

# Osteoporosis in active working women

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## Abstract

**Introduction:** Osteoporosis is a progressive metabolic bone disease characterized by reduction of mineral density of bone, which leads to reduction of bone firmness, increased fragility and increased risk of bone fractures. The aims of this study were to determine the age structure and average values of BMI in female patients with a diagnosis of osteoporosis and osteopenia, to determine the value of T-score before and after therapy, and to show a correlation of frequency of fractures in relation to already given diagnosed and the presence of menopause.

**Methods:** A retrospective study was conducted on 50 female respondents with diagnosis of osteoporosis and osteopenia. Included female respondents underwent densitometry or ultrasound screening method of heels in which high degree of osteopenia and osteoporosis is detected.

**Results:** The average age of the female respondents included in this study was  $48.06 \pm 11.97$  years and all the respondents were in the category of women with normal body weight. There is a difference in the values of T-score of respondents with osteoporosis compared to osteopenia. Value of T-score decreases in relation to increase of number of years, so the older female respondents had lower values of T-score.

**Conclusion:** The incidence of osteoporosis and osteopenia was higher among active working female respondents in menopause. Respondents with osteoporosis had lower values of T-score, physical and medication therapy in combination led to improvement of T-score. Female respondents with a low value of T-score, with diagnosis of osteoporosis and in menopause, mostly had bone fractures.

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*Keywords: Osteoporosis, T-score, fracture*

## Introduction

Osteoporosis is a progressive metabolic bone disease characterized by reduction of mineral density of bone, which leads to reduction of bone firmness, increased fragility and increased risk of bone fractures. Fractures can occur after minor trauma or even without injury (so-called spontaneous fractures) (1). Osteoporosis is more common during aging when bone mass is progressively disappearing. In women, loss of ovarian function at menopause precipitates rapid bone loss so then many women acquire the criteria for osteoporosis to till 70 year (2).

Epidemiology of fractures follows a similar trend of bone density loss. The frequency of distal radius fractures is growing around age of 50 years and reaches a plateau before the age of 60 years with a moderate increase thereafter. In contrast, the incidence of hip fractures doubles every 5 years after the 70th year of age. At least 1.5 million fractures occur annually in the USA due to osteoporosis. As the population has a tendency to a longer life span, the total number of fractures will continue to grow (2). Around 300,000 hip fractures are recorded in the USA each year and most of them require hospitalization and surgical intervention. The probability that 50-year-old white man gets a hip fracture is 14% for women and 5% for men, and the risk for African Americans is much lower. Hip fractures due to the osteoporosis are associated with high incidence of deep vein thrombosis and pulmonary embolism and mortality rate is between 5 and 20%

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during the first months after surgical intervention (3). In the USA and Europe fractures related to the osteoporosis are more common among women than men, especially in women's postmenopausal bone mass loss. However, this gender difference in bone density and hip fractures related to the ages is not so obvious in other cultures, especially due to genetics, physical activity and nutrition (2). "Gold standard" for diagnosing osteoporosis is densitometry. Several types of densitometry methods are differentiated such as DXA (Dual Energy X-ray absorption-metry), SPA (single photon absorptiometry) and DPA (dual photon absorptiometry). Densitometers based on DXA are typically used. DXA is a method that uses x-rays with two intensities in very small doses which are released through a bone and behind the bone there are sensors measuring the x-rays that passed through the bone and the result is computer-processed. Difference between the released and absorbed x-rays allows the assessment of bone mineral density which is expressed in absolute values of g/cm<sup>2</sup>. BMD (bone mineral density) is the amount of mineral matter per square centimeter of bone. T-score (T value) represents the deviation of the measured value of the BMD from the value of bone mass of young people expressed in standard deviations. Bone density (or BMD) is used in clinical medicine as an indirect indicator of osteoporosis and fracture risk. BMD is measured at the lumbar spine, femoral neck (hip) and the lower third of the thumb bone. The dose of radiation is very low, the search is simple, painless and quick. It takes 10-15 minutes, requires no preparation other than removing the metal parts from clothes. It is performed by sitting and putting the forearm on apparatus bed or lying on it. Advantages of this method are low doses of radiation, high precision and relatively low cost. The dose of radiation received during the densitometry is so low that even people who work with the device do not protect themselves in a special way and it has a value of 1-3 mRem (4). The aims of this study were to determine the age structure and average values of BMI in female respondents with a diagnosis of osteoporosis and osteopenia, to determine the value of T-score before and after therapy, and to show a correlation of fractures frequency in relation to already given diagnosed and the presence of menopause.

## Methods

The study was conducted on 50 female respondents with diagnosis of osteoporosis and osteopenia. Testing was conducted at P.I. Department of Occupational Health of Sarajevo Canton in the period from September 2010 year until November 2011 year. In the research included female respondents are those who underwent densitometry or ultrasound screening method of heels in which high degree of osteopenia and osteoporosis is detected. There were included and whose respondents who used the services of physical therapy and who had been previously diagnosed osteoporosis. Female respondents in the course of a year, every three months, were using physical therapy (kinesitherapy, TENS, magnetic therapy, Solux combination of UV-and IR and diadynamic current) for 15 days.

### *Statistical analysis*

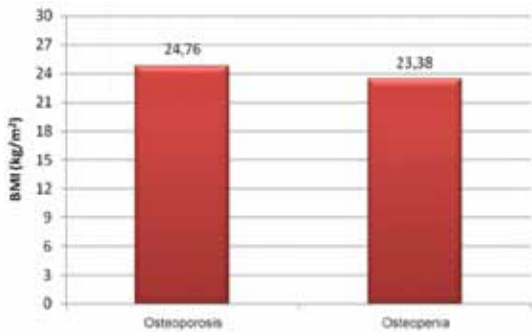
Nominal and ordinal variables in the study were analyzed with  $\chi^2$  test, and when there was the lack of expected frequencies Fisher's exact test was used. For continuous variables in the study the symmetry of their distribution was firstly analyzed by using the Kolmogorov Smirnov test. When the distribution of continuous variables was symmetrical, arithmetic mean and standard deviation were used to show the mean values and degree of dispersion. For comparison of variables parametric tests were used (Student-test and ANOVA test). When the distribution of continuous variables was asymmetric, to show the mean values and degree of dispersion median and interquartile range were used, and for their comparing nonparametric tests (Mann-Whitney U test, Kruskal-Wallis test).

## Results

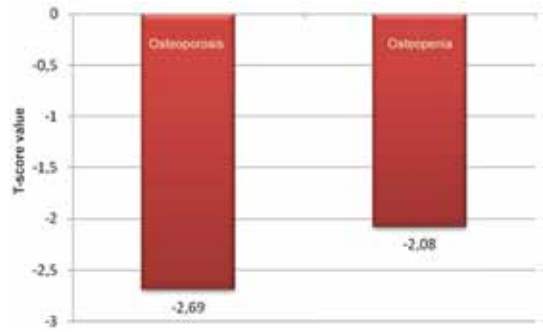
Analysis of age structure of female respondents in relation to the diagnosis led to the information that the average number of respondents with osteoporosis was  $50 \pm 11$  years, with osteopenia  $45.59 \pm 12.93$  years. The average number of age for all female respondents included in this study was  $48.06 \pm 11.97$  years. By applying nonparametric Mann-Whitney test, we came to the statistical conclusion that the average number of age of female respondents with osteoporosis is statistically significantly different compared to respondents with osteopenia,  $Z = -1322$ ,  $p = 0186$  (Table 1).

**TABLE 1.** The average age of female respondents based on diagnosis

Diagnosis	No. of female respondents	Average age	Standard deviation	Median	Minimum	Maximum
Osteoporosis	28	50.00	11.00	54.00	29.00	63.00
Osteopenia	22	45.59	12.93	46.50	26.00	65.00
Total	50	48.06	11.97	53.00	26.00	65.00



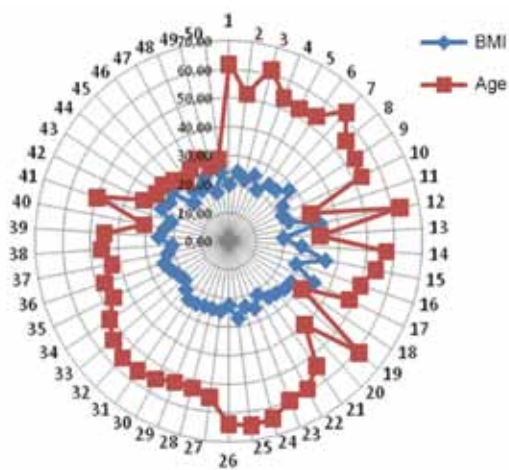
**FIGURE 1.** The average BMI values of female respondents based on diagnosis



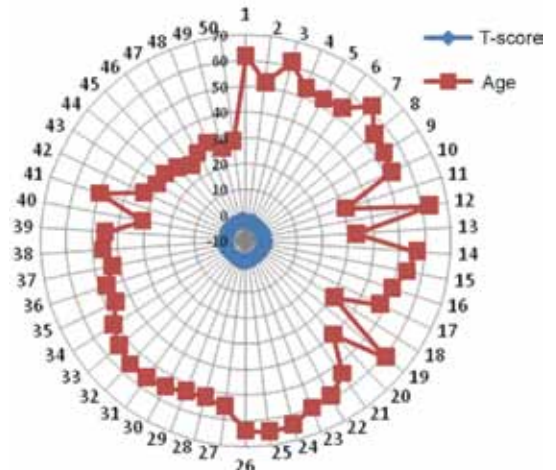
**FIGURE 3.** Average values of T-score based on diagnosis before therapy

Mann-Whitney test showed a statistically significant difference in mean BMI values of female respondents with osteoporosis compared to osteopenia, and that respondents with osteoporosis had a higher BMI,  $Z = -0.847$ ,  $p = 0.384$ . Although there is statistically significant difference in mean values of BMI, both groups were in the category of women with normal body weight

(Figure 1). Using Pearson's correlation we found that there is no correlation between the age of the respondents and their BMI,  $p = 0.115$  (Figure 2). Mann-Whitney test showed a statistically significant difference in mean T-score values of female respondents with osteoporosis compared to osteopenia, and that respondents with osteoporosis had lower values of T-score,  $Z = -5.690$ ,  $p = 0.001$  (Figure 3).



**FIGURE 2.** Correlation of age and BMI of female respondents



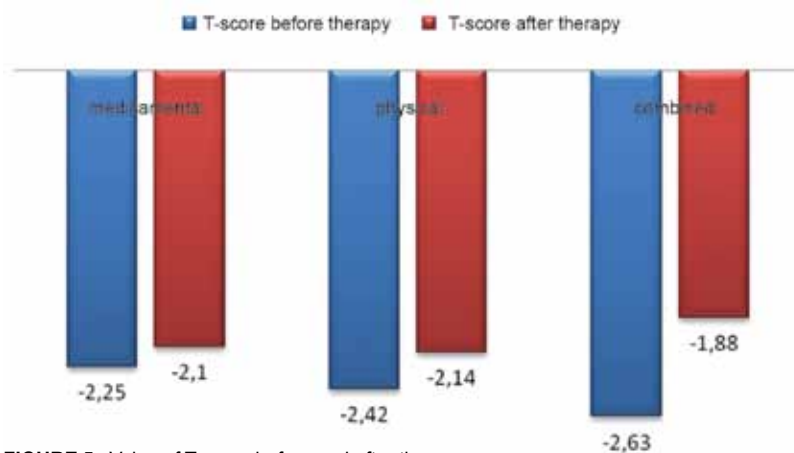
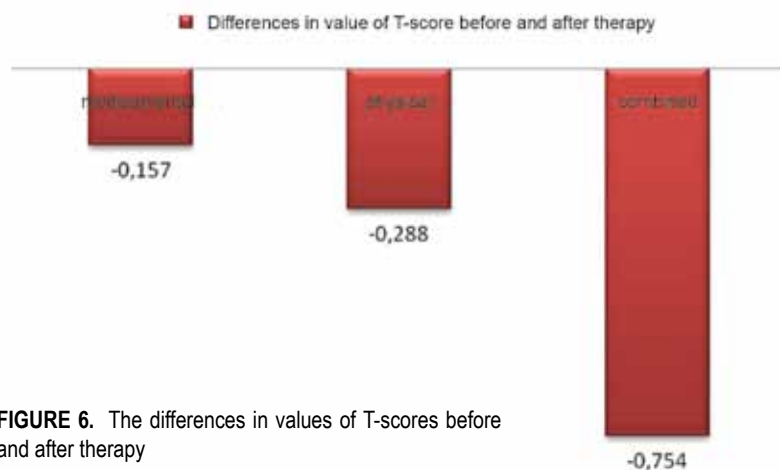
**FIGURE 4.** Correlation between T-score and age of the female respondents

**TABLE 2.** Correlation of frequency of fractures in female respondents in relation to the diagnosis, menopause, and BMI and T-score values

Fracture	T-Score	BMI	Menopause	Diagnoses	Minimum	Maximum
Yes	T_Score	Pearson Correlation	1	-.331	.330	.885**
		Sig. (2-tailed)		.319	.322	.000
		N	11	11	11	11
	BMI	Pearson Correlation	-.331	1	-.141	-.215
		Sig. (2-tailed)	.319		.680	.526
		N	11	11	11	11
Menopause	Pearson Correlation	.330	-.141	1	.607*	
	Sig. (2-tailed)	.322	.680		.048	
	N	11	11	11	11	
Diagnoses	Pearson Correlation	.885**	-.215	.607*	1	
	Sig. (2-tailed)	.000	.526	.048		
	N	11	11	11	11	

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

**FIGURE 5.** Value of T-score before and after therapy**FIGURE 6.** The differences in values of T-scores before and after therapy

Using Pearson correlation has led to the information that the T-score and age of the female respondents are in direct negative correlation, and that the values of T-score are reducing compared to the increase in the number of age, and that older respondents have a lower value of T-score,  $p = 0.002$  (Figure 4).

## Discussion

Osteoporosis is characterized by reduced bone strength, and has a higher prevalence in postmenopausal women although it also occurs in men and women who have risk factors for bone demineralization. Its main clinical manifestations are fractures of the spine and hip. Osteoporosis is represented in more than 10 million people in the

USA, but only 10-20% are diagnosed and treated. It is estimated that currently in BiH there is 162 000 people suffering from osteoporosis. (1) In a conducted study in the USA, 2007 year 3276 patients were included. From the total number of female respondents 1800 (54.6%) of them had symptoms of osteopenia and osteoporosis, and were older than 40 years (5). By analysis of BMI it is established that they were on the verge of a normal body weight and malnutrition BMI 18.54 kg/m<sup>2</sup>. Today, a true image about involvement of the osteoporosis in population is now revealing in the world, as the collected measurement data began to crystallize and analyze it is all the clearer picture of actual conditions in the world today. Information about the involvement of osteoporosis in the world's population now give such a proportion of osteoporosis, so called the silent epidemic. Therefore, the decade of 2000-2010 years was declared "The decade of bones and joints" by the WHO. The data are, unfortunately, so alarming (6). It is a disease of modern era, largely depending on our lifestyle. Osteoporosis is a progressive bone disease, manifested by balance disorder in which bone is being built up and decomposed. Eventually there is a significant reduction of bone mass and bone, and as the person gets older all the worse image, exacerbated by natural outflow of calcium. Such a thin bones with reduced bone mass, are more fragile and prone to fractures. And it reveals the real problem of this disease - it has no symptoms until the actual fracture. No symptoms, no pain, no restrictions are warning. It is estimated that 8-10% of the world population is suffering from osteoporosis. In the next 20 years of this century double increase in the number of patients is expected. Osteoporosis is popularly considered "women's disease" and is often associated with menopause. This is partially true, since one in three women and one in eight men are at risk of the most serious complications of osteoporotic fractures (7). It is important to assess risk factors in adults. After evaluations (assessments) of risk factors for osteoporosis, measurements of bone mineral density (BMD, Bone Mineral Density) should be done by ultrasonic densitometry - a fast, economical method without radiation. Measurements are made on the heel bone. This method can be used as a screening method, and later more precise DXA method,

which is based on the application of low-energy X rays, according to WHO recommendations (1). Jankovic, in the study that included 688 women aged 45-69 years, implemented densitometry, and based on the T-score we found that osteoporosis occurred in 141 female respondents (T-score  $\leq$  -2.5), 400 osteopenia ( T-score  $\leq$  -2.5 to -1), and 147 of them had normal T-score (8). Once osteoporosis develops, it definitely becomes a condition that can not be cured but its further progress can be stopped and partially repaired bone mineralization. Although the occurrence and the development of osteoporosis are genetically conditioned, undeniable fact is that its occurrence and intensity of progression largely depend on external factors, or lifestyle. Increased risk of early development and rapid progression of osteoporosis have women who do not feed in an appropriate manner in the life, do not take sufficient quantities of calcium and vitamin D (especially during the second decade of life), are not sufficiently physically active, consume cigarettes and excessive amounts of alcoholic beverages. To avoid unintended consequences, it is necessary to diagnose osteoporosis at the time. Early diagnosis and timely beginning of treatment are of utmost importance, especially in people who have one or more risk factors for occurrence of osteoporosis (9,10). The analysis of mean values of T-score before and after therapy has led to information that T-score has been improving after all forms of therapy, and that there is statistically significant difference in values before and after therapy,  $p = 0.000$ . The greatest improvement occurred by combination of physical and medicamental therapy, then in female respondents with only physical therapy (three times per year for 15 days), and the least improvement in the respondents on medicamental therapy (Figure 5). In the framework of physical therapy exercises for osteoporosis are used which necessary to continue in the home is setting too, daily, with the advice for proper nutrition, long walks, swimming and dancing. Adding exercise with light weights or elastic bands can be helpful for the upper body. Many medications can create conditions that reduce bone density. Long-term use of corticosteroids such as prednisone, is a huge risk for the loss of calcium. People who consume corticosteroids should increase their daily calcium intake to 1500

mg, vitamin D to 1000 IU, and if possible consume medications from the group of biphosphonates (alendronate or etidronate). Excessive doses of thyroid hormones can also contribute to osteoporosis; fortunately adjustment of the dose can prevent such an action. Medications for anti-epileptic seizures, such as phenytoin and barbiturates, also contribute to calcium loss. People who take large amounts of aluminum containing antacids can also suffer from calcium loss. Good alternative are calcium containing antacids. Other drugs that increase bone loss are immunomodulators (eg, methotrexate, cyclosporine) and some hormones for treatment of endometriosis and cholestyramine (a drug for cholesterol reduction) (11). Bone fractures in female respondents are in correlated with the values of T-score, given diagnosis and menopause. Female respondents with lower values of T-score, with a diagnosis of osteoporosis

and in menopause often had bone fractures. BMI and bone fractures are not correlated (Table 2). Jaganjac, in her study, did not establish a causal relationship between the number of fractures in female respondents with osteoporosis and osteopenia. (12)

## Conclusions

The results of research show that the incidence of osteoporosis and osteopenia was higher among active working age female respondents who were in menopause, and that respondents with osteoporosis had a lower BMI. Female respondents with osteoporosis had lower values of T-score, and that physical and medicament therapy in combination led to improvement of T-score. Female respondents with lower values of T-score, with a diagnosis of osteoporosis and in menopause often had bone fractures.

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