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Original Article

Vitamin D is associated with a low quality of life: a primary care study

Juliana Ebling Brondani[1], Tamires Tolazzi Martins[2], Ana Elise Barin[2], Fabio Vasconcellos Comim[3], Melissa Orlandin Premaor[3]

ABSTRACT

Introduction: Some studies have described impairment in quality of life of vitamin-deficient subjects. However, little is known about this association in primary care. This study aimed to evaluate the association between vitamin D deficiency and quality of life in postmenopausal women attending primary care in the municipality of Santa Maria – Brazil.

Methods: A cross-sectional study was carried out with postmenopausal women over 55 years of age, accompanied in primary care, from March to August 2014. These women were randomly selected among the participants of a cohort study in the municipality of Santa Maria – Brazil. Data were collected through a standardized questionnaire, quality of life was assessed using the Short Form-36 Health Survey (SF-36), and 25-hydroxyvitamin D were measured using the ALPCO® ELISA method.

Results: Of the total of 78 studied women, 11.54% had vitamin D deficiency. Women with vitamin D deficiency had a poorer quality of life assessed by SF-36. In the regression analysis, both vitamin D deficiency and falls were independently associated with a lower physical component of the SF-36.

Conclusion: Vitamin D deficiency is associated with poorer quality of life in the studied postmenopausal women.

Keywords: *Vitamina D deficiency; Postmenopausal; Quality of life; SF-36; Primary health care*

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1 Programa de Pós-Graduação em Farmacologia, Universidade Federal de Santa Maria. Santa Maria, RS, Brasil.

2 Grupo de Pesquisas em Doenças Osteometabólicas Crônicas, Departamento de Clínica Médica, Universidade Federal de Santa Maria. Santa Maria, RS, Brasil.

3 Departamento de Clínica Médica, Universidade Federal de Minas Gerais. Belo Horizonte, MG, Brasil.

Corresponding author:
Melissa Orlandin Premaor
melissa.premaor@ebserh.gov.br
Departamento de Clínica Médica, Universidade Federal de Minas Gerais
Avenida Professor Alfredo Balena, 190 – sala 246
31270-901, Belo Horizonte, MG, Brasil.

INTRODUCTION

Described as a steroid hormone[1-3], vitamin D presents its classic actions in bone metabolism. Its main actions are on calcium and phosphorus homeostasis; however, the vitamin D receptor is found in almost all human tissues[2]. Its deficiency may cause secondary hyperparathyroidism with loss of bone mass and consequent development of osteopenia and osteoporosis[3]. Low serum levels of 25(OH)D have been associated with bone fractures and falls[1-3]. Moreover, studies conducted in the last couple of decades have described associations between low serum levels of 25(OH)D and diseases that were not classically associated with bone metabolism. There is enough evidence to link vitamin D deficiency with a high prevalence of cancer, impaired immunity, and metabolic syndrome[1-3]. Besides, vitamin D deficiency appears to be associated with unfavorable outcomes[1-3]. Subjects with breast cancer, colon cancer, or prostate cancer who have vitamin D deficiency have the worst prognosis[3]. An excess of mortality associated with low levels of 25(OH)D has been described in observational studies[3].

Despite the mechanisms of action of vitamin D and its association with a range of serious diseases suggesting that vitamin D deficiency may be associated with poorer health-related quality of life (HRQoL), only a few studies have evaluated this issue[4-7]. Although these studies have shown an overall association between low serum levels of 25(OH)D and low HRQoL, they mainly included subjects with comorbidities or subjects recruited in the tertiary setting. In this context, little is known about the association between vitamin D deficiency and the HRQoL in primary care. This study aimed to

evaluate the association between vitamin D deficiency and the HRQoL in postmenopausal women attending the primary care of the municipality of Santa Maria – Brazil.

METHODS

Settings

The study was designed as a cross-sectional study nested in a cohort study[8] at the municipality of Santa Maria, located in southern Brazil. The primary cohort study included 1,057 postmenopausal women over 55 years of age who attended the primary care of the municipality. For this sub-study, women were randomly selected among 1057 recruited. The sample size was calculated expecting a difference of 10 points in the HRQoL score between women with and without vitamin D deficiency, a standard deviation of 12 points, an alpha error of 0.05%, and a power of 90%. The estimated number of patients that should be included in the study was 62. This study was approved by the Ethics Committee of the Federal University of Santa Maria (CAAE 11166012.6.0000.5346). Informed consent was obtained from all participants.

Measurements

A standardized questionnaire translated into Portuguese was applied by our research time with the permission of researchers from The Global Longitudinal Study Osteoporosis (GLOW) and The Center for Outcomes Research, University of Massachusetts Medical School (http://www.outcomes-umassmed.org/GLOW/default.aspx)[9]. HRQoL was assessed through the Short Form-36 Health Survey (SF-36) (license number QM016471), which comprises 36 questions that evaluate the quality of life in two domains: physical component (physical functioning, role-physical, bodily pain, and general health) and mental component (vitality, social functioning, role-emotional, and mental health)[10]. Weight and height were measured according to the recommendations of the World Health Organization (WHO)[11]. The physical activity of the women participating in the study was evaluated by the weekly frequency scale Baecke questionnaire[12]. All fractures were confirmed by X-ray verification or medical report. Major fractures were those located in the femur, humerus, wrist, or clinical vertebral, and that occurred after 45 years[8]. The risk of fractures was calculated using the Fracture Risk Assessment Tool (FRAX® – WHO, https://www.sheffield.ac.uk/FRAX/tool.aspx?country=55) without the addition of the bone mineral density value (BMD). Serum levels of total 25(OH)vitamin D [25 (OH) D] were evaluated by Enzyme-Linked Immunosorbent Assay (ELISA) (ALPCO, Salem, MA, USA). Intra-assay coefficient of variation was 4.8% (PTH – serum), All tests were done according to the manufacturer's instructions. Serum levels of albumin, total calcium, phosphorus, and creatinine were measured using the standardized methods on the Cobas MIRA® automated analyzer (Roche Diagnostic, Basel, Switzerland).

Statistical analysis

Data are described as prevalence rate (%) or mean and standard deviation. Vitamin D deficiency was considered present in those women who presented a 25(OH)D serum level lower than 20 ng/mL. Student's t-test, Fisher's exact test, and Mann-Whitney U were used to find possible differences between groups with and without vitamin D deficiency. Univariate linear regression analysis was used to evaluate potential factors associated with HRQoL. Multiple linear regression analysis models were used to determine the factors independently associated with HRQoL. All variables that had a p-value less than 0.1 entered the model. The two-tailed p-value less than 0.05 was considered significant. Analyzes were performed using the IBM SPSS statistical software (version 19 for Windows, Armonk, NY, USA).

RESULTS

The main characteristics of the study participants are shown in Table 1. Of the 84 women recruited, only 78 completed the SF36 questionnaire. Women with vitamin D deficiency used calcium supplementation less frequently than women without vitamin D deficiency. There was a trend towards more hospital admissions in women with vitamin D deficiency.

Table 1: Characteristics of the studied women.

	Without vitamin D deficiency n = 69	With vitamin D deficiency n = 9	p-value
Demographic parameters			
Age	69.0 (7.6)	73.7 (8.5)	0.474*
BMI[a]	29.5 (5.8)	27.1 (5.5)	0.237*
Education > 8 years	33.8%	4.5%	0.258**
Health insurance	55.9%	55.6%	1.0**

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Tabela 1: Continuação.

	Without vitamin D deficiency n = 69	With vitamin D deficiency n = 9	p-value
Clinical parameters			
Smoking	10.6%	11.1%	1.0**
Alcohol abuse	0	0	NA
Baecke – physical activity[b]	2.4 (0.5)	2.18 (0.6)	0.131*
Comorbidity[c]	66.7%	85.7%	0.421**
Hospital admission in the last year	15.9%	44.4%	0.063**
Vitamin D supplement use	16.2%	33.3%	0.352*
Calcium supplement use	25.0%	11.7%	0.018**
Falls in the last year	33.3%	44.4%	0.711**
Major fracture			
FRAX score – major fracture risk	6.5 (4.7)	12.0 (9.6)	0.187***
FRAX score – hip fracture risk	2.3 (2.8)	6.8 (8.3)	0.403***
Biochemical parameters			
Calcium	8.1 (1.4)	7.4 (1.1)	0.196*
Phosphorus	3.6 (1.1)	2.9 (1.0)	0.080*
Albumin	4.5 (0.8)	4.5 (0.9)	0.823*
Creatinine	0.7 (0.2)	0.8 (0.1)	0.447*
PTH	21.1 (21.5)	21.8 (18.2)	0.557***

[a] Body mass index; [b] Baecke score of physical activity in exercise and laser; [c] At least one of the following: asthma, COPD, osteoarthritis, rheumatoid arthritis, heart failure, systemic arterial hypertension, ischemic heart disease, Parkinson's disease, cancer, or diabetes.

* Calculated by Student's t-test; ** Calculated by Fisher's exact test; *** Calculated by the Mann-Whitney U test.

Table 2 and Figure 1 display the HRQoL of the women studied. Women with vitamin D deficiency presented a lower quality of life than those without vitamin D deficiency. Further, the summary of the physical component of quality of life was lower in women with vitamin D deficiency compared to those without it [mean (SD) 47.62 (8.5) vs. 39.56 (10.4), p = 0.023, respectively], Figure 1. There was no difference in the mental component summary between the groups [mean (SD) 53.53 (12.6) vs. 52.01 (10.1), p = 0.713, respectively]. Women with vitamin D deficiency also had a lower total functional capacity (physical functioning) and worse performance in the emotional aspects (role-emotional), Table 2.

Table 2: Health-related quality of life of the studied women.

	Without vitamin D deficiency n = 69	With vitamin D deficiency n = 9	p-value
Physical health			
Physical functioning	46.05 (8.9)	37.55 (13.7)	0.014*
Role-physical	48.03 (11.5)	39.83 (14.5)	0.084*
Bodily pain	43.34 (11.1)	35.79 (8.3)	0.067*
General health	52.59 (10.2)	46.76 (13.3)	0.145*
Mental health			
Vitality	54.05 (11.4)	49.63 (12.8)	0.308*
Social functioning	51.72 (10.0)	44.81 (12.0)	0.074*
Role-emotional	50.65 (10.3)	41.74 (14.4)	0.040*
Mental health	46.48 (11.3)	44.41 (15.1)	0.639*

* Calculated by Student's t-test.

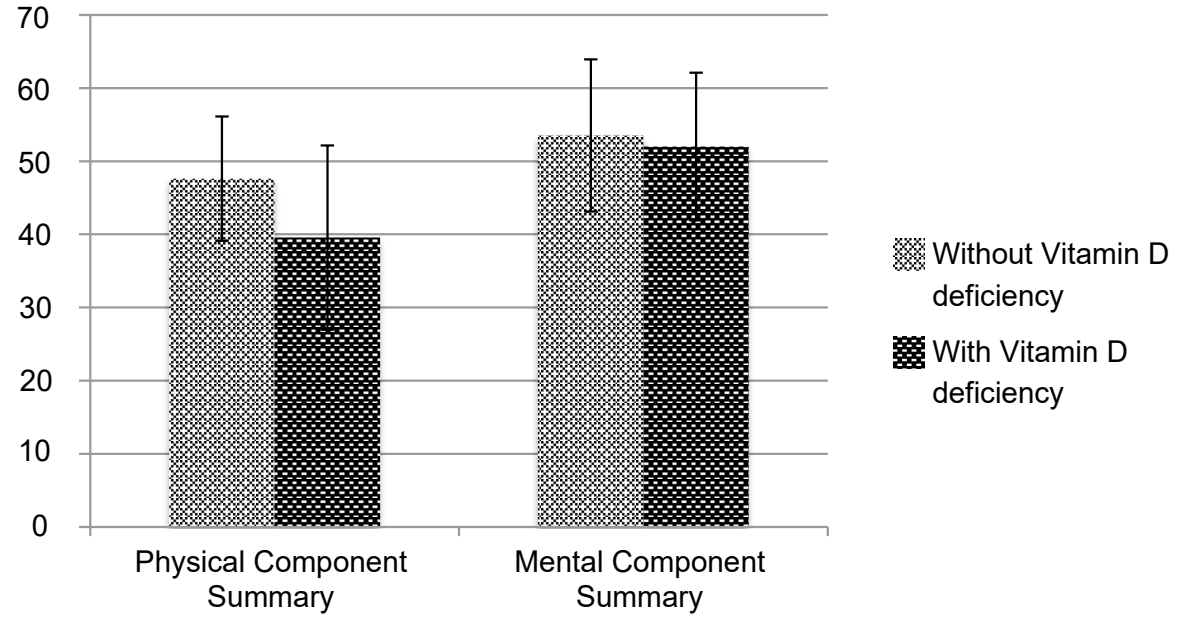

Figure 1: Summary of the physical and mental components of quality of life in the studied women.
*The p-value, calculated by the Student's t-test, for the Physical Component Summary was < 0.05.

The univariate analysis for the summary of the physical and mental component of the HRQoL in the studied women is described in the supplementary material, tables 1S and 2S. In the multivariate analysis for the summary of the physical component of quality of life, only vitamin D deficiency and falls in the last year were independently associated with a lower score (Table 3).

Table 3: Multivariate analysis of the factors associated with the physical component summary of health-related quality of life in the studied women.

	B	Standard Error	Beta	p-value
Vitamin d deficiency	−11.707	3.291	−0.385	0.001
BMI	−0.345	0.173	−0.212	0.051
Major fracture	−3.694	1.947	−0.205	0.063
Falls in the last year	−6.534	2.022	−0.342	0.002

Calculated by linear regression, backward. Dependent variable: summary of the physical component of quality of life. The following variables were included in the model: vitamin D deficiency, major fracture, serum phosphorus levels, use of calcium supplementation, hospitalization, body mass index (BMI), age, presence of comorbidity, schooling > 8 years, Baecke score of physical activity, and falls in the last year. The following variables remained in the model: vitamin D deficiency, BMI, major fracture, and falls in the previous year.

DISCUSSION

We observed a worse HRQoL in women with vitamin D deficiency when compared to non-deficient women. Further, vitamin D deficiency and falls had a negative impact on the physical domain of quality of life, i. e., both factors were independently associated with the decrease in the quality of life in these women.

There are few studies evaluating the association between vitamin D deficiency and HRQoL in primary settings or healthy populations. Furthermore, most of the studies that evaluated this association were performed in tertiary care patients[13,14]. Few studies have evaluated the association between vitamin D deficiency and HRQoL in the general population[7,15]. The Longitudinal Ageing Study Amsterdam study examined the association between HRQoL measured by the Short Form-12 Health Survey (SF-12) and vitamin D deficiency (defined as values below 20 ng/mL) and found that subjects with vitamin D deficiency had worse scores on the physical component of HRQoL. In contrast, the Korean National Health and Nutrition Examination Survey (KNHANES V) conducted in Korea from 2007 to 2012 found no differences in the EQ-5D mobility, self-care, usual activities, and pain/discomfort domains in adults

(age between 20 and 49 years) with and without vitamin deficiency[15]. In this research, the cut-off point for vitamin D deficiency was higher than ours (30 ng/mL)[15].

Different studies in different research settings have found different prevalences of vitamin D deficiency[16]. Our study, performed in the primary care of a tropical country, observed a frequency of 11.54% of vitamin D deficiency. This finding is in agreement with data from the recent large multicountry multicenter study, VITamin D and OmegA-3 TriaL-VITAL, a clinical trial with 26,871 subjects that evaluated the effects of vitamin D supplementation on primary cancer prevention. It observed that only 12.7% of the participants had vitamin D deficiency (25(OH)D < 20ng/ml)[17].

The association between falls and poorer HRQoL in the individuals studied suggests that this poorer quality of life may be part of the fragility syndrome[18]. Furthermore, the association between falls and worse quality of life has been reported in several studies[18,19], as was the association between falls and vitamin D deficiency[1,3,20]. In our study, both variables were associated with a worse physical component of HRQoL assessed by SF-36.

Our study has some limitations. The cross-sectional nature of the study does not allow us to evaluate whether vitamin D deficiency has any causal relationship with HRQoL or if it is only a marker of it. Moreover, the frequency of vitamin D deficiency was lower than expected, and this small number of patients might not have been able to detect some associations described in the literature, such as the association between vitamin D deficiency and the mental component of the SF-36. Although we calculated the sample size a priori, we believe that a study with a greater number of participants would be desirable to explore other possible associations and covariate variables. Nevertheless, for funding and logistical reasons, we were unable to recruit a much larger sample than calculated. On the other hand, our study also has some strengths; it was carried out in a primary care setting, facilitating its generalization to this setting. Further, the original study cohort is representative of the Brazilian population attending primary care, which also facilitates the out study generalization. Besides, this is one of the few studies to evaluate the association between HRQoL and vitamin D deficiency in Latin America.

In conclusion, our results show an association between low HRQoL and vitamin D deficiency in postmenopausal women attending primary care. Studies evaluating whether this association has a causal relationship or whether vitamin D deficiency is only a marker of poor quality of life need to be conducted. Better evidence on the effects of vitamin D supplementation and improvement of HRQoL needs to be sought. Similarly, studies evaluating the use of the 25(OH)D serum levels as a marker of poor HRQoL or even fragili**ty** syndrome need to be performed.

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Conflicts of Interest

The authors declare no conflict of interest.

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SUPPLEMENTARY MATERIAL

Table 1S: Univariate analysis of factors associated with the physical component summary of health-related quality of life in the studied women.

	B	Standard error	Beta	p-value
Age	−0.230	0.136	−0.180	0.094
BMI[a]	−0.400	0.165	−0.274	0.100
Education > 8 years	4.646	1.738	0.280	0.009
Health insurance	1.529	2.019	0.082	0.451
Smoking	0.515	1.610	0.034	0.750
Alcohol abuse	−0.510	2.488	−0.022	0.838
Baecke – physical activity[b]	4.966	2.071	0.250	0.019
Comorbidity[c]	−5.029	2.137	−0.251	0.021
Hospital admission in the last year	−1.35	1.74	−0.08	0.439
Vitamin D supplement use	0.327	1.274	0.028	0.798
Calcium Supplement use	1.375	1.179	0.125	0.247
Falls in the last year	−6.683	1.931	−0.350	0.001
Major fracture	−4.200	1.918	−0.232	0.030
Calcium	0.962	0.757	0.136	0.207
Phosphorus	0.991	0.961	0.110	0.305
Albumin	1.214	1.158	0.112	0.297
Creatinine	4.520	4.656	0.104	0.334
PTH	−0.011	0.136	−0.027	0.823
Vitamin D deficiency	−8.053	3.462	−0.268	0.023

[a] Body mass index; [b] Baecke score of physical activity in exercise and laser; [c] At least one of the following: asthma, COPD, osteoarthritis, rheumatoid arthritis, heart failure, systemic arterial hypertension, ischemic heart disease, Parkinson's disease, cancer, or diabetes.

Calculated by univariate linear regression.

Table 2S: Univariate analysis of factors associated with the mental component of health-related quality of life in the studied women.

	B	Standard Error	Beta	p-valor
Age	0.176	0.155	0.123	0.254
BMI[a]	−0.162	0.193	−0.091	0.403
Education > 8 years	0.279	2.038	0.015	0.892
Health insurance	3.836	2.247	0.182	0.091
Smoking	−1.461	1.805	−0.087	0.420
Alcohol abuse	−0.857	2.799	−0.033	0.760
Baecke – physical activity[b]	1.619	2.071	0.073	0.502
Comorbidity[c]	−3.083	2.453	−0.137	0.212
Hospital admission in the last year	−2.888	1.939	−0159	0.140
Vitamin D supplement use	−2.397	1.382	0.185	0.086
Calcium Supplement use	0.238	1.310	0.020	0.856
Falls in the last year	−5.595	2.239	−0.260	0.014
Major fracture	−0.390	2.217	−0.019	0.861
Calcium	0.614	0.857	0.077	0.476

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Tabela 2S: Continuação.

	B	Standard Error	Beta	p-valor
Phosphorus	−0.639	1.085	−0.063	0.558
Albumin	−1.448	1.302	−0.119	0.269
Creatinine	6.855	5.214	0.140	0.192
PTH	−0.020	0.057	−0.042	0.725
Vitamin D deficiency	1.521	4.125	0.044	0.713

[a] Body mass index; [b] Baecke score of physical activity in exercise and laser; [c] At least one of the following: asthma, COPD, osteoarthritis, rheumatoid arthritis, heart failure, systemic arterial hypertension, ischemic heart disease, Parkinson's disease, cancer, or diabetes.

Calculated by univariate linear regression.

In the multiple linear regression analysis, mode backward, we included vitamin D use, health plan, and falls in the last year. Remained in the model only the variable falls in the previous year.