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Higher education and better knowledge of osteoporosis improve bone health in Polish postmenopausal women

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Abstract

Introduction: The aim of the study was to establish the influence of knowledge of osteoporosis and educational level on bone health.
Material and methods: The study group consisted of 351 women, aged 50–88 years (mean 66.3 ± 8.6). None of them had had any previous personal experience with osteoporosis diagnosis and treatment. They filled in a questionnaire consisting of 10 questions assessing their knowledge about osteoporosis. All of them underwent femoral neck densitometry (GE Lunar, USA).
Results: The mean score in the knowledge questionnaire was 7.4 ± 1.6 points (range 2–10). The lowest percentage of correct answers was observed in the sentences regarding the possibility of successful cure of osteoporosis and the role of physical activity in osteoporosis treatment. The mean score in the osteoporosis questionnaire correlated negatively with the age of the participants ($r = –0.2$, $p < 0.05$) and was better among patients with higher educational degree (8.2 vs. 6.4 points, $p < 0.001$). Both the educational degree and the level of knowledge of osteoporosis correlated with bone mineral density (BMD) and T-score.
Conclusions: Elderly and less educated women showed lower levels of knowledge about osteoporosis and its consequences. The study suggests that bone health in postmenopausal women may be indirectly improved by education concerning osteoporosis and its prevention.

Key words: *education; fracture; prophylaxis; knowledge; age-related osteoporosis*

Introduction

Due to changes in lifestyle, modern civilization needs to cope with the growing problem of osteoporosis, especially in older adults. Bone fractures in older age often lead to irreparable health problems, with permanent immobilisation, infectious and thrombotic complications, and social and economic burden [1,2]. Osteoporosis mostly affects postmenopausal women, due to cessation of ovarian production of oestrogen, which plays a protective, antiresorptive role in mineral balance [3, 4]. It is estimated that the average total body calcium loss is highest within 3–4 years after menopause and then it gradually decreases along with lower calcium absorption [5]. Other risk factors leading to this disease include chronic use of glucocorticosteroids, alcohol abuse, cigarette smoking, co-morbidities such as chronic renal failure and thyroid hormone imbalance, as well as unhealthy dietary habits [6, 7]. The modifiable risk factors such as lifestyle habits (healthy diet or physical exercise) are easy to adopt. There are only 2 steps to lifestyle change — the first is a comprehensive knowledge of osteoporosis and the second is the patient's willingness to prevent the disease. Regarding available research projects, the main sources of knowledge to women are magazines, newspapers, TV programmes, family members, and medical professionals [8, 9]. Because medical staff have no direct impact on the patient's motivation, there is a huge job to be done by education. However, there is another issue: the role of the awareness of osteoporosis in bone health is still unclear and needs further exploration [10–12].

The aim of the study was to elucidate the influence of women's knowledge about osteoporosis and educational level on bone health.

Material and methods

All the participants were recruited from volunteers who had visited one of the following 3 medical centres in central Poland: the Healthcare and Occupational Medicine Centre in Konin, the National Centre of Osteoporosis, and the Outpatient Osteoporosis Clinic (both in Warsaw), in order to undergo bone densitometry. All the patients were at their first visit and had never been treated for or diagnosed with osteoporosis. Informed consent was obtained from each study participant.

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Table 1. *Educational level in study group*

Educational level	Number of participants	Percentage of group (%)
Elementary	52	14.8
Vocational	116	33
Secondary	162	46.2
University	21	6

All the enrolled women were after menopause. The cohort was limited to homogenous postmenopausal women to avoid the influence of varying metabolic changes in bone tissue before and after menopause. These confounding factors can be analysed in future. The exclusion criteria comprised a positive history of osteoporosis or osteoporotic fractures, no dual X-ray absorptiometry before the study, and any co-morbidities or medications that could potentially influence bone metabolism (chronic renal failure, liver, thyroid, parathyroid diseases, gastric resection, diabetes mellitus, chronic glucocorticosteroids, thyroid hormones, antiepileptics, proton pump inhibitors, and antithrombotic treatment).

The final study group consisted of 351 postmenopausal women with mean age 66.3 ± 8.6 years (range 50–88). Table 1 presents the educational characteristics of the group.

All the study participants filled out a questionnaire concerning their knowledge of osteoporosis, as proposed by Magnus et al. [13]. It consisted of 10 sentences, which the participants assessed as "true" or "false". In the case of a sentence in which the participant's answer was "I don't know" or there was no answer, it was classified as a wrong answer. The maximum score was 10 and the minimum was 0. The questionnaires were filled out before a DXA examination and before a medical interview with a physician. The questionnaires were printed and arranged for individual use, but if there were problems with reading (visual disorders) or understanding particular words (except for 'osteoporosis'), such participants were helped by medical staff. Complete filling out of the questionnaire took approximately 8-10 minutes. After completing the questionnaire, all the sentences were checked and discussed with responders, which improved their awareness of osteoporosis.

The bone mineral density (BMD) of the non-dominant femoral neck was established in all the study participants, using a DPX Lunar (USA) densitometer. The coefficient of variation (CV%) for the femoral neck was established for all devices used and was found to be within the range 1.2 to 1.4%.

Statistical analysis

Statistical analysis was carried out using the Statistica 13.1 (StatSoft) software package. All the figures were generated in Excel (Microsoft Office 14). Descriptive statistics were used for the general study group presentation and for the expressions of means, medians, and standard deviations. The group was divided by age, using age median values. The Spearman test was used in the correlations of non-parametric variables, whereas comparisons between 2 independent groups were performed using the U Mann-Whitney test. In the correlation analysis minus values of T-scores were used. The Kruskal-Wallis test by rank was used for nonparametric comparison of 3 or more groups. Covariance analysis was done using ANCOVA. P value less than 0.05 was assumed as statistically significant.

Results

Knowledge of osteoporosis

The mean score in the questionnaire was 7.4 ± 1.6 points (range 2–10, 95% confidence interval [CI] 7.2-10). See Table 2 for the percentages of correct answers for particular sentences.

The mean score in the osteoporosis questionnaire correlated negatively with the age of the participants ($r = –0.2$, $p < 0.05$). Next, the participants were divided by age into 2 subgroups with the age threshold of 67 years. Subgroup 1 (age range 50–66 years) consisted of 167 participants (47.6% of the whole group) and subgroup 2 (age range 67–88 years) — 184 participants (52.4%). The percentages of correct answers to questions in the osteoporosis questionnaire are presented in Figure 1.

The mean score in the osteoporosis questionnaire was significantly higher in subgroup 1 (7.6 ± 1.4; 95% CI: 7.4–7.9 *vs*. 7.1 ± 1.8; 95% CI: 6.8–7.4; $p = 0.005$).

Table 2. *Percentage of correct answers concerning osteoporosis knowledge*

	Correct answer	Number of correct answers	Percentage of correct answers
Q1: "Osteoporosis may sometimes cause great pain"	True	322	91.7
Q2: "Osteoporosis means increased calcium in the skeleton"	False	297	84.6
Q3: "It is possible to prevent osteoporosis"	True	241	68.7
Q4: "It is important to be engaged in physical activity in order to avoid osteoporosis"	True	242	68.9
Q5: "Osteoporosis mostly affects men"	False	335	95.4
Q6: "Osteoporosis may be cured"	False	145	41.3
Q7: "Osteoporosis mostly affects older individuals"	True	276	78.6
Q8: "Osteoporosis increases the risk of fracturing bone"	True	283	80.6
Q9: "Osteoporosis is a minor health problem"	False	242	68.9
Q10: "Those with osteoporosis should not engage in physical activity due to the risk of falling causing a fracture"	False	197	56.1

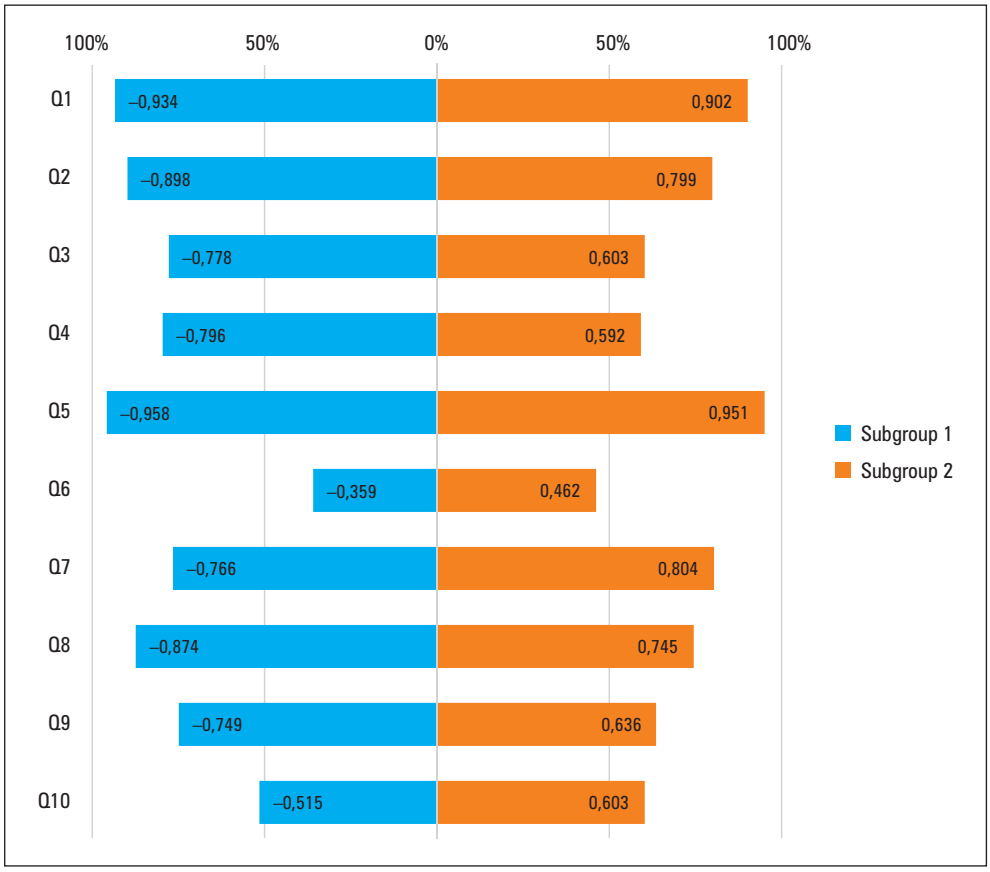

Figure 1. *Percentages of correct answers to the osteoporosis questionnaire in particular subgroups. Q1 — first question in the questionnaire; Q2–Q10 — further questions, according to the Magnus questionnaire; Subgroup 1 — age range 50–66 years; Subgroup 2 — age ≥ 67 years*

The percentages of correct answers differed significantly between the age subgroups for the following questions: Q2 ($p = 0.01$), Q3 ($p < 0.001$), Q4 ($p < 0.001$), Q6 ($p = 0.04$), Q8 ($p = 0.002$), and Q9 ($p = 0.02$).

Bone health

The mean BMD for the femoral neck was 0.815 ± 0.131 (95% CI: 0.489–1.111) g/cm^2. The mean T-score for the study group was –1.4 ± 1.1 (95% CI: –4.1–2.5). Based on the T-score value, according to WHO guidelines [14], 62 participants (17.7%) were diagnosed with osteoporosis, 157 (44.7%) had osteopaenia, and 132 (37.6%) had T-score values within the normal range.

The mean score in the osteoporosis questionnaire correlated positively with the T-score and BMD of the femoral neck (for both parameters $r = 0.14$; $p < 0.05$).

Educational level

The factor that could have potentially influenced the level of knowledge was the education level. Due to the maldistribution between the aforementioned classes, the statistical analyses were done after an additional division of the general study group. The participants were divided into 2 groups: Group A, 168 women with elementary or vocational education; and Group B, 183 participants with secondary or high education. The mean knowledge was significantly higher in the women with a higher-educational degree (8.2 ± 0.9; 95% CI: 8.1–8.3 *vs.* 6.4 ± 1.8; 95% CI: 6.2–6.7; $p < 0.001$) (Fig. 2). They were also significantly younger than those with a lower educational level (Group A) (64.1 ± 8.6; 95% CI: 62.9–65.4 *vs.* 68.6 ± 8.1; 95% CI: 67.4–69.8 years; $p < 0.001$). Next, we performed age adjustment in a covariance analysis, with age as a covariate, and the differences in knowledge level remained significant ($p < 0.001$).

The participants with lower educational level had significantly lower bone density of the femoral neck (0.79 ± 0.128; 95% CI: 0.774–0.814 *vs.* 0.83 ± 0.132; 95% CI: 0.814–0.852 g/cm^2; $p = 0.001$) and T-score (–1.5 ± 1.1; 95% CI: –1.7–[–1.4]; *vs.* –1.2 ± 1.1; 95% CI –1.4–[–1.1] SD; $p = 0.02$).

Discussion

Better knowledge of osteoporosis and the methods of its prophylactics should bring changes in daily routines and dietary habits. The study confirmed the connection

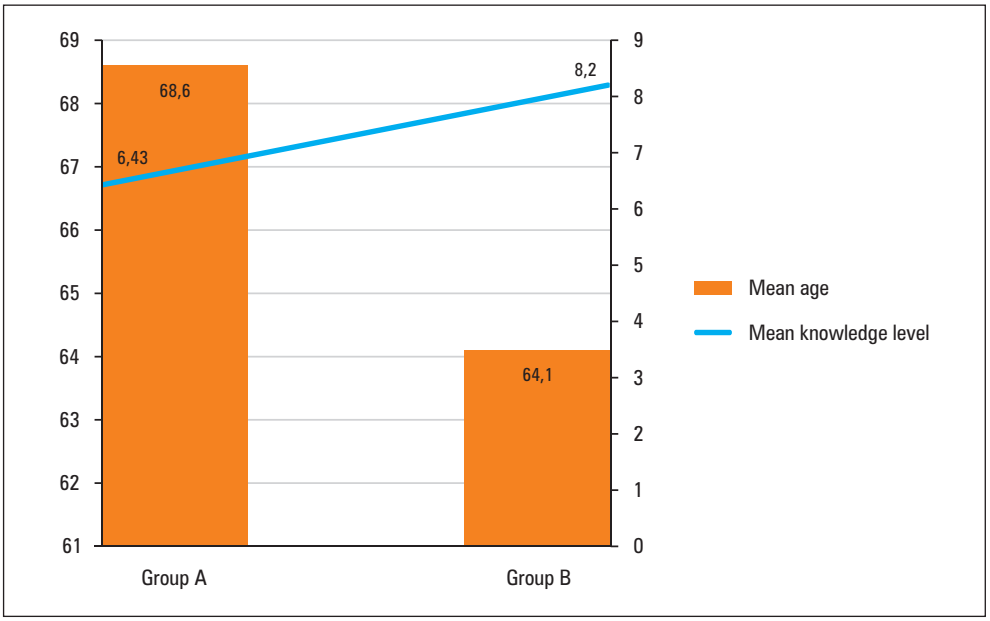

Figure 2. *Mean scores in knowledge questionnaires in Groups A and B. Group A — women with elementary or vocational education; Group B — secondary or higher education; mean knowledge level is presented as a sum of points (max 10 points)*

between the participants' knowledge of osteoporosis and bone health. Nevertheless, the older women in our study demonstrated worse knowledge of osteoporosis and a lower educational level. It is characteristic that bone mineral density is lower with older age, which was also observed in this research.

The mean score in the questionnaire used in our study was 7.4 points, which seems to be satisfactory in the aspect of the whole group. In a similar study [10], conducted on the Polish population of postmenopausal women, the mean scores were comparable: 7.3 points in a questionnaire by Magnus et al. was the mean result for the whole postmenopausal group. In our study, the mean score in the questionnaire for the group consisting of older participants was 7.1 points, which is a slightly worse result. There were also differences in the sentences that proved difficult for the responders; in our study, the difficult statements included Q6 ("Osteoporosis may be cured") and Q10 ("Those with osteoporosis should not engage in physical activity due to the risk of falling and causing a fracture"), whereas in the Silesia Osteo Active Study the most difficult questions included Q7 ("Osteoporosis mostly affects older individuals") as well as Q6 ("Osteoporosis may be cured"). The belief that osteoporosis may be cured is easy to explain: medical knowledge is improving, and an increasing number of state-of-the-art treatment methods are implemented, also in the field of osteoporosis. Nonetheless, the study participants had no previous personal experience of osteoporosis, so their belief could not have resulted from being familiar with osteoporosis treatment. The low percentage of correct answers to this question may also have resulted from the incorrect assumption that osteoporosis, with its complications, is a condition that is curable and not life-threatening. This may also be confirmed by the low (compared to other sentences) percentage of correct answers to Q9 ("Osteoporosis is a minor health problem"). Similar conclusions can be found in another study, which targeted the older population of women in Canada [15].

It was surprising that only 81% of responders (and only 75% from Subgroup 2) linked osteoporosis with higher risk of fractures; slightly more participants knew that the disease was connected with low calcium content in bones. This may be interpreted that 19% of the females did not understand what osteoporosis is in general. Comparing those results with the Magnus et al. study from 1994 [13], the percentage of correct answers to Q8 ("Osteoporosis increases the risk of fracturing bone") was high in females (95.6%), but to Q2 ("Osteoporosis means increased calcium in the skeleton") it was lower (73.8%). The mean score in the questionnaire was 7.5 points in the female group. These 2 studies are separated by many years, so the current knowledge of osteoporosis should be better, but the comparison of those studies does not confirm this hypothesis. Different populations taking part in the 2 studies may explain the situation.

In our observation, the younger participants presented better knowledge of osteoporosis than the older ones. It is well-known that the main risk group of osteoporosis includes postmenopausal women, so greater effort should be undertaken with regard to this

subpopulation. Older women, despite technological progress, have limited access to reliable sources of information (newspapers, magazines, radio) and less often use the Internet. Also, the age-related communication barriers observed in older individuals, such as visual or hearing disorders, constrain their access and proper understanding of the medical problem. Studies conducted with the use of other questionnaires addressing osteoporosis seem to confirm this observation [16].

In present study the bone status correlated with the level of knowledge about osteoporosis. It is expected that greater awareness of osteoporosis and its conscious prevention could modify dietary habits and physical activity and eliminate unhealthy habits. Nevertheless, this hypothesis was contradicted in some studies [11, 12]. Better bone parameters in the cited studies were observed in patients with negative smoking history and those on calcium supplementation. No other correlations were observed from the questionnaire, regarding knowledge, health beliefs, motivation, physical activity, and dairy consumption. This may suggest that proper knowledge was not translated into healthy habits (except for smoking and calcium supplementation). On the other hand, another study, conducted on the Iranian population, revealed that an intervention regarding osteoporosis health beliefs led to a significant increase in both lumbar and femoral neck BMD values [17]. In another study, a telephone survey and osteoporosis questionnaire (FOOQ) was conducted among 127 patients hospitalised within the last 2 years due to fragility fractures. It occurred that, despite of previous fragility fracture history, the level of knowledge of osteoporosis remained low [18]. Also in the Hispanic population, as Díaz-Correa et al. showed, the level of knowledge about osteoporosis among patients hospitalized because of a first fracture was low [19]. The authors suggested that this may have resulted from the lack of prior densitometry and therefore proper treatment, which was well documented, and from the lack of osteoporosis counselling by their primary care physicians. Better knowledge of osteoporosis and its risk factors may also improve patient adherence to osteoporosis therapy and compliance with recommendations [20, 21]. Our observation is also in accordance with Polish guidelines for the diagnosis and management of osteoporosis [22].

In our study, the women with higher education had better knowledge of osteoporosis. A large epidemiological study on Polish postmenopausal women revealed that those with higher education more often decided to undergo vitamin D supplementation and hormone replacement therapy, but education alone did not have an impact on bone health [23]. A large Chinese population-based study indicated that the educational level was an independent and significant factor for the osteoporosis prevalence rate [24]. There is no doubt that regular physical activity is essential for maintenance of bone health [25, 26]. The exact type of exercises and their frequency should be carefully selected in patients with a previous history of fractures, but physical activity is nonetheless beneficial for bone health [27, 28]. The second extremely important modifiable factor is a balanced diet, rich in calcium and vitamin D, magnesium, potassium, carotenoids, etc. [29–31]. Other factors positively influencing bone health include avoidance of cigarette and excessive alcohol consumption, prevention of falls, and maintaining body weight within normal range (especially not excessively low) [32–34]. The observed differences among the aforementioned research indicate the need to seek new ways to translate knowledge about osteoporosis into prophylaxis. The missing element on the path from health education to healthy bones seems to be the stimulus for physical action, such as activation groups for elderly women, i.e. physical activity or cooking courses. Another explanation might be the socio-historical background; older women, whose youth was affected by World War II and post-war transformations, may have had a worse education, and their mean peak bone mass might have been different depending on non-medical conditions.

The current study has some limitations. The studied group was not an epidemiological sample, data were collected only for women, and bone densitometry was limited to the femoral neck only. Moreover, no confounders, such as the socioeconomic status, cognitive and physical functioning, or calcium/vitamin D supplementation, were taken into account for the analysis, so the results should be interpreted with some caution. However, all the studied women had no personal experience before study participation, which makes the questionnaire results more reliable.

Conclusion

The level of knowledge was worse among the older and less educated women. Osteoporosis knowledge seems to have an impact on bone health. The level of knowledge in the population of Polish postmenopausal women is satisfying. More emphasis should be put on an informative campaign about osteoporosis prophylaxis and its consequences, as well as on the positive role of physical activity in primary and secondary prevention.

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