KNOWLEDGE OF OSTEOPOROSIS AND CALCIUM AND ITS ASSOCIATION WITH DIETARY CALCIUM INTAKE AMONG STUDENTS IN UNIVERSITI TUNKU ABDUL RAHMAN (UTAR), KAMPAR

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By

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ABSTRACT

KNOWLEDGE OF OSTEOPOROSIS AND CALCIUM AND ITS ASSOCIATION WITH DIETARY CALCIUM INTAKE AMONG STUDENTS IN UNIVERSITI TUNKU ABDUL RAHMAN (UTAR), KAMPAR

Tan Hui Ning

Adequate calcium intake is important to achieve peak bone mass and prevent osteoporosis risks. Meanwhile, most Malaysians had a low calcium intake, below the recommended 1000 mg/day. Studies regarding the association between knowledge and calcium intake among university students are insufficient. Thus, this research aimed to assess the level of osteoporosis knowledge, calcium knowledge, and dietary calcium intake among students in Universiti Tunku Abdul Rahman (UTAR), Kampar as well as to determine the association between the three variables. A cross-sectional survey was conducted online among UTAR Kampar students between 19 to 30 years old from February 2022 to July 2022. A total of 165 respondents were recruited and completed the survey comprised of sociodemographic, osteoporosis knowledge, calcium knowledge, and food frequency questionnaires. One-way ANOVA and Independent t-test were used to examine the discrepancy in calcium intake among different knowledge levels. Pearson's correlation was to determine the association between osteoporosis knowledge, calcium knowledge and dietary calcium intake. This study found that majority of respondents had moderate

osteoporosis knowledge (63.6%) and good calcium knowledge (53.9%). Most students knew consumption of calcium-rich food can prevent osteoporosis (81.8%), but were unaware of the recommended calcium intake for their age (50.9%). Generally, females had higher knowledge with a significant difference ($p<0.05$) observed for osteoporosis knowledge, but not calcium knowledge. Besides, the dietary calcium intake of UTAR students was low with an average calcium consumption of 369.5±83.54 mg/day. Male students had a higher intake but no significant difference was reported. Calcium intake was significantly different between levels of osteoporosis knowledge and calcium knowledge ($p<0.001$). There were moderately positive associations reported between osteoporosis knowledge, calcium knowledge and dietary calcium intake ($p<0.001$). Overall, the students had decent osteoporosis and calcium knowledge levels, but their calcium intake remained low. Hence, future educational intervention is needed to enhance students' attitude and calcium intake for effective osteoporosis prevention.

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Lastly, I would like to appreciate all the respondents who voluntarily took part in this survey. I also thank my dearest members of my family and friends for their support and consideration. Their efforts and contribution are of utmost valued.

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.

Tan Hui Ning

APPROVAL SHEET

This final year project report entitled **"KNOWLEDGE OF OSTEOPOROSIS AND CALCIUM AND ITS ASSOCIATION WITH DIETARY CALCIUM INTAKE AMONG STUDENTS IN UNIVERSITI TUNKU ABDUL RAHMAN (UTAR), KAMPAR"** was prepared by TAN HUI NING 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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(Ms. Nurul Aimi binti AB Kadir) Date: 30th August 2022

Supervisor

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Date: 30th August 2022

PERMISSION SHEET

It is hereby certified that **TAN HUI NING** (ID No: **18ADB03815**) has completed this final year project report entitled "KNOWLEDGE OF OSTEOPOROSIS AND CALCIUM AND ITS ASSOCIATION WITH DIETARY CALCIUM INTAKE AMONG STUDENTS IN UNIVERSITI TUNKU ABDUL RAHMAN (UTAR), KAMPAR" under the supervision of Ms. Nurul Aimi binti AB Kadir from the Department of Allied Health Science, Faculty of Science.

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

Yours truly,

(TAN HUI NING)

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
CFS	Centre of Foundation Studies
CK	Calcium Knowledge
COVID-19	Coronavirus Disease
DCI	Dietary Calcium Intake
EU	European Union
FAS	Faculty of Arts and Social Science
FBF	Faculty of Business and Finance
FEGT	Faculty of Engineering and Green Technology
FFQ	Food Frequency Questionnaire
FICT	Faculty of Information and Communication Technology
FSc	Faculty of Science
ICS	Institute of Chinese Studies
IOF	International Osteoporosis Foundation
MANS	Malaysian Adult Nutrition Survey
MSU	Management and Science University
N	Number of Respondents
OK	Osteoporosis Knowledge
RNI	Recommended Nutrient Intake
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
UL	Tolerable Upper Intake Level
UiTM	Universiti Teknologi MARA

UKM	Universiti Kebangsaan Malaysia
UNISEL	Universiti Selangor
UPM	Universiti Putra Malaysia
UTAR	Universiti Tunku Abdul Rahman

CHAPTER 1

INTRODUCTION

1.0 Chapter Overview

In this chapter, the background of the study, problem statement, general and specific objectives of the study as well as the hypothesis will be discussed in detail.

1.1 Research Background

Bones are the hardest connective tissue in the human body. By weight, they are composed of roughly 70% of minerals including calcium phosphate in the form of hydroxyapatite, 25% organic constituents containing collagen fibers, and less than 5% of lipid and water (Vannucci et al., 2018; Dey, 2020). Bones provide the structural framework for the body. They enable movement, protect internal organs as well as bear body weight and external forces. Besides, they also serve as a reservoir for the accumulation of calcium to sustain bone health and bone resorption to supply calcium into the blood when necessary (Tsugawa and Shiraki, 2020). Peak bone mass (PBM) is largely influenced by genetic factors as well as gender, nutrition, and exercise (Sozen, Ozisik and Calik-Basaran, 2017). Bone mass reaches its peak during late adolescence and young adulthood and then declines afterward. As bone loses its strength with aging, bone diseases are likely to occur.

Some common bone disorders include bone fractures, scoliosis, Paget's disease, osteoarthritis, rheumatoid arthritis as well as osteoporosis primarily.

Osteoporosis has been a global health concern for decades, affecting more than 200 million people worldwide (Kaushal et al., 2018). It is a progressive skeletal disease characterized by compromised bone strength due to low bone mass and resorption of bone tissue (NIH Consensus, 2001). When an imbalance in bone turnover occurs, excessive bone resorption outpaces the bone replacement, causing the bone to become more porous and fragile (Vannucci et al., 2018). According to the statistics of the International Osteoporosis Foundation (IOF) (2020), one in every three women and one in every five men aged over 50 will experience osteoporotic fractures in their lifetimes worldwide. Osteoporotic fractures can result in disability, decreased workplace productivity, and impaired daily lives, posing a serious health threat to the public.

Calcium plays an important role in the healthy growth, development and maintenance of the skeleton. Adequate calcium consumption is necessary for gaining ideal bone mass and decreasing the rate of bone loss that comes with aging (Cashman, 2007). The requirement for calcium varies throughout the lifespan, with increased needs during childhood for supporting bone growth; adolescence and young adulthood for attaining peak bone density; during pregnancy and lactation for supplying to the baby, and in later life (Vannucci et al., 2018). However, an average low dietary calcium intake especially among Asia countries with less than 500 mg/day has been observed over the years (Kumssa et al., 2015; Balk et al., 2017). The data was consistent with the existing Malaysian Adult Nutrition Survey (MANS) 2014, showing the median intake of calcium by Malaysian adults was 356 mg/day with no significant difference between genders. The intake was inadequate to meet the daily calcium

requirement (1000 mg/day) for Malaysian adults as proposed by the Recommended Nutrient Intake (RNI) 2017.

Hence, having adequate knowledge of osteoporosis and calcium would be one of the key necessities to increase calcium intake and maintain bone health. Research by Chan et al. (2019) showed a significant correlation between osteoporosis knowledge and osteoprotective behaviors. The researchers suggested that osteoporosis knowledge was associated positively with the perceived benefits of exercise and calcium intake, enhanced health motivation as well as increased dairy and calcium supplement consumption. On the other hand, a correlation was found between nutrition knowledge and calcium intake (Nguyen and Murimi, 2021). Research conducted among 209 Thailand adolescents showed the participants had an overall low knowledge regarding calcium sources and only 30% of them attained the Thai recommended daily intake of calcium (800mg) (Jaisaard et al., 2021). It can be foreseen that a lack of nutritional information hinders healthy eating patterns. Overall, poor osteoporosis and calcium knowledge are likely associated with a low dietary calcium intake.

1.2 Problem Statement

There are quite a few similar studies that have been done in Malaysia. Most of the relevant studies emphasized the KAP regarding osteoporosis without identifying dietary calcium intake (Leng, Ali and Yusof, 2017; Amin et al., 2018; Ramli, Rahman and Haque, 2018; Cheng et al., 2020). Similarly, previous studies that assessed dietary calcium intake did not examine the osteoporosis

knowledge of participants (Sham, 2013; Folasire and Akinrinde, 2017; Yap et al., 2019; Azhar and Jaafar, 2020). Meanwhile, some researchers examined both the osteoporosis knowledge and calcium intake of the target population (Sharma et al., 2010; Enright and Bai, 2014; Chan et al., 2019; Chiang and Ahmad-Jamal, 2020). However, many of them were conducted in other countries, involving adolescence or the elderly. They focused only on dairy product intake and there were inconsistent findings in terms of the association between the variables. Based on the data above, there is no study being conducted on the discovery of the association between osteoporosis knowledge, calcium knowledge, and dietary calcium intake in Malaysia. Instead, young adults should be the target population since the key aspect to prevent osteoporosis is to attain peak bone mass during the early years. Their levels of osteoporosis and calcium knowledge along with dietary calcium intake should be assessed as indicators of future bone fractures.

Table 1.1: Previous research studied solely osteoporosis.

Sample Studies	**Topic**	**Findings**	**Limitations**
Leng, Ali and Yusof (2017) (n=232)	Knowledge, Attitude and Practices towards Osteoporosis Prevention among Adults in Kuala Lumpur, Malaysia	A moderate level of knowledge about osteoporosis prevention There was a significant difference in knowledge across gender	The study did not examine calcium knowledge and dietary calcium intake.

Table 1.1 continued: Previous research studied solely osteoporosis.

Sample Studies	Topic	Findings	Limitations
Amin et al. (2018) (n=212)	Assessment of knowledge, belief and self-efficacy regarding osteoporosis among female academicians in Malaysia	The level of knowledge on osteoporosis was low	The study did not examine calcium knowledge and dietary calcium intake. It was conducted among females
Ramli, Rahman and Haque (2018) (n=106)	Knowledge, Attitude, and Practice Regarding Osteoporosis Among Allied Health Sciences Students in a Public University in Malaysia	A fair level of knowledge regarding osteoporosis There was no significant difference in knowledge across gender There was no significant association between knowledge with practices on osteoporosis	The study did not examine calcium knowledge and dietary calcium intake. It involved only allied health sciences students
Cheng et al. (2020) (n=384)	Assessment of Knowledge, Attitude and Practice of Malaysian Women Towards Osteoporosis	Participants had poor levels of knowledge and practice toward osteoporosis A positive correlation between knowledge and practice toward osteoporosis	The study did not examine calcium knowledge and dietary calcium intake. It was conducted among females

Table 1.2: Previous research studied either calcium knowledge, calcium intake or both.

Sample Studies	Topic	Findings	Limitations
Sham et al. (2013) (n=336)	Knowledge and Perception of Calcium Intake among Students in University Technology MARA	There was a significant difference between gender in calcium knowledge There was no association between knowledge and dairy products intake	This study did not examine the osteoporosis knowledge It assessed only the intake of dairy products
Folasire and Akinrinde (2017) (n=400)	Calcium Knowledge and Consumption Pattern of Calcium-rich Foods among Female University Students in South-west Nigeria	There was no significant association between calcium knowledge and frequency of calcium-rich food intake	This study did not examine the osteoporosis knowledge It did not assess the mean dietary calcium intake of respondents It was conducted in Nigeria
Yap et al. (2019) (n=198)	Ethnic variation in osteoporosis risk factors: dietary calcium, vitamin D intake and body mass index (BMI)	Participants had a low dietary calcium intake	This study did not determine the knowledge of osteoporosis and calcium It did not identify the differences in dietary calcium intake across gender

Table 1.2 continued: Previous research studied either calcium knowledge, calcium intake or both.

Sample Studies	Topic	Findings	Limitations
Azhar and Jaafar (2020) (n=75)	Assessment of Dietary Calcium Intake Among Female University Students	Participants had a low dietary calcium intake There was no significant relationship between knowledge and dietary calcium intake	This study did not examine the osteoporosis knowledge It was conducted among females

Table 1.3: Previous research studied both osteoporosis knowledge and calcium intake.

Sample Studies	Topic	Findings	Limitations
Sharma et al. (2010) (n=717)	Psychosocial Factors Influencing Calcium Intake and Bone Quality in Middle-School Girls	Calcium intake was positively correlated with knowledge of osteoporosis and calcium-rich foods	The study was done 10 years ago It was conducted among middle-school girls in Texas, United State
Enright and Bai (2014) (n=228)	Influence of Education Sources on Osteoporosis Knowledge and Calcium Intake in Adult Women: A cross-sectional study	There was an association between osteoporosis knowledge and calcium intake	The study did not examine calcium knowledge It was conducted in New Jersey, United State
Chan et al. (2019) (n=367)	Knowledge, Beliefs, Dietary, and Lifestyle Practices Related to Bone Health among Middle-Aged and Elderly Chinese in Klang Valley, Malaysia	There were significant differences between gender in dietary practices that affect bone health	The study did not examine calcium knowledge It was conducted among older adults

Table 1.3 continued: Previous research studied both osteoporosis knowledge and calcium intake.

Chiang and Ahmad-Jamal (2020) (n=333)	The osteoporosis knowledge, belief and calcium intake behavior among students in a medical sciences university	The osteoporosis knowledge was fair and the dairy products intake was low No association between osteoporosis knowledge and dairy products intake	The study did not examine calcium knowledge It focused only on dairy products intake

1.3 Research Objectives

1.3.1 General Objective

1. To determine the association between osteoporosis knowledge, calcium knowledge and dietary calcium intake.

1.3.2 Specific Objectives

1. To determine osteoporosis and calcium knowledge levels among UTAR students in Kampar campus.
2. To assess the dietary calcium intake among UTAR students in Kampar campus.
3. To examine the discrepancy in the dietary calcium intake among different knowledge levels of UTAR students in Kampar campus.
4. To determine the association between osteoporosis knowledge, calcium knowledge and dietary calcium intake among UTAR students in Kampar campus.

1.4 Research Questions

1. What are the osteoporosis and calcium knowledge levels among UTAR students in Kampar campus?
2. How is the dietary calcium intake among UTAR students in Kampar campus?
3. Is there a discrepancy in the dietary calcium intake among different knowledge levels of UTAR students in Kampar campus?
4. Is there an association between osteoporosis knowledge, calcium knowledge and dietary calcium intake among UTAR students in Kampar campus?

1.5 Hypothesis

1. The osteoporosis knowledge and calcium knowledge levels among UTAR students in Kampar are poor.
2. The dietary calcium intake among UTAR students in Kampar is low.
3. There are discrepancies in the dietary calcium intake among different knowledge levels of UTAR students in Kampar campus.
4. There is an association between osteoporosis knowledge, calcium knowledge, and dietary calcium intake among UTAR students in Kampar campus.

CHAPTER 2

LITERATURE REVIEW

2.0 Chapter Overview

In this chapter, the review of literature, significance of the study and conceptual framework adopted for this study will be explained in detail.

2.1 Literature Review

2.1.1 Global Osteoporosis Burden

The prevalence of osteoporosis is increasing among the world's population. This condition results in an exponential surge in the number of fracture incidences, putting a greater economic burden on healthcare systems. Kanis et al. (2013) reported a direct cost of €38.7 billion accounted for the osteoporotic fractures in 27 European Union (EU) countries in 2010. Another study done in the EU further indicated that among 21.3 million individuals who were at risk of osteoporosis, 12.3 million of them went untreated (Hernlund et al., 2013). Besides, a relatively high rate of fragility fractures was observed in the United States and the United Kingdom, costing about $17.9 billion and £4 billion annually in medical expenditure respectively (Clynes et al. 2020). Meanwhile, in Asian countries, an updated study by Cheung et al. (2018) projected a dramatic increase in hip fractures from 1.1 million cases in 2018 to 2.5 million cases in 2050, accounting for 50% of cases worldwide. Malaysia was expected to experience the highest rate of increase in the total number of hip fractures (3.55-fold) among 9 regions followed by Singapore (3.53-fold), Hong Kong (2.86-

fold), Korea (2.85-fold), Thailand (2.79-fold), Taiwan (2.69-fold), China (2.40-fold), India (2.39-fold), and lastly Japan (1.36-fold).

2.1.2 Hip Fracture Epidemiology in Malaysia

Osteoporosis is often underdiagnosed and undertreated in Malaysia. As a result, the osteoporotic condition is reflected in the incidence of fragility fractures, primarily hip fractures. The incidence of hip fractures among Malaysians was first described by Lee, Sidhu and Pan (1993) showing elevating hospital admission to the Kuala Lumpur General Hospital. The occurrence of hip fractures reported increased from 1981 (48 per 100,000 individuals) to 1989 (70 per 100,000 individuals). The trend continued to rise and affect mainly elderly patients in the country. A retrospective study by Lee and Khir (2007) revealed that the prevalence of hip fractures from 1996 to 1997 was 90 per 100,000 population in Malaysia. The cost of direct hospitalization for hip fractures reported was up to RM22 million, not considering the expense of following rehabilitation services. Moreover, a subsequent review observed a rate of approximately 150 to 250 per 100,000 population hip fractures in Malaysia (Kanis et al., 2012). This finding suggested a relatively high incidence rate, correlating with recent research conducted among 786 respondents in Klang Valley, showing the prevalence of impaired bone health and osteoporosis was 38.0% and 12.3%, respectively (Chin et al., 2020).

2.1.3 Osteoporosis Knowledge

Previous studies revealed a relatively low knowledge level about osteoporosis among populations in developing countries including Nigeria, Pakistan, Saudi

Arabia and New Zealand (Njeze-Ngozi et al., 2017; Bilal et al., 2017; Mujamammi et al., 2021; Patel et al., 2021). In Malaysia, a previous study performed among 232 adults in Kuala Lumpur revealed that 48.3% of the participants had limited osteoporosis knowledge and their intake of calcium-rich food including dairy products, canned sardines and salmon, breakfast cereal, fruits and vegetables was low (Leng, Ali and Yusof, 2017). This result was in line with another research conducted in the Hospital Universiti Sains Malaysia, demonstrating that 59.5% of older women had fair to poor knowledge, while 53.5% had poor prevention practices (Embong and Yew, 2021). In terms of young adults, local research done in public universities indicated a moderate level of osteoporosis knowledge among Malaysian students but their acts to avoid the disease were inadequate (Ramli, Rahman and Haque, 2018; Chan et al., 2021). The researchers suggested no significant association between knowledge with practice towards osteoporosis (Ramli, Rahman and Haque, 2018). Taken together, these studies highlighted poor osteoporosis knowledge among participants, but the relationship between knowledge and dietary practice remained unclear.

2.1.4 Calcium Knowledge

Inadequate knowledge regarding the sources and recommended intake of calcium was reported among the majority of the students (58.6%) at University Technology MARA (UiTM), Shah Alam (Sham et al., 2013). This finding was consistent with the literature from other countries. In Canada, research found that the participants did not know the benefit of adequate calcium intake during young adulthood as they believed the practice was significant for children and

older women, but not for them (Marcinow et al., 2017). Apart from that, Folasire and Akinrinde (2017) indicated a large number of university students in Nigeria had inadequate calcium knowledge, seldom ate calcium-rich foods, and were unaware of the role of calcium in osteoporosis prevention. A similar result was obtained by a study on KAP toward calcium intake among young adults in Indonesia, discovering a relatively fair knowledge (72%), negative attitude (66%) and insufficient dietary intake (98%) of calcium among the subjects (Dewi, Hidayat and Rachmawati, 2018). Overall, inadequate calcium knowledge was observed among young adults and it was associated positively with low dietary calcium intake.

2.1.5 Dietary Calcium Intake

Dietary calcium intake varies among populations. A comprehensive review across 74 countries noticed the highest intakes (>950 mg/day) in Northern Europe, followed by a fair intake (400-700 mg/day) in Africa and South America while the least dietary calcium intake (<400 mg/day) was seen in Asia-Pacific region such as China, Indonesia, Vietnam and Malaysia (Balk et al., 2017). This result was consistent with the available local studies, showing the dietary calcium intake of Malaysians averaged between 348 mg/day to 397 mg/day, below 40% of the recommended value by RNI (2017) (Mirnalini et al., 2008; Suriawati et al., 2016; Yap et al., 2019; Azhar and Jaafar, 2020). The disparity in dietary calcium intake between countries is likely due to the various diets and food sources of calcium. In the Malaysian diet, calcium is obtained mostly from dairy products, canned sardines and anchovies, legumes, vegetables as well as grain and cereal products (RNI, 2017). Apart from that, Palacios et al. (2021)

proposed a high availability of commercial food products fortified with calcium in developed countries which was less common in low- and middle-income nations.

2.2 Conceptual Framework

Pertaining to the topic of this study, it can be foreseen that osteoporosis knowledge is one of the key factors to influence the dietary calcium intake among young adults. Besides, the quality of calcium consumption is most likely to be affected when there is a lack of understanding about calcium. With low levels of both osteoporosis and calcium knowledge, young adults are less likely to consume adequate calcium in their daily lives. As a result, poor calcium intake for prolonged periods leads to calcium deficiency, resulting in impaired bone health and decreased quality of life.

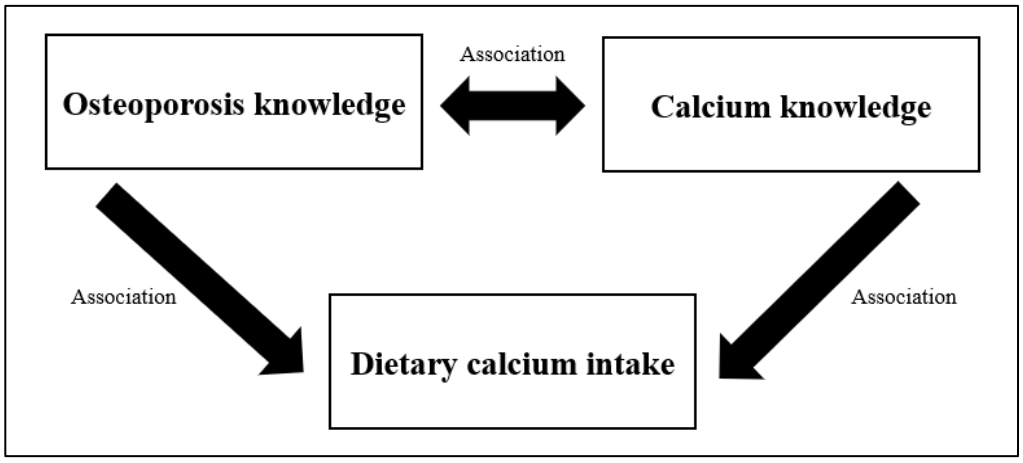

Figure 2.1: Conceptual framework on the association between osteoporosis knowledge, calcium knowledge and dietary calcium intake.

2.3 Significance of Study

This study describes the level of knowledge about calcium and osteoporosis so that health authorities can decide whether there is a need for further education or intervention. In addition, this study provides data on current dietary calcium intake among UTAR students, thus it acts as an indicator for future bone disease occurrence. Moreover, this study may help dietitians to acknowledge the trend of inadequate calcium intake among university students, thus they can improve students' calcium intake as early prevention of bone diseases.

CHAPTER 3

MATERIALS AND METHODS

3.0 Chapter Overview

In this chapter, the methodology, target population, sample size, inclusion and exclusion criteria, research instruments, the procedure for data collection and data analysis will be described in detail.

3.1 Study Design

This research was conducted at Universiti Tunku Abdul Rahman Kampar Campus (UTAR Kampar) using a cross-sectional design. A cross-sectional study is frequently used in public health research to estimate the prevalence of health outcomes for better planning, monitoring, and assessing public health (Wang and Cheng, 2020). The research was conducted in a period from October 2021 to October 2022. Convenience sampling, a non-probability sampling method was applied in the selection of participants for this study due to time, money, and workforce constraints. Through convenience sampling, the researcher managed to reach the target population more easily. Before data collection, ethical approval from the university had been requested (Appendix A). This was to guarantee that the study was conducted in accordance with the requirements. All information obtained was kept confidential and would not be shared with the public or any other unauthorized personnel. The data was handled and analyzed exclusively by the researcher and supervisor carrying out the research.

3.2 Target Population

The target population of this study was UTAR Kampar students whose ages ranged from 18 to 30 years old. The participants from different faculties in Kampar campus were recruited online, including Centre of Foundation Studies (CFS Kampar), Faculty of Arts and Social Science (FAS), Faculty of Business and Finance (FBF), Faculty of Engineering and Green Technology (FEGT), Faculty of Information and Communication Technology (FICT), Faculty of Science (FSc) and Institute of Chinese Studies (ICS Kampar).

3.3 Sample Size

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

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

where,

n = estimated sample size

Z^2 = Z value at the desired confidence level

p = proportion of the population

q = 1-p

e = margin of error

The researcher assumed half of the population having relatively low knowledge on osteoporosis and calcium as well as inadequate dietary calcium intake. Hence, p = 0.5. With a 95% confidence level and 8% margin of error, the sample size required for this study was 150 students. Also, 10% of attrition rate was added in the case that respondents failed to complete the survey. Hence, the final

sample size was 165 participants. The sample size calculation was illustrated as followed:

$$n = \frac{1.96^2(0.50)(0.50)}{0.08^2}$$

$$n = 150.06$$

$$n \approx 150$$

With an additionally 10% for non-response rate,

$$n \approx 150 + 10\%$$

$$n = 165$$

3.4 Inclusion and Exclusion Criteria

Establishing sampling criteria for study respondents is a significant step prior to data collection. Inclusion and exclusion criteria determine who can be included or omitted from the study sample. The inclusion criteria ensure the study sample is in a constant and uniform manner (Garg, 2016). In contrast, the exclusion criteria are characteristics that disqualify subjects from the study. Typical inclusion and exclusion criteria include age, gender, ethnicity, socioeconomic status, physical activity, presence of certain diseases and et cetera.

Table 3.1: Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
● Foundation/ Undergraduate students ● 18 - 30 years old ● Enrolled in UTAR Kampar campus	● UTAR staff ● International students ● Enrolled in UTAR Sungai Long campus

3.5 Research Instruments

Research instruments are designed to collect data related to the topic of interest from the target sample. In this study, the researcher has conducted a survey based on the specific objectives of the study. The questionnaire was developed in the English language and it took around 5 to 10 minutes to complete. It consisted of four sections, Section A: Socio-demographic questionnaire; Section B: Bone health and osteoporosis knowledge questionnaire; Section C: Calcium knowledge questionnaire and Section D: Food frequency questionnaire. The questionnaire was attached in Appendix B. To ensure high validity, the questionnaire for this study was derived from previous research studies and literature related to the research topic. Also, a pilot study was performed for the reliability of the instruments.

3.5.1 Section A: Socio-demographic Questionnaire

There was a total of six questions in this section. Five questions were designed to obtain the demographic profile of respondents including gender, ethnicity, age, faculty and year of study. Meanwhile, the last question was allocated to identify

whether the participant had a personal history of fracture or osteoporosis. Nominal and interval scales were applied in this section. Participants were required to answer the questions by choosing the options given.

3.5.2 Section B: Bone Health and Osteoporosis Knowledge Questionnaire

Section B consisted of a validated questionnaire modified from prior research by Tayel et al. (2013). The purpose of this section was to assess the level of bone health and osteoporosis knowledge of the respondents. There was a total of 24 closed-ended questions in this section. Nine questions were allocated regarding general information on bone health and osteoporosis followed by eight questions regarding risk factors of osteoporosis and seven questions regarding preventive behaviors of osteoporosis. The respondents were required to answer all questions based on their understanding. For each question, respondents who chose 'True' received a score of (2), 'I don't know' received a score of (1), and 'False' received a score of (0). Altogether, the possible range of scores was between 0 to 48 for a total of 24 questions. The classification on knowledge level was determined according to Tayel et al. (2013) as shown in Table 3.2.

Table 3.2: Level of classification in osteoporosis knowledge (Tayel et al., 2013).

Level of Classification	Total Score
Poor knowledge	< 60%
Fair knowledge	60 - 80%
Good knowledge	> 80%

3.5.3 Section C: Calcium Knowledge Questionnaire

Section C comprised a calcium knowledge questionnaire modified from Folasire and Akinrinde (2017) with good internal reliability and consistency. The purpose of this section was to assess the level of calcium knowledge of the respondents. Of a total of 16 questions, seven questions were about general knowledge of calcium. The questions inquired about the calcium function, calcium absorption, storage and excretion as well as calcium interaction with bone. The remaining eight questions emphasized on the understanding of dietary calcium intake. Similarly, all questions were closed-ended questions and each of them was assigned with three alternatives including 'True', 'False' and 'I don't know'. Thus, the possible range of scores was between 0 to 32. The knowledge level was categorized with reference to the research by Folasire and Akinrinde (2017) as shown in Table 3.3.

Table 3.3: Level of classification in calcium knowledge (Folasire and Akinrinde, 2017).

Level of Classification	Total Score
Poor knowledge	< Mean score
Good knowledge	> Mean score

3.5.4 Section D: Food Frequency Questionnaire

In this section, a food frequency questionnaire (FFQ) which comprised 30 food items was adopted from the valid calcium FFQ by Wong (2020) with reference to Yang et al. (2017). The food items were identified and included in the calcium

FFQ as they accounted for 90% of the calcium intake of the total population in the prior study. They were classified into eight food groups: (I) Milk and milk products; (II) Cereal and cereal products; (III) Fish and seafood; (IV) Meat, poultry and egg; (V) Vegetables; (VI) Others; (VII) Beverages as shown in Table 3.4. The calcium content of food items was referred to the Malaysia Atlas of Food Exchange & Portion Sizes and Nutrient Composition of Malaysian Food.

Table 3.4: Food groups classification of calcium FFQ.

No.	Food Group	Food Item
I	Milk and milk products	Milk, milk powder, condensed milk, ice cream, cheese, yogurt, cultured milk drink (Yakult), butter, margarine, soybean milk
II	Cereal and cereal products	Noodles, rice, pizza, white bread, bun, biscuit
III	Fish and seafood	Anchovies, tuna/sardine, fish
IV	Meat, poultry and egg	Fried chicken, other chicken dishes, processed meat products, egg, beef/mutton
V	Vegetables	Leafy vegetables, non-leafy vegetables
VI	Others	Fruits, snacks
VII	Beverage	Cocoa-based drink (Milo), malted/cereal-based drink (Horlick)

Each food item was assigned with multiple options varying from monthly, weekly, and daily frequency. Respondents had to recall and choose the option to

indicate the frequency of consuming the particular food in the past month. For instance, if the respondent consumed 1 glass of milk every day in the past month, he/she was required to select '1 glass per day'. The frequency weights applied to estimate the daily intake were as below:

Daily = frequency/1

Weekly = frequency/7

Monthly = frequency/30

The dietary calcium intake (mg/day) for each respondent was calculated. Then the estimated mean calcium intake was categorized by referring to the Recommended Nutrients Intake for Malaysian adults (RNI, 2017) as demonstrated in Table 3.5.

Table 3.5: Level of classification on dietary calcium intake.

Level of Classification	**Mean Dietary Calcium Intake**
Very low intake	≤ 500 mg/day
Inadequate intake	501 - 999 mg/day
Adequate intake	≥ 1000 mg/day

3.5.5 Pilot Study

A pilot study aims to ensure the efficacy of research instruments and identify potential problems that might be encountered in the following research procedures (Van-Teijlingen and Hundley, 2001). In this study, the researcher conducted a pre-testing to measure the reliability of the particular modified

questionnaires. The pilot study involved 10 UTAR Kampar students on 18 and 20 January 2022. As a result, the bone health and osteoporosis questionnaire and calcium knowledge questionnaire demonstrated a relatively fair and good internal reliability and consistency with a Cronbach's alpha value of 0.687 and 0.765 respectively. Besides, the participants managed to understand and answer the questions accordingly.

Table 3.6: Qualitative Interpretation of Cronbach's Alpha (Taber, 2018; Wikarsa and Angdresey, 2021)

Cronbach's Alpha	Internal Reliability and Consistency
$\alpha \geq 0.9$	Excellent
$0.7 \leq \alpha < 0.9$	Good
$0.6 \leq \alpha < 0.7$	Fair
$0.5 \leq \alpha < 0.6$	Poor
$0.5 < \alpha$	Unacceptable

3.6 Data Collection

The questionnaire was designed via an online platform known as Google Form. It was then distributed to UTAR Kampar students through WhatsApp and Microsoft Teams. Data were collected for 6 months from February 2022 to July 2022. Informed consent was given before data collection to ensure that participation in the study was voluntary. If the respondents had inquiries or difficulties in understanding and answering the questions, they could reach out to the researcher through email or contact stated in the survey form.

3.7 Data Analysis

After data collection was completed, results from Sections A, B and C were cleaned and coded using the Statistical Package for the Social Sciences (SPSS) version 26 for the tabulation and analysis. For dietary calcium intake, the estimated mean was calculated using Microsoft Excel (as shown in Appendix B). Also, the skewness and kurtosis tests were applied to identify if the variables were normally distributed. Descriptive data include socio-demographic variables and level of knowledge were presented in frequency (n), percentage (%), mean and standard deviation. One-way ANOVA test was performed to determine the association between dietary calcium intake and three-level osteoporosis knowledge. Meanwhile, the association between dietary calcium intake and two-level of calcium knowledge was assessed using the Independent t-test. Furthermore, Pearson's correlation test was conducted to measure the linear relationship between the three variables. For each test, $p<0.05$ was applied to indicate statistically significant. All data was illustrated in tabular and graphical form.

CHAPTER 4

RESULT

4.0 Chapter Overview

In this chapter, the data analyzed by using the Statistical Package for the Social Sciences version 26 (IBM SPSS Statistic 26) will be outlined and explained in detail.

4.1 Background information

A total of 200 questionnaires had been distributed via various online platforms to UTAR students. However, the response rate was 82.5% after applying the exclusion criteria in which 22 students were not responding, 9 students were not eligible for the study and 4 of them did not complete the survey form. Hence, the final count of respondents available for the study was 165. The data analysis on 165 respondents was shown as followed.

4.2 Sociodemographic Characteristics of Respondents

Table 4.1 described the sociodemographic background of the 165 respondents. A majority of respondents were Chinese (62.4%) and aged between 21 to 25 years old (53.9%). Besides, there were more female respondents (n=96) which incorporated 58.2% of the total respondents compared to the male counterparts (n=69) made up 41.8% of the total respondents in the study. As for faculty, students from FCs contributed the highest portion, which was 54 students (32.7%), followed by FBF (17%) and FEGT (13.9%) while students from ICS contributed the least portion in the study with 4.2%. It was also noticed that more

than one-third of the respondents (43.6%) were studying their second year while completing the survey form. Lastly, in terms of personal history, most of the respondents (87.3%) did not experience fractures or had been diagnosed with osteoporosis prior to the research.

Table 4.1: Sociodemographic characteristics of respondents (n=165).

Characteristics	**Frequency**	
	n	**%**
Gender		
Male	69	41.8
Female	96	58.2
Ethnicity		
Chinese	103	62.4
Indian	41	24.8
Malay	21	12.7
Age		
18 - 20	44	26.7
21 - 25	89	53.9
26 - 30	32	19.4
Faculty		
FAS[1]	15	9.1
FBF[2]	28	17.0
FEGT[3]	23	13.9
FICT[4]	20	12.1
FSc[5]	54	32.7
ICS[6]	7	4.2
CFS[7]	18	10.9
Year of study		
Year 1	43	26.1
Year 2	35	21.2
Year 3	72	43.6
Year 4	15	9.1

Table 4.1 continued: Sociodemographic characteristics of respondents (n=165).

Characteristics	Frequency	
	n	%
Have you ever experienced a fracture or been diagnosed with osteoporosis?		
Yes	21	12.7
No	144	87.3

[1] Faculty of Arts and Social Science
[2] Faculty of Business and Finance
[3] Faculty of Engineering and Green Technology
[4] Faculty of Information and Communication
[5] Faculty of Science
[6] Institute of Chinese Studies
[7] Centre for Foundation Studies

4.3 Osteoporosis Knowledge of Respondents

The individual score was generated after adding up each of the scores obtained from three components including general information, risk factors and preventive behaviors. With a maximum score of 48, the knowledge of the respondents was categorized into three levels: Poor (< 28.8), Fair (28.8 – 38.4) and Good (> 38.4). Among 165 respondents, a total of 105 students (63.6%) had fair knowledge whereas 38 students (23%) had good knowledge and 22 students (13.3%) had poor knowledge. The mean knowledge score was 34.6 which fell under the fair category while the standard deviation was 3.56. When comparing between genders, the mean score among females (35.6±5.28) was higher than males (33.2±5.19). The findings demonstrated the difference between gender and bone health knowledge was statistically significant with a p-value of 0.003. The results of bone health knowledge among the respondents were outlined in Table 4.2 and Figure 4.1.

Table 4.2: Osteoporosis knowledge levels of respondents (n=165).

Variable	Total n (%)	Gender		p-value
		Male n (%)	Female n (%)	
Knowledge level				0.003*
Poor	22 (13.3)	14 (20.3)	8 (8.3)	
Fair	105 (63.6)	45 (65.2)	60 (62.5)	
Good	38 (23.0)	10 (14.5)	28 (14.5)	
Mean±SD	34.6±3.56	33.2±5.19	35.6±5.28	

* p-value < 0.05 is significant. SD: standard deviation.

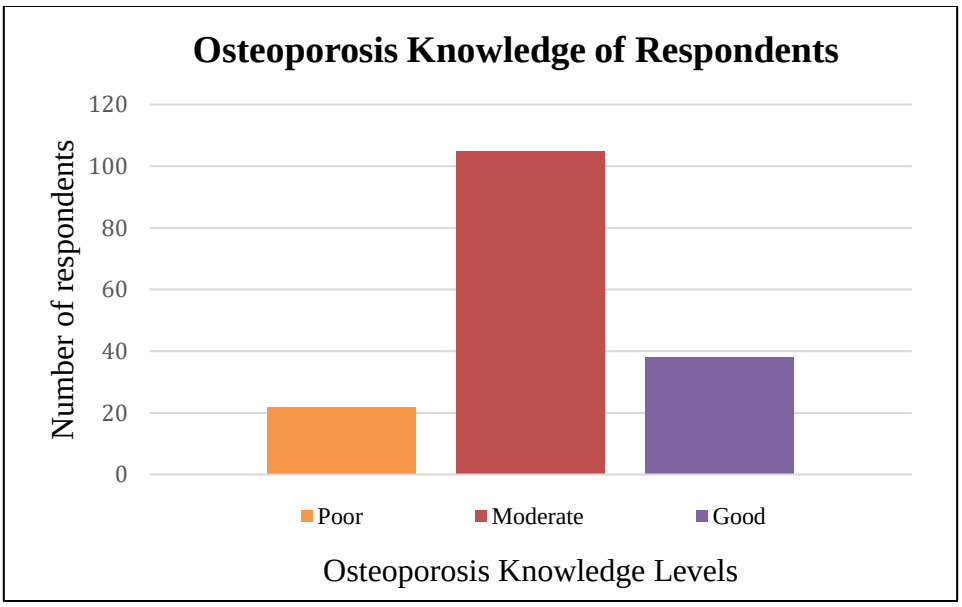

Figure 4.1: Osteoporosis knowledge of respondents (n=165).

Based on Table 4.3, most of the participants (87.9%) understood that bone disorders are likely to happen while aging. Besides, about one-third of the respondents knew that osteoporosis condition might result in tooth loss and fragility fractures (65.5%) as well as dowager's hump (64.2%). Apart from that, a majority of students were well aware of the risk factors of osteoporosis in which old age, family history and habitual soft drink consumption took a relatively high frequency with 80%, 68.5% and 62.4%, respectively. In terms of

lifestyle preventive behaviors, 81.8% of the respondents (n=135) were conscious that the consumption of fish like tuna and salmon could prevent the disease. However, more than half of the respondents did not know that osteoporosis could be prevented by increased vegetable intake (50.3%) and reduced meat and poultry intake (58.2%).

Table 4.3: Distribution of correct answers for osteoporosis knowledge.

Questions	Frequency	
	n	%
General information on bone health and osteoporosis		
Peak bone mass is attained during adolescence until young adulthood	103	62.4
Bone diseases are likely to develop while aging	145	87.9
Osteoporosis and osteoarthritis are preventable while aging	102	61.8
Unlike osteoarthritis, osteoporosis may show no symptoms	77	46.7
Dowager's hump is one of the signs of osteoporosis	106	64.2
A bone mineral density test can be used to diagnose osteoporosis	94	57.0
Men are more prone to osteoporosis	96	58.2
People with osteoporosis are prone to tooth loss and fragility fractures	108	65.5
There is no cure for osteoporosis	71	43.0
Risk factors of osteoporosis		
Old age	132	80.0
Family history	113	68.5
Sedentary lifestyle	94	57.0
Long-term use of glucocorticoids	88	53.3
High sodium intake	84	50.9
High consumption of tea and coffee drinks	90	54.5
Habitual soft drinks consumption	103	62.4
Smoking	94	57.0
Lifestyle preventive behaviors of osteoporosis		
High-impact exercises (e.g. weight bearing)	97	58.8
Consumption of fish (e.g. tuna and salmon)	135	81.8
Increase consumption of green vegetables	82	49.7
Decrease consumption of meat and poultry	69	41.8
Decrease consumption of alcohol	102	61.8
Calcium supplements use	102	61.8
Regular sun exposure	104	63.0

4.4 Calcium Knowledge of Respondents

Table 4.4 presented the findings on the calcium knowledge of the respondents. Overall, the respondents had an average calcium knowledge score of 23.9±3.9. Female respondents showed a slightly greater mean knowledge score (24.1±4.05) compared to male respondents (23.6±3.69). Hence, there was no significant difference between gender and calcium knowledge ($p>0.05$) in which gender does not affect calcium knowledge among the students. Out of 165 respondents, 46.1% of the students (n=76) were observed to have poor calcium knowledge with a total score lower than 23.9. In contrast, there were 89 students (53.9%) who acquired 23.9 scores and above, indicating good calcium knowledge. The score was a sum up of 2 sections in the questionnaire which were the general knowledge of calcium and dietary calcium intake.

Table 4.4: Calcium knowledge level of respondents (n=165).

Variable	Total n (%)	Gender		p-value
		Male n (%)	Female n (%)	
Knowledge level				0.457
Poor	76 (46.1)	32 (46.4)	44 (45.8)	
Good	89 (53.9)	37 (53.6)	52 (54.2)	
Mean±SD	23.9±3.90	23.6±3.69	24.1±4.05	

*p-value < 0.05 is significant. SD: standard deviation.

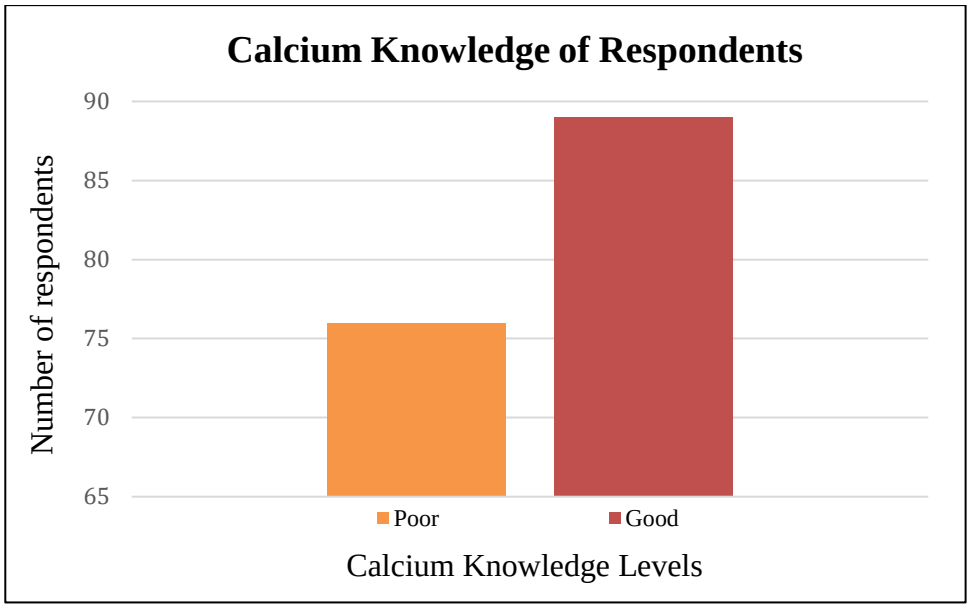

Figure 4.2: Calcium knowledge of respondents (n=165).

In terms of general knowledge of calcium, most of the respondents (92.7%) knew that calcium and vitamin D are prominent nutrients for bone health. In addition, they also perceived the role of vitamin D with calcium in the body (73.3%). There were nearly two-thirds of the students believed that calcium is obtained solely through diet (66.1%) and is eliminated through the skin, nails, hair and metabolic wastes every day (63%). For calcium intake, a majority of students were well aware of the purpose and dietary sources of adequate calcium intake, with 87.9% and 86.1% of total respondents, respectively. But, more than half population had no idea about the recommended nutrient intake (RNI) (n=84) and the tolerable upper intake level (UL) (n=86) of calcium for their age. Moreover, only 57 students (34.9%) agreed that calcium supplement is better absorbed when it is taken in a smaller dosage. The frequency of correct answers for calcium knowledge was outlined in Table 4.5.

Table 4.5: Distribution of correct answers for calcium knowledge.

Questions	Frequency	
	n	%
General knowledge of calcium		
Calcium and vitamin D are important for bone health	153	92.7
Vitamin D helps to absorb and regulates calcium in the blood	121	73.3
99% of total body calcium is stored in bone	91	55.2
Calcium must be obtained from the diet	109	66.1
Dietary calcium deficiency causes the body to take calcium from bone	93	56.4
Calcium level is maintained by hormones (e.g. calcitonin)	89	53.9
Calcium is eliminated through skins, nails, hair, sweat, urine and feces	104	63.0
Knowledge of dietary calcium intake		
Adequate calcium intake aids in strengthening bones, joints and teeth	145	87.9
The RNI for calcium differs between genders among age groups	108	65.5
The RNI for calcium among adults aged 20-30 years is 1000 mg/day	81	49.1
The UL for calcium among adults aged 19-30 years is 2500 mg/day	79	47.9
Excessive calcium intake may lead to kidney stones	106	64.2
Dairy products are excellent sources of calcium	142	86.1
An adult's daily calcium requirement is fulfilled by 3 glasses of milk	77	46.7
Calcium supplements are best absorbed when consumed in small doses	57	34.5
Calcium tablets interact with other medications when taken together	94	57.0

Note: RNI: recommended nutrient intake, UL: tolerable upper intake level.

4.5 Dietary Calcium Intake of Respondents

The dietary calcium intake (DCI) of participants was categorized into three levels: Low (<500 mg/day), Inadequate (500–999 mg/day) and Adequate (≥1000 mg/day). Based on the results in Table 4.6, nearly all participants (92.7%) had a relatively low daily calcium intake whereas the remaining 7.3% had inadequate intake. None of the participants managed to consume adequate calcium which is 1000 mg/day in the previous month. Besides, the study showed an average calcium intake of 369.5±83.54 mg/day among participants, which fell under the low category. A slightly higher intake was demonstrated by male students compared to female students, with 370.3±79.63 mg/day and 368.9±86.64, respectively. Overall, there was no significant difference ($p>0.05$) in DCI between gender. Both male and female respondents achieved a mean intake

below 40% of recommended intake (1000mg/day) by RNI (2017). The DCI of respondents were summarized in Table 4.6 and Figure 4.3.

Table 4.6: Dietary calcium intake of respondents (n=165).

Variable	Total n (%)	Gender		p-value
		Male n (%)	Female n (%)	
Dietary calcium intake (mg/day)				0.914
Low	153 (92.7)	87 (90.6)	66 (95.7)	
Inadequate	12 (7.3)	9 (9.4)	3 (4.3)	
Adequate	-	-	-	
Mean±SD	369.5±83.54	370.3±79.63	368.9±86.64	

*p-value < 0.05 is significant. SD: standard deviation.

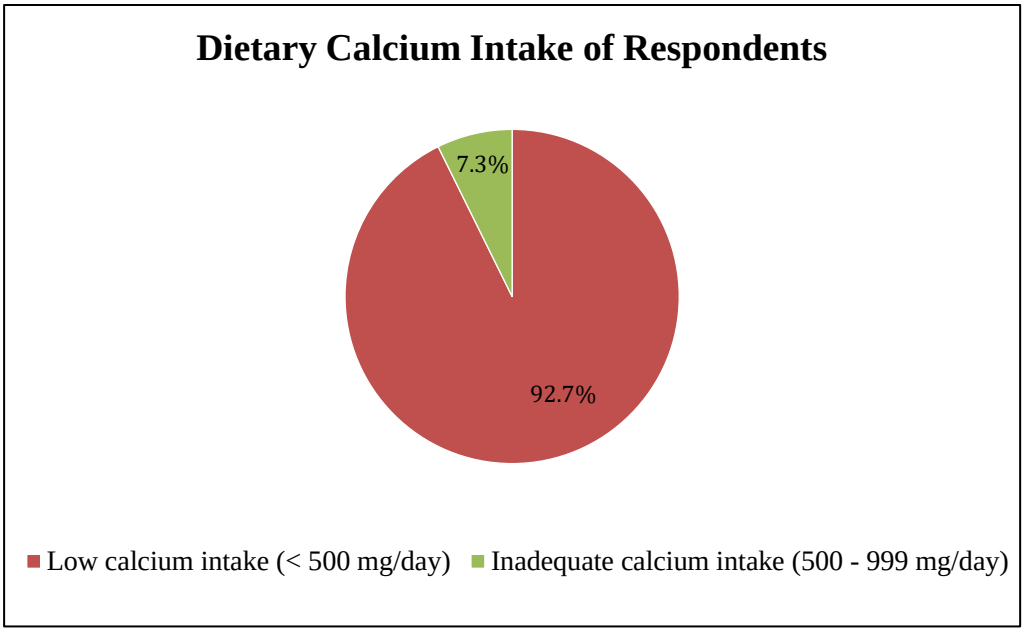

Figure 4.3: Dietary calcium intake of respondents (n=165).

4.6 Difference in DCI among Knowledge Levels of Respondents

4.6.1 DCI among Osteoporosis Knowledge Levels

Osteoporosis knowledge among respondents was categorized as poor, fair and good. Poor knowledge was defined as a total score of <60% whereas fair knowledge was 60%-80% of the total score and good knowledge was >80% of the total score. In order to investigate whether levels of osteoporosis knowledge influenced calcium intake, a one-way ANOVA test was performed. One-way ANOVA is used when there are one categorical independent variable and one quantitative variable in which the independent variable must have at least three levels. 95% statistical significance level was applied with $\alpha = 0.05$.

Table 4.7 described the difference in DCI among different knowledge levels of respondents. A higher calcium intake was observed among respondents with good knowledge (429.3±83.54) compared to those with fair knowledge (364.8±71.87) and poor knowledge (288.5±58.74). A significant association was found between knowledge levels and calcium intake ($p<0.05$). Hence, it was concluded that osteoporosis knowledge did play a significant role in affecting calcium intake.

Table 4.7: The difference in DCI among osteoporosis knowledge levels.

	DCI (mg/day)	**p-value**
	Mean±SD	
Knowledge level		0.001
Poor	288.5±58.74	
Fair	364.8±71.87	
Good	429.3±83.54	

*p-value < 0.05 is significant. DCI: dietary calcium intake, SD: standard deviation.

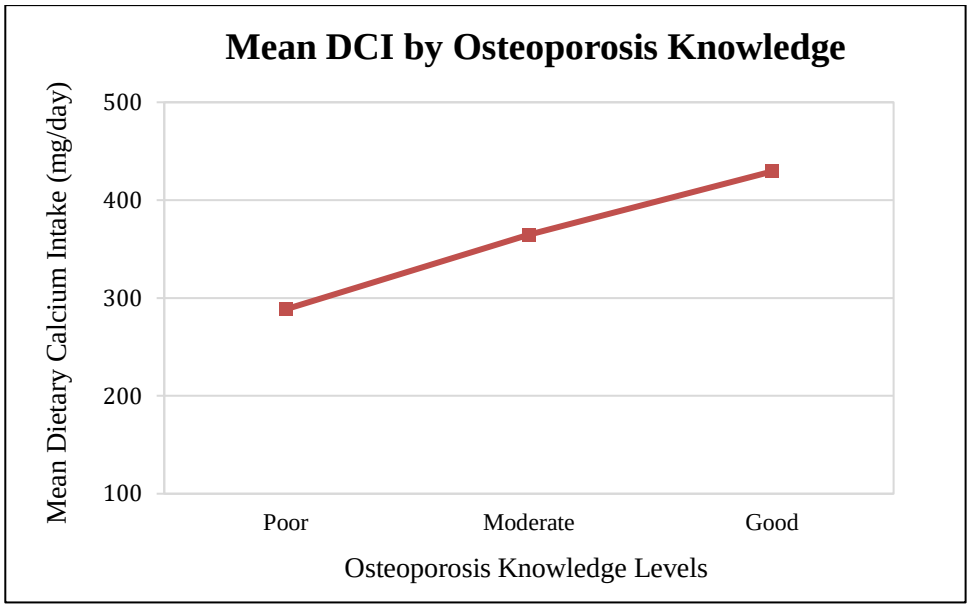

Figure 4.4: Mean DCI by osteoporosis knowledge levels.

4.6.2 DCI between Calcium Knowledge Levels

The results of calcium knowledge among participants were categorized into two levels. Poor knowledge indicated a total score below the mean value (23.9), while good knowledge indicated a total score greater than the mean value. Given a two-level categorical variable and one continuous variable, an independent t-test was conducted to assess whether there is a significant difference between the means in calcium knowledge and calcium intake. The statistical significance level was set at 95% and $\alpha = 0.05$.

Based on Table 4.8, a good calcium knowledge level demonstrated a higher calcium intake (412.4±76.16) compared to a poor calcium knowledge level (319.2±60.86). The result also proved a statistically significant difference between calcium knowledge levels and calcium intake with a p-value of < 0.05. Thus, it could be defined that degree of knowledge could influence the dietary calcium intake among the respondents.

Table 4.8: The difference in DCI among calcium knowledge levels.

	DCI (mg/day)	p-value
	Mean±SD	
Knowledge level		<0.001
Poor	319.2±60.86	
Good	412.4±76.16	

*p-value < 0.05 is significant. DCI: dietary calcium intake, SD: standard deviation.

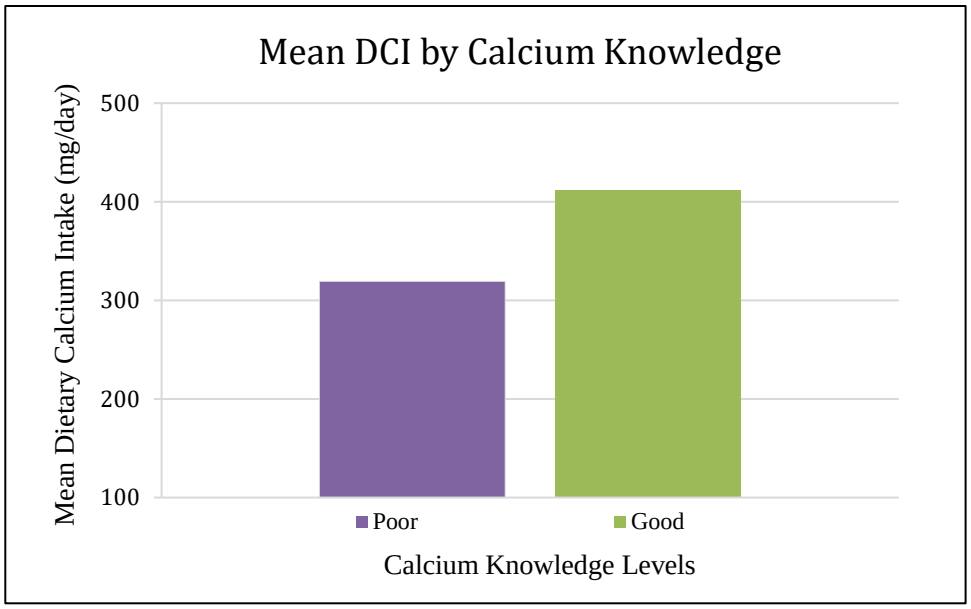

Figure 4.5: Mean DCI by Calcium Knowledge Levels.

4.7 Association between Osteoporosis Knowledge, Calcium Knowledge and Dietary Calcium Intake

The association between bone health knowledge, calcium knowledge and calcium intake were determined using the Pearson correlation analysis. Based on Table 4.9, Pearson's correlation coefficient revealed a moderate positive correlation (r = 0.587) between osteoporosis knowledge and calcium knowledge with a p-value of <0.001. A significant moderate positive correlation indicated a linear relationship between the two variables. In another word, osteoporosis

knowledge would increase as the calcium knowledge increased among students, but the relationship between them was moderate.

Moreover, the results of Pearson correlation coefficients suggested an association between knowledge and dietary calcium intake. A significant moderate positive correlation ($r = 0.475$, $p<0.001$) was found between osteoporosis knowledge and dietary calcium intake. Hence, it was assumed that better osteoporosis knowledge would contribute to an increased calcium intake. Similarly, calcium knowledge was found to associate with dietary calcium intake with a moderate positive correlation coefficient ($r=0.533$, $p<0.001$). The dietary calcium intake increased as the knowledge of calcium increased. Overall, it was reported that the higher the knowledge, the higher the calcium intake among respondents.

Table 4.9: Association between osteoporosis knowledge, calcium knowledge and dietary calcium intake.

	1		2		3	
	r	P-value	r	P-value	r	P-value
1. OK		-				
2. CK	0.587	<0.001		-		
3. DCI	0.475	<0.001	0.544	<0.001		-

*p-value < 0.05 is significant. OK: osteoporosis knowledge, CK: calcium knowledge, DCI: dietary calcium intake.

CHAPTER 5

DISCUSSION

5.0 Chapter Overview

In this section, the data from the previous chapter will be interpreted and described thoroughly along with valid justifications. The significance of the findings will be discussed relating to previous literature and research questions.

5.1 Sociodemographic Characteristics

In this study, more than half of the respondents were female (n=96) in which the ratio of male to female respondents was 1:1.4. A higher response rate among females was observed, corresponding to past research reflected women were more likely to respond to the online survey (Smith, 2008). Besides, a majority of the respondents were Chinese aged between 21 to 25 years old and were in their third-year pursuing study at UTAR Kampar campus. In terms of faculty, Faculty of Science (FSc) students took a large proportion because they were more reachable and were likely to have an interest in the health-related survey (Bovijn, Esterhuizen and Schalkwyk 2017). Also, more than 80% of respondents disclosed that they had never been diagnosed with osteoporosis or experienced fractures. This indicated no bone-related medical history and most students had healthy bone strength and density.

5.2 Osteoporosis Knowledge of Respondents

The current study revealed a moderate knowledge toward osteoporosis with an average score of 34.6 among 165 respondents. The finding was aligned with

previous research conducted among young adults in Malaysia and other countries (Chen et al., 2012; Althobiti, Al-Nagshabandi and Mohamed, 2020; Chiang and Ahmad-Jamal, 2020; Chan et al., 2021). In contrast, there were studies demonstrated an even lower knowledge of osteoporosis among university students (Bilal et al., 2017; Amin et al., 2018; Cheng et al., 2020). The disparities in the knowledge among populations were likely associated with the type of education and positive family history of osteoporosis. Khan et al. (2014) proved a higher osteoporosis knowledge among students from the science stream compared to students with an applied or pure art background. Individuals with a family history of osteoporosis would be exposed to more information such as from mothers and relatives, contributing to a higher comprehension (Wahba et al., 2010; Al-Muraikhi et al., 2017). Besides, this study indicated a significant difference in knowledge across gender. The finding that females were better-informed than males was consistent with several prior studies (Yeap, Goh and Gupta, 2010; Leng, Ali and Yusof, 2017; Ramli, Rahman and Haque, 2018). This can be justified as women might have better ideas and awareness about osteoporosis as they are more prone to the disease (Chan et al., 2019).

Overall, the understanding of the general aspects of osteoporosis was satisfactory. A majority of respondents were aware of osteoporosis may occur while aging as well as possible complications including fractures, tooth loss and Dowager's hump. It was a good sign that students knew bone diseases are preventable (61.8%) and the most critical period to attain maximum bone density was during adolescence until young adulthood (62.4%). The observation was parallel to several studies conducted among university students (Tayel et al.,

2013; Al-Naggar et al., 2016). However, more than half of the respondents failed to identify there are no symptoms and treatment for osteoporosis unlike osteoarthritis, similar to previous research (Chan et al., 2021). This can be explained as most participants (87%) have never been diagnosed with osteoporosis and they are clueless about the clinical manifestations.

With regard to risk factors, a majority of respondents answered correctly that old age, family history, soft drinks intake, sedentary lifestyle and smoking habit would contribute to osteoporosis. On the contrary, the present study discovered that nearly half of the students were unaware of the effects of prolonged use of glucocorticoids and high sodium intake on bone health. Similar results obtained by Tayel et al. (2013) observed a lack of knowledge among Egypt students about these two particular risk factors. This finding induced an alarming need to educate students about the side effect of glucocorticoid as it is the primary cause of osteoporosis in the young generation (Briot and Roux, 2015).

In the prevention domain, the role of fatty fish consumption towards bone health was better recognized compared to intakes of vegetables, meat as well as alcohol. This might be because the target population in the study knew that fish are a good source of vitamin D and omega-3 fatty acids which aid in calcium absorption and prevent bone loss (Li et al., 2017). Besides, most students (58.8%) claimed that high-impact activities could prevent the particular disease. This finding coincided with the suggestions from the International Osteoporosis Foundation (IOF) (2022) which to practice weight-bearing and muscle strengthening exercises.

5.3 Calcium Knowledge of Respondents

Based on the result, the study population had a modest knowledge concerning calcium. The ratio of poor to good knowledge among the respondents was 1:1.2. This finding corresponded to prior research conducted in Bangladesh and Nigeria (Uddin et al., 2013; Folasire and Akinrinde, 2017). Most students were familiar with the benefits of calcium in bone health despite the disparities in ethnicity and cultural background. Meanwhile, a local study among university students by Sham et al. (2013) revealed a majority had low knowledge regarding dietary calcium intake, which contradicted the current findings. The differences in the knowledge were likely due to age as the prior research had a younger main age category of 19 to 22 years old. In addition, no significant difference in calcium knowledge was observed across gender in the present study. This could be justified as both males and females were at the same education level and thus had similar calcium knowledge.

Specifically, knowledge of dietary calcium intake was lower compared to the general understanding of calcium. A majority of respondents were unaware of the recommended nutrient intake as well as the tolerable upper intake level of calcium for their age. A similar observation was indicated by Folasire and Akinrinde (2017) as almost 90% of the target population did not know the amount of calcium that they should consume daily. Furthermore, there was only one-third of students in the study understood that smaller dosages of calcium supplements are better absorbed in the human body. This result corroborated Marcinow (2015), who suggested a knowledge reinforcement among young

adults to induce greater nutrition literacy and promote higher adherence to adequate calcium intake.

5.4 Dietary Calcium Intake of Respondents

This study reported a low dietary calcium consumption among UTAR students with an average calcium intake of 369.5 ± 83.54 mg/day. This result was consistent with previous studies conducted among undergraduate students in Universiti Malaysia Terengganu as well as the International Islamic University Malaysia in Kuantan. The mean estimated calcium intake of students from the two universities was 348.3 ± 235.1 mg/day and 377.93 ± 179.08 mg/day, respectively (Yap et al., 2019; Azhar and Jaafar, 2020). In comparison with the RNI (2017), the mean calcium intake of the students only achieved about 37% of the proposed daily requirement, which was 1000 mg/day for adults aged 20 to 49 years old.

Interestingly, all students who participated in this study did not meet the RNI for calcium. The result was comparable to Abdull-Hakim, Muniandy and Danish (2012) demonstrating more than 90% of students from Universiti Teknologi MARA (UiTM), Universiti Putra Malaysia (UPM), Universiti Selangor (UNISEL) and Management and Science University (MSU) did not attain the daily requirement for calcium as well. There was only 7% of UTAR students had a relatively higher calcium intake ranging between 500 to 999 mg/day while the remaining was below 500 mg/day. This alarmingly low calcium intake was associated with infrequent dairy product consumption among youngsters. A similar trend had been reported by the Malaysian Adult Nutrition Survey

(MANS) (2003) and (2008) in which Malaysians consumed an average of 0.14 servings of milk and dairy products daily and the highest intake frequency was found among the elderly rather than young adults. The possible reason for inadequate dairy intake was that students tend to skip breakfast (Yu et al, 2021). Commonly consumed calcium-rich breakfasts among Malaysians include breakfast cereals, hot or powdered beverages (e.g. Milo and Horlick) and high-fat milk (Mustafa et al., 2019) Hence, the habit of skipping breakfast can directly decrease the calcium intake. Besides, university students are busy with a constant schedule of lectures, assignments and examinations. They are having stress and are likely to consume less, resulting in a low nutrient intake including calcium (Cheng and Mohd-Kamil, 2020).

In addition, male students were observed with a slightly higher calcium consumption compared to female counterparts with a mean intake of 370.3±79.63 mg/day and 368.9±86.64 mg/day, respectively. Hence, this study suggested no significant difference in dietary calcium intake between genders. The result was aligned with previous studies conducted among students in local public universities, showing that genders had no impact on either cow's or soy milk consumption (Sham et al., 2013; Chan et al., 2021) On the contrary, contradictory findings were reported in older age group whereby women consumed more dairy products and calcium supplements than men. This could be justified as a majority of them were postmenopausal and more prone to osteoporosis, thus they used to consume more calcium (Chan et al., 2019). Taken together, this study proposed that the difference in calcium intake across genders is only affected by old age and disease susceptibility but not among young adults.

5.5 Difference in DCI between Knowledge Levels of Respondents

According to a prior study conducted in South Korea (Kim, 2018), higher knowledge of bone disorders was reported in the low caffeine intake group compared to the high caffeine intake group as students knew caffeine can induce increased loss of calcium through urination. Consistent finding was observed among adults in Iran, demonstrating those with higher health literacy level were less likely to consume fast food as they were well aware of the effects of unhealthy diets on their health (Namdar et al., 2021). Similarly, in the current study, the researcher noticed that UTAR students with good osteoporosis knowledge consumed more than 400 mg of calcium per day, comparatively higher than moderate and poor knowledge groups. The higher the osteoporosis knowledge, the greater the calcium intake. Participants with better osteoporosis knowledge acknowledged the importance of consuming high calcium and they were more willing to overcome the perceived barrier to calcium to prevent the disease (Chiang and Ahmad-Jamal, 2020).

Moreover, current study observed a significant difference in the dietary calcium intake between calcium knowledge levels. UTAR students with high calcium knowledge generally had a greater estimated calcium intake than those with poor comprehension. The result supported prior local research by Sham et al. (2013) indicating that a majority of university students had low perception and intake of calcium at the same time as evidenced by infrequent consumption of dairy products. A comparable observation was reported in research involving female university students in Egypt as those with lower calcium knowledge had infrequent consumption of calcium-rich food (Folasire and Akinrinde, 2017).

Taken together, these findings suggested that nutrition knowledge has a significant impact on diet quality (Geaney et al., 2015). A better understanding of nutrition can increase the perceived benefits of nutrients, which further improve eating patterns (Salahshoori et al., 2014; Scalvedi et al., 2021).

5.6 Association between Osteoporosis Knowledge, Calcium Knowledge and Dietary Calcium Intake

Based on the findings of the present study, osteoporosis knowledge was moderately correlated with calcium knowledge. Until now, there was no prior research had investigated the relationship between these two variables specifically. However, Chiang and Ahmad-Jamal (2020) did find a weak correlation (r=0.127) between osteoporosis knowledge scores and perceived benefits of calcium. Relevant research conducted in MSU, Malaysia also revealed an association between knowledge of disease and knowledge in choosing food (Selvamoney and Abdalqader, 2019). Thus, it was justified as when people were getting information regarding certain diseases, at the same time, they were likely exposed to relevant dietary prevention knowledge.

Osteoporosis knowledge can indirectly affect dietary calcium intake (Sharma et al., 2010). It was explained by previous studies in the US and Malaysia, showing that disease knowledge had an impact on calcium intake. But, the association between the two variables was considered weak (Enright and Bai, 2014; Chan et al., 2019). Contradicting these studies, the association between osteoporosis knowledge and dietary calcium intake in this study was significantly moderate. The positive correlation was justified as osteoporosis knowledge induced calcium self-efficacy, which in turn could affect calcium consumption. Having

calcium self-efficacy can result in a continuous commitment to increase calcium intake with the purpose to build peak bone density and prevent the disease in later life (Azhar and Jaafar, 2020). The discrepancy in the strengths of correlation was likely due to the different ethnicity and age group of the target population involved.

In terms of knowledge and practice of calcium, results from Folasire and Akinrinde (2017) reported no significant association between calcium knowledge and food intake frequency including legumes, meat, dairy products, seafoods and cereals. Similarly, relevant studies by Sham et al. (2013) and Azhar and Jaafar (2020) also claimed that there was no association between calcium knowledge and intake of calcium-rich food among local university students. However, these findings were not consistent with the current study showing a significant moderate positive correlation between the variables. The researcher found that good calcium knowledge would contribute to increased dietary calcium intake. In other words, people with high calcium knowledge are mostly aware of the food sources and daily requirement of calcium, thus they tend to consume more. The disparities in the findings were likely because prior research was conducted in a foreign country. Besides, present study examined the consumption of foods that accounted for 90% of the calcium intake of the Malaysian population, unlike prior research that measured the intake of particular calcium-rich food.

5.7 Strengths and Limitations of Study

With regards to the strengths of the study, current study applied validated questionnaires to assess the osteoporosis knowledge, calcium knowledge and dietary calcium intake among UTAR students in Kampar campus. Validated questionnaires are particularly crucial to ensure the data collected would show good reliability and are not subject to measurement error.

Despite the strengths, the researcher acknowledged several limitations in the study. Since the study was a cross-sectional design, data were collected at a single point. Thus, the associations between variables were not determined longitudinally. In addition, the convenience sampling method was used thus there could be a selection bias. Also, there was no equal representation of the target population. Most respondents were female, Chinese and from the Faculty of Science. Thus, the results lacked generalization to represent the Malaysian population with various ethnicities. Moreover, the survey was distributed online with self-administered questionnaires. There was a high possibility of underreporting as well as recall bias, especially during the dietary calcium intake section. Furthermore, the short calcium FFQ applied in the study might result in inaccurate estimates of daily calcium intake as not all types of food were included. Anyhow, it was preferred over 24-hour dietary recall or detailed FFQ in the current study due to the limitation of physical contact during COVID-19 and to avoid a high dropout rate.

5.8 Future Recommendations

Future studies are recommended to determine the long-term cause and effect relationship between dietary calcium intake with osteoporosis knowledge and calcium knowledge. Longitudinal studies can be conducted to prospectively monitor a cohort of university students to measure their knowledge levels and their effect on dietary calcium intake over time. Instead of convenience sampling, the random sampling method is used to avoid selection bias. Participants in selected groups will be chosen randomly to make generalizations of the target population. In addition, a face-to-face interview is conducted to replace an online self-administrated survey if the circumstances allow. This is because the interview is guided and there will be higher accuracy in the results. A three-day food record or detailed FFQ comprising various food from all food groups is also recommended. These assessments are better at estimating one's usual diet, thereby inducing a more accurate measure of daily calcium intake. Lastly, it is advised to include more socio-demographic data as calcium intake might be influenced by characteristics such as food accessibility, socio-economic status and lactose intolerance.

CHAPTER 6

CONCLUSION

Participants in this study had moderate osteoporosis knowledge and good calcium knowledge levels. Females were more knowledgeable compared to their male counterparts with a significant difference observed in osteoporosis knowledge ($p<0.05$), but not in calcium knowledge. In terms of dietary calcium intake, UTAR Kampar students had an average calcium intake of 369.5±83.54 mg/day, below 40% of the daily calcium requirement (1000 mg/day) proposed by RNI, 2017. The dietary calcium intake was considered low with no participants meeting the requirement. Male students had higher calcium intake than female students but no significant difference was found. For the difference between dietary calcium intake and knowledge levels, those with good osteoporosis knowledge had the highest calcium intake among knowledge categories. Similarly, students with good calcium knowledge had a higher calcium intake than those with poor knowledge. Overall, there was a significant association between osteoporosis knowledge, calcium knowledge and dietary calcium intake. All three variables were reported to be correlated moderately.

Introducing sufficient knowledge and promoting calcium intake in the early years of life is an important step toward reducing osteoporosis risks. Future educational programmes such as nutrition seminars and workshops should be organized by university authorities to deliver information such as risk factors and complications of osteoporosis, benefits of adequate calcium intake and daily calcium requirement. Besides, public health authorities can utilize social media

platforms to disseminate information on excellent calcium sources and to increase osteoporosis awareness as university students have high accessibility to the internet. Altogether, these interventions help promote calcium intake among young adults to achieve peak bone density and prevent osteoporosis later in life. As recommendations, future research can explore other personal or environmental factors that affect the dietary calcium intake among university students.

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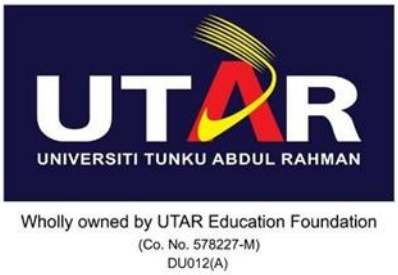
APPENDICES

APPENDIX A

Ethical Approval Letter

APPENDIX B



Universiti Tunku Abdul Rahman
Jalan Universiti, Bandar Barat, 31900 Kampar, Perak

Title: Knowledge of Osteoporosis and Calcium and Its Association with Dietary Calcium Intake among Students in Universiti Tunku Abdul Rahman (UTAR), Kampar

Survey Questionnaire

Dear participants,

I am Tan Hui Ning (Y3S2), currently taking Bachelor of Science (Honours) Dietetics. I am doing my Final Year Project (FYP) which is entitled Knowledge of Osteoporosis and Calcium and Its Association with Dietary Calcium Intake among Students in Universiti Tunku Abdul Rahman (UTAR), Kampar. I would like to invite you to participate in this research survey.

This questionnaire is aimed to assess the knowledge of osteoporosis and calcium and its association with dietary calcium intake among UTAR students in Kampar campus.

This questionnaire consists of four sections:
Section A: Sociodemographic Information
Section B: Bone Health and Osteoporosis Knowledge
Section C: Calcium Knowledge
Section D: Food Frequency Questionnaire (FFQ)

To participate, all the following criteria must be fulfilled:

1. Foundation or undergraduate students in UTAR, Kampar campus
2. Aged 18-30 years old
3. Malaysian

Estimated time for completion: 10 – 15 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 analyzed 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: t.h.n0113@gmail.com/ thn0113@1utar.my
WhatsApp: +6016-7277929

Consent

1. By submitting this form you hereby authorize and consent to us processing (including disclosing) your personal data and any updates of your information, for the purposes and/or for any other purposes related to the purpose.

2. 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 fulfill 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.

1. Acknowledgment of notice
    - I have been notified by you and that I hereby understood, consented and agreed to per UTAR above notice.
    - I disagree, my personal data will not be processed.

2. Exclusion Criteria
    - International students
    - UTAR students enrolled in the Sungai Long campus
    - UTAR staff

    Have you met any of these criteria?
    - Yes (Unfortunately, you did not fulfill the criteria of the study. Thank you for your precious time.)
    - No

Section A: Sociodemographic Information

In this section, I would like to collect some of your personal information. There is a total of six questions in this section and you are required to choose one option for each question.

Characteristics	**Options**
Gender	o Male o Female
Ethnicity	o Chinese o Malay o Indian o Other: _____
Age	o 18 – 20 o 21 – 25 o 26 - 30
Faculty	o Faculty of Engineering and Green Technology o Faculty of Information and Communication Technology o Faculty of Science o Faculty of Business and Finance o Faculty of Arts and Social Science o Institute of Chinese Studies o Centre for Foundation Studies
Year of Study	o Year 1 o Year 2 o Year 3 o Year 4
Personal history	Have you ever experienced a fracture or been diagnosed with osteoporosis? o Yes o No

Section B: Bone Health and Osteoporosis Knowledge Questionnaire

There is a total of 24 questions in this section, including:
Question 1-9 regarding general knowledge of bone health and osteoporosis;
Question 10-17 regarding the risk factors of osteoporosis;
Question 18-24 regarding lifestyle preventive behaviors of osteoporosis.

Please choose one option for each question below based on your understanding.

Questions	**Options**		
General knowledge	True	False	I don't know
Peak bone mass (PBM) is reached during late adolescence and young adulthood.			
As aging, the bone loses its strength, bone diseases are likely to develop.			
Both osteoporosis and osteoarthritis are preventable while one's getting old.			
Unlike osteoarthritis, osteoporosis may show no symptoms.			
Dowager's hump is one of the signs of osteoporosis.			
A bone mineral density test can be used to diagnose osteoporosis.			
Men are less likely to develop osteoporosis even though they have larger skeletons than women.			
People with osteoporosis are more likely to experience tooth loss and fragility fractures.			
There is no cure for osteoporosis.			

Questions	Options		
Risk factors	True	False	I don’t know
Old age			
Family history			
Sedentary lifestyle			
Long-term use of glucocorticoids			
High sodium intake			
High consumption of tea and coffee drinks			
Habitual soft drinks consumption			
Smoking			

Questions	Options		
Lifestyle preventive behaviors	True	False	I don’t know
High-impact exercises (e.g. weight bearing)			
Consumption of fish (e.g. tuna and salmon)			
Increase consumption of green vegetables			
Decrease consumption of meat and poultry			
Decrease consumption of alcohol			
Calcium supplements use			
Regular sun exposure			

Section C: Calcium Knowledge Questionnaire

There is a total of 16 questions in this section, including:
Question 1-7 regarding knowledge about calcium;
Question 8-16 regarding knowledge about dietary calcium intake.

Please choose one option for each question below based on your understanding.

Questions	**Options**		
Knowledge about calcium	True	False	I don't know
Calcium and vitamin D are important for bone health			
Vitamin D helps to absorb and regulates calcium in the blood			
99% of total body calcium is stored in bone			
Calcium must be obtained from the diet			
Dietary calcium deficiency causes our body to take calcium from bones			
Calcium level is maintained by hormones (e.g. calcitonin)			
Calcium is eliminated through skins, nails, hair, sweat, urine and feces			

Questions	Options		
Knowledge about dietary calcium intake	True	False	I don't know
Adequate calcium intake aids in strengthening bones, joints and teeth			
The RNI for calcium differs between genders among age groups			
The RNI for calcium among adults aged 20-30 years is 1000 mg/day			
The UL for calcium among adults aged 19-30 years is 2500 mg/day			
Excessive calcium intake may lead to kidney stones			
Dairy products are excellent sources of calcium			
An adult's daily calcium requirement is fulfilled by 3 glasses of milk			
Calcium supplements are best absorbed when consumed in small doses			
Calcium tablets interact with other medications when taken together			

Section D: Food Frequency Questionnaire (FFQ)

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 one serving of milk once a week in the past month, please indicate '1' in the 'weekly' frequency. Meanwhile, if you didn't consume the particular food in the previous month, please indicate '0' in the 'monthly' frequency.

Types of food	Usual serving size	Frequency		
		Daily	Weekly	Monthly
Milk and milk products				
Milk	1 glass			
Milk powder	2 dessertspoons			
Condensed milk	1 dessertspoon			
Ice cream (milk-based)	1 small scoop			
Sliced cheese	1 slice			
Yogurt	1 small tub			
Cultured milk (Yakult)	1 bottle			
Butter	1 dessertspoon			
Margarine	1 dessertspoon			
Soybean milk	1 glass			
Cereal and cereal products				
Noodles	1 medium plate			
Rice	1 chinese bowl			
Pizza	1 large wedge			
White bread	2 slices			
Bun	1 bun			
Biscuit	3 pieces			
Fish and seafoods				
Anchovy	1 dessertspoon			
Tuna/sardine	1 dessertspoon			
Fish (grilled/fried)	1 whole, small			
Poultry, meat and egg				
Chicken (fried)	1 piece			
Chicken (curry/kicap)	1 piece			
Nugget	3 pieces			
Egg	1 whole			
Beef/mutton	1 palm size			

Vegetables				
Leafy vegetables	3 tablespoons			
Non-leafy vegetables	3 tablespoons			
Others				
Fruits (orange)	1 whole			
Kuih (doughnut)	1 piece			
Beverage				
Cocoa-based drink (Milo)	1 glass			
Malted/cereal-based drink (Horlick)	1 glass			

Very much appreciate for your participation.

Thank you for your precious time.

Appendix C

FFQ Calculator

FFQ Calculator

Food item	Usual serving size	Calcium content per serving (mg)	Frequency of Per day (1)	Per week	Per week (?/7)	Per month	Per month (?/30)	Daily calcium intake (mg/day)	Weekly calcium intake (mg/day)	Monthly calcium intake (mg/day)
Milk and milk products										
Milk	1 glass (200 ml)	270.4			0.00		0.00	0.00	0.00	0.00
Milk powder	2 dessertspoons (35g)	221.4			0.00		0.00	0.00	0.00	0.00
Condensed milk	1 dessertspoons (20g)	66.2			0.00		0.00	0.00	0.00	0.00
Ice-cream, milk based	1 scoop (60g)	66.5			0.00		0.00	0.00	0.00	0.00
Sliced cheese	1 slice (21g)	103			0.00		0.00	0.00	0.00	0.00
Plain yogurt	1 small tub (60g)	136			0.00		0.00	0.00	0.00	0.00
Cultured milk (yakult)	1 bottle (80ml)	40			0.00		0.00	0.00	0.00	0.00
Butter	1 dessertspoons (10g)	1.6			0.00		0.00	0.00	0.00	0.00
Margarine	1 desserspoons (15g)	2			0.00		0.00	0.00	0.00	0.00
Soybean milk	1 glass (200 ml)	38.1			0.00		0.00	0.00	0.00	0.00
Cereal and cereal products										
Noodles	1 plate (251g)	47.8			0.00		0.00	0.00	0.00	0.00
Rice	2 scoops (109g)	3.3			0.00		0.00	0.00	0.00	0.00
Pizza	1 large wedge (100g)	85			0.00		0.00	0.00	0.00	0.00
White bread	2 slices (58g)	22.4			0.00		0.00	0.00	0.00	0.00
Bun	1 bun (35g)	33.3			0.00		0.00	0.00	0.00	0.00
Biscuit	3 pieces (24g)	5.1			0.00		0.00	0.00	0.00	0.00
Fish and seafoods										
Anchovy	1 dessertspoon (6g)	23.7			0.00		0.00	0.00	0.00	0.00
Tuna/sardine	1 dessertspoon (35g)	70.3			0.00		0.00	0.00	0.00	0.00
Fish (grilled/fried)	1 whole (110g)	42			0.00		0.00	0.00	0.00	0.00
Poultry, meat and egg										
Chicken (fried)	1 piece (154g)	249.8			0.00		0.00	0.00	0.00	0.00
Chicken (curry/kicap)	1 piece (125g)	51.4			0.00		0.00	0.00	0.00	0.00
Nugget	3 pieces (52g)	54			0.00		0.00	0.00	0.00	0.00
Egg	1 whole (53g)	30.3			0.00		0.00	0.00	0.00	0.00
Beef/mutton	1 palm size (47g)	10.4			0.00		0.00	0.00	0.00	0.00
Vegetables										
Leafy vegetables	1 scoop (44g)	55.3			0.00		0.00	0.00	0.00	0.00
Non-leafy vegetables	1 scoop (42g)	5.9			0.00		0.00	0.00	0.00	0.00
Others										
Fruits (orange)	1 whole/ piece (144g)	57.4			0.00		0.00	0.00	0.00	0.00
Kuih (doughnut)	1 piece (64g)	30.1			0.00		0.00	0.00	0.00	0.00
Beverage										
Cocoa-based drink	1 glass (200 ml)	104			0.00		0.00	0.00	0.00	0.00
Malted/cereal based drink	1 glass (200 ml)	188.4			0.00		0.00	0.00	0.00	0.00
							TOTAL	0.00	0.00	0.00
							SUM TOTAL		0.00	

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ID Number(s)	18ADB03815
Programme / Course	BACHELOR OF SCIENCE (HONOURS) DIETETICS
Title of Final Year Project	KNOWLEDGE OF OSTEOPOROSIS AND CALCIUM AND ITS ASSOCIATION WITH DIETARY CALCIUM INTAKE AMONG STUDENTS IN UNIVERSITI TUNKU ABDUL RAHMAN (UTAR), KAMPAR

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