Introduction

Vitamin D plays an important role in calcium-phosphorus homeostasis. Vitamin D maximized intestinal calcium absorption, and indirectly inhibits parathyroid hormone (PTH) secretion. Vitamin D deficiency can be the reason of the secondary hyperparathyroidism, and as a result can lead to bone density deterioration and bone mass loss that is closely linked to osteoporosis and fragility fractures in late adulthood.

The impact of vitamin D deficiency on the bone mineral density among adults population is controversial for today. Busse B. et al. (2013) noted histomorphometric data of a greater ratio of osteoid volume per bone volume, lower cortical and trabecular thicknesses, and reduced proportion of mineralized bone volume per tissue volume in subjects with vitamin D deficiency. Wei Q.S. et al. (2015) found that serum 25(OH)D levels is positively associated with lumbar spine and femoral neck BMD only in elderly women. Deng W.M. et al. (2015) informed that serum 25(OH)D can be predictor for BMD at femoral neck ($R^2 = 0.42$) in southern Chinese postmenopausal women.

The aim of the study was to study the influence of blood 25(OH)D level into the structural-functional state of bone tissue among Donetsk region population.

Materials and methods

The study involved 215 residents of Donetsk region aged 20-79 years. Researches were done during the autumn-spring period. The average age of the subjects was (54.5 ± 12.2) years.

Upon screening all the study subjects underwent blood sampling with a subsequent assessment of 25(OH)D level in serum. Diagnosis of vitamin D deficiency and insufficiency was established based upon the recent Clinical Practice Guideline of the Endocrine Society (2011). Vitamin D deficiency was diagnosed at 25(OH)D values below 50 nmol/L (severe VDD when these values were below 25 nmol/L). Vitamin D insufficiency was registered at 25(OH)D levels between 50 and 75 nmol/L. Finally, the subjects having 25(OH)D levels between 75 and 150 nmol/L were considered the ones with a healthy vitamin D status.

The blood sample was subsequently analyzed by electrochemiluminescence (ECL) method in Elecsys analyzer with cobas test systems. The structural and functional state of the bone tissue was measured on the heel by Quantitative ultrasound densitometer "Sahara" (Hologic).
Baseline variables were analyzed for difference using the independent samples T-test. Significance was set at p<0.05. The study results are presented in the following manner: Me ± SD and Me [LQ; UQ]. “Statistika6.0” © StatSoft, Inc. was used for data processing purposes.

**Results**

The observations revealed a high incidence of vitamin D deficiency (87.5%) among Donetsk region residents. Only 0.9% examined had normal 25(OH)D level. Secondary hyperparathyroidism was recorded in 10.7%.

There were found no impact of age, sex, body mass index on the blood 25(OH)D level. The reason of revealed peculiarity can be explained by high frequency of vitamin D deficiency.

Systemic osteoporosis was diagnosed in 6.6% and systemic osteopenia in 44.9% of residents.

To study the influence of blood 25(OH)D level on ultrasound densitometry data (broadband ultrasound attenuation, speed of sound, stiffness index), all examined subjects were divided into three groups according their blood 25(OH)D level: the first group (group 1) included persons with blood 25(OH)D level less than 25 nmol/L, the second (group 2) – with blood 25(OH)D level from 25 to 50 nmol/L and third (group 3) - 50 nmol/L and above.

Only in a group of elderly people there was observed significantly higher bone densitometry data in subjects with blood 25(OH)D level 50 nmol/L and above compared to subjects with severe vitamin D deficiency. T-score in subjects of group 1 was (-1.00 [-1.40; -0.90]) versus group 3 (-1.85 [-2.55; -1.30]) SD–(p<0.05); stiffness indexin group 1 was (71.15[60.60; 81.10]) versus group 3 (86.70 [78.40; 87.90]) % (p<0.05). Speed of sound parameter, which reflects the elastic properties of the bone, in subjects with severe vitamin D deficiency was significantly lower (1505.6 [1497.8; 1527.5]) compared to group with blood 25(OH)D level 50 nmol/L and above (1532.7 [1521.3; 1542.3]) m/s (p<0.05). It wasn’t found the significant deference in broadband ultrasound attenuation parameter between two groups (56.80 [43.05; 69.40] in group 1 versus 64.00 [62.60; 68.90] dB/MHz in group 3 (p>0.05)).