INTRODUCTION

Although women are at greater risk of osteoporosis, men also suffer from the disease. The aging of the population is the reason for the greater prevalence of osteoporosis. The male population of the European Union, including the United Kingdom and Switzerland (EU27 + 2) aged 75 yrs. and over is expected to grow by 43%. The percentage change for people aged 50 and over is higher for men than for women in three countries (Cyprus, Denmark and Ireland). About 20-25% of the people with osteoporosis are men. In the United States, two million American men already have osteoporosis, and 12 million are at risk for bone loss and low bone density [1, 2].

In 2019, approximately 32 million people with osteoporosis were registered in the EU27 + 2, of which 6.5 million were men [3]. According to previous studies, men have a higher risk of death after a fracture regardless of the location of the fracture [4, 5].

The incidence of fractures in men has a classic bimodal peak at 15-45 years and after 70 years. The first peak is probably secondary to traumatic fractures, while the second peak is associated with osteoporosis or osteopenia. Men get femoral fractures on average 10 years later than women. A 50-year-old man has a lifetime risk of osteoporotic fractures of 13-25%, but this frequency depends on other factors, including race, ethnicity and geography. A study published in 2013 reported the cost of osteoporotic fractures in the 27 EU countries. The economic burden is estimated at € 37 billion in 2010, with 26,300 years of life lost [6].

Assessment of bone mineral density is a key component of the overall management of osteoporosis and is used for screening, diagnosis, risk prediction, patient selection for treatment and monitoring of treatment. The gold standard for diagnosing osteoporosis is undoubtedly the DXA study of the axial skeleton. The WHO classification according to BMD and T-score values applies to males over 50 years of age and only applies to DXA of the lumbar spine, proximal femur and forearm. According to WHO criteria, osteoporosis is defined as BMD, which is 2.5 standard deviations (SD) or more below the average for young healthy women (T-score < -2.5 SD) [7-12].
The aim of the present study was to assess BMD and T-score of the lumbar spine and femoral neck through DXA in men and to compare their values in the different age decades.

**Patients and Methods**

About 359 men were examined for age, height, weight, BMI, BMD and T-score on the lumbar spine and femoral neck.

**Distribution of men by age, height, weight and BMI**

The average age of the studied people was 56 years ± 14 years (range 21-86 years), average weight – 79.7 ± 15.5 kg (range 44-130 kg), average height – 173.3 ± 7 cm (range 150-195 cm) and average BMI was 26.5 ± 4.6 kg/m² (range 15.2-55.1 kg/m²).

BMI below 18.5 kg/m² is considered underweight, BMI between 18.5 and 24.9 kg/m² is considered normal weight, and BMI equal to or above 25 kg/m² is defined as overweight. In the group of men, 197/359 men (54.9%) are overweight, 154/359 men (42.9%) are normal weight and 8/359 men (2.2%) are underweight.

**Distribution of men by age**

Out of a total of 359 men, 12 (3.3%) are 20-29 yrs. old, 26 (7.2%) are 30-39 yrs. old, 81 (22.6%) are 40-49 yrs. old, 74 (20.6%) are 50-59 yrs. old, 104 (29%) are 60-69 yrs. old, 49 (13.6%) are 70-79 yrs. old and 13 (3.6%) are ≥ 80 yrs. old, fig. 1.

**Assessment of the BMD and T-score of the lumbar spine and femoral neck**

264 men were evaluated for total lumbar spine BMD and 95 men had results for femoral neck BMD. T-score values are considered normal if they are > -1 SD, osteopenic if the T-score is ≤ -1 and > -2.5 SD, and osteoporotic if T-score is < -2.5 SD. Each zone with available T-score value is defined in three groups: normal, osteopenic and osteoporotic.

**Statistical analysis**

The statistical program SPSS version 19.0 was used to evaluate the data. The information collected is summarized through descriptive statistics in tables with mean values, minimum values, maximum values, standard deviations and standard errors. The ANOVA test analyzes whether there are statistically significant differences in BMD and T-score of the lumbar spine and femoral neck between the different age decades.

**Results**

Age, weight, height and BMI differ significantly between age groups: p-values corresponding to 0.000 for the characteristics of each parameter studied, table 1.

BMI categories also differ significantly between age groups, p = 0.000, table 2.

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**Table 1. Age, weight, height, BMI and their p-value regarding their differentiation between age groups**

<table>
<thead>
<tr>
<th>Characteristics of the assessed men</th>
<th>Number</th>
<th>Mean</th>
<th>SD.</th>
<th>SE.</th>
<th>Min.</th>
<th>Max.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>359</td>
<td>56.31</td>
<td>13.965</td>
<td>.737</td>
<td>21</td>
<td>86</td>
<td>0.000</td>
</tr>
<tr>
<td>Weight</td>
<td>359</td>
<td>79.710</td>
<td>15.539</td>
<td>.8201</td>
<td>44.0</td>
<td>130.0</td>
<td>0.000</td>
</tr>
<tr>
<td>Height</td>
<td>359</td>
<td>173.27</td>
<td>6.816</td>
<td>.360</td>
<td>150</td>
<td>195</td>
<td>0.000</td>
</tr>
<tr>
<td>BMI</td>
<td>359</td>
<td>26.491053</td>
<td>4.5992677</td>
<td>.2427401</td>
<td>15.2249</td>
<td>42.4490</td>
<td>0.000</td>
</tr>
</tbody>
</table>

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**Fig. 1. Distribution of men by age**
Screening of osteoporosis in men

Table 2. Distribution according to BMI categories

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Number</th>
<th>(%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI categories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 18.5 kg/m²</td>
<td>8</td>
<td>2.2%</td>
<td>0.000</td>
</tr>
<tr>
<td>18.5-24.9 kg/m²</td>
<td>154</td>
<td>42.9%</td>
<td></td>
</tr>
<tr>
<td>&gt; 25 kg/m²</td>
<td>197</td>
<td>54.9%</td>
<td></td>
</tr>
</tbody>
</table>

The mean total BMD of the lumbar spine differed significantly over the different age decades in men (p = 0.000). The mean BMD values of the femoral neck did not differ significantly in the different age decades in men (p = 0.07). It is noteworthy that the age groups 20-29 and 30-39 years show lower mean total lumbar spine BMD and median femoral neck BMD compared to other age groups. In men over 50 years of age, the lowest mean total lumbar spine BMD is present in the 60-69 age group, and the lowest mean femoral neck BMD is present in the 70-79 age group, Fig. 2. The prevalence of normal BMD, osteopenia and osteoporosis of the lumbar spine showed that osteoporosis is present in 34 of 264 men (12.9%), Fig. 3. The prevalence of normal BMD, osteopenia and osteoporosis of the femoral neck showed that osteoporosis was present in 13 of 93 men (14%). After reaching the age of 50 yrs. in the group of men, the lowest average BMD is represented in the age decade 60-69 yrs. for the lumbar spine and in the age decade 70-79 for the femoral neck.

**DISCUSSION**

Unlike women, men do not have rapid bone loss after the age of 50.

While screening with DXA scan is an indisputable approach to BMD assessment, there is disagreement about which skeletal sites should be used to assess BMD and which reference population should be used (male or female) when calculating the male T-score [15].

Lateral imaging of the spine with standard radiography or densitometric assessment of vertebral fractures (VFA) is recommended when T-score is < -1.0 SD for men aged ≥ 80 years, height reduction of ≥ 4 cm, intake of corticosteroids corresponding to ≥ 5 mg equivalent to prednisone or equivalent per day for ≥ 3 months, history of previous vertebral fracture.

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**Fig. 2. (a) BMD of the lumbar spine and (b) BMD of the femoral neck by age**

**Fig. 3. Distribution of men with normal BMD, osteopenia and osteoporosis of a) lumbar spine and b) femoral neck**
Updated guidelines from the World Health Organization (WHO) Center and the International Osteoporosis Foundation (IOF) define the use of diagnostic thresholds in men aged 50 yrs. and older and recommend measuring BMD with cervical DXA as a reference standard for diagnosis of osteoporosis in men [16]. The National Osteoporosis Guidelines Group (NOGG) in the UK endorses WHO and IOF recommendations [17]. In the United States, the use of central DXA of the hip and spine is recommended to diagnose osteoporosis [18]. When a scan of the spine or hip cannot be interpreted in men with hyperparathyroidism or they are receiving androgen therapy for prostate cancer, the endocrine society recommends the use of the forearm (1/3 radius). In Canada, the diagnosis is based on the lowest T-score for BMD measured on the lumbar spine, hip or femoral neck and also recommends the use of forearm measurements if lumbar spine or hip scans cannot be used [19-21].

It should be noted that not all scientists believe that screening for osteoporosis in men is justified. The U.S. Preventive Services Task Force concludes that there is currently insufficient evidence to recommend widespread screening for BMD in men based on a lack of studies examining the impact of screening on fracture incidence or fracture-related morbidity and mortality of randomized trials of drugs therapy for the prevention of fractures in men. In addition, there are few studies on the cost-effectiveness of bone densitometry screening in men, although one study found that screening may be cost-effective in men aged 80 and over and in men over 65 who have experienced a previous fracture [7].

A Canadian multicenter study of osteoporosis showed that men, followed for an average of 8.3 years, had lower values for major osteoporotic fractures and low-energy fractures in controlling age and lumbar spine BMD than women [13].

Data from the Geelong Osteoporosis study show that 619 men aged 60-93 yrs. were followed up to 9 years after measuring BMD and registered fractures. Using the Australian reference database for men with femoral neck fractures, 207 had normal BMD, 357 had osteopenia and 55 had osteoporosis [22].

At the Congress of the American Society of Rheumatology on November 5-9, 2020, a study was presented that older men (aged 65 or over) who had a fracture were underdiagnosed and untreated for osteoporosis. The study analyzed 9,876 Medicare beneficiaries in the United States who had an osteoporotic fracture (most commonly spinal [31%], hip [27.9%] or ankle [9.8%]). It is worrying that only 2.1% have been diagnosed with osteoporosis and treated accordingly; 2.8% were diagnosed but not treated, and 2.3% were treated but not diagnosed. In addition, in the 2 years before their fracture, less than 6% of men had their bone mineral density measured, which highlights the lack of consistent guidelines for screening in men [10].

The NHANES 2005-2006 study, conducted by the National Center for Health Statistics (NCHS) in 3,157 adult Americans aged 50 yrs. and over, analyzed data on cervical BMD. The results show that 30% of older men have osteopenia of the femoral neck, and 2% of them have osteoporosis in this area [23].

In another study conducted in South Korea in 2008 and 2010, the authors reported BMD in 2,305 men aged 50-79 yrs. who underwent a DXA scan of the total hip, femoral neck and lumbar spine. The proportions of osteoporosis of the total hip, femoral neck and lumbar spine were 0.7%, 3.3% and 7.0%, respectively. Another study in men aged 69 to 74 yrs. found that osteoporosis occurred in 10.2% of the men. In fact, the prevalence of osteoporosis is difficult to calculate accurately due to the small number of men who undergo DXA screening.

Boyanov M and a team studied the BMD of 315 Bulgarian men aged 20 to 84 yrs. (mean age 53.74 ± 14.67 yrs.). Peak BMD was observed in men aged 30 to 39 yrs.: 0.560 ± 0.065 g/cm² (distal site) and 0.490 ± 0.070 g/cm² (ultra-distal site). A steady decrease in BMD was found, reaching 0.492 ± 0.064 g/cm² in the distal and 0.412 ± 0.069 g/cm² in the ultradistal region in the age group > 70 yrs. Age has a rather small negative effect on the BMD of the forearm, described by a linear model. In men over the age of 50 yrs., the prevalence of osteoporosis in the distal area is 21.19%, compared with 20.45% in women. Low bone mass is observed in 48.77% of the men and in 32.50% of the women. Normal BMD is more common in women (47.05%) than in men (30.04%) [24].

**Conclusion**

Osteoporosis screening is needed because of established concerns about osteoporosis in men, such as the fact that one third of the femoral fractures occur in men and that men are twice as likely to die within one year of a femoral fracture. Awareness of the risk of fractures and fatalities leads to some increase in the assessment of BMD and treatment in men.

The relationship between BMD and the risk of fractures in men is considered to be approximately similar to that in women. There is no consensus
on screening for male osteoporosis. Many men do not pay attention to the risk of fractures despite the obvious risk factors. Assessment by medical history, physical examination, calculation of FRAX plus BMD through DXA scan will help in the diagnosis and treatment of osteoporosis.

**References**