Artigo Original

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Eating behavior of patients with Type 2 Diabetes and/or Hypertension

Comportamento alimentar de pacientes com diabetes tipo 2 e/ou hipertensão

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Resumo

Introdução: A obesidade, o diabetes mellitus e a hipertensão arterial sistêmica constituem as principais doenças crônicas não transmissíveis associadas à nutrição inadequada. Para auxiliar os pacientes a alcançarem mudanças no estilo de vida, um passo importante é identificar os perfis comportamentais. Objetivos: Este estudo teve como objetivo caracterizar o comportamento alimentar de pacientes adultos brasileiros com diabetes e hipertensão e comparar os escores dos domínios entre sexo, grupos etários e índice de massa corporal (IMC). Métodos: O estudo transversal avaliou os domínios do comportamento alimentar em pacientes do Centro de Diabetes e Hipertensão da Universidade Federal de Pelotas, utilizando o *Three Factor Eating Questionnaire*. Também comparou padrões comportamentais entre diferentes grupos. Resultados: Um total de 97 pacientes voluntários foram incluídos, sendo a maioria idosos (60,82%) e do sexo feminino (61,86%). A Restrição Cognitiva teve o maior escore entre os domínios. As mulheres tiveram escores mais altos em Alimentação Emocional (AE) do que os homens ($p<0,003$). Adultos tiveram escores significativamente mais altos em AE ($p<0,001$) e Descontrole Alimentar (DA) ($p<0,010$) em comparação com os idosos. Indivíduos com sobrepeso tiveram escores elevados em AE ($p=0,003$) e DA ($p=0,028$) na amostra geral. Adultos com sobrepeso tiveram um escore de AE mais alto ($p=0,014$), enquanto adultos com obesidade tiveram escores mais altos tanto para AE ($p=0,036$) quanto para os domínios de DA ($p=0,041$). Conclusão: Foram observadas diferenças nos escores dos domínios com base no sexo, faixa etária e IMC. Compreender o comportamento alimentar dessa população pode ser crucial para planejar intervenções eficazes no manejo do diabetes e da hipertensão.

Palavras-chave: nutrição comportamental; psicometria; three-factor eating questionnaire; diabetes mellitus; hipertensão; obesidade

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Abstract
Introduction: Obesity, diabetes mellitus, and systemic arterial hypertension constitute the main chronic non-communicable diseases associated with inadequate nutrition. To help patients achieve lifestyle changes, an important step is to identify behavioral profiles. Aims: This study aimed to characterize the eating behavior of Brazilian adult patients with diabetes and hypertension and compare its domain scores between sex, age groups, and body mass index (BMI). Methods: The cross-sectional study assessed eating behavior domains in patients from the Diabetes and Hypertension Center of the Federal University of Pelotas using the Three-Factor Eating Questionnaire. It also compared behavioral patterns between different groups. Results: A total of 97 volunteer patients were included, with the majority being elderly (60.82%) and female (61.86%). Cognitive Restraint had the highest score among the domains. Females scored higher in Emotional Eating (EE) than males ($p<0.003$). Adults had significantly higher scores in EE ($p<0.001$) and Uncontrolled Eating (UE) ($p<0.010$) domains compared to the elderly. Subjects with overweight scored high in EE ($p=0.003$) and UE ($p=0.028$) across the sample. Adults with overweight had a higher EE score ($p=0.014$), while adults with obesity had higher scores for both EE ($p=0.036$) and UE domains ($p=0.041$). Conclusion: Differences in domain scores based on sex, age group, and BMI were observed. Understanding the eating behavior of this population can be crucial for planning effective interventions to address diabetes and hypertension management.
Keywords: behavioral nutrition; psychometrics; three-factor eating questionnaire; diabetes mellitus; hypertension; obesity

Introduction

Eating behavior has been widely investigated as a key factor that can influence how we eat, how we choose our food, and how much weight we gain. The World Health Organization (WHO) has estimated more than 1.9 billion adults were overweight and 650 million were obese. Overall, 39.0% of the world's adult population were overweight, while the prevalence of obesity worldwide practically tripled between 1975 and 2016[1]. More than half of Brazilians adults are overweight, while obesity affects 22.0% of men and 22.2% of women[2], and this has become a major challenge for professionals and the health system[3]. Obesity is influenced by physiological, psychological, cognitive, social, and behavioral factors, including eating[4]. Therefore, understanding and identifying these mechanisms are extremely important for guiding clinical conduct. Also, patients living with obesity are part of a risk group for other chronic non-communicable diseases (NCD), such as type 2 diabetes mellitus (T2DM), systemic arterial hypertension (SAH), cardiovascular diseases (CVD), and certain types of cancer[5,6].

Obesity, T2DM, and SAH constitute the main NCD associated with inadequate nutrition and carry a great economic burden for the Brazilian healthcare system, called *Sistema Único de Saúde* (SUS) [Brazilian Unified Health System][5]. Furthermore, the main causes of cardiometabolic death in Brazil are poor diet, high blood pressure, and high body mass index (BMI)[7]. The key points to control NCD are lifestyle changes and adherence to dietary and pharmacological treatment. To achieve these goals, a crucial step is to identify the behavioral profile of these patients[8].

Eating behavior can be classified into three domains: Emotional Eating (EE), Cognitive Restriction (CR), and Uncontrolled Eating (UE). Briefly, EE regards the susceptibility to eating in response to emotional stress and negative mood; CR is characterized as the cognitive

and self-imposed limitation of food ingestion to control weight; and UE is the tendency to lose control of overeating when feeling hungry or when exposed to external cues, even without the presence of hunger[9,10].

The *Three-Factor Eating Questionnaire* (TFEQ) was developed to measure these three dimensions of human eating behavior. It was originally proposed by Stunkard and Messick (1985)[11], consisting of 51 items, and was subsequently reviewed in a new version with 21 items[10]. The Brazilian Portuguese version was translated by Natacci and Júnior (2011) and psychometric validated by Medeiros et al. (2017).

Some studies have shown the association of the domains of eating behavior with the traditional risk factors for chronic diseases[13,14]. Other studies reported associations among the domains of eating behavior with sex[15], age range[15,16] and BMI[13,14,16]. Moreover, a recent survey showed the relationship between mood disorders and eating behavior with chronic comorbidities in T2DM and SAH in Mexican patients[16]. Also, studies have found an association between T2DM, SAH, and obesity with higher scores in eating behavior domains[13]. Moreover, increased body weight was associated with TFEQ scores and the risk of developing diabetes[17]. Therefore, the purpose of this study was to characterize the eating behavior of patients with T2DM and SAH among Brazilian adults and to compare its domains between sex, BMI, and age range.

Materials and Metods

Study design and population

This is a cross-sectional study conducted from February 2019 to March 2020. All patients undergoing nutritional treatment at the public Nutrition Outpatient Clinic of the Diabetes and Hypertension Center, who were aged over 18 years old and did not have any cognitive disorders that would have hindered their ability to respond to the questionnaire, were invited to participate in the current study. The participants were included after reading and signing the informed consent. During this period, 293 patients were attended to at the nutrition service, out of which 97 agreed to participate, met the inclusion criteria, and were included in the study. As this study employed convenience sampling, the sample size was not calculated.

Ethical Statement

The research conducted in this study was approved by the Research Ethics Committee of the Faculty of Medicine of the Federal University of Pelotas (Approval no. 4.145.604). All participants in this study were volunteers, and the questionnaire was administered face-to-face after obtaining verbal and written consent through the signing of the informed consent form.

Outcomes

Trained interviewers administered the *Three Factor Eating Questionnaire – Revised 21* (TFEQ-R21) to the participants during nutritional assistance. In summary, this scale includes 6 items for Cognitive Restriction (CR), 6 items for Emotional Eating (EE), and 9 items for Uncontrolled Eating (UE). The questionnaire can be accessed in its original publication[9,10]. The scores for each domain were calculated and presented on a scale from 0 to 100 points, as previously described in the literature[9,18].

Higher scores indicate a tendency to the respective eating behavior.

Clinical data

Sociodemographic and anthropometric data (age, sex, weight, height, and BMI) were collected from nutritional anamnesis reports of the service and used as expositions. The weight was obtained using a Welmy® digital scale (200 Kg capacity and minimum accuracy of 50g). Height was measured with an aluminum stadiometer attached to the scale with a minimum accuracy of 0.1 cm. The individual was in a standing position with his/her head in the Frankfurt plan. The BMI was calculated by dividing the weight (in kilograms) by the height (in meters) squared and classified according to age range as eutrophic, overweight, or obesity, for adults under 60 years old[19] or elderly aged 60 years old or more[20].

Data Analysis

Data were analyzed in the *GraphPad Prism*® software version 5.03 and were expressed in percentages, mean and standard deviation, or median and interquartile range, depending on their nature. The sample was divided by sex, age group, and BMI for the analyses. The Shapiro-Wilk normality test was conducted. The comparison between medians of each group was performed using the Mann-Whitney U test, and to compare medians among domains, the Kruskal-Wallis test was conducted, with a significance level set at 5%.

Results

A total of 97 volunteer patients were included, and the majority were elderly (60.82%) and female (61.86%), with a mean age of 62 ± 11.15 years old. Overweight was present in 88.66% of the total sample, and obesity in 65.79% of the adults. The mean BMI was 33.20 ± 7.07 Kg/m² (Table 1). Cognitive Restraint was the domain with the highest score in this sample of patients living with T2DM and/or SAH *(p<0.0001)*. It is important to note that there is no cutoff point for each domain, so it is not possible to describe the prevalence of behaviors, only compare the domain means between each group.

Table 1. Demographic, anthropometric characteristics and domains of eating behavior of patients from the Nutrition Outpatient Clinic of the Diabetes and Hypertension Center. Pelotas/RS, Brazil, 2020. (N=97).

Variables	n* (%)
Sex	
Female	60 (61.9)
Male	37 (38.1)
Age Groups	
Adults	38 (39.2)
Elderly	59 (60.8)
Chronic Diseases	
T2DM and SAH	67 (69.0)
T2DM	15 (15.5)
SAH	15 (15.5)

Variables	n* (%)
Body Mass Index (Kg/M²)	
Eutrophic	11 (11.3)
Overweight	86 (88.7)
Adult's Body Mass Index[a]	
Eutrophic	3 (7.9)
Overweight	10 (26.3)
Obesity	25 (65.8)
Elderly's Body Mass Index[b]	
Eutrophic	8 (13.6)
Overweight	51 (86.4)
Eating Behavior domains	**Median (P25 -P75)**
Emotional Eating (EE)	17 (0 - 39.0)
Cognitive Restraint (CR)	50 (33.0 - 72.0)
Uncontrolled Eating (UE)	22 (7.0 - 37.0)

* Total number of individuals
[a] Body Mass Index (BMI) was classified according to analysis for adults[19].
[b] Body Mass Index (BMI) was classified according to analysis for the elderly[20].

Significant differences between sex and age groups were observed in the behavioral domains. Females presented higher scores than males in the EE domain *(p=0.003)*. Adults had significantly higher scores in the EE domain *(p<0.001)* and the UE domain *(p=0.010)* when compared to the elderly (Table 2).

Table 2. Demographic characteristics for each eating behavior domain of patients from the Nutrition Outpatient Clinic of the Diabetes and Hypertension Center. Pelotas/RS, Brazil, 2020 (N=97).

Variables	Emotional Eating (EE) Median (P25 - P75)	Cognitive Restraint (CR) Median (P25 - P75)	Uncontrolled Eating (UE) Median (P25 - P75)
Sex			
Female (n=60)	22.0 (6.0 - 54.5)	56.0 (33.0 - 72.0)	20.5 (7.0 - 41.0)
Male (n=37)	11.0 (0 - 28.0)	39.0 (30.5 - 72.0)	22.0 (9.0 - 33.0)
***p*-value [c]**	**0.003****	**0.375**	**0.973**
Age Groups			
Adults (n=38)	33.0 (9.75 - 57.2)	50.0 (33.0 - 62.5)	31.5 (11.0 - 48.0)
Elderly (n=59)	11.0 (0 - 28.0)	56.0 (28.0 - 78.0)	19.0 (7.0 - 33.0)
***p*-value [c]**	**<0.001****	**0.481**	**0.010***

[c] Comparison among medians was performed with the *Mann–Whitney U* test.
* Statistical significance *(P<0.05)*.

When considering the entire sample, significant differences in EE *(p=0.003)* and EU *(p=0.028)* scores were found between BMI categories. Additionally, adults with overweight scored higher for EE when compared to eutrophic adults *(p=0.014)*, and adults with obesity scored higher for EE *(p=0.036)* and UE *(p=0.041)* than eutrophic

adults. No significant differences between BMI groups were observed in other domains (Table 3).

Table 3. Eating behavior domains according to anthropometric characteristics and age range of patients from the Nutrition Outpatient Clinic of the Diabetes and Hypertension Center. Pelotas/RS, Brazil, 2020 (N=97).

Variables	Emotional Eating (EE) Median (P25 - P75)	Cognitive Restraint (CR) Median (P25 - P75)	Uncontrolled Eating (UE) Median (P25 - P75)
Total sample Body Mass Index [ab]			
Eutrophic (n=11)	0 (0 - 11.0)	33.0 (28.0 - 44.0)	4.0 (0 - 33.0)
Overweight (n=86)	17.0 (6.0 - 39.0)	56.0 (33.0 - 72.0)	22.0 (11.0 - 38.0)
***p*-value [c]**	**0.003****	**0.083**	**0.028***
Adult's Body Mass Index [a]			
Eutrophic (n=3)	0 (0 - 6.0)	28.0 (22.0 - 39.0)	4.0 (0 - 15.0)
Overweight (n=10)	41.5 (11.0 - 65.2)	55.5 (41.25 - 73.5)	42.0 (14.0 - 55.75)
***p*-value [c]**	**0.014***	**0.076**	**0.075**
Obesity (n=25)	39.0 (14.0 - 80.5)	44.0 (33.0 - 64.0)	37.0 (17.0 - 50.0)
***p*-value [cd]**	**0.036***	**0.086**	**0.041***
Elderly's Body Mass Index [b]			
Eutrophic (n=8)	3.0 (0 - 11.0)	33.0 (28.0 - 77.75)	9.5 (1.0 - 33.0)
Overweight (n=51)	11.0 (0 - 28.0)	56.0 (33.0 - 78.0)	19.0 (7.0 - 30.0)
***p*-value [c]**	**0.106**	**0.399**	**0.381**

[a] Body Mass Index (BMI) was classified according to analysis for adults[19].
[b] Body Mass Index (BMI) was classified according to analysis for the elderly[20].
[c] Comparison among medians was evaluated by *Mann–Whitney U* test.
[d] When comparing eutrophic with obesity.
* Statistical significance *(P<0.05)*.

Discussion

This study characterized the eating behavior of patients with T2DM and SAH undergoing treatment in a public nutritional clinic. CR was the domain with the highest score in this sample. Females presented higher EE scores than males; in addition, adults scored higher for EE and UE than the elderly. The main result was the differences between eating behaviors — EE and UE domains — in adults with obesity. Most of this sample was elderly and female and presented as overweight or obesity. It is well established that eating behaviors can interfere with the control of T2DM and SAH[13,16] and can be influenced by depression and anxiety symptoms[21,22].

Previous studies demonstrated a positive association between high scores in eating behavior domains and risk for T2DM, hypertension, and obesity[13,16]. However, the association between sociodemographic factors and eating behavior patterns remains unclear. A previous study with Mexican adult patients with NCD (n= 61), such as T2DM and SAH, did not find any association with eating behaviors between the sexes[16]. In addition, a study in Korea with 82 adults with obesity and healthy weight[14] also presented no association between eating

behavior and sex. On the other hand, a cross-sectional study conducted among Lebanese university students (n=400)[15] and a cohort study with American university students (n=241)[23], both with young adults, showed differences in eating behavior between sexes, in which females scored higher than males in the EE domain, which was also observed in our sample.

Adults scored higher in the EE and the UE domains when compared to the elderly, corroborating a previous study conducted with T2DM patients[16]. Overall, eating behavior domains, such as EE and UE, also were positively correlated with perceived stress in young adults[24]. Furthermore, studies with T2DM adult patients from Brazil[25] and Denmark[26] have already demonstrated a high prevalence of emotional disorders, such as perceived stress and depressive symptoms.

In addition, the present study also found a positive association between EE and UE in patients with overweight, which was significantly more expressive in adults. In a Finnish cohort study with 5,024 adults and elderly adults, it was possible to observe that adults with higher EE scores may be particularly vulnerable to weight gain[27]. Higher scores in the EE and UE domains were associated with obesity, central obesity, T2DM, and hypertension in a sample of US Latinos (n=578)[13], and high BMI in Dutch patients with T2DM (n=120)[28]. The EE domain has been associated with a diet rich in sweets and salty foods, as well as to greater intake of energy-dense foods[18] with or without depressive symptoms[29], which also is related to obesity. Our research group has already identified that the present sample of patients with diabetes and hypertension demonstrated a higher risk of CVD and low quality of their diet[30,31]. Also, brain cognitive dysfunction has been linked to patterns of eating behaviors and obesity[14].

Moreover, several studies have found the same relationship among the EE and UE domains, sex, and BMI in young adults[14,15,23], in Australian females[32], adults, and elderly[33], and more specifically, in individuals that presented risk factors for CVD[13] and developing diabetes[17]. The association between obesity and EE, CR, and UE domains in a sample of patients with NCD — such as patients with obesity, diabetes, and hypertension — is already well described in the literature[13,14,16,17,28]. Moreover, a longitudinal study conducted in Singapore (n=140) found that high EE and UE scores contributed to obesity in patients with diabetes[34].

The CR score in our sample can be explained by the fact that the patients are diabetic and hypertensive, which can lead to greater concern about their diet or perhaps because at some point in their life they received guidance on healthy eating from some healthcare professional. Moreover, in a sample of North American adults (n=522), individuals with high scores in the CR domain tended to be more sensitive to health perceptions[35]. Therefore, it is necessary to incorporate strategies for changing eating behavior to reduce the prevalence of obesity, as well as T2DM, by focusing on factors of perception of eating and sense of control[36,37]. Further, a multidisciplinary team should conduct weight management programs[17] taking into account all psycho-environmental aspects.

As a limitation, the researchers recognize that the sample under study is relatively small and that it would be useful to investigate extremely important sources of bias, such as depressive and anxiety

symptoms, sleep patterns, psychiatric diagnosis, and psychotropic drugs, among others. Furthermore, the confounding effect can be a limitation; where most of the sample was made up of females and elderly, which may have affected the results of the total sample. Even so, it was possible to characterize and find differences between groups in this sample of people living with diabetes and/or hypertension. It is noteworthy that these results deal with a population with a specific health condition and should not be extrapolated to the general population.

Conclusion

This investigation aimed to characterize the eating behavior of patients with T2DM and SAH. This study demonstrated that Cognitive Restriction was the eating behavior domain with the highest score in this sample of patients. Furthermore, an association was found between overweight, EE, and UE scores. When the sample was stratified by sex and age groups, females presented higher scores in the EE domains than males and adults presented significantly higher EE and UE scores when compared to the elderly.

Investigations that seek to understand the eating behavior of patients with DM2 and SAH are important in nutritional treatment and aggravations prevention. Therefore, additional studies are necessary to examine eating behaviors, especially in chronic patients, taking into consideration psycho-environmental aspects.

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Conflict of interest

All authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this manuscript

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