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ORIGINAL RESEARCH

Lifestyle correlates of low bone mineral density in Albanian women

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Abstract

Aim: The aim of this study was to assess the association of lifestyle/behavioral factors with low bone mineral density in Albanian women, a transitional country in the Western Balkans.
Methods: A cross-sectional study was conducted in Tirana city in 2010 including a population-based sample of 549 women aged 35 years and above (response rate: 92%). Low bone mineral density (osteopenia and/or osteoporosis defined as a bone mineral density T-score less than -1) was assessed with a bone ultrasound device which is simple and easy to use for screening of bone mineral density in population-based studies. Binary logistic regression was used to determine the relationship of low bone mineral density with behavioral factors in this study population.
Results: The prevalence of low bone mineral density in this study population was 28.4% (156/549). In multivariable-adjusted logistic regression models, low bone mineral density was positively associated with smoking (OR=4.1, 95%CI=2.2-7.4) and coffee consumption (OR=2.3, 95%CI=1.3-4.1), but inversely related to overweight and obesity (OR=0.4, 95%CI=0.2-0.7 and OR=0.3, 95%CI=0.2-0.6, respectively).
Conclusion: This study offers useful evidence about the lifestyle/behavioral determinants of low bone mineral density among women in this transitional South Eastern European population. Health professionals and policymakers in Albania should be aware of the major behavioral factors which increase the risk of low bone mineral density in order to provide correct treatment and control of this condition in the general population.

Keywords: Albania, bone mineral density, bone ultrasound, bone ultrasound device, osteopenia, osteoporosis, Tirana.

Conflicts of interest: None.

Introduction

Low bone mineral density, especially osteoporosis, is characterized by excessive skeletal fragility and susceptibility to trauma fracture (1), particularly among older individuals (2,3). Conventionally, low bone mineral density includes osteopenia and osteoporosis. Osteopenia is deemed as en initial step of osteoporosis notwithstanding the fact that not every person with osteopenia may inevitably experience osteoporosis (4-6). As a rule of thumb, osteopenia is defined as a bone mineral density T-score lower than -1.0 and greater than -2.5 (7). On the other hand, osteoporosis is defined as a bone mineral density T-score of -2.5 or lower (7). It is important to note that osteopenia is an indication of normal aging, as opposed to osteoporosis which is evident in pathologic aging (1,5).

The prevalence of low mineral bone density, especially osteoporosis, increases with age (2,3,8). Furthermore, the prevalence of osteoporosis is higher in women, especially after menopause (1,8,9). In addition, unhealthy behavioral patterns consisting of smoking, excessive alcohol consumption and physical inactivity increase the risk of low bone mineral density and/or exacerbate the conditions of osteopenia and osteoporosis (5,10,11). On the other hand, body weight has been shown to exert a beneficial effect on increasing bone mass which, in turn, reduces the risk of osteoporosis (1). Furthermore, fat mass has been described as a protective factor against osteoporosis in several studies conducted worldwide (12-14). However, the findings related to excessive fat mass are not consistent and several other studies have reported that it may not protect against decreases in bone mass (15-17).

The assessment of bone mineral density is typically done with dual X-ray absorptiometry (DEXA) procedure (18). At the same time, assessment of bone mineral density can be also performed with portable scanners using ultrasound, and portable machines can measure density in the heel (19,20). As a matter of fact, quantitative ultrasound is currently used worldwide due to its low cost, simplicity of performance, mobility and due to the lack of ionizing radiation (19).

After the fall of the communist regime in 1990, Albania, a transitional country in the Western Balkans, has been characterized by a particularly difficult political and socioeconomic situation associated with periodic civil unrests and high rates of unemployment (21).

According to a recent report, the burden of musculoskeletal disorders has increased in Albania in the past two decades (22). The overall share of musculoskeletal disorders accounted for 8.5% of the total burden of disease in 1990, whereas in 2010 it amounted to 11.0% (22,23). There is evidence of a stronger increase in females than in males. In both sexes, there was a similar moderate yet steady increase from 1990-2005 (22,23). Subsequently, there was a steeper increase in females, but a smaller increase in males, which additionally accentuated the excess burden of disease explained by the musculoskeletal disorders in females compared to males (22). The burden of musculoskeletal disorders in Albania was similar to most of the countries in South Eastern European (SEE) region in both 1990 and 2010 (22,23). In 2010, the share of musculoskeletal disorders was 11.0% of the total burden of disease in several SEE countries including Albania. Essentially, musculoskeletal disorders are said to have increased in Albania probably due to a higher accessibility to the health care services in addition to the ageing pattern of the Albanian population (22).

To date though, data on the prevalence and determinants of osteopenia and osteoporosis in the Albanian population is scarce. In this framework, the aim of our study was to assess the lifestyle/behavioral correlates of low bone mineral density (osteopenia and/or osteoporosis) in Tirana city, the capital of Albania, a transitional country in the Western Balkans

characterized by an intensive process of urbanization and internal migration of the population in the past twenty five years.

Methods

A cross-sectional study was conducted in 2010 including a population-based sample of women aged 35 years and above residing in Tirana city, the capital of Albania.

Regarding the sample size, a minimum of 540 women was estimated as the minimal number required for inclusion in this study. In order to account for potential non-response, we decided to invite 600 women to participate in our study. The inclusion criteria consisted of women aged 35 years and above residing in Tirana city. Of 600 eligible individuals invited to take part in this study, 549 women agreed to participate (mean age: 55.6±9.1 years; response rate: 92%).

The bone mineral density among study participants was assessed with a bone ultrasound device which is simple and easy to use for screening of bone mineral density in population-based studies (19,20). From this point of view, ultrasound is considered as a quick, cheap and non-radiating device for assessing bone quality (19,20). Low bone mineral density was defined as a bone mineral density T-score less than -1 that is osteopenia and/or osteoporosis.

The physical examination included also measurement of height and weight for all study participants based on which body mass index (BMI) was calculated (kg/m^2) and categorized in the analysis into normal weight ($BMI \leq 25\ kg/m^2$), overweight (BMI: 25.1-29.9 kg/m^2) and obesity ($BMI \geq 30\ kg/m^2$).

The other lifestyle/behavioral factors were assessed through an interviewer-administered structured questionnaire including information on smoking habits (dichotomized in the analysis into: yes vs. no), alcohol intake (yes vs. no), coffee consumption (yes vs. no) and tea consumption (yes vs. no).

Demographic and socioeconomic data (age, marital status, educational level and employment status of study participants) were also collected for all women included in this study.

Binary logistic regression was used to assess the association of low bone mineral density (outcome variable) with lifestyle/behavioral factors (independent variables). Initially, crude (unadjusted) odds ratios (ORs) and their respective 95% confidence intervals (95%CIs) were calculated. Next, all the lifestyle factors (smoking, alcohol intake, coffee and tea consumption and BMI) together with demographic and socioeconomic characteristics (age, marital status, educational level and employment status) were entered simultaneously into the logistic regression models. Multivariable-adjusted ORs and their respective 95%CIs 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

The prevalence of low bone mineral density (osteopenia and/or osteoporosis) in this study population was 156/549=28.4% (Table 1). The prevalence of smoking was significantly higher in women with low bone mineral density compared with those with normal bone mineral density (25.6% vs. 8.7%, respectively; $P<0.001$). There were no differences regarding the prevalence of alcohol intake.

The prevalence of both coffee consumption and tea consumption was significantly higher in women with low bone mineral density than in those with normal bone mineral density (83.3% vs. 68.2%, $P<0.001$ and 53.8% vs. 41.2%, $P=0.005$, respectively).

On the other hand, the prevalence of both overweight and obesity was significantly lower in women with low bone mineral density compared with women with normal bone mineral density (30.8% vs. 40.2% and 23.7% vs. 32.2%, respectively; overall P<0.001) (Table 1).

Table 1. Distribution of lifestyle/behavioral factors in a sample of Albanian women by bone mineral density status

Variable	Total (N=549)	Normal bone mineral density (N=393)	Low bone mineral density (N=156)	P†
Smoking:				
No	475 (86.5)*	359 (91.3)	116 (74.4)	<0.001
Yes	74 (13.5)	34 (8.7)	40 (25.6)	
Alcohol intake:				
No	514 (93.8)	369 (93.9)	145 (93.5)	0.508
Yes	34 (6.2)	24 (6.1)	10 (6.5)	
Coffee consumption:				
No	151 (27.5)	125 (31.8)	26 (16.7)	<0.001
Yes	398 (72.5)	268 (68.2)	130 (83.3)	
Tea consumption:				
No	303 (55.2)	231 (58.8)	72 (46.2)	0.005
Yes	246 (44.8)	162 (41.2)	84 (53.8)	
BMI:				
Normal weight	179 (32.7)	108 (27.6)	71 (45.5)	<0.001
Overweight	205 (37.5)	157 (40.2)	48 (30.8)	
Obesity	163 (29.8)	126 (32.2)	37 (23.7)	

* Absolute numbers and their respective *column* percentages (in parentheses).

† P-values from Fisher's exact test.

Table 2 presents the association of low bone mineral density with lifestyle factors of the women included in this study.

In crude (unadjusted) logistic regression models, there was evidence of a strong and statistically significant association of low bone mineral density with smoking (OR=3.6, 95%CI=2.2-6.0), but not alcohol intake (OR=1.1, 95%CI=0.5-2.3). On the other hand, there was a strong association of low bone mineral density with coffee consumption (OR=2.3, 95%CI=1.5-3.7) and tea consumption (OR=1.7, 95%CI=1.2-2.4). On the contrary, the odds of overweight and obesity were lower among women with a low bone mineral density compared with their counterparts with normal bone mineral density (OR=0.5, 95%CI=0.3-0.7 and OR=0.4, 95%CI=0.3-0.7, respectively).

In multivariable-adjusted logistic regression models, low bone mineral density was positively associated with smoking (OR=4.1, 95%CI=2.2-7.4), coffee consumption (OR=2.3, 95%CI=1.3-4.1) and (non-significantly) with tea consumption (OR=1.4, 95%CI=0.9-2.2), but inversely related to overweight and obesity (OR=0.4, 95%CI=0.2-0.7 and OR=0.3, 95%CI=0.2-0.6, respectively) (Table 2).

Table 2. Association of low bone mineral density with lifestyle/behavioral factors among women in Tirana, Albania

Variable	Crude (unadjusted models)		Multivariable-adjusted models	
	OR (95%CI)*	P*	OR (95%CI)*	P*
Smoking:				
No	1.00 (reference)	<0.001	1.00 (reference)	<0.001
Yes	3.64 (2.20-6.02)		4.07 (2.23-7.40)	
Alcohol intake:				
No	1.00 (reference)	0.880	1.00 (reference)	0.478
Yes	1.06 (0.49-2.27)		0.73 (0.30-1.75)	
Coffee consumption:				
No	1.00 (reference)	<0.001	1.00 (reference)	0.003
Yes	2.33 (1.46-3.74)		2.33 (1.34-4.07)	
Tea consumption:				
No	1.00 (reference)	0.008	1.00 (reference)	0.134
Yes	1.66 (1.15-2.42)		1.40 (0.90-2.16)	
BMI:		**<0.001 (2)†**		**<0.001 (2)†**
Normal weight	1.00 (reference)	-	1.00 (reference)	-
Overweight	0.47 (0.30-0.72)	0.001	0.39 (0.23-0.65)	<0.001
Obesity	0.45 (0.28-0.72)	0.001	0.32 (0.18-0.55)	<0.001

* Odds ratios (OR: low bone mineral density vs. normal bone mineral density), 95% confidence intervals (95%CIs) and p-values from binary logistic regression. Besides the variables presented in the table, multivariable-adjusted models were additionally controlled for age, marital status, employment status and educational level.

† Overall p-value and degrees of freedom (in parentheses).

Discussion

This study including a representative sample of women residing in Tirana – the capital city of transitional Albania which was the most isolated country in Europe during the communist regime – offers useful evidence about selected lifestyle/behavioral predictors of low bone mineral density (osteopenia and osteoporosis) in the adult female population. Smoking and coffee consumption were positively associated, whereas overweight and obesity were inversely related to osteopenia and osteoporosis in this sample of Albanian women, after controlling for other lifestyle factors and several demographic and socioeconomic characteristics.

Our findings related to a positive association between low bone mineral density with smoking and coffee consumption are in line with previous reports from the international literature (5). In our study, the association of osteopenia and osteoporosis with coffee consumption was strong and remained unaffected upon simultaneous adjustment for a wide array of covariates including alcohol intake and tea consumption. Furthermore, the positive relationship with smoking was even stronger after multivariable adjustment for other behavioral characteristics.

In our study, overweight and obesity were strong correlates of osteopenia and osteoporosis. The negative association of overweight and obesity with low bone mineral density was accentuated in multivariable-adjusted logistic regression models. Our findings regarding body mass are compatible with several reports from the international literature (1,24). From this point of view, higher body weight or higher BMI is known to be a protective factor against bone loss in both men and women worldwide (1,24-26). Nevertheless, overweight and

obesity are related to a gain in fat mass as well as an increase in lean mass. Therefore, identification of the specific roles that fat mass itself plays in bone mass regulation is important to establish the clinical implications of osteoporosis (24). Several studies have indicated that both fat mass and lean mass can lead to an increase in bone mass which, in turn, reduces the risk of osteoporosis (13,24). On the other hand, according to some other studies, fat mass has a negative effect on bone mass after controlling for body weight (1,27). Importantly, regarding total fat mass, subcutaneous fat has been reported to be beneficial for bone mass, whereas visceral fat has negative effects (24,28).

This study may have some limitations. Notwithstanding the representativeness of the sample of women included in this study, the possibility of selection bias, at least to some extent, may be an issue which cannot be completely excluded. In any case, Tirana women are not assumed to represent the overall Albanian women and, hence, findings from this study cannot be generalized to the overall female population in Albania. In our survey, we employed a standardized and internationally valid instrument for assessment of low bone mineral density in population-based studies. Furthermore, findings from the quantitative ultrasound measurements of bone mineral density correlate well with the dual energy X-ray absorptiometry (DXA) (19), which is one of the most widely validated tools for measurement of BMD in clinical practice (18). On the other hand, the lifestyle/behavioral data collected through the interview may have been subject to information bias. This may be the case of smoking, alcohol intake, as well as coffee and tea consumption. Seemingly though, there is no plausible explanation of a differential reporting of lifestyle factors between women distinguished by the presence of osteopenia and/or osteoporosis in our study. Conversely, measurement of height and weight provides little grounds for biased estimates of overweight and obesity in our study sample.

In conclusion, our study provides important evidence about the lifestyle/behavioral determinants of low bone mineral density in Tirana, the capital city of Albania. Smoking and coffee consumption were significant predictors of low bone mineral density (osteopenia and osteoporosis) in this study sample of Tirana women. Future studies in Albania should assess the magnitude and distribution of osteopenia and osteoporosis in population-based samples of the general population.

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