Osteoporosis awareness and health beliefs among Lebanese women aged 40 years and above

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Abstract

Summary Our study investigated the characteristics of Lebanese women population groups with the poorest knowledge of osteoporosis definition, risk factors, and preventive measures in order to identify categories that should be targeted in future campaigns and educational programs. Higher knowledge scores were reached in women who already heard about the disease and had a formal education. As a result, osteoporosis awareness campaigns and educational programs are mostly needed in populations with lower educational levels.

Introduction Our study investigated the characteristics of Lebanese women population groups with the poorest knowledge of osteoporosis definition, risk factors, and preventive measures.

Methods A cross-sectional study, conducted between March and June 2018, enrolled 560 community dwelling women aged 40 years and above. A questionnaire was used to collect data. A proportionate random sample from all Lebanese Mohafazat was used. Data collection was performed through personal interviews. The median was used as a cutoff point for both the Knowledge and Health Belief scales.

Results The study results showed that 47.3% of participants had a poor knowledge score. Women who received no education, compared to a higher education and have not previously heard about the disease, had lower knowledge scores. In addition, women not taking calcium and vitamin D supplements and not exercising or exercising less than 20 min per day compared to those having these characteristics had lower osteoporosis knowledge levels. A lower knowledge score was associated with less recognized benefits of adequate calcium intake and regular physical activity, more perceived barriers towards their practice, and a less important health motivation. A lower level of education correlated to the same results.

Conclusion Lower knowledge scores were reached in women who have never heard of osteoporosis and had a lower level of education. As a result, osteoporosis awareness campaigns and educational programs need to target population categories with lower educational levels.

Keywords Knowledge · Osteoporosis · Health belief · Lebanon

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Introduction

Osteoporosis is a serious bone disease affecting hundreds of millions of individuals around the world [1]. It is defined by the World Health Organization (WHO) as a skeletal disorder characterized by a decreased bone mass and micro-structural degradation leading to a loss of bone strength and an increased risk of bone fractures mainly involving the spine, hips, and wrists [2]. These fractures are associated with a high morbidity related to pain and disability, mortality, and economic burden [3, 4]. According to a study in which elderly Lebanese individuals aged between 65 and 84 years old from the greater Beirut area were enrolled, osteoporosis was found to be prevalent in 33% of women and 22.7% of men [5].

There are two types of osteoporosis-related risk factors: modifiable and non-modifiable [6, 7]. Non-modifiable risk factors involve age, gender, ethnic origin, the presence or not of osteoporosis in the family along with the history of fractures after a minimal trauma in first-degree relatives, the date of the first menarche and menopause, etc. Modifiable elements mainly include lifestyle behaviors such as smoking, alcohol consumption, poor physical activity, and a diet deficient in adequate calcium and vitamin D levels. Furthermore, men and women are both affected by osteoporosis, but women have a higher risk mainly because of menopause leading to a well-defined entity called "postmenopausal osteoporosis" [8]. In fact, at menopause, the hormonal production of the ovaries is substantially reduced and blood levels of estrogen essential for bone homeostasis markedly decrease [8–12].

There are several treatment options for osteoporosis. They are divided into three different categories: anti-catabolic (anti-resorptive), anabolic drugs, and drugs having both effects. Anti-catabolic drugs reduce the bone turnover which is normally the difference between the formation and the resorption phase, by mainly reducing the latter. Examples include biphosphonates, estrogens, selective estrogen receptor modulators (SERMS), calcitonin, and inhibitors of the receptor activator of the nuclear factor kappa B ligand (RANKL). The anabolic drug category, with teriparatide being the major drug, increases bone remodeling with a greater stimulation of bone formation over resorption and acts at the level of bone microarchitectural parameters most importantly being the cortical and trabecular bone, improving their structure. Deciding on whether to treat or not depends on the results of bone density measured by a dual X-Ray absorptiometry bone mineral density scan (DXA-BMD) and the 10-year risk of developing a fragility fracture using the Fracture Risk Assessment tool (FRAX).

Several research studies have shown a positive relationship between osteoporosis knowledge and application of preventive measures. In fact, in a study in which an informational booklet about osteoporosis was administered to women, with a subsequent follow-up done, has yielded a better knowledge with more favorable attitudes and preventive practices towards the disease [13].

In Lebanon, there is a lack of sufficient evidence and recent data associated to public osteoporosis awareness. For this reason, we developed a study to investigate and identify Lebanese women population groups with the poorest knowledge of osteoporosis definition, risk factors, and preventive measures in order to identify those that should be targeted in future awareness campaigns and educational programs.

Numerous scales assessing the level of knowledge and health belief status associated with osteoporosis were used in previous studies. However, when attempting to compare them, we found that none of these scales consisted of the whole number of questions needed to get a complete idea about these parameters. Subsequently, we used in our study a questionnaire that included questions selected from these well-validated scales. The questions are related to participant's background characteristics, knowledge about key osteoporosis facts, and health belief status.

Materials and methods

Study and population

A cross-sectional study was conducted between March and June 2018, which enrolled 560 community dwelling women aged 40 years and above using a proportionate random sample from all Lebanese governorates (Beirut, Mount Lebanon, North, South, and Bekaa). The cutoff point of 40 years was chosen in regard to the particular importance of osteoporosis knowledge and health beliefs in this category due to the effects of menopause on bone density and fracture risk. Each governorate is divided into Caza (stratum). Two villages were randomly selected from the list of villages provided by the Central Agency of Statistics in Lebanon (2005) [14]. Patients were randomly selected from each village. Excluded were women with cognitive impairment, dementia, or who refused to fill the questionnaire. Data collection was performed through personal interviews with participants by trained, study independent personnel.

Sample size calculation

A sample of 341 women was targeted to allow for adequate power for bivariable and multivariable analyses to be carried out according to the Epi info sample size

calculations with a population size of 5 million in Lebanon, a 51.5% expected frequency of good osteoporosis knowledge among the general population [15], a 95% confidence limits, a power of 80%, and an acceptable margin of error of 5%.

Data collection

We utilized a questionnaire that included translated items from existing questionnaires to investigate sociodemographic characteristics as well as osteoporosis knowledge and beliefs. A thorough literature review highlighted the presence of 5 osteoporosis-related scales mostly used in research studies: *the osteoporosis knowledge assessment tool (OKAT)* [16], *the osteoporosis knowledge test (OKT)* [17], *the osteoporosis questionnaire (OPQ)* [18], *the facts on osteoporosis quiz (FOOQ)* [19], designed to collect data related to knowledge of osteoporosis facts and *the Osteoporosis Health Belief Scale (OHBS)* [20] investigating disease-related beliefs. These tools were the basis for the development of a questionnaire used in this study (**Appendix 1**). Our questionnaire was in Arabic, the native language of Lebanon, and was divided into three parts. The first part **(Part 1: Demographic characteristics)** involved 22 questions including the age, the governorate, the family monthly income, the history of personal and familial diseases (including osteoporosis) and surgeries, the presence or not of menopause, the lifestyle (smoking, alcohol consumption, physical activity, calcium, and vitamin D intake), the medications taken, and whether one's had ever heard about osteoporosis. The educational level (illiterate, primary, secondary, technical, or university level of education) was also included. Technical education involves programs that aim to develop in students specific technical skills in order to directly enter the workforce. The family monthly income was divided into 3 categories based on the monthly salary of the household as follows: low (1000 USD), intermediate (1000–2000 USD), and high (> 2000 USD).

The second part **(Part 2: The Knowledge Scale)** intended to get information concerning the knowledge of osteoporosis facts was subdivided into 3 sections: "**Definition of Osteoporosis**," "**Risk Factors of Osteoporosis**," and "**Preventive Measures**." Questions making part of the first four scales listed above were distributed between these three categories.

Integrated questions were selected upon consulting osteoporosis experts with the attempt to include the biggest number of questions related to this bone disorder along with a questionnaire that is easy to understand using a simple wording and asking about the basics. Furthermore, we tried to avoid repetition and eliminated similar questions to avoid redundancy (e.g., "If your mother or father have had osteoporosis" (OPQ); "Family history of osteoporosis strongly predisposes a person to osteoporosis" (OKAT); Having a mother or a grandmother who has osteoporosis is" (OKT); "Family history of osteoporosis is not a risk factor for osteoporosis" (FOOQ)) and complicated questions that usually need a more advanced knowledge (e.g.: "Which of the following is the recommended amount of calcium intake for an adult?"(answer in mg-OKT)). Additionally elements not directly associated to our topic were removed (e.g., "Side effects of HRT include" (OPQ); "Osteoporosis and osteoarthritis are" (OPQ)). This yielded a total of 42 questions; for each question, "1" point was given for a correct response and "0" for an incorrect or "I don't know" response. Hence, the total score ranged between 0 and 42. The "I do not know" answer was added in order to avoid the selection by participants of a "False" response or a random one while completely ignoring the correct answer.

No modifications were made to the original items expect for 6 of them:

- a question selected from the OPQ "The condition characterized by fragile or brittle bones is commonly known as" was modified to "Osteoporosis is a condition characterized by" with additionally a change of the answers from "(1) Arthritis; (2) Osteoporosis; (3) Spondylitis; (4) Don't Know" into "(1) Bone pain increased with activity; (2) Fragile or brittle bones; (3) Decreased muscle strength causing bone fragility; (4) Don't Know." This was done in order for individuals completing the questionnaire, to choose the right definition of osteoporosis rather than directly giving it in the question and including elements not related to the topic such as "Arthritis" and "Spondylitis."
- The item "Osteoporosis is more common in men" from the OKAT was modified to "Osteoporosis is more common in women" to emphasize on the risk of osteoporosis in this category.
- The question "By age 80, the majority of women have osteoporosis" (OKAT) was changed into "The risk of osteoporosis gradually increases starting the age of 50 years" based on the fact that menopause (developing around 50 years of age) is the principal factor leading to osteoporosis in women. Subsequently, it is essential for us to know if Lebanese women are aware of this process.
- The first element of the FOOQ "Physical activity increases the risk of osteoporosis" was modified to "Regular physical activity increases the risk of osteoporosis" to highlight the importance of the regular pattern of exercising.
- A question selected from the OKAT "There are no effective treatments for osteoporosis available in Australia" was also changed into "There are no effective treatments for osteoporosis available in Lebanon" since the study is conducted among Lebanese women.

- The question "An adequate calcium intake helps reducing the development of osteoporosis" was added because calcium is one of the main supplements that should be prescribed, as recommended, for postmenopausal women and it is critical to have an idea whether Lebanese women perceive it as essential for the prevention and reduction of the onset of osteoporosis or not.

The last part "**Part 3: Health Belief Scale**" used *The osteoporosis Health Belief scale (OHBS)*. In its original version, the OHBS includes 42 statements divided into 7 categories. Every question has 5 possible answers: "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree" scored respectively "1, 2, 3, 4, 5." Subsequently, every subscale has a scoring varying between 6 and 30. Each category is analyzed separately with higher scores related to a greater health belief status.

The first category asks about the perceived risk of developing osteoporosis "**Perceived susceptibility**" (items 1 to 6) and the second about how severe it is considered "**Perceived seriousness**" (items 7 to 12). The third and the fourth respectively investigate the degree of advantage that women find from practicing a regular physical activity "**Exercise benefits**" (items 13 to 18) and from consuming calcium-rich products "**Calcium benefits**" (items 19 to 24). Moreover, the fifth and sixth categories included questions about perceived boundaries against regular exercising "**Exercise barriers**" (items 25 to 30) and adequate calcium intake "**Calcium barriers**" (items 31 to 36). Finally, the "**Health Motivation**" category (items 37 to 42) measures the degree of willingness to be screened and treated for osteoporosis when it is present.

The questionnaire used in our study involved 28 selected questions from the original scales. Multiple questions were not included because their translation to Arabic would have resulted in the same meaning (e.g., "It is extremely likely that you will get osteoporosis" and "There is a good chance that you will get osteoporosis" ♦ "If you had osteoporosis you would be crippled" and "When you think about osteoporosis you get depressed"). Moreover, other questions were removed because of similarities with other ones, e.g., in the "Exercise barriers" subscale, the question "Exercising regularly makes you uncomfortable" is a general question, whereas the rest of the questions making part of this scale explain why it would be uncomfortable.

In order for the questionnaire to be accessible to all Lebanese women, its English version was translated to Arabic by a certified translator, then a second certified translator translated the Arabic version back to English. The translators had a good understanding of the content and concept of the different scales. It is noteworthy that the English versions did not significantly differ; therefore, the translated Arabic version was used as is. A committee including specialists in the field (internists, rheumatologists, and endocrinologists), a

language expert, and our translators examined the Arabic questionnaire to make sure it has an idiomatic equivalence [21, 22]. A pilot study was conducted on 20 women to ensure the complete understanding and clarity of the questions. No changes were made thereafter.

Statistical analysis

Data analysis was conducted using SPSS software version 23. The independent sample *t* test was used when comparing two means, whereas the ANOVA and Kruskal-Wallis tests were used to compare between three groups or more, and Pearson correlation coefficient was used to correlate between continuous variables. A stepwise linear regression was conducted, taking the knowledge score as the dependent variable. All variables that showed a $p < 0.1$ in the bivariate analysis were taken as independent variables in each model to decrease the possibility of confounding factors. Besides, Cronbach's alpha was recorded for reliability analysis for all the scales. A *p* value less than 0.05 was considered significant. In the absence of a cutoff point for the "**Knowledge Scale**" and "**Health Belief Scale**," we chose the medians as cutoff points.

Results

Sociodemographic and other characteristics of the participants

The sociodemographic and other characteristics of the participants are summarized in Table 1. The results of the Chi-square test showed that a significantly higher percentage of participants with poor knowledge about osteoporosis was found in participants who live in Bekaa (11.3% vs 2.4%) and were illiterate (20.8% vs 7.1%). Moreover, a significantly higher percentage of participants with poor knowledge were unemployed (62.3% vs 45.4%) and had a low family monthly income (56.6% vs 43.1%). Finally, the results of the Student *t* test showed that participants with a poor knowledge had a higher mean age (52.42 vs 50.34 years). The osteoporosis knowledge score mean and standard deviation for the whole sample were 24.13 ± 6.12 (median = 25; minimum = 0 and maximum = 42). The percentage of patients who had adequate knowledge (scores ≥ 25) about osteoporosis was 52.7% (295 patients). The Cronbach alpha for this scale was high (0.825).

Bivariate analysis

To assess factors associated with the knowledge score, the Student *t* test was used for dichotomous/binary variables, whereas the ANOVA test was used for variables that had 3 categories or more. The results showed that a higher mean knowledge score (25.90 ± 5.38) was found in participants

Table 1 Sociodemographic and other characteristics of the participants

Variable	Inadequate knowledge (score < 25) (N = 265)	Adequate knowledge (score ≥ 25) (N = 295)	p value
District			< 0.001
Beirut	53 (20%)	53 (18%)	
Mount Lebanon	45 (17%)	46 (15.6%)	
North Lebanon	64 (24.2%)	109 (36.9%)	
South Lebanon	73 (27.5%)	80 (27.1%)	
Bekaa	30 (11.3%)	7 (2.4%)	
Educational level			< 0.001
Illiterate	55 (20.8%)	21 (7.1%)	
Primary	47 (17.7%)	40 (13.6%)	
Secondary	68 (25.7%)	70 (23.7%)	
University	54 (20.4%)	125 (42.4%)	
Technical	41 (15.5%)	39 (13.2%)	
Work status			< 0.001
Unemployed	165 (62.3%)	134 (45.4%)	
Employed	100 (37.7%)	161 (54.6%)	
Family monthly income			0.006
Low	150 (56.6%)	127 (43.1%)	
Intermediate	84 (31.7%)	126 (42.7%)	
High	31 (11.7%)	42 (14.2%)	
Cigarette smoking status			0.081
Non-smoker	178 (67.2%)	218 (73.9%)	
Smoker	87 (32.8%)	77 (26.1%)	
	Mean ± SD	Mean ± SD	
Age (in years)	52.42 ± 10.76	50.34 ± 9.37	0.015
Number of alcohol glasses consumed per day	0.04 ± 0.25	0.01 ± 0.11	0.097

Numbers are presented as number (percentage) or mean ± standard deviation

from North Lebanon compared to all other districts, with a university level of education (26.51 ± 5.67) compared to all other levels, in women taking calcium and vitamin D supplements (25.47 ± 6.40) compared to those taking either supplement alone or no supplement, and in those not taking corticosteroids, aromatase inhibitors, heparin, or chemotherapy compared to those with current or previous usage of these medications. Finally, the Pearson test showed that increased age was significantly correlated with decreased knowledge ($r = -0.097$) (Supplementary Table 1).

Multivariable analysis

The results of a linear stepwise regression, taking the knowledge score as the dependent variable, showed that technical (Beta = 1.36; CI 0.013–2.714) and university levels of education (Beta = 2.95; CI 1.956–3.951) compared to illiteracy, those who previously heard about osteoporosis (Beta = 5.70; CI 3.764–7.653), those who take calcium and vitamin D supplements compared to none (Beta = 1.61; CI 0.381–2.850), and those exercising 10–20 min per day (Beta = 2.73; CI 0.891–4.572) and more than 30 min per day (Beta = 1.84; CI 0.311–3.377) compared to no exercising were significantly associated with higher knowledge about osteoporosis. On another hand, women with a previous fracture (Beta = − 2.03; CI − 3.147–− 0.917), taking calcium supplements only (Beta = − 1.63; CI − 2.942–0.334), exercising for less than 10 min daily (Beta = −5.49; CI − 8.386–− 2.605) compared to no exercising, having diabetes (Beta = − 1.65; CI − 2.906–− 0.398), hyperparathyroidism (Beta = − 4.94; CI − 9.016–− 0.883), and taking current chemotherapy treatment (Beta = − 4.07; CI − 7.358–− 0.783) compared to no treatment were significantly associated with lower knowledge about osteoporosis (Table 2).

Health belief model

The description of the health belief model scores subscales, with the respective Cronbach alpha values for each of these subscales, can be found in Supplementary Table 2.

Table 2 Multivariable analysis: linear regression taking the knowledge score as the dependent variable

Variable	Unstandardized beta	Standardized beta	*p* value	Confidence interval	
University level of education	2.954	0.225	< 0.001	1.956	3.951
Hearing about osteoporosis	5.708	0.220	< 0.001	3.764	7.653
Ever been broken, even minor fractures	− 2.032	− 0.139	< 0.001	− 3.147	− 0.917
Diabetes	− 1.652	− 0.1	0.010	− 2.906	− 0.398
Calcium supplements only	− 1.638	− 0.097	0.014	− 2.942	− 0.334
Exercise less 10 min daily	− 5.496	− 0.150	< 0.001	− 8.386	− 2.605
Exercise 10–20 min daily	2.732	0.109	0.004	0.891	4.572
Hyperparathyroidism	− 4.949	− 0.09	0.017	− 9.016	− 0.883
Chemotherapy current usage	− 4.071	− 0.096	0.015	− 7.358	− 0.783
Exercise more than 30 min	1.844	0.09	0.018	0.311	3.377
Calcium and vitamin D supplements	1.616	0.101	0.010	0.381	2.850
Technique level of education compared to illiteracy	1.363	0.078	0.048	0.013	2.714

Bivariate analysis of factors associated with each OHBS subscale

The bivariate analysis results of factors associated with each of the OHBS subscales are summarized in Supplementary Table 3. A significantly higher susceptibility score was found in illiterate people compared to all other educational levels (8.88). In addition, a higher age ($r = 0.204$) and a higher number of kids ($r = 0.140$) were associated with an increased susceptibility score. A higher mean seriousness score was found in illiterate women compared to all other educational levels.

An increased age ($r = − 0.101$) and an increased number of kids ($r = − 0.041$) were significantly associated with decreased exercise benefits score. Whereas an increased knowledge score ($r = 0.295$) and ($r = 0.265$) was respectively associated with increased exercise benefits score and mean calcium benefits scores.

A higher exercise barriers score was found in illiterate women compared to all other educational levels and in women with higher age ($r = 0.225$), whereas a higher knowledge score was correlated with a lower exercise barriers score ($r = − 0.142$). In addition, a higher calcium barriers score was found with increased age ($r = 0.132$), whereas a higher knowledge score was correlated with a lower calcium barriers score ($r = − 0.198$). Finally, a higher health motivation score was found in women with higher knowledge about osteoporosis ($r = 0.275$).

Multivariable analysis

The results of a linear regression, taking the susceptibility score as the dependent variable, showed that age (Beta = 0.051; CI 0.031–0.072) was significantly associated with a higher susceptibility score. Being employed (Beta = − 0.514; CI − 0.944–− 0.083) was significantly associated with a higher seriousness score.

A higher knowledge (Beta = 0.129; CI 0.094–0.164), divorced status compared to single (Beta = 1.004; CI 0.076–1.933), and smoking waterpipe compared to non-smokers (Beta = 0.511; CI 0.007–1.015) were associated with a higher exercise benefits score. Furthermore, an increase in the knowledge score (Beta = 0.093; CI 0.064–0.122) was significantly associated with a higher calcium benefits score, whereas cigarette smoking compared to non-smokers (Beta = −0.581; CI − 0.971–− 0.192) was significantly associated with a lower calcium benefits score.

Increased age (Beta = 0.081; CI 0.047–0.115) and a technical educational level compared to illiteracy (Beta = 1.083; CI 0.133–2.033) were associated with a higher exercise barriers score, whereas a higher knowledge score (Beta = − 0.068; CI − 0.123–− 0.013) and being employed vs unemployed (Beta = − 0.846; CI − 1.540–− 0.151) were associated with a lower exercise barriers score.

Increased age (Beta = 0.034; CI 0.011–0.056) was significantly associated with a higher calcium barriers score, whereas a higher knowledge score (Beta = − − 0.086; CI − 0.122–− 0.049) and a primary level of education compared to illiteracy (Beta = −0.7; CI − 1.317–− 0.083) were significantly associated with a lower calcium barriers score.

Finally, a higher knowledge score (Beta = 0.187; CI 0.132–0.241) was significantly associated with a higher health motivation score (Table 3).

Discussion

This study assessed the level of knowledge about osteoporosis in women aged 40 years or more in a representative sample of the Lebanese population. The results showed that women who received no education, compared to a higher education and have not previously heard about the disease, had lower

Table 3 Multivariable analysis

Variable	Unstandardized beta	Standardized beta	*p* value	Confidence interval	
Linear regression 1 taking the susceptibility score as the dependent variable					
Age	0.051	0.204	< 0.001	0.031	0.072
Linear regression 2 taking the seriousness score as the dependent variable					
Work status (employed vs unemployed)	− 0.514	− 0.099	0.02	− 0.944	− 0.083
Linear regression 3 taking the exercise benefits score as the dependent variable					
Knowledge score	0.129	0.290	< 0.001	0.094	0.164
Divorced status compared to single	1.004	0.086	0.034	0.076	1.933
Waterpipe smoking compared to non-smokers	0.511	0.08	0.047	0.007	1.015
Linear regression 4 taking the calcium benefits score as the dependent variable					
Knowledge score	0.093	0.257	< 0.001	0.064	0.122
Cigarettes smoking compared to non-smokers	− 0.581	− 0.119	0.003	− 0.971	− 0.192
Linear regression 5 taking the exercise barriers score as the dependent variable					
Age	0.081	0.198	< 0.001	0.047	0.115
Knowledge score	− 0.068	− 0.101	0.015	− 0.123	− 0.013
Work status (employed vs unemployed)	− 0.846	− 0.102	0.017	− 1.540	− 0.151
Technique educational level compared to illiteracy	1.083	0.092	0.026	0.133	2.033
Linear regression 6 taking the calcium barriers score as the dependent variable					
Knowledge score	− 0.086	− 0.191	< 0.001	− 0.122	− 0.049
Age	0.034	0.123	0.003	0.011	0.056
Primary education compared to illiteracy	− 0.7	− 0.092	0.026	− 1.317	− 0.083
Linear regression 7 taking the health motivation score as the dependent variable.					
Knowledge score	0.187	0.275	< 0.001	0.132	0.241

knowledge scores. In addition, women not taking calcium and vitamin D supplements and not exercising at all or exercising less than 20 min per day compared to those having these characteristics had lower osteoporosis knowledge scores. A lower knowledge score was also associated with less recognized benefits of adequate calcium intake and regular physical activity, more perceived barriers towards their practice, and a less important health motivation. A lower level of education correlated to the same results.

Multiple studies conducted in the USA, Canada, Poland, India, and the Middle East have aimed to evaluate the knowledge of osteoporosis main causes and consequences, attitudes essential to limit its occurrence along with personal health beliefs in a subject [23–29]. The majority of previous studies pointed at the need for further education. Our study was conducted among Lebanese women aged 40 years and above in order to investigate the characteristics of Lebanese women population groups with the poorest knowledge of osteoporosis definition, risk factors, and preventive measures in order to identify categories that should be targeted in future campaigns and educational programs.

The mean osteoporosis knowledge score was lower in participants who never went to school as compared to those who attended a technical college or a university. This is in accordance with other research projects in which the greater osteoporosis awareness was found in women with higher education levels and was attributed to increased availability and easier access to information [28, 30–33]. Our results could be similarly explained. In fact, the greater degree of education could have helped women find and appraise health information and subsequently apply these skills to osteoporosis knowledge throughout life. This higher degree of education is usually associated to a higher socio-economic status and subsequent employment with better lifestyle conditions and improved states of health and wellbeing [34].

Lower knowledge scores were found in women who never previously heard about osteoporosis. It is also the case of a survey carried out in Singapore in which women with this characteristic were less aware of osteoporosis facts regarding risk factors and complications [35]. Additionally, it has been established that one's exposure to another individual with osteoporosis, and not necessarily a relative, led to an improved understanding of the issue [36]. This finding supports the development of peer-education programs in order to improve osteoporosis knowledge.

In contrast to a study conducted in the USA, concluding that there is an absence of any association between the degree of knowledge and the practice of preventive measures, particularly diet supplementation as recommended and regular physical activity [37], women enrolled in this study having

less healthier lifestyles reached less important knowledge scores. In fact, those not taking any calcium and vitamin D supplements had a less recognition of osteoporosis key points relatively to those taking calcium supplements. Women with a self-reported regular physical activity lasting less than 10 min compared to those exercising between 10 and 20 min had reached lower knowledge scores. This could be directly interpreted by two different theories that we advance. The first one considers that women with healthier lifestyles could be enough motivated to seek additional information about the different medical disorders. Whereas the second theory states that women with higher health literacy had the required abilities to find and understand health information and then also the resources necessary to put that information into practice. As a result, improved health literacy has the potential to increase access to health care [38].

Women who had a bone fracture and those who are affected by diseases like diabetes and hyperparathyroidism or are exposed to treatments as current chemotherapy and past heparin therapy, all at risk of accelerated bone loss, were less informed about osteoporosis. A study conducted in Canada among patients of both genders, who were managed by orthopedic surgeons for any type of fragility fracture, demonstrated that there is a major lack of awareness linked to osteoporosis even in those at an increased risk of developing or already being affected by this bone disorder [39]. In the same study, individuals who were able to adequately define osteoporosis were those who have been diagnosed to have it and thus, additional information might have been provided by their physicians regarding the different aspects of the disease. Furthermore, it has been demonstrated by multiple research projects that medical doctors were not the main source of information [24, 25]. In contrast, media such as television and internet corresponded to the leading origin. The findings of our study might be attributed to the lack of information given by healthcare professionals to patients with or at increased risk for the disease.

As previously discussed, health behaviors are highly related to the degree of knowledge related to osteoporosis. Furthermore, personal beliefs are also major factors that influence attitudes. In the current study, a higher susceptibility score was reached in women with a more advanced age. This correlates well with other studies that found a positive relationship between older age and a greater noted osteoporosis risk [40, 41]. This could be explained by the fact that osteoporosis is considered a disease of the elderly by younger age groups with no short-term risk of developing it. Furthermore, an increasing age was associated with increased calcium and exercise barriers. The main reason could be that people of older ages have multiple comorbidities not allowing them, in certain cases, to be able to readily perform physical activities (e.g., osteoarthritis, heart failure) and include calcium-rich products like milk, cheese, and ice cream in their diet (e.g., diabetes, dyslipidemia).

Women with a lower knowledge, less healthy lifestyles, and a less important educational status had lower calcium and exercise benefits scores, higher calcium and exercise barriers scores, and were much less motivated to engage in practices and behaviors aiming to reach a better health status. Besides, unemployed women had particularly more recognized exercise barriers and perceived a lower seriousness of the disease as compared to employed ones. In light of these findings, better knowledge helps people develop suitable preventive behaviors. Thereby, presenting information in ways that reach socially disadvantaged populations and with lower levels of education may help improve health behaviors in this group.

Limitations

This research project has multiple limitations. It followed a cross-sectional design being not capable of establishing a cause and effect relationship. The reached sample may not have been representative of the whole Lebanese population as the biggest number of respondents lived in North Lebanon. In view of a questionnaire administered via an interview, anonymity may have not been completely respected and respondent and information biases are possible since participants may have misreported or underreported some of their exposures and characteristics. The questionnaire was translated into Arabic, but this has implications for non-Arabic speaking women in the area possibly excluding those with the poorest osteoporosis knowledge. The cutoff point that was used to determine adequate knowledge was based on the median score and is not representative of the level of knowledge that is necessary for the management/prevention of osteoporosis. The cutoff points of the questionnaire have not been validated and therefore estimates of "poor" knowledge scores may not reflect the level of knowledge required to engage in osteoporosis behaviors. It is possible that women with greater knowledge were more likely to self-report their health behaviors, which could lead to a result associated to better application of preventive measures in the case when it could be not. Moreover, the Arabic translation of these existing questionnaires has not been tested for reliability or validity in this population. A future study will be targeted towards validating this developed scale. Furthermore, the most complicate questions were excluded from this questionnaire with subsequently a less accurate estimate of "poor" knowledge.

Conclusion

This study showed that certain Lebanese women population groups have poorer knowledge than others and osteoporosis health beliefs also differed between them. Thus, the Lebanese community should aim at developing osteoporosis education

programs tailored to meet the needs of the population groups identified in the study as having poor osteoporosis knowledge. In addition, medical practitioners carry the responsibility for providing patients at an increased risk of the disease with adequate information. Furthermore, as a next step, the translation of the previously developed osteoporosis questionnaires utilized in this study should the tested and validated for appropriateness in this population group.

Compliance with ethical standards

The Institutional Review Board of the Holy Spirit University of Kaslik (USEK), in compliance with the Hospital's Regulatory Research Protocol, approved this study protocol based on the fact that the autonomy and confidentiality of participants were respected and since it was an observational study, no harm will be prompted to them. The purpose and requirement of the study were informed to each patient. Consent was obtained as written approval on the ethical consent form.

Conflicts of interest   None.

Appendix

Appendix 1

Background characteristics

1-Demographic data: <u>Mohafazat:</u> □ Beyrouth   □ Mount Lebanon   □ North   □ South   □ Bekaa

2-Age:

3-Number of births:

4- Level of education: □ Illiterate   □ Primary   □ Secondary   □ Vocational   □ Higher education (university, academy, college, institute, conservatories…)

5-Employment: □ Working   □ Not working

6-Socio-economic level (salary per month): □ Less than 1.5 million L.L.   □ Between 3 and 1.5 million L.L.   □ More than 3 million L.L.

7-General health condition:

7.1-Endocrinopathies: □ Hypercortisolism   □ Hypogonadism   □ Hyperparathyroidism   □ Prolactinoma

□ Hyperthyroidm   □ Diabetes Mellitus   □ Agromegaly   □ Absence of disease

7.2-Inflammatory Diseases: □ Rheumatoid arthritis   □ Spondyloarthropathies   □ Absence of disease

7.3-Digestive Diseases: □ Gastrectomy   □ Inflammatory Bowel diseases (Crohn's disease, Ulcerative Colitis)

□ Extended Intestinal Resection   □Malabsorption □Malnutrition   □Severe chronic liver disease □ Absence of disease

7.4-Neoplastic Diseases: □ Multiple Myeloma   □ Metastatic Bone Tumors   □ Absence of disease

7.5-Genetic Diseases: □ Osteogenesis Imperfecta   □ Homocystinuria   □ Hemochromatosis

□ Diseases of the collagenous tissue (Marfan, Ehlers-Danlos, Elastorrhexia)

8-Menopausal Status: □ Non menopausal   □ Menopausal

9-Smoking:

Tobacco	Smoker		Number of cigarettes per day	
	Non-Smoker			
Waterpipe	Smoker		Number of waterpipe consumption	
			The duration of each time	
	Non-Smoker			

10-Alcohol Consumption: Number of glasses per day:

11-Intake of calcium and/or vitamin D supplements:

□ Calcium supplements   □ Vitamin D supplements

12-Drugs:

Drugs	Actual use	Prior use	No use
Corticosteroids (including inhaled corticosteroids			
Aromatase inhibitors: Anastrozole (Arimidex®, Zortex®); Letrozole (Femara®); Exemestane (Aromasine®)			
High-dose thyroid hormones: Levothyroxine (Euthyrox®, Elroxin®)			
Heparin for prolonged treatment			
Anti-cancer chemotherapy			
Lithium			
Hormone replacement therapy			

13- Have you ever heard about osteoporosis?   □ Yes   □ No

   13.1- If you answered by ''Yes'' to the previous question: what is the source of your information?

   □ Internet   □ General Practitioner   □ Family members   □ Friends   □ Radio   □ Television   □ Readings

   □ Conferences

14- Do you know somebody that suffers from osteoporosis: □ Yes   □ No

15-Have you ever been diagnosed as having osteoporosis?   □ Yes   □ No

16-In case you responded by ''Yes'' to the previous question: how was the diagnosis done?

 □ The physician announced it orally   □ You did a DXA SCAN* and the diagnosis was made based on it* A **DEXA scan** is a radiographic test using X-rays that measures bone mineral density (BMD) intended to diagnose osteoporosis

17-In case you responded by ''Yes'' to the question number 16: have you ever been treated for osteoporosis?   □ Yes   □ No

18- Is there any family history of osteoporosis?   □ Yes   □ No

19- Have you ever had a low trauma fracture?   □ Yes   □ No

20-Do you have a family history of a low trauma fracture?   □ Yes   □ No

21- Do you perform any physical activity on a regular basis?   □ Yes   □ No

21.1- If you answered by ''Yes'' to the previous question: how often do you perform this physical activity?

 □ Once weekly   □ Twice weekly   □ Three times weekly   □ More than three times weekly

21.2-If you answered by ''Yes'' to the previous question: for how long this physical activity is performed?

□ More than 30 minutes   □ Between 20 and 30 minutes   □ Between 10 and 20 minutes   □Less than 10 minutes

21.3-If you answered by ''Yes'' to the previous question: how many times per week do you perform this activity?

□ Daily   □ 3 to 5 times   □ 1 to 2 times

Definition of osteoporosis				
Osteoporosis is a condition characterized by	Bone pain increased with activity	Fragile or brittle bones	Decreased muscle strength causing bone fragility	Don't Know
Osteoporosis affects men and women	True	False	Don't Know	
Osteoporosis is more common in women	True	False	Don't Know	
White women are at highest risk of fracture as compared to other races	True	False	Don't Know	
Osteoporosis leads to an increased risk of bone fractures	True	False	Don't Know	
The risk of osteoporosis gradually increases starting the age of 50 years	True	False	Don't Know	
From age 50, most women can expect at least one fracture before they die.	True	False	Don't Know	
Osteoporosis usually causes symptoms (e.g. pain) before fractures occur.	True	False	Don't Know	
Normally, bone loss speeds up after menopause	True	False	Don't Know	
The most important time to build bone strength is between 9 and 17 years of age	True	False	Don't Know	
Most people gain bone mass after 30 years of age	True	False	Don't Know	
There are treatments of osteoporosis after it develops	True	False	Don't Know	
There are no effective treatments for osteoporosis available in Lebanon.	True	False	Don't Know	
Risk Factors				
Early menopause is not a risk factor for osteoporosis	True	False	Don't Know	
If based on your knowledge, early menopause is a risk factor for osteoporosis: What is the reason for that?	Psychological distress	Lack of sex hormones	Neither of the above	**Don't Know**
Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life	True	False	Don't Know	
Smoking does not increase the risk of osteoporosis.	True	False	Don't Know	
Alcoholism is not linked to the occurrence of osteoporosis.	True	False	Don't Know	
Family history of osteoporosis strongly predisposes a person to osteoporosis.	True	False	Don't know	
Excessive dieting	Can cause osteoporosis	Is good for your bones	Has no effect on bones	Don't Know
Eating a diet low in milk products is	More Likely	Less Likely	Nothing to do with	Don't know
Taking cortisone for a long time is	More Likely	Less Likely	Nothing to do with	Don't Know
Regular physical activity increases the risk of osteoporosis.	True	False	Don't Know	
A lifetime of low intake of calcium and vitamin D does not increase the risk of osteoporosis.	True	False	Don't Know	

Appendix 1-Osteoporosis Knowledge Scale

Preventive measures			
There are many ways to prevent osteoporosis	True	False	Don't Know
Any type of physical activity is beneficial for osteoporosis.	True	False	Don't Know
Which of the following exercises is the best way to reduce a person's chance of getting osteoporosis	Swimming	Walking Briskly	Doing Kitchen Chores	**Don't Know**
	Bicycling	Yoga	Housecleaning	Don't Know
	Jogging or running for exercise	Golfing using golf cart	Gardening	Don't Know
How many days a week do you think a person should exercise to strengthen the bones	1 day a week	2 days a week	3 or more days a week	Don't know
What is the least amount of time a person should exercise on each occasion to strengthen the bones?	Less than 15 minutes	20 to 30 minutes	More than 45 minutes	Don't know
An adequate calcium intake helps reducing the development of osteoporosis	True	False	Don't Know
Children 9 to 17 years of age get enough calcium from one glass of milk each day to prevent osteoporosis	True	False	Don't Know
Which of the following is the best reason for taking a calcium supplement	If a person skips breakfast	If a person does not get enough calcium from diet	If a person is over 45 years old	Don't Know
Which of these is a good source of calcium	Apple	Cheese	Cucumber	Don't Know
	Watermelon	Bread	Canned sardines	Don't know
	Chicken	Broccoli	Grapes	Don't Know
	Yogurt	Strawberries	Cabbage	Don't Know
	Ice cream	Grapefruit	Radishes	Don't Know
How much milk must an adult drink to meet the recommended amount of calcium	½ glass daily	1 glass daily	2 or more glasses daily	Don't Know
Sardines and broccoli are good sources of calcium for people who cannot take dairy products.	True	False	Don't Know
Hormone therapy prevents further bone loss at any age after menopause.	True	False	Don't Know

Appendix 1-Knowledge Scale

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Susceptibility					
Your chances of getting osteoporosis are high					
Because of your body build, you are more likely to develop osteoporosis					
Your family history makes it more likely that you will get osteoporosis					
Seriousness					

The thought of having osteoporosis scares you					
It would be very costly if you got osteoporosis					
It would be very serious if you got osteoporosis					
Exercise Benefits					
Regular exercise prevents problems that would happen from osteoporosis					
Regular exercise helps to build strong bones					
Regular exercise cuts down the chances of broken bones					
You feel good about yourself when you exercise to prevent osteoporosis					
For the following 6 questions (numbers 19 to 24), "Taking in enough calcium "means taking enough calcium by eating calcium rich foods and/or taking calcium supplements.					
Calcium Benefits					
You have lots to gain from taking in enough calcium to prevent osteoporosis					
You would not worry as much about osteoporosis if you took in enough calcium					
Taking in enough calcium cuts down on your chances of broken bones					
Exercise Barriers					
You feel like you are not strong enough to exercise regularly					
You have no place where you can exercise					
Your husband or family discourages you from exercising					
Exercising regularly would mean starting a new habit which is hard for you to do					
Exercising regularly upsets your every day routine					
Calcium Barriers					
Calcium rich foods cost too much					
Eating calcium rich foods means changing your diet which is hard to do					
In order to eat more calcium rich foods you have to give up other foods that you like					
Calcium rich foods have too much cholesterol					
Health Motivation					
You eat a well-balanced diet					
You look for new information related to health					
Keeping healthy is very important for you					
You try to discover health problems early					
You have a regular health check-up even when you are not sick					
You follow recommendations to keep you healthy					

<u>Appendix 1-Health Belief Scale</u>

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