

BONE MINERAL DENSITY AND OSTEOPOROSIS IN RURAL AND URBAN WOMEN. EPIDEMIOLOGICAL STUDY OF THE LUBLIN REGION (EASTERN POLAND)

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Abstract: The aim of this study was determination of the values of bone mineral density (BMD L₂-L₄) and evaluation of occurrence of osteoporosis (according to densitometric criteria valid until 2000) among normal women living in rural and urban environments (especially postmenopausal) in comparison to other populations. Subjects of the study were 503 normal women aged 30-79 (mean 49.5 years), all residents of Lublin Region (eastern Poland). Analysed population was divided into two subgroups: urban (n=282, 56%) and rural (n=221, 44%). 65 (12.9%) women working as farmers, 107 (21.3%) were retired; other occupations were performed by 325 (64.6%) women. The lumbar spine (L₂-L₄) of all subjects was examined in anterior-posterior position using the dual X-ray absorptiometry - DEXA (LUNAR Corp.) at the Densitometric Laboratory of the Institute of Agricultural Medicine in Lublin from November 1999–June 2000. No statistically significant differences were observed in mean values of BMD between urban and rural populations, nor between farmers and other occupations. Mean values of BMD in every age range were similar to the populations of North America and Northern Europe. The prevalence rates of osteoporosis according to WHO criteria in the entire analysed population were calculated as 6.9%, and osteopenia as 25.4%. The prevalence of osteoporosis and osteopenia increased with advancing age. In women younger than 45 years osteoporosis was not observed, and the prevalence of osteopenia was 12.6%. In women between 45–55 years the prevalence of osteoporosis was 5.7 % and of osteopenia 25.6%. In women older than 55 years of age osteoporosis was observed in 18.5% and osteopenia in 40.7%.

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INTRODUCTION

The currently accepted definition of osteoporosis is “a systemic skeletal disease characterised by low bone mass and microarchitectural deterioration of bone tissue leading to enhanced bone fragility, and consequent increase in fracture risk”. The definition of osteoporosis captures the notion that bone mineral density is a very important component of fracture risk. Until 2000, densitometric criteria of osteoporosis were defined as bone mineral density that is 2.5 standard deviations less than young

adult mean at any skeletal localisation (eg. spine, forearm, femoral neck). The densitometric criteria for diagnosing osteoporosis established in 2000 are more strict, and only the examination of the femoral neck can fit them.

The main after-effect of the non-diagnosed osteoporosis is hip fracture, which constitutes a major health problem in terms of suffering and in terms of use of resources [8]. The tests that form the basis for the diagnosis of osteoporosis and prediction of fracture risk are bone mineral density (BMD) and bone mineral content (BMC) measurements. The “golden standard” for the assessment

of bone mineral density and content is dual energy absorptiometry (DEXA). BMD (BMC) in regional sites such as the hip, spine, distal forearm and the whole body can be measured with high precision and accuracy using this method [10]. Values of bone mineral density (BMD) are normally distributed at all ages and are relatively constant in both genders under the age of 50 years. Bone loss occurs thereafter, particularly in women, in whom it coincides with both ageing and declining ovarian function. These two factors influence bone loss differently: while age-related bone loss shows a linear trend with ageing, post-menopausal bone loss is maximal during the first years after menopause, and progressively decreases in subsequent years [28, 29, 30, 38]. The rapid fall in bone density after the menses stop, have indicated the menopause as the most important factor in the bone loss. Menopause, either natural or surgical, and ageing, are considered the most important risk factors of osteoporosis and osteopenia [19, 29, 30].

The aim of this study was determination of the values of bone mineral density (BMD L₂-L₄) and evaluation of occurrence of osteoporosis (according to WHO criteria valid until 2000) among normal women living in rural and urban environments (especially postmenopausal) of the Lublin Region in comparison to other populations.

MATERIALS AND METHODS

Examined population. Subjects of the study were 503 normal women - all residents of Lublin Region (eastern Poland), including both urban and rural population. Data

of women were drawn from the computer census kept in town halls of Lublin (urban population) and Urzędów (rural population). Urzędów district was chosen because of its typically rural features such as: 40 kilometers from the nearest town, lack of industry, significant percentage of farmers. A medical history was taken on each subject using a specially prepared questionnaire in order to evaluate previous diseases, fractures, age at menarche, age at menopause, lifestyle, dietary habits, drugs and other factors affecting bone metabolism. Exclusion criteria were: history of chronic diseases affecting bone tissue and taking drugs which could interfere with bone mass (such as bisphosphonates, calcitonin, anabolic steroids, fluoride, vitamin D, corticosteroids). All data: medical history, BMD, age, weight, height were entered into a computer database, and 503 subjects aged 30-79 (mean 49.5) were selected. This group of women was divided into two subgroups: urban (n = 282, 56%) and rural (n = 221, 44%). Estimation of the bone mineral density (BMD) values was carried out on 469 subjects; those with massive degenerative changes of the lumbar vertebrae were excluded.

Bone densitometry. The lumbar spine (L₂-L₄) of all subjects was examined in anterior-posterior (AP) position using dual X-ray absorptiometry - DEXA (LUNAR Corp.) at the Densitometric Laboratory of the Institute of Agricultural Medicine in Lublin from November 1999–June 2000. Commonly occurring small degenerative changes of the lumbar vertebrae in older women were not excluded from the scans due to limitations of the method

Table 1. Structure of analysed population by place of residence and occupation.

Population	Rural		Urban		Total	
	n	%	n	%	n	%
Farmers	62	28.05	3	1.06	65	12.92
Other occupations	95	42.98	230	81.85	325	64.61
Retired	59	26.69	48	17.08	107	21.27
Not answered	6	2.26	0	0	6	1.19

Table 2. Comparison of BMD values for AP spine L₂-L₄ for Lublin Region population to the USA, and population of Northern Europe, France and Japan. BMD values are presented in grams per square centimeter (g/cm²) in 10-year age intervals [19, 20, 21, 22, 23, 24, 26, 27, 28].

Age	USA/Europe		France		Japan		Poland (Lublin Region)	
	n	BMD L ₂ -L ₄	n	BMD L ₂ -L ₄	n	BMD L ₂ -L ₄	n	BMD L ₂ -L ₄
20-29	672	1.200	89	1.156	106	1.124	0	-
30-39	916	1.214	95	1.190	141	1.135	36	1.273
40-49	1,630	1.180	180	1.121	319	1.151	221	1.211
50-59	2,472	1.096	342	1.020	378	0.959	164	1.136
60-69	1,942	1.016	233	0.912	311	0.865	40	1.017
70-79	1,273	0.988	65	0.859	179	0.821	8	1.023
Total	8,905	-	1,004	-	1,434	-	469	-

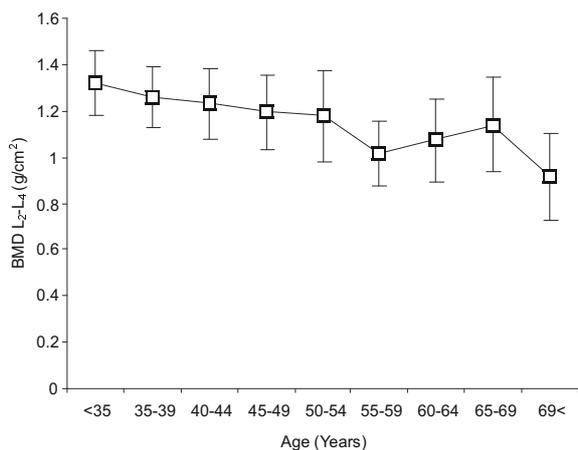


Figure 1. BMD of women from Lublin Region (Poland) (Mean ± SD).

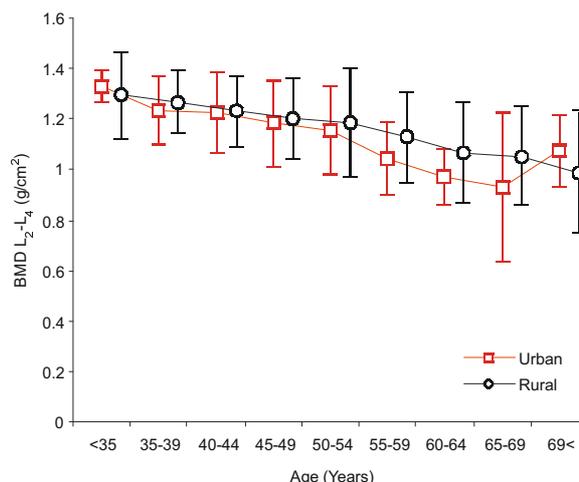


Figure 2. BMD of analysed population by place of residence (Mean ± SD).

used (eg. manual “cutting out” all the osteophytes can not be achieved using only anterior-posterior scans).

Statistical analysis. Mean differences were tested by Student’s t-test for non-paired data. Probabilities (p) ≤ 0.05 were considered significant.

RESULTS AND DISCUSSION

Analysed population was divided into two subgroups: urban (n = 282, 56%) and rural (n = 221, 44%). 65 (12.9%) women working as farmers, 107 (21.3%) were retired,

other occupations were represented by 325 persons (64.6%); six women did not determine their occupation. In the category “other occupations” the most frequent were manual workers, clerks, office workers, accountants, teachers and nurses (Tab. 1).

Figure 1 shows mean bone mineral density (BMD) values for lumbar spine (L₂–L₄) for Lublin Region population. Table 2 shows the comparison of BMD values for AP spine L₂–L₄ for Lublin Region population to the USA, Northern Europe, and the population of France and Japan. BMD values are presented in grams per square centimeter (g/cm²) in 10-year age intervals. The comparison

Table 3. Comparison of mean BMD values for AP spine L₂–L₄ (g/cm²) between rural and urban women of Lublin Region.

Age	≤ 44		45–55		56 ≤	
	Rural	Urban	Rural	Urban	Rural	Urban
n	60	60	90	151	54	49
BMD L ₂ –L ₄	1.248	1.233	1.092	1.162	1.081	1.030
SD	0.138	0.152	0.187	0.172	0.196	0.153
t	0.585		1.303		1.501	
df	118		239		101	
p	0.559		0.193		0.136	

Table 4. Prevalence of osteoporosis and osteopenia among rural and urban women from Lublin Region, according to densitometric (2000) criteria.

Population	Rural				Urban			
	Osteoporosis		Osteopenia		Osteoporosis		Osteopenia	
	n	%	n	%	n	%	n	%
≤ 44	0	0.0	7	10.0	0	0.0	10	14.4
45 - 55	4	4.0	23	23.2	11	6.7	44	27.1
56 ≤	11	19.2	19	33.3	9	17.6	25	49.0

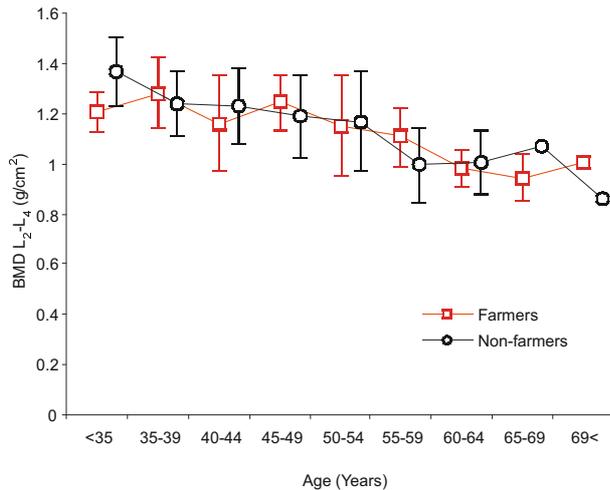


Figure 3. BMD of analysed population by occupation (Mean \pm SD).

values shown in Table 2 were obtained from databases drawn up on the basis of the studies of the different reference populations. Those studies were performed using DEXA instrumentation (LUNAR DPX) at university medical centres and clinics in the United States, France, England, Northern Europe and Japan. Mean BMD values of women from Lublin Region in every age range correspond closely to the populations of North America and Northern Europe. Compared to the French and Japanese populations, the present data are insignificantly higher (Tab. 2).

Mean bone mineral density (BMD) values for lumbar spine (L_2-L_4) in every age range were higher in rural population than in urban population, but the difference was not statistically significant (Tab. 3, Fig. 2).

The comparison between mean bone mineral density (BMD) values for lumbar spine (L_2-L_4) in farmers and non-farmers did not show statistically significant differences in each age range (Fig. 3).

The prevalence rates of osteoporosis according to densitometric criteria (2000) in whole analysed population were calculated as 6.9%, and osteopenia as 25.4%. Not surprisingly, the prevalence of osteoporosis and osteopenia increased with advancing age. In women younger than 45 years osteoporosis was not observed, and the prevalence of osteopenia was 12.6%. In women between 45–55 years the prevalence of osteoporosis was 5.7% and of osteopenia 25.6%. In women older than 55 years of age osteoporosis was observed in 18.5% and osteopenia in 40.7%. In the latter group, only 40% women had normal BMD measurement result. In women younger than 45 years osteopenia occurs more often in urban population than in rural population (14.4% vs 10%). In women between 45–55 years both osteoporosis and osteopenia also occurred more often in urban population (6.7% vs 4%, 27.1% vs 23.2%). In women older than 55 years of age osteoporosis occurred more often in rural population (19.2% vs 17.6%), but the occurrence of

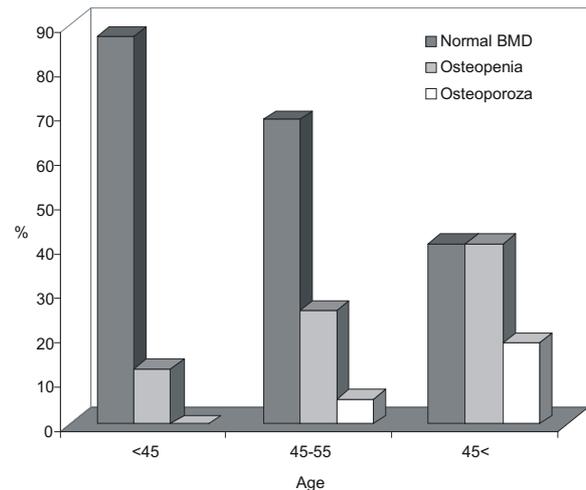


Figure 4. Occurrence of osteoporosis and osteopenia in women from Lublin Region, depending on age.

osteopenia was much higher in urban population (49% vs 33.3%) (Tab. 4, Fig. 4).

From an epidemiological point of view, osteoporosis defined as bone mineral density that is 2.5 standard deviations less than young adult mean, is not easy to identify because densitometric measurements are still not readily accessible, and also because commonly used densitometric equipment is insufficiently comparable. Much more comparable and easier to carry out is hip fracture assessment because the majority of cases are hospitalised and usually treated surgically, and many studies of hip fracture incidence have been carried out till now [2, 4, 9, 20, 25, 27, 35, 39]. The life-time risk of hip fracture is 15%, but the prevalence of osteoporosis is much higher [1]. The percentage of people with osteoporosis and osteoporotic hip fractures differs among populations, nations, races, and rates are highest in whites living in Northern Europe and North America, intermediate in Orientals, and the lowest in black populations [6, 11, 12, 14, 16, 18, 20, 21, 22, 37]. These relationships have not yet been explained, but most probably their reason, apart from genetic factors, seems to be due to differences in: level of urbanisation, lifestyle, level of physical activity, dietary calcium intake, cigarette smoking and alcohol consumption [2, 9, 11, 24, 36]. However, more recent studies show that bone mineral density (hip and spine) does not differ significantly in Japanese, Chinese, and whites from the United States after adjusting for height and weight [5, 34]. The prevalence of osteoporosis in older women reported in the USA is between 30–53% [23, 26] or less – 21.7% [3]. In the Japanese female population aged between 50–69 years, prevalence of osteoporosis at the spine was calculated as 35.1% (compared to 15.5% in women younger than 50 years and 59% in those older than 69 years of age) [13]. The prevalence of osteoporosis in normal Spanish women at the lumbar spine is: 4.31% in the group aged 45–49 years, 9.09% in the group aged 50–

59 years, 24.29% in the group 60–69 years, and 40.0% in the group aged 70–79 years [7]. Epidemiological studies on osteoporosis carried out until now in Poland concerned people living in big cities, and no data about rural populations are available [11, 12, 16, 21, 24].

CONCLUSIONS

Osteoporosis prevalence (based on the criteria valid until 2000) diagnosed by DEXA at the AP spine in the population of women living in the Lublin Region (eastern Poland) is not high compared to other populations. Mean BMD values of women from the Lublin Region in every age range correspond closely to the populations of North America and Northern Europe. No statistically significant differences in mean values of BMD were observed between urban and rural populations, nor between farmers and other occupations.

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