

# Inter - Relationship of Awareness, Knowledge, Attitude, Some Socio-Economic Variables and Osteoporosis in Sample of Egyptian Women

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## Abstract

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**BACKGROUND:** Osteoporosis is a global health problem, and its prevalence is rapidly increasing worldwide.

**AIM:** The aim was to assess the awareness concerning some nutritional and socio-economic variables causes the disease in a sample of Egyptian women.

**METHODS:** This study was done among 116 female volunteers. They were divided into two groups, pre and post-menopausal, with a mean age of  $42.05 \pm 8.25$  &  $51.13 \pm 5.82$  years and mean body mass index (BMI) of  $30.83 \pm 8.18$  &  $34.24 \pm 8.80$  kg/m<sup>2</sup>. A standardised questionnaire, socioeconomic and food frequency chart were used to assess osteoporosis and food intake awareness. Bone mineral density was measured by dual-energy X-ray absorptiometry (DEXA). Statistical analyses were done using simple percentage and Chi-square test.

**RESULTS:** Data revealed that a low percentage of pre and post-menopausal women were aware of osteoporosis and fracture (16.67% & 12.96% and 30.65% & 19.35%). They had incomplete knowledge about the sources and the beneficial effects of consumption of calcium and vitamin D rich diet. Non-osteoporotic women showed more awareness. Odds ratio predict occupations and educations levels as risk factors for osteoporosis.

**CONCLUSION:** Awareness about osteoporosis and consumption healthy diet were low among Egyptian women, so it is important to implement special osteoporosis prevention program.

## Introduction

The International Osteoporosis Foundation reported that osteoporosis is a serious disease in the Middle East [1]. Because of the overwhelming impacts of osteoporosis, International Osteoporosis Foundation (2011) creates preventive strategies which should be executed to lessen the risk of osteoporotic fractures later on. Three stages to unbreakable bones" is prescribed by the International Osteoporosis Foundation which pieces of advice remaining active, eating regimen rich in calcium, and avoid vitamin D inadequacy to improve bone and muscle health and decrease the danger of osteoporosis [2].

Boonen and his colleagues (2004) reported that both calcium and vitamin D are essential nutrients of an integrated strategy for the prevention and treatment of osteoporosis in patients with dietary insufficiency [3]. Regardless of the increase in its significance, osteoporosis is broadly perceived as a preventable and treatable illness; along these lines, a suitable identification and the board framework that incorporates a way of life changes may minimise the burden on public health resources worldwide. Recommendation rules prescribe discontinuance of tobacco use, avoidance of excessive alcohol intake investment in standard exercise, and a satisfactory intake of calcium and vitamin D for keeping up bone health [4]. However, several studies have demonstrated that osteoporosis patients don't pursue

the suggested clinical rules after the diagnosis of illness [5].

Moreira et al. found that physical exercise is an essential stimulus for the prevention and treatment of osteoporosis. In any case, it is not clear yet which methodology would be better to activate bone metabolism and upgrade the physical capacity of postmenopausal women [6].

Du and his colleagues suggested a conclusive positive or negative association between bone mineral density (BMD) and socioeconomic status (SES) proved to be difficult. However, individuals who are at an extreme SES are the most vulnerable group to have relatively low BMD [7]. The importance of education for osteoporosis has been confirmed by several studies. Okumus et al. found that both pre- and postmenopausal women that obtained a higher level of education exhibited better information about osteoporosis dependent on their awareness questionnaire score [8].

The objective of this study was to identify and to evaluate the risk factors of osteoporosis in the studied sample, and to assess their knowledge level concerning some nutritional and socio-economic variables causes the disease.

## Methods

The sample size was calculated based on the previous study regarding the association between osteoporosis and menopausal state, 53 subjects in each group were adequate, assuming  $\alpha = 0.05$ ,  $B = 0.04$  and power of 95.2%.

This study was done amongst 116 female volunteers. The exclusion criteria; any critical health problems as cardiovascular, hepatic or renal diseases, diabetes mellitus, as well any diseases that could affect bone health (thyroid, parathyroid, adrenal).

They were divided into 2 groups, 54 women were pre-menopausal, and 62 women were post-menopausal regarding (menopausal state), with a mean age of  $42.05 \pm 8.25$  &  $51.13 \pm 5.82$  years and mean body mass index (BMI) of  $30.83 \pm 8.18$  &  $34.24 \pm 8.80$  kg/m<sup>2</sup>. Women were considered to be postmenopausal if they were  $\geq 55$  years or reported not having had a menstrual period during the past 12 months. Institutional ethics committee approval was taken (number 16 / 127) through a project titled " Bone mass among Overweight and Obese Women: Mechanism and Intervention". Besides, informed written consent was obtained from each participant to be included in the study. Data collected in "Management of visceral obesity and growth disturbance unit" in the Medical Research Centre of

Excellence (MRCE) – National Research Centre.

A standardised questionnaire regarding the perception of personal risk of osteoporosis and fractures was used. Socioeconomic data were collected, the frequency chart was used to assess their awareness about nutrients intake especially food rich in calcium and vitamin D in addition to physical activity evaluation. The data for this study was collected by the direct method with the help of a self-prepared and validated questionnaire under the supervision of a dietary consultant. Education level was evaluated by questionnaire commonly divided into four stages: illiteracy, primary school, secondary and university level. Occupation types also divided into four groups: not working, workers, employee and professional and owner of private business.

Each group divided into three groups: normal, osteopenia, and osteoporosis according to their bone health status. BMD (in grams per square centimetre) was measured in the total hip (trochanter, Ward's area and femoral neck) and lumbar spine (L2 – L4) by dual-energy X-ray absorptiometry (DEXA) with (NorlandXr-46, with host software version: 3.9.6 / 2.3.1., USA). The instruments were calibrated daily according to the manufacturer's instructions. Osteoporosis is established by measurement of BMD of the hip and spine using the T-score which was calculated using the following formula:

$$T \text{ score} = (\text{measured bone density} - \text{maximum bone density}) / \text{the maximum standard deviation}$$

T-score  $\geq -1.0$  were grouped as normal, T-score  $< -1.0$  to  $< -2.5$  were put in the osteopenia, and T-score  $< -2.5$  were categorised as having osteoporosis following the diagnostic criteria established by the World Health Organization (WHO, 2003) in adults [9].

Anthropometric parameters: Relevant anthropometric measurements were recorded, including height and weight using standard methods following the recommendations of the International Biological Program [10].

Statistical analyses were carried out with SPSS version 22 software, using simple percentage and Chi-square test of significance and alpha level set at  $p = 0.05$ .

## Results

Table 1 shows the mean  $\pm$  SD of age, weight, height and BMI of pre and post-menopausal women. The post-menopausal women were heavier but shorter. However, both of them were obese as their BMI was  $30.83 \pm 8.18$  and  $34.24 \pm 8.80$ , respectively.

**Table 1: Mean ± SD of age, weight, height and BMI of pre and post-menopausal women**

Parameters	Pre-menopausal No. (54)		Post-menopausal No. (62)	
	Mean ± S D		Mean ± S D	
Age (Year)	42.05 ± 8.25		51.13 ± 5.82	
Weight (kg)	76.96 ± 2.27		80.15 ± 1.90	
Height (m)	1.58 ± 5.59		1.53 ± 6.73	
Body Mass Index (kg/ht <sup>2</sup> )	30.83 ± 8.18		34.24 ± 8.80	

Table 2 shows the distribution of pre and postmenopausal women according to their awareness of osteoporosis and fracture. Out of 54 pre-menopausal women, 16.67% had heard about osteoporosis while and 12.96% about the fracture, while 30.65% among the post-menopausal had heard about osteoporosis and 19.35% about the fracture.

**Table 2: Distribution of pre and postmenopausal women according to their awareness of osteoporosis and fracture**

Parameters	Pre-menopausal No. (54)		Post-menopausal No. (62)	
	No.	%	No.	%
Risk perception of osteoporosis				
No	45	83.33	43	69.35
Yes	9	16.67	19	30.65
Fracture				
No	47	87.04	50	80.65
Yes	7	12.96	12	19.35

Table 3 shows a significant difference between the percent of the frequent consumption of different food items for pre and post-menopausal women. The higher percent frequency consumption of some of the common carbohydrate foods was range from 36.5- 39.1% at the period twice / week for the pre and postmenopausal women respectively. For the milk and dairy products, the most common items consumed were cheese, where 60.4% of the premenopausal women consumed cheese every day.

**Table 3: The percent of the frequency consumption (%) of different food items for pre and post-menopausal women**

Items	Pre-menopausal No. (54)					Post-menopausal No. (62)					P-Value
	Didn't eat	Every day	Twice / week	Every / week	More	Didn't eat	Every day	Twice / week	Every / week	More	
<b>Carbohydrate Foods</b>											
Bread	0.0	38.1	31.1	30.8	0.0	0.0	50.2	37.4	12.5	0.0	
Bakery products	9.5	57.1	33.4	0.0	0.0	6.2	60.3	25.4	8.1	0.0	
Pasta	2.1	2.5	45.1	50.2	0.0	1.4	3.2	54.2	41.5	0.0	
Total	3.7	32.6	36.5	27.2	0.0	2.5	37.9	39.1	20.7	0.0	0.010*
<b>Milk &amp; Milk Products</b>											
Milk	12.4	35.7	28.3	18.7	4.9	16.2	26.4	24.8	27.4	5.2	
Cheese	14.3	60.4	10.2	5.1	10.0	15.9	32.7	21.4	18.8	11.2	
Yoghurt	19.0	11.5	12.4	42.6	14.5	27.1	5.8	11.7	25.1	30.3	
Total	15.3	35.9	16.9	22.1	9.8	18.7	21.6	19.3	23.8	16.6	0.301
<b>Animal protein foods</b>											
Chicken	1.3	2.1	41.3	52.1	3.2	1.1	3.4	54.2	39.5	1.8	
Meat	4.1	0.0	21.4	43.2	31.3	6.3	0.0	49.7	38.4	5.6	
Fish	4.8	0.0	35.2	46.2	13.8	6.2	0.0	30.1	40.9	22.8	
Egg	5.6	54.8	23.8	10.3	5.5	4.1	22.9	18.8	36.4	17.8	
Total	3.9	14.3	30.4	37.9	13.5	4.4	6.5	38.2	38.8	12.1	0.092
<b>Plant protein food</b>											
Legumes	1.3	56.1	23.6	16.0	3.0	2.3	50.2	24.1	15.3	8.1	0.690
<b>Fresh &amp; Cooked Vegetables</b>											
Fresh	8.6	14.5	32.4	28.6	15.9	10.4	9.8	30.6	38.7	10.5	
Cooked	0.0	21.9	36.2	33.6	8.3	0.0	11.3	28.4	41.1	19.2	
Total	4.3	18.3	34.1	31.2	12.1	5.1	6.3	31.5	42.4	14.7	0.004**
<b>Fruits</b>											
Fresh Fruits	2.2	19.3	40.6	23.8	14.1	2.1	11.5	32.4	36.7	17.3	
Fruit Juices	9.5	11.9	28.6	33.3	16.7	14.9	5.2	22.1	33.4	24.4	
Total	5.9	15.7	34.6	28.5	15.3	8.3	8.6	27.3	35.1	20.7	0.015*
<b>Sweet Beverages</b>											
Sweet	4.8	18.4	36.5	29.1	11.2	3.6	21.4	28.7	32.1	14.2	0.000**
Tea	3.7	48.4	29.2	11.6	7.1	1.2	56.1	30.7	8.6	3.4	
Carbonated drink	2.6	12.3	40.1	42.6	2.4	1.3	14.8	43.5	38.7	1.7	
Total	3.4	30.1	34.6	27.1	4.8	1.1	36.1	37.1	23.4	2.3	0.499

\*Significant at P ≤ 0.05; \*\*Highly Significant at P ≤ 0.001.

chicken consumption represents animal protein reported 52.1 and 54.2% / week, legumes consumption as a plant protein food was 56.1- 50.2 / day for both groups. Vegetables and fruits showed the high percent frequency of consumption at range from 34.1 and 34.6% twice / week for the premenopausal women and 42.3 and 35.1% every week for the postmenopausal women. Beverages represent by tea and carbonate carbohydrate, about half of the women of both groups drunken tea every day (48.4, 56.1%), while carbonate beverage consumed at the rate 42.6% every week for the premenopausal and 43.5% twice/week for the postmenopausal women.

Table 4 shows significant differences between the percent distribution of pre and post-menopausal women' according to their attitude and health awareness for improving their bone health. The women awareness in both groups about the consumption of milk, milk products and leafy vegetables was very low especially the last item where the percent under definitely yes was ranged from 0 to 2.38%. Animal protein foods including meat, chicken and fish also showed a low degree of awareness that ranges from 7.14 to 27.09, while that for the egg was zero percent in both groups. Awareness about the harmful effect of the carbonate beverages between the studied two groups was ranging from 14.29 to 37.50%. The beneficial effect of the physical exercise was achieved by 56.29 & 38.50% of the two groups respectively.

**Table 4: Percent distribution of pre and post-menopausal women' according to their attitude and health awareness for improving their bone health**

Questions	Answers				P-Value
	No %	Probably No %	Probably yes %	Definitely yes %	
Total No: (116): Pre-menopausal: (54), Post-menopausal: (62)					
Are drinking milk and eating dairy products improve your bone health?					
Pre-menopausal	7.14	26.19	40.48	26.19	0.068
Post-menopausal	27.10	39.58	25.00	8.33	
Are milk and dairy products contain a lot of Vitamin D & Calcium?					
Pre-menopausal	9.52	28.57	42.86	19.05	0.055*
Post-menopausal	25.00	39.58	29.17	6.25	
Are eating leafy vegetables improve your bone health?					
Pre-menopausal	26.19	45.24	26.19	2.38	0.003**
Post-menopausal	52.08	31.25	16.67	0.00	
Are leafy vegetables contain a lot of Vitamin D & Calcium?					
Pre-menopausal	30.95	50.00	19.05	0.00	0.000**
Post-menopausal	72.92	18.75	8.33	0.00	
Are eating meat & liver to improve your health?					
Pre-menopausal	2.38	45.24	33.33	19.05	0.281
Post-menopausal	6.25	37.50	39.58	16.67	
Does our meats & liver contain a lot of Vitamin D?					
Pre-menopausal	21.43	38.10	33.33	7.14	0.568
Post-menopausal	10.42	20.82	41.67	27.09	
Is eating egg improve your health?					
Pre-menopausal	23.81	42.86	33.33	0.00	0.000**
Post-menopausal	39.58	45.83	14.59	0.00	
Is eating Baladi bread to improve your health?					
Pre-menopausal	4.76	28.57	42.86	23.81	0.010*
Post-menopausal	25.00	18.88	35.57	20.55	
Are drinking a lot of Beverages harm your health?					
Pre-menopausal	14.29	23.80	42.86	19.05	0.499
Post-menopausal	37.50	41.67	14.58	6.25	
Is physical exercise improve bone health?					
Pre-menopausal	3.14	19.30	21.27	56.29	0.013*
Post-menopausal	10.27	22.84	28.69	38.20	

\*Significant at P ≤ 0.05; \*\*Highly Significant at P ≤ 0.001.

Table 5 shows the attitude and awareness about osteoporotic protective foods, calcium intake and physical activity among women according to their education levels and occupations. Data proved that education was associated with higher awareness. The awareness among the illiterate premenopausal women about the beneficial effects of the five items

However, 9.8% and 16.6% of both groups had a very low rate of consumption. Egg consumption reported a high rate of frequency consumption among the premenopausal women (54.8% every day), while

was ranging from 4.2 to 10.3%, while for higher education, the percent was 37.2 to 43.4%. The same results were found among the post-menopausal women, where the percent was ranging from 3.5 to 14.9% and 28.4 to 49.7% for the two educational levels respectively. The association between occupation and osteoporosis awareness was also highest among the employee and the professional jobs followed by those who had private business compared to others who did not work or work as workers in both groups.

**Table 5: Attitude and awareness of osteoporosis among studied women according to their Education and occupations**

Awareness items	Drinking milk & Eating Dairy Products %	Eating leafy vegetables %	Eating Fish %	Taking Calcium %	Doing physical activity %	
Education Levels: Total No: (116): Pre-menopausal: (54), Post-menopausal: (62)						
Illiteracy	No:3 (5.6%)	Pre- menopausal 8.7%	7.9% **	5.1%	10.3%**	4.2%**
Primary	No:8 (6.9%)	Post- menopausal 5.7%	4.6%**	4.2%	14.9%**	3.5%**
Secondary	No:12 (10.3%)	Pre- menopausal 20.6%	19.7%**	22.3%**	24.6%**	18.2%
University	No:20 (37.9%)	Post- menopausal 18.3%	15.3%**	13.6%**	29.8%**	17.9%
Not working	No:44 (37.9%)	Pre- menopausal 31.9%**	33.5%**	32.2%**	27.9%	34.2%**
Workers	No:24 (38.7%)	Post- menopausal 29.9%**	31.2%**	32.5%**	26.9%	33.9%**
Employee and Professional	No:26 (48.1%)	Pre- menopausal 38.8%**	38.9%**	40.4%**	37.2%	43.4%**
Owner of private Business	No:52 (44.8%)	Post- menopausal 46.1%**	48.9%**	49.7%**	28.4%	44.7%**
Type of Occupations						
Not working	No:9 (16.7%)	Pre- menopausal 11.5%**	4.2%**	5.7%**	18.5%**	7.5%**
Workers	No:31 (26.7%)	Post- menopausal 9.1%**	3.4%**	4.7%**	17.3%**	7.2%**
Employee and Professional	No:7 (6.0%)	Pre- menopausal 20.2%	6.4%**	8.5%**	17.6%	9.7%**
Owner of private Business	No:4 (6.5%)	Post- menopausal 18.7%	5.7%**	6.9%**	16.8%	8.9%**
Not working	No:24 (44.4%)	Pre- menopausal 49.4%	62.0%**	62.1%**	47.1%	54.4%**
Workers	No:50 (43.1%)	Post- menopausal 48.1%	60.5%**	58.5%**	44.5%	55.8%**
Employee and Professional	No:18 (33.3%)	Pre- menopausal 18.9%**	27.4%**	23.7%**	16.7%	28.4%**
Owner of private Business	No:28 (24.1%)	Post- menopausal 24.1%**	30.4%**	27.9%**	21.4%	28.1%**

\*Significant at P ≤ 0.05; \*\*Highly Significant at P ≤ 0.001.

Table 6 shows the association between awareness, behaviour, education and occupations with the bone density of the lumbar spine and femur;

Regarding the lumbar spine, there was a statistically significant association with an awareness of eating leafy vegetables and doing physical activity (p = 0.018 and 0.014), as the majority of participants (67.8% and 73.6%) respectively had an osteopenic spine.

Also, there was a statistically significant association between femur density and awareness of eating fish (p = 0.053), as 24.2% of participants had normal bone density while 59.7% had an osteopenic femoral neck. The behaviour of taking calcium was statistically significant (p = 0.019), as 41.2% of participants had osteoporotic and 47.1% had an osteopenic femoral neck.

Regarding education, there was statistically significant association (p = 0.018 and 0.007) with lumbar spine and femur respectively as, the incidence of osteoporotic bone density was increased (36.5% at the spine and 40.4% at the femur) with higher educational level (university), moreover most of the

participated women had osteopenic bone regarding to level of education.

**Table 6: Association between awareness, behaviour, education and occupations with the bone density of the spine & femur**

Bone status (Anatomical sites)	Normal bone density No. (%)		Osteopenia No. (%)		Osteoporosis No. (%)		P-Value		
	Spine	Femur	Spine	Femur	Spine	Femur	Spine	Femur	
Awareness and Behavior: Total No (116)									
Eating dairy products	No:50 (43.1%)	5 (10%)	12 (24%)	33 (66%)	26 (52.0%)	12 (24.0%)	12 (24.0%)	0.582	0.972
Eating leafy vegetables	No:59 (50.9%)	3 (5.1%)	10 (16.9%)	40 (67.8%)	4 (50.8%)	16 (27.1%)	3 (32.2%)	0.018*	0.103
Eating Fish	No:62 (53.5%)	8 (12.9%)	15 (24.2%)	44 (71.0%)	37 (59.7%)	10 (16.1%)	10 (16.1%)	0.174	0.053*
Taking Calcium	No:39 (33.6%)	2 (5.9%)	4 (11.8%)	21 (61.8%)	16 (47.1%)	11 (32.4%)	14 (41.2%)	0.115	0.019*
Doing physical activity	No:53 (45.7%)	2 (3.8%)	9 (17.0%)	39 (73.6%)	31 (58.5%)	12 (22.6%)	13 (24.5%)	0.014*	0.282
Education									
Illiteracy	No:8 (6.9%)	0 (0%)	0 (0%)	8 (100%)	7 (87.5%)	0 (0%)	1 (12.5%)	0.018*	0.007**
Primary	No:12 (10.3%)	2 (16.7%)	5 (38.5%)	10 (83.3%)	8 (61.5%)	0 (0%)	0 (0%)		
Secondary	No:44 (37.9%)	7 (15.9%)	12 (27.9%)	30 (68.2%)	24 (55.8%)	7 (15.9%)	7 (16.3%)		
University	No:52 (44.8%)	7 (13.5%)	10 (19.2%)	26 (50.0%)	21 (40.4%)	19 (36.5%)	21 (40.4%)		
Occupation									
Not working	No:31 (26.7%)	7 (22.6%)	9 (29.0%)	23 (74.2%)	21 (67.7%)	1 (3.2%)	1 (3.2%)	0.017*	0.001**
Workers	No:7 (6.0%)	0 (0%)	0 (0%)	5 (71.4%)	0 (0%)	0 (0%)	0 (0%)		
Employee and Professional	No:50 (43.1%)	6 (12.0%)	11 (22.0%)	33 (66.0%)	28 (56.0%)	11 (22.0%)	11 (22.0%)		
Owner of private Business	No:28 (24.1%)	3 (10.7%)	7 (25.0%)	13 (46.4%)	7 (25.0%)	12 (42.9%)	14 (50.0%)		

\*Significant at P ≤ 0.05; \*\*Highly Significant at P ≤ 0.001.

Occupations was highly statistically significant with bone density (p = 0.017 and 0.001 for spine and femur respectively), as the highest percentage of osteoporotic bone was detecting at who had private business (42.9% at the spine and 50% for the femur), while the manual worker; (71.4% & 57.1%) were osteopenic and (28.6% & 42.9%) were osteoporotic for spine and femur respectively.

Finally, the odds ratio was done to predict risk factors for osteoporosis at the lumbar spine and femur; Table 7 revealed that there was a statistically significant difference with occupations and educations which could be detected by the 95% confidence interval (CI) and p-value (≤ 0.05-0.01).

**Table 7: Odds ratio to predict risk factors for osteoporosis at the lumbar spine and femur**

		Odd Value	95% Confidence Interval	P-Value
Occupation	Spine	12.5	1.62-96.74	0.003**
	Femur	16.4	2.13-126.03	0.001**
Education	Spine	1.5	1.196- 1.497	0.040*
	Femur	4.93	0.61- 39.63	0.100

\*Significant at P ≤ 0.05; \*\*Highly Significant at P ≤ 0.001.

## Discussion

Osteoporosis is a global medical problem, and its prevalence is quickly expanding around the world. In Egypt; osteopenia prevalence (53.9%) and osteoporosis prevalence (28.4%) [22]. Misunderstanding about osteoporosis and the absence of preventive activity among women are as yet not change, making primary avoidance at an early

age the best mediation [11]. As a result of hormonal changes or deficiency of calcium or vitamin, bones become weak and fragile due to loss of tissue. Besides, after menopause, due to a decrease in estrogen levels in the women body bone loss increases [12].

Data of this study revealed the low osteoporosis awareness of the pre and postmenopausal women about the term osteoporosis and fracture; yet data showed that the postmenopausal women were more aware of the risk of the disease, as 30.65% & 19.35% of them had heard about osteoporosis and fracture compared to 16.67% & 12.96% of the pre-menopausal women. In this context; Njeze Ngozi et al. stated that increased prevalence of osteoporosis disease is attributed to low awareness of the disease among the general population referred to as a 'silent disease' [13].

Even though the genetic factor is the important determinant of bone density, however, lifestyle and environmental factors like sedentary life, low intake of calcium and vitamin D and smoking are all other hazard variables of osteoporosis [14]. Knowledge concerning healthy foods was determined by responses to the specific questions; in this study, we had asked questions related to predicting factors of osteoporosis. Including; important components of building bones, to access the frequency of consumption and the awareness of the subjects. Data revealed that women had incomplete knowledge about the sources and the healthy effect of these protective foods. Low percent of the pre and postmenopausal women knowing the beneficial effects of milk and milk products and confirmed the information that milk and dairy products are good sources of calcium and vitamin D (definitely yes). The same results were obtained with other food items that were included. Fujii and his colleagues studied the everyday consumption of green and yellow vegetables and its impact on keeping up bone mass in young women [15]. They found that bone density is linked with lifestyle factors including good nutrition, in the light of the fact that vegetables and fruits, are rich in the nutrient vitamin C and their daily intake had a favourable effect to bone metabolism.

Our data revealed that moderate percent of premenopausal women had knowledge about the healthy effect of increasing activity and exercise on osteoporosis compared to the low percentage of postmenopausal women. It is found that sedentary life which neglects physical exercise and unloading the skeleton leading to decreased bone mass, whereas mechanical loading through exercise increases bone mineral density [16]. Muscle mass is important fact determined and measure the muscle-strengthening exercise which is a defensive factor against bone fracture. A few investigations have announced a positive connection between 'lean body mass and BMD, which suggested that the muscle applies mechanical burden powers on the bone and is

subsequently a metabolically dynamic organ influencing bone health [17], [18].

Alternatively, related awareness to bone density status showed that moderate percent including non-osteoporotic women (normal bone density and osteopenic) were more aware of the importance of consumption of healthy food items which protect against osteoporosis like leafy vegetables and fish, and also about the beneficial effect of physical activity. Also, the knowledge of taking calcium supplement was high for participants had osteopenia which could be explained that they might use calcium as a medication to elevated bone density.

To identify the effect of the socioeconomic status on the women awareness and the bone density status, the educational situation and the type of job were selected. Odds ratio that predicts risk factors for osteoporosis at the lumbar spine and femur revealed that there was a statistically significant difference with occupations and educations which could be detected by the 95% confidence interval (CI) and p-value ( $\leq 0.05-0.01$ ).

Current findings indicated that education levels were significantly associated with the knowledge about the importance of consuming healthy food items influencing bone health and protect against osteoporosis. Specifically, awareness was observed among the higher percent of both pre and postmenopausal women who had attained a high education level (p-value < 0.05), compared to other levels. On the contrary, the association between education levels and bone density showed a higher incidence of osteoporotic change with a higher educational level ( $p = 0.018$  and  $0.007$ ). In agreement with this result Kim et al., have demonstrated that education level was only significantly associated with osteoporosis in men, after adjusting for age, sex, and health behaviours, while the relationship was inverted with women [19]. Other studies demonstrated that there were complicated relationships among the levels of attitudes, knowledge, osteoporosis behaviours and educational level [20]. Since osteoporosis is multifactorial diseases, as hormonal levels, genetic and other causes which might play an important role in the onset of the disease that could explain the previous information obtained [14].

In this study, the association of awareness and different types of occupations among the pre and postmenopausal women was in favour of those holding professional jobs. Also, data concerning the association between types of occupations with bone density revealed a high statistically significant difference between the different groups. The highest percentage of osteoporotic state was detected among women who had a private business. This may attribute to the nature of their work which does not need much physical activity. Njeze Ngozi et al. showed that osteoporosis awareness was significantly

associated with age and occupation but not gender, marital status, and level of education [13].

In conclusion, data of this study revealed the low osteoporosis awareness of the pre and postmenopausal Egyptian women about the term osteoporosis and fracture. Also, a high percent of them was not aware of the healthy effect of consumption of the osteoporosis protective foods rich in calcium, and vitamin D. Moderate percent of them had awareness about the beneficial effect of physical activity. The results indicated that the socioeconomic status like education levels and the type of work were considered as risk factors for osteoporosis. This is why it is important to work in different ways on a special osteoporosis prevention program helping women to maintain good bone health.

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## Author contribution

Prof. Dr Nayera E. Hassan is the Principal investigator (P.I.), designed the project and the study as well revised every step of the project and gave conceptual advice; Prof. Dr Salwa M. El Shebini is the nutritional consultant and wrote the manuscript; Dr Nihad H. Ahmed collected nutritional data and performed the statistical analysis; Dr Safenaz Y. El Sherity performed the anthropology measurements, DEXA Scan and shared at the statistical analysis; Prof. Dr Sahar A. El-Masry and Prof. Dr Enas R. Abdel Hamed gave their conceptual advice; Dr Heba T. Aboud collected the nutritional data from participates and taken anthropology measurements. All authors read and approved the final manuscript.

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