talenta PUBLISHER

**CARING:**
Indonesian Journal of Nursing Science

# Knowledge and Awareness Regarding Osteoporosis Among A Selected Community of Miri, Sarawak

*Bit-Lian YEE[1]*, Agatha Christeeble Anak PADANG[2], Lay-Khim GOH[2], Saedah MUDA[1]*

[1]*Open University Malaysia, Cluster of Health Sciences, Petaling Jaya Learning Center, 46350 Petaling Jaya, Malaysia*

[2]*International Medical University, School of Health Sciences, Bukit Jalil, 57000 Kuala Lumpur, Malaysia*

**Abstract.** Osteoporosis is one of the diseases concerned and has been identified as significantly increasing the progression of aging globally. The incidence of total hip fracture cases associated with osteoporosis is expected to increase because of the rise in the prevalence of the elderly as an effect on high life expectancy and good health services quality. Therefore, this study's main objective is to investigate the level of knowledge and awareness of osteoporosis among the public in Sarawak, Malaysia. This cross-sectional study was conducted to 224 public respondents. We used a questionnaire on knowledge, attitude, and practices by Tripathi and colleagues. Results of this study indicated that demographic variables gender and educational level had a significant association with the level of knowledge among the public but not for the age, race, marital status, occupational and household income variables. In conclusion, this study revealed that most respondents presented with high knowledge and a high level of awareness regarding osteoporosis disease. It is recommended that local authorities continue the effort regarding health promotion on issues surrounding osteoporosis.

**Keywords:** awareness; cross-sectional; knowledge; osteoporosis; prevalence; public

Received 10th May 2022 | Revised 24th July 2022 | Accepted 31th July 2022

*Corresponding author at: *Open University Malaysia, Cluster of Health Sciences, Petaling Jaya Learning Center, 46350 Petaling Jaya, Malaysia.*

E-mail address: yeebl@oum.edu.my


Published by Talenta Publisher
e-ISSN: 2685-7162
Journal Homepage: https://talenta.usu.ac.id/IJNS

## 1. Introduction

Evidence shows that osteoporosis is not only a major cause of fractures; it also ranks high among diseases that cause people to become bedridden with serious complications. These complications may be life-threatening in elderly people. Because of the morbid consequences of osteoporosis, the prevention of this disease and its associated fractures is considered essential to the maintenance of health, life quality, and independence in the elderly population.

Brooke-Wavell et al. (2022) discover that osteoporosis affects an enormous number of people of both sexes and all races, and its prevalence will increase as the population ages. Another study by Alswat (2017) reveals almost the same finding. Among various risk factors identified for osteoporosis are age, gender, a prior fracture, family history of fractures, and lifestyle-related risk factors such as physical inactivity and smoking. Its occurrence is four times more common in women than in men. A similar study by McCloskey et al. (2021) finds that the risk of osteoporosis is related to genetic and environmental factors. Besides gender, age, body mass index (BMI), alcohol consumption, smoking, inadequate calcium intake, and insufficient physical activity are associated with an increased risk of osteoporosis and osteoporotic fractures. Although osteoporosis can result in devastating physical, psychosocial, and economic consequences, it is, however, can be prevented, diagnosed, and treated before fractures occur. Hence, knowledge and awareness of all aspects of osteoporosis is highly significant to all groups of the community, in particular, before they reach 50.

Osteoporosis regards as a "silent" systemic skeletal disease because it is an invisible and painless disease process (Samia et al., 2017). Osteoporosis is characterized by progressive systemic impairment of bone mass and microarchitecture, leading to bone fragility and increasing the risk for bone fracture, especially at the wrist, hip, and spine (Cheng et al., 2020; Ramli et al., 2018; Samia et al., 2017). Fractures associated with osteoporosis have been recognized as a global health issue in the elderly (Amin & Mukti, 2017), which increase morbidity and mortality such as causing pain, disability, loss of independence, and decreased quality of life (Amin & Mukti, 2017; Ramli et al., 2018; Samia et al., 2017). In 2005. the prevalence of osteoporosis in Malaysia was reported as 24.1% (Amin & Mukti, 2017; Cheng et al., 2020; Ramli et al., 2018). Osteoporosis is associated with modifiable and non-modifiable risk factors. Modifiable risk factors include low calcium and/or vitamin D intake, a sedentary lifestyle, cigarette, alcohol, caffeine, and estrogen deficiency. Whereases, non-modifiable risk factors include female gender, aging, family history, Chinese ethnic group, premature menopause, and history of fracture (Chan et al., 2019; Cheng et al., 2020; Ramli et al., 2018; Samia et al., 2017). Critical understanding of the individual knowledge, perception, and beliefs about osteoporosis effectively motivates lifestyle choices for better bone health, which could effectively prevent the occurrence of fractures related to osteoporosis (Chan et al., 2019). Several studies were done to examine the level of knowledge and belief regarding osteoporosis in West Malaysia (Amin, S., Mukti, 2017; Chan et al., 2019; Cheng et al., 2020; Leng et al., 2017; Ramli et al., 2018) and the limited study was done in East Malaysia. This study is focused on a randomly selected community of Miri, Sarawak, to explore to what extent their knowledge and awareness of osteoporosis.

## 2. Research Methods

A cross-sectional descriptive study design was used in this study. Two public shopping malls were selected for data collection for this study: Permaisuri Mall and Bintang Mall in Miri, Sarawak. These two sites are chosen because they are the most visited malls compared to other shopping malls in Miri and are suitable to meet this study's target sample. The population selected for this study is the general adult public population available in the main city of Miri, Sarawak. According to the administration of both Permaisuri Mall and Bintang Mall, the daily number of visitors in Permaisuri Mall is 800 – 1000 people, and Bintang Mall has been 700 – 900 people during Malaysian Movement Control Order (MCO) since March 2020. As for this study purpose, daily statistics on visitors from two malls are added and divided, and the final total was added to find the total number of samples needed for this study. The final population sample size is 500 samples for this study.

Non-probability sampling methods with a simple random population sampling from two selected malls. Of 224 participants, 112 were selected from Permaisuri Mall, and the balance of 112 participants was selected from Bintang Mall in Miri town, Sarawak. The first month of data collection was conducted in Permaisuri Mall with a target of 25 respondents for one week, and five weeks were needed to select 112 respondents in Permaisuri Mall. Then, the next five weeks were conducted in Bintang Mall to get 112 respondents with the same range of target samples of 25 per week. Before selecting the target samples, convenience sampling was applied to recruit apparently from each shopping mall to meet the target sample. Based on the Raosoft calculation method, the margin error is 5%, with a 95% confidence level and 50% response distribution. Therefore, the final total sample collected for this study is 224 participants.

A set of self-administrated questionnaires was used in the study. The questionnaire was written in English and Bahasa Melayu. The instrument tool for this study comprises three sections. Section A was Socio-Demographic Characteristics. This section consists only of the participants' age groups, professions, and work years. Section B was Knowledge on Osteoporosis Inventory. This part was from knowledge of osteoporosis among women in Alexandria (Egypt): A community-based survey by El-Tawab et al. (2016). The original researcher granted permission to adapt the questionnaire. Knowledge content validity of 0.87 and internal consistency reliability of 0.76 El-Tawab et al. (2016). Knowledge on osteoporosis questionnaires consists of 20 items measured using three points Likert-scale ranging from *yes* (1), *no* (2), and *don't know* (3). Knowledge scores are obtained by reversing the scores on the six negative items (1,3,11,12, 16, and 18) and then summing all 20 items. Total scale scores may range from 1 to 20. Each favorable answer given by a participant was given one point, then the points were calculated for each participant based on a scale of Knowledge: High (>10 points) and Low (<10 points). A wrong answer and not sure is valued as zero point in this study (El-Tawab et al., 2016). The highest score indicates a high level of knowledge, and the lowest score indicates a low level of work knowledge on osteoporosis.

Section C was Awareness on Osteoporosis. Questionnaire of this section was adapted by using previously tested questionnaire in the literature: Knowledge, attitude and practice about osteoporosis in South-Western Saudi Arabia: A cross sectional survey by Tripathi et al., 2019). Permission to adapt the questionnaire was granted from the original researcher. This questionnaire consist of 12 items was developed and structured specifically to fulfill the requirement to assess level of awareness among public on osteoporosis. Level of awareness questionnaire consists of 12 items assessing awareness which measured by two-point Likert scale: Yes (1) and No (2). Each Yes answer given by participant was given one point, then the points were calculated for each participant based on scale of Awareness: High (>7 points) and Low (<6 points) (Tripathi et al., 2018). The content of each item was entered and calculated on Cronbach's alpha test with result of high of Cronbach's alpha coefficient (0.80) (Tripathi et al., 2019). However, for this study, reliability is accepted with Cronbach alpha value of 0.86.

A pilot study was carried out for one week in December 2020 with 30 respondents. They were excluded from the main study. Cronbach's alpha test result was greater than 0.70. The experts reviewed the content validity of the adapted questionnaire: Consultant Orthopaedic and Trauma Surgeon (Miri Hospital) and Senior Orthopaedic Trained Nurse (Miri Hospital) for its content and relevance. All data entered in inter-item reliability and tested for consistency items. The final analysis found the reliability of this questionnaire accepted with a Cronbach alpha value of 0.86.

Research ethical approval was obtained from the Research and Ethics Committee of the International Medical University with registration (BN I/2020(PR-41)). A permission letter was also obtained to collect data at Permaisuri Mall and Bintang Mall, Miri Sarawak. A self-administered questionnaire in English and Malay was distributed to 112 respondents in Permaisuri Mall and 112 in Bintang Mall Miri, Sarawak. The data collection was about ten weeks, from December 2020 to February 2021. After a detailed explanation of the research purpose and the respondents agreed to participate in the research voluntarily, a copy of the consent form was given and signed by the respondents before handing it over to the researcher. Once the respondent signed consent, a questionnaire via Google Form Questionnaire was sent via Whats App mobile apps. A hard copy of the questionnaire was given to respondents who had no internet access and requested to answer on paper rather than in a softcopy format. All collected hard copy questionnaires were collected and sealed into envelope files for confidentiality.

## 3. Research Results

### a. Demographic Data

The total number of respondents was 224, with a 100% answer rate. Table 4.2.1 summarizes participants' socio-demographic characteristics.

**Table 1** Participants' Demographic Characteristics (n=224)

| Demographic Characteristics | Frequency (n) | Percent (%) |
|---|---|---|
| **Age** | | |
| Below 27 years | 26 | 11.60% |
| 28-37 years | 85 | 37.95% |
| 38-47 years | 51 | 22.80% |
| 48-57 years | 49 | 21.87% |
| Above 58 years | 13 | 5.78% |
| Total | 224 | 100% |
| **Race** | | |
| Malay | 48 | 21.40% |
| Chinese | 17 | 7.60% |
| Indian | 4 | 1.80% |
| Sabah/Sarawak Bumiputera | 155 | 69.20% |
| Total | 224 | 100% |
| **Gender** | | |
| Male | 60 | 26.80% |
| Female | 164 | 73.20% |
| Total | 224 | 100% |
| **Educational Level** | | |
| No formal education | 0 | 0% |
| Primary School | 3 | 1.30% |
| Secondary School | 62 | 27.70% |
| Tertiary School | 159 | 71.00% |
| Total | 224 | 100% |
| **Occupational** | | |
| Government Servant | 154 | 68.80% |
| Private Sector | 48 | 21.40% |
| Self-employed | 15 | 6.70% |
| Non-working | 5 | 2.20% |
| Student | 2 | 0.90% |
| Total | 224 | 100% |
| **Household Income** | | |
| Below RM1000 | 5 | 2.20% |
| RM1000-RM2500 | 51 | 22.80% |
| RM2500-RM4000 | 78 | 34.80% |
| Above RM4000 | 90 | 40.20% |
| Total | 224 | 100% |

In this study, most participants are from the age range between 28 to 37 years old with 85 participants (37.95.00%), and the lowest participant above 58 years old with 13 participants (5.78%). The minimum age is 21, and the maximum age is 70 years old. The mean score for age is 39.43 (SD±10.672) years old. There were 48 participants (21.40%) in the Malay category, and most 155 participants were Sabah or Sarawak Bumiputera (69.20%).

Sixty participants (26.80%) were male, and 164 were female (73.20%). In this study, about 3 participants (1.30%) had attended primary education, 62 participants (27.70%) with secondary school with SPM achievement, and 159 participants (71.00%) had achieved tertiary level. The majority of 154 participants (68.80%) worked as a government servant, 48 participants (21.40%) in the private sector, 15 participants were self-employed (6.70%), and 5 participants were non-working (2.20%), and only 2 participants (0.90%) still studying. About 5 participants (2.20%) had income less than RM1000 per month, and most of the participants, 90 (40.20%), had an average of RM4000 and above monthly income.

**b. Level of Knowledge on Osteoporosis**

The overall finding of this study shows 73 participants (33.00%) had demonstrated a low level of knowledge, and 151 participants (67.00%) had demonstrated a good level of knowledge regarding osteoporosis. Each favorable answer given by a participant was given one point, then the points were calculated for each participant based on the scale of Knowledge: High (>10 points) and Low (<10 points). A wrong answer and not sure is valued as zero point in this study (El-Tawab et al., 2016).

**Table 2** Participants' Analysis on Level of Knowledge of Osteoporosis (n=224)

| Item | Correct Answer n (%) | Wrong Answer n (%) | Not Sure n (%) |
|---|---|---|---|
| Physical activity increases the risk of osteoporosis *(False)* | 105 (46.90%) | 86 (38.40%) | 33 (14.70%) |
| High-impact exercise (weight training) improves bone health *(True)* | 92 (41.10%) | 90 (40.20%) | 42 (18.80%) |
| Most people gain bone mass after 30 years of age *(False)* | 41 (18.30%) | 104 (46.40%) | 79 (35.30%) |
| Lower weight women have osteoporosis more than heavy women *(True)* | 71 (31.70%) | 104 (46.40%) | 49 (21.90%) |
| The most important time to build bone strength is between 9 and 30 years of age *(True)* | 162 (72.30%) | 24 (10.70%) | 38 (17.00%) |
| Normally, bone loss speeds up after menopause *(True)* | 169 (75.40%) | 14 (6.30%) | 41 (18.30%) |

| No | Item | Correct Answer n (%) | Wrong Answer n (%) | Not Sure n (%) |
|---|---|---|---|---|
| 7 | High caffeine with low calcium intake increases the risk (True) | 190 (84.80%) | 4 (1.80%) | 30 (13.40%) |
| 8 | There are many ways to prevent osteoporosis (True) | 179 (79.90%) | 7 (3.10%) | 38 (17.00%) |
| 9 | Without preventive measures, 20% of women older than 50 years will have a fracture due to osteoporosis in their lifetime (True) | 167 (74.60%) | 8 (3.60%) | 49 (21.90%) |
| 10 | There are treatments for osteoporosis after it develops (True) | 136 (60.70%) | 28 (12.50%) | 60 (26.80%) |
| 11 | A lifetime of low intake of calcium and vitamin D does not increase the risk of osteoporosis (False) | 71 (31.70%) | 91 (40.60%) | 62 (27.70%) |
| 12 | Smoking does not increase the risk of osteoporosis (False) | 124 (55.40%) | 54 (24.10%) | 46 (20.50%) |
| 13 | Walking has a great effect on bone health (True) | 130 (58.00%) | 52 (23.30%) | 42 (18.80%) |
| 14 | After menopause, women not on estrogen need about 1500 mg of calcium (for example 5 glasses of milk) (True) | 156 (69.60%) | 35 (15.60%) | 33 (14.70%) |
| 15 | Osteoporosis affects men and women *(True)* | 176 (78.60%) | 18 (8.00%) | 30 (13.40%) |
| 16 | Early menopause is not a risk factor for osteoporosis (False) | 50 (22.30%) | 127 (56.70%) | 47 (21.00%) |
| 17 | Children 9-17 years of age get enough calcium from one glass of milk each day to prevent osteoporosis (True) | 154 (68.80%) | 30 (13.40%) | 40 (17.90%) |
| 18 | A family history of osteoporosis is not a risk factor *(False)* | 63 (28.10%) | 109 (48.70%) | 52 (23.20%) |
| 19 | Sardines are rich in calcium and vitamin D *(True)* | 111 (49.60%) | 51 (22.80%) | 62 (27.70%) |
| 20 | Low back pain, fractures, loss of height, and loss of teeth are complications of osteoporosis *(True)* | 164 (73.20%) | 26 (11.60%) | 34 (15.20%) |

**c. Level of Awareness on Osteoporosis**

Overall performance of this study found that the majority have a high level of awareness, with 191 participants (85.00%) and 33 participants (15.00%) presenting with low awareness. Osteoporosis awareness questionnaires consist of 12 measured by two points Likert-scale; 1=Yes and 2=No. Each Yes answer given by a participant was given one point, then the points were calculated for each participant based on the scale of Awareness: High (>7 points) and Low (<6 points) (Tripathi et al., 2019).

**Table 3** Participants' Analysis on Level of Awareness of Osteoporosis (n=224)

| No | Item | Yes n (%) | No n (%) |
|---|---|---|---|
| 1 | Do you know about osteoporosis? | 185 (82.60%) | 39 (17.40%) |
| 2 | Do you know the causes of osteoporosis? | 163 (72.80%) | 61 (27.20%) |
| 3 | Do you know the symptoms of osteoporosis? | 150 (73%) | 73 (32.60%) |
| 4 | Do you know the risk of osteoporosis? | 175 (78.10%) | 49 (21.90%) |
| 5 | Women are more prone to having osteoporosis | 176 (78.60%) | 48 (21.40%) |
| 6 | Less sun exposure can lead to osteoporosis | 90 (40.20%) | 134 (59.80%) |
| 7 | Osteoporosis is a risk factor for bone fracture? | 199 (88.80%) | 25 (11.20%) |
| 8 | The signs of osteoporosis usually appear before fractures? | 177 (79.00%) | 47 (21.00%) |
| 9 | Physical activities are helpful for the prevention of osteoporosis | 191 (85.30%) | 33 (14.70%) |
| 10 | The genetic factors and family history of osteoporosis are risk factors for osteoporosis? | 115 (51.30%) | 109 48.70%) |
| 11 | Osteoporosis has no available and effective treatments? | 89 (39.70%) | 135 (60.30%) |
| 12 | A high intake of dairy products could prevent osteoporosis? | 205 (91.50%) | 19 (8.50%) |

**d. Association between the level of knowledge and demographic data (age, race, gender, educational level, occupational, household income) of osteoporosis**

The research objectives and hypothesis of this study were to determine any significant association between the level of knowledge regarding osteoporosis with socio-demographic data (age, race, gender, educational level, occupational, household income) of osteoporosis among the public in Miri, Sarawak. Chi-square analysis was performed to examine the association between variables. Table 4 shows the significant association between level of knowledge and socio-demographic data (age, race, gender, educational level, occupational and household income) of osteoporosis among the public.

**Table 4** Chi-square analysis result between the level of knowledge on osteoporosis with socio-demographic data (n=224)

| **Demographic Characteristics** | **Total** | **Level of Knowledge** | | **p value** |
|---|---|---|---|---|
| | **(n)** | **Low** | **High** | |
| **Age** | | | | |
| Below 27 years | 26 | 10(13.69%) | 16(10.59%) | 0.435 |
| 28-37 years | 95 | 29(39.72%) | 66(43.70%) | |
| 38-47 years | 51 | 19(26.02%) | 32(21.19%) | |
| 48-57 years | 39 | 9(12.32%) | 30(19.86%) | |
| Above 58 years | 13 | 6(8.25%) | 7(4.66%) | |
| Total | 224 | 73(100%) | 151(100%) | |
| **Race** | | | | |
| Malay | 48 | 15(20.54%) | 33(21.85%) | |
| Chinese | 17 | 3(4.10%) | 14(9.27%) | 0.232 |
| Indian | 4 | 0(0%) | 4(2.66%) | |
| Sabah/Sarawak Bumiputera | 155 | 55(75.36%) | 100(66.22%) | |
| Total | 224 | 73(100%) | 151(100%) | |
| **Gender** | | | | |
| Male | 60 | 26(35.61%) | 34(22.51%) | 0.038 |
| Female | 164 | 4764.39%) | 117(77.49%) | |
| Total | 224 | 73(100%) | 151(100%) | |
| **Educational Level** | | | | |
| No formal education | 0 | 0(0%) | 0(0%) | |
| Primary School | 3 | 0(0%) | 3(1.98%) | 0.050 |
| Secondary School | 62 | 14(19.17%) | 48(31.80%) | |
| Tertiary School | 159 | 59(80.83%) | 100(66.22%) | |
| Total | 224 | 73(100%) | 151(100%) | |

| Demographic Characteristics | Total (n) | Level of Knowledge | | p value |
|---|---|---|---|---|
| | | Low | High | |
| **Occupational** | | | | |
| Government Servant | 154 | 44(60.27%) | 110(72.84%) | |
| Private Sector | 48 | 19(26.02%) | 29(19.20%) | 0.900 |
| Self-employed | 15 | 7(9.58%) | 8(5.29%) | |
| Non-working | 5 | 1(1.40%) | 4(2.67%) | |
| Student | 2 | 2(2.73%) | 0(0%) | |
| Total | 224 | 73(100%) | 151(100%) | |
| **Household Income** | | | | |
| Below RM1000 | 5 | 3(4.10%) | 2(1.32%) | |
| RM1000-RM2500 | 51 | 13(17.80%) | 38(25.16%) | |
| RM2500-RM4000 | 78 | 27(36.98%) | 51(33.77%) | 0.384 |
| Above RM4000 | 90 | 30(41.12%) | 60(39.75%) | |
| Total | 224 | 73(100%) | 151(100%) | |

This study's result showed that six socio-demographic characteristics were associated with knowledge level among 224 participants. Gender was found to be significant with the level of knowledge with *a p*-value (0.038). The education level factor was also significantly associated with *a p*-value (0.050). Other socio-demographic characteristics such as age ($p$=0.435), race ($p$=0.232), occupational ($p$=0.900), and household income ($p$=0.384) were found to have no significant association with the level of knowledge about osteoporosis among public.

**Table 5** Summary of Result for Hypothesis

| Hypothesis | Variables | Status |
|---|---|---|
| There is a significant association between the level of knowledge regarding osteoporosis with socio-demographic data (age, race, gender, educational level, household income) of osteoporosis among The public in Miri, Sarawak | Age | Not Supported |
| | Race | Not Supported |
| | Gender | Supported |
| | Educational Level | Supported |
| | Occupational | Not Supported |

**4. Research Discussion**

This study was conducted to determine the knowledge level of osteoporosis among the public in Miri, Sarawak. Thus, this study has identified that only 67.00% of participants have a good level of knowledge compared to 33.00% of participants who experienced a low level of knowledge on osteoporosis. There is evidence suggesting osteoporosis diseases continue to be an issue among the general community even though it is one of the less popular or fewer concerning diseases to life-threatening condition for the public. In contrast, a study conducted in Kuala Lumpur, Malaysia, revealed a moderate level of knowledge (51.60%) among the adult population from five different districts (Titiwangsa, Batu, Kepong, Segambut, and Cheras) with 232 samples (Leng et al., 2017). This study has presented a high level of knowledge because the majority of 154 participants (68.80%) worked as government servants, and about 48 participants (21.40%) in the private sector. Working adults will allow them to have great access and exposure to health information, particularly osteoporosis, a common chronic disease affecting half of the women population and often leading to osteoporotic-related fractures in the future. Inability to recognize early signs and symptoms of osteoporosis will cause osteoporosis to worsen and potentially untreated if the most general population is still unaware and does not seek correct osteoporosis treatment. Furthermore, 159 participants (71.00%) had achieved tertiary level, and this shows that most of them are well-educated and have a good level of thinking and understanding about osteoporosis.

Current literature strongly suggests that introducing good collaboration among the community and health sector is one of the effective management programs to overcome issues arising from the incidence of fracture-related osteoporotic bone, especially among women post-menopausal (Aladwani et al., 2019; Leng et al., 2017; Wright el al., 2019). With help from updated social media applications available currently to enhance health information delivery to the community regarding the early sign and symptoms of osteoporosis along with various treatments available in a health care setting in this country. Easily accessible health care facilities for any queries and getting osteoporosis treatment also help to enhance public trust and confidence in help for osteoporosis disease (Rotman-Pikielny et al., 2019), especially in the rural area, especially in Sarawak.

The level of awareness was found to be higher in this study compared to the level of knowledge regarding osteoporosis. A Health Belief Model on Osteoporosis model based on Health Promotion Model by Nola Pender in 1996 (Samia et al., 2018) was applied to investigate and answer the research question of this study to determine the level of knowledge and awareness among the public Miri, Sarawak. This Health Belief Model introduces the information on osteoporosis as it helps distribute osteoporosis health information to increase knowledge regarding osteoporosis prevention measures and available treatments. Public with a high level of awareness toward osteoporosis will apply Health Belief Model to motivate and seek further detail on health osteoporosis information and will learn more based on this theoretical framework.

The finding of this study indicated that gender ($p<0.038$) and educational level ($p<0.50$) had a significant association with the level of knowledge regarding osteoporosis. Interestingly, a similar researcher by Hassan et al. (2019) in Egypt reported that a higher level of knowledge was found to be significant to women. In the United States of America, Wright et al. (2019) surveyed that the educated group of samples had a significant association with the level of knowledge. Women who have reached age over 50 years are more prone to experience osteoporosis compared to males. Similar to research done by Tripathi et al. (2019) in Saudi Arabia, this study also found that a higher level of education has presented a high level of knowledge on osteoporosis. However, a study performed by Leng et al. (2017) found that educational level and age had no significant association with the level of knowledge on osteoporosis.

According to the recent literature, there is a need for promotion interventions to improve and maintain the level of knowledge and awareness among the community. Even though the present study revealed a high level of knowledge and awareness among the public, this result does not indicate the real practice of people practicing appropriate lifestyles and ways to prevent osteoporosis. Self-efficacy plays a major role in motivating human beings to practice and adapt appropriate lifestyles to prevent osteoporosis (Idrees et al., 2018). A good habit of consuming a high calcium intake and frequent exercising have significantly proven to prevent osteoporosis (Idrees et al., 2018). Thus, this study suggests organizational health care sector promote standardized programs on osteoporosis health education to encourage the public to practice an appropriate dietary lifestyle and good habits of exercising to maintain good bone strength and index for healthier bone and prevent osteoporosis.

An interesting finding in this study also revealed that most respondents have poor knowledge about the sign of early menopause as one of the risk factors for osteoporosis. Early menopause is one of the great risk factors in contributing to osteoporosis disease that will slowly develop in women with a lack of estrogen hormone. This result might be due to misconception or misunderstanding on how lack of estrogen hormone can lead to osteoporosis. Most women understand that osteoporosis could occur when someone aged 55 and above is at great risk for osteoporosis. Most women still presented with a poor understanding of early menopause can lead to early osteoporosis because they had no idea that estrogen hormone had a significant impact on bone health (Ji & Yu, 2015).

The present study also revealed that more than respondents had demonstrated poor knowledge regarding recommended food intake to reduce the risk of osteoporosis. Statement regarding low calcium and vitamin D intake for the long term does not increase the risk of osteoporosis was poorly scored by 91 respondents, and surprisingly 62 respondents appeared to have no idea regarding these statements. Food rich in calcium, such as milk, spinach, and anchovies, help to boost calcium absorption into the bone with the help of Vitamin D. A study done by (Wu et al., 2017). Wu et al. had proven a significant association between regular intake of adequate calcium (2 glasses per day) and increased bone mineral density among women aged 50 years above.

A similar result also agreed by (Yao et al., 2021) reported that high calcium intake is crucial among the gerontology community, especially women, as it had a significant association with increased bone mineral density after a long-term oral intake.

**Limitations of the study**

After reviewing over articles, a few obstacles have been encountered in conveying this study. The first obstacle is the small number of participants in this study. The small number of participants will not represent the overall finding of Miri city's population in Sarawak because the data is only from one city. In order to make the result represent all public in Malaysia, further studies can be conducted in public involving large-scale populations in other states in Malaysia. Another limitation identified is the study design adopted from other studies using a cross-sectional design, so it is possible to conclude a causal effect on the relationship between the variables.

## 5. Conclusion and Future Research

According to the present study's results, it could be concluded that a clear picture of a high level of knowledge and awareness among the public regarding osteoporosis. The result of this study can be an assessment tool and data for healthcare workers to assess and screen for any major possible risk factors that may contribute to the high incidence of osteoporotic-related fracture, especially among women generally. Besides that, this study data can be used as database information for other researchers to investigate confounding factors and may suggest using combined data collection method; a self-administered questionnaire with a checklist form observed by nurses or appointed certified public or orthopedic nurses in the hospital or community setting. In contrast with this study, it would be excellent if it could be done in a long duration of data collection because it can assess and compare any possible changes in the result of the study. These changes can provide the direction in creating long and short-term interventions such as educational seminars or online educational promotions to enhance awareness of the importance of osteoporosis preventive measures. Besides that, a recommendation for future research is that utilizing an entirely representative sample of a larger population involving other provinces such as Kuching and Sibu would be invaluable in exploring this further. Future research could work to establish the impact on health outcomes, as well as suggestions on improving public health facilities that can be improved to allow the community to exercise more to strengthen bone density to lower the risk of osteoporosis.

**Acknowledgments**

We would like to thank our content experts who validated the questionnaire, Miss Norzatulsyima Binti Nasaruddin (Consultant Orthopaedic and Trauma Surgeon, Miri Hospital) and Madam Seripah Sekina (Senior Orthopaedic Trained Nurse, Miri Hospital), Managers of two malls, who humbly wanted to remain anonymous. We are also grateful to the malls visitors who volunteered in this study.

**References**

[1] Aladwani, S., Alosaini, M. E., Althunayan, S. A., Alrowaidan, A. K., Al-Abrah, S. M., Alhawas, F. A. A., Aloyayri, M. A.& Almulhem, A. A. (2019). A survey to assess osteoporosis knowledge of the general population of Riyadh, Saudi Arabia. *International Journal of Pharmaceutical Research & Allied Sciences, 8*(4), 174-179.

[2] Alswat, K.A. Gender Disparities in Osteoporosis. *J. Clin. Med. Res.*; 2017; *9*, pp. 382-387. [DOI:https://dx.doi.org/10.14740/jocmr2970w][PubMed:https://www.ncbi.nlm.nih.gov/pubmed/28392857]

[3] Amin, A. & Mukti, N.A. (2017). Assessment of knowledge level on osteoporosis among a private university students in Malaysia. *Imperial Journal of Interdisciplinary Research*, 3(3), 141-145.

[4] Chan, C.Y., et al. (2019). 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*, 16(1787), 1-20. DOI:10.3390/ijerph16101787.

[5] Cheng, Y.T., et al. (2020). Assessment of knowledge, attitude and practice of Malaysian women towards osteoporosis. *Current Trends in Biotechnology and Pharmacy*, 14(5), 55-63. DOI : 10.5530/ctbp.2020.4s.6.

[6] El-Tawab, S. S., Saba, E. K. A., Elweshahi, H. M. T. & Ashry, M. H. (2016). Knowledge osteoporosis among women in Alexandria (Egypt): A community based survey. *The Egyptian Rheumatologist, 38*, 225-231. http://dx.doi.org/10.1016/j.ejr.2015.08.001

[7] Hassan, N. E., El-Shebini, S. M., El-Masry, S. A., Ahmed, N. H., El-Sherity, S. Y., El-Hamed, E. R. A. & Aboud, H. T. (2019). Inter-relationship of awareness, knowledge, attitude, some socio-economic variables and osteoporosis in sample of Egyptian women. *Open Access Macedonian Journal of Medical Sciences, 7*(15), 2538-2544. https://doi.org/10.3889/oamjms.2019.707

[9] Idrees, Z., Zakir, U., Khushdil, A., & Shehzadi, H. (2018). Osteoporosis: Knowledge and practices among females of reproductive age group. *Rawal Medical Journal, 43*(1), 56-60.

[10] Ji, M. & Yu, Q. (2015). Primary osteoporosis in postmenopausal women. *Chronic Diseases and Translational Medicine, 1*, 9e13.https://doi.org/10.1016/j.cdtm.2015.02.006

[11] Leng, L. S., Ali, A. & Yusof, H. M. (2017). Knowledge, attitude and practices towards osteoporosis prevention among adults in Kuala Lumpur, Malaysia. *Malaysia Journal Nutrition, 23*(2), 279-290. Doi: 10.3126/ijssm.v4i3.17803

[12] McCloskey, E.; Rathi, J.; Heijmans, S.; Blagden, M.; Cortet, B.; Czerwinski, E.; Hadji, P.; Payer, J.; Palmer, K.; Stad, R. et al. (2021). The osteoporosis treatment gap in patients at risk of fracture in European primary care: A multi-country cross-sectional observational study. *Osteoporos. Int.;* 32, 251-259. [DOI: https://dx.doi.org/10.1007/s00198-020-05557-z]

[13] Rotman-Pikielny, P., Leonenko, M., Barzilai, L., Nabriski, D., Twito, O. & Kagan, R. (2019). Patient's knowledge and opinions regarding osteoporosis, osteoporosis treatment and oral health care. *International Journal of Orthopaedic and Trauma Nursing*, 150(10), 830-838. https://doi.org/10.1016/j.adaj.2019.05.019

[14] Ramli, N. Rahman, N.A. & Haque, M. (2018). Knowledge, attitude, and practice regarding osteoporosis among allied health sciences students in a public university in Malaysia. *Erciyes Medical Journal*, 40(4), 210-217. DOI: 10.5152/etd.2018.18103.

[15] Samia, A. et al., (2017). An overview of osteoporosis and heath promotional strategies for community based osteoporosis prevention in Malaysia. *International Journal of Public Health and Clinical Sciences*, 4(1), 28-40.

[16] Samia, A., Hejar, A. R., Suriani, I. & Emilia, Z. A. (2018). Effectiveness of health belief model based educational intervention on osteoporosis knowledge test among female academician in Malaysia. *International Journal of Healthcare Sciences, 6*(1), 384-390.

[17] Tripathi, R., Makeen, H. A., Albarraq, A. A., Meraya, A. M., Tripathi, P., Faroug, H. & Ibrahim, S. (2018). Knowledge, attitude and practice about osteoporosis in south-western Saudi Arabia: A cross-sectional survey. *International Journal of Health Promotion and Education, 57*(3), 1-9. https://doi.org/10.1080/14635240.2018.1538809

[18] Wright, N., Melton, M. E., Sohail, M., Herbey, I., Davies, S., Levitan, E. B., Saag, K. G. & Ivankova, N. V. (2019). Race plays a role in the knowledge, attitudes and beliefs of women with osteoporosis. *Journal of Racial and Ethnic Health Disparities*. https://doi.org/10.1007/s40615-019-00569-w

[19] Wu, J., Xu, L., Lv, Y., Dong, L., Zheng, Q. & Li, L. (2017). Quantitative analysis of efficacy and associated factors of calcium intake on bone mineral density in postmenopausal women. *Osteoporos Int*, *28*, 2003–2010. https://doi.org/10.1007/s00198-017-3993-4

[20] Yao, X., Hu, J., Kong, X. & Zhu, Z. (2021). Association between Dietary Calcium Intake and Bone Mineral Density in Older Adults. *Ecology of Food and Nutrition, 60*(1), 89-100. https://doi.org/10.1080/03670244.2020.1801432