# Osteoporosis Risk Prediction Among a Group of Postmenopausal Females: A Case-Control Study

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**Abstract:**
**Background:** Osteoporosis is often called the silent disease as the first symptom of osteoporosis is a fracture. In Egypt, 53.9% of postmenopausal women have osteopenia and 28.4% have osteoporosis. Failure to identify patients at risk for osteoporosis and fracture results in missed opportunities for prevention. **Objectives:** The study objectives were to assess the association between osteoporosis risk factors and severity of osteopenia/osteoporosis in postmenopausal females and to suggest a simple screening tool for prediction of osteopenia/osteoporosis in primary health care.
**Methods:** This is a case-control study. A sample size of 210 candidates was calculated using Epi-Info version 6. Purposive non-probability sampling technique was used for selection of the candidates. Interviewing questionnaire, Correlations and logistic regression analysis were used.
**Results**: The independent significant predictors for osteopenia/osteoporosis were: advanced age, inadequate physical exercise, inadequate indoor sun exposure, personal history of fragility fractures, improper pregnancy spacing, high parity, early menopause, low body-mass index and family history of osteoporosis. **Conclusion:** This study revealed a high prevalence of undiagnosed osteopenia and osteoporosis. It is recommended to use the above 9 risk factors as a simple cost-effective tool in Primary Health Care (PHC) for early prediction of abnormal bone mineral density (BMD). The majority of these factors can be modified for the early prevention.
**Keywords:** Menopause, Osteoporosis, Screening, Women.

## Introduction:

Osteoporosis is a systemic skeletal disorder characterized by compromised bone strength and mass, with a consequent increase in bone fragility.[1] It is called the silent disease as its first symptom is fractures.[2] It is a major problem worldwide and occurs mainly in postmenopausal females.[3] According to WHO, osteoporosis presents in 15% of women aged 50–59 years and increases quickly to 70% of those over 80 years old.[1]

In Egypt, 53.9% of postmenopausal women have osteopenia and 28.4% have osteoporosis.[4] Identification of patients at risk for osteoporosis is the first step in fracture prevention.[5] Clinical screenings for osteoporosis often focus on T scores.[6] Low BMD alone is less predictive of fracture.[7-8] Combining assessments of BMD and risk factors for osteoporosis provides a more effective clinical strategy for establishing the patients risk levels. Numerous risk factors were linked to osteoporosis as; age, low Body Mass Index (BMI) and premature menopause.[9]

Individuals have elevated fractures risk might be identified by clinical risk factors alone.[10] Family physicians should recommend

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diagnostic testing depending on the risk factors.[11] The current study aimed at prevention of osteopenia/osteoporosis and their complications -including fractures- among postmenopausal women through early detection of risk factors. The objectives were to identify risk factors of osteopenia/osteoporosis in postmenopausal females, to assess the association between risk factors and severity of osteopenia/osteoporosis in postmenopausal females and to suggest a simple model for prediction of osteopenia/osteoporosis in postmenopausal women to be applied as a screening tool in PHC.

**Methods:**

This was a case-control study. Cases were postmenopausal females attending Radiology department in Kasr Alainy hospital and suffering from osteopenia or osteoporosis as confirmed by Dual-energy X-ray Absorptiometry (DXA) scan. Control group was postmenopausal non-osteoporotic females (approved by DXA scan) selected from Family Medicine clinic in Kasr Alainy hospital.

A sample size of 210 candidates was calculated using Epi-Info version 6. The minimum sample size needed to detect an odds ratio (OR) of 2.5 (minimum significant adjusted odds ratio was found by Grgurevic and Gledovic,[12] was 105 cases and 105 controls based on a case-control ratio of 1:1, with a two-sided alpha level of 0.05, 80% power, and with an expected exposure frequency in the control group of 20%. Purposive non-probability sampling technique was used for selection of the candidates.

Inclusion criteria included all postmenopausal women diagnosed by DXA scan as osteopenia or osteoporosis. Exclusion criteria included previously diagnosed osteoporotic patients on medical treatment for osteoporosis and surgically induced menopause.

**The study phases**:

The study was conducted over the period of the last three years. It passed into three phases:

1. **Preparatory phase:** over a period of six months. This phase included review of literature; study design; preparation, validation and testing of tools and obtaining approval from ethical committees.

**The study tool:**

A structured questionnaire was designed to assess the risk factors of osteoporosis in postmenopausal females, which included: socio-demographic characters, medical

history, personal habits and lifestyle including Activity of daily living (ADL), past history, gynecological and reproductive history and Family history:

- Socio-demographic characters adopted from modified Fahmi and El-Sherbini, socio-economic scoring questionnaire to assess the social class of candidates.[13].
- The medical condition, including the diseases and medications, adopted from 2014 clinician`s guide to prevention and treatment of osteoporosis published in National Osteoporosis Foundation (NOF).[14]
- Recommended physical activity adopted using the American College of Sports Medicine`s (ACSM) recommendation for preserving bone health which recommend weight-bearing activities (tennis, stair climbing, jogging or walking) three to five times per week (30-60 minute/day).[15]
- ADL adopted using Katz index of independence in Activity of daily living.[16]

The other parts of the questionnaire were based on an online questionnaire titled "Bone Mineral Density Questionnaire- female" prepared by Irish osteoporosis society (IOS) after modification of some items to cope with the Egyptian cultures and habits.[17] Validation of the tool was done by experts' review. A Pilot testing of the questionnaire was done on 25 postmenopausal women in order to check the clarity of the structured questionnaire and estimate the time needed to complete it.

As most of women were illiterate, the questionnaire had to be completed by interviewing. Some modifications were done; question related to calcium supplementation intake during pregnancy and lactation was added and question related to alcohol intake was deleted, as it is not appropriate to the candidates' culture. The pilot questionnaires were not added to the study results.

2. **Data collection phase:** Data were collected over a period of two year and three months. All postmenopausal women attending Radiology department for DXA scan either directly or referred from outpatient clinics or internal departments, and proved by DXA scan to have osteopenia or osteoporosis were included as cases. Postmenopausal women attending the Family Medicine clinic for any reason were included as controls after proven as non-osteoporotic by DXA scan. It is to be noted that some of the candidates who was collected from the Family Medicine department as control and proven by DXA scan to be osteoporotic were shifted to cases.

Candidates were examined regarding weight and height and BMI was calculated. The ability of candidates to rise from chair (5 times) without using arms was assessed as an indicator for prediction of fall and subsequent fractures.[18] The DXA scan was performed after the completion of the questionnaires to ensure of fairness during interviewing the candidates and to avoid being subjective in reporting findings. Women were classified as either cases or controls, regarding their T-score according to WHO classification of osteoporosis.[11]

It is to be noted that after having the interview questionnaire and DXA scan, many cases turned up to be suffering from osteopenia or osteoporosis. It ended up that to reach the required number for control group we reached a total of 168 cases (out of 274 examined, i.e. 61.3%). None of the patients were discarded and data analysis was done for 168 cases (94 had osteopenia and 74 had osteoporosis) and 106 controls. Management of women was done by prescribing appropriate medical treatment, referral when needed and follow-up in family medicine clinic.

3. **Data management and analysis phase:**

It took a period of three months. All collected questionnaires were revised for completeness. The collected data were coded and entered on the computer using spread sheet "Microsoft Office Excel Software" program, 2007.The data were analyzed using the statistical package for social science (SPSS) version 15.

The data were summarized using number and percentage for qualitative variables, mean and standard deviation for quantitative variables which were normally distributed while median and inter-quartile range (IQR) was used for quantitative variables which were not normally distributed. Comparison between groups were done using Chi-square test for qualitative variables, independent sample t-test and analysis for variance (ANOVA) test with post-hoc test for quantitative normally distributed variables while non-parametrical Kruskal-Wallis and Mann-Whitney tests were used for quantitative variables which were not normally distributed.

Correlations were done to test for linear relations between variables. Logistic regression analysis was done to test for significant predictors for osteopenia/osteoporosis. P- Values less than or equal to 0.05 were considered as statistically significant (P-values were calculated four times for each variable; controls versus cases, controls versus

osteopenia cases, controls versus osteoporosis cases and osteoporosis versus osteopenia cases).

**Ethical consideration:**

Approvals of the research and ethical committee of Family Medicine department and Faculty of Medicine, Cairo University were taken. Informed consents were taken from candidates after explaining the study. Approval of the IOS questionnaire's authors to use and modify the questionnaire was taken. Treatment of all women as needed was emphasized.

**Results:**

Statistically significant differences were found between cases and controls in all socio-demographic parameters, except marital status. Controls had a statistically higher social class and education than cases. Osteopenia cases were statistically significantly younger than osteoporosis cases (P=0.001) (Table-1).

Regarding the personal habits, physical exercise was significantly more practiced by the control group. Walking was the most physical activity practiced by both cases (86.5%) and controls (95.4%). The ADL of Katz index of independency was statistically insignificant between all groups, in which all the participants took high score (either 6/6 or 5/6); which indicated full functions and independency. The ability to rise from the chair of controls was significantly better (P<0.001).

Both indoor and outdoor sun exposure was significantly better among controls; outdoor sun exposure also was statistically significant between cases of osteopenia and osteoporosis (P<0.001). Both postmenopausal calcium and vitamin-D intake were low in general, but controls had a higher intake than cases, and this difference was statistically insignificant except for vitamin-D supplementations intake between controls and osteopenia cases (P=0.023) (Table-2).

The body weight and height were significantly lower in cases compared to controls. Also this difference was statistically significant between osteopenia and osteoporosis cases (P=0.027). Cases show statistically significant higher frequencies of fragility fractures, repeated fractures, height loss, bony pains and family history of osteoporosis and low-trauma fractures. The relative most reported to had osteoporosis and low-trauma fractures was the mother, in both cases (63.2% and 63.0%, respectively) and controls (85.7% and 81.3%, respectively) (Table-3).

Cases had significantly older age of menarche, younger age of menopause and more years after menopause compared to controls. Years after menopause were statistically significant between osteopenia and osteoporosis cases (P=0.002). History of regular menses was statistically significant between osteopenia cases and controls (P=0.031). History of premenstrual tension syndrome was statistically significant between osteoporosis cases and controls (P=0.043).

Number of deliveries and full-term children were significantly less among controls. Pregnancy spacing and calcium supplementations during pregnancy were significantly more practiced by controls. Calcium supplementations during lactation were statistically significant only between osteoporosis and osteopenia cases, in which none of osteoporosis had these supplementations (P=0.030) (Table-4).

Correlations between different parameters and osteopenia/osteoporosis were done. The BMD was negatively related to age (r=-0.306), age of youngest child (r=-0.212), age of last fracture (P=0.020, r=-0.529), years of menopause (r=-0.250), duration of diabetes (P=0.007, r=-0.411) and duration of hypertension (P=0.008, r=-0.314), while it was positively related to weight (r=0.329). Logistic regression analysis was done to test significant predictors of osteopenia/osteoporosis. All significant parameters were tested. Only Advanced age, inadequate physical exercise, inadequate indoor sun exposure, personal history of fragility fracture, improper pregnancy spacing, high parity, early menopause, low BMI and family history of osteoporosis were found to be significant predictors for osteopenia/osteoporosis (Table-5).

**Discussion:**

There is a high prevalence of undiagnosed osteopenia/osteoporosis in postmenopausal females. In the current study, the prevalence of abnormal BMD was 61.3% (27.0% had osteoporosis and 34.3% had osteopenia). A case-control study done in 2014 in Ethiopia to assess risk factors of osteoporosis revealed that 63.8% of females had osteoporosis.[19] Osteopenia/osteoporosis risk factors should be assessed for prevention of this major problem. In this study, age is an independent risk factor for osteopenia/osteoporosis.

This was the case in a case-control study done in 2014 in Karachi to assess the risk factors of osteoporosis; the majority of cases were between 50-59 years of age,[20] the age of cases in the current study fall in this range. The current study revealed that early

menopause is an independent risk factor for osteopenia/osteoporosis. This finding is strongly supported by a case-control study done in 2010 in Belgrade to assess risk factors of osteoporosis in postmenopausal females. The menopause before 47 years of age was significantly independently associated with osteoporosis and the age of menopause in cases was also younger than controls.[12]

Age and age of menopause are non-modifiable risk factors of osteopenia/osteoporosis which should be assessed in all postmenopausal women. Personal history of fragility fractures is an important indicator for osteoporosis as found by a study done in 2006 in UK to assess the susceptibility to osteoporosis.[21] The current study proved history of fragility fracture is an independent risk factor for osteopenia/osteoporosis. Age of last fracture was negatively correlated to BMD.

This is expected as with increased age of last fracture, age of women also increased. On the other hand, a study done in 2014 demonstrated that no significant association between fractures and osteoporosis.[20] Family history of osteoporosis in the current study is an independent risk factor for osteopenia/osteoporosis. A cross-sectional study done in 2011 in Italy to assess epidemiology of osteoporosis is also enforcing this finding.[22] The emphasis on history of osteoporotic fractures in female relatives in the current study probably reflects the belief that osteoporosis is mostly a disease of women.

Combination of supplemental calcium and vitamin-D reduce the risk of fracture as approved by a controlled-clinical trial done in 2004 in Denmark to assess role of vitamin-D and calcium supplementation in prevention of osteoporotic fractures in elderly **(23).** The current study supported these results as cases had a lower intake than controls. Calcium and vitamin-D supplementation to all postmenopausal females in PHC is an important preventive measure for osteopenia/osteoporosis; encouragement and follow-up of their adherence is recommended.

Unfortunately, in Egypt, 89.8% of females do not practice any physical activity[24] Lifetime physical activity positively contributes to total BMD.[25] The current study highlighted that physical exercise was significantly less practiced by cases. Lack of physical exercise is an independent risk factor for osteopenia/osteoporosis. This was supported by a study done in 2010 that stated significantly less physical activity in cases.[12] As a result of this finding, exercise is

recommended for all females, from childhood to postmenopausal, to prevent osteopenia/osteoporosis. In Egypt, overweight (66.2%) and obesity (41.6%) are highly prevalent in women.[24] The current study proved that low BMI is an independent risk factor for osteopenia/osteoporosis. A study done in 2010 showed that cases had significantly lower BMI than controls and body weight below 65 kg was independently associated with osteoporosis.[12]

Low BMI and weight loss are indicator of lower BMD and osteoporosis.[26] A study done in UK in 2008 to assess risk factors for bone loss in postmenopausal Caucasian women found that a caloric restrictive diet for more than three months and loss of weight of more than ten kilogram were statistically significantly reported by more cases than controls.[27] This was not the case in the current study as restrictive diet and weight loss were less among cases. This was unexpected finding but can be explained that controls compensated the deficiency in caloric restrictive diet by other healthy food which they already consumed better than cases.

Socio-demographic characters are associated with various chronic diseases. However inconsistent findings between these characters and osteoporosis had been observed.[28] A study done in 2011 revealed that osteoporosis was associated with poor education.[22] The current study followed the same pattern, cases had significantly low education.

This can be explained by that better educated females know more about osteoporosis in contrast to less educated females.[29] Normally we could expect that a sedentary lifestyle, which is more common in urban than rural population, contributes to the development of osteoporosis. But this was not the case in the current study in which more cases were significantly from rural residence. This was the same in a study done in 2014 who found that rural residents were 1.93 times more likely to develop osteoporosis.[19] This can be explained by residence in rural areas is associated by high prevalence of malnutrition.

**Study Limitation:**

The questionnaire took around 45-60 minutes for each candidate that is considered little bit long duration. It was difficult to find the non-osteoporotic postmenopausal women. Some candidates had difficulties to recall the past history. The cost of DXA scan was high.

**Conclusion:**

This study revealed a high prevalence of undiagnosed osteopenia and osteoporosis. It is recommended to use the above 9 risk factors as a simple cost-effective tool in Primary Health Care

(PHC) for early prediction of abnormal bone mineral density (BMD). The majority of these factors can be modified for the early prevention.

It is recommended to use the independent significant predictors of osteopenia/osteoporosis (advanced age, inadequate physical exercise, inadequate indoor sun exposure, personal history of fragility fractures, improper pregnancy spacing, high parity, early menopause, low BMI and family history of osteoporosis) as a simple screening model for prediction of osteopenia/osteoporosis in postmenopausal women in PHC. Further research is needed to assess the sensitivity of this model as a screening test.

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**Table (1): Socio-demographic characteristics among the studied groups**

| Socio-demographic characteristics | Cases | | | | | | Controls | | P-value* |
|---|---|---|---|---|---|---|---|---|---|
| | Osteoporosis | | Osteopenia | | Total | | | | |
| | No.=**74** | % | No.=**94** | % | No.=**168** | % | No.=**106** | % | |
| **Age (by years):** Mean ± SD | 59.0 ± 7.6 | | 55.4 ± 6.4 | | 57.0 ± 7.2 | | 54.2 ± 4.9 | | **<0.001** |
| **Current residence:** | | | | | | | | | **0.032** |
| ▪ Urban | 43 | 58.1 | 56 | 59.6 | 99 | 58.9 | 76 | 71.7 | |
| ▪ Rural | 31 | 41.9 | 38 | 40.4 | 69 | 41.1 | 30 | 28.3 | |
| **Previous residence:** | | | | | | | | | **0.007** |
| ▪ Urban | 34 | 45.9 | 42 | 44.7 | 76 | 45.2 | 70 | 66.0 | |
| ▪ Rural | 24 | 32.4 | 27 | 28.7 | 51 | 30.4 | 22 | 20.8 | |
| ▪ Shifted from urban to rural | 7 | 9.5 | 11 | 11.7 | 18 | 10.7 | 8 | 7.5 | |
| ▪ Shifted from rural to urban | 9 | 12.2 | 14 | 14.9 | 23 | 13.7 | 6 | 5.7 | |
| **Education:** | | | | | | | | | **0.001** |
| ▪ Illiterate | 34 | 45.9 | 47 | 50.0 | 81 | 48.2 | 35 | 33.0 | |
| ▪ Read & write | 20 | 27.0 | 15 | 16.0 | 35 | 20.8 | 11 | 10.4 | |
| ▪ Primary &preparatory education | 10 | 13.5 | 8 | 8.5 | 18 | 10.7 | 20 | 18.9 | |
| ▪ Secondary education | 5 | 6.8 | 17 | 18.1 | 22 | 13.1 | 30 | 28.3 | |
| ▪ University education | 5 | 6.8 | 7 | 7.4 | 12 | 7.1 | 10 | 9.4 | |
| **Years of education:** | | | | | | | | | **0.001** |
| ▪ Median (IQR) | 0.5 (0: 6) | | 0.1 (0: 12) | | 0.1 (0: 6) | | 6 (0: 12) | | |
| **Occupation:** | | | | | | | | | **0.014** |
| ▪ Not working | 57 | 77.0 | 70 | 74.5 | 127 | 75.6 | 63 | 59.4 | |
| ▪ Working | 13 | 17.6 | 22 | 23.4 | 35 | 20.8 | 39 | 36.8 | |
| ▪ Retired | 4 | 5.4 | 2 | 2.1 | 6 | 3.6 | 4 | 3.8 | |
| **Marital status:** | | | | | | | | | 0.648 |
| ▪ Single | 3 | 4.1 | 0 | 0.0 | 3 | 1.8 | 3 | 2.8 | |
| ▪ Married | 41 | 55.4 | 59 | 62.8 | 100 | 59.5 | 67 | 63.2 | |
| ▪ Widow | 25 | 33.8 | 22 | 23.4 | 47 | 28.0 | 26 | 24.5 | |
| ▪ Divorced | 4 | 5.4 | 6 | 6.4 | 10 | 6.0 | 8 | 7.5 | |
| ▪ Separated | 1 | 1.4 | 7 | 7.4 | 8 | 4.8 | 2 | 1.9 | |
| **Medical insurance:** | | | | | | | | | **<0.001** |
| ▪ Has no insurance | 62 | 83.8 | 76 | 80.9 | 138 | 82.1 | 65 | 61.3 | |
| ▪ Has insurance | 12 | 16.2 | 41 | 19.1 | 30 | 17.9 | 41 | 38.7 | |
| **Family income (LE/month):** | | | | | | | | | **<0.001** |
| ▪ Median (IQR) | 800 (537: 1425) | | 1000 (500: 1500) | | 900 (500: 1500) | | 1200 (737: 2850) | | |
| **Social class:** | | | | | | | | | **0.002** |
| ▪ Low | 42 | 57.6 | 51 | 54.3 | 93 | 55.7 | 39 | 36.8 | |
| ▪ Middle | 22 | 30.1 | 24 | 25.5 | 46 | 27.5 | 32 | 30.2 | |
| ▪ High | 9 | 12.3 | 19 | 20.2 | 28 | 16.8 | 35 | 33.0 | |

- P value of relation between cases (total) and controls.

**Table (2): Personal habits of the studied groups**

| Personal habits | Cases | | | | | | Controls | | P -value* |
|---|---|---|---|---|---|---|---|---|---|
| | Osteoporosis | | Osteopenia | | Total | | | | |
| | No.=**74** | % | No.=**94** | % | No.=**168** | % | No.=**106** | % | |
| **Physical exercise:** | | | | | | | | | **<0.001** |
| ▪ Yes | 18 | 24.3 | 19 | 20.2 | 37 | 22.0 | 65 | 61.3 | |
| ▪ No | 56 | 75.7 | 75 | 79.8 | 131 | 78.0 | 41 | 38.7 | |
| **Recommended physical exercise:** | | | | | | | | | **<0.001** |
| ▪ Yes | 16 | 21.6 | 9 | 9.6 | 25 | 14.9 | 50 | 47.2 | |
| ▪ No | 58 | 78.4 | 85 | 90.4 | 143 | 85.1 | 56 | 52.8 | |
| **Indoor sun exposure:** | | | | | | | | | **<0.001** |
| ▪ Yes | 40 | 54.1 | 53 | 56.4 | 93 | 55.4 | 81 | 76.4 | |
| ▪ No | 34 | 45.9 | 41 | 43.6 | 75 | 44.6 | 25 | 23.6 | |
| **Outdoor sun exposure**:** | | | | | | | | | **<0.001** |
| ▪ Yes | 23 | 31.1 | 61 | 64.9 | 84 | 50.0 | 85 | 80.2 | |
| ▪ Infrequent | 41 | 55.4 | 24 | 25.5 | 56 | 38.7 | 21 | 19.8 | |
| ▪ No | 10 | 13.5 | 9 | 9.6 | 19 | 11.3 | 0 | 0 | |
| **Postmenopausal:** | | | | | | | | | |
| **Calcium supplementations:** | | | | | | | | | |
| ▪ Yes | 21 | 28.4 | 22 | 23.4 | 43 | 25.6 | 34 | 32.1 | 0.245 |
| ▪ No | 53 | 71.6 | 72 | 76.6 | 125 | 74.4 | 72 | 67.9 | |
| **Vitamin D supplementation:** | | | | | | | | | |
| ▪ Yes | 13 | 17.6 | 8 | 8.5 | 21 | 12.5 | 21 | 19.8 | 0.102 |
| ▪ No | 61 | 82.4 | 86 | 91.5 | 147 | 87.5 | 85 | 80.2 | |
| **Coffee consumption:** | | | | | | | | | **<0.001** |
| ▪ Rare/never | 58 | 78.4 | 74 | 78.7 | 132 | 78.6 | 54 | 50.9 | |
| ▪ Monthly | 4 | 5.4 | 2 | 2.1 | 6 | 3.6 | 5 | 4.7 | |
| ▪ 1-3 times weekly | 2 | 2.7 | 11 | 11.7 | 13 | 7.7 | 22 | 20.8 | |
| ▪ 4-6 times weekly | 0 | 0.0 | 1 | 1.1 | 1 | 0.6 | 1 | 0.9 | |
| ▪ Once daily | 9 | 12.2 | 4 | 4.3 | 13 | 7.7 | 21 | 19.8 | |
| ▪ More than once daily | 1 | 1.4 | 2 | 2.1 | 3 | 1.8 | 3 | 2.8 | |
| **Tea consumption:** | | | | | | | | | 0.123 |
| ▪ Rare/never | 13 | 17.6 | 12 | 12.8 | 25 | 14.9 | 7 | 6.6 | |
| ▪ Monthly | 0 | 0.0 | 1 | 1.1 | 1 | 0.6 | 1 | 0.9 | |
| ▪ 1-3 times weekly | 6 | 8.1 | 8 | 8.5 | 14 | 8.3 | 6 | 5.7 | |
| ▪ 4-6 times weekly | 0 | 0.0 | 1 | 1.1 | 1 | 0.6 | 0 | 0.0 | |
| ▪ Once daily | 16 | 21.6 | 21 | 22.3 | 37 | 22.0 | 36 | 34.0 | |
| ▪ More than once daily | 39 | 52.7 | 51 | 54.3 | 90 | 53.6 | 56 | 52.8 | |
| **Soft drinks consumption:** | | | | | | | | | 0.574 |
| ▪ Rare/never | 53 | 71.6 | 65 | 69.1 | 118 | 70.2 | 75 | 70.8 | |
| ▪ Monthly | 3 | 4.1 | 3 | 3.2 | 6 | 3.6 | 2 | 1.9 | |
| ▪ 1-3 times weekly | 11 | 14.9 | 16 | 17.0 | 27 | 16.1 | 22 | 20.8 | |
| ▪ 4-6 times weekly | 5 | 6.8 | 1 | 1.1 | 6 | 3.6 | 1 | 0.9 | |
| ▪ Once daily | 2 | 2.7 | 8 | 8.5 | 10 | 6.0 | 6 | 5.7 | |
| ▪ More than once daily | 0 | 0.0 | 1 | 1.1 | 1 | 0.6 | 0 | 0.0 | |

*P-value of relation between cases (total) and controls. **Outdoor sunlight exposure is 15 minutes/day during summer half-year.

**Table (3): Personal history of the studied groups**

| Personal history | Cases | | | | | | Controls | | P- value* |
|---|---|---|---|---|---|---|---|---|---|
| | Osteoporosis | | Osteopenia | | Total | | | | |
| | No.=**74** | % | No.=**94** | % | No.=**168** | % | No.=**106** | % | |
| **Weight (by Kilograms):** | | | | | | | | | **<0.001** |
| ▪ Mean ± SD | 75.6 ± 14.1 | | 81± 13.5 | | 78.8 ± 14.0 | | 88 ± 12.8 | | |
| **Height (by centimeters):** | | | | | | | | | **<0.001** |
| ▪ Mean ± SD | 154.2 ± 7.4 | | 155.0 ± 6.4 | | 154.7 ± 6.9 | | 157.8 ± 5.7 | | |
| **BMI:** | | | | | | | | | **0.001** |
| ▪ Normal | 9 | 12.2 | 4 | 4.3 | 13 | 7.7 | 3 | 2.8 | |
| ▪ Overweight | 18 | 24.3 | 20 | 21.3 | 38 | 22.6 | 9 | 8.5 | |
| ▪ Obese | 47 | 63.5 | 70 | 74.5 | 117 | 69.6 | 94 | 88.7 | |
| **Restrictive diet:**** | | | | | | | | | **<0.001** |
| ▪ Yes | 5 | 6.8 | 14 | 14.9 | 19 | 11.3 | 32 | 30.2 | |
| ▪ No | 69 | 93.2 | 80 | 85.1 | 149 | 88.7 | 74 | 69.8 | |
| **Frequent restrictive diet:** | | | | | | | | | **0.001** |
| ▪ Yes | 3 | 4.1 | 5 | 5.3 | 8 | 4.8 | 18 | 17.0 | |
| ▪ No | 71 | 95.9 | 89 | 94.7 | 160 | 95.2 | 88 | 83.0 | |
| **Weight loss:***** | | | | | | | | | 0.346 |
| ▪ Yes | 19 | 25.7 | 26 | 27.7 | 45 | 26.8 | 34 | 32.1 | |
| ▪ No | 55 | 74.3 | 68 | 72.3 | 123 | 73.2 | 72 | 67.9 | |
| **Underweight during Childhood:****** | | | | | | | | | 0.982 |
| ▪ Yes | 18 | 24.3 | 25 | 26.6 | 43 | 25.6 | 27 | 25.5 | |
| ▪ No | 56 | 75.7 | 69 | 73.4 | 125 | 74.4 | 79 | 74.5 | |
| **Fragility fractures:** | | | | | | | | | |
| ▪ Yes | 33 | 44.6 | 29 | 30.9 | 62 | 36.9 | 10 | 9.4 | **<0.001** |
| ▪ No | 41 | 55.4 | 65 | 69.1 | 106 | 63.1 | 96 | 90.6 | |
| **Repeated Fragility fractures:** | | | | | | | | | |
| ▪ Yes | 9 | 12.2 | 10 | 10.6 | 19 | 11.3 | 4 | 3.8 | **0.028** |
| ▪ No | 65 | 87.8 | 84 | 89.4 | 149 | 88.7 | 102 | 96.2 | |
| **Height loss:** | | | | | | | | | **<0.001** |
| ▪ Yes | 35 | 47.3 | 39 | 41.5 | 74 | 44.0 | 10 | 9.4 | |
| ▪ No | 39 | 52.7 | 55 | 58.5 | 94 | 56.0 | 96 | 90.6 | |
| **Bony pains:** | | | | | | | | | **0.032** |
| ▪ Yes | 48 | 64.9 | 67 | 71.3 | 115 | 68.5 | 59 | 55.7 | |
| ▪ No | 26 | 35.1 | 27 | 28.7 | 53 | 31.5 | 47 | 44.3 | |
| **Family history of Osteoporosis:** | | | | | | | | | |
| ▪ Yes | 16 | 21.6 | 22 | 23.4 | 38 | 22.6 | 7 | 6.6 | **<0.001** |
| ▪ No | 58 | 78.4 | 72 | 76.6 | 130 | 77.4 | 99 | 93.4 | |
| **Osteoporotic fractures:** | | | | | | | | | |
| ▪ Yes | 18 | 24.3 | 28 | 29.8 | 46 | 27.4 | 16 | 15.1 | **0.018** |
| ▪ No | 56 | 75.7 | 66 | 70.2 | 122 | 72.6 | 90 | 84.9 | |

*P- value of relation between cases (total) and controls. ******Caloric restrictive diet for more than 3 months. ***Weight loss of more than 10 kg or more than 10% of body weight. ****Body weight below average compared to children of the same age.

**Table (4)**: **Menstrual and obstetric history of the studied groups**

| Menstrual and obstetric history | Cases | | | Controls (No.=106) | P- value* |
|---|---|---|---|---|---|
| | Osteoporosis (No.=74) | Osteopenia (No.=94) | Total (No.=168) | | |
| **Age of menarche (by years):** | | | | | **0.004** |
| ▪ Mean ± SD | 13.5 ± 1.8 | 13.3 ± 1.7 | 13.4 ± 1.7 | 12.8 ± 1.5 | |
| **History of regular menses:** | | | | | P0. 093 |
| ▪ No | 3 (4.1%) | 0 (0.0%) | 3 (1.8%) | 6 (5.7%) | |
| ▪ Yes | 71 (95.9%) | 94 (100%) | 165 (98.2%) | 100 (94.3%) | |
| **History of premenstrual tension syndrome:** | | | | | 0.110 |
| ▪ No | 27 (36.5%) | 26 (27.7%) | 53 (31.5%) | 24 (22.6%) | |
| ▪ Yes | 47 (63.5%) | 68 (72.3%) | 115 (68.5%) | 82 (77.4%) | |
| **Age of menopause (by years):** | | | | | **0.007** |
| ▪ Mean ± SD | 47.4 ± 6.0 | 47.6 ± 5.2 | 47.5 ± 5.6 | 49.2 ± 4.4 | |
| **Years of menopause:** | | | | | **<0.001** |
| ▪ Median (IQR) | 10 (5 :18) | 6 (2 :13) | 7 (3 :14.7) | 3 (2: 6) | |
| **Number of pregnancies:** | | | | | 0.065 |
| ▪ Median (IQR) | 6 (4: 8) | 5 (3.7: 7) | 6 (4: 7) | 5 (4: 6) | |
| **Number of deliveries:** | | | | | **0.002** |
| ▪ Median (IQR) | 5 (3: 7) | 4 (3: 6.2) | 5 (3: 7) | 4 (3: 5) | |
| **Number of full-term children:** | | | | | **0.002** |
| ▪ Median (IQR) | 5 (3: 7) | 4 (3: 6) | 5 (3: 7) | 4 (3: 5) | |
| **Number of Breast-feedings:**** | | | | | 0.060 |
| ▪ Median (IQR) | 4 (2: 6) | 4 (2: 6) | 4 (2: 6) | 3 (2: 5) | |
| **Age of youngest child:** | | | | | **0.038** |
| ▪ Mean ± SD | 23.8 ± 7.7 | 21.4 ± 7.3 | 22.4 ± 7.6 | 20.4 ± 7.5 | |
| **Calcium supplementations:** | | | | | |
| **During pregnancy: (No.=260)** | | | | | **<0.001** |
| ▪ No | 62 (91.2%) | 74 (81.3%) | 136 (85.5%) | 62 (61.4%) | |
| ▪ Yes | 6 (8.8%) | 17 (18.7%) | 23 (14.5%) | 39 (38.6%) | |
| ▪ Total | 68 (100%) | 91 (100%) | 159 (100%) | 101 (100%) | |
| **During lactation: (No.=255)** | | | | | 0.130 |
| ▪ No | 68 (100%) | 84 (93.3%) | 152 (96.2%) | 89 (91.8%) | |
| ▪ Yes | 0 (0%) | 6 (6.7%) | 6 (3.8%) | 8 (8.2%) | |
| ▪ Total | 68 (100%) | 90 (100%) | 158 (100%) | 97 (100%) | |
| **Pregnancy spacing: (No.=259) **** | | | | | **0.024** |
| ▪ Never | 19 (28.4%) | 23 (25.3%) | 42 (26.6%) | 15 (14.9%) | |
| ▪ Some pregnancies | 23 (34.3%) | 33 (36.3%) | 56 (35.4%) | 32 (31.7%) | |
| ▪ All pregnancies | 25 (37.3%) | 35 (38.5%) | 60 (38.0%) | 54 (53.5%) | |
| ▪ Total | 67 (100%) | 91 (100%) | 158 (100%) | 101(100%) | |

*P-value of relation between cases (total) and controls. **Breastfeeding (6 months or more for each child). **Pregnancy spacing is 2 years between pregnancy and the following one.

**Table (5): Significant predictors for abnormal BMD (osteopenia and osteoporosis)**

| Predictors | P- value* | Odds ratio | 95% Confidence Interval |
|---|---|---|---|
| ▪ Age (years) | 0.005 | 1.352 | 1.095 - 1.670 |
| ▪ Recommended physical exercise | 0.012 | 11.230 | 1.700 - 74.194 |
| ▪ Sun exposure (indoor) | 0.002 | 17.935 | 2.809 - 114.521 |
| ▪ Personal history of fragility fractures | 0.004 | 267.280 | 5.815 - 12284.410 |
| ▪ Pregnancy spacing:<br>▪ Never<br>▪ Sometimes | 0.033<br>0.009<br>0.070 | <br>29.976<br>8.061 | <br>2.329 - 385.820<br>0.844 - 77.028 |
| ▪ Number of deliveries | 0.017 | 1.751 | 1.106 - 2.774 |
| ▪ Age of menopause (years) | 0.013 | 0.759 | 0.610 - 0.944 |
| ▪ BMI | 0.004 | 0.788 | 0.670 - 0.927 |
| ▪ Family history of osteoporosis | 0.003 | 155.309 | 5.816 - 4147.632 |

*P- value of relation between cases (total) and controls

**الملخص العربى**

**التنبؤ بمخاطر هشاشة العظام بين مجموعة من الإناث بعد انقطاع الطمث**

مها عبد الرحمن موافي ، ليلى محمود كامل ، سهى طلعت حامد ، داليا أحمد محمد ، يارا مجدي طه محمد

**الخلفيه:** غالبًا ما يُطلق على مرض هشاشة العظام اسم المرض الصامت ، حيث أن العرض الأول لهشاشة العظام هو الكسر. تعاني 53.9 ٪ من النساء في مصر بعد انقطاع الطمث ، من استسقاء العظام بينما 28.4 ٪ لديهن هشاشة العظام. الفشل في تحديد المرضى المعرضين لخطر الإصابة بهشاشة العظام والكسور يؤدي إلى فقدان فرص الوقاية.

**الهدف:** كانت أهداف الدراسة هي تقييم العلاقة بين عوامل خطر الإصابة بهشاشة العظام وشدة استسقاء العظام / هشاشة العظام في الإناث بعد بعد انقطاع الطمث، واقتراح أداة فحص بسيطة للتنبؤ باستسقاء العظام / هشاشة العظام في الرعاية الصحية الأولية.

**طرق البحث:** هذا البحث هو دراسة مقطعيه. وكان عدد المشاركين في الدراسة هو 210 سيدة في سن انقطاع الطمث تم اختيارهم عن طريق أخذ العينات غير الاحتمالية. تم استخدام استبيان المقابلة ، الترابط وتحليل الانحدار اللوجستي لتحليل وعرض النتائج.

**النتائج:** كانت التنبؤات المستقلة المستقلة لنخر العظام / هشاشة العظام هي: التقدم في العمر ، التمارين البدنية غير الكافية ، عدم كفاية التعرض لأشعة الشمس في الأماكن المغلقة ، التاريخ الشخصي لكسور الهشاشة ، المباعدة غير الجيدة بين الحمل ، الحمل المتكرر ، انقطاع الطمث المبكر ، انخفاض مؤشر كتلة الجسم والتاريخ العائلي لهشاشة العظام.

**الخلاصه:** كشفت هذه الدراسة عن ارتفاع معدل انتشارنخر العظام وهشاشة العظام الذي لم يتم تشخيصه. وخلصت الى أن استخدام عوامل الخطر التسع السابقة كأداة بسيطة وفعالة من حيث التكلفة في الرعاية الصحية الأولية للتنبؤ المبكر للكثافة المعدنية غير الطبيعية للعظام.