



## CALCIUM AND VITAMIN D IN ADULTS ATTENDING AN OUTPATIENT NUTRITION CLINIC

*Cálcio e vitamina d em adultos atendidos em ambulatório de nutrição*

*Calcio y vitamina D en adultos asistidos en ambulatorio de nutrición*

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### ABSTRACT

**Objective:** To assess calcium and vitamin D intake in patients attending a reference outpatient nutrition clinic. **Methods:** Quantitative cross-sectional study carried out from November 2015 to June 2016 to analyze 1,000 dietary recalls of patients aged 20 to 59 years attending an outpatient nutrition clinic of a university center in the countryside of Rio Grande do Sul. Recalls with incomplete household measures were excluded. Measures were standardized using pictures from a household measures book. The analysis of calcium and vitamin D intake was based on the Dietary Reference Intakes. Data were analyzed using descriptive and inferential statistics with a significance level of 5%. **Results:** Calcium and vitamin D intake was symmetrical, with 89.5% (n=895) of inadequate vitamin D intake and 86.6% (n=866) of inadequate calcium intake, i.e., below the daily recommendation. Men presented significantly higher calcium intake compared to women ( $p<0.001$ ), while vitamin D intake showed no significant differences between genders ( $p=0.307$ ). **Conclusion:** There was a high inadequacy of calcium and vitamin D intake in the population analyzed.

**Descriptors:** Calcium, Dietary; Vitamin D; Adult.

### RESUMO

**Objetivo:** Avaliar o consumo de cálcio e vitamina D de pacientes atendidos em um ambulatório de Nutrição de referência. **Métodos:** Estudo transversal quantitativo realizado no período de novembro de 2015 a junho de 2016 avaliou 1.000 recordatórios alimentares de pacientes na faixa etária de 20 a 59 anos do ambulatório de Nutrição de um centro universitário do interior do Rio Grande do Sul, Brasil. Excluíram-se os recordatórios com medidas caseiras incompletas. Para a padronização dessas medidas utilizou-se registro fotográfico de um livro de medidas caseiras. Utilizou-se como referência para análise de ingestão do cálcio e vitamina D a Dietary Reference Intakes. Os dados foram analisados por meio de estatística descritiva e inferencial com nível de significância de 5%. **Resultados:** O consumo de cálcio e de vitamina D foi simétrico, apresentando 89,5% (n=895) de inadequação do consumo de vitamina D e 86,6% (n=866) de inadequação do consumo de cálcio, portanto, abaixo da recomendação diária. Homens apresentaram ingestão significativamente maior de cálcio em comparação às mulheres ( $p<0,001$ ), enquanto o consumo de vitamina D não apresentou diferença significativa entre os sexos ( $p=0,307$ ). **Conclusão:** Verificou-se elevada inadequação quanto à ingestão de cálcio e vitamina D pela população estudada.

**Descritores:** Cálcio na Dieta; Vitamina D; Adulto.



## RESUMEN

**Objetivo:** Evaluar el consumo de calcio y vitamina D de pacientes asistidos en un ambulatorio de nutrición de referencia. **Métodos:** Estudio transversal cuantitativo realizado en el período entre noviembre de 2015 y junio de 2016 evaluó 1.000 recordatorios alimentarios de pacientes en la franja de edad entre 20 y 59 años del ambulatorio de nutrición de un centro universitario de un pueblo de Rio Grande do Sul, Brasil. Se excluyeron los recordatorios con las medidas caseras incompletas. Para la estandarización de esas medidas se utilizó el registro fotográfico de un libro de medidas caseras. Se utilizó como referencia para el análisis de la ingesta de calcio y vitamina D la Dietary Reference Intakes. Los datos fueron analizados a través de la estadística descriptiva e inferencial con el nivel de significación del 5%. **Resultados:** El consumo de calcio y vitamina D ha sido simétrico presentando el 89,5% (n=895) de inadecuación para el consumo de vitamina D y el 86,6% (n=866) de inadecuación para el consumo de calcio, por lo tanto, abajo de la recomendación diaria. Los hombres presentaron ingesta significativamente mayor de calcio en comparación con las mujeres ( $p < 0,001$ ) mientras el consumo de vitamina D no ha presentado diferencia significativa entre los sexos ( $p = 0,307$ ). **Conclusión:** Se verificó una elevada inadecuación de la ingesta de calcio y vitamina D de parte de la población estudiada.

**Descriptor:** Calcio en la Dieta; Vitamina D; Adulto.

## INTRODUCTION

For the promotion and maintenance of health, it is essential to have adequate nutrition<sup>(1)</sup>. The best path to a good health and, consequently, good bone health is a diversified diet, especially with the correct levels of calcium and vitamin D<sup>(2)</sup>, which are fundamental in maintaining bone health and reducing the risk of osteoporosis<sup>(3)</sup>.

Even after human beings have already completed their growth phase, they will need a diet rich in nutrients, especially calcium, because a considerable amount of this mineral is lost daily<sup>(2)</sup>. Vitamin D, along with calcium, has the function of maintaining homeostasis and enhancing the transport of calcium in the small intestine, which increases its absorption<sup>(4)</sup>.

Vitamin D (calciferol) is found in animals (vitamin D3 or cholecalciferol) or vegetables (vitamin D2 or ergocalciferol) and it can be ingested through feeding or formed in cutaneous tissues endogenously through sun exposure<sup>(4,5)</sup>.

The need for vitamin D varies according to the age group, remaining at 15µg per day for both genders from 20 to 59 years old<sup>(6)</sup>; however, few foods naturally contain it<sup>(4,7)</sup>. Thus, without daily consumption of naturally rich or enriched foods, individuals may end up developing deficiencies in serum vitamin D levels, especially in conditions such as: lack of daily exposure to sunlight, use of sunscreens, sedentary lifestyle, nutritional status, abuse of oral medications that interfere with its absorption, and unbalanced diet, leading to inadequate dietary intake<sup>(8,9)</sup>.

Calcium is the most abundant mineral in the human body. It is a nutrient of extreme importance for the performance of various vital functions of the organism and is mostly found in the bones (99%) and in blood plasma and several tissues (1%), with the skeleton being its main reservoir<sup>(10)</sup>. Its intestinal absorption is regulated by vitamin D<sup>(11)</sup> and is affected by factors that negatively influence its bioavailability and digestibility<sup>(10,12)</sup>.

The daily calcium intake recommendation for both genders from 20 to 59 years old is 1000 mg, with 1200 mg being recommended for women aged 50 and over<sup>(13)</sup>. Excessive daily intake of calcium and vitamin D above 2000mg and 4000 IU, respectively, are associated with complications such as hypercalcemia<sup>(5)</sup>.

Calcium is found in foods, and they are its best source. The foods that have the highest bioavailability of this mineral are milks and their derivatives, certain fish such as sardines and salmon, and some dark green leaves<sup>(4)</sup>. Vitamin D is not widely available in foods and its main sources are animal products rather than fruits, vegetables and cereals. Main sources are fish liver oil, fish with high fat content, yolk and fortified products such as fortified margarine, cereals and juices<sup>(14)</sup>. Low levels of vitamin D are associated with high levels of parathyroid hormone (PTH) and, consequently, high rates of resorption and high risk of fractures<sup>(7)</sup>.

The present study is justified by the need to know the intake of calcium and vitamin D in a population served in a nutrition clinic of a university center in the countryside of Rio Grande do Sul so as to improve the guidelines aimed at preventing complications that may occur due to the poor and/or excessive intake of these micronutrients, thus fostering health promotion in the adult population analyzed.

Given that, the present study aimed to assess calcium and vitamin D intake in patients attending a reference outpatient nutrition clinic.

## METHODS

A quantitative cross-sectional study was carried out from November 2015 to June 2016 to analyze 1000 food recalls of users attending the nutrition clinic of a university center in the countryside of Rio Grande do Sul, Brazil.

The study included recalls of men and women aged 20 to 59 years old completed in the period from 2010 to 2016. Incomplete recalls and individuals outside the established age group were excluded.

Food consumption was estimated using a 24-hour food recall completed during the food anamnesis based on the patient's accounts during consultations performed between 2010 and 2016 by Nutrition students trained and supervised by a Nutrition professor. For the standardization of household measures, the application of the food recall included photographs of a book of household measures entitled "Practical methods for calculating diets"<sup>(15)</sup> and utensils for a better visualization and accuracy of information provided by the patient during the recall.

Household measures data were calculated using the 2008 Professional DietWin® Software. After that, the amounts of calcium and vitamin D consumed were compared with the Dietary Reference Intakes (DRIs) according to age and gender<sup>(13)</sup>, as they represent a new paradigm for the establishment of nutritional indicators of consumption.

To obtain the results, the following descriptive statistics were calculated: mean, standard deviation, median and interquartile range for quantitative variables and absolute and relative frequency for qualitative variables. Normality of the quantitative variables was assessed by the Kolmogorov-Smirnoff test, with calcium and vitamin D intake presenting symmetrical distribution.

For the comparison of the variables between the genders, the Student's t-test was used for the independent samples and the Chi-squared test was used for the qualitative variables. The participants were divided into groups according to the age group (<30 years, 31-40 years, 41-50 years, >50 years). For the comparison of intake of calcium and vitamin D according to age, the ANOVA test was used followed by the Tukey's test for the post-hoc analyses. For the adequacy of calcium and vitamin D in relation to the DRIs, the participants' mean nutrient intake was calculated and then divided by the recommended value, and the result was multiplied by 100 to be expressed in %. Values of  $p < 0.05$  were considered significant. The statistical analyses were performed in the Statistical Package for the Social Sciences (SPSS) 20.0.

The present study was approved by the Research Ethics Committee of the Univates University Center (*Centro Universitário Univates*) under Approval No. 0087/10.

## RESULTS

The mean age of the participants was  $25.43 \pm 5.80$  years and most of them were women – 76.3% (n=763).

Calcium and vitamin D intake among the study participants was symmetrical, with a mean calcium intake of  $606.57 \pm 361.61$  mg/day and a mean vitamin D intake of  $2.30 \pm 2.27$  µg/day. Adequacy of calcium and vitamin D intake was found in 52.82% and 12.47% of the participants, respectively. The participants' mean nutrient intake was divided by the recommended value and then multiplied by 100 and expressed in%.

The recommended intake of vitamin D is 15µg daily. Of all the participants, 89.5% (n=895) presented vitamin D intake below the recommendation. Likewise, 86.6% (n=866) of the participants presented calcium intake below the recommendation, which is 1000mg daily for both men and women aged 20 to 59 years and 1200mg daily for women aged 50 years and over.

Table I depicts calcium and vitamin D intake according to gender and demonstrates that men presented a significantly higher intake of calcium compared to women. There were no significant differences in vitamin D intake between genders ( $p=0.307$ ). Regarding the relative frequency of participants with intake within or above the recommendation, 21.9% (n=52) of men and 10.7% (n=82) of women presented adequate calcium intake and 8.0% (n=19) of men and 11.3% (n=86) of women had adequate vitamin D intake ( $p=0.001$ ).

Table I - Calcium and vitamin D intake according to the participants' gender. Rio Grande do Sul, 2015-2016.

Variables	Men (n=237) mean±SD*	Women (n= 763) mean±SD*	p value
Calcium (mg)	705.31±418.70	575.87±336.36	<0.001 <sup>1</sup>
Vitamin D (µg)	2.43±2.31	2.25±2.25	0.307 <sup>1</sup>
Adequate calcium intake	52 (21.9%)	82 (10.7%)	<0.001 <sup>2</sup>
Adequate vitamin D intake	19 (8.0%)	86 (11.3%)	0.153 <sup>2</sup>

\* Data are described as mean ± standard deviation. 1: Student's t test for independent samples. 2: Chi-squared test.

The participants were grouped into quartiles according to the age group for comparison of calcium and vitamin D intake. There was a higher intake of these micronutrients in the group of participants aged 41 to 50 years, as shown in Table II. The groups differed significantly in vitamin D intake, with a trend towards a significant difference in calcium intake according to the participants' age (p=0.063).

Table II - Calcium and vitamin D intake according to age quartiles. Rio Grande do Sul, 2015-2016.

Variables	Calcium (mg) mean±SD*	Vitamin D (µg) mean±SD*
≤ 30 years (n=851)	594.71±363.40	2.17±2.01 <sup>a</sup>
31 - 40 years (n= 107)	659.78±357.11	2.87±3.01 <sup>b,c</sup>
41 - 50 years (n=30)	731.77±274.61	3.86±2.84 <sup>c</sup>
≥ 50 years (n=7)	698.98±421.52	1.82±2.65 <sup>a,b,c</sup>
p value	0.063	<0.001

\* Data are described as mean ± standard deviation. ANOVA test with post-hoc Tukey. Different superscript letters indicate significant difference between groups and correspond to (p<0.05).

## DISCUSSION

More than half of the patients analyzed in the present study had inadequate intake of calcium and vitamin D in relation to the DRIs. This finding demonstrates the need to raise population's awareness of the importance of adequate intake of these micronutrients with a view to health promotion and disease prevention, particularly probable complications such as osteoporosis, which has been considered a global public health problem<sup>(14,16)</sup>.

A systematic review of meta-analysis indicated a high prevalence of nutrient intake inadequacy in the adult population, including calcium and vitamin D<sup>(11)</sup>. Currently, there is evidence that vitamin D plays a number of roles in addition to calcium metabolism<sup>(16-19)</sup> and it is one of the most important minerals for bone formation and resorption. It is responsible for the "hardness" and protection of soft tissues<sup>(10,20)</sup> and it increases skeleton calcium mobilization, thus resulting in porous bone through secondary hyperparathyroidism<sup>(21)</sup>.

Osteoporosis is a silent bone disease<sup>(22)</sup> defined as a skeletal disorder<sup>(23)</sup> that can affect 17% of women and 7% of men<sup>(24)</sup> and that can occur due to several factors. It is characterized by loss of bone mass and deterioration of the bones, which make them more fragile and susceptible to fractures<sup>(14,22)</sup>. Increased consumption foods rich in calcium and vitamin D had a positive effect on loss of bone mineral density (BMD)<sup>(25,26)</sup>. There are recommendations that indicate that adequate intake of these nutrients associated with phosphorus after the age of 50 can improve BMD and reduce the risk of fractures caused by osteoporosis by 45%, thus constituting a bone health benefit<sup>(27-30)</sup>.

Several findings of studies of dietary recalls have revealed low intake of both vitamin D and calcium<sup>(16,19,31-36)</sup>. Other studies of different age groups also showed a mean intake of calcium below the recommended for individuals aged between 19 and 65 years<sup>(16,19,31-37)</sup>. These findings corroborate the findings of the present study. It is known that the recommended level is between 1000 and 1200mg per day depending on the age group and gender. Given the data described and found in the present study, this situation is of great concern because the current literature has demonstrated the preventive effect of calcium on several diseases<sup>(32)</sup>.

Cohort studies<sup>(27,38)</sup> that assessed calcium intake through food frequency questionnaires found a mean calcium intake of 792±428 mg per day among men and women and a mean calcium intake of 572±150 mg among women, a value that is similar to the value found among women in the present study. This finding may be characterized as a risk for the development of bone diseases due to the poor intake of such mineral in comparison with the current recommendations<sup>(39)</sup>.

Another study carried out with 233 individuals of both genders found that none of the participants in all age groups met the daily intake of calcium recommended in the Estimated Average Requirements (EAR)<sup>(13)</sup>, with no significant differences between the genders<sup>(40)</sup>. Another study aimed at assessing food consumption through food records in 34,003 individuals aged 10 years or older grouped into age groups (10-18 years, 19-59 years and  $\geq 60$  years) found daily calcium and vitamin D intake levels of 511mg and 3.18 $\mu$ g, respectively, in men and women aged 19-59 years<sup>(35)</sup>. In the present study, the mean intake of calcium and vitamin D varied between age groups, with values below the recommended in all age groups. These values suggest possible future consequences, such as failure to maintain calcium homeostasis, which is vital for the proper functioning of the nervous system, growth and maintenance of bone density<sup>(10)</sup>.

In a cross-sectional study, 69.2% of the women over the age of 26 presented an inadequate intake; however, 88.2% of the women under the age of 26 exhibited an inadequate intake<sup>(31)</sup>. A comparison of the Brazilian regions also revealed a high prevalence of inadequate calcium and vitamin D intake in the adult population aged 20 to 59 years, with a mean calcium intake inadequacy of 84% among men and 92% among women and a 99.6% rate of inadequate vitamin D intake in both genders<sup>(1)</sup>. These findings are similar to those found in the present study, in which 78.1% of men and 89.3% of women presented inadequate calcium intake and 92% of men and 88.7% of women aged 20 to 59 years presented inadequate vitamin D intake. One explanation for the lower inadequacy of calcium intake among men found in another study was the increase in energy consumption compared to women<sup>(1)</sup>.

Regarding vitamin D intake in other studies carried out with women, intakes of 3.08 $\mu$ g per day<sup>(40)</sup> and 1.2 $\mu$ g per day have been found<sup>(17)</sup>. Regarding gender differences, another study found mean intakes of 2.18 $\pm$ 2.31  $\mu$ g per day among men and 1.72 $\pm$ 1.56  $\mu$ g per day among women, both aged 31 to 50 years. Mean intakes of 2.70 $\pm$ 1.84  $\mu$ g per day among men and 2.98 $\pm$ 2.12  $\mu$ g per day among women were found in the age range of 51 to 70 years<sup>(35)</sup>. These findings are similar to the findings of the present study, in which men presented a mean intake of 2.43  $\pm$  2.31  $\mu$ g per day and women presented a mean intake of 2.25 $\pm$ 2.25  $\mu$ g per day, both aged 20 to 59 years. These values may be due to inadequate consumption of rich or fortified foods and low exposure to sunlight<sup>(16,41)</sup>.

The limitations of the present study refer to the information collected through the 24-hour dietary recalls, which expressed the current and not usual consumption. The information collected referred to only one day because it was the only one available in the medical records.

## CONCLUSION

In the present study, calcium and vitamin D intakes were inadequate in the study population, thus representing a high risk for the development of bone diseases since the vast majority of the participants consume amounts significantly lower than the current recommendations.

## CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

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