

Independent correlates of bone mineral density among women in Albania

Artur Kollcaku¹, Julia Kollcaku², Valbona Duraj¹, Teuta Backa¹, Argjend Tafaj¹

¹Rheumatology Service, University Hospital Center “Mother Theresa”, Tirana, Albania;

²Ambulatory Health Service, Polyclinic, Tirana, Albania.

Corresponding author: Dr. Artur Kollcaku;
Address: Rr. “Dibrës”, No. 371, Tirana, Albania;
Telephone: +355674039706; E-mail: artur_kollcaku@yahoo.com

Abstract

Aim: The purpose of this study was to determine selected socio-demographic and lifestyle/behavioral independent correlates of low bone mineral density among women in post-communist Albania.

Methods: We carried out a cross-sectional study in Tirana city in 2010 involving a population-based sample of 549 women ≥ 35 years (mean age: 55.6 ± 9.1 years; response rate: 92%). Bone mineral density was assessed with a bone ultrasound device which is recommended for screening of bone mineral density in similar population-based studies. General linear model was used to calculate mean T-scores for bone mineral density between different socio-demographic and behavioral categories of women included in this study.

Results: In multivariable-adjusted general linear models, mean value of the T-score was significantly lower among older women ($P < 0.001$), those with a lower level of education ($P < 0.001$), in smokers ($P = 0.001$), women who reported a frequent consumption of coffee ($P = 0.019$) and in normal weight women ($P < 0.001$). Upon multivariable adjustment for the other covariates, the association with tea consumption was borderline statistically significant ($P = 0.092$). Furthermore, in multivariable-adjusted models, there were no significant relationships with marital status, or employment status ($P = 0.108$ and $P = 0.097$, respectively).

Conclusion: This study informs about selected independent factors associated with bone mineral density in adult women in the Albanian population. Our findings may help rheumatologists and other health professionals in Albania to identify the socio-demographic and behavioral groups of women who are most at risk for development of low bone mineral density in this transitional society.

Keywords: bone mineral density, bone ultrasound, bone ultrasound device, osteopenia, osteoporosis, Tirana, T-score.

Introduction

Osteopenia and osteoporosis represent different stages in the process of low bone mineral density (1,2). These conditions lead to extreme skeletal fragility and vulnerability to trauma fracture, especially in the elderly who are subject to different types of fractures (1-3). Conventionally, low bone mineral density includes osteopenia and osteoporosis (4). T-score is used to define the degree of bone mineral density in population-based studies. Based on the values of the T-score, individuals are classified as experiencing osteopenia if the bone mineral density T-score is lower than -1.0 and greater than -2.5 (4). Conversely, individuals are categorized with osteoporosis their bone mineral density T-score has a value of -2.5 or lower (4). Studies conducted worldwide indicate that the prevalence of low mineral bone density is positively related to age (3,5), women particularly after menopause (5,6), smokers, individuals who consume excessive amounts of alcohol, and those with a sedentary lifestyle (1,7,8). On the contrary, body weight reduces the risk of low bone mineral density according to the international literature (6).

In several population-based studies, bone mineral density is determined by use of portable machines which measure density in the heel (9,10). Actually, quantitative ultrasound is used in many epidemiological studies in different countries due to its low cost, simplicity of performance, mobility and also due to the lack of ionizing radiation (9).

Albania came out of the most rigid communist regime in Europe in 1990. Since, Albania has experienced a rapid process of political and socioeconomic transformation. There is evidence of a significant demographic and epidemiological transition in Albania in the past twenty five years which is reflected in a significant shift from infectious diseases to non-communicable diseases (11). Thus, according to the Global Burden of Disease 2010 Study, non-communicable diseases in Albania accounted for about 88% of all deaths in 2010, of which, 55% were from cardiovascular diseases and

19% from cancer (12). Therefore, Albania has already joined most of the European countries which have to cope with the particularly high share of non-communicable diseases that bears a significant burden for their health care systems (11).

The overall burden of musculoskeletal disorders has increased in Albania in the past two decades, especially among females (11). Hence, there is evidence of an increase of 3.7% in the proportional disability-adjusted life years (DALYs) in females compared to only 2.0% in males (11,12). It is argued that the burden of musculoskeletal disorders has increased in Albania due to a higher accessibility to the health care services in the past two decades coupled with a rapid ageing trend which is evident in the Albanian population (11). Hence, according to the national Institute of Statistics, the share of the population aged 65 years and above has increased in Albania up to 11% in 2011 (13). Due to the particularly high share of the older population, there is evidence of a high proportion of musculoskeletal disorders in Slovenia and especially in Greece – two countries which experience the largest proportion of the older populations in the South Eastern European region (11).

However, the information about the magnitude and predictors of low bone mineral density in the Albanian population is scant to date. In this context, we aimed to determine selected socio-demographic and lifestyle/behavioral factors which are independently associated with low bone mineral density in Albanian women.

Methods

This cross-sectional study, carried out in the Albanian capital in 2010, consisted of a population-based sample of 549 women aged ≥ 35 years who were resident in Tirana city (overall response rate was 92%). Mean age of women included in this study was 55.6 ± 9.1 years.

For all women, the bone mineral density among was assessed through a bone ultrasound device which is recommended for screening of bone mineral

density in similar population-based studies (9,10). All women who participated in this study were measured height and weight which enabled calculation of the body mass index (BMI, expressed in kg/m²). In the statistical analysis, BMI was trichotomized into normal weight (BMI_≤25 kg/m²), overweight (BMI: 25.1-29.9 kg/m²) and obesity (BMI_≥30 kg/m²). In addition to measurement of bone mineral density and anthropometric indexes, all women were administered a structured questionnaire inquiring about selected demographic and socioeconomic characteristics (age, marital status, educational attainment and employment status) and lifestyle/behavioral factors

(including smoking status, coffee and tea consumption, as well as alcohol intake – all these variables were dichotomized in the analysis into: “yes” vs. “no”). General linear model was used to calculate mean values of the T-scores for bone mineral density (outcome variable) among women differing in their demographic and socioeconomic characteristics (age-group, marital status, educational attainment and employment status) and behavioral/lifestyle factors (coffee and tea consumption, alcohol intake and BMI). Initially, crude mean values of the T-scores, their respective 95% confidence intervals (95% CIs) and the p-values were calculated from unadjusted

Table 1. Crude mean values of T-score for bone mineral density by socio-demographic characteristics and behavioral factors in a sample of Albanian women in 2010 (N=549)

Variable	Mean*	95% CI*	P*
Age-group:			
≤50 years	0.40	from 0.20 to 0.60	<0.001
>50 years	-0.45	from -0.58 to -0.32	
Employment:			
Employed	-0.17	from -0.30 to -0.05	0.464
Unemployed	-0.29	from -0.57 to -0.01	
Marital status:			
Married	-0.14	from -0.26 to -0.01	0.035
Not married	-0.46	from -0.74 to -0.19	
Educational level:			
Low	-0.93	from -1.24 to -0.61	<0.001
Middle	-0.12	from -0.27 to 0.04	0.570
High	-0.04	from -0.24 to 0.15	reference
Smoking:			
No	-0.11	from -0.23 to 0.02	<0.001
Yes	-0.76	from -1.07 to -0.45	
Alcohol intake:			
No	-0.19	from -0.31 to -0.07	0.785
Yes	-0.25	from -0.72 to 0.21	
Coffee consumption:			
No	0.05	from -0.17 to 0.27	0.010
Yes	-0.29	from -0.42 to -0.15	
Tea consumption:			
No	-0.06	from -0.22 to 0.09	0.013
Yes	-0.36	from -0.53 to -0.19	
BMI:			
Normal weight	-0.49	from -0.69 to -0.29	<0.001
Overweight	-0.12	from -0.30 to 0.07	0.286
Obesity	0.04	from -0.17 to 0.24	reference

* Crude (unadjusted) mean values, 95% confidence intervals (95% CIs) and p-values from the General Linear Models.

general linear models. Subsequently, all the demographic and socioeconomic characteristics and the lifestyle/behavioral factors were entered simultaneously into the general linear models. Multivariable-adjusted mean values of the T-scores, their respective 95% CIs and the p-values were calculated. In all cases, a p-value of ≤ 0.05 was considered as statistically significant. Statistical Package for Social Sciences (SPSS, version 15.0) was used for all the statistical analyses.

Results

Mean T-score for bone mineral density in this sample of 549 women aged 35 years and above residing in Tirana was -0.19 (95% CI: from -0.31 to -0.08). Table 1 presents the crude (unadjusted) mean T-score for bone mineral density by demographic and socioeconomic characteristics and lifestyle/behavioral factors of study participants. Mean T-score was significantly lower in older women (>50 years)

Table 2. Multivariable-adjusted mean values of T-score for bone mineral density by socio-demographic and behavioral factors in a sample of Albanian women in 2010 (N=549)

Variable	Mean*	95% CI*	P*
Age-group:			
≤50 years	0.02	from -0.34 to 0.38	<0.001
>50 years	-0.78	from -1.09 to -0.47	
Employment:			
Employed	-0.25	from -0.55 to 0.04	0.097
Unemployed	-0.51	from -0.89 to -0.12	
Marital status:			
Married	-0.26	from -0.55 to 0.02	0.108
Not married	-0.50	from -0.89 to -0.10	
Educational level:			
Low	-0.86	from -1.29 to -0.43	<0.001
Middle	-0.19	from -0.50 to 0.12	0.409
High	-0.09	from -0.43 to 0.25	reference
Smoking:			
No	-0.11	from -0.42 to 0.19	0.001
Yes	-0.64	from -1.03 to -0.26	
Alcohol intake:			
No	-0.48	from -0.72 to -0.23	0.404
Yes	-0.28	from -0.77 to 0.20	
Coffee consumption:			
No	-0.23	from -0.60 to 0.14	0.019
Yes	-0.53	from -0.82 to -0.23	
Tea consumption:			
No	-0.29	from -0.61 to 0.04	0.092
Yes	-0.47	from -0.81 to -0.14	
BMI:			
Normal weight	-0.69	from -1.02 to -0.36	<0.001
Overweight	-0.35	from -0.70 to 0.01	0.059
Obesity	-0.10	from -0.46 to 0.27	reference

* Multivariable-adjusted mean values, 95% confidence intervals (95% CIs) and p-values from the General Linear Models.

compared with their younger counterparts (≤ 50 years) pointing to a higher prevalence of low bone mineral density: -0.45 vs. 0.40 , respectively ($P < 0.001$). There was no evidence of an association with employment status. Unmarried women had a significantly lower T-score than married women ($P = 0.035$) probably due to the confounding effect of age in unadjusted general linear models. Low educated women had the lowest T-scores in this study population, a finding which was statistically significant compared with the highly educated women ($P < 0.001$). Mean value of the T-score was considerably lower among smokers than non-smokers (-0.76 vs. -0.11 , respectively, $P < 0.001$). Similarly, mean T-scores were significantly lower among women who reported a frequent coffee consumption and/or tea consumption ($P = 0.010$ and $P = 0.013$, respectively). Conversely, there was no association with alcohol intake. There was a graded relationship with BMI: mean T-score was the lowest among normal weight women and the highest among obese women ($P < 0.001$) (Table 1).

In multivariable-adjusted general linear models, mean value of the T-score was significantly lower among older women ($P < 0.001$), those with a lower level of education ($P < 0.001$), in smokers ($P = 0.001$), women who reported a frequent consumption of coffee ($P = 0.019$) and in normal weight women ($P < 0.001$) (Table 2). Upon multivariable adjustment for the other covariates, the association with tea consumption was borderline statistically significant ($P = 0.092$). Furthermore, in multivariable-adjusted models, there were no significant relationships with marital status, or employment status ($P = 0.108$ and $P = 0.097$, respectively) (Table 2).

Discussion

This study provides evidence on selected independent socio-demographic and lifestyle/behavioral correlates of bone mineral density in a population-based sample of women in Tirana. After controlling simultaneously for all the socio-demographic and behavioral factors, the mean value of the T-score was significantly lower among older women, women

with a lower educational attainment, those who smoked and reported an excessive coffee consumption and in normal weight women. Furthermore, tea consumption was a borderline statistically significant independent predictor of bone mineral density in multivariable-adjusted models including all the other behavioral factors in addition to demographic and socioeconomic characteristics.

Regarding the lifestyle/behavioral predictors of bone mineral density, our findings related to smoking and coffee consumption are compatible with several previous reports from studies conducted elsewhere which have pointed to a positive association between these behavioral patterns and the risk of low bone mineral density (1). We obtained evidence of a significant relationship with each of these two lifestyle characteristics even after adjustment for a whole range of other behavioral factors in addition to demographic and socioeconomic characteristics. Furthermore, in our study we obtained evidence of an independent association of body weight with bone mineral density. Mean values of the T-scores were the highest among obese women indicating a beneficial (protective) effect of body mass on the risk of low bone mineral density including osteopenia and osteoporosis. These findings are also in line with several reports from studies conducted in different countries of the world (6,14).

Regarding the demographic factors, our study revealed a particularly strong independent relationship of age with bone mineral density: older participants had a significantly lower T-score indicating a considerably higher risk for development of osteopenia and osteoporosis. These findings resemble the previous reports from the international literature too (1,6).

Our study conducted in transitional Albania may have suffered from several limitations pertinent to the study design, the possibility of selection bias, as well as different types of information bias. We consider that the sample included in our study was representative of the overall adult women who are resident in Tirana, the capital city of Albania.

Nonetheless, it is logical to assume that women who are resident in Tirana do not necessarily reflect all Albanian women. If so, our findings are applicable only to women residing in Tirana and not to all the Albanian women. Regarding the possibility of information bias, it should be pointed out that we used an international standardized tool for determination of bone mineral density, which is a commonplace procedure in similar population-based studies, as recommended in the international literature (9,10). Therefore, assessment of bone mineral density is assumed to have been unbiased among female participants included in this study. Likewise, anthropometric indices were measured in a standardized manner and, therefore, these indices are also assumed to be unbiased in our study sample. On the contrary, the information about demographic and socioeconomic characteristics, as well as the assessment of lifestyle/behavioral factors was done

through interview which bears the risk, at least to some extent, of information bias. This may be particularly the case for lifestyle/behavioral factors which are difficult to measure. Yet, there is no indication in our study for a potential difference in reporting of socio-demographic characteristics and/or lifestyle factors between women who differed in their bone mineral density scores.

Regardless of these potential limitations, our work offers useful evidence about selected socio-demographic and behavioral factors which are independently associated with bone mineral density among women residing in Tirana, which is largest city in transitional Albania. Our findings may help rheumatologists and other health professionals in Albania to identify the socio-demographic and behavioral groups of women who are most at risk for development of low bone mineral density in this transitional society.

Conflicts of interest: None declared.

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