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Prevalence and awareness of osteoporosis among postmenopausal Palestinian women

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Abstract

Summary The prevalence and awareness of postmenopausal osteoporosis was assessed among 569 postmenopausal women randomly selected from the population. Osteoporosis was assessed based on bone mineral density (BMD) values at three indicative sites. The results indicate a significant prevalence of the disease among this fraction of the population with a poor knowledge of its risk factors.

Introduction Postmenopausal osteoporosis is a major health problem at the individual and population levels. Assessment of its prevalence and awareness of risk factors provide the basis for health plans to control the disease. No previous studies have been done in our population. A cross-sectional study including 569 postmenopausal women showed a significant prevalence of osteoporosis with a poor awareness of risk factors.

Methods Included in the study were 569 randomly selected postmenopausal women ($\geq$49 years of age). BMD was measured in 505 subjects at the lumbar spine, femoral neck and total hip using dual energy x-ray absorptiometry. Awareness was evaluated using a special questionnaire.

Results Osteoporosis affected the lumbar spine, femoral neck and total hip in 24%, 14% and 29.7% of subjects, respectively. There was a significant negative correlation ($p<0.001$) between age and number of years since menopause and BMD at all the sites evaluated. Conversely, BMD increased at the three sites as weight, height and BMI increased. There was a significant positive correlation between BMD at the three sites and the physical characteristics of the subjects (weight, height and BMI) ($p<0.001$ at the hip and femoral neck, and $p=0.05$ at the lumbar spine). BMD was higher at the lumbar spine and femoral neck among subjects aware of the disease (0.893 and 0.746 g/cm^2, respectively) than among subjects unaware of the disease (0.835 and 0.712 g/cm^2, respectively). This investigation is the first among Palestinian women in this region. It indicates the urgent need for a comprehensive national programme to reduce the incidence of osteoporosis.

Conclusion Postmenopausal osteoporosis is significant among the Palestinian population and there is a poor awareness of the risk factors.

Keywords BMD · Osteoporosis risk factors · Postmenopausal osteoporosis · Palestinian women

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Introduction

Osteoporosis is a major public health problem associated with a high incidence of bone fractures that are significantly linked with excess morbidity, mortality and a high financial burden, even in highly developed countries [1]. Osteoporosis leads to more deaths in the UK than ovarian, uterine and cervical cancers combined [2]. The disease is common among elderly women due to an acceleration of bone loss which occurs after the menopause [3]. Age-related bone loss begins in the fourth decade in both sexes [4, 5]. The increase in the incidence of hip fractures with ageing is primarily due to an age-related reduction in bone strength,

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and is complicated by the continuous increase in the number of elderly people in the community [6, 7].

Osteoporosis is a multifactorial disorder that is affected by an array of risk factors that influence bone mineral density (BMD) and consequently increase the probability of acquiring the disease [8]. Clearly, the higher the number, duration and intensity of these factors, the greater the risk of developing osteoporosis, while their absence does not indicate that BMD will be normal or that osteoporosis will not occur [9]. The most dominant risk factors in society include postmenopausal age, diet (shortage of calcium intake) and lack of regular exercise [6, 10]. In addition, osteoporosis development is influenced by several genetic factors [11–13]. Unfortunately, osteoporosis receives a low level of attention in primary health-care programmes in most underdeveloped countries, where most women are largely unaware of the serious complications associated with osteoporosis.

Minimizing the risk of acquiring the disease begins by modification of individuals' life-style to combat related risk factors and identification of patients at high risk in order to reduce the likelihood of fractures in the future. Life-style modification includes avoidance of alcohol consumption and cigarette smoking, and ensuring a high-quality and balanced diet, regular exercise, and adequate calcium and vitamin D intake (dietary or via supplements). Daily skin exposure to sun light for more than 15 minutes is also highly recommended [14, 15]. More recently, Shin et al. have demonstrated the need for adequate nutrient intake and that high consumption of protein-containing foods and dairy products is associated with a reduced risk of a low body mass index (BMI) [16].

The present study was carried out to investigate the prevalence of osteoporosis among postmenopausal Palestinian women in the West Bank region of Palestine. Eventually, the extended objective of our work is to evaluate the seriousness of osteoporosis in the society in comparison to the populations of neighbouring and other countries, and to unravel the cause(s) of the disease in our population. Moreover, the correlation between osteoporosis in our population and genetic polymorphism in specific marker genes is currently under investigation.

Material and methods

Subjects

The subjects participating in the study were chosen at random from urban and suburban communities using special population maps made available to us by the Palestinian Central Bureau of Statistics (PCBS). A total of 569 postmenopausal women (≥49 years of age) from the

central Bethlehem district were randomly selected from the population by the computer system at the PCBS facility and interviewed in their house. Eventually, 505 of the interviewed subjects reported to a Palestinian osteoporosis diagnostic centre for BMD scanning, and this corresponded to an 88.8% overall response rate.

Data collection

Data were collected in two stages. First, individuals' personal information was obtained and their awareness of osteoporosis assessed through personal interview at their house using a specially prepared questionnaire that was designed in consultation with several experts in the field from various local institutions. The questionnaire included a series of questions designed to assess the subject's specific knowledge concerning the disease and the various risk factors for osteoporosis, including signs and symptoms of the disease, prevention, diagnosis and other related questions. Initially, a pilot study was conducted on the questionnaire to evaluate its reliability and validity. The level of the subject's awareness of the disease was categorized according to the following scale: <40% correct answers indicated a poor knowledge (unaware), 41–69% correct answers indicated a reasonable knowledge, and 70–100% correct answers represented a good knowledge (aware) [17]. Second; bone status was assessed by direct BMD measurement using dual energy x-ray absorptiometry (Hologic QDR 4500 Elite) at the lumbar spine (L1–L4), total hip and femoral neck. The BMD results at the three locations were directly correlated with the various risk factors based on the information collected from the study subjects.

Statistical analysis

The SPSS program was used for data entry and analysis. The analysis included frequencies, descriptive statistics, and bivariate correlation (Pearson's). Simple linear and multiple

Table 1 General description of study subjects

Characteristic	No. of subjects	Mean	Standard deviation
Age (years)	569	61.56	8.47
Age at menopause (years)	569	48.6	4.7
Weight (kg)	569	77.1	14.2
Height (cm)	569	155	0.064
BMI (kg/m^2)	569	32.17	6.33
BMD (g/cm^2)			
Lumbar spine	505	0.852	0.143
Femoral neck	505	0.729	0.119
Total hip	505	0.824	0.143

Table 2 Prevalence of postmenopausal osteoporosis/osteopenia at the lumbar spine, femoral neck and total hip

Site	Osteoporosis	Osteopenia	Normal
Spinal	29.7%	40.4%	29.9%
Femoral neck	24%	47.9%	28.1%
Total hip	14%	46%	40%
At any Site	40.6%	74%	50%
At all sites	8%	5.5%	16%

regression analysis were performed to assess the relationships between BMD and age, weight, height and BMI. A p value ≤ 0.05 was considered significant.

Results

The average weight, height, BMI and BMD of the participating subjects are shown in Table 1. The collective epidemiological data indicate that about 12% of subjects were aware, 61% reasonably aware and 27% were basically unaware of the disease and the relevant risk factors. The range of correct positive answers obtained from all participants was 11.5–91.3% and the mean score was 50.6% with standard deviation 15.8%.

According to the WHO criteria for the diagnosis of osteoporosis using Caucasian reference data, the prevalence of osteoporosis among our study subjects was calculated to be about 30% at lumbar spine, 14% at the total hip, 24% at the femoral neck, about 41% at any site, and 8% at all sites, as shown in Table 2. Similarly, the prevalence of osteopenia was about 40% at the lumbar spine, 46% at the total hip, about 48% at the femoral neck, 74% at any site and about 6% at all sites (Table 2). Between 49 and ≥ 80 years of age,

osteoporosis significantly increased from 0% to 75% at the spine ($p < 0.001$), from about 5% to 62% at the femoral neck ($p = 0.042$) and from 0% to about 88% at the total hip ($p = 0.008$; Table 3). Furthermore, between <5 and >20 years since menopause, osteoporosis significantly increased from about 17% to 47%, from about 12% to 41%, and from 6.5% to about 28% at the spine, femoral neck, and total hip, respectively ($p < 0.001$) as shown in Table 4. Moreover, there was a correlation between BMI and BMD. In subjects with a BMI in the range 18.5–24.9 kg/m^2, the prevalence of osteoporosis was about 57% at the spine, 54% at the femoral neck and 37% at the total hip. The prevalence of osteoporosis was about 24%, 17% and 10% at the spine, femoral neck and total hip, respectively, in subjects with a BMI ≥ 30 kg/m^2 ($p < 0.001$; Table 5).

Age and the physical characteristics of the subjects were directly correlated with BMD. As expected, BMD significantly decreased at all sites (lumbar spine, femoral neck and total hip; $p < 0.001$) with increasing age (≥ 49 years), and the severity of the decrease was more significant with increasing number of years since menopause, as shown in Table 6. Conversely, BMD increased at the lumbar spine, femoral neck and total hip as weight, height and BMI increased (Table 7). For example, BMDs at the lumbar spine were 0.644, 0.781, 0.814, 0.853, 0.885, 0.893 and 0.912 g/cm^2 in subjects weighing <50, 50–59, 60–69, 70–79, 80–89, 90–99 and ≥ 100 kg, respectively, were 0.774, 0.855 and 0.910 g/cm^2 in subjects of height 140–149, 150–159 and ≥ 160 cm, respectively, and were 0.767, 0.826 and 0.875 g/cm^2 in subjects with a BMI of 18.5–24.9, 25–29.9 and ≥ 30 kg/m^2, respectively. There was a significant positive correlation between BMD and the physical characteristics of the subjects (weight, height and BMI) at the three sites ($p < 0.001$ for the femoral neck and total hip, and $p = 0.05$ for the lumbar spine). BMD was also higher in

Table 3 Osteoporosis/osteopenia at the lumbar spine, total hip and femoral neck in relation to age

Site		Age (years)				
		49	50-–59	60–69	70–79	≥ 80
Lumbar spine	Osteoporosis	–	19% (40)	36% (62)	45.2% (42)	75% (6)
	Osteopenia	23.8% (5)	41.7% (88)	40.7% (70)	41.9% (39)	25% (2)
	Normal	76.2% (16)	39.3% (83)	23.3% (40)	12.9% (12)	–
	Total	100% (21)	100% (211)	100% (172)	100% (93)	100% (8)
Total hip	Osteoporosis	–	4.3% (9)	13.4% (23)	33.3% (31)	87.5% (7)
	Osteopenia	38% (8)	36% (76)	58.1% (100)	51.6% (48)	12.5% (1)
	Normal	62% (13)	59.7% (126)	28.5% (49)	15.1% (14)	–
	Total	100% (21)	100% (211)	100% (172)	100% (93)	100% (8)
Femoral neck	Osteoporosis	4.8% (1)	11.4% (24)	27.3% (47)	47.3% (44)	62.5% (5)
	Osteopenia	33.3% (7)	44.5% (94)	56.4% (97)	44.1% (41)	37.5% (3)
	Normal	16.9% (13)	44.1% (93)	16.3% (28)	8.6% (8)	–
	Total	100% (21)	100% (211)	100% (172)	100% (93)	100% (8)

$p < 0.001$ lumbar spine, $p = 0.008$ total hip, $p = 0.042$ femoral neck, vs. age.

Table 4 Osteoporosis/osteopenia at the lumbar spine, total hip and femoral neck in relation to the number of years since menopause

Site		Time since menopause (years)				
		<5	5–10	11–15	16–20	>20
Lumbar spine	Osteoporosis	16.9% (13)	25.7% (27)	32.9% (26)	38.9% (28)	46.6% (54)
	Osteopenia	42.9% (33)	43.8% (46)	46.8% (37)	36.1% (26)	41.4% (48)
	Normal	40.2% (31)	30.5% (32)	20.3% (16)	25% (18)	12% (14)
	Total	100% (77)	100% (105)	100% (79)	100% (72)	100% (116)
Total hip	Osteoporosis	6.5% (5)	3.8% (4)	16.5% (13)	20.8% (15)	28.4% (33)
	Osteopenia	28.6% (22)	49.5% (52)	49.4% (39)	54.2% (39)	57.8% (67)
	Normal	64.9% (50)	46.7% (49)	34.1% (27)	25% (18)	13.8% (16)
	Total	100% (77)	100% (105)	100% (79)	100% (72)	100% (116)
Femoral neck	Osteoporosis	11.7% (9)	16.2% (17)	27.8% (22)	33.3% (24)	41.3% (48)
	Osteopenia	42.9% (33)	52.4% (55)	49.4% (39)	54.2% (39)	50.9% (59)
	Normal	45.4% (35)	31.4% (33)	22.8% (18)	12.5% (9)	7.8% (9)
	Total	100% (77)	100% (105)	100% (79)	100% (72)	100% (116)

$p<0.001$ lumbar spine, $p<0.001$ total hip, $p<0.001$ femoral neck, vs. years since menopause.

subjects who were aware of the disease (lumbar spine 0.893 g/cm², femoral neck 0.746 g/cm²) than in those unaware of the disease (lumbar spine 0.835 g/cm², femoral neck 0.712 g/cm²).

Concerning food supplements and therapy, only about 19% of the subjects were taking calcium supplement and about 12% were taking vitamin D supplement. Only 6% of subjects were taking daily multivitamins and 0.9% were on oestrogen replacement therapy. As shown in Table 8, the majority of the subjects (62%) were aware that postmenopausal women are more susceptible to osteoporosis than men, but only about 25% were aware of the significance of previous fractures and 23% of the significance of a family history in acquiring osteoporosis. Most subjects (60–65%) responded correctly when asked about the effect of specific risk factors including caffeine (about 65%) and smoking (about 60%), while 69% of them failed to independently mention a specific risk factor. About 77% of subjects were

aware that immobility is a risk factor and that limiting movement reduces bone remodelling resulting in weak bones. Only 26% of subjects were aware that ovariectomy is a risk factor, and about 15% thought that thin women with small body frame are more susceptible to osteoporosis. On the contrary, about 81% of subjects were aware that inadequate calcium intake contributes to osteoporosis development.

Table 9 shows the level of subjects' knowledge concerning various behavioural factors in osteoporosis prevention. The majority of subjects (about 79%) were aware of the significance of building strong bones at an early age, even in childhood (85%), as a basic means to defend against osteoporosis. The majority of subjects (~88%) were also aware of the benefit of regular exercise on bone density, while only ~42% were aware of the positive effect of exposure to sunlight on acquiring strong and healthy bones. Regarding diagnosis and symptoms of the disease, only about 37% of subjects were aware of BMD testing, even though about 75%

Table 5 Osteoporosis/osteopenia at the lumbar spine, total hip and femoral neck in relation to BMI

Site		BMI (kg/m²)		
		18.5–24.9	25–29.9	≥30
Lumbar spine	Osteoporosis	56.5% (26)	35.5% (48)	23.5% (76)
	Osteopenia	19.6% (9)	41.5% (56)	42.9% (139)
	Normal	23.9% (11)	23% (31)	33.6% (109)
	Total	I00% (46)	I00% (135)	I00% (324)
Total hip	Osteoporosis	37% (17)	16.3% (22)	9.6% (31)
	Osteopenia	52.1% (24)	51.9% (70)	42.9% (139)
	Normal	10.9% (5)	31.8% (43)	47.5% (154)
	Total	I00% (46)	I00% (135)	I00% (324)
Femoral neck	Osteoporosis	54.4% (25)	30.4% (41)	17% (55)
	Osteopenia	30.4%(14)	51.1% (69)	49% (159)
	Normal	15.2% (7)	18.5% (25)	34% (110)
	Total	I00% (46)	I00% (135)	I00% (324)

$p<0.001$ lumbar spine, $p<0.001$ total hip, $p<0.001$ femoral neck, vs. BMI.

Table 6 Correlation between age and number of years since menopause and BMD

Variable	Categories	No. of subjects	BMD (g/cm^2)					
			Lumbar spine		Total hip		Femoral neck	
			Mean (SD)	Trend	Mean (SD)	Trend	Mean (SD)	Trend
Age (years)	49	21	0.982 (0.122)	–	0.902 (0.102)	–	0.805 (0.086)	–
	50–59	211	0.894 (0.126)	−0.088	0.88 (0.119)	−0.022	0.78 (0.108)	−0.025
	60–69	172	0.83 (0.142)	−0.064	0.807 (0.143)	−0.073	0.703 (0.098)	−0.025
	70–79	93	0.782 (0.135)	−0.048	0.73 (0.127)	−0.077	0.66 (0.127)	−0.077
	≥80	8	0.691 (0.104)	−0.091	0.601 (0.097)	−0.129	0.586 (0.084)	−0.074
Time since menopause (years)	<5	77	0.897 (0.129)	–	0.886 (0.152)	–	0.778 (0.106)	–
	5–10	105	0.868 (0.13)	−0.029	0.854 (0.12)	−0.036	0.744 (0.106)	−0.034
	11–15	79	0.831 (0.118)	−0.037	0.81 (0.121)	−0.044	0.711 (0.111)	−0.033
	16–20	72	0.833 (0.163)	−0.002	0.781 (0.126)	−0.029	0.694 (0.047)	−0.017
	>20	116	0.777 (0.13)	−0.056	0.735 (0.127)	−0.046	0.666 (0.121)	−0.028

$p<0.001$ age, $p<0.001$ time since menopause, vs. BMD (at the three sites).

were aware of the need for postmenopausal women to check their bones regularly. In contrast, about 19% of subjects believed that osteoporosis has warning signs, while about 40% had no view on this matter. Regarding subjects' general knowledge about osteoporosis (Table 10), about 47% had heard of osteoporosis, while only about 32% knew that osteoporosis is not an infectious disease.

Only about 10% knew about oestrogen, and an even smaller proportion (7%) were aware of the importance of oestrogen in maintaining healthy bones. The majority of subjects (about 84%) were able to mention two or more rich dietary sources of calcium. The majority (about 80%) of subjects were strongly of the view that they needed more information on osteoporosis.

Table 7 Correlation between physical variables (weight, height and BMI) and BMD

Variable	Categories	No. of subjects	BMD					
			Lumbar spine		Total hip		Femoral neck	
			Mean (SD)	Trend	Mean (SD)	Trend	Mean (SD)	Trend
Weight (kg)	<50	10	0.644 (0.109)	–	0.62 (0.108)	–	0.558 (0.064)	–
	50–59	45	0.781 (0.149)	0.137	0.738 (0.129)	0.118	0.655 (0.111)	0.097
	60–69	69	0.814 (0.136)	0.033	0.783 (0.13)	0.045	0.695 (0.108)	0.04
	70–79	129	0.853 (0.121)	0.039	0.829 (0.142)	−0.046	0.724 (0.107)	0.029
	80–89	111	0.885 (0.148)	0.032	0.861 (0.139)	0.032	0.767 (0.126)	0.043
	90–99	67	0.893 (0.124)	0.008	0.853 (0.115)	−0.008	0.760 (0.104)	−0.007
	≥100	42	0.912 (0.142)	0.019	0.908 (0.139)	0.055	0.801 (0.1)	0.041
Height (cm)	<130	1	0.678	–	0.892	–	0.766	–
	130–139	2	0.737 (0.211)	0.059	0.762 (0.183)	−0.13	0.78 (0.163)	0.014
	140–149	82	0.774 (0.14)	0.037	0.751 (0.138)	−0.011	0.662 (0.117)	−0.118
	150–159	322	0.855 (0.134)	0.081	0.829 (0.131)	0.078	0.734 (0.115)	0.072
	≥160	98	0.91 (0.143)	0.055	0.871 (0.162)	0.042	0.769 (0.114)	0.035
BMI (kg/m^2)	<18.5	–	–	–	–	–	–	–
	18.5–24.9	46	0.767 (0.155)	–	0.726 (0.13)	–	0.645 (0.112)	–
	25–29.9	135	0.826 (0.14)	0.059	0.795 (0.154)	0.069	0.699 (0.11)	0.054
	≥30	324	0.875 (0.136)	0.049	0.85 (0.131)	0.055	0.754 (0.116)	0.055

$p<0.001$ weight, $p<0.001$ height, $p<0.001$ BMI, vs. BMD (at the total hip and femoral neck; $p=0.05$ at the lumbar spine).

Table 8 Awareness of study subjects about various risk factors for osteoporosis

Variable	Correct answer	Yes		No		Don't know	
		No.	%	No.	%	No.	%
Postmenopausal women more susceptible to osteoporosis	Yes	354	62.2	30	5.3	185	32.5
Surgical removal of ovaries decreases the likelihood of developing osteoporosis	No	46	8.1	148	26	375	65.9
Previous fractures have no effect on developing osteoporosis	No	140	24.6	273	48	156	27.4
Family history has no effect on developing osteoporosis	No	131	23	271	47.6	167	29.3
Thin or small body frame women more susceptible to osteoporosis	Yes	86	15.1	300	52.7	183	32.2
Inadequate calcium intake contributes to the development of osteoporosis	Yes	458	80.5	16	2.8	95	16.7
Caffeine-containing beverages (coffee, tea, soft drinks such as cola) increase the likelihood of developing osteoporosis	Yes	369	64.9	64	11.2	136	23.9
Immobility decreases the likelihood of developing osteoporosis	No	57	10	436	76.6	76	13.4
Smoking tobacco has no effect on developing osteoporosis	No	100	17.6	337	59.2	132	23.2

The level of awareness of osteoporosis was significantly associated with age ($p=0.001$), educational level ($p<0.001$), and residency ($p<0.001$; data not shown). Moreover, awareness was significantly associated with the use of dietary supplements, mainly calcium, vitamin D ($p<0.001$) and multivitamins ($p<0.002$), as shown in (Table 11). However, oestrogen replacement therapy was not significantly linked to awareness ($p=0.095$). This was due to the fact that hormonal treatment is instituted based on clinical examination and evaluation, but knowledge of the disease would increase treatment compliance and thus reduce the risk of osteoporotic fractures among women at risk [18]. Milk consumption was also significantly linked to awareness level among the study subjects ($p<0.001$; data not shown). The correlation between awareness of the disease and age was negative, but between awareness and education level was positive. Education level is well known to influence health awareness in a country, and according to the Central Bureau of Statistics of Norway is the strongest factor predicting knowledge of osteoporosis [19].

Discussion

This study was the first comprehensive effort to evaluate the prevalence and awareness of osteoporosis among postmenopausal Palestinian women in the West Bank region of Palestine. According to WHO criteria, the prevalence of osteoporosis among this group in our society was calculated to be about 30% at the lumbar spine, 14% at the total hip, 24% at the femoral neck, about 41% at any site, and 8% at all sites. The reported prevalence of osteoporosis varies between populations largely depending on the skeletal site that was used in the evaluation. It has been reported that about 30% of western women ≥50 years of age have osteoporosis at any site and 16.2% have osteoporosis at the hip [20, 21]. A study of self-reported osteoporosis in Israel found that 13.6% of Jewish women and 14% Arab women had osteoporosis [22], while in Lebanon (using US/European reference data) the prevalence of osteoporosis was 31% at the lumbar spine and 13% at the femoral neck [23]. In addition, we also investigated

Table 9 Awareness of study subjects about osteoporosis prevention, diagnosis and symptoms

Variable	Correct answer	Yes		No		Don't know	
		No.	%	No.	%	No.	%
Building strong bones, especially before the age 30 years, is the best defence against developing osteoporosis	Yes	452	79.4	18	3.2	99	17.4
Osteoporosis prevention begins in childhood	Yes	482	84.7	39	6.9	48	8.4
Frequent exposure of the skin to sun contributes to the development of osteoporosis	No	146	25.7	237	41.7	186	32.7
Regular exercise such as walking increases bone density	Yes	502	88.2	26	4.6	41	7.2
Bone loss in osteoporosis occurs without symptoms or warning signs	Yes	107	18.8	236	41.5	226	39.7
Have you heard of BMD testing?	–	212	37.3	357	62.7	–	–
Postmenopausal women should test their bones to check if they are at risk of developing osteoporosis	Yes	424	74.5	36	6.3	109	19.2

Table 10 General knowledge of subjects about osteoporosis

Variable	Correct answer	Yes		No		Don't know	
		No.	%	No.	%	No.	%
Heard about osteoporosis?	–	268	47.1	301	52.9	–	–
Osteoporosis can be transmitted from one woman to another	No	12	2.1	181	31.8	376	66.1
Heard about oestrogen?	–	54	9.5	515	90.5	–	–
Is oestrogen important in maintaining healthy bone?	Yes	40	7	3	0.5	526	92.4
Know two or more sources of calcium[a]	–	480	84.4	55	9.7	34	6
Need more information on osteoporosis?	–	453	79.6	116	20.4	–	–

[a] *Yes* know two or more; *No* know one; *Don't know* know none.

the decrease in bone mass among our study subjects with age, and also found a statistically significant association between age and osteoporosis among postmenopausal women, since both cortical and trabecular bone mass declined with increasing age. The prevalence of femoral neck osteoporosis increased shortly after 49 years of age up to 80 years of age from 4.8% to 62.5%. Similarly, spinal osteoporosis increased from 0% to 75% and total hip osteoporosis increased from 0% to 87.5% in the same age range. These results are consistent with those of previous studies on this matter [3, 24]. It should be noted that a limitation of our study was the unequal age distribution of our subjects with relatively few women over the age of 70 years, but this limitation does not seem to have affected the main findings concerning the status of osteoporosis in our population.

The menopause is a significant physiological event in a woman's life especially in relation to the status of the bones, since the loss of the hormone oestrogen causes a marked decrease in bone mass. The present results demonstrate that the prevalence of osteoporosis increases about 3.5 times

between <5 and ≥20 years after the menopause. Since BMI is one of the most common factors affecting osteoporosis among women [14], we investigated its impact on bone status among our study subjects. The results demonstrate that one-third of the subjects (about 29%) were obese and even a larger fraction (about 62%) were overweight. This is higher than comparable findings among Jewish and Arab women living in Israel (Jewish women 22.3% obese and 37.8% overweight, Arab women 34% obese and 42% overweight) [22]. These results indicate a significant positive association between BMI and the incidence of osteoporosis at the lumbar spine, total hip, and femoral neck. In a recent study, Premaor et al. found a significant positive association between hip *t*-score and BMI and a significant negative association with age [25].

Regarding the degree of awareness of the study subjects about osteoporosis and the various risk factors, only about 12% of postmenopausal women correctly answered at least 70% of the questions that were included in the calculation of the knowledge score on osteoporosis. This finding is similar to that found in a study of awareness among Asian

Table 11 Correlation between use of dietary supplements and oestrogen replacement therapy and awareness level

Supplementation		Awareness level				p value
		Aware	Reasonable	Unaware	Total	
Calcium	Yes	21	43	6	70	
	No	45	305	149	499	
	Total	66	348	155	569	<0.001
Vitamin D	Yes	28	66	13	107	
	No	38	282	142	462	
	Total	66	348	155	569	<0.001
Multivitamins	Yes	7	21	5	33	
	No	59	327	150	536	
	Total	66	348	155	569	<0.002
Oestrogen replacement	Yes	3	2	–	5	
	No	63	346	155	564	
	Total	66	348	155	569	0.095

and Asian-American college students [26]. In the present study the level of awareness about osteoporosis was significantly associated with age, education level, residency, food supplements and milk consumption. These findings provide direct evidence that the number of women in this age group who are well advised about the disease is low. This was mostly due to several factors including lack of adequate relevant health education, poor contact between subjects and health professionals, severe shortage of adequate health centres for women of postreproductive age, absence of regular programmes for periodic health and clinical evaluation due to cultural beliefs (milk only for children, and doctors only for the sick), fairly large family sizes, and poor economic conditions.

This investigation demonstrated that only a small percentage of postmenopausal women take preventive measures including ensuring adequate nutrition and consumption of vital food supplements that help to maintain healthy bones. These findings point to the urgent need to raise the level of awareness about osteoporosis in society and to recognize osteoporosis as one of the major health complications that requires immediate attention at both the official level and the public level.

In conclusion, our findings demonstrate that awareness and education are important decisive factors that play important roles in maintaining healthy bones among postmenopausal women through adopting health prevention practices and measures. Moreover, our cohort of subjects provided the opportunity to evaluate other determinants of bone health including genetic markers which are strongly implicated [13] and are currently the subject of ongoing study.

Conflicts of interest None.

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