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Evaluation of anthropometric indicators and food consumption in patients with type 2 diabetes mellitus

Avaliação de indicadores antropométricos e consumo alimentar em pacientes com diabetes mellitus tipo 2

Evaluación de indicadores antropométricos y consumo de alimentos en pacientes con diabetes mellitus tipo 2

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ABSTRACT

Objective: To evaluate the anthropometric indicators and food consumption of people with Type 2 Diabetes *Mellitus* treated at a Basic Health Unit in the city of São Luís, Maranhão. **Methods:** This is a cross-sectional and descriptive study with a quantitative approach conducted with 36 patients who have Type 2 Diabetes *Mellitus*, treated at a Basic Health Unit in the capital city of Maranhão. Semi-structured forms were used to collect sociodemographic and anthropometric data, as well as related to eating habits. The analyses were performed using descriptive statistics, with data represented as mean, frequency and their respective standard deviations, in addition to *Pearson*'s correlation test between the quantitative variables. **Results:** The sample was mostly represented by women (54.4%), older adults (59.6%), sedentary people (63.1%), who had high abdominal obesity (80.4%), ingested a low amount of fiber (93.5%) and consumed a large amount of protein (67.4%), saturated fat (69.6%) and sucrose (57.5%). **Conclusion:** Factors such as inadequate weight and unregulated eating habits can represent risks for glycemic control and contribute to worsening of Diabetes *Mellitus*.

Descriptors: Diabetes mellitus. Nutritional status. Eating.

RESUMO

Objetivo: Avaliar os indicadores antropométricos e o consumo alimentar de pessoas com diabetes *mellitus* tipo 2 atendidas em uma unidade básica de saúde na cidade de São Luís, Maranhão. **Métodos:** Trata-se de um estudo do tipo transversal, descritivo, com abordagem quantitativa realizado com 46 pacientes portadores de diabetes *mellitus* tipo 2, atendidos em uma unidade básica de saúde da capital maranhense. Foram utilizados formulários semiestruturados para a coleta de dados sociodemográficos, antropométricos e relacionados aos hábitos alimentares. As análises foram realizadas por meio de estatística descritiva, com dados sendo representados através de média, frequência e seus respectivos desvios padrões além do teste de correlação de *Pearson* entre as variáveis quantitativas. **Resultados:** A amostra foi representada em maioria por mulheres (54,4%), idosos (59,6%), sedentários (63,1%), que apresentavam alta obesidade abdominal (80,4%), ingeriam baixa quantidade de fibras (93,5%) e consumiam em grande quantidade proteínas (67,4%), gorduras saturadas (69,6%) e sacarose (57,5%). **Conclusão:** Fatores como peso inadequado e alimentação desregulada podem representar risco para o controle glicêmico e contribuir para o agravamento do diabetes *mellitus*.

Descritores: Diabetes mellitus. Estado nutricional. Ingestão de alimentos.

RESUMÉN

Objetivo: Avaliar os indicadores antropométricos e o consumo alimentar de pessoas com diabetes *mellitus* tipo 2 atendidas em uma unidade básica de saúde na cidade de São Luís, Maranhão. **Métodos:** Trata-se de um estudo do tipo transversal, descritivo, com abordagem quantitativa realizado com 46 pacientes portadores de diabetes *mellitus* tipo 2, atendidos em uma unidade básica de saúde da capital maranhense. Foram utilizados formulários semiestruturados para a coleta de dados sociodemográficos, antropométricos e relacionados aos hábitos alimentares. As análises foram realizadas por meio de estatística descritiva, com dados sendo representados através de média, frequência e seus respectivos desvios padrões além do teste de correlação de Pearson entre as variáveis quantitativas. **Resultados:** A amostra foi representada em maioria por mulheres (54,4%), idosos (59,6%), sedentários (63,1%), que apresentavam alta obesidade abdominal (80,4%), ingeriam baixa quantidade de fibras (93,5%) e consumiam em grande quantidade proteínas (67,4%), gorduras saturadas (69,6%) e sacarose (57,5%). **Conclusão:** Fatores como peso inadequado e alimentação desregulada podem representar risco para o controle glicêmico e contribuir para o agravamento do diabetes *mellitus*.

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INTRODUCTION

Diabetes *Mellitus* is a chronic non-communicable disease that causes the patient to suffer metabolic disorders characterized by chronic hyperglycemia, as a consequence of changes in macronutrient metabolism resulting from decrease or absence of insulin action. [1]

In Type 2 Diabetes *Mellitus* (DM2) there is relative insulin deficiency, characterized by absence of its secretion or decrease in its sensitivity in the target tissues, which can trigger chronic hyperglycemia. [2,3]

In 2019, the International Diabetes Federation (IDF) estimated the prevalence of the disease in 463 million adults aged between 20 and 79 years old, which represented almost 9.5% of the world population in this age group. [2] In this same age group, Brazil ranks 5th among the 10 countries with the highest number of adults with DM2, representing 16.8 million individuals. According to the Ministry of Health, in 2018 the municipality of São Luís, state of Maranhão, presented a prevalence value of 6.3% of its population diagnosed with diabetes, with 7.1% of males and 5.6% of females. [4]

When diagnosed with DM2, it is important for the individual to start the treatment, which includes the following: body weight control, lifestyle changes, healthy eating, practice of physical exercise, blood glucose monitoring, maintenance of foot integrity, medication use and smoking cessation, considered fundamental measures to prevent complications. [5]

Treatment of the disease should initially be carried out within the Primary Care scope, as it can significantly avoid the number of hospitalizations and deaths resulting from long-term complications. [2] Some studies[6,7] show a high percentage of overweight individuals with inadequate glycemic control, indicating the need for more research that considers the study of food groups rather than individual products to assess the link between nutrition and Type 2 Diabetes and facilitate dietary counseling.

Therefore, the importance of deepening knowledge about food consumption and nutritional status was recognized considering the anthropometric indicators, [8] as this evaluation performed in outpatients may support planning of effective interventions in prevention and control of the harms that DM2 can cause, in order to exert a positive impact on the clinical and economic aspects of the patient and the health system.

In individuals with DM2, nutritional status should be continually evaluated, in addition to adopting healthy eating habits that are compatible with their conditions and needs. These factors exert an impact on control of the disease, avoiding complication risks, hospitalizations and medication-related expenses, as well as enabling better adaptation of these individuals to their condition. Therefore, the objective of this paper was to evaluate the anthropometric indicators and food consumption of people with Type 2 Diabetes *Mellitus* treated at a Basic Health Unit (BHU) in the municipality of São Luís, MA.

METHODS

A cross-sectional and descriptive study with a quantitative approach, in accordance with the *STROBE* guidelines[9] and which derives from the project entitled "Preventing complications: Self-care ability, difficulties and expectations in managing Diabetes *Mellitus*". It was conducted between July and August 2019 in the outpatient service of a BHU from the District of Coroadinho, municipality of São Luís, MA. The sample was defined by non-probabilistic convenience and was comprised by 46 patients diagnosed with DM2, selected by the researcher while they were waiting for an appointment in the BHU waiting room, being informed of the study objectives and invited to participate, having clarified that they could request to be removed from the study at any moment, if deemed necessary. The inclusion criteria were as follows: individuals aged ≥18 years old, of both genders, subjected to anthropometric assessment using traditional methods, who were fed exclusively via the oral route and were treated at the health unit. Pregnant women and people with no DM2 diagnosis were not included in the study.

Data collection was conducted in the BHU, at the time of the routine appointments. Semi-structured forms were used, and sociodemographic data were considered for characterization of the sample, namely: age, gender, marital status, schooling and income levels, as well as those related to life habits and chronic non-communicable diseases (CNCDs): dyslipidemia, arterial hypertension, cardiovascular diseases and kidney failure, in addition to medication use to control diabetes. In order to evaluate nutritional status, the following anthropometric measures were taken: weight, height and waist and hip circumference. To ensure accuracy of the measurements, they were all taken according to the techniques recommended by Lohman, [10] in duplicate, and the mean of the measurements was used.

Body weight was measured in a digital scale, with a maximum capacity of 200 kg and precision of 100 g. The patients were weighted in a standing position, in the center of the scale, barefooted and with light clothing. For height, an anthropometer with a range from 0 to 2.13 m and 0.1 cm subdivisions was used. The Body Mass Index (BMI) was calculated as the ratio of current weight (kg) and height squared (m) and compared to the reference standards published in the guideline on nutritional therapy in Diabetes *Mellitus*[11] as proposed by the World Health Organization (WHO), determining the older adult's nutritional health. [12]

Waist Circumference (WC) was measured by encircling the abdominal region at the midpoint between the distance from the last rib and the iliac crest, at exhalation, according to the protocol established by the WHO[10,11] and Hip Circumference (HC) was measured with the patient in a standing position, by circling the hip in the area of greatest perimeter at the height of the buttocks, passing through the pubic symphysis, parallel to the floor, both using a non-extendable anthropometric tape. To analyze the incidence of abdominal obesity, the Waist/Height Ratio (WHeR) was used, which is a visceral adiposity indicator. WHeR was determined by

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the WC (cm) / Height (cm) ratio and classified as high when ≥ 0.52 for men and ≥ 0.53 for women.[13]

To assess food consumption, a 24-hour food reminder survey was used.[14] Through this instrument, it was possible to estimate the nutrient intake regarding nutritional composition of the food plan. The consumption of total carbohydrates, sucrose, proteins, total lipids, saturated fatty acids, monounsaturated fatty acids, fiber, cholesterol and sodium was evaluated. The aforementioned home-made measures were standardized according to the table of measures published in 2011 by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*, IBGE).[15]

All the information on nutrient intake was subsequently analyzed separately using the TACO[16] and POF-IBGE[17] food composition tables. With the aid of the *Dietbox®* software, which allows selecting food composition tables and performing calculations, the resulting data were analyzed based on the Nutritional Reference Values, established by the Brazilian Society of Diabetes (*Sociedade Brasileira de Diabetes*, SBD).[1]

The data were organized in *Excel®* and analyzed in *GraphPad Prism®*, version 8.0.2. A descriptive analysis was performed with presentation of minimum, maximum, means and standard deviations, in addition to inferential statistics with application of *Pearson*'s correlation test,[18] which varies from -1 to 1, with no correlation (r=0.00), very weak correlation (r=0.01-0.19), weak correlation (r=0.20-0.39), moderate correlation (r=0.40-0.69), strong correlation (r=0.70-0.89), very strong correlation (r=0.90-0.99) and perfect correlation with r=1.00, indicating the strength of the relationship between the variables. The current study was approved by the Research Ethics Committee (*Comitê de Ética em Pesquisa*, CEP) of the Federal University of Maranhão under number 3,000,818, respecting the principles established in Resolution No. 466/12 of the National Health Council (*Conselho Nacional de Saúde*, CNS), which governs research studies with human beings. The participants who agreed to take part signed the Free and Informed Consent Form (FICF).

RESULTS

The sample was comprised by adults and older adults of both genders, with predominance of females (54.4%). Their age varied between 32 and 81 years old, with a mean of 60.3 ± 10.3 and predominance of older adults (59.6%). In relation to schooling, 43.5% stated having Incomplete Elementary Schooling. Regarding marital status, 58.7% reported living with a partner, and 78.3% of the patients stated earning between one and two minimum wages as monthly income.

Of the patients evaluated, 63.1% stated that they did not practice physical activity, 78.3% indicating having other comorbidities related to DM2 and, in relation to medication use for DM2 treatment, 50.0% reported using oral hypoglycemic agents (**Table 1**).

As for nutritional status, 47.4% of the adults were overweight and 60.7% of the older adults presented excess weight and, in relation to the risk indicator of cardiovascular and metabolic complications by means

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of the WC assessment, 80.4% were at risk. The Waist/Height Ratio (WHeR) abdominal adiposity indicator was high in 89.1% of the cases (**Table 2**).

Table 1. Practice of physical activity, presence of comorbidities and medication use among the patients with Type 2 Diabetes *Mellitus* treated in a Basic Health Unit. São Luís, Maranhão, Brazil, 2019.

VARIABLES	N	%
Physical Activity		
Yes	17	36.9%
No	29	63.1%
Other CNCDs*		
Yes	36	78.3%
No	10	21.7%
Drug treatment		
Oral hypoglycemic agent	23	50.0%
Insulin	8	17.4%
Hypoglycemic agent and insulin	14	30.4%
No treatment	1	2.2%

Source: authors (2022).
*CNCDs (Chronic Non-Communicable Diseases): dyslipidemias, arterial hypertension, cardiovascular diseases and kidney failure.

Table 2. Anthropometric evaluation of patients with Type 2 Diabetes *Mellitus* treated in a Basic Health Unit. São Luís, Maranhão, Brazil, 2019.

VARIABLES	N	%
Body Mass Index		
Older adult		
Low weight	4	14.3%
Normal weight	7	25.0%
Excess weight	17	60.7%
Adult		
Low weight	1	5.3%
Normal weight	5	26.3%
Overweight	9	47.4%
Obesity	4	21.0%
WC*		
No risk	9	19.6%
Risk	37	80.4%
WHR**		
Adequate	8	17.4%
Inadequate	38	82.6%
WHeR***		
Normal	5	10.9%
High	41	89.1%

Source: authors (2022).
*WC: Waist Circumference; **WHR: Waist Hip Ratio; ***WHeR: Waist Height Ratio

In relation the assessment of food consumption among the individuals evaluated, the study showed that the mean amount of daily meals per day varied between three and six, with a mean consumption of 4.6 ± 0.9 meals/day. The consumption of total carbohydrates (43.5%), as well as of monounsaturated fatty acids (50.0%), cholesterol (60.9%) and sodium (91.3%), was within the expected parameters for most of the patients. However, it is noted that consumption of fiber in 93.5% of the patients presented values below the recommendations, whereas consumption of proteins (67.4%), sucrose (57.5%) and saturated fatty acids (69.6%) had a percentage above the recommended level (**Table 3**).

Table 3. Food consumption among the patients with Type 2 Diabetes *Mellitus* treated in a Basic Health Unit. São Luís, Maranhão, Brazil, 2019.

VARIABLES	N	%	MEAN (SD)
Food consumption			
Total carbohydrates			
<45%	12	26.1%	
45-60%	20	43.5%	53.7 (12.5)
>60%	14	30.4%	
Sucrose			
≤5%	20	42.5%	26.4 (50.1)
>5%	27	57.5%	
Protein			
<15%	9	19.6%	
15-20%	6	13.0%	24.6 (10.5)
>20%	31	67.4%	
Total lipids			
<20%	22	47.8%	
20-35%	18	39.1%	21.7 (9.8)
>35%	6	13.1%	
Saturated fatty acids			
<6%	14	30.4%	11.1 (7.9)
≥6%	32	69.6%	
Monounsaturated fatty acids			
<5%	12	26.1%	
5-15%	23	50.0%	11.1 (8.3)
>15%	11	23.9%	
Fiber (g)			
<30% g	43	6.5%	
30-50% g	3	93.5%	14.8 (7.9)
>50% g	0	0.0%	
Cholesterol			
<300 mg	28	60.9%	322.0 (249.8)
≥300 mg	18	39.1%	
Sodium			
<2,000 mg	42	91.3%	1,167.8 (1,526.6)
≥2,000 mg	4	8.7%	

Source: authors (2022).

Regarding the correlation between the variables, *Pearson*'s correlation test (*Pearson*'s r) was applied between the BMI and age variables with the macro-/micro-nutrient values and anthropometric data of all 46 participants. The results indicated a weak and positive correlation between consumption of carbohydrates (r=0.33) and BMI, a strong positive correlation between WC (r=0.87) and BMI, and a moderate correlation of HC and NC (r=0.66 and r=0.68 respectively) with the BMI variable. For age, cholesterol consumption (r=-0.34) presented a weak and negative correlation with age. For the others, a weak or very weak correlation was noticed, as shown in **Table 4**.

Table 4. *Pearson*'s correlation between consumption of micro/macro-nutrients/ anthropometric data and BMI/age of the patients with Type 2 Diabetes *Mellitus* treated in a Basic Health Unit. São Luís, Maranhão, Brazil, 2019.

VARIABLES	BMI	AGE
Proteins	0.23	-0.29
Carbohydrates	**0.33**	0.22
Lipids	0.14	-0.26
Fibers	0.08	-0.18
Sodium	0.07	-0.23
Cholesterol	0.03	**-0.34**
Polyunsaturated	0.23	-0.07
Monounsaturated	0.12	-0.21
Trans fat	-0.26	0.06
Saturated fat	0.12	-0.25
WC	**0.87**	0.10
HC	**0.66**	-0.21
NC	**0.68**	0.02

Source: authors (2022).

DISCUSSION

The prevalence of aged individuals in the population of this study can be related to the increase in Brazilian life expectancy, added to the aging process and to an increase in the number of cases of chronic non-communicable diseases (CNCDs), such as Type 2 Diabetes *Mellitus*. [19,20]

In a study carried out with aged people monitored in Primary Care in the municipality of Porteiras-CE, 76.7% of the participants were female (21),[19] similarly to our findings, which may suggest greater search for the health services by women, leading to early diagnoses and favorable prognoses. [22]

In other Brazilian cities, a number of studies have shown that more than 70% of the patients with DM2 lived on one to two minimum wages,[23,24] similarly to our results, highlighting that the economic factor can be one of the obstacles that make it difficult for patients to adhere to the treatment, exerting negative impacts on glycemic control,[25] in addition to low schooling levels, as limited access to information, such as the ability to read, write and understand, can contribute to low search for health services and to irregular adherence to the treatment, implying unfavorable prognoses,[23] as evidenced in a research study conducted with patients treated in the Family Health Strategy, where 53% had Incomplete Elementary Schooling. [26]

When analyzing the individuals' lifestyle for DM2 control, Moura et al. (2019)[27] observed that 54.9% of the participants did not practice physical activity, corroborating our results, which showed predominance of sedentary individuals. This result exerts a negative impact on glycemic control, as periodic physical exercise reduces the activity of proteins that act on the insulin signaling pathway, in addition to regulating the glycemic levels.[2] Thus, combating sedentary lifestyles exerts a significant impact on glycemic control and on reducing comorbidities associated with DM2. [27]

Regarding the measurement of anthropometric measures, the BMI is one of the most important indicators in the assessment of nutritional status and in the risk of morbidity and mortality associated with nutritional status.[19] In this study there was a significant percentage of aged and adult patients with overweight and excess weight. In older adults, such factor can be influenced by physiological changes, changes in lifestyle and dietary imbalances,[21] as in this age group there is a decrease in functional capacity and muscle strength, hindering the practice of physical activity that helps in weight control, glycemic control and nutritional status,[28] which was also evidenced by other researchers. [21,28,29]

Regarding the assessment of waist circumference, considered a predictor for the risk of developing cardiovascular diseases and metabolic complications associated with obesity,[8] the prevalence of individuals at risk for the development of CVDs in our study shows the importance of maintaining ideal body weight as a preventive measure. A similar result was found by Vignoli et al. (2015)[30] who, when evaluating nutritional status, food consumption and quality of life of patients with DM2, evidenced that 74.07% were at high risk of developing these diseases, as in a survey with patients from a Basic Health Unit in Pará, where 56.10% of the participants were at high and very high risk of developing metabolic complications associated with obesity.[31]

Another anthropometric indicator used to assess the incidence of visceral fat is the Waist/Height Ratio, as the waist circumference measurement is proportional to that of each individual's height[1] and, for our study, there was high prevalence of inadequacy of this indicator when associated with others, although presence of abdominal obesity was observed in this study population. This can be explained by constitution of the sample, predominantly comprised by aged people, considering that a number of changes in body composition occur at this stage, with storage of adipose tissue in greater amounts in the intra-abdominal and intramuscular forms instead of subcutaneously, a factor directly associated with weight and body fat gain and other metabolic changes.[31]

In relation to consumption of macronutrients, there was adequate consumption of carbohydrates, which can contribute to weight reduction and is considered an important indicator in glycemic control, as evidenced in a randomized study[32]. However, it is important to emphasize that the quality and amount of carbohydrates consumed can affect the glycemic levels, and their consumption should include fruit, vegetables and whole grains, avoiding carbohydrate sources with high concentrations of fats, sugars and sodium.[1,33] Sucrose consumption, for example, was considered high; however, its consumption is not restricted to DM2 patients, as it does not change blood glucose more than other carbohydrate sources, although its recommendation is moderate since, in excess, it can be associated with unbalanced nutritional habits consisting of energy-and sugar-dense food products.[1]

The low fiber intake by the participants of this study, similar to what was found by Santos et al.,[34] evidenced a consumption far below the SBD recommendations, which points to beneficial effects on blood glucose and lipid metabolism, in addition to favoring maintenance of the intestinal function.[1]

Regarding protein consumption, most of the patients reported a high-protein diet. This result emphasizes the importance of continuous monitoring of the intake of this macronutrient, as individuals with DM2 may present albuminuria which, if not controlled, can progress to diabetic nephropathy. It is noted that, in individuals with DM2 and preserved renal function, once ingested, protein seems to increase the insulin levels without increasing the glucose concentrations.[1,31]

High consumption of proteins can also be related to a higher consumption of saturated fat because food products, such as meat, milk and its derivatives and legumes, are rich in both nutrients.[33] The need to reduce the saturated fat intake is crucial in individuals with diabetes, as they are at greater risk of death due to coronary heart diseases, in addition to the increased intake of saturated fatty acids, trans fatty acids and dietary cholesterol. associated with

increased LDL cholesterol.[30] In addition, the adequate intake of monounsaturated fatty acids, sodium and cholesterol by our participants is highlighted, showing the importance of following a diet rich in monounsaturated fatty acids rather than polyunsaturated fatty acids, contributing to glycemic control and to reducing cardiovascular risk markers.[1]

This study has the following limitations: the fact that it was carried out in a short period of time, with an approach to nutritional status performed only through anthropometry and, in this case, noticing the need to evaluate body composition to understand nutritional status in studies with this approach. In addition to that, food consumption among people with DM2 was evaluated and, despite rigor in the application of the 24-hour food reminder, considering a typical day for the respondent and with a description of times and types of preparation using homemade measures, in addition to the beverages drank in this time interval, we agree that the fact that this instrument was applied only once can be a limiting factor of the research. Perhaps performing three applications of 24-hour reminders would be more effective. Even so, the current study can contribute to understanding the nutritional profile of patients with DM 2 and foster strategies that enable actions for food and nutrition surveillance, health promotion and prevention of Diabetes *Mellitus* complications.

CONCLUSION

The evaluation of anthropometric indicators indicated overweight individuals in 60% of the older adults group and in almost 50% of the adults group. The Waist/Height Ratio was high in 89.1% of the sample and nearly 80% of the participants were at high risk for cardiovascular and metabolic diseases. The mean intake of meals per day was 4.6, with consumption within the recommended range of food products rich in carbohydrates, monounsaturated fatty acids, cholesterol and sodium. Factors related to dietary imbalance represented a risk for glycemic control and may contribute to worsening of Diabetes *Mellitus*; therefore, it is recommended that other studies be carried out with the purpose of defining interventions related to maintenance of adequate weight, physical activity and healthy food consumption.

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