BJPS

Brazilian Journal of Pharmaceutical Sciences

http://dx.doi.org/10.1590/s2175-97902022e20497

Article

Prevalence of hypertension and obesity in patients with type 2 Diabetes *Mellitus*

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Faced with the increase of type 2 Diabetes *mellitus* (DM2) and the failure in treatment, questions have been raised about the clinical situation of these patients. The present study analyzes the prevalence of hypertension and obesity in DM2 patients. Data were collected through interviews and anamnesis of 16 participants. After the meetings, in which capillary glycemia and blood pressure were measured, the participants received guidance about glycemic monitoring, blood pressure control and changes in lifestyle. Approximately 75% of the participants were women with average age of 65 years, 87.5% were sedentary, 18.75% smoked and/or used alcoholic beverages and none performed regular blood glucose monitoring. The initial blood glucose average was 148 mg/dL and finally decreased to 133 mg/dL. There was no significant difference in blood pressure levels. Regarding the body mass index, 89.4% of the patients were above normal standards and 100% had altered waist circumference values. There is a need for studies like this in order to promote educational practices for health and disease control, highlighting the importance of multidisciplinary teams and the pharmaceutical professional, since non-adherence to blood glucose monitoring, also associated with hypertension and obesity, can interfere with the individual's clinical condition.

KEYWORDS: Chronic noncommunicable disease. Hyperglycemia. Hypertensive. Overweight. Educational practices.

INTRODUCTION

Chronic noncommunicable diseases (NCD) have increased significantly in the world population with the appearance of circulatory system diseases, chronic respiratory diseases, neoplasms and diabetes. Most of the factors are related to the population's lifestyle habits according to Diretrizes da Sociedade Brasileira de Diabetes (SBD, 2019-2020).

Diabetes *mellitus* (DM) and Systemic Arterial Hypertension (SAH) are part of NCDs, which are related to the main causes of morbidity and mortality across the country (Malfatti, Assunção, 2011; Schmidt *et al.,* 2011). It is estimated that if current trends persist, the number of diabetics may reach 642 million by 2040; in Brazil, this number has reached about 14.3 million adults (20 to 79 years old) (International Diabetes Federation - IDF, 2017).

The classification of DM, characterized by hyperglycemia, is based on the etiology and not on the type of treatment, thus the World Health Organization (WHO) and the American Diabetes Association (ADA) proposed four clinical classes: type 1 DM (DM1), Type 2 DM (DM2), gestational DM, and also specific types of diabetes due to other causes (ADA, 2020).

Among the clinical classes mentioned, DM2 appears in 90% to 95% of cases, characterized by defects in action and secretion of insulin. This is characterized by the progressive loss of insulin secretion through β cells, contextualized as insulin resistance (Kahn, Cooper, Del Prato, 2014; Diretrizes da Sociedade Brasileira de Diabetes - SBD, 2014-2015). The following are the main risk factors: age over 45 years, family history, overweight (Body Mass Index – BMI> 25 kg / m²), physical inactivity,

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low HDL-C, high total cholesterol and triglycerides, and the presence of SAH (Marinho *et al.,* 2013).

SAH is a multifactorial disease, frequently associated with metabolic, hormonal changes and trophic phenomena, which consist of cardiac and vascular hypertrophy, its main characteristic is elevated blood pressure (Duarte *et al.,* 2019; Laar *et al.,* 2019). In Brazil, SAH affects 32.5% (36 million) of adult individuals, more than 60% of the elderly, contributing directly or indirectly to 50% of deaths from cardiovascular disease (Santos, 2016; Diretrizes da Sociedade Brasileira de Cardiologia - SBC, 2017).

The emergence of SAH is closely related to the economic, social and cultural environment (Malta *et al.,* 2016). And in Brazil it is also related to unemployment, low wages, sedentary lifestyles, age, sex, family history, stress, smoking, excessive consumption of salt, fat, carbohydrates, alcoholism and lack of information (Duarte *et al.,* 2019). These factors have resulted in increased numbers of hypertensive patients, leading to unfavorable consequences such as heart attacks, kidney diseases and neurological diseases, increasing the population's morbidity (Porto *et al.,* 2020).

Obesity is classified as a multifactorial disease and has become a global pandemic. Over 650 million people face a complex interaction between biological, epigenetic, psychosocial, and environmental factors, as well as industrial factors (Ralston *et al*., 2018; Upadhyay *et al*., 2018). Thus, it is now argued that a variety of environmental factors can be superimposed on diet and exercise to influence the development of obesity (Lee, Blumberg, 2019).

Chronic and microvascular complications of DM, such as diabetic nephropathy, diabetic retinopathy, diabetic neuropathy and macrovascular diseases, can lead to acute myocardial infarction, stroke and peripheral vascular disease resulting mainly from inadequate control, time of evolution and disease factors (Tschiedel, 2014). In turn, SAH is one of the most important risk factors for the development of cardiovascular diseases, which are characterized by high and sustained blood pressure levels (Petrie, Guzik, Touyz, 2018). Furthermore, obesity is often associated with complications that affect cardiovascular, endocrine, and gastrointestinal (GI) systems (Lee, Blumberg, 2019), leading to severe comorbidities when associated with other NCDs.

Considering the growing number of patients with DM2, SAH and obesity, also due to the significant number of therapeutic failures, there are questions about the epidemiological profile and about the possible changes in the glycemic profile, blood pressure and BMI of type 2 diabetic patients registered in Basic Health Units (UBS) in Barra do Garças-MT. Thus, this study examines the prevalence of hypertension and obesity in type 2 diabetic patients.

MATERIAL AND METHODS

Study design and population

This is an observational analytical cross-sectional study with a quantitative approach, characterized as a data collection survey, considering the description of factors related to the population.

The data were collected through interviews, subsequently measuring the blood pressure and capillary glycemia and anthropometric variables during previously scheduled home visits to the participants. The participants were attended at two Basic Health Units (UBS): UBS São Sebastião and UBS Fundação Rotariana, in the city of Barra do Garças-MT, together with the health agents of the region.

Inclusion/exclusion criteria

In our study, the participants included must be regularly registered in the Family Health Program (PSF), be of legal age and diagnosed with diabetes or diabetes and hypertension. We excluded the participants with related kidney disease or who did not follow the above-mentioned restrictions.

Sample Characterization / Ethical aspects

16 participants who were regularly registered in the Family Health Program (PSF) were selected, of these, 2 were diagnosed as diabetic and 14 as diabetic and hypertensive. The interview was conducted through a questionnaire with objective and specific questions and only with participants who had signed the Free and

Informed Consent Term and in accordance with the approval of the Research Ethics Committee of the Federal University of Mato Grosso, by protocol number: 3.356.510 (CAAE: 14294319.4.0000.5587).

Data collection

For 5 months, patients were followed up, guided and evaluated for blood pressure measurement using a stethoscope and sphygmomanometer, capillary blood glucose using the Accu-Chek Performa® glucometer and test strips. In one of the meetings, the participants were also assessed for anthropometric variables.

In addition, during this period, participants received guidance in all visits, with educational practices via information leaflets and dialogs, to maintain health, including glycemic / blood pressure monitoring and guidelines for lifestyle changes. Figure 1 shows the study design and data collection of all home visits as a timeline.

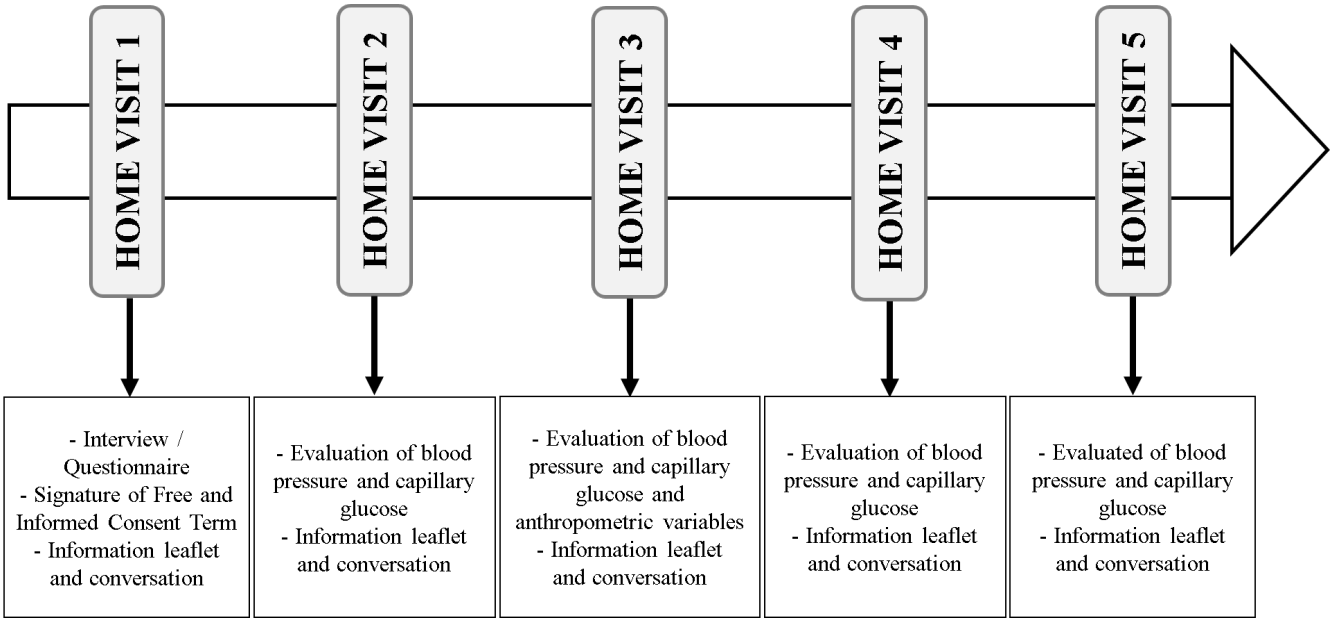

FIGURE 1 – Study design and data collection of all home visits.

Data Collection Instrument

The anthropometric variables used in this study were BMI and waist circumference (WC). BMI was obtained using the BMI formula = weight (kg) / height^2 (m), which classifies individuals according to the cutoff points: low weight <18.5 kg/m^2; eutrophic 18.5-24.9 kg/m^2; overweight 25.0-29.9 kg/m^2; obesity I 30.0-34.9 kg/m^2; obesity II 35.0-39.9 kg/m^2; and obesity III ≥ 40 kg/m^2, according to the World Health Organization (WHO, 1995).

WC was obtained using a flexible measuring tape, positioned immediately above the umbilical scar and the reading taken at expiration time. Weight was measured using a portable scale, with the subject standing and barefoot; and height was measured by a stadiometer, with the individual standing, barefoot, heels together, back straight and arms extended at the side of the body.

The classification of cardiovascular risk used the cutoff points proposed by the National Cholesterol Education Program (NCEP, 2001), which indicate high cardiovascular risk for WC values ≥94 cm for men and ≥ 80 cm for women and very high values ≥102 cm for men and ≥88 cm for women.

The recommendations of the Brazilian Diabetes Society (SBD, 2019-2020) for blood glucose levels were

used as a parameter, as metabolic control goals, which advocate pre-prandial glycemic values from 80 to 130mg/dL for established type 2 diabetic patients, according to the American Diabetes Association (ADA, 2020).

For a classification / diagnosis of SAH according to the Ministério da Saúde (2017), there's a standard set of measurements determined according to the systolic and diastolic pressure, respectively: normal readings are below 120 mmHg/80 mmHg; prehypertension of 120-129 mmHg and <80 mmHg; mild hypertension (stage 1) of 130-139 mmHg and 80-89 mmHg; severe hypertension (stage 2) with readings above 140 mmHg and 90 mmHg; hypertensive crisis above 180 mmHg and 110 mmHg; diabetic and chronic renal patients below 130 mmHg and 80 mmHg.

Data analysis / Statistical analysis

Descriptive analyses were performed to assess the patients' characteristics. As quantitative variables, the Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess normality. The figures, tables and statistical analyzes between four collections/home visits were performed using the GraphPad Prism5 software, using the Student's T test. It was considered statistically significant when the p value is less than or equal to 0.05.

RESULTS AND DISCUSSION

This work included the 16 participants, evaluating diabetic or diabetic and hypertensive individuals, 75% (n = 12) of the female gender and 25% (n = 4) of the male gender (Table I). These data corroborate the findings in the study by Silva *et al.* (2018), in which about 64% of the patients attended were women and 36% were men. This can be explained by the fact that women are more concerned with their own health, thus increasing the number of women diagnosed with diabetes in relation to men (Schlichthorst *et al.,* 2016; Silva, Araújo, Campos, 2018).

TABLE I - Clinical and lifestyle characterization of the 16 diabetics treated at two Basic Health Units in Barra do Garças-MT

VARIABLES	N	%
Gender		
Women	12	75.00
Men	4	25.00
Age		
< 50	2	12.50
≥ 50	14	87.50
Polypharmacy		
<5	14	87.50
≥ 5	2	12.50
Hypertensive		
Yes	14	87.50
No	2	12.50
Diagnostic time of DM		
< 5 years	5	31.25
> 5 years	11	68.75
Laboratory analyzes per year		
Once	9	56.25
More than one time	7	43.75
Daily glycemic control	0	0.00
Practice of physical activity		
Yes	2	12.50
No	14	87.50
Use of alcoholic beverages		
Yes	3	18.75
No	13	81.25
Smoker		
Yes	3	18.75
No	13	81.25

N= number of participants; % = percentage of responses about clinical situation and lifestyle.

Regarding the use of medications, about 87.5% of the participants used less than 5 medications and 12.5%

used more than 5 medications (Table I), which in this case characterizes a polypharmacy (Veronin, 2022). In the study by Lima *et al.* (2015), most diabetic patients used less than five medications, with an average of 4.6 medications. These data are quite worrying, given that the use of several medications, although sometimes not classified as polypharmacy, can present adverse drug reaction (ADR) risks and drug interactions (Munger, 2010; Lima *et al.,* 2015; Noale *et al.,* 2016; Rocha *et al.,* 2017), mainly causing impacts on the health of the elderly (Munger, 2010; Secoli, 2010; Noale *et al.,* 2016).

In our study, 87.5% of all evaluated participants were hypertensive (Table I). Pinho *et al.* (2015) presented similar data, that indicated that the majority of diabetic patients were also hypertensive, a fact that can be explained by a higher prevalence of diabetic individuals presenting characteristics such as obesity, physical inactivity, high triglycerides and total cholesterol levels, stimulation of hyperinsulinemia on the sympathetic nervous system, sodium retention and the excitatory activity of hyperglycemia in the renin-angiotensin-aldosterone system (Ormazabal *et al.,* 2018).

It is important to keep in mind that DM is characterized as a heterogeneous group of metabolic disorders that presents hyperglycemia, due to defects in the action of insulin or in the secretion of insulin. This chronic disorder in glucose metabolism, with persistent increase in glycemia, can trigger acute or chronic complications in the cardiovascular, renal and neurological system (Kahn, Cooper, Del Prato, 2014; Francisco *et al.,* 2018).

As for the time of diagnosis of DM2, 68.75% were diagnosed more than 5 years ago and 31.75% less than five years ago. Bernini *et al.* (2017) showed that 30.5% of patients had less than five years of diagnosis, while those diagnosed more than five years ago were around 69.5%. This prevalence has increased substantially over the last decades due to several factors such as sedentary lifestyle, higher rate of urbanism, obesity, inadequate diet (diets rich in simple carbohydrates), population aging (Bernini *et al.,* 2017). When asked about performing laboratory tests, approximately 56.25% said they performed routine tests at least once a year and 43.75% more than once a year (Table I).

The alarming data found in our research was that none of these participants underwent daily glycemic control, this data corroborates the work of Rocha *et al.* (2017). In part, many patients stated they are afraid of self-applying the test, or are unable to buy a device, while others said that they look for it in the public service (UBS) and complain about the lack of materials (Rocha *et al.,* 2017).

In addition, regarding to physical activity, only 12.5% practiced some activity, about 18.75% used alcoholic beverages and the same percentage were smoking patients (Table I). These data agreed with Silva *et al.* (2018), who reported that 19.4% of the study participants did physical activity, 19.6% used alcohol, and 16.5% smoked, aspects that can negatively influence the patient's health.

In the first evaluation of pre-prandial capillary blood glucose, the average was 148.88 mg/dL, in the second evaluation it was 140.00 mg/dL, in the third it was 147.44 mg/dL and in the fourth and last evaluation the average was about 133.56 mg/dL (Figure 2), considering both genders. The study by Lima, Menezes and Peixoto (2018) found an average initial capillary glycemia of 213.9 mg / dL, shifting to 138.6 mg / dL at the final evaluation.

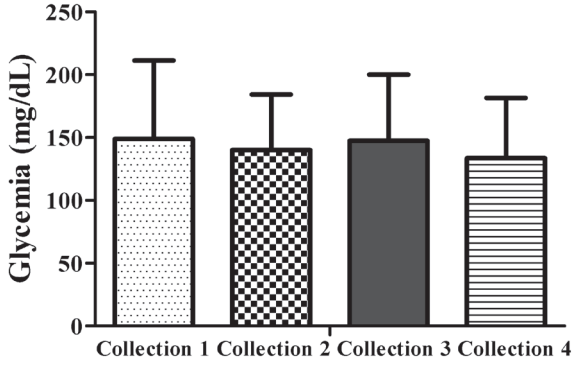

FIGURE 2 - Mean and standard deviation of glycemia of patients between the 1st to 4th collection (n=16).

Regarding our results, although there was no statistical difference between the collections performed, glycemic averages show that better knowledge regarding DM, whether through educational pamphlets, lectures, home monitoring, can bring positive results to the patient's health (Lima, Menezes, Peixoto, 2018; Salinero-

Fort *et al.,* 2011), since glycemic levels decreased in the last collection.

It is emphasized that in the diagnosis, the normal glycemia value is <100 mg/dL fasting for non-diabetic patients. As a metabolic control goal for the patients with already established DM, ADA *et al.* (2020) recommends pre-prandial glycemia between 80 to 130mg/dL and postprandial less than 180 mg/dL, showing that the participants did not have adequate control of glucose levels.

Diabetic and concomitantly hypertensive patients represented 87.5% (n=14), 92.85% were women (n = 13) and only 7.15% were men (n = 1) (Figure 3). Regarding the prevalence being higher in the female audience, also found by Fagundes, Corso and González-Chica (2017), that showed a total of 68.6% of women, this data can also be explained by these patients' greater demand for health services (Schlichthorst *et al.,* 2016).

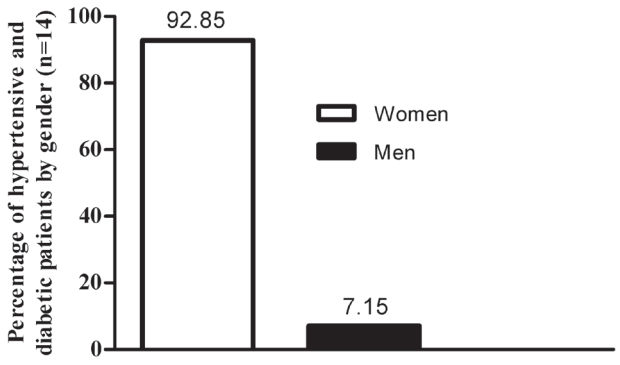

FIGURE 3 – Percentage (%) of hypertensive and diabetic patients by gender (n=14), related to the total number of study participants, n=16.

In addition, it is known that the number of hypertensive patients in Brazil has increased 14.2% in ten years, from 22.5% in 2006 to 25.7% in 2016, with a higher number of diagnoses in women (Ministério da Saúde, 2017). From 1990 to 2018 the diagnoses of hypertension cases increased from 50% to 75%, showing the health teams' greater performance and the population looking for these services (Jardim *et al.,* 2018).

As previously mentioned, there was a high prevalence of SAH (87.5%) in the study participants, in addition to being diagnosed with DM. As for blood pressure measurements, these patients underwent four assessments of systolic and diastolic pressure at different times, with mean and standard deviation shown in Table II.

Despite all monitoring related to blood pressure levels, there was no statistical difference between the different measurements. However, a noticeable tendency that these parameters decreased was observed during the meetings held. Because patients do not exert control and care over blood pressure maintenance the levels tend to be out of control. Therefore, if there was regular monitoring, the number of comorbidities and complications would drastically be reduced.

TABLE II - Mean and standard deviation of blood pressure (BP) of patients performed during collections and home visits

Measurement (BP)	Systolic pressure (mmHg)	Diastolic pressure (mmHg)
1	134.00 ± 17.11	83.00 ± 9.46
2	133.00 ± 15.37	84.00 ± 12.63
3	135.00 ± 15.04	89.00 ± 12.37
4	131.00 ± 11.47	83.00 ± 6.19

Costa (2013), presented in his work the importance of monitoring, guidance, attention to these patients, in which educational practices were carried out by lectures, guidelines and questionnaires about diets, medications, among other procedures. It was observed that over the course of 5 months of our study, there was an increase in the number of patients who were interested in participating in the project, which showed their greater concern in relation to health. Thus, blood glucose and blood pressure levels, when accompanied by the pharmacist, in addition to supporting adherence to therapy, represent an important tool in the prevention of diabetic complications. The importance of health education for improving the quality of life of the diabetic patient is highlighted, thus avoiding, biological complications (Salinero-Fort *et al.,* 2011). Thus, this professional can perform pharmacotherapeutic follow-up, with self-care instruction for the prevention and treatment of the disease, performing the capillary blood glucose test (Alayoub *et al.,* 2018).

The anthropometric parameters (Table III) showed that the patients' BMI of 89.4% was above normal standards, with the male mean of 34.1±4.6 representing grade I obesity and the female mean of 29.3±3.6 indicating the classification as overweight. In addition, 100% of the sample had high waist circumference values, the male average was 127.0±4.6 and the female average of 104.0±11.3 indicating a very high risk for cardiovascular diseases, which clearly shows the risks of metabolic complications associated with obesity.

TABLE III - Anthropometric parameters of diabetic individuals, according to gender

Anthropometric parameters	Men	Women
	M ± SD	M ± SD
Body Weight (Kg)	101.0 ± 13.0	68.5 ± 9.8**
BMI (Kg/m^2)	34.1 ± 4.6	29.3 ± 3.6*
WC (cm)	127.0 ± 4.6	104.0 ± 11.3**

BMI = Body Mass Index; WC = Waist Circumference. Values expressed as mean (M) ± standard deviation (SD). * p <0.05; ** p <0.0001 - compared to the male group (Student t test).

Statistically analyzing body weight, BMI and WC, showed significant differences between men and women, where all parameters decreased in women when compared to men. A study by Da Vitória and Guandalini (2017), with type 2 diabetic patients treated in primary care, found that 74% of individuals were classified as obese through the BMI and WC assessment. Another study by Silveira *et al.* (2016), detected 49% of obesity in the evaluated sample, and it was observed that the prevalence of obesity was significantly higher in the elderly who had previous DM diagnoses. These results are associated with our found data, and shows obesity as a fundamental factor in the pathogenesis of type 2 DM, reinforcing the importance of combating excess weight in the control of the disease, since excess weight is a trigger for comorbidities in diabetes and premature death of these patients (Wilding, 2014).

Type 2 Diabetes *mellitus* and arterial hypertension are commonly associated syndromes, since diabetic patients are twice as likely to have hypertension. In addition, hypertensive patients usually have insulin resistance and are at greater risk of acquiring diabetes than normotensive people. The main problem of this association is morbidity and mortality due to cardiovascular disease, which share similar risk factors such as atherosclerosis, endothelial dysfunction, inflammation and vascular remodeling, dyslipidemia (Jardim *et al*., 2018; Petrie, Guzik, Touyz, 2018). And, it has been estimated that approximately 90% of type 2 diabetic patients are overweight or obese (Daousi *et al.,* 2006), though certainly, not all obese individuals develop type 2 diabetes and not all individuals with type 2 diabetes are obese (Maggio, Pi-Sunyer, 2003).

CONCLUSION

We know the importance of adhering to monitoring blood glucose and blood pressure, and controlling body weight, so as to not negatively interfere in the control of these chronic diseases and develop associated health problems. Hence, multidisciplinary treatment combined with monitoring can increase adherence to pharmacological and non-pharmacological treatment, considered essential measures for clinical and laboratory control.

This kind of research is necessary, as the goal is to promote health through the influence of the educational process on disease control, which also highlights the importance of multidisciplinary teams, including the pharmacist. Thereby, educational practices combined with the primary care team can improve the prevention of chronic diseases, solving and/or avoiding biological complications, costly for the healthcare system.

ACKNOWLEDGMENTS

We would like to thank the health agents of the Basic Health Units: São Sebastião and Fundação Rotariana, in the city of Barra do Garças-MT and all the participants. The Araguaia Valley University Center which was our structural support for laboratory and data analysis, and the coordinators of the pharmacy and nutrition course who supported us in carrying out this work.

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Received for publication on 23th June 2020
Accepted for publication on 17th October 2020