21 (10.2)	37 (18.0)
Educational Level			
Less than diploma	22 (10.7)	33 (16.1)	55 (26.8)
Diploma	12 (5.9)	16 (7.8)	28 (13.7)
Bachelor of degree	29 (14.1)	45 (22.0)	74 (36.1)
Master	10 (4.9)	6 (2.9)	16 (7.8)
PhD	17 (8.3)	7 (3.4)	24 (11.7)
Others: Foundation	3 (1.5)	5 (2.4)	8 (3.9)
Monthly income			
< RM 2,500	38 (18.5)	56 (27.3)	94 (45.9)
RM2,500 – RM4,999	27 (13.2)	29 (14.1)	56 (27.3)
RM5,000 – RM7,499	19 (9.3)	15 (7.3)	34 (16.6)
RM7,500 – RM9,999	6 (2.9)	4 (2.0)	10 (4.9)
≥ RM 10,000	3 (1.5)	8 (3.9)	11 (5.4)
Personal history of osteoporosis/ fracture			
Yes	5 (2.4)	8 (3.9)	13 (6.3)
No	88 (42.9)	104 (50.7)	192 (93.7)
Family history of osteoporosis/ fracture			
Yes	12 (5.9)	14 (6.8)	26 (12.7)
No	81 (39.5)	98 (47.8)	179 (87.3)
Smoking Status			
Smoker	5 (2.4)	5 (2.4)	10 (4.9)
Non-smoker	88 (42.9)	107 (52.2)	195 (95.1)
Source of knowledge			
Books or magazines	34 (16.6)	42 (20.5)	76 (37.1)
Newspaper	27 (13.2)	32 (15.6)	59 (28.8)
Friends	40 (19.5)	56 (27.3)	96 (46.8)
Family members	41 (20.0)	47 (22.9)	88 (42.9)
Professions	29 (14.1)	29 (14.1)	58 (28.3)
Social media	66 (32.2)	74 (36.1)	140 (68.3)
Online websites	56 (27.3)	61 (29.8)	117 (57.1)

n = number of participants

4.3 Osteoporosis Knowledge of the Participants

Table 4.2 presented the distribution of responses to each OPAAT question used to assess the osteoporosis knowledge level among 205 participants. Correct answers were highlighted in bold. The results showed that 177 participants (86.3%) understood that osteoporosis made bones weaker, more brittle, and more prone to fractures. Additionally, more than half of the participants (55.13%) aware that osteoporosis typically presented without symptoms. However, fewer participants recognized that osteoporosis was different from osteoarthritis (41.0%), and only 19.5% correctly understood that osteoporosis did not cause joint pain or swollen fingers.

More than half of the participants correctly identified certain consequences of osteoporosis, such as back pain (61.0%), loss of height or a hunched back (73.2%), and loss of mobility (64.4%). However, a significant majority (80.5%) incorrectly believed that osteoporosis could cause tooth loss. Furthermore, only 72 participants (35%) knew that medications like sleeping pills did not reduce the risk of falling. Lastly, nearly half of the participants (53.2%) correctly disagreed with the statement "Being underweight helps prevent osteoporosis."

Table 4.2: Distribution of answers for osteoporosis knowledge.

No.	Statement	Yes n (%)	No n (%)	I don't know n (%)
1.	Makes bones weaker, more brittle and more likely to break (fracture).	**177 (86.3)**	9 (4.4)	19 (9.3)
2.	Osteoporosis occurs because bone is removed faster than it is formed.	**94 (45.9)**	32 (15.6)	79 (38.5)
3.	Osteoporosis and osteoarthritis are different names we can use to describe the same disease.	52 (25.4)	**84 (41.0)**	69 (33.7)
4.	Osteoporosis usually has no symptoms.	**52 (25.4)**	113 (55.1)	40 (19.5)
5.	Postmenopausal women are not at risk for osteoporosis.	27 (13.2)	**120 (58.5)**	58 (28.3)
6.	Osteoporosis is an untreatable disease.	47 (22.9)	**107 (52.2)**	51 (24.9)
7.	A bone mineral density test should be performed monthly to monitor bone loss.	88 (42.9)	**42 (20.5)**	75 (36.6)
8.	Results in back pain.	**125 (61.0)**	29 (14.2)	51 (24.9)
9.	Loss of height or hunchback.	**150 (73.2)**	16 (7.8)	39 (19.0)
10.	Loss of mobility (unable to move around myself).	**132 (64.4)**	44 (21.5)	29 (14.1)
11.	Results in tooth loss.	113 (55.1)	**37 (18.0)**	55 (26.8)
12.	Results in joint pain or swelling of fingers.	111 (54.1)	**40 (19.5)**	54 (26.3)
13.	Exercise will wear out bones.	89 (43.4)	**61 (29.8)**	55 (26.8)
14.	Certain medications (such as sleeping tablets or high blood pressure medications) may reduce the risk of falling.	40 (19.5)	**72 (35.1)**	93 (45.4)
15.	Being underweight helps prevent osteoporosis.	43 (21.0)	**109 (53.2)**	53 (25.9)

Note: The correct answers are bolded.

The results of osteoporosis knowledge levels among the 205 participants were outlined in Table 4.3 and Figure 4.1 based on the total scores from the 15 OPAAT questions. The findings indicated that participants generally had a low level of osteoporosis knowledge, with a mean score of 6.84 ± 2.92 out of a possible 15. According to Table 4.3, 116 participants (56.6%) fell into the low osteoporosis knowledge level category, while only 25 participants (12.2%) demonstrated a high level of osteoporosis knowledge.

Table 4.3: Osteoporosis knowledge levels of the participants (n=205).

Percentage of total OPAAT score (%)	Knowledge level	Frequency n (%)	Mean (SD)
≤50	Low (0-7)	116 (56.6)	6.84 (2.92)
51-69	Moderate (8-10)	64 (31.2)	
≥70	High (11-15)	25 (12.2)	

SD = standard deviation, n = number of participants

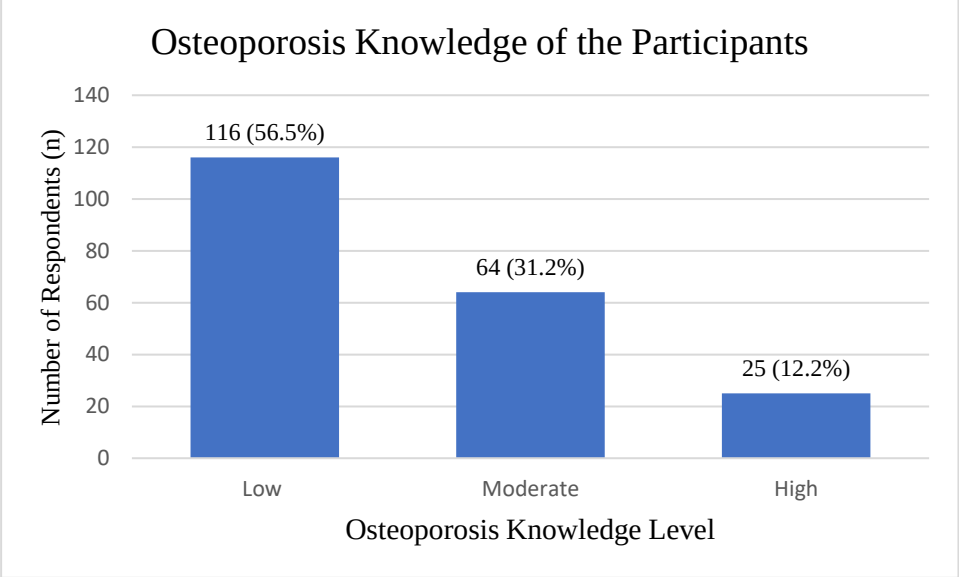


Figure 4.1: The distribution of osteoporosis knowledge levels of the participants (n=205).

4.4 Osteoporosis Health Belief Levels of the Participants

Table 4.4 presented the distribution of responses on the OHBS, which was used to assess the osteoporosis health beliefs of the participants (n=205). The most frequent responses were highlighted in bold parentheses for each statement. The data showed that relatively few participants strongly agreed with statements related to their susceptibility to osteoporosis, with less than 20% believing they were at high risk of developing the condition. However, majority of the participants acknowledged the seriousness of osteoporosis as a health concern. Specifically, 53.7% of participants either agreed or strongly agreed with statements highlighting the severe implications of osteoporosis, such as the potential high cost of managing the disease, although nearly 50% did not believe they would be crippled by it.

In the calcium benefits category of the OHBS, there was a strong consensus among participants regarding the importance of calcium for bone health. A significant majority, over 83.4%, agreed or strongly agreed that adequate calcium intake was crucial for preventing osteoporosis. This widespread agreement suggested that the role of calcium in osteoporosis prevention was well-recognised among the study participants. Conversely, when assessing perceived barriers to calcium intake, most participants either disagreed or remained neutral. For example, 48.8% and 39.5% were neutral about the statements “Calcium-rich foods cost too much” and “Calcium-rich foods have too much cholesterol”, respectively.

Additionally, participants demonstrated strong motivation to engage in health-promoting behaviours. Nearly 82% and 66% of participants agreed or strongly agreed with statements emphasizing the importance of maintaining good health and their willingness to follow health recommendations, respectively. This high level of agreement reflected a proactive attitude among participants, showing their commitment to preventive measures and staying informed about their bone health.

Table 4.4: Distribution of level of agreement for the statements in OHBS (n=205).

Statement	Level of Agreement (%)				
	SD	**D**	**N**	**A**	**SA**
Perceived Susceptibility to Osteoporosis					
1. Your chances of getting osteoporosis are high.	15.6	28.8	**(36.6)**	14.6	4.4
2. Because of your body build, you are more likely to develop osteoporosis.	16.1	32.2	**(35.6)**	14.6	1.5
3. It is extremely likely that you will get osteoporosis.	20.5	31.2	**(32.7)**	15.1	5.0
4. There is a good chance that you will get osteoporosis.	16.1	**(32.7)**	32.2	18.0	1.0
5. You are more likely than the average person to get osteoporosis.	16.1	35.1	**(36.1)**	12.2	5.0
6. Your family history makes it more likely that you will get osteoporosis.	24.2	**(38.5)**	26.3	8.8	2.0
Perceived Seriousness of Osteoporosis					
7. The thought of having osteoporosis scares you.	11.2	25.4	23.4	**(35.6)**	4.4
8. If you had osteoporosis, you would be crippled.	13.7	**(37.1)**	25.9	22.4	1.0
9. Your feelings about yourself would change if you got osteoporosis.	12.7	19.5	24.9	**(38.0)**	4.9
10. It would be very costly if you got osteoporosis.	4.9	15.1	26.3	**(44.4)**	9.3
11. When you think about osteoporosis you get depressed.	13.2	27.8	22.9	**(30.2)**	5.9
12. It would be very serious if you got osteoporosis.	9.8	27.8	26.8	**(28.3)**	7.3

Table 4.4 continued: Distribution of level of agreement for the statements in OHBS (n=205).

Benefits of calcium intake					
13. Taking in enough calcium prevents problems from osteoporosis.	1.0	3.4	12.2	**(55.6)**	27.8
14. You have lots to gain from taking in enough calcium to prevent osteoporosis	0.5	6.3	19.0	**(57.1)**	17.1
15. Taking in enough calcium prevents painful osteoporosis.	2.0	5.4	29.8	**(46.8)**	16.1
16. You would not worry as much about osteoporosis if you took in enough calcium.	1.5	8.8	27.8	**(45.9)**	16.1
17. Taking in enough calcium cuts down on your chances of broken bones.	2.0	5.9	23.9	**(51.7)**	16.6
18. You feel good enough about yourself when you take in enough calcium to prevent osteoporosis.	0.5	4.4	31.2	**(50.2)**	13.7
Barriers to calcium intake					
19. Calcium-rich foods cost too much	9.3	34.6	**(39.5)**	13.2	3.4
20. Calcium-rich foods do not agree with you.	10.2	38.0	**(39.0)**	11.2	1.5
21. You do not like calcium-rich food.	11.2	**(38.0)**	35.1	13.2	2.4
22. Eating calcium-rich foods means changing your diet which is hard to do.	13.7	**(36.1)**	32.7	14.1	3.4
23. In order to eat more calcium-rich foods you have to give up other foods that you like.	15.6	**(37.1)**	29.3	13.7	4.4
24. Calcium-rich foods have too much cholesterol.	11.2	24.9	**(48.8)**	13.2	2.0

Table 4.4 continued: Distribution of level of agreement for the statements in OHBS (n=205).

Health Motivation					
25. You eat a well-balanced diet.	3.4	17.1	**(37.1)**	34.6	7.8
26. You look for new information related to health.	2.4	9.3	33.7	**(47.3)**	7.3
27. Keeping healthy is very important for you.	0.0	4.4	13.7	**(50.7)**	31.2
28. You try to discover health problems early.	1.0	7.8	28.3	**(49.3)**	13.7
29. You have a regular health check-up even when you are not sick.	10.7	17.1	**(32.2)**	28.3	11.7
30. You follow recommendations to keep you healthy.	2.4	6.3	25.4	**(57.1)**	8.8

SD= Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA= Strongly Agree

Note: Most frequent responses are in bold parentheses.

Table 4.5 presents the mean and standard deviation for each OHBS category. The participants perceived their susceptibility to osteoporosis as low, with a mean score of 14.87 ± 5.00). They had a medium perception of the seriousness of osteoporosis (17.81 ± 5.20) and perceived barriers to calcium intake (15.61 ± 4.15). In contrast, the participants reported high perceived benefits of calcium intake (22.73 ± 3.75) and strong health motivation (21.26 ± 3.84). Overall, the participants were considered to have a moderate level of osteoporosis health beliefs with an overall mean of 18.46 ± 2.40.

Table 4.5: Level of health beliefs towards osteoporosis.

Aspects	Overall (n=205), n (%)	Mean (%) (SD) Possible range: 6-30	Interpretation related to osteoporosis
Perceived Susceptibility to Osteoporosis (Q1-6)			
Low (0-50%)	103 (50.2)		
Moderate (51-69%)	78 (38.0)	14.87 (5.00)	Low
High (70-100%)	24 (11.7)		
Perceived Seriousness of Osteoporosis (Q7-12)			
Low (0-50%)	67 (32.7)		
Moderate (51-69%)	65 (31.7)	17.81 (5.20)	Moderate
High (70-100%)	73 (35.6)		
Perceived Benefits of Calcium Intake (Q13-18)			
Low (0-50%)	6 (2.9)		
Moderate (51-69%)	43 (21.0)	22.73 (3.75)	High
High (70-100%)	156 (76.1)		
Perceived Barriers to calcium intake (Q19-24)			
Low (0-50%)	95 (46.3)		
Moderate (51-69%)	88 (42.9)	15.61 (4.15)	Moderate
High (70-100%)	22 (10.7)		
Health motivation (Q25-30)			
Low (0-50%)	16 (7.8)		
Moderate (51-69%)	65 (31.7)	21.26 (3.84)	High
High (70-100%)	124 (60.5)		

4.5 Calcium Intake of the Participants

Table 4.6 and Figure 4.2 displayed the mean and standard deviation of dietary calcium intake among the participants across six different food groups. The results indicated that dairy products (258.93 ± 287.47 mg/day) were the primary source of calcium, while cereals and cereal products (16.00 ± 12.60 mg/day) contributed the least to the participants' overall calcium intake.

Table 4.6: Calcium intake of participants according to food groups.

Food groups	Calcium Intake (mg/day)	
	Mean	SD
Dairy products	258.93	287.47
Fish, poultry, and meat	92.90	80.22
Soy and soy products	49.12	72.59
Fruits and vegetables	80.40	66.40
Cereal and cereal products	16.00	12.60
Others	62.52	198.50

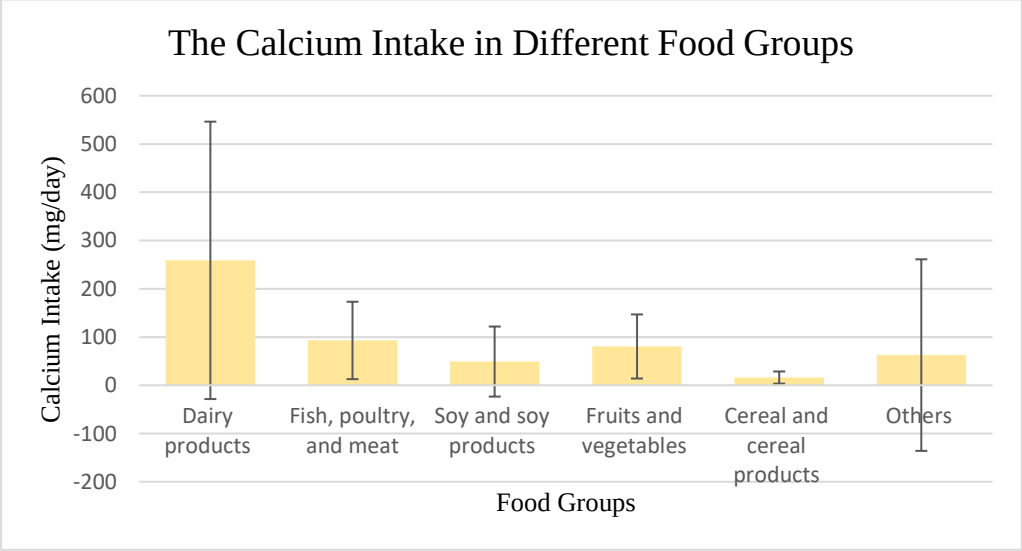


Figure 4.2: The calcium intake in different food groups among the participants (n=205).

Table 4.7 categorizes the current daily calcium intake of 205 participants based on their Food Frequency Questionnaire (FFQ) responses. The average daily calcium intake among the participants was 530 mg, with a standard deviation of 353.2 mg, which represents 53% of the recommended calcium intake according to the Recommended Nutrient Intake (RNI). The data revealed that majority of the participants (59.5%) consumed between 25% and 75% of the RNI for calcium, while 20% had an intake below 25% of the RNI, and 20.5% exceeded 75% of the RNI.

Table 4.7: The classification of calcium intake among the participants.

% Calcium intake with reference to RNI	Daily calcium intake (mg/day)	Frequency n (%)	Mean (SD)
<25%	0-249	41(20.0)	530 (353.2)
25-75%	250-750	122 (59.5)	
>75%	751-1000	42(20.5)	

Following that, Figure 4.3 showed that only 12% of participants had adequate calcium intake as they consumed 1000mg/day of calcium or above.

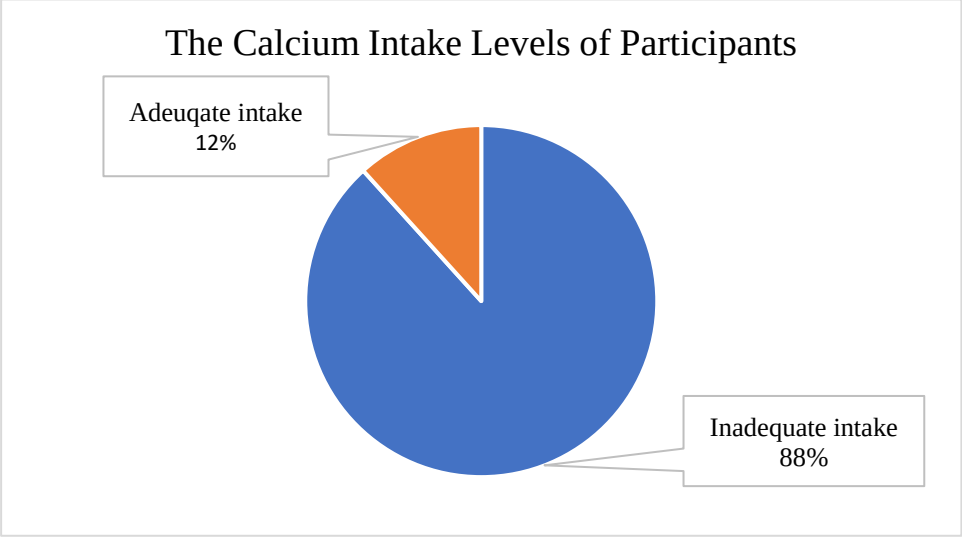


Figure 4.3: The distribution of calcium intake levels among the participants (n-205).

4.6 Association between Osteoporosis Knowledge, Health Beliefs, and Calcium Intake

Table 4.8 represents the association between osteoporosis knowledge, each category of osteoporosis health beliefs, and daily calcium intake by using Pearson's Chi square Test. As a result, this study revealed that there were significant associations in the calcium intake level based on the osteoporosis knowledge level (p = 0.045) and health motivation (p = 0.021) while others had no significant association with calcium intake level.

Table 4.8: The association between Osteoporosis knowledge level, health beliefs and daily calcium intake of participants.

	n (%)				
	% Calcium intake with reference to RNI				
	< 25%	**25-75%**	**>75%**	**χ2**	**p-value**
Total OPAAT Score					
Low	32(15.6)	62 (30.2)	22 (10.7)		
Moderate	7 (3.4)	43 (21.0)	14 (6.8)	9.761	**0.045***
High	2 (1.0)	17 (8.3)	6 (2.9)		
OHBS					
Perceived Susceptibility					
Low	21(10.2)	65 (31.7)	17 (8.3)		
Medium	17 (8.3)	45 (22.0)	16 (7.8)	5.628	0.229
High	3 (1.5)	12 (5.9)	9 (4.4)		
Perceived Seriousness	15 (7.3)	39 (19.0)	13 (6.3)		
Low	16 (7.8)	36 (17.6)	13 (6.3)	2.948	0.567
Medium	10 (4.9)	47 (22.9)	16 (7.8)		
High					
Perceived benefits of calcium intake					
Low	0 (0.0)	4 (2.0)	2 (1.0)		
Medium	15 (7.3)	19 (9.3)	9 (4.4)	9.503	0.050
High	26 (12.7)	99 (48.3)	31 (15.1)		

Table 4.8 continued: The association between Osteoporosis knowledge level, health beliefs and daily calcium intake of participants.

Perceived barriers to calcium intake					
Low	**14 (6.8)**	**60 (29.3)**	**21 (10.2)**		
Medium	**21 (10.2)**	**51 (24.9)**	**16 (7.8)**	**3.541**	**0.472**
High	**6 (2.9)**	**122 (5.4)**	**5 (2.4)**		
Health Motivation					
Low					
Medium	5 (2.4)	10 (4.9)	1 (0.5)		
High	20 (9.8)	34 (16.6)	11 (5.4)	11.522	**0.021***
	16 (7.8)	78 (38.0)	30 (14.6)		

Pearson's Chi-square test

*Significant at the 0.05 level (2-tailed).

4.7 Correlation between Age, Total OPAAT Score, OHBS Score, and Calcium Intake Among Participants

The Spearman's rank correlation analysis provided insights into the relationships between osteoporosis knowledge, health beliefs, age, and calcium intake among the participants in this study. Table 4.9 illustrates the correlation between age, total OPAAT score, OHBS score, and calcium intake. The analysis revealed that age had a weak negative correlation with perceived seriousness ($\rho = -0.164$, $p = 0.018$) and a weak positive correlation with calcium intake ($\rho = 0.181$, $p = 0.01$), both of which were statistically significant. Additionally, the total OPAAT score showed significant weak correlations with calcium intake and most OHBS categories except perceived seriousness ($\rho = 0.131$, $p = 0.061$).

Moreover, various categories within the OHBS were correlated to each other in this study. For example, perceived susceptibility was weakly positively correlated with perceived seriousness ($\rho = 0.205$, $p = 0.003$), indicating that

individuals who view themselves as more susceptible to osteoporosis tend to think that the seriousness of osteoporosis is high. At the same time, perceived seriousness had a weak positive correlation with the perceived benefits of calcium intake ($\rho = 0.232$, $p = 0.001$) and health motivation ($\rho = 0.304$, $p = 0.000$). Additionally, a weak positive correlation was noted between perceived benefits of calcium intake and health motivation ($\rho = 0.238$, $p = 0.001$). Finally, there was a weak negative between calcium intake and perceived barriers to calcium intake ($\rho = -0.240$, $p = 0.001$)

Table 4.9: Correlation between age, OPAAT score, OHBS and calcium intake among participants.

	Spearman's Correlation Coefficient (ρ)						
	Age	Total OPAAT score	Perceived Susceptibility	Perceived Seriousness	Perceived benefits of calcium intake	Perceived barriers to calcium intake	Health Motivation
Total OPAAT score	-0.005						
Perceived Susceptibility	-0.005	0.138*					
Perceived Seriousness	-0.164*	0.131	0.205*				
Perceived benefits of calcium intake	-0.90	0.191*	-0.149*	0.232*			
Perceived barriers of calcium intake	-0.039	-0.181*	0.161*	0.148*	-0.152*		
Health Motivation	0.056	0.189*	0.067	0.304*	0.238*	-0.083	
Calcium Intake	0.181*	0.141*	0.001	-0.002	0.177*	-0.240*	0.176*

*Correlation is significant at the 0.05 level (2-tailed), tested using Spearman's rank test.

CHAPTER 5

DISCUSSION

5.1 Sociodemographic Characteristics

Firstly, the sociodemographic profile of the study participants revealed a diverse range of characteristics. For example, the gender distribution in this study was slightly skewed, with 55% female and 45% male participants. This distribution aligns with previous osteoporosis-related studies which showed a higher participation rate from female participants (Khan et al., 2014; Amin and Mukti, 2017). Additionally, a significant portion of the participants in this study were aged 18-40 (59.5%), likely because this age group is more accessible and proficient in English, making them more willing to participate. Moreover, majority of the participants (93.7%) reported no personal history of osteoporosis or bone fractures in this study which is consistent with a previous study conducted by Khan et al. (2014) reported that 95.5% of the participants were not diagnosed with bone-related issues. This might be due to the younger age of participants who generally have higher bone density and a lower incidence of fractures taking a large proportion in the study.

Following that, more than half of the participants reported that their primary sources of knowledge and information were social media (68.3%) and online websites (57%). However, this finding is different from the study conducted by Lim, Ali, and Yusof (2017) which showed that online sources accounted for 23.7% only, followed by newspapers (20.4%). This change may be due to the increasing

accessibility and reliance on digital technology in recent years, making more individuals prefer social media and online platforms to assess health information quickly. This can be supported by a recent study conducted by Ayyash et al., (2023) which showed that the main sources of information about osteoporosis were medical website (55.4%), followed by social media (42.7%). Hence, this highlights the growing reliance on digital platforms for health-related information, especially among younger and more educated individuals. Overall, the sociodemographic data provide essential context for interpreting the study's findings.

5.2 Osteoporosis Knowledge

The current study found that Chinese adults in Kampar exhibited a low level of osteoporosis knowledge, with an average OPAAT score of 6.84 ± 2.92 out of 15. Over half of the participants (56.6%) demonstrated low osteoporosis knowledge, while only 12.2% had a high level of awareness. This finding aligns with previous research by Lim, Ali, and Yusof (2017), which showed that most Malaysian adults in Kuala Lumpur also had low osteoporosis knowledge, with just 12.5% achieving a high score. The perception of risk and the occurrence of osteoporosis within a family are crucial factors influencing the level of knowledge about the condition (Mortada, Seifi, and Abdo, 2020). As a result, one possible explanation for why many participants did not demonstrate a high level of osteoporosis knowledge is that they do not view themselves as at risk for the condition. This is often due to the common stereotype that osteoporosis primarily affects elderly women (Khan et al., 2014). This misconception may

lead them to underestimate their vulnerability, resulting in a lower motivation to seek information about osteoporosis. Moreover, further explanation could be that only 12.7% of participants in this study reported having a positive family history of osteoporosis. This is because individuals with a family history of osteoporosis are more likely to be exposed to information regarding osteoporosis from family members or relatives, which contributes to a greater understanding of the osteoporosis condition (Al-Muraikhi et al., 2017).

In contrast, two studies presented different findings. Ramli, Rahman, and Haque (2018) reported a moderate level of osteoporosis knowledge among the participants, while the research by Elnaem et al. (2017) found that nearly half of the participants possessed adequate knowledge of osteoporosis. These differences can be attributed to the fact that both studies focused on university students in health science disciplines such as medicine, pharmacy, physiotherapy, and dietetics. Students in these fields are likely more exposed to osteoporosis-related knowledge through their studies, which cover topics like disease pathophysiology, anatomy, physiology, and the importance of calcium in bone health. The study conducted by Elnaem et al. (2017) specifically noted that students from allied health sciences had a higher osteoporosis knowledge score compared to students from other academic programs.

In this study, 86.3% of the participants correctly identified that osteoporosis leads to weaker, more brittle bones, making them more prone to fractures. This result closely mirrors the findings of Khan et al. (2014), where 87% of the participants answered the same question correctly. However, these percentages

are lower compared to other studies by Chan et al. (2019a) and Chan et al. (2019b), which reported correct response rates of 96.2% and 95.8%, respectively. The difference in awareness may be attributed to the age disparity between the study populations. Both this study and research from Khan et al. (2014) included young adults as the participants, while studies from Chan et al. (2019a) and Chan et al. (2019b) targeted individuals aged 40 and above. Young adults often prioritize other health concerns over osteoporosis, leading to lower awareness of the condition compared to older adults. A study conducted by Chan et al. (2018) also found that young adults tend to be less interested in osteoporosis. Besides, as people age, they often become more conscious of health issues related to aging, including the risk of osteoporosis.

Furthermore, the study revealed that only 41.0% of participants recognized that osteoporosis is different from osteoarthritis, and just 19.5% understood that osteoporosis does not cause joint pain or swollen fingers. These findings are consistent with previous research, where 51.9% of participants were aware of the distinction between osteoporosis and osteoarthritis (Ramli, Rahman, and Haque, 2018). Moreover, 76.6% of participants in this study failed to identify that osteoporosis often presents without symptoms, similar to a study by Chan et al. (2021), which found that more than half of the participants were unaware that osteoporosis typically lacks symptoms. This lack of awareness may be due to the fact that most participants (93.7%) and their family members (87.3%) had never been diagnosed with osteoporosis, leaving them unfamiliar with the specific characteristics and symptoms of this condition.

5.3 Osteoporosis Health Beliefs

The study revealed that participants had a moderate level of health beliefs regarding osteoporosis which aligns with findings from two other Malaysian studies that used the same OHBS tool (Chan et al., 2019a; Chan et al., 2019b). However, there were some different findings in specific categories like perceived susceptibility, perceived seriousness, and perceived barriers to calcium intake.

Firstly, the perceived susceptibility to osteoporosis among the participants was low. This may be because young adults often regard osteoporosis as a condition primarily affects older individuals, leading them to believe their risk is minimal (Al-Muraikhi et al., 2017). Furthermore, 87.3% of participants reported no family history of osteoporosis or bone fractures. Hence, participants with no family history of osteoporosis may not see osteoporosis as an urgent concern because no family members have been diagnosed with the condition (Bordes et al., 2020). This can be seen in the research by Endicott (2013) mentioned that individuals with a family history of osteoporosis tend to perceive a higher risk of developing the condition compared to those without such a history.

Then, study participants also showed a moderate level of perceived seriousness regarding osteoporosis. One possible explanation for this is that the participants have partial awareness of osteoporosis so they do not pay much attention to osteoporosis (Ramli, Rahman and Haque, 2018). They might know that osteoporosis is a bone-related disease but lack a comprehensive understanding of its severe consequences. For example, only 61% of participants knew

osteoporosis could cause back pain, and just 64% of participants were aware that osteoporosis could lead to loss of mobility. Moreover, Khan et al. (2014) noted that people often view osteoporosis as an inevitable part of aging, rather than as a serious disease that could even be life-threatening. This perception may stem from the belief that osteoporosis is less severe compared to other conditions like heart disease, acquired immunodeficiency syndrome (AIDS), cancer, and diabetes, which are considered to have more serious health consequences (Khan et al., 2014).

After that, the study also found that participants had a high perceived benefit of calcium intake for osteoporosis prevention. This is because calcium is widely recognized as an essential mineral for maintaining bone health. Evidence supporting this includes a study showing that 84.8% of participants understood that low calcium intake increases the risk of osteoporosis (Al-Naggar et al., 2019). Additionally, individuals over 40 years old were aware of the importance of calcium supplements in preventing osteoporosis (Chan et al., 2019b). As a result, 83.4% of participants in this study agreed or strongly agreed that consuming adequate calcium could help solve osteoporosis-related issues. This strong consensus reflects not only a general understanding of calcium's role in bone health but also an acknowledgment of its effectiveness in minimizing the risks associated with osteoporosis.

However, participants reported a moderate level of perceived barriers to calcium intake. This could be linked to the fact that 73.2% of participants were from low-income families (earning less than RM5,000). As calcium-rich foods like milk

and dairy products can be expensive and have a short shelf life, they might be less affordable for individuals with lower income (Bourassa et al., 2022). The OHBS results in Table 4.4 indicate that about 44% of participants agreed or strongly agreed that calcium-rich foods are too costly, even though nearly half reported that they like calcium-rich foods. Besides, another possible reason could be the inconvenience of incorporating calcium-rich foods or supplements into daily routines due to lack of habitual consumption, leading to moderate perceived barriers despite the recognized benefits of calcium to prevent osteoporosis.

The study revealed that participants were highly motivated to engage in health-related behaviours. Nearly 66% of them agreed or strongly agreed that they would adhere to health recommendations, and almost 82% considered staying healthy to be important. However, this finding is inconsistent with the Health Belief Model (HBM), which posits that high perceived susceptibility to a disease is crucial for adopting healthy behaviours (Khan et al., 2014). As a result, although they might not view themselves as at high risk for osteoporosis, they still follow health recommendations because they believe in the overall importance of maintaining good health.

5.4 Daily Calcium Intake

One effective approach to preventing osteoporosis is by increasing bone density, which can be significantly improved through optimized daily calcium intake (Lim et al., 2022). Calcium is a vital mineral in the body, acting as a core component of bone structure (Wariyah et al., 2021). Adequate calcium intake is crucial for bone mineralization, which strengthens bone density and lowers the risk of fractures. Without sufficient calcium, bones may weaken and become porous, leading to osteoporosis, where they are more prone to fractures (Zamzuri et al., 2019). This is because a lack of calcium triggers increased bone resorption to maintain the necessary levels of ionized calcium in the extracellular fluids in the body (Zamzuri et al., 2019). Therefore, maintaining an optimal calcium intake through diet or supplements is essential for supporting bone health and preventing osteoporosis as people age.

The current study reported a low average calcium intake of 530 ± 353.2 mg/day among Chinese adults in Kampar, Perak, represented only 53% of the RNI for calcium intake. Based on Table 5.1 below, several previous studies conducted showed that the majority of the Chinese participants did not meet the recommended daily intake of calcium (1000mg/day). This indicates a significant gap between actual calcium consumption and the recommended levels, highlighting a potential public health concern regarding bone health in this population.

However, the calcium intake among participants in this study was slightly higher than in previous studies, which could be attributed to differences in the age of target populations, as the sample studies in Table 5.1 mostly focus on the elderly. One possible reason for this is that younger adults may be able to consume more calcium through their diet than older adults, as older adults tend to have lower appetites and reduced energy intake compared to younger adults (Giezenaar et al., 2016). Although the elderly may consume dairy products more frequently than younger adults, they tend to consume smaller portions due to reduced appetite and dietary restrictions (Luz et al., 2021). As a result, the total amount of dairy products consumed by the elderly might still be less than that consumed by younger adults, who typically eat larger portions at a time.

Table 5.1: The total calcium intake of Chinese participants from several studies.

Sample studies	Total calcium intake (mg/day)
(Zamzuri et al., 2019)	421.7 ± 344.3
(Yap et al., 2019)	362.3
(Lim et al., 2022)	316.6 ± 125.4
(Chee et al., 2010)	497 ± 233 mg

Following this, only 12% of participants in this study had an adequate calcium intake. One possible reason for the low calcium intake could be dietary habits that do not prioritize calcium-rich foods. Milk and dairy products are not typically a staple in the Malaysian diet, as these foods are more often associated with Western eating habits (Lim et al., 2022; Niu et al., 2024). According to the FFQ used in the study, Chinese adults in Kampar consume more rice, meats, poultry, and green leafy vegetables. This finding was parallel with a study by

Niu et al. (2024) highlighted that the traditional Chinese diet mainly consists of leafy green vegetables, pork, pork products, and rice, where none of which are especially high in calcium.

Additionally, the low calcium intake could be explained by the fact that the majority of the participants (92.7%) did not take calcium supplements. Chan et al. (2019) found that about half of the participants believed that regular calcium supplement use could lead to kidney stones, which may discourage them from using supplements. Besides, several other factors may also deter adults from taking calcium supplements, including a lack of awareness about the importance of calcium, insufficient motivation to begin taking supplements, and the belief that their diet alone provides enough calcium (Chan et al., 2018). As a result, these factors likely contribute to the inadequate calcium intake observed in this study.

However, the study revealed that dairy products remained the primary source of calcium intake (258.93 ± 287.47 mg/day), even though dairy products were not being the most frequently consumed food in this study. This finding aligns with the results from Lim et al. (2022), who reported that milk and dairy products (113.9 ± 108.1 mg/day) contributed the largest portion to overall calcium intake. This is because dairy products such as milk, cheese, and yogurt are rich in calcium. For example, 100g of rice provides only 4.25mg to 6.32mg of calcium, whereas 100g of milk or yogurt can provide between 100mg and 180mg of calcium (Cormick & Belizán, 2019; Wariyah et al., 2021).

Overall, the study highlights a concerning gap between actual calcium intake and recommended levels among Chinese adults in Kampar, Perak. Despite dairy products being the primary source of calcium, the overall intake remains insufficient, largely due to dietary habits and low supplement use. This underscores the need for increased awareness and dietary interventions to promote adequate calcium consumption for better bone health.

5.5 Association between Osteoporosis Knowledge, Health Beliefs, and Calcium Intake

The current study revealed a significant association between calcium intake and the level of osteoporosis knowledge ($p = 0.045$). For example, inadequate consumption of calcium-rich foods might be linked to a lack of knowledge regarding calcium sources and the daily calcium requirements for adults (Lim, Ali, and Yusof, 2017). Besides, understanding the serious potential consequences of osteoporosis such as fractures, back pain, and long-term disability, can motivate individuals to increase their calcium intake as a preventive measure against the disease. There was no prior research had investigated the relationship between these two variables specifically. However, Chan et al. (2019a) did acknowledge that osteoporosis knowledge is a key factor influencing osteoporosis preventive behaviours. This approach is consistent with the findings of the current study, which emphasize the importance of knowledge in encouraging behaviours that support bone health, such as ensuring sufficient daily calcium intake.

In addition, this study also highlighted a significant association between calcium intake and health motivation ($p = 0.021$). This finding aligned with the research by Chan et al. (2019a), which demonstrated a positive association between osteoporosis health beliefs and the consumption of dairy products and calcium among participants. The parallel results emphasize the critical role of motivation in encouraging individuals to engage in osteoporosis preventive behaviours although an individual may have adequate knowledge regarding osteoporosis. This underscores the need for health interventions that not only educate but also inspire and motivate individuals to take action toward better bone health. Overall, the current study revealed that individuals with strong health beliefs and sufficient knowledge are more likely to engage in health-related behaviours, such as consuming an adequate amount of calcium each day.

5.6 Correlation between Age, Osteoporosis Knowledge, Health Beliefs, and Calcium Intake

The current study showed a significant correlation between age, osteoporosis knowledge, health beliefs, and calcium intake among Malaysian Chinese adults in Kampar, Perak. The analysis revealed that age had a weak but significant negative correlation with the perceived seriousness of osteoporosis ($\rho = -0.164$, $p = 0.018$). This indicates that as age increases, there is a tendency for individuals to perceive osteoporosis as less severe. This aligns with a study conducted by Nayak et al. (2010) mentioned that older participants were less likely to believe that osteoporosis is a serious condition than younger ones. This could be justified as people age, they may normalize or accept conditions like osteoporosis as a

natural part of aging. Besides, older participants may think there was no need to worry about the disease as they are still active and can carry out their usual activities (Bordes et al., 2020).

Additionally, the total OPAAT score, which indicates osteoporosis knowledge among the participants, showed significant but weak correlations with calcium intake and most OHBS categories, except for perceived seriousness ($\rho = 0.002$, $p = 0.972$). This finding is consistent with a study from Malaysia that reported osteoporosis knowledge was correlated with several categories of osteoporosis health beliefs, such as perceived benefits of calcium intake and health motivation (Chan et al., 2019b). For instance, a significant positive correlation between osteoporosis knowledge and perceived susceptibility ($\rho = 0.138$, $p = 0.049$) and calcium intake ($\rho = 0.141$, $p = 0.044$) was found in the current study. These findings align with the results of the study itself, which showed that Malaysian Chinese adults in Kampar, who generally had a low level of osteoporosis knowledge, also had a low level of perceived susceptibility to osteoporosis and consumed inadequate amounts of calcium.

Moreover, the various categories within the OHBS were correlated with each other in this study. The most significant correlation was between perceived seriousness and health motivation ($\rho = 0.304$, $p = 0.000$), indicating that individuals who believe osteoporosis is a serious condition tend to be more motivated to engage in health-promoting behaviours, such as consuming enough calcium. This is because when individuals perceive a significant threat to their health, they are more likely to follow recommended preventive behaviours

(Demirtaş-Madran, 2021). Another reason for this finding could be the fear of long-term consequences. Fear is a motivating force that drives people to take action to avoid negative outcomes (Demirtaş-Madran, 2021). Hence, if people believe that osteoporosis could lead to back pain and loss of mobility, the fear of physical limitations and reduced quality of life pushes them to adopt preventive measures. Therefore, viewing osteoporosis as a severe condition can serve as a trigger, encouraging individuals to take proactive steps to reduce their risk of developing the disease.

Additionally, the most significant negative correlation was between perceived barriers to calcium intake and actual calcium intake ($\rho = -0.240$, $p = 0.001$). This indicates that as participants perceive fewer barriers or difficulties in consuming calcium-rich foods, their calcium intake tends to increase. A similar outcome was reported by Chan et al. (2019b), where lower perceived barriers to calcium intake were associated with higher dairy intake ($r = -0.080$, $p = 0.024$) among Malaysian adults aged over 40 years. A possible explanation is that reducing perceived barriers can enhance confidence, which in turn promotes behavioural changes (Lucero & Chen, 2020; Blom et al., 2021). When individuals view a task as less challenging, they feel more capable of accomplishing it. For instance, if someone believes they can easily incorporate calcium-rich foods like milk or yogurt into their diet, they are more likely to do so. Thus, by minimizing or eliminating barriers to calcium intake, individuals experience less stress or hesitation, making them more likely to adopt behaviours that support better bone health, such as increasing their calcium consumption.

5.7 Strengths and Limitations of Study

This study has several notable strengths. Firstly, it focuses specifically on Malaysian Chinese adults in Kampar, Perak, providing a deeper understanding of osteoporosis knowledge and health beliefs within a particular ethnic and geographical group. This focus is crucial for developing tailored interventions in Kampar. Additionally, the study employed validated measurement tools, such as the OPAAT and OHBS, to assess osteoporosis knowledge and health beliefs among participants, ensuring that the data collected is reliable and comparable with other studies. The correlation analysis conducted between age, osteoporosis knowledge, osteoporosis health beliefs, and calcium intake offered a detailed statistical understanding of the relationships within the data. This analysis not only highlighted associations between these key variables but also revealed potential patterns and trends that could be significant in understanding how demographic factors and personal beliefs influence dietary behaviours related to bone health. Hence, by exploring these correlations, the study provided valuable insights into how various factors interact to impact osteoporosis prevention and management, thereby informing future interventions and educational programs targeting diverse age groups.

Moreover, this study addressed a significant gap in osteoporosis research by including a diverse age range of participants, from 18 to 64 years old. This is because many previous studies have predominantly focused on older adults or university students. The broader age inclusion in this study allowed for a more comprehensive understanding of osteoporosis knowledge, health beliefs, and calcium intake across different life stages. By minimizing the age gap, the

findings became more representative and applicable to a wider population, enhancing both the generalizability and relevance of the results.

However, the study also had several limitations. The first limitation was the absence of direct bone health measurements, such as bone mineral density (BMD). This is because, without this data, it is difficult to fully understand how the knowledge and health beliefs of participants can influence their actual bone health. Additionally, the questionnaire was distributed in English, which posed a challenge as participants had varying levels of education and language proficiency. Consequently, some participants, particularly those aged 50 and above or with lower educational status, might not fully understood the questions. This could have led to misinterpretations or inconsistent responses.

Furthermore, the study had a limited scope of variables, focusing mainly on one specific osteoporosis preventive behaviour which was daily calcium intake. Other important factors, such as physical activity and vitamin D consumption, which also play a role in osteoporosis risk, were not included but could be considered in future research. Additionally, the FFQ used in the study might not have accurately estimated calcium intake, as it did not encompass all types of foods contributing to calcium consumption. This limitation could result in either an underestimation or overestimation of actual calcium intake among the participants.

5.8 Recommendations for Future Study

Firstly, a key recommendation for future research is to incorporate the assessment of bone health status alongside knowledge and behavioural factors. By measuring BMD through quantitative ultrasound (QUS) devices or dual-energy X-ray absorptiometry (DEXA) scans, researchers can gain deeper insight into how knowledge, beliefs, and calcium intake affect bone health. The QUS method offers a cost-effective solution for large-scale bone health evaluations, while DEXA scans provide precise and comprehensive details on bone density. Therefore, including these assessment tools in future research would improve the reliability of the results and make the findings more applicable to public health strategies.

Furthermore, survey instruments should be culturally and linguistically tailored to the study population. Developing a Chinese version of the questionnaire, which includes osteoporosis knowledge questions, OHBS scales, and the FFQ, is recommended to accurately assess osteoporosis knowledge, health beliefs, and calcium intake among Chinese participants. Conducting a pilot study to refine the language and ensure clarity is also advisable. This approach is likely to increase participant engagement and response rates, as participants would feel more comfortable completing the questionnaire in their native language. Additionally, it would reduce the likelihood of misinterpretation, thereby minimizing the risk of inaccurate or inconsistent data due to language barriers.

Moreover, future research should consider broadening the scope of the study by incorporating additional relevant variables, such as physical activity levels and vitamin D intake, which are crucial for preventing osteoporosis. For instance, physical activity levels among the Chinese population could be assessed using reliable tools like the International Physical Activity Questionnaire (IPAQ) in subsequent osteoporosis studies. Hence, future research would offer a more comprehensive and holistic understanding of the factors influencing osteoporosis risk among Malaysian Chinese adults.

Lastly, a more comprehensive FFQ should be developed to enhance the accuracy and precision of dietary assessments. This revised version could include a broader range of calcium-rich foods, particularly those commonly consumed in Malaysia, such as nuts, seeds, edamame, almonds, or fortified cereals. By expanding the variety of foods listed in the FFQ, future studies could more reliably estimate calcium intake, better reflecting the dietary habits of the population and thereby improving the validity of findings related to osteoporosis prevention.

CHAPTER 6

CONCLUSION

Osteoporosis is a bone disease characterized by low bone density and increased bone fragility, which makes bones more susceptible to fractures. Osteoporosis often develops silently over time and without noticeable symptoms until a fracture occurs. As a result, many people are unaware of the severe impacts of osteoporosis such as experiencing chronic pain, reduced mobility, and a higher risk of fractures which can significantly impact the overall quality of life. Fortunately, osteoporosis can be prevented through dietary modifications. Consuming an adequate amount of calcium is essential for maintaining bone density and strength, which helps reduce the risk of osteoporosis.

In this study, Malaysian Chinese adults in Kampar, Perak demonstrated a low level of knowledge about osteoporosis, highlighting the need for targeted educational programs. The participants had moderate health beliefs about osteoporosis, with low perceived susceptibility, a moderate level of perceived seriousness and perceived barriers to calcium intake, and a high level of perceived benefits of carrier intake and health motivation. In addition, among health belief categories, health motivation was found to have a significant association with calcium intake.

Besides, the study also found a significant association between osteoporosis knowledge and calcium intake. Hence, study participants with a lack of awareness regarding osteoporosis had an average calcium intake of 530 ± 353.2

mg/day, below the daily calcium requirement (1000 mg/day). Following that, there was only 12.2% of participants had adequate calcium intake in this study. These findings stress the importance of increasing awareness and motivation to encourage better preventive practices, such as adequate calcium consumption. The most notable correlation was between perceived barriers (like cost and availability) and calcium intake, suggesting that these obstacles may limit proper calcium intake among the Chinese population.

In conclusion, these findings are significant for public health efforts aimed at reducing osteoporosis risk. They underscore the importance of knowledge and health beliefs in shaping calcium intake behaviour. Public health authorities should leverage social media and online platforms to spread information about osteoporosis and the importance of calcium intake, as these are widely used sources of information among the Chinese community. Addressing both educational gaps and barriers can help promote effective osteoporosis prevention among Malaysian Chinese adults.

References

Al-Bashaireh, A.M., Haddad, L.G., Weaver, M., Chengguo, X., Kelly, D.L. and Yoon, S., 2018. The Effect of Tobacco Smoking on Bone Mass: An Overview of Pathophysiologic Mechanisms. *Journal of Osteoporosis*, [e-journal] 2018(1), pp.1–17. https://doi.org/10.1155/2018/1206235.

Al-Muraikhi, H., Said, H., Selim, N. and Chehab, M.A.H., 2017. The knowledge of osteoporosis risk factors and preventive practices among women of reproductive age in the state of Qatar: a cross-sectional survey. *International Journal Of Community Medicine And Public Health*, [e-journal] 4(2), pp.522-527. https://doi.org/10.18203/2394-6040.ijcmph20170284.

Al-Naggar, R.A., Ismail, N., Zaliha, I., Nor Aini, M.N., Nadira, A.M., Nik Shamsidah, N.I., and Ikhsan, M., 2019. Knowledge, Attitude and Practice of Osteoporosis among Malay Adults in Selangor, Malaysia. *RJPBCS*, 7(3), pp.2116–2124.

Amin, S. and Mukti, N.A., 2017. Assessment of knowledge level on osteoporosis among a private university students in Malaysia. *Imperial journal of interdisciplinary research,* 3(3), pp.141–145.

Ayyash, M., Jaber, K., Daghash, R., Abu-Farha, R. and Alefishat, E., 2023. Perception and awareness of osteoporosis and its related risk factors among women: A cross-sectional study. *Electronic Journal of General Medicine*, [e-journal] 20(3). https://doi.org/10.29333/ejgm/13010.

Azhar, F.A. and Jaafar, N.H., 2020. Assessment of dietary calcium intake among female university students. *International Journal of Allied Health Sciences*, [e-journal] 4(3), pp.1440–1448. https://doi.org/10.31436/ijahs.v4i3.502.

Blom, V., Drake, E., Kallings, L.V., Ekblom, M.M. and Nooijen, C.F.J., 2021. The effects on self-efficacy, motivation and perceived barriers of an intervention targeting physical activity and sedentary behaviours in office workers: a cluster randomized control trial. *BMC Public Health 21*, [e-journal] 1048(2021). https://doi.org/10.1186/s12889-021-11083-2.

Bordes, d.J., Prasad, S., Pratt, G., Suarez-Almazor, M.E. and Lopez-Olivo, M.A., 2020. Knowledge, beliefs, and concerns about bone health from a systematic review and metasynthesis of qualitative studies. *PLOS ONE*, [e-journal] 15(1). https://doi.org/10.1371/journal.pone.0227765.

Bourassa, M.W., Abrams, S.A., Belizán, J.M., Boy, E., Cormick, G., Quijano, C.D., Gibson, S., Gomes, F., Hofmeyr, G.J., Humphrey, J., Kraemer, K., Lividini, K., Neufeld, L.M., Palacios, C., Shlisky, J., Thankachan, P., Villalpando, S. and Weaver, C.M., 2022. Interventions to improve calcium intake through foods in populations with low intake. *Annals of the New York Academy of Sciences*, [e-journal] 1511(1), pp.40–58. https://doi.org/10.1111/nyas.14743.

Chan, C., Mohamed, N., Ima-Nirwana, S. and Chin, K.-Y., 2018. A Review of Knowledge, Belief and Practice Regarding Osteoporosis among Adolescents and Young Adults. *International Journal of Environmental Research and Public Health*, [e-journal] 15(8), pp.1727. https://doi.org/10.3390/ijerph15081727.

Chan, C.Y. et al., 2021. Osteoporosis knowledge and practice among Malaysian university students. *The Journal of the Pakistan Medical Association*, 71(2), pp.30–36.

Chan, C.Y., Subramaniam, S., Chin, K.-Y., Ima-Nirwana, S., Muhammad, N., Fairus, A., Mohd Rizal, A.M., Ng, P.Y., Nor Aini, J., Aziz, N.A. and Mohamed, N., 2019a. Knowledge, Beliefs, Dietary, and Lifestyle Practices Related to Bone Health among Middle-Aged and Elderly Chinese in Klang Valley, Malaysia. *International Journal of Environmental Research and Public Health*, [e-journal]16(10). https://doi.org/10.3390/ijerph16101787.

Chan, C.Y., Subramaniam, S., Chin, K.-Y., Ima-Nirwana, S., Muhammad, N., Fairus, A., Ng, P.Y., Jamil, N.A., Abd Aziz, N. and Mohamed, N., 2019b. Levels of Knowledge, Beliefs, and Practices Regarding Osteoporosis and the Associations with Bone Mineral Density among Populations More Than 40 Years Old in Malaysia. *International Journal of Environmental Research and Public Health*, [e-journal] 16(21). https://doi.org/10.3390/ijerph16214115.

Chan, P.J., Nurul, Z.Z., Chuah, J.S., Nabil, M.M.A., Isa, N.M., Sabarul, A.M. and Nazrun, A.S., 2014. Association between Risk Factors of Osteoporosis and Bone Mineral Density in Women of Different Ethnic Groups in a Malaysian Hospital. *International Journal of Osteoporosis and Metabolic Disorders*, [e-journal] 7(1), pp.1–11. https://doi.org/10.3923/ijom.2014.1.11.

Chee, WSS., Chong, P.N., Chuah, K.A., T Karupaiah, Mustafa, N., Seri Suniza, Karuthan Chinna, Horcajada, M.N., L Ameye and E Offord-Cavin, 2010. Calcium Intake, Vitamin D and Bone Health Status of Post-menopausal Chinese Women in Kuala Lumpur. *PubMed*, 16(2), pp.233–42.

Cheou, N.Y., 2021. *Osteoporosis Knowledge, Health Beliefs and Calcium Intake among UTAR Student*. Bachelor's degree. Universiti Tunku Abdul Rahman.

Cheraghi, Z., Doosti-Irani, A., Almasi-Hashiani, A., Baigi, V., Mansournia, N., Etminan, M. and Mansournia, M.A., 2019. The effect of alcohol on osteoporosis: A systematic review and meta-analysis. *Drug and Alcohol Dependence*, [e-journal] 197(1), pp.197–202. https://doi.org/10.1016/j.drugalcdep.2019.01.025.

Cheung, C.L., Ang, S.B., Chadha, M., Chow, E.S.L., Chung, Y.S., Hew, F.L., Jaisamrarn, U., Ng, H., Takeuchi, Y., Wu, C.H., Xia, W., Yu, J. and Fujiwara, S., 2018. An updated hip fracture projection in Asia: The Asian Federation of Osteoporosis Societies study. *Osteoporosis and Sarcopenia*, [e-journal] 4(1), pp.16–21. https://doi.org/10.1016/j.afos.2018.03.003.

Chiang, W., Husni, M. and Jamal, A., 2020. The Osteoporosis Knowledge, Belief and Calcium Intake Behaviour among Students in a Medical Sciences University. *International Journal of Public Health Research*, 10(1), pp.1195–1208.

Chin H.C., Subramaniam, S., Chin, K.Y., Soelaiman Ima-Nirwana, Muhammad, N., Fairus, A., Pei Yuen Ng, Nor Aini Jamil, Noorazah Abd Aziz and Mohamed, N., 2022. Effect of a Screening and Education Programme on Knowledge, Beliefs, and Practices Regarding Osteoporosis among Malaysians. 19(10), pp.6072. https://doi.org/10.3390/ijerph19106072.

Chiu, C.-T., Lee, J.-I., Lu, C.-C., Huang, S.-P., Chen, S.-C. and Geng, J.-H., 2024. The association between body mass index and osteoporosis in a Taiwanese population: a cross-sectional and longitudinal study. *Scientific Reports*, [e-journal] 14(1), pp.8509. https://doi.org/10.1038/s41598-024-59159-4.

Cochran, W.G., 977. *Sampling techniques*. 3rd ed. New York: Wiley.

Cormick, G. and Belizán, J.M., 2019. Calcium Intake and Health. *Nutrients*, [e-journal] 11(7), pp.1606. https://doi.org/10.3390/nu11071606.

Elnaem, M.H., Jamshed, S.Q., Elkalmi, R.M., Baharuddin, M.F., Johari, M.A., Aziz, N.A.B.A., Sabri, S.F.B.A. and Ismail, N.A.B., 2017. Osteoporosis Knowledge among Future Healthcare Practitioners: Findings from a Malaysian Public University. *Journal of Pharmacy & Bioallied Sciences,* 9(2), pp.115–120.

Embong, H. and Yew, J.M., 2021. Knowledge and Practices of Osteoporosis Preventive Measure Among Women in a Tertiary Teaching Hospital. *The Malaysian Journal of Nursing,* [e-journal] 12(4), pp.77-86. https://doi.org/10.31674/mjn.2021.v12i04.011.

Endicott, R.D., 2013. Knowledge, Health Beliefs, and Self-Efficacy regarding Osteoporosis in Perimenopausal Women. *Journal of Osteoporosis*, 2013, [e-journal] pp.1–6. https://doi.org/10.1155/2013/853531.

Giezenaar, C., Chapman, I., Luscombe-Marsh, N., Feinle-Bisset, C., Horowitz, M. and Soenen, S., 2016. Ageing Is Associated with Decreases in Appetite and Energy Intake—A Meta-Analysis in Healthy Adults. *Nutrients*, [e-journal] 8(1). https://doi.org/10.3390/nu8010028.

Godos, J., Giampieri, F., Chisari, E., Micek, A., Paladino, N., Forbes-Hernández, T.Y., Quiles, J.L., Battino, M., La Vignera, S., Musumeci, G. and Grosso, G., 2022. Alcohol Consumption, Bone Mineral Density, and Risk of Osteoporotic Fractures: A Dose–Response Meta-Analysis. *International Journal of Environmental Research and Public Health*, 19(3), pp.1515.

Ibrahim, N.A., Nabil, N. and Ghaleb, S., 2019. Pathophysiology of the Risk Factors Associated with Osteoporosis and their Correlation to the T-score Value in Patients with Osteopenia and Osteoporosis in the United Arab Emirates. *Journal of Pharmacy & Bioallied Sciences*, [e-journal] 11(4), pp.364–372. https://doi.org/10.4103/jpbs.JPBS_4_19.

Jaisaard, R., Kanjanarach, T., Chanaboon, S. and Ban, B., 2021. Consumption of Calcium and Knowledge About Calcium Sources and Nutrition Labels Among Lower Secondary School Students in Thailand. *Risk Management and Healthcare Policy*, [e-journal] 14, pp.3829–3840. https://doi.org/10.2147/RMHP.S312264.

Khan, Y.H., Sarriff, A., Khan, A.H. and Mallhi, T.H., 2014. Knowledge, Attitude and Practice (KAP) Survey of Osteoporosis among Students of a Tertiary Institution in Malaysia. *Tropical Journal of Pharmaceutical Research*, [e-journal] 13(1), pp.155–162. http://dx.doi.org/10.4314/tjpr.v13i1.22.

Kim, T.H., Lee, Y.S., Byun, D.W., Jang, S., Jeon, D.S. and Lee, H.H., 2013. Evaluation of the Osteoporosis Health Belief Scale in Korean Women. *Journal of Bone Metabolism*, [e-journal] 20(1), pp.25-30. http://dx.doi.org/10.11005/jbm.2013.20.1.25.

Lee, J.K. and Khir, A.S.M., 2007. The incidence of hip fracture in Malaysians above 50 years of age: variation in different ethnic groups. *APLAR Journal of Rheumatology*, [e-journal] 10(4), pp.300–305. https://doi.org/10.1111/j.1479-8077.2007.00314.x.

Lee, Y.Y. and Muda, W.W.A.M., 2019. Dietary intakes and obesity of Malaysian adults. *Nutrition Research and Practice*, [e-journal] 13(2), pp.159–168. https://doi.org/10.4162/nrp.2019.13.2.159.

Lee, Y.Y. and Wan Muda, W.A.M., 2019. Dietary intakes and obesity of Malaysian adults. *Nutrition Research and Practice*, [e-journal] 13(2), pp.159–168. https://doi.org/10.4162/nrp.2019.13.2.159.

Lim, H.P., Nasaruddinn, N.S., Mat Daud, N. and Jamil, N.A., 2022. Ethnic Differences in Bone Health Status and its Association with Calcium Intake, Physical Activity and Body Mass Index among Malaysian Older Adults from Bangi and Kajang, Selangor, Malaysia. *Malaysian Applied Biology*, [e-journal] 51(3), pp.147–157. https://doi.org/10.55230/mabjournal.v51i3.2410.

Lim, P.S., Ong, F.B., Adeeb, N., Seri, S.S., Noor-Aini, M.Y., Shamsuddin, K., Hapizah, N., Mohamed, A.L., Mokhtar, A. and Wan, H.W.H., 2005. Bone health in urban midlife Malaysian women: risk factors and prevention. *Osteoporosis international: a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA*, [e-journal] 16(12), pp.2069–2079. https://doi.org/10.1007/s00198-005-2003-4.

Lim, S.L., Ali, A. and Yusof, H., 2017. Knowledge, attitude and practices towards osteoporosis prevention among adults in Kuala Lumpur, Malaysia. *Malaysian Journal of Nutrition*, 23(2), pp.279–290.

Lin, Z., Shi, G., Liao, X., Huang, J., Yu, M., Liu, W., Li, X., Zhan, H. and Cai, X., 2023. Correlation between sedentary activity, physical activity and bone mineral density and fat in America: National Health and Nutrition Examination Survey, 2011–2018. *Scientific Reports*, [e-journal] 13(1). https://doi.org/10.1038/s41598-023-35742-z.

Lowe, N.K., 2019. What Is a Pilot Study? *Journal of Obstetric, Gynecologic & Neonatal Nursing*, [e-journal] 48(2), pp.117–118. https://doi.org/10.1016/j.jogn.2019.01.005.

Lucero, K.S. and Chen, P., 2020. What Do Reinforcement and Confidence Have to Do with It? A Systematic Pathway Analysis of Knowledge, Competence, Confidence, and Intention to Change. *Journal of European CME*, [e-journal] 9(1). https://doi.org/10.1080/21614083.2020.1834759.

Luz, R., Barros, M.B. de A., de Assumpção, D., Domene, S.M.Á. and Barros Filho, A. de A., 2021. Do adults and older people follow current guidelines for milk consumption? *Public Health Nutrition*, [e-journal] 24(14), pp.4622–4629. https://doi.org/10.1017/S1368980021000057.

Min, C.-Y., Yoo, D.-M. and Choi, H.-G., 2021. Associations between Physical Activity, Sunshine Duration and Osteoporosis According to Obesity and Other Lifestyle Factors: A Nested Case–Control Study. *International Journal of Environmental Research and Public Health*, [e-journal] 18(9). https://doi.org/10.3390/ijerph18094437.

Ministry of Health Malaysia, 2022. *Clinical Practice Guidelines: Management of Osteoporosis.* 3rd ed. Putrajaya: Ministry of Health Malaysia.

Mortada, E.M., Seifi, O.S.E. and Abdo, N.M., 2020. Knowledge, Health Beliefs and Osteoporosis Preventive Behaviour Among Women of Reproductive Age in Egypt. *Malaysian Journal of Medicine and Health Sciences* [online] 16(1), pp.9–16. Available at: <https://medic.upm.edu.my/upload/dokumen/2020011611515402_MJMHS_0057.pdf> [Accessed 1 September 2024].

Nayak, S., Roberts, M.S., Chang, C.-C.H. and Greenspan, S.L., 2010. Health beliefs about osteoporosis and osteoporosis screening in older women and men. *Health Education Journal*, [e-journal] 69(3), pp.267–276. https://doi.org/10.1177/0017896910364570.

Niu, J., Li, B., Zhang, Q., Chen, G. and Angeliki Papadaki, 2024. Exploring the traditional Chinese diet and its association with health status—a systematic review. *Nutrition Reviews*. [e-journal] https://doi.org/10.1093/nutrit/nuae013.

Nohan, A.F., Adznam, S.N.A., Jamaluddin, R. and Norazman, C.W., 2020. Diet Quality and its Associated Factors among Community Dwelling Older Adults in Urban District in Kuala Lumpur, Malaysia. *Malaysian Journal of Medicine and Health Sciences,* 16(6), pp.153-162.

Pinar, G. and Pinar, T., 2020. The Impact of Health Belief Model Based Educational Intervention on Women's Knowledge, Beliefs, Preventive Behaviors and Clinical Outcomes About Osteoporosis. *SAGE Open*, [e-journal] 10(3). https://doi.org/10.1177/21582440209414.

Pouresmaeili, F., Kamali Dehghan, B., Kamarehei, M. and Yong Meng, G., 2018. A comprehensive overview on osteoporosis and its risk factors. *Therapeutics and Clinical Risk Management*, [e-journal] 14(1), pp.2029–2049. https://doi.org/10.2147/TCRM.S138000.

Ramli, N., Rahman, N.A.A. and Haque, M., 2018. Knowledge, Attitude, and Practice Regarding Osteoporosis Among Allied Health Sciences Students in a Public University in Malaysia. *Erciyes Tıp Dergisi/Erciyes Medical Journal*, [e-journal] 40(4), pp.210–217. https://doi.org/10.5152/etd.2018.18103.

Ranganathan, P. and Caduff, C., 2023. Designing and validating a research questionnaire - Part 1. *Perspectives in Clinical Research*, [e-journal] 14(3), pp.152–155. https://doi.org/10.4103/picr.picr_140_23.

Schober, P., Boer, C. and Schwarte, L.A., 2018. Correlation coefficients: Appropriate Use and Interpretation. *Anesthesia & Analgesia*, [e-journal] 126(5), pp.1763–1768. https://doi.org/10.1213/ANE.0000000000002864.

Soleymanian, A., Niknami, S., Hajizadeh, E., Shojaeizadeh, D. and Montazeri, A., 2014. Development and validation of a health belief model based instrument for measuring factors influencing exercise behaviors to prevent osteoporosis in pre-menopausal women (HOPE). *BMC Musculoskeletal Disorders*, [e-journal] 15(1). https://doi.org/10.1186/1471-2474-15-6.

Stratton, S.J., 2021. Population research: Convenience Sampling Strategies. *Prehospital and Disaster Medicine*, [e-journal] 36(4), pp.373–374. https://doi.org/10.1017/S1049023X21000649.

Subramaniam, S., Chan, C.-Y., Soelaiman, I.-N., Mohamed, N., Muhammad, N., Ahmad, F., Abd Manaf, M.R., Ng, P.-Y., Jamil, N.A. and Chin, K.-Y., 2019. Prevalence and Predictors of Osteoporosis Among the Chinese Population in Klang Valley, Malaysia. *Applied Sciences*, 9(9). https://doi.org/10.3390/app9091820.

Suriawati, A., Majid, H.A., Al-Sadat, N., Mohamed, M. and Jalaludin, M., 2016. Vitamin D and Calcium Intakes, Physical Activity, and Calcaneus BMC among School-Going 13-Year Old Malaysian Adolescents. *Nutrients*, [e-journal] 8(10). https://doi.org/10.3390/nu8100666.

Tam, C.L., Bonn, G., Yeoh, S.H., Yap, C.C. and Wong, C.P., 2016. Physical Activity and Its Correlates among Adults in Malaysia: a Cross-Sectional Descriptive Study. *PLOS ONE*, [e-journal] 11(6). https://doi.org/10.1371/journal.pone.0157730.

Toh, L.S., Lai, P.S.M., Wu, D.B.-C., Wong, K.T., Low, B.Y. and Anderson, C., 2015. The Development and Validation of the Osteoporosis Prevention and Awareness Tool (OPAAT) in Malaysia. *PlOS ONE*, [e-journal] 10(5). https://doi.org/10.1371/journal.pone.0124553.

Wang, X. and Cheng, Z., 2020. Cross-sectional studies: Strengths, weaknesses, and Recommendations. *Chest*, [e-journal] 158(1), pp.65–71. https://doi.org/10.1016/j.chest.2020.03.012.

Wariyah, Ch., Anwar, C., Astuti, M. and Supriyadi, 2021. Calcium fixation on fortified rice made with various rice varieties. *Food Research*, 5(1), pp.285–290.

Yap, S.Y., Aziz, Y., A., A. and Yusof, H.M., 2019. Ethnic variation in osteoporosis risk factors: dietary calcium, vitamin D intake and body mass index (BMI). *Food Research*, [e-journal] 3(6), pp.741–748. https://doi.org/10.26656/fr.2017.5(1).348.

Zamzuri, M., Hamirudin, A.H., Zainudin, N., Sidek, S., and Rahman, N.A.A., 2019. Trend in dietary calcium intake among elderly in Kuantan, Pahang. *International Journal of Allied Health Sciences*, [e-journal] 3(4), pp.884–893. https://doi.org/10.31436/ijahs.v3i4.189.

Appendices

Appendix A

Ethical Approval Letter

UNIVERSITI TUNKU ABDUL RAHMAN DU012(A)
Wholly owned by UTAR Education Foundation Co. No. 578227-M

Re: U/SERC/78-252/2024

22 March 2024

Dr Teh Lai Kuan
Head, Department of Allied Health Sciences
Faculty of Science
Universiti Tunku Abdul Rahman
Jalan Universiti, Bandar Baru Barat
31900 Kampar, Perak.

Dear Dr Teh,

Ethical Approval For Research Project/Protocol

We refer to the application for ethical approval for your students' research projects from Bachelor of Science (Honours) Dietetics programme enrolled in course UDDN3108. We are pleased to inform you that the application has been approved under Expedited Review.

The details of the research projects are as follows:

No	Research Title	Student's Name	Supervisor's Name	Approval Validity
1.	Level of Knowledge and Practice Regarding Osteoporosis Among Working Adults in Kampar, Perak	Tuong Ke Hui	Ms Nurul Aimi Binti AB Kadir	22 March 2024 – 21 March 2025
2.	Intuitive Eating Behavior among Young Chinese Adults in UTAR	Oon Choy Li		
3.	Osteoporosis Knowledge, Health Beliefs and Calcium Intake Among Malaysian Chinese Adults in Kampar, Perak	Thean Hui Ru		

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

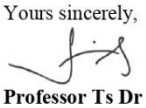
(4) Written consent be obtained from the institution(s)/company(ies) in which the physical or/and online survey will be carried out, prior to the commencement of the research.

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
Tel: (605) 468 8888 Fax: (605) 466 1313
Sungai Long Campus : Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor Darul Ehsan, Malaysia
Tel: (603) 9086 0288 Fax: (603) 9019 8868
Website: www.utar.edu.my

Should the students collect personal data of participants in their studies, please have the participants sign the attached Personal Data Protection Statement for records.

Thank you.

Yours sincerely,



Professor Ts Dr Faidz bin Abd Rahman
Chairman
UTAR Scientific and Ethical Review Committee

c.c Dean, Faculty of Science
Director, Institute of Postgraduate Studies and Research

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Appendix B

Questionnaire Used in This Study

Wholly owned by UTAR Education Foundation
(Co. No. 578227-M)
DU012(A)

Dear participants, I am Thean Hui Ru (Y3S1), currently taking Bachelor of Science (Honours) Dietetics. I am doing my Final Year Project (FYP) which is entitled Osteoporosis Knowledge, Health Beliefs and Calcium Intake among Malaysian Chinese Adults in Kampar, Perak. I would like to invite you to participate in this research survey.

This questionnaire is aimed to assess the level of osteoporosis knowledge, health beliefs and daily calcium intake among Malaysian Chinese adults in Kampar, Perak.

This questionnaire consists of **FIVE sections**:

1. Consent form
2. Section A: Sociodemographic Information
3. Section B: Osteoporosis Prevention and Awareness Tool (OPAAT) Questions
4. Section C: Osteoporosis Health Belief Scales (OHBS) Questions
5. Section D: 30-item Food Frequency Questionnaire (FFQ)

To participate, all the following criteria must be fulfilled:

- Malaysian Chinese citizens.
- Aged 18 – 64.
- Reside in Kampar, Perak.

Estimated time for completion: **15– 30 minutes**

All information collected in this survey is anonymous and will not be shared with the public or any other unauthorized personnel. The data will exclusively be handled and analysed discretely by the student and supervisor carrying out the research.

Please do not hesitate to contact me if you face any problems or inquiries.

Email: huiruthean@gmail.com/ huiru1023@1utar.my WhatsApp: 011-26509798

PERSONAL DATA PROTECTION NOTICE

Please be informed that in accordance with Personal Data Protection Act 2010 ("PDPA") which came into force on 15 November 2013, Universiti Tunku Abdul Rahman ("UTAR") is hereby bound to make notice and require consent in relation to collection, recording, storage, usage and retention of personal information.

1. Personal data refers to any information which may directly or indirectly identify a person which could include sensitive personal data and expression of opinion. Among others it includes:

a. Name
b. Identity card
c. Place of Birth
d. Address
e. Education History
f. Employment History
g. Medical History
h. Blood type
i. Race
j. Religion
k. Photo
l. Personal Information and Associated Research Data

2. The purposes for which your personal data may be used are inclusive but not limited to:

a) For assessment of any application to UTAR
b) For processing any benefits and services
c) For communication purposes
d) For advertorial and news
e) For general administration and record purposes
f) For enhancing the value of education
g) For educational and related purposes consequential to UTAR
h) For replying any responds to complaints and enquiries
i) For the purpose of our corporate governance
j) For the purposes of conducting research/ collaboration

3. Your personal data may be transferred and/or disclosed to third party and/or UTAR collaborative partners including but not limited to the respective and appointed outsourcing agents for purpose of fulfilling our obligations to you in respect of the purposes and all such other purposes that are related to the purposes and also in providing integrated services, maintaining and storing records. Your data may be shared when required by laws and when disclosure is necessary to comply with applicable laws.

4. Any personal information retained by UTAR shall be destroyed and/or deleted in accordance with our retention policy applicable for us in the event such information is no longer required.

5. UTAR is committed in ensuring the confidentiality, protection, security and accuracy of your personal information made available to us and it has been our ongoing strict policy to ensure that your personal information is accurate, complete, not misleading and updated. UTAR would also ensure that your personal data shall not be used for political and commercial purposes.

Consent:

6. By submitting or providing your personal data to UTAR, you had consented and agreed for your personal data to be used in accordance to the terms and conditions in the Notice and our relevant policy.

7. If you do not consent or subsequently withdraw your consent to the processing and disclosure of your personal data, UTAR will not be able to fulfil our obligations or to contact you or to assist you in respect of the purposes and/or for any other purposes related to the purpose.

8. You may access and update your personal data by contacting me through

Email: huiruthean@gmail.com/ huiru1023@1utar.my WhatsApp: 011-26509798

Acknowledgment of Notice

[ ] I have been notified and that I hereby understood, consented and agreed per UTAR above notice.

[ ] I disagree, my personal data will not be processed.

.....

Name:

Date:

Exclusion Criteria

- Individuals with specific dietary restrictions (e.g. vegan diet)
- Pregnant women

Have you met any of these criteria? ☐ No

Section A: Sociodemographic Information

Full Name : _____

Age : ☐ 18-30 ☐ 31-40
☐ 41-50 ☐ 51-64

Gender : ☐ Male
☐ Female

Educational Level : ☐ Less than diploma
☐ Diploma
☐ Bachelor of degree
☐ Master
☐ PhD
☐ Others :

Monthly income : ☐ < RM 2,500
☐ RM2,500 – RM4,999
☐ RM5,000 – RM7,499
☐ RM7,500 – RM9,999
☐ ≥ RM 10,000

Personal history : Have you ever experienced a fracture or been diagnosed with osteoporosis?
☐ Yes
☐ No

Family history : Have you family member ever experienced a fracture or been diagnosed with osteoporosis?
☐ Yes
☐ No

Smoking Status : ☐ Smoker
☐ Non-smoker

Source of knowledge : ☐ Books or magazines
☐ Newspaper
☐ Friends
☐ Family members
☐ Professions (doctor, dietitian, nutritionist)
☐ Social media (Facebook, Whatsapp, Instagram)
☐ Online websites
☐ Others:

Section B: Osteoporosis Prevention and Awareness Tool (OPAAT) Questions

Please "✓" one option for each question below based on your understanding

No.	Questions	Options		
		True	False	I don't know
1.	Makes bones weaker, more brittle and more likely to break (fracture).			
2.	Osteoporosis occurs because bone is removed faster than it is formed.			
3.	Osteoporosis and osteoarthritis are different names we can use to describe the same disease.			
4.	Osteoporosis usually has no symptoms.			
5.	Postmenopausal women are not at risk for osteoporosis.			
6.	Osteoporosis is an untreatable disease.			
7.	A bone mineral density test should be performed monthly to monitor bone loss.			
8.	Results in back pain.			
9.	Loss of height or hunchback.			
10.	Loss of mobility (unable to move around myself).			
11.	Results in tooth loss.			
12.	Results in joint pain or swelling of fingers.			
13.	Exercise will wear out bones.			
14.	Certain medications (such as sleeping tablets or high blood pressure medications) may reduce the risk of falling.			
15.	Being underweight helps prevent osteoporosis.			

Section C: Osteoporosis Health Belief Scales (OHBS) Questions

Below are some questions about your beliefs about osteoporosis. There are no right or wrong answers. After reading each statement, please circle if you STRONGLY DISAGREE, DISAGREE, are NEUTRAL, AGREE, or STRONGLY AGREE with the statement.

Read each statement and **CIRCLE** one best option that explains what you believe.

SD = STRONGLY DISAGREE
D = DISAGREE
N = NEUTRAL
A = AGREE
SA = STRONGLY AGREE

No.	Statement	Options				
Susceptibility						
1.	Your chances of getting osteoporosis are high.	SD	D	N	A	SA
2.	Because of your body build, you are more likely to develop osteoporosis.	SD	D	N	A	SA
3.	It is extremely likely that you will get osteoporosis.	SD	D	N	A	SA
4.	There is a good chance that you will get osteoporosis.	SD	D	N	A	SA
5.	You are more likely than the average person to get osteoporosis.	SD	D	N	A	SA
6.	Your family history makes it more likely that you will get osteoporosis.	SD	D	N	A	SA
Seriousness						
7.	The thought of having osteoporosis scares you.	SD	D	N	A	SA
8.	If you had osteoporosis, you would be crippled.	SD	D	N	A	SA
9.	Your feelings about yourself would change if you got osteoporosis.	SD	D	N	A	SA
10.	It would be very costly if you got osteoporosis.	SD	D	N	A	SA
11.	When you think about osteoporosis you get depressed.	SD	D	N	A	SA
12.	It would be very serious if you got osteoporosis.	SD	D	N	A	SA

Benefits of calcium intake						
13.	Taking in enough calcium prevents problems from osteoporosis.	SD	D	N	A	SA
14.	You have lots to gain from taking in enough calcium to prevent osteoporosis	SD	D	N	A	SA
15.	Taking in enough calcium prevents painful osteoporosis.	SD	D	N	A	SA
16.	You would not worry as much about osteoporosis if you took in enough calcium.	SD	D	N	A	SA
17.	Taking in enough calcium cuts down on your chances of broken bones.	SD	D	N	A	SA
18.	You feel good enough about yourself when you take in enough calcium to prevent osteoporosis.	SD	D	N	A	SA
Barriers to calcium intake						
19.	Calcium-rich foods cost too much	SD	D	N	A	SA
20.	Calcium-rich foods do not agree with you.	SD	D	N	A	SA
21.	You do not like calcium-rich food.	SD	D	N	A	SA
22.	Eating calcium-rich foods means changing your diet which is hard to do.	SD	D	N	A	SA
23.	In order to eat more calcium-rich foods you have to give up other foods that you like.	SD	D	N	A	SA
24.	Calcium-rich foods have too much cholesterol.	SD	D	N	A	SA
Health Motivation						
25.	You eat a well-balanced diet.	SD	D	N	A	SA
26.	You look for new information related to health.	SD	D	N	A	SA
27.	Keeping healthy is very important for you.	SD	D	N	A	SA
28.	You try to discover health problems early.	SD	D	N	A	SA
29.	You have a regular health check-up even when you are not sick.	SD	D	N	A	SA
30.	You follow recommendations to keep you healthy.	SD	D	N	A	SA

Section D: 30-Item Food Frequency Questionnaire

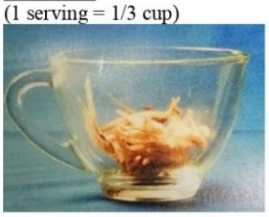
This is a food frequency questionnaire (FFQ) comprised of 30 food items. In this section, you will be asked about your usual eating habits over the past month. Please choose the option which best indicates the number of times you consume the particular food.

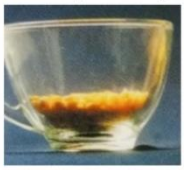
For example,

If you have consumed three serving of milk once a week in the past month, please "✓" in the option of 3-4 servings per week.

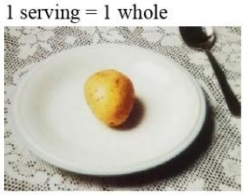
Food items	Frequency of intake (based on number of servings)	
DAIRY PRODUCTS		
Dairy milk (all types, include milk in coffee, tea and cereal) 1 serving = 1 glass (250ml) 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Yogurt 1 serving = 1 cup (125 g) 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Cheese 1 serving = ¼ cup or 1 slice 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

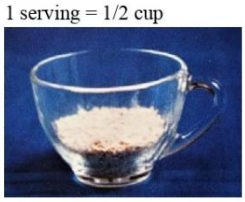
Food items	Frequency of intake (based on number of servings)	
Milk powder (Nestle, Anlene, Fernleaf brand etc.) 1 serving = 4 dessert spoons 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Malted milk drink (Milo, Horlick etc.) 1 serving = 3 dessert spoon heaps 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Ice cream 1 serving = 1/2 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
FISH, POULTRY AND MEAT		
Egg 1 serving = 1 whole 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Food items	Frequency of intake (based on number of servings)	
Canned sardines (1 serving = 1/3 can)  	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Anchovies (1 serving = 1/3 cup) 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Poultry and meat (chicken, duck, pork, beef etc.) 1 serving = 3 oz 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Fish, fresh or frozen, cooked 1 serving = 3 oz  	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Food items	Frequency of intake (based on number of servings)	
Shellfish, all type (prawn, crab, clams, oyster etc.) 1 serving = 3 oz 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
SOY AND SOY PRODUCTS		
Tau-kua/egg tofu 1 serving = 1 piece or ½ cylinder  	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Chickpea/dhal 1 serving = 1/4 cup  	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Tempeh 1 serving = 1 piece 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Food items	Frequency of intake (based on number of servings)	
Unsweetened soy milk  1 serving = 1 glass (250ml)	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
FRUITS & VEGETABLES		
Apple and Pear 1 serving = 1 whole 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Orange (1 serving = 1 medium whole) 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Pineapple 1 serving = 1 slice 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Cauliflower/broccoli 1 serving = 1 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Food items	Frequency of intake (based on number of servings)	
Dark green vegetables, cooked (spinach, sawi, kale, cabbage, bok choy, okra etc.) 1 serving = 1/2 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Carrot 1 serving = 1/2 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Potatoes, sweet potatoes, taro 1 serving = 1 whole 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
CEREALS AND CEREALS PRODUCTS		
Bread (any bread) 1 serving = 1 slice 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Food items	Frequency of intake (based on number of servings)	
Rice, cooked (white rice, brown rice, fried rice etc.) 1 serving = 1/4 plate 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Noodles (wet noodle, udon noodle, spaghetti, instant noodle etc.) 1 serving = 1/2 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Oats, rolled 1 serving = 1/2 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
OTHERS		
Fast food **(hamburger/cheeseburger)** 1 serving = 1 item 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____

Food items	Frequency of intake (based on number of servings)	
Coffee and tea (regular, decaffeinated) 1 serving = 1 cup 	o Never o 1 serving per month or less o 2 – 3 servings per month o 1 – 2 servings per week o 3 – 4 servings per week o 5 – 6 servings per week	o 1 serving per day o 2 – 3 servings per day o 4 – 5 servings per day o 6 or more servings per day o Others _____
Calcium supplement 	o Yes o No # If yes, name of product & amount taken each day (e.g. KAL Calcium Citrate, 1000mg) _____	

That is the end of the survey. ☺

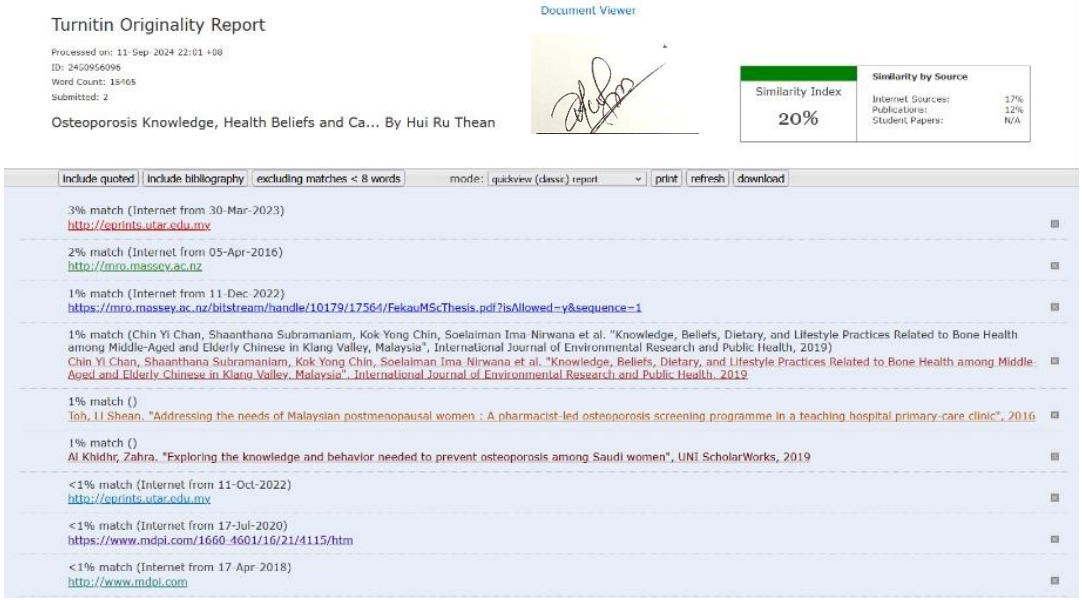
Thank you for spending your precious time to participate in this survey.

Once again, your information will be kept strictly confidential and will only be used in this research.

Thank you and have a nice day.

Appendix C

Turnitin Report



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Appendix D

Turnitin Originality Report

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Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
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FACULTY OF SCIENCE

Full Name(s) of Candidate(s)	Thean Hui Ru
ID Number(s)	20ABD05149
Programme / Course	Bachelor of Science (HONS) Dietetics
Title of Final Year Project	Osteoporosis Knowledge, Health Beliefs and Calcium Intake Among Malaysian Chinese Adults in Kampar, Perak.

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: 20 % **Similarity by source** Internet Sources: 17 % Publications: 12 % Student Papers: N/A %	
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Note: Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor
Name: Ms Nurul Aimi Binti AB Kadir
Date: 13/9/2024

Signature of Co-Supervisor
Name: _____
Date: _____