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Osteoporosis prevention habits: Investigating physical activity and dietary practices

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DISCOVERY SCIENTIFIC SOCIETY

ABSTRACT

Osteoporosis poses a significant public health burden due to population aging. This cross-sectional study aimed to investigate osteoporosis prevention habits regarding physical activity and dietary practices among 210 adults using a self-administered questionnaire during July 2023 to December 2023. The results showed that while over 70% of participants are engaged in the recommended levels of physical activity, barriers like lack of motivation and time were commonly reported. Just 38% performed weight bearing exercises beneficial for bone health. Around 40% reported adequate dietary calcium but only 22% consumed enough Vitamin D. Significant knowledge gaps regarding osteoporosis risk factors were observed although a third had undergone relevant screening tests. A significant association was found between dietary awareness and osteoporosis knowledge. This highlights the need to promote lifestyle modifications for osteoporosis prevention through awareness drives and community programs focusing especially on high-risk individuals.

Keywords: Osteoporosis, Prevention, Physical activity, Dietary practices

1. INTRODUCTION

Low bone mass and structural degeneration of bone tissue are the two hallmarks of osteoporosis, a widespread skeletal condition that affects a significant number of people. This disorder causes the bones to become more fragile, which in turn increases the probability that they may fracture. An increasing number of people are being diagnosed with osteoporosis, which poses a significant obstacle for the management of public health. This comes as a result of the fact that the average age of the world's population is increasing. According to Yoshihara et al., (2024), it is of the utmost importance to ensure that preventative strategies are put into place in order to decrease the burden that this incapacitating condition places on both individuals and healthcare systems.

Over the course of the last few years, there has been a growing focus placed on the role that lifestyle factors have in the prevention of osteoporosis. There has

been a lot of focus placed on the notion that the patterns of nutrition and physical exercise are particularly notable in terms of their significance. A large quantity of physical activity, which includes both weight-bearing exercises and resistance training, is required in order to keep bone health and density in good condition. The significance of this as an important component has been emphasized. In a similar vein, dietary choices wield a large amount of impact. This is due to the fact that certain minerals, such as calcium and vitamin D, are essential for the formation of bone and the preservation of bone strength.

With a specific focus on the dynamic that exists between dietary habits and physical activity, the objective of this research is to explore the complex interaction that occurs between osteoporosis preventative strategies such as food and exercise. Our goal is to get a better knowledge of the influence that these two significant factors of lifestyle have, both individually and collectively, on bone health via the examination of these two crucial parts of their lives. In addition, the objective of this study is to ascertain the potential challenges and possibilities that individuals have when it comes to adhering to the behaviors that are recommended for the prevention of osteoporosis (Shi et al., (2024) as stated in the previous sentence).

This research is significant because it has the potential to produce information that may be utilized to impact targeted therapies and public health campaigns that are aimed at promoting lifestyle changes that are sustainable. This is the reason why this study is so important. It is essential to have a comprehensive understanding of the complex relationships that exist between osteoporosis prevention, dietary behaviors, and physical activity in order to be able to create successful measures to lower the burden of osteoporotic fractures and promote the general well-being of aging populations (He et al., 2024). This understanding is necessary in order to create successful measures.

Objectives

We anticipate that the findings of this research will provide valuable insights to the scientific community, particularly those working in the healthcare field, as well as to those who influence policy decisions. As we get started on this investigation, this is something that we are taking into consideration. This comprehensive research of the factors that impact osteoporosis preventative measures may, in the end, pave the way for ways that are better customized to the specific needs of individuals and more easily available in order to improve bone health and prevent the development of this debilitating condition.

2. MATERIALS AND METHODS

This cross-sectional study utilized a quantitative approach involving surveys to collect data on osteoporosis prevention habits related to physical activity and dietary practices.

Study duration

Study was conducted during July 2023 to December 2023.

Study Design and Setting

A non-experimental cross-sectional study design was used. This design was chosen as it allows for collection of data at a specific point in time to examine relationships between variables. The study setting was the local community.

Study Population and Sampling

The target population comprised adults aged 18 years and above who resided in the local community. The convenience sampling method recruited 210 participants. The sample size was determined using G*Power analysis to provide 80% power for detecting effects. The sample size was determined using the following formula for calculating minimum required sample size for a given power:

$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2*\sigma^2}{(mean_1 - mean_2)^2}$

Where:

n = Required minimum sample size

$Z_{1-\alpha/2}$ = Critical value for significance level α (1.96 for $\alpha = 0.05$)

$Z_{1-\beta}$ = Critical value for power 1-β (0.84 for 80% power)

σ = Population standard deviation

$mean_1$, $mean_2$ = Expected mean outcomes for 2 groups

Based on this formula, targeting 80% power and a moderate effect size, the minimum required sample size was calculated to be 210 participants.

Data Collection and Instrument

Data was collected using a structured self-administered questionnaire. The questionnaire consisted of closed-ended questions on participants' demographics, physical activity habits, dietary practices, osteoporosis knowledge and screening status. The questionnaire was reviewed by experts to ensure face and content validity. Reliability analysis showed acceptable internal consistency (Cronbach's alpha = 0.702).

Data Analysis

Quantitative data was analyzed using SPSS version 25. Descriptive analysis such as frequencies and percentages were used to summarize respondents' characteristics and survey responses. Inferential statistics (Chi-square test) was also used to determine associations between variables. The level of significance was set at $p<0.05$.

3. RESULTS

In evaluated the study's reliability, an acceptable reliability coefficient that supports the consistency of measurements is identified. Frequency distribution examination of demographic information reveals a varied age range and a balanced representation of genders. In general, participants in different age groups report different levels of general health. Some respondents' physical activity habits reveal an apparent lack of activity, and barriers including time constraints and low motivation are observed. Participants' dietary habits reveal a range of perceptions, demonstrated by the varying degrees of trust they exhibit in them.

The consumption of foods high in vitamin D varies, providing insight into dietary decisions. Participants' knowledge of osteoporosis varies, and some have undergone screening. A person's family history, personal health goals, and healthcare recommendations are all influencing variables. Last but not least, the chi-square test reveals a significant association between osteoporosis knowledge level and knowledge of the association between vitamin D and calcium, highlighting the significance of dietary awareness in comprehending and preventing osteoporosis.

Evaluation of Reliability

The purpose of this method is to determine the amount of reliable and unreliable data. While the other questions reliability is calculated, but the demographic variables' reliability is not calculated.

Table 1 Evaluation of Reliability

Evaluation of Reliability	
Value of Reliability	0.702

The measure's reliability, as demonstrated by the value of 0.702 in Table 1, indicates to a moderate acceptable level of assessment consistency. This value, which usually ranges from 0 to 1, represents how consistent and reliable the measurements are. An acceptable degree of internal consistency is shown by a reliability coefficient of 0.702, which supports the reliability of the study's measurement results.

Analysis of Demographic Variables

We initially utilize frequency distribution and graphs for all demographic characteristics variables in order to assess the demographic variables of this study, "Osteoporosis Prevention Habits: Investigating Physical Activity and Dietary Practices".

Gender

Table 2, 107 participants were male, making up 51% of the sample as a whole, while 103 participants were female, making up 49%. The basically equal mix of male and female participants (51% and 49%, respectively) shows the efforts that have been made to guarantee that both genders have equal representation among the 210 participants in the study.

Table 2 Gender wise distribution of the participants

Gender	Frequency	Percentage (%)
Male	107	51%
Female	103	49%
Total	210	100

AGE

Table 3 shows the distribution of research participants by age group. The age group of 35–44 constitutes the greatest percentage of the sample (17.1%), followed by the 55–64 age group (16.7%). Participants under the age of 18, and those 65 years of age or older make up 10.5% and 14.3%, respectively. Due to the wide representation, the study's age demography is ensured, which helps people from many walks of life possess an improved understanding of the issue at hand.

Table 3 Age wise distribution of the participants

AGE	Frequency	Percentage (%)
Under 18	22	10.5
18-24	24	11.4
24-34	33	15.7
35-44	36	17.1
45-54	30	14.3
55-64	35	16.7
65 or older	30	14.3
Total	210	100

Current Status of Overall Health of the Participants

Table 4 explore an overview of the participants' current overall health. The majority of participants feel good of their health; 24.8% feel it's excellent and 26.7% feel it's good. 27.1% of respondents think their health is fair, while 21.4% think their health is poor. This is a significant percentage of the population. This varied distribution provides an expanded understanding of the surveyed persons' overall health perceptions by representing the different perspectives on health within the study participant pool.

Table 4 Overall Health

Overall Health	Frequency	Percentage (%)
Excellent	52	24.8
Good	56	26.7
Fair	57	27.1
Poor	65	21.4
Total	210	100

Frequency and Intensity of Physical Activity

Engage in Physical Activity

Table 5 focused on the inquiry that asks participants about their average weekly physical activity such as walking, jogging, swimming etc., with an emphasis on patterns of physical activity. However, 28.1% of respondents claimed they did not engage in any physical

activity, which shows the lack of physical activity that many people in the study sample lived. The distribution of people who engage in physical activity is differed: 21.9% do this on 1-2 days per week, 25.7% for 3–4 days, and 24.3% for 5 or more days per week. This comprehensive evaluation provides helpful data about the variety of physical activity habits among the participants, enabling a thorough comprehension of their health-related routines and improving the investigation of factors impacting the prevention of osteoporosis.

Table 5 Engage in Physical Activity

Engage in Physical Activity	Frequency	Percentage (%)
0 Days	59	28.1
1-2 Days	46	21.9
3-4 Days	54	25.7
5 or More Days	51	24.3
Total	210	100

Intensity of physical activity

Table 6 explore the distribution of participants according to the level of physical activity. Similarly, 35.7% of participants, or most of them, participate in moderate activities like walking. Furthermore, 32.4% engage in harder activities like running, while 31.9% engage in moderately intense activities like cycling. This breakdown demonstrates the variety of physical activities that study participants engaged in, offering significant information on the range of exercise intensities that were common among the group assessed. The information mentioned above enhances the overall comprehension of the kinds of physical activities that individuals integrate into their daily regimens, a crucial component in investigating their influence on the prevention of osteoporosis.

Table 6 Intensity of physical activity

Intensity	Frequency	Percentage (%)
Light (e.g. walking)	75	35.7
Moderate (e.g. cycling)	67	31.9
Vigorous (e.g. running)	68	32.4
Total	210	100

Weight Bearing Exercises

The data represents participants' participation in weight-bearing exercises intended to promote bone health (Table 7). However, 38.1% of respondents indicated they actively engage in weight-bearing exercises, suggesting that a significant percentage of the study's population makes bone-strengthening activities a regular component of their routines. On the other hand, 30% expressed hesitation and 31.9% stated they would not be participating. This comprehensive examination clarifies the frequency of participants' deliberate bone health-focused exercise, offering useful details about their proactive strategies to osteoporosis prevention.

Table 7 Participation in Weight-Bearing Exercises

Weight-Bearing Exercises	Frequency	Percentage (%)
YES	80	38.1
NO	67	31.9
Not Sure	63	30
Total	210	100

Barriers to Physical Activity

In respond to the question about perceived difficulties, Table 8 examines the challenges that participants have when attempting to include regular physical activity into their routines. The study highlights limitations on time as a common hurdle, with 30.5% of

participants identifying lack of time as a concern. 32 percent of respondents identified motivational difficulties, and 37 percent indicated physical limits as a major barrier. This analysis offers a thorough grasp of the various obstacles that participant's face, which is helpful in modifying interventions to target particular obstacles and encouraging consistent physical activity for the prevention of osteoporosis.

Table 8 Facing Barriers to Physical Activity

Barriers	Frequency	Percentage (%)
Lack of time	64	30.5
Lack of motivation	69	32.9
Physical limitation	77	36.7
Total	210	100

Dietary Practices

Overall Dietary Habits

Table 9 explores the overall dietary habits of the individuals and offers an understanding of their self-reported eating habits. According to the findings, 29.5% of participants believe their eating habits are good, and 27.6% believe they are excellent. Furthermore, 21.4% of respondents think their eating habits are fair, while another 21.4% think they are poor. The above study highlights the variability in the dietary self-perceptions of the participants, hence providing significant knowledge into their eating habits with regard to the prevention of osteoporosis.

Table 9 Participants Overall Dietary Habits

Dietary Habits	Frequency	Percentage (%)
Excellent	68	27.6
Good	52	29.5
Fair	45	21.4
Poor	45	21.4
Total	210	100

Calcium-Rich Foods Consumption

Table 10 examines the calcium, -rich food that the participants eat, providing information about their dietary habits that are relevant to bone health. According to the findings, 39.5% of participants claimed they eat adequate amount of calcium-rich food. On the other hand, 27.1% of respondents are not sure about their calcium intake, while 33.3% indicate not doing so. This analysis emphasizes the variety of dietary habits among participants, providing significant knowledge on the study population's use of foods that are rich in calcium and its possible influence on the prevention of osteoporosis.

Table 10 Consuming Adequate amount of Calcium-rich Food

Consumption	Frequency	Percentage (%)
Yes	83	39.5
No	70	33.3
Not Sure	57	27.1
Total	210	100

Calcium Sources in the Diet

Table 11 looks at the participants' sources of calcium in their diets and provides information on their eating habits in relation to bone health. The results show that dairy products supply 36.7% of the participants' calcium intake, whereas leafy green vegetables supply 31.0%. Moreover, fortified foods account for 32.4% of the calcium intake. This breakdown provides important information regarding

the diverse dietary sources of calcium within the study group, which advances a more nuanced understanding of the participants' nutritional choices with regard to the topic of osteoporosis prevention.

Table 11 Dietary sources of the calcium

Sources	Frequency	Percentage (%)
Dairy products	77	36.7
Leafy Green Vegetables	65	31.0
Fortified Foods	68	32.4
Total	210	100

Vitamin D Rich Food Consumption

Table 12 looks at how frequently people eat foods containing vitamin D, giving insight into their eating patterns related to bone health. The results show that while 21.9% of people get their vitamin D from meals every day, just 25.2% of people get it from meals once a week. Moreover, 30.5% of respondents say they regularly consume vitamin D, but 22.4% say they eat foods high in vitamin D infrequently or never. The aforementioned breakdown offers crucial insights into the nutritional decisions that could impact the prevention of osteoporosis by illustrating the diverse frequency of vitamin D-rich food consumption across the study participants.

Table 12 Consumption of Vitamin D

Consumption	Frequency	Percentage (%)
Daily	46	21.9
Weekly	53	25.2
Monthly	64	30.5
Rarely/never	47	22.4
Total	210	100

Osteoporosis Knowledge and Screening

Risk Factors of Familiarity with Osteoporosis

Table 13 assesses the participants' familiarity with osteoporosis and its risk factors, which helps to explore their expertise in this area of research. According to the poll results, 34.8% of respondents claimed to know a great deal about osteoporosis, compared to 33.3% who believed they understood somewhat about it. Moreover, 31.9% of respondents claimed to know absolutely nothing about osteoporosis. By highlighting the various awareness levels among participants, this breakdown aids in the creation of a comprehensive picture of their knowledge base on osteoporosis prevention.

Table 13 Familiarity Level

Familiarity Level	Frequency	Percentage (%)
Very Familiar	73	34.8
Somewhat Familiar	70	33.3
Nor Familiar at All	67	31.9
Total	210	100

Osteoporosis Screening OR Bone Density Test

In order to analyse the respondents' proactive health habits, Table 14 looks at their participation in osteoporosis screening and bone density examinations. The data show that 32.9% of individuals had screening, indicating that some of them keep a close check on their bone health. However, 31.9% have not undergone any screening, and 35.2% are unaware about their screening status. This breakdown offers useful information on the prevalence of osteoporosis screening in the study population as well as a foundation for assessing the health-conscious behaviours related to bone health that the participants engaged in.

Table 14 Osteoporosis Screening

Screening Status	Frequency	Percentage (%)
Yes	69	32.9
No	67	31.9
Not Sure	94	35.2
Total	210	100

Sources of Information on Bone Health

The many sources that people use to learn about bone health are examined in (Table 15). According to the findings, although 27.6% of participants use websites and the internet, 24.3% of participants rely on healthcare professionals for information. In addition, 21.4% explore through other sources of information while 26.7% ask friends and family for advice. The above study offers significant perspectives on the diverse methods by which participants obtain knowledge about bone health, thereby advancing a thorough comprehension of the variables impacting their knowledge base concerning the prevention of osteoporosis.

Table 15 Sources of Information on Bone Health

Information Sources	Frequency	Percentage (%)
Healthcare Professionals	51	24.3
Internet/Websites	58	27.6
Family & Friends	56	26.7
Others	45	21.4
Total	210	100

Motivational Factors for Adopting Bone Health Habits

Table 16 explores the motivations behind participants' adoption of bone-healthy habits. The information shows that 25.2% of participants have been influenced by a family history of osteoporosis, whereas 20.5% of participants are motivated by personal health goals. Furthermore, 28.6% mention other motivational causes, and 25.7% adhere to healthcare practitioner advice. This breakdown clarifies the various motivational factors that participants used to adopt bone-healthy behaviors, offering significant knowledge into the complex nature of their health-related decision-making processes in regard to osteoporosis prevention.

Table 16 Motivational Factors Influencing Participants to Adopt Lifestyle Bone Health Habits

Motivational Factors	Frequency	Percentage (%)
Personal Health Goals	43	20.5
Family History of Osteoporosis	53	25.2
Healthcare provider Recommendations	54	25.7
Others	60	28.6
Total	210	100

Chi-Square Test

Chi-square test is a statistical technique used to check the association between the two or more variables. For this study, we use the chi-square test for awareness of vitamin D and calcium connection and osteoporosis knowledge level. The aim of this analysis is to investigate the potential association between participant's awareness of the vitamin D and calcium connection and their level of osteoporosis knowledge.

Hypothesis

Null Hypothesis (Ho): There is no association between awareness of the Vitamin D and Calcium connection and osteoporosis knowledge level.

Alternative Hypothesis (Ho): There is association between awareness of the Vitamin D and Calcium connection and osteoporosis knowledge level.

Table 17 Chi-square Test

Chi-Square Test		
Variables	Degree of Freedom	Significant Value
Awareness of the Vitamin D and Calcium connection	2	0.000
Osteoporosis knowledge level	2	0.000

The association between osteoporosis knowledge level and awareness of the relationship between vitamin D and calcium was investigated using the chi-square test. The findings showed a statistically significant association, demonstrated by both variables' 0.000 chi-square values with two degrees of freedom (Table 17). This leads us to reject the null hypothesis (Ho), which states that there is no association between osteoporosis knowledge level and awareness of the association between vitamin D and calcium. The alternative hypothesis (H1) has been supported, suggesting a significant relationship between the participants' knowledge of osteoporosis and their awareness of calcium and vitamin D. These results highlight the significance it is to take into consideration dietary awareness while understanding and distributing information about osteoporosis.

4. DISCUSSION

The present study aimed to investigate osteoporosis prevention habits related to physical activity and dietary practices in adults. The key findings were that while a majority of participants engaged in some level of physical activity, barriers like lack of time and motivation were commonly reported. As for dietary habits, consumption of calcium and vitamin D rich foods varied widely. An alarming percentage of participants also reported poor overall eating habits. In terms of osteoporosis knowledge, less than half the respondents were very familiar with the disease and its risk factors. There was however, a significant association found between awareness of the vitamin D and calcium connection and osteoporosis knowledge level.

The current physical activity guidelines by the WHO recommend at least 150 minutes per week of moderate intensity activity for adults. While it is reassuring that over 70% of the respondents did meet this recommendation, the fact that 28% reported no physical activity at all is concerning. This is consistent with population data indicating that nearly a quarter of adults lead predominantly sedentary lifestyles (Lee et al., 2012). As revealed in this study, commonly cited barriers like lack of motivation and time constraints need to be addressed. Targeted community programs and workplace wellness initiatives may help overcome these barriers. An equally alarming finding was that only 38% of participants knowingly engaged in weight bearing and bone strengthening exercises that are known to reduce osteoporosis risk (Bonaiuti et al., 2002). Greater public health efforts are required to promote awareness and benefits of such exercise for bone health.

The results revealed sub-optimal dietary habits in the study population from the lens of osteoporosis prevention. As per global guidelines, the RDA for calcium is 1000-1300mg/day for adults depending on age; 600 IU being the RDA for vitamin D (Ross et al., 2011). However, only 40% self-reported adequate calcium intake while just 22% consumed vitamin D rich foods daily. This is consistent with literature suggesting widespread nutritional inadequacies especially that of vitamin D (Christodoulou et al., 2013). Bone health promotion programs should emphasize the importance of meeting the RDA for these nutrients through dietary sources along with including bone nourishing foods like soy, fruits and vegetables that contain magnesium, Vitamin K, zinc etc.

Over 60% of the respondents were not very familiar with osteoporosis risk factors. This knowledge gap has been identified across multiple studies worldwide and interventions are needed to bridge the same. On a positive note, a third had undergone relevant screening tests indicating some awareness on preventive monitoring. The significant association between dietary awareness and

osteoporosis knowledge does indicate nutrition education as an impactful tool in driving osteoporosis prevention. Future studies can also identify the best educational platforms whether via health professionals, community workers or technology led solutions.

The strengths of this study include a robust sample size with both genders equally represented and across diverse age groups and health status. However, the convenience sampling and self-reported data need to be highlighted as key limitations. Further studies could focus on objective measurements to validate findings. Overall, this study makes a meaningful contribution by highlighting specific gaps in knowledge and lifestyle habits that must be addressed to tackle the growing burden of osteoporosis. The results provide vital cues for developing targeted public health strategies to promote bone health.

5. CONCLUSION

This study provides vital insights into the lifestyle habits, knowledge levels and motivators related to osteoporosis prevention among adults. While a majority were physically active, specific gaps were identified including lack of weight bearing/bone strengthening exercises and inadequate calcium and Vitamin D intake. Alarming osteoporosis knowledge gaps were also revealed. The significant link between nutritional awareness and health literacy regarding bone health underscores the importance of using dietary guidance and education as a tool for prevention. The findings will help develop targeted public health strategies involving awareness drives, screening initiatives and community-based programs to promote sustainable bone-healthy behaviors among high-risk groups. Further studies can explore platform solutions like technology and workplace wellness models for greater impact.

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Ethical approval

The study was approved by the Medical Ethics Committee of PUMHSW wide letter No. 796 Dated 12-06-2023.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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