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Prevalence of self-reported diagnosis of osteoporosis in Brazil, 2006

ABSTRACT

OBJECTIVE: To estimate the prevalence of self-reported osteoporosis (with previous medical diagnosis) and the associated risk and protection factors.

METHODS: A cross-sectional study was carried out, based on data from the system *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL – telephone-based surveillance of risk and protective factors for chronic diseases). A total of 54,369 individuals aged ≥ 18 years living in homes served by at least one fixed telephone line in Brazilian state capitals and the federal district in 2006 were interviewed. Estimates of osteoporosis in relation to socioeconomic and behavioral factors and the body mass index were stratified according to sex. The risk of occurrence of osteoporosis was calculated for each variable separately and through a multivariate model, taking the odds ratio to be a proxy for the prevalence ratio.

RESULTS: The reported prevalence of osteoporosis was 4.4%, predominantly among women (7.0%) ≥ 45 years of age whose marital status was not single and who were former smokers. Among men, age > 65 years, married or widowed status and sedentarism were positively associated with this outcome.

CONCLUSIONS: Among the factors associated with osteoporosis, modifiable characteristics relating to disease prevention were highlighted, such as physical activity and smoking habits.

DESCRIPTORS: Osteoporosis, epidemiology. Risk Factors. Chronic Disease, prevention & control. Health Surveys. Brazil. Telephone interview.

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INTRODUCTION

The aging of the Brazilian population is reflected in the current total of more than 16 million individuals over the age of 60 years. This number is projected to exceed 50 million in 2050.[a] Consequently, the chances of occurrences of age-related diseases among the population, such as osteoporosis, are increasing.

Racial and genetic, anthropometric, sociocultural, economic, nutritional and lifestyle differences, along with the way in which public healthcare resources are used in different countries around the world, contribute towards explaining the divergences in the incidence and prevalence of osteoporosis.

A survey conducted in Latin America estimated that the prevalence of osteoporosis in the vertebrae was between 12% and 18% and in the proximal femur, between 8% and 22%, among women over the age of 50 years.[9] Clark et al[6] estimated a prevalence of vertebral fractures of 11.2% in a random sample of 1,922 women over the age of 50 years, in five Latin American countries, including Brazil.

In São Paulo, in a study on 301 individuals over the age of 70 years, the prevalence of osteoporosis was found to be between 22% and 33% among women and between 6% and 16% among men.[3] Among the risk factors most associated with low bone density, advanced age, low consumption of dairy products and daily consumption of alcoholic drinks have been highlighted. On the other hand, high body mass index (BMI $\geq$ 30 kg/m²) and daily physical activity lasting more than 30 minutes perform a protective role.[b] However, the prevalence of osteoporosis and factors associated with it among the Brazilian population have not been fully clarified.

The aim of the present study was to estimate the frequency of self-reported osteoporosis (with a previous medical diagnosis) and associated factors.

METHODS

This was a cross-sectional study based on data from the system of telephone-based surveillance of risk and protective factors for chronic diseases (*Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico*, VIGITEL), in 2006. The design, sampling and methodological details of this system have been described in other studies.[10,c]

The sampling procedures used in VIGITEL had the aim of obtaining probabilistic samples of individuals aged $\geq$ 18 years who were living in Brazilian state capitals and the Federal District, in households with a fixed telephone line. Interviews were conducted by telephone with 54,369 individuals (21,294 men and 33,075 women).[c] The interviews included questions about demographic and socioeconomic characteristics; dietary patterns; details about physical activity; and occurrences of chronic non-transmittable diseases. In addition, the interviewees were asked to declare their weight and height, consumption of cigarettes and alcoholic drinks, self-assessed general state of health and any medical diagnoses of arterial hypertension, diabetes, high cholesterol or osteoporosis.

In the present study, the frequency of osteoporosis was estimated, based on a previous medical diagnosis, and the associated factors. The selection of these factors took into account the definition proposed by the World Health Organization (WHO) for diagnosis, prevention and treatment of diseases.[b] Thus, the following were included: age (18-24, 25-34, 35-44, 45-54, 55-64 or $\geq$ 65 years); skin color (white or nonwhite); weight at 20 years of age (quartiles, with cut-off points at 58, 65 and 72 kg for men and 48, 52 and 58 kg for women); height (quartiles, with cut-off points at 167, 172 and 177 cm for men and 155, 160 and 165 cm for women); nutritional status at 20 years of age and currently (low weight, normal weight, overweight or obese, according to BMI); smoking (never smoked, former smoker or smoker, independent of the number of cigarettes); sedentarism (yes or no) and leisure physical activity (yes or no); and dietary habits.

Sedentarism was defined as situations in which the interviewee had not practiced any leisure physical activities over the preceding three months, did not make any vigorous physical exertions at work, did not go to work on foot or by bicycle, and did not do any heavy cleaning at home. Physical activity practices were defined as follows: light or moderate activity (minimum of 30 minutes on five or more days a week) or vigorous activity (minimum of 20 minutes on three or more days a week).

The dietary habits included: consumption of dairy products, red meat with fat or chicken with skin (categorized as yes or no); salt consumption was defined as no, yes or yes sometimes; adequate consumption of fruits and vegetables (yes or no, according to whether

the reported intake of these foods was more than five times a day); and regular consumption of fruits and vegetables (yes or no, according to whether the reported intake of these foods was on five or more days per week). In addition, the number of years of schooling (0-8, 9-11 or 12 or more years of study) and marital status (single, married, separated or divorced, or widowed) were included.

The frequency of self-reported osteoporosis was calculated for each category of the variables studied. Afterwards, the risk of occurrence of osteoporosis was calculated for each variable individually, using a logistic regression model. All the analyses were stratified according to sex and adjusted for all the variables that potentially could interfere with the occurrence of osteoporosis.

All the estimates considered three weighting factors: number of telephone lines in the home, number of adults in the home and the ratio of certain categories between the 2000 demographic census and VIGITEL findings. For the whole population, the ratio of the proportion of adults in each city between the demographic census and the VIGITEL findings was added in.

To process the data, the SPSS software application, version 13, was used.

Because this survey consisted of telephone interviews, the free and informed consent statement was replaced by verbal consent that was obtained at the time of the telephone contact with the interviewees. The VIGITEL project was approved by the Ministry of Health's *Comissão de Ética em Pesquisa em Seres Humanos* (Ethics Committee for Research on Human Beings).

RESULTS

Out of the 54,369 individuals interviewed, 4.4% said that they had been medically diagnosed with osteoporosis, especially women (7% versus 1.3% among the men). Reported osteoporosis increased significantly with age. Among the individuals with lower schooling level, osteoporosis reached 6.1% of the total population and around 10% of the women with up to eight years of schooling. It was observed that diagnoses of osteoporosis were predominantly reported by individuals of white skin color, particularly the women (7.9%). Among widows, it reached 25% of the women (Table 1).

Table 1. Percentages[a] of individuals aged ≥ 18 years who reported that they had previously received a medical diagnosis of osteoporosis, according to sex and sociodemographic variables. Brazil, 2006. (N = 54,369)

Variable	Total		Male		Female	
	%	95% CI	%	95% CI	%	95% CI
Age (years)						
18 to 24	0.9	0.7;1.0	0.6	0.4;0.8	1.1	0.8;1.4
25 to 34	0.7	0.5;0.8	0.4	0.3;0.6	0.9	0.7;1.1
35 to 44	1.4	1.2;1.6	0.9	0.7;1.2	1.8	1.5;2.2
45 to 54	5.2	4.7;5.7	2.0	1.5;2.4	8.0	7.2;8.8
55 to 64	12.0	11.1;12.9	2.8	2.1;3.5	19.2	17.7;20.7
≥65	22.0	20.9;23.2	5.1	4.1;6.2	32.7	31.0;34.4
Schooling level (years)						
0 to 8	6.1	5.8;6.4	1.8	1.5;2.0	9.9	9.4;10.4
9 to 11	2.4	2.2;2.7	0.7	0.5;0.9	3.8	3.4;4.2
≥12	2.5	2.2;2.8	1.2	0.9;1.5	3.7	3.1;4.2
Skin color						
White	5.2	4.9;5.5	1.6	1.3;1.8	7.9	7.5;8.4
Nonwhite	3.9	3.7;4.1	1.2	1.1;1.4	6.3	5.9;6.7
Marital status						
Single	1.5	1.3;1.6	0.4	0.3;0.5	2.4	2.1;2.7
Married	4.5	4.3;4.8	2.0	1.7;2.2	7.0	6.6;7.4
Separated/Divorced	6.1	5.2;6.9	1.3	0.6;1.9	8.9	7.6;10.1
Widowed	22.2	20.6;23.7	2.7	1.0;4.4	25.0	23.3;26.7
Total	4.4	4.2;4.6	1.3	1.2;1.5	7.0	6.7;7.3

[a] Weighted percentage, to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population in each city according to the 2000 demographic census, taking into account the population weight of each city.

Table 2. Percentage[a] of individuals aged ≥ 18 years who reported that they had previously received a medical diagnosis of osteoporosis, according to sex and risk factors for osteoporosis currently and at the age of 20 years. Brazil, 2006. (N = 54,369)

Variable	Total		Male		Female	
	%	95% CI	%	95% CI	%	95% CI
Weight at 20 years of age						
1st quartile	5.4	5.0;5.9	2.2	1.7;2.6	8.7	7.8;9.5
2nd quartile	3.0	2.7;3.4	1.1	0.8;1.4	5.7	4.9;6.5
3rd quartile	3.9	3.5;4.4	1.3	1.0;1.7	6.5	5.7;7.3
4th quartile	2.6	2.2;3.0	1.0	0.7;1.3	4.4	3.6;5.1
Height						
1st quartile	6.1	5.7;6.5	2.0	1.6;2.3	10.2	9.5;11.0
2nd quartile	4.1	3.8;4.5	1.1	0.9;1.4	7.0	6.4;7.5
3rd quartile	3.3	2.9;3.6	0.8	0.5;1.0	5.4	4.8;6.0
4th quartile	3.0	2.7;3.3	1.3	1.0;1.6	4.7	4.2;5.3
Nutritional status at 20 years of age						
Low weight	6.0	5.3;6.7	2.5	1.8;3.3	7.9	6.9;8.8
Normal weight	3.3	3.1;3.6	1.1	0.9;1.3	6.1	5.6;6.6
Overweight	3.1	2.5;3.8	2.0	1.4;2.6	5.9	4.2;7.5
Obese	3.3	1.7;4.9	1.5	0.0;3.0	5.3	2.4;8.2
Current nutritional status						
Low weight	4.1	3.2;5.0	1.6	0.5;2.7	5.0	3.8;6.1
Normal weight	3.5	3.3;3.7	1.4	1.2;1.6	5.3	5.0;5.7
Overweight	4.3	4.0;4.6	1.1	0.9;1.3	8.4	7.7;9.0
Obese	7.1	6.4;7.7	1.8	1.3;2.3	12.1	10.9;13.3
Smoking						
Never smoked	4.5	4.2;4.7	1.1	0.9;1.2	6.7	6.4;7.1
Former smoker	5.2	4.8;5.6	1.8	1.5;2.1	9.3	8.5;10.1
Current smoker	3.0	2.7;3.4	1.5	1.2;1.8	5.2	4.5;5.9
Sedentarism						
No	3.8	3.6;4.0	0.9	0.7;1.0	5.7	5.4;6.0
Yes	5.8	5.4;6.1	2.0	1.8;2.3	12.1	11.3;12.9
Physical activities during leisure time						
No	4.6	4.4;4.8	1.4	1.3;1.6	7.1	6.8;7.4
Yes	3.3	2.9;3.6	1.0	0.7;1.3	6.3	5.5;7.1

[a] Weighted percentage, to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population in each city according to the 2000 demographic census, taking into account the population weight of each city.

The highest frequency of osteoporosis was observed in the groups in the lowest quartile of weight, height and nutritional status at 20 years of age, and among currently obese individuals, former smokers, sedentary individuals and those who had not been practicing physical activities during leisure time (Table 2). Furthermore, the frequency was 9.3% among female former smokers and 5.2% among female smokers.

Osteoporosis was reported more frequently by women whose diet included habitual consumption of dairy products, adequate consumption of fruits and vegeta-bles, and regular consumption of fruits; and by both men and women who reported that they did not habitually consume red meat with fat or chicken with skin, and who reported regular consumption of cooked vegetables and greens (Table 3).

Among the men, the odds ratio (OR) adjusted for confounding variables showed that age of 65 years or over, married status or living in a stable partnership, widowed status and sedentary habits were associated with reported osteoporosis. Higher schooling levels, normal weight at 20 years of age, height in the third quartile

Table 3. Percentage[a] of individuals aged ≥ 18 years who reported that they had previously received a medical diagnosis of osteoporosis, according to sex and dietary practices. Brazil, 2006. (N = 54,369)

Diet variable (consumption)	Total		Male		Female	
	%	95% CI	%	95% CI	%	95% CI
Habitual milk and dairy product intake						
No	3.1	2.8;3.4	1.1	0.9;1.4	4.8	4.3;5.3
Yes	4.8	4.6;5.0	1.4	1.2;1.6	7.7	7.3;8.0
Habitual consumption of red meat with fat or chicken with skin						
No	5.5	5.3;5.8	1.6	1.4;1.8	7.8	7.5;8.2
Yes	2.6	2.4;2.8	1.1	0.9;1.3	5.0	4.5;5.4
Habitual consumption of added salt						
No	4.5	4.2;4.7	1.5	1.3;1.7	6.9	6.4;7.3
Yes, sometimes	4.4	4.2;4.7	1.2	1.0;1.4	7.1	6.7;7.5
Yes	3.9	3.3;4.5	1.6	1.1;2.1	6.9	5.7;8.0
Adequate consumption of fruits and vegetables (≥ 5 times a day)						
No	4.2	4.0;4.4	1.3	1.2;1.5	6.8	6.5;7.1
Yes	6.7	5.9;7.4	1.5	0.9;2.2	9.0	7.9;10.0
Regular consumption of fruits (≥ 5 days a week)						
No	3.0	2.8;3.2	1.2	1.0;1.4	5.0	4.7;5.4
Yes	6.2	5.9;6.5	1.6	1.3;1.9	8.9	8.4;9.4
Regular consumption of vegetables and greens (≥ 5 days a week)						
No	4.7	4.4;4.9	1.5	1.3;1.7	7.8	7.4;8.2
Yes	4.0	3.8;4.3	1.0	0.8;1.3	6.2	5.8;6.6

[a] Weighted percentage, to adjust the sociodemographic distribution of the VIGITEL sample to the distribution of the adult population in each city according to the 2000 demographic census, taking into account the population weight of each city.

and current nutritional status of not being in the low weight category were protection factors (Table 4).

Among the women, after statistical adjustments, the main factors associated with reported osteoporosis were age over 45 years, non-single status, height in the third quartile and former smoker status. With advancing age, there was a gradual increase in the risk. Higher schooling levels and nonwhite skin color (black or mixed) were identified as protection factors (Table 5).

DISCUSSION

The present study updates the characterization of osteoporosis in Brazil and shows its frequency and associated factors. The data presented are approximations for prevalence, since they were based on reported medical diagnoses of osteoporosis. Thus, the data represent more the access to healthcare services than the real prevalence of the disease. In this way, the frequency of the disease may have been underestimated.

The present study confirms that osteoporosis mainly affects postmenopausal white women with a reported previous smoking habit and lower schooling level.[3,4,7]

In Europe, the United States and Japan, osteoporosis affects around 75 million people[8] and it is estimated that more than eight million hip fractures will occur over the next 50 years.[8,a] In Brazil, Siqueira et al[15] found from a sample of more than 3,000 individuals that the prevalence of fractures among the population of Pelotas (southern region) was 28.3%.[15] Recently, the Brazilian Osteoporosis Study (BRAZOS)[13] showed that around 6% of the Brazilian population over the age of 40 years reported having a medical diagnosis of osteoporosis. However, low-impact fractures were reported by 15.1% of the women and 12.8% of the men, thus confirming that the frequency of reported osteoporosis may have been underestimated.

Cauley et al[4] evaluated the risk of fractures among almost 160,000 women who took part in the Women's Health Initiative and observed that ethnicity gave rise to different risk factors. The principal predictor for fractures among black women was completion of schooling up to at least high school level. Among Hispanics, it was short height, and among Asians, it was advanced age. On the other hand, among white women, several characteristics were associated, such as advanced age, lower schooling level and smoking.

[a] National Institute of Health. Osteoporosis prevention, diagnosis and therapy. Consensus Statement Online. USA. 2000 [Internet]. [cited 2007 Nov 12]. Available from: http://www.micromri.com/uploads/File/Osteoporosis%20consensus%20statement%20by%20NIH.pdf

Table 4. Odds ratio (OR) and 95% confidence interval for osteoporosis among men in the adult population sample from the Brazilian state capitals and Federal District, according to selected variables. Brazil, 2006

Characteristic	OR		OR	
	Crude	95% CI	Adjusted[a]	95% CI
Age (years)				
18 to 24	1		1	
25 to 34	0.717	0.432;1.190	0.518	0.261;1.028
35 to 44	1.578	1.016;2.453	0.840	0.426;1.655
45 to 54	3.400	2.248;5.143	1.023	0.506;2.068
55 to 64	4.857	3.162;7.459	1.693	0.833;3.443
≥65	9.087	6.090;13.559	3.053	1.505;6.191
Schooling level (years)				
0 to 8	1		1	
9 to 11	0.380	0.279;0.518	0.610	0.414;0.900
≥ 12	0.671	0.496;0.908	0.637	0.419;0.958
Skin color				
White	1		1	
Black and mixed	0.78	0.62;0.98	0.933	0.687;1.269
Others	0.79	0.50;1.23	1.062	0.578;1.951
Marital status				
Single	1		1	
Married or in a partnership	5.166	3.662;7.287	2.989	1.721;5.191
Separated or divorced	3.322	1.809;6.100	1.531	0.631;3.712
Widowed	7.113	3.460;14.623	2.890	1.141;7.323
Height				
1st quartile	1		1	
2nd quartile	0.576	0.434;0.765	0.740	0.511;1.071
3rd quartile	0.396	0.278;0.565	0.279	0.159;0.490
4th quartile	0.669	0.505;0.886	1.271	0.873;1.851
Nutritional status at 20 years of age				
Low weight	1		1	
Normal weight	0.433	0.303;0.679	0.480	0.325;0.708
Overweight	0.789	0.505;1.233	0.952	0.576;1.573
Obese	0.586	0.207;1.665	0.659	0.222;1.952
Current nutritional status				
Low weight	1		1	
Normal weight	0.859	0.425;1.737	0.399	0.178;0.896
Overweight	0.695	0.340;1.422	0.283	0.123;0.652
Obese	1.100	0.523;2.317	0.371	0.153;0.901
Smoking				
Never	1		1	
Former smoker	1.737	1.359;2.219	0.818	0.584;1.147
Current smoker	1.410	1.064;1.869	1.020	0.694;1.498
Sedentarism				
No	1		1	
Yes	2.298	1.844;2.862	2.102	1.560;2.831
Physical activity during leisure time				
No	1			
Yes	0.753	0.607;0.936	1.006	0.746;1.3569

[a] Adjusted for all the other variables

Table 5. Odds ratio (OR) and 95% confidence interval for osteoporosis among women, according to selected variables. Brazil, 2006. (N = 54,369)

Characteristic	Prevalence of osteoporosis			
	OR Bruto		OR Ajustado[a]	
		95% CI		95% CI
Age (years)				
18 to 24	1		1	
25 to 34	0.829	0.589;1.168	0.980	0.566;1.698
35 to 44	1.664	1.226;2.259	1.524	0.896;2.592
45 to 54	7.770	5.955;10.137	6.983	4.261;11.446
55 to 64	21.340	16.443;27.694	15.437	9.379;25.407
≥65	43.488	33.726;56.077	39.593	23.962;65.422
Schooling level (years)				
0 to 8	1		1	
9 to 11	0.364	0.323;0.410	0.949	0.784;1.150
≥12	0.345	0.294;0.405	0.755	0.601;0.947
Skin color				
White	1		1	
Black and mixed	0.83	0.76;0.91	0.939	0.800;1.103
Others	0.48	0.39;0.60	0.442	0.285;0.685
Marital status				
Single	1		1	
Married or in a partnership	2.986	2.594;3.437	1.465	1.153;1.862
Separated or divorced	3.870	3.170;4.723	1.430	1.031;1.983
Widowed	13.278	11.366;15.512	1.642	1.230;2.193
Height				
1st quartile	1		1	
2nd quartile	0.655	0.581;0.740	0.882	0.726;1.070
3rd quartile	0.499	0.435; 0.573	0.632	0.499;0.801
4th quartile	0.434	0.376;0.502	1.071	0.849;1.352
Nutritional status at 20 years of age				
Low weight	1		1	
Normal weight	0.762	0.650;0.895	1.013	0.839;1.223
Overweight	0.734	0.530;1.071	0.920	0.627;1.350
Obese	0.658	0.366;1.186	0.821	0.417;1.617
Current nutritional status				
Low weight	1		1	
Normal weight	1.078	0.838;1.386	0.894	0.561;1.425
Overweight	1.742	1.350;2.248	0.772	0.478;1.248
Obese	2.635	2.021;3.436	0.873	0.528;1.443
Smoking				
Never	1		1	
Former smoker	1.415	1.272;1.575	1.313	1.093;1.577
Current smoker	0.753	0.645;0.879	0.973	0.749;1.264
Sedentarism				
No	1		1	
Yes	2.263	2.056;2.491	0.968	0.805;1.163
Physical activity during leisure time				
No	1			
Yes	0.954	0.865;1.052	0.862	0.731;1.016

[a] Adjusted for all the other variables

Excess weight was negatively associated with the risk of fractures. Moreover, the presence of eight or more risk factors doubled the chance of fractures, compared with the women with four risk factors or fewer.[4]

In Brazil, the factors associated with reduced bone mineral density were evaluated among 413 white women over the age of 59 years who were attended at a healthcare clinic in the municipality of Santos (southeastern region).[7] It was shown that BMI, regular milk intake and practicing physical activity during leisure time had a protective role in relation to bone density. Pinheiro et al[12] studied 275 postmenopausal white women and concluded that the main risk factors associated with low-impact fractures were a family history of hip fractures, low weight and advanced age. In the present study, there was greater frequency of osteoporosis among the individuals in the lowest quartiles of weight and height at the age of 20 years, and among those classified as low weight. Nevertheless, considering the current nutritional status, there was greater prevalence among obese individuals.

The relationship between body weight and osteoporosis has been greatly discussed,[11,14] since the action of weight on bone mass can be explained through its principal components (lean and fat mass). Body fat seems to be a protective factor against fractures and also involves hormonal mechanisms. Increased serum levels of estrogen, leptin, insulin, preptin and amylin, in obese individuals, may act directly and/or indirectly on the activity of osteoblasts and osteoclasts, thereby causing increased bone mass.[11] Lean mass has a beneficial effect on bone mass, especially through the piezoelectric effect.[14]

Height is also a factor frequently associated with osteoporosis and fractures, since it is an indicator of bone size. Men present greater bone density and lower incidence of fractures than women. Greater bone mineral density can be attributed to greater bone diameter, particularly for the femur, and thus lower risk of fractures than in a bone of smaller diameter.[2] In the present study, medium height in both men and women was associated with osteoporosis.

Although most individuals with previous reports of osteoporosis were sedentary, only the men presented an association between sedentarism and osteoporosis. In the BRAZOS study,[13] sedentarism was identified in 76% of the population and was significantly associated with greater risk of fractures due to bone fragility, in both sexes.

The interviewees' dietary habits showed an effect known as reverse causality, in which individuals who reported the presence of osteoporosis also reported greater and more adequate intake of milk and dairy products and fruits and vegetables. The main explanation for this is based on changes in lifestyle habits after receiving the medical diagnosis of osteoporosis, probably as a result of receiving guidance from healthcare professionals. It also needs to be borne in mind that in a cross-sectional study, questions relating to reverse causality cannot be precisely assessed. Nonetheless, the data from the present study indicate that these changes in dietary habits may be beneficial, given that milk and dairy products (because of their calcium content) and fruit and vegetable consumption are promoters of bone health.[1,5,16,17] Fruits and vegetables are foods with recognized properties for preventing various chronic non-transmittable diseases, including osteoporosis, mainly because of their high content of vitamins and minerals such as vitamin K, potassium and magnesium.[17] In a general manner, diets that are rich in fruits and vegetables promote an alkaline environment, thus reducing the demand for calcium ions from the skeleton to buffer the acidic effect caused by excessive protein intake.[1]

Studies among Chinese women have shown the relationship between milk and dairy product consumption and prevention of osteoporosis and fractures. In the study by Chee et al,[5] Chinese women aged between 55 and 65 years received dietary supplementation with powdered milk (equivalent to 1,200 mg of calcium) for 24 months. The authors observed a significant reduction in bone loss in the group that received supplementation.[5] Subsequently, Ting et al[16] evaluated the bone density of these women 21 months after ending the study and found that the group that received supplementation did not show any significant loss of bone density in relation to the start of the study, except in the lumbar spine. Furthermore, the women who received supplementation showed higher daily calcium intake even after the end of the study.

With regard to the smoking habit, it was concluded from a meta-analysis involving more than 40,000 individuals[18] that smokers presented significant reductions in bone density, along with higher risk of vertebral fractures (13% in women and 32% in men).[18] Our results reinforce the finding that smoking is associated with a risk of fracture that is 30% greater among women (OR = 1.313; 95% CI: 1.093;1.577).

One limitation of this study was that we did not perform bone densitometry, and therefore the frequency data on the disease may have been underestimated. Furthermore, no investigations were made regarding reports of previous fractures and family histories of fractures, which are risk factors frequently associated with osteoporosis and fractures.

In conclusion, the present study on a representative sample of the adult population of Brazil made it possible to identify modifiable factors relating to the prevention of osteoporosis, such as diet, physical activity and lifestyle habits.

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