Analysis of Risk Factors for Osteopenia and Osteoporosis Among Adults and Elderly in Primary Health Care

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Abstract

Objective: To analyze the distribution of risk factors for osteopenia and osteoporosis among adults and elderly in primary care. Method: sectional study of quantitative approach. Random sample extracted from registered adults and elderly from the five Family Health Strategy units belonging to an Expanded Family Health and Primary Care Center in Dourados, MS. Data collected between March and December 2015. The sample consisted of 44 adults and 103 elderly, of which only 109 performed all examinations. Body mass index, bone densitometry, serum calcium, 25 serum hydroxyvitamin D and a structured questionnaire were used. Results: The factors that were significantly associated with the risk of osteopenia and osteoporosis (p <0,05) were female gender, alcohol consumption and normal body mass index. Conclusion: the identification of these risk factors made it possible to trace their distribution profile, which will be of great value for carrying out health promotion actions and prevention of these diseases in Primary Health Care.

Keywords: Risk factors; Elderly; Metabolic bone diseases; Osteoporosis; Healthy aging.

1. Introduction

The Osteoporosis and osteopenia are increasingly prevalent conditions that generate significant health consequences for fractured individuals [1]. They are considered similar and precursor diseases and are characterized by a reduction in bone mass and bone tissue, producing mechanical fragility and a greater predisposition to fractures, although this reduction is less severe among osteopenic individuals [2].

The Osteoporosis is the most frequent osteometabolic disease among the elderly [2]. Although it is seen as a female health problem, mainly due to weather-related changes, in the last 20 years male osteoporosis has been highlighted, since about 30% of hip fractures occur in men [3].

The main risk factors for osteoporosis and fractures are: age; female gender; white or oriental ethnicity; personal and family history of fracture; low Bone Mineral Density (BMD) of the femoral neck; low Body Mass Index (BMI); use of oral glucocorticoid (dose ≥ 5mg of prednisone for more than three months); environmental factors, among which smoking, excessive alcohol intake (≥ three units per day), physical inactivity, and low calcium dietary intake [4].

The Osteoporosis is a multifactorial disease, the most important result of which is the occurrence of low-impact fractures, affecting more than 200 million people worldwide [3]. A study among American postmenopausal women found that the costs related to hospitalization and treatment of osteoporotic fractures outweigh the costs related to other pathologies [5]. In 2018, more than 840.000 cases of osteoporotic fractures were estimated, generating a total annual cost of approximately $1,17 billion, according to a study conducted in four Latin American countries, including Brazil [6].

Researchers in southern Brazil identified a mortality rate above 25% after 12 months of a hip fracture and that this rate is 4,3 times the expected mortality for individuals over 50 years of age [7]. These fractures compromise the independence of individuals who survive them, with more than 50% of them becoming dependent for daily activities and many of them needing institutionalization [3].

About 80% of eligible patients do not receive treatment for the disease and may generate recurrent fractures [8]. It is necessary to intervene quickly after any fracture due to fragility, especially in postmenopausal women, since it can be a unique opportunity to prevent new fractures in a short period of time, considering their increased risk for such outcome[9].

Therefore, the main objective was to analyze the risk factors for osteopenia and osteoporosis among adults and the elderly of Basic Care.

2. Materials and methods

Sectional and quantitative approach study. The sample was randomized, taken from the population of adults and elderly registered in the five units of Family Health Strategy (FHS) that belonged to the area of coverage of the Expanded Core of Family Health and Basic Care (ECFH-BC) in the Northern region of the municipality of Dourados, Mato Grosso do Sul, according to data from the Information System of Basic Care (ISBC) [10]. The data were collected from March to December 2015.

The sample calculation was based on the study that estimates proportions from the finite population of 4048 people, using the 95% confidence interval, 10% margin of error and 50% expected proportion of people with osteoporosis [11].

People of both sexes from the age of 50 were considered as inclusion criteria, and individuals belonging to the indigenous ethnicity, as well as bedridden individuals, incapable of locomotion or with limitations to respond to it, due to some mental illness, were excluded from the survey.

The sample consisted of 147 persons, 44 adults (aged between 50 and 59 years) and 103 elderly (60 years and over).

Body Mass Index (BMI), bone densitometry, serum calcium, 25 serum hydroxivitamin D and a structured questionnaire were used.

Considered the parameters of BMI for elderly, The Pan American Health Organization [12]. The variables were reclassified into two categories: normal (BMI <28kg/m2) and overweight (BMI ≥28 kg/m2).

For the BMI for adults, the World Organization Health parameters were used. In this case, they were grouped into: normal (BMI <24.9 kg/m2) and overweight (BMI ≥25 kg/m2). This dichotomous reclassification of the BMI variable was necessary due to the low number of individuals per category to perform regression calculations.

The research was developed through home visits, where the weight and height of those assessed were measured. The structured questionnaire was also applied, upon acceptance of the individuals to participate in the research and signing of the Free and Informed Consent Term (FICT).

The criteria for requesting bone densitometry (BOD) were the same as those adopted by the Dourados Municipal Health Department (MS) until the beginning of the collection date (March 2015).

The individuals with indication for the DO examination were scheduled by the Regulation System (REGSYS) and later, referred to the Center for Women's Service (CWS) of Dourados (MS), to perform the examination of bone densitometry and diagnosis [13].

Bone densitometry examination was performed by absorptiometry densitometry and radiography with dual energy (DXA – *Double Energy X-Ray Absorptiometry*). The results were considered, according to the World Health Organization (WHO) consensus, as normal, when densitometry showed up to -1 T Score standard deviation (SD); osteopenia, from -1 to -2,5 SD T Score and osteoporosis when the result is below -2,5 SD [14].

Complementary tests were also performed, such as serum calcium and 25 hydroxyvitamin D. The cut-off points considered for serum calcium were between 8,6 and 8,8mg/dl for lower limit and 10,2 and 10,3mg/dl for upper limit of normality [15]. As for the levels of 25 hydroxivitamin D it was considered: deficient (< 20ng/ml), insufficient (20-29ng/ml) and sufficient (30-100ng/ml) [16].

A questionnaire containing sociodemographic data (gender, age, marital status, education, income and family arrangement) and health characteristics was used to check the interference of control variables [17]. Regarding health characteristics, the following variables were evaluated: smoking; alcohol intake; fracture history; family history of osteopenia and/or osteoporosis; history of maternal osteoporotic fracture; age of menopause; sun exposure; use of sunscreen; physical activities and use of drugs/supplements.

The data collected were tabulated and with the help of Predictive Analytics Software (PASW) version 21 statistical analyses were performed using absolute and relative frequency, mean, median and standard deviation (dp).

The univariate analytical approach and later the univariate logistic regression model were used to verify the association of the variables that contribute to the incidence of osteoporosis. The association between bone densitometry classification and the other variables evaluated in this study was evaluated using the chi-square test, with Bonferroni correction when necessary.

The multivariate logistic regression technique was then applied. All variables with a significance value, $p < 0,20$, were included in the regression model in the univariate analysis. The logistic regression model used was the Enter method for estimating prevalence ratios and applying the likelihood ratio test to obtain statistical significance ($p<0,05$) [18].

The collection of data met the guidelines of CNS Resolution 466/2012 and only occurred after the approval of the Ethics and Research Committee of the Dom Bosco Catholic University (UCDB) under protocol 866.086.

3. Results

Of the 147 evaluated, 108 (73,5%) were female. The mean age of the participants was 65,3 years (dp=±9,6; median=64), ranging from 50 to 89 years old.

The majority (70,0%) were elderly, 55,1% were married or had a stable union, 82,0% were educated, 84,3% lived with spouse and/or relatives and 70,7% had family income below two minimum wages. It should also be noted that 40,1% of the individuals were diagnosed with overweight.

Considering the risk factors evaluated and that only 109 individuals performed all the tests, 92,5% presented some type of risk factor for osteopenia or osteoporosis and only 7,5% did not present the factors for these diseases.

Of the 109 patients evaluated 38,5% (n=42) had osteopenia and 26,6% (n=29) already had osteoporosis.

Table 1 shows the distribution of factors associated with the diagnosis of osteopenia and osteoporosis in the lumbar region or femur or both, referring to adults and elderly people served by NASF North.

Most patients were female (73,4% - n=80), older than 60 years (70,6% - n=77), had no maternal family history of osteoporosis (84,4% - n=92), did not consume alcohol (83,5% - n=91), was not a smoker (61,5% - n=67), had no history of fractures (75,2% - n=82), did not perform physical activity (66,1% - n=72), did not use hormone replacement (only among women); 75,0% - n=60), menopause had started after 50 years (only among women; 57,5% - n=46), was overweight (85,3% - n=93), did not use antacids (91,7% - n=100), did not use calcium supplementation (91,7% - n=93) or vitamin D (92,7% - n=101) and had normal serum vitamin D dosage (65,3% - n=64).

There was an association between bone densitometry and the following variables: gender (p=0,011), alcohol consumption (p=0,038), body mass index classification (p=0.001) and antacid use (p=0,001). The percentage of men with normal densitometry was higher than that observed among women (chi-square test, with Bonferroni correction, p<0,05). On the other hand, the percentage of women with osteoporosis was higher than that observed among men (p<0,05).

A percentage of patients who consumed alcohol presented normal densitometry when compared to those who did not use alcohol (p<0,005). In addition, a higher percentage of overweight people presented normal densitometry when compared to those with normal BMI (p<0,05). In contrast, a lower percentage of overweight patients presented osteoporosis when compared to those with normal BMI (p<0,05).

When using antacids, a percentage of patients who did not use antacids had normal densitometry when compared to those who used antacids (p<0,05). On the other hand, a higher percentage of patients who used antacids had osteoporosis when compared to those who did not use antacids (p<0,05).

The other variables evaluated in this study were not significantly associated with bone densitometry of patients (chi-square test, p-value ranging from 0,081 to 0,920).

A multivariate analysis of the evaluation of the association of bone densitometry and the other variables evaluated in this study was performed, initially including in the logistic regression model all the variables in Table 1 that presented a value of p<0,20, which are: gender, age range, family history of osteopenia or osteoporosis, use of alcohol, body mass index and use of antacids.

In Table 2 presents the results of the multivariate logistic regression model for osteopenia and Table 3 presents the results of the multivariate assessment for osteoporosis.

In multivariate analysis the only variable that was shown to be associated with osteopenia was the use of alcohol (logistic regression test, p=0,049), in which case the use of alcohol was protective in relation to osteopenia (Odds Ratio=0,23).

The gender of the patients was significantly associated with osteoporosis (p=0,022), being more prevalent in female patients (Odds Ratio=9,64).

Age has also been associated with osteoporosis, which is more frequent in people aged 60 and over (Odds Ratio=7,52). The other variables were not associated with osteoporosis.

Table 1. Distribution of factors associated with the diagnosis of osteopenia and osteoporosis in the lumbar region or femur or both, referring to adults and elderly attended by NASF North. Dourados, MS, 2015 (N=109).

Variable	Bone mineral densitometry						Total (%)	Value of p
	Normal		Osteopenia		Osteoporosis			
	N	%	N	%	N	%		
Gender of evaluation								
Male	15	51,7a	12	41,4a	2	6,9b	29 (26,6)	0,011
Female	23	28,8b	30	37,5a	27	33,8a	80 (73,4)	
Age (years)								
Less than 60	12	37,5	16	50,0	4	12,5	32 (29,4)	0,081
60 or more	26	33,8	26	33,8	25	32,5	77 (70,6)	
Maternal family history of osteoporosis								
No	31	33,7	33	35,9	28	30,4	92 (84,4)	0,102
Yes	7	41,2	9	52,9	1	5,9	17 (15,6)	
Alcohol consumption								
No	27	29,7b	38	41,8a	26	28,6a	91 (83,5)	0,038
Yes	11	61,1a	4	22,2a	3	16,7a	18 (16,5)	
Was or is a smoker								
No	25	36,8	22	32,8	20	29,9	67 (61,5)	0,293
Yes	13	31,7	20	46,7	9	21,4	42 (38,5)	
History of fractures								
No	30	36,6	33	40,2	19	23,2	82 (75,2)	0,368
Yes	8	29,6	9	33,3	10	37,0	27 (24,8)	
Performs physical activity								
No	26	36,1	25	34,7	21	29,2	72 (66,1)	0,492
Yes	12	32,4	17	45,9	8	21,6	37 (33,9)	
Hormonal repositioning								
No	16	26,7	21	35,0	23	38,3	60 (75,0)	0,324
Yes	7	35,0	9	45,0	4	20,0	20 (25,0)	
Period when menopause began								
Before 50 years	12	35,3	14	41,2	8	23,5	34 (42,5)	0,232

After 50 years	11	23,9	16	34,8	19	41,3	46 (57,5)	
Body mass index								
Normal	1	6,3b	5	31,3a	10	62,5a	16 (14,7)	0,001
Overweight	37	39,8a	37	39,8a	19	20,4b	93 (85,3)	
Use antacid								
No	38	38,0a	40	40,0a	22	22,0b	100 (91,7)	0,001
Yes	0	0,0b	2	22,2a	7	77,8a	9 (8,3)	
Use supplemental calcium								
No	35	35,0	38	38,0	27	27,0	100 (91,7)	0,920
Yes	3	33,3	4	44,4	2	22,2	9 (8,3)	
Use a vitamin supplement D								
No	36	35,6	39	38,6	26	25,7	101 (92,7)	0,730
Yes	2	25,0	3	37,5	3	37,5	8 (7,3)	
*** Dosage of serum vitamin D**								
Normal	20	31,3	27	42,2	17	26,6	64 (65,3)	0,625
Deficient	13	38,2	11	32,4	10	29,4	34 (34,7)	
No information	5		4		2			

* Serum vitamin D dosage: the sum was 98, because only this number of individuals took the test. Different letters in the column represent difference between categories of the variable, in that category of bone densitometry (chi-square test with Bonferroni correction, p<0,05).

Table 2. Joint analysis of osteopenia classification in relation to gender, age group, family history of osteopenia or osteoporosis, alcohol use, body mass index and antacid use of adults and elderly attended by NASF North. Dourados, MS, 2015 (N=109).

Variables	Categories	OR [IC95%]	Value of p
Sex	Male	1	0,941
	Female	0,96 (0,29 - 3,15)	
Age group	Less than 60	1	0,371
	60 or more	0,62 (0,22 - 1,77)	
Family history of osteopenia or osteoporosis	No	1	0,920
	Yes	0,94 (0,28 - 3,21)	
Use of alcoholic beverages	No	1	0,049
	Yes	0,23 (0,06 - 0,99)	
Body Mass Index	Normal	1	0,156

	Overweight	0,19 (0,02 - 1,87)	
Use of antacid	No	1	0,999
	Yes	*TDA	

Estimates: Log likelihood ratio = 99,63; Nagelkerke R^2 = 0,172.
Model adjustment. $X^2_{(6)}$ = 33,98; p = 0,680. Global correct rank percentage = 61,3%.
*TDA= Test does not apply.

Table 3. Joint analysis of osteoporosis classification in relation to gender, age group, family history of osteopenia or osteoporosis, alcohol use, body mass index and antacid use of adults and elderly attended by NASF North. Dourados, MS, 2015 (N=109).

Variables	Categories	OR [IC95%]	Value of p
Sex	Male	1	0,022
	Female	9,64 (1,38 – 67,30)	
Age group	Less than 60	1	0,031
	60 or more	7,52 (1,20 – 47,11)	
Family history of osteopenia or osteoporosis	No	1	0,998
	Yes	*NSA	
Use of alcoholic beverages	No	1	0,754
	Yes	0,73 (0,10 – 5,28)	
Body Mass Index	Normal	1	0,055
	Overweight	0,08 (0,01 - 1,06)	
Use of antacid	No	1	0,998
	Yes	*TDA	

Estimates: Log likelihood ratio = 49,01; Nagelkerke R^2 = 0,632.
Model adjustment. $X^2_{(6)}$ = 42,66; p < 0,001. Global correct rank percentage = 82,1%.
* TDA= Test does not apply.

4. Discussion

In this study it was possible to verify that the percentage of women with osteoporosis was higher than that of men. In addition, osteoporosis was more observed in individuals with normal BMI and who used antacids. However, in the multivariate analysis, only the use of alcohol was associated with osteopenia, as a protective factor.

On the other hand, the age group was associated with osteoporosis, and the risk of people aged 60 years and over for osteoporosis was 7,52 times higher than that of individuals under 60 years of age.

Further investigation is recommended in future studies, considering a more representative sample, in order to identify other factors that may be interfering with the risk of osteoporosis and that have not reached the proposed level of significance or have not been studied in this work.

The relationship between the use of antisecretory (proton pump inhibitors) and bone metabolism has been pointed out in the literature by some researchers [19,20], although it is not yet well elucidated. It is supposed that this fact is explained by the elevation of the gastric hydrogen ion potential (pH), which would affect the absorption of calcium, since the mineral is insoluble in basic medium.

An experimental study in which 50 rats were submitted to prolonged use of omeprazole, in different dosages, observed bone demineralization of the femur of animals exposed to high doses of omeprazole, which may suggest susceptibility to bone fractures [19].

The Brazilian Consensus of Potentially Inappropriate Medicines for the Elderly recommends that proton pump inhibitors be prescribed with caution and that their use be discontinued before eight weeks of treatment or that their dosage be reduced, considering their potential for the development of osteoporosis/fracture, among other consequences [20].

With the results of Table 3, it is possible to conclude that there was a strong relationship of significant dependence between normal body mass index and positive diagnosis of osteoporosis. People who presented normal body mass index presented 10 times more chances of presenting positive diagnosis of osteoporosis than an overweight individual. People who do not consume alcohol are 3,9 times more likely to be diagnosed with osteoporosis than individuals who consume moderately alcoholic beverages. On the other hand, the data showed that the use of antisecretory results in a 100% chance of being diagnosed with osteoporosis in this population.

It should be noted that although these three variables are jointly significant and important, they represent only 24% of the total variation ($R^2 = 0,241$) and that for future studies further investigation is recommended, considering a more representative sample, in order to identify other factors that may be interfering with the risk of osteoporosis and that have not reached the proposed level of significance or have not been studied in this work.

Another study [21], aiming to determine the prevalence of osteopenia and osteoporosis among women in a specialized clinic in southern Brazil, found age after 50 years and menopause in this period as risk factors for osteoporosis, which converges with our results, although these variables did not present a significant association in this study.

This higher prevalence of the disease in women can be explained by the balance between bone formation and bone resorption, which becomes progressively negative with advancing age and the greatest bone loss occurs after the age of 65. However, men are less likely to develop the disease for two reasons: first, they gain more bone mass during puberty and second, they lose less bone mass during aging because they do not experience sudden loss of estrogen, as occurs with menopausal women [21].

A cross-sectional clinical study with 107 women attended in the Health Integrality Practices Program (HIPP) identified sedentarism as one of the risk factors for osteoporosis. On the other hand, this study showed a higher prevalence of individuals who perform physical activity among those diagnosed with osteoporosis; however, this association was not significant and may have occurred at random [22].

Regarding the alcohol intake factor, in the present study there was a significant association between the absence of alcohol use and the risk of osteoporosis, and this finding is controversial in the literature. Another researcher found that the absence of alcoholism was one of the protective factors for the disease [21]. It is known that excessive alcohol intake is harmful to bone, reducing the number of osteoblasts and increasing bone resorption [23], however, in the population studied, 86,4% do not ingest alcohol on a weekly basis, which can represent that a low or moderate intake of alcohol has a protective effect on bone health. In terms of BMI and risk of osteoporosis, the results show in the literature [21,24] that the higher the BMI, the lower the risk for osteoporosis, since obese individuals have a higher peripheral conversion of gonadal hormones, which improves bone mass maintenance and protects against the deleterious effects of hypoestrogenism. Another study showed [25] that obese women had a lower prevalence of osteopenia compared to eutrophic women, as well as a lower prevalence of osteoporosis compared to eutrophic and overweight women.

5. Conclusion

The identification of the prevalence of osteopenia and osteoporosis and their risk factors in this population made it possible to trace their distribution profile, enabling health promotion and disease prevention actions in Primary Care.

The limitations of the study are the type of study (cross-sectional), the sample size and that only one region of the municipality was contemplated. In addition, a large number of individuals did not perform all the tests.

It is essential to develop new studies, including a larger number of individuals, with greater proportionality between genders, as well as inserting new tests and even with representativeness of macro-regions in the state of Mato Grosso do Sul, in view of the scarcity of studies in this region.

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