

**Vitamin D Deficiency versus high body mass index in acute coronary syndrome**  
**Deficiência de Vitamina D versus índice de massa corporal elevada na síndrome coronariana aguda**

**Deficiencia de Vitamina D versus índice de masa corporal elevada en el síndrome coronario agudo**

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The prevalence of overweight and obese people has increased in the last decades, becoming a worldwide problem, as did hypovitaminosis D. Studies have shown that people with higher Body Mass Index levels have vitamin D deficiency (25[OH]D) more frequently than normal weight people. This study aimed to evaluate whether the prevalence of vitamin D deficiency is higher in overweight or obese people, considering those hospitalized in a tertiary hospital due to acute coronary syndrome. Data collection took place from September 2015 to May 2016. A structured questionnaire was applied and 25(OH)D serum was dosed. The sample was prepared in 25(OH)D serum levels of <20ng/mL and ≥20ng/mL, and the anthropometric variables were analyzed. There was not significant correlation between body mass parameters and vitamin D. The population of the study, however, has characteristics that can balance the effects of a bigger body mass, making extra studies necessary for an analysis.

**Descriptors:** Vitamin D Deficiency; Obesity; Overweight; Acute coronary syndrome.

A prevalência de sobrepeso e obesidade aumentou nas últimas décadas, tornando-se um problema global, juntamente à hipovitaminose D. Estudos demonstram que indivíduos com maiores valores de Índice de Massa Corporal relacionam-se mais frequentemente a status deficiente de vitamina D (25[OH]D) do que aqueles eutróficos. Este estudo procurou avaliar se há maior prevalência de deficiência de vitamina D em indivíduos com sobrepeso ou obesidade admitidos em hospital terciário devido à síndrome coronariana aguda. A coleta de dados ocorreu entre setembro de 2015 e maio de 2016. Aplicou-se questionário estruturado e dosou-se 25(OH)D sérica. Separou-se a amostra em níveis séricos de 25(OH)D <20ng/mL e ≥20ng/mL e fez-se análise das variáveis antropométricas. Não foi observada correlação significativa entre parâmetros de massa corporal e vitamina D. Contudo, a população estudada tem determinantes que podem balancear os efeitos de maior massa corporal, sendo necessários mais estudos para análise.

**Descritores:** Deficiência de Vitamina D; Obesidade; Sobrepeso; Síndrome coronariana aguda.

La prevalencia de sobrepeso y obesidad aumentó en las últimas décadas, tornándose un problema global, junto a la hipovitaminosis D. Estudios demuestran que individuos con mayores valores de Índice de Masa Corporal se relacionan más frecuentemente a status deficiente de vitamina D (25[OH]D) que aquellos eutróficos. Este estudio evalúa si hay mayor prevalencia de deficiencia de vitamina D en individuos con sobrepeso u obesidad admitidos en hospital terciario debido síndrome coronaria aguda. La colecta de datos ocurrió entre septiembre de 2015 a mayo de 2016. Se aplicó cuestionario estructurado y se dosificó 25(OH)D sérica. Se separó la muestra en niveles séricos de 25(OH)D <20ng/mL y ≥20ng/mL y se hizo análisis de las variables antropométricas. No fue observada correlación significativa entre parámetros de masa corporal y vitamina D. No obstante, la población estudiada tiene determinantes que pueden balancear los efectos de mayor masa corporal, siendo necesarios más estudios para análisis.

**Descriptores:** Deficiencia de Vitamina D; Obesidad; Sobrepeso; Síndrome coronario agudo.

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## INTRODUCTION

The prevalence of overweight and obese people increased in the last decades, in Brazil<sup>1</sup> and in many other places in the world, such as the United States<sup>2</sup> and in European countries<sup>3</sup>. This growth is related to the changes in the lifestyle of the population, such as changes in diet, and in the levels of physical activity. It is a very relevant issue for public health, since the obesity is associated to many comorbidities, such as metabolic syndrome, diabetes mellitus type 2, arterial hypertension, sleep disturbances and cardiovascular diseases<sup>4</sup>.

Hypovitaminosis D is another problem related to excessive weight. Observational studies have shown that people with higher Body Mass Index (BMI) levels have vitamin D deficiency [25(OH)D] more frequently than normal weight people<sup>5</sup>. Among the reasons for this predisposition, are mechanisms of sequestration and storage of this vitamin in the adipose tissues, due to its metabolism, the tendency of low ingestion of foods that are rich in vitamin D and a low exposition to the sun among obese individuals<sup>6,7</sup>.

A recent review study also points out the higher incidence of Acute Coronary Syndrome (ACS) among individuals with hypovitaminosis D, although it is not possible yet to say whether this deficiency is an independent risk factor or another index of this clinical conditions, since low levels of vitamin can be explained by the fact that individuals with ACS are already more fragile<sup>8</sup>.

This study aimed to evaluate whether the prevalence of vitamin D deficiency is higher in overweight or obese people, considering those hospitalized in a tertiary hospital due to acute coronary syndrome.

## METHOD

The study was conducted with patients in the General Hospital of the Triângulo Mineiro Federal University (UFTM). Those diagnosed with ACS by the physician of the Urgency and Emergency Unit, according to the American Heart Association (AHA) were selected<sup>9</sup>.

Data collection took place in no more than 48 hours from the patients'

hospitalization and took place from September 2015 to May 2016. The information was found from the application of a structured questionnaire and the collection of blood samples for the dosage of vitamin D. The biochemical method used was the chemiluminescence, and a dosage of 25-hydroxy vitamin D was conducted.

54 patients were selected. Information was gathered regarding their age, gender, color, origin, marital status, access to health insurance, presence of diabetes mellitus, hypertension, previous cardiovascular events, use of medication, vitamin supplements, average daily sun exposure, smoking and drinking.

The anthropometry of the patients was evaluated according to the BMI calculation (their weight, in kilograms, divided by their height squared), arm circumference and the waist-hip ratio were measured, as was the skinfold thickness of the triceps, verified using an adipometer. Patients that were in severe clinical conditions, mechanical ventilation or had known kidney diseases were not selected to participate.

The literature diverges when it comes to classifying the ideal levels of vitamin D. In this study, individuals with levels below 20ng/mL were considered to have this deficiency, while those with levels higher than 20ng/mL were not<sup>10</sup>.

The statistical analysis was conducted through a univariate, descriptive and exploratory research, using means, standard deviation, simple and relative frequencies, and maximum and minimum values, according to the normality of the data. To compare the groups according to the levels of vitamin D, the chi-square test and Student's t test were used. The principle of normality was respected through the use of the Kolmogorov-Smirnov test ( $p > 0.05$ ).

This study was approved by the Research Ethics Committee at UFRM in August 2015, under protocol CAAE 45121815.5.0000.5154.

**RESULTS**

The mean age of the participants was 61.30±11.56 (in years), and 61.11% of the

participants were male. The anthropometric variables of the individuals are organized in Table 1.

**Table 1.** Anthropometric data of the analyzed patients. Uberaba-MG, 2015-2016.

Variable	Mean ± Standard deviation
Height (meters)	1.65 ± 0.08
Weight (kilograms)	71.97 ± 12.51
BMI (Kg/m <sup>2</sup> )*	26.81 ± 4.56
Arm circumference (centimeters)	30.47 ± 3.61
Triceps skinfold thickness (centimeters)	14.30 ± 9.23

\*BMI: Body Mass Index (kilograms/meters<sup>2</sup>)

From the totals in question, the mean of vitamin D values was 29.89±10.50ng/mL. Nine individuals presented vitamin deficiency.

In the context of ACS, 24.07% of patients were diagnosed with unstable angina, 51.85% had acute myocardial infarctions with ST-segment elevation, and 25.07% had acute myocardial infarction with no ST-segment elevation. Thirteen patients had a previous history of cardiovascular disease. 29 individuals were hypertensive and 12, diabetic.

Only two patients used vitamin D supplements and ten made regular use of sunscreen. Regarding sun exposure, 74.07% of patients had more than 30 minutes of

exposure daily, and 25.93% were exposed for a smaller period.

Regarding the color of their skin, 64.8% were white, 11.1% brown and 24.07% black - data reported by the participants themselves.

In the analyzed sample, the anthropometric indexes regarding obesity and overweightness (BMI≥25kg/m<sup>2</sup>) were related to lower vitamin D mean levels, but with no statistical significance, as Table 2 shows.

In Table 2, a statistically significant relation between the 25(OH)D levels of patients with BMI≥25kg/m<sup>2</sup> and BMI<25kg/m<sup>2</sup> and those with sun exposure higher than 60 minutes a day can also be seen. The group with no overweight/obesity had higher levels.

**Table 2.** Analysis of groups classified according to their BMI and the means of 25(OH)D values. Uberaba-MG, 2015-2016.

	BMI≥25kg/m <sup>2</sup>		BMI<25kg/m <sup>2</sup>		p
	n	25(OH)D(ng/mL)	n	25(OH)D(ng/mL)	
<b>All participants</b>	34	28.95±8.25	20	31.49±13.61	0.39
<b>Sex</b>					
<b>Male</b>	18	30.30 ± 9.50	15	34.40±13.13	0.30
<b>Female</b>	16	27.44 ± 6.55	5	22.76±12.20	0.27
<b>Color</b>					
<b>Black</b>	9	26.67±6.35	4	34.23±8.14	0.09
<b>White</b>	22	29.29±8.69	13	30.82±15.65	0.71
<b>Brown</b>	3	33.31±10.76	3	30.75±13.07	0.80
<b>Daily sun exposure</b>					
<b>None</b>	1	16.89±0	0	0	
<b>&lt;30 minutes</b>	9	25.15±6.76	4	18.80±7.00	0.14
<b>30-60 minutes</b>	2	34.36±0.36	2	16.09±14.13	0.20
<b>&gt;60 minutes</b>	22	30.57±8.43	14	37.31±11.01	0.04

The analysis of the absolute number of patients with or with no 25(OH)D deficiency was also analyzed according to its relation to BMI, as Table 3 shows. A chi-squared test was

conducted, finding  $p=0.31$ . However, despite the numerically important difference in the percentages, data analyzed had no statistical significance.

**Table 3.** Classification of the sample regarding the BMI and the vitamin D status. Uberaba-MG, 2015-2016.

	BMI $\geq$ 25kg/m <sup>2</sup>	BMI<25kg/m <sup>2</sup>
	Individuals (%)	Individuals (%)
<b>Vitamin D status</b>		
<b>Deficient</b>	7 (20.59)	2 (10.00)
<b>Not deficient</b>	27 (79.41)	18 (90.00)

## DISCUSSION

Vitamin acts as a hormone, regulating the function of more than 200 genes in many different systems of the organism, such as the cardiovascular, musculoskeletal, metabolic/endocrine and immunologic ones<sup>6,11</sup>. Many factors contribute for its serum levels, such as melanin concentration in the skin, the distance they live from the equatorial line; the use of sunscreens; the BMI; among others<sup>12</sup>. In this study, along with the BMI, some of the factors that may influence the levels of the vitamin were evaluated.

In literature, the correlation between obesity and serum levels of vitamin D have been correlated, and overweight individuals are more prone to have low values in this regard<sup>13</sup>. It is still not clear if the hypovitaminosis precedes obesity or is one of its consequences<sup>14</sup>. In this study, data points out to the same results found in literature, since the highest mean vitamin values were found in patients with a BMI<25kg/m<sup>2</sup>, even though it was not possible to find a statistical correlation between a BMI $\geq$ 25kg/m<sup>2</sup> and a BMI<25kg/m<sup>2</sup>, perhaps due to the small sample size.

When the total number of 25(OH)D deficient and non-deficient individuals regarding their BMI, although data indicated a higher tendency to hypovitaminosis in overweight ones, there was, once more, no statistical correlation with BMI values. This result is in accordance to widely accepted results in the scientific community, since there is more 25(OH)D deficiency among

obese people than in the normal weight population<sup>13,14</sup>.

Skin phototyping also has a large influence on the production of vitamin D. According to Fitzpatrick's scale, people of types V and VI have the lowest production of the vitamin when exposed to the sun. In accordance to a recent study, this difference in the synthesis according to the phototype is more significant in high-latitude countries, while there is not a significant difference in tropical countries, since sun exposure is naturally higher in them<sup>15</sup>. In disagreement to what is exposed here, an Australian study found that obese people with lighter skins colors tend to have lower levels of 25(OH)D. Although the individuals' reports about their own color were used here, as opposed to Fitzpatrick's scale, there was not a significant connection between the types of skin and the 25(OH)D levels.

Regarding the time of exposure to the sun, higher levels of 25(OH) were found among individuals with BMI lower than 25kg/m<sup>2</sup> who had more exposure (more than 60 minutes a day). Data from the literature reiterates that the time of exposure to the sun is directly related to the 25(OH) levels, although it is not possible to state the ideal time of exposure so that adequate vitamin levels can be obtained<sup>15</sup>. It was also found that, when exposed to ultraviolet radiation, the 25(OH)D of obese individuals increases less than that of non-obese ones. That can be justified by the fact that the adipose tissue stores the vitamin<sup>14</sup>. On the other hand, a study in 2017 did not find such a correlation

in morbidly obese individuals, finding the time of exposure to the sun and the parts of the body exposed not to be statistically significant regarding the serum levels of the vitamin<sup>16</sup>.

## CONCLUSION

Although there are many studies showing an inverse relationship between the body mass index and vitamin D levels, in our study no statistical correlation to this effect could be found.

Delays in definitive ACS diagnostics and the exclusion criteria adopted by the study, that excluded for instance patients with previous known kidney diseases (a known risk factor for hypovitaminosis D) negatively influenced the size of the sample, which may have led the data to lack statistical significance.

The population of the study has characteristics that contribute for higher values of 25(OH)D, such as the fact that they live in a tropical region, are mostly white and have good levels of daily exposure to the sun, all of which may have led the number of vitamin-deficient individuals found to be low.

More studies are necessary so that this situation can be investigated in this geographic location, due to the impact that 25(OH)D deficiency, associated to excessive weight, can generate in the health of the population, even though both these factors can be modified.

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#### CONTRIBUTIONS

**Lucas Miranda Amgarten and Maria Luísa Pereira Gomes** took part in data collection, analysis and interpretation of data, and in the writing of the article. **Guilherme Rocha Pardi** contributed in the conception, design, critical review and statistical analysis of data.

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