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Association between stress and eating behavior in college students

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Abstract

Objective: To evaluate the association between stress, food behavior and food intake in a college population. *Methods:* Thirty college students (18-30 years and BMI 22.7 ± 4.4 kg.m^{-2}) have participated in the study. Self-administered questionnaires were used to assess the stress symptoms (Perceived Stress Scale) and the eating behavior (Three-Factor Eating Questionnaire-21, Portuguese version). Quantitative (energy and macronutrients) and qualitative (consumption frequency of food groups: (1) high in sugars, (2) fast food type ready-to-eat snacks and sandwiches and (3) fruits and vegetables) food intake was assessed from 3-day food records. College students were classified into two groups, according to the scores of PSS: Lower stress group: 1st PSS tertile score and Higher stress group: PSS 3rd. tertile score. *Results:* Students with higher stress, compared with those with lower levels, had higher scores for the eating behavior of emotional eating (46.0 ± 28.1 x 22.8 ± 17.9, respectively, p = 0.03) and uncontrolled eating (41.7 x 26.3 ± 14.9 ± 12.3, respectively, p = 0.05) and higher frequency of consumption of fast food type ready-to-eat snacks and sandwiches (2.7 ± 1.8 x 1.0 ± 1.3, respectively, p = 0.03). No significant differences for quantitative food intake were observed between groups. *Conclusion:* Students with higher stress levels had higher scores for emotional eating and uncontrolled eating, and higher frequency of consumption of fast food type ready-to-eat snacks and sandwiches.

Key words: Psychological Stress. Feeding Behavior. Food Intake.

Introduction

Stress is now considered a global problem, and studying it has gained prominence in the scientific literature because of the multitude of negative effects on human health.[1] Individual biological response to stress is influenced by how individuals experience stressful experiences and varies according to physiological, psychological and environmental features that interact to produce different responses among individuals,[2] such as an increase in appetite, ingestion of alcohol and other substances of abuse.[3]

Evidence suggests that stress alters eating behavior, redirecting food choices to food with greater palatability and energy value, especially those high in sugar and fat.[4,5] The literature also suggests that the effects of stress on food consumption seem to differ according to individual characteristics such as gender. Previous studies have found that stressed women have higher calorie food consumption when compared to less stressed ones, which has not been seen for men.[4,6] Women may react more strongly to stress and/or depressive symptoms in relation to food intake probably because these conditions are associated with the relaxation of social rules involved in food selection.[7]

Chronic stress situations are associated with increased exposure to cortisol, which has effects on the brain reward pathways (BRP). Cortisol increases BRP sensitivity, which can trigger excessive consumption of high palatability foods.[8] Other hormones such as dopamine, leptin and insulin also act at the central level, stimulating the desire for palatable foods. In turn, foods high in fat and sugar generate pleasure and positive emotions, increasing the desire for their consumption and associating the memory of their consumption with the feeling of reward.[9] Thus, the redirection of food choices when facing stressful situations, translated by the tendency to changing food preferences and increased consumption of foods that are usually consumed with caution (such as foods high in sugar), is related to the attempt to use food as a way to relieve this emotional state.[10,11]

In this sense, we have an interlacing of biological and psychological perspectives on the relationship between stress and food consumption. On the one hand, we have physiological responses to the consumption of palatable foods that influence and guide their future use. And on the other, we have hedonic and emotional motivations that guide and influence food consumption and sometimes overlap with biological mechanisms.

Decision-making in relation to food choices is a complex process and there are other factors, as well as emotions such as stress, involved in this action. Among them, the life course stands out, which does not refer simply to the development or progression of the stages of life but considers

the socio-cultural environment to which the individual is exposed and the dynamic processes of life that go beyond these stages, including trajectories and transition times that generate changes in the direction of their food choices.[12]

College students are at a time of major transition in life and are particularly prone to emotional imbalances. University entrance can be a stressful experience in view of the major life changes involved in the transition to college and symptoms of stress and depression are common among college students.[13-15] Academic requirements and new social demands, together with the newly won freedom and responsibility for food selection, purchase and preparation can directly affect the eating behavior and generate negative impacts on food choices.

For adequate and specific intervention strategies to be developed, it is important to broaden our understanding of stress interferences on college students' eating habits. This better understanding can support preventive educational activities and also promote health. In this aspect, this study aims to evaluate the association between stress and behavior and food intake for college students.

Methods

Study design and research subjects

This is a pilot study, exploratory and cross-sectional developed with graduate students at "Universidade Federal do Triângulo Mineiro" [Brazilian Federal University of the Triângulo Mineiro]. The sample was by convenience (non-probabilistic). Recruiting volunteers was done through disseminating posters in public places at the university and invitations in classrooms. Those interested would be scheduled for data collection, which occurred in two stages: 1) Checking inclusion/exclusion criteria; evaluations: anthropometric, of the symptoms of stress and eating behavior, and guidelines for conducting a food record (FR) of 3 days; 2) Submitting the FR of 3 days. The study was conducted from August 2013 to August 2014.

In total, 80 students were scheduled. Of these, excluding those who did not meet the inclusion criteria and those who did not attend the 1st and/or 2nd stages of the pilot study, 30 students were evaluated, aged 18-30 years. Subjects diagnosed with eating disorders, using appetite suppressants or other medications that alter appetite and those who were performing some kind of treatment with weight loss goal were excluded.

The study was approved by the UFTM Research Ethics Committee (REC) (certificate of filing no. 2373) and all participants signed an Informed Consent Form.

Anthropometric assessment

Body weight (kg) and height (m) were measured in an electronic scale with an accuracy of 0.1 kg and a 0.5-cm graduation for subsequent calculation of body mass index (BMI). All measurements were performed according to previously standardized techniques[16] and by the same professional trained and qualified for this purpose.

Stress evaluation

To evaluate the stress symptoms, the *Perceived Stress Scale* (PSS) was used in the version translated to and validated for Portuguese. This scale measures perceived stress, i.e., how individuals perceive situations as stressful. PSS is a general scale and can be used in different age groups as it does not contain questions that are specific to the context. It contains 14 items which were created to check how unpredictable, uncontrollable and overloaded the participants evaluate their lives. Each question has answer options ranging from zero to four (0 = never, 1 = almost never, 2 = sometimes, 3 = often, and 4 = always). The scale total is the sum of the scores of these 14 items and the scores can range from zero (minimum) to 56 (maximum).[17]

For the interpretation of the PSS results, cutoffs are not suggested because it is understood that perceived stress is a continuous variable that must be analyzed as such.[17] Therefore, to evaluate the association between stress, eating behavior and food intake, the calculation of the PSS score tertiles was made and the students were classified into two groups: Lower stress Group: 1st tertile of the PSS score and higher stress Group: 3rd tertile of the PSS score. The classification choice of the participants in tertiles was given in order to get two groups actually distinct and in opposite poles in the level of stress, which is not achieved when the classification is made by the median.

Eating behavior standard evaluation

The eating behavior was assessed by the *Three-Factor Eating Questionnaire*-21 (TFEQ-21) in its version translated to and validated for Portuguese.[18] The dietary patterns assessed with this questionnaire were: cognitive restraint (CR), emotional eating (EE) and uncontrolled eating (UE).

CR addresses six items and identifies food control in order to reduce weight and/or change body shape. This consists of a mental condition that is adopted by the individual in relation to food with the objective of reducing caloric intake. The EE scale also has six items and measures the propensity to excessive eating in response to likely negative emotional states. As for the UE

scale, it has nine items and verifies the tendency to lose food control in the presence of hunger or other stimuli. The total score of each behavior (score 0 to 100 points) was computed by a previously described method.[18]

Just as for the PSS, there are no cutoffs for eating patterns assessed by TFEQ-21. The guidance is that its assessment be made associated with other variables of interest.[18]

Assessment of current food consumption

The current food intake was assessed by the three-day FR, with specific guidelines for the its proper performance. The main advantage of this method lies in the fact that taking note of food must be done at the time of consumption, reducing memory bias. Participants were also advised to maintain their usual dietary intake on the days of recording it. However, it should be highlighted that the simple fact that the participants were aware that their consumption would be evaluated could generate interference on it.

Nutritional analysis of records was done with the help of software Dietpro 5i®. Data were calculated regarding the amount of energy (kcal), proteins (g and %), carbohydrates (g and %) and total lipids (g and %) ingested.

Besides the nutrition content analysis, an assessment was also made on the frequency/regularity of consumption of some food groups. Food groups of interest in the study which were considered for this analysis are: (1) Food group high in sugar (chocolate powder mixes, chocolates, candies and junk food in general, cookies and sugary drinks); (2) Food group of fast food type ready-to-eat snacks and sandwiches; and (3) Food group of fruits and vegetables. Obtaining the numerical value corresponding to the consumption frequency/regularity was done by counting the number of times the foods that made up each of these groups were consumed by the participants on the three days evaluated. The main interest of this evaluation was to determine not the amount or size of the serving consumed but the consumption frequency/regularity of these foods to subsequently verify the association between this regularity and stress.

Data analysis

The data normality was checked from the Kolmogorov–Smirnov test. Given that not all variables had a normal type distribution, the use of the non-parametric Mann-Whitney test to compare means between the higher versus lower stress groups and the Spearman's rank correlation coefficient for correlations between variables were standardized. The level of significance adopted was of 5% ($p \leq 0.05$).

Results

Sample characterization

Thirty students were evaluated, with average weight and BMI of 60.8 ± 12.9 kg and 22.7 ± 4.4 kg/m², respectively. Participants were classified into two groups, according to tertiles of the PSS score (lower stress Group: 1st tertile – 15 to 22 points and higher stress Group: 3rd tertile – 31 to 40 points) and there were no significant differences in the anthropometric parameters between them (Table 1).

Table 1. Anthropometric data of the participants' food consumption and eating behavior standard, according to PSS score tertiles. Uberaba, MG, 2014.

Variables	Lower stress group (n = 11)	Intermediate group (n = 09)	Higher stress group (n = 10)	p-value
BMI (kg.m^{-2})	22.9 ± 4.5	22.0 ± 2.5	23.5 ± 6.1	0.71
PSS score	35.4 ± 2.9	25.0 ± 2.3	17.9 ± 2.0	< 0.0001
Energy consumption (kcal)	1608.3 ± 384.0	1808.0 ± 478.0	1713.1 ± 412.7	0.60
Carbohydrates (g)	206.1 ± 62.8	240.2 ± 95.6	232.8 ± 83.4	0.37
Carbohydrates (%)	52.4 ± 9.7	53.1 ± 6.0	52.5 ± 9.4	0.90
Proteins (g)	61.9 ± 19.8	72.9 ± 17.7	69.3 ± 15.5	0.33
Proteins (%)	15.7 ± 4.3	16.0 ± 2.8	17.0 ± 3.3	0.34
Lipids (g)	57.9 ± 21.4	59.0 ± 15.5	52.9 ± 11.4	0.55
Lipids (%)	31.6 ± 7.9	29.6 ± 5.3	29.5 ± 7.0	0.65
CR behavior (points)	37.2 ± 17.4	52.5 ± 19.3	45.7 ± 26.6	0.56
EE behavior (points)	46.0 ± 28.1	53.1 ± 24.6	22.8 ± 17.9	0.05
UE behavior (points)	41.7 ± 14.9	35.4 ± 19.3	26.3 ± 12.3	0.03

Values presented in means ± SD. CR – cognitive restraint, EE – emotional eating, UE – uncontrolled eating. Lower stress group: 1st tertile of the PSS score (15 to 22 points), higher stress Group: 3rd tertile of the PSS score (31 to 40 points) and intermediate Group: 2nd tertile of the PSS score (23 to 30 points). The comparisons were done between the higher stress Group versus the lower stress Group.

Stress and food consumption

Energy food and macronutrient intake was not different between the higher and lower stress groups (Table 1). As for the analysis of the consumption frequency/regularity, it revealed that the consumption of fast food type ready-to-eat snacks and sandwiches was more frequent for students with higher stress (2.7 ± 1.8 x 1.0 ± 1.3, p = 0.03). For the other food groups evaluated, no difference was observed between the groups (Figure 1).

It is also important to note that for the total sample a higher consumption frequency of foods high in sugar compared to the consumption of fruits and vegetables was observed (10.6 ± 4.3 x 4.1 ± 2.4, p < 0.001).

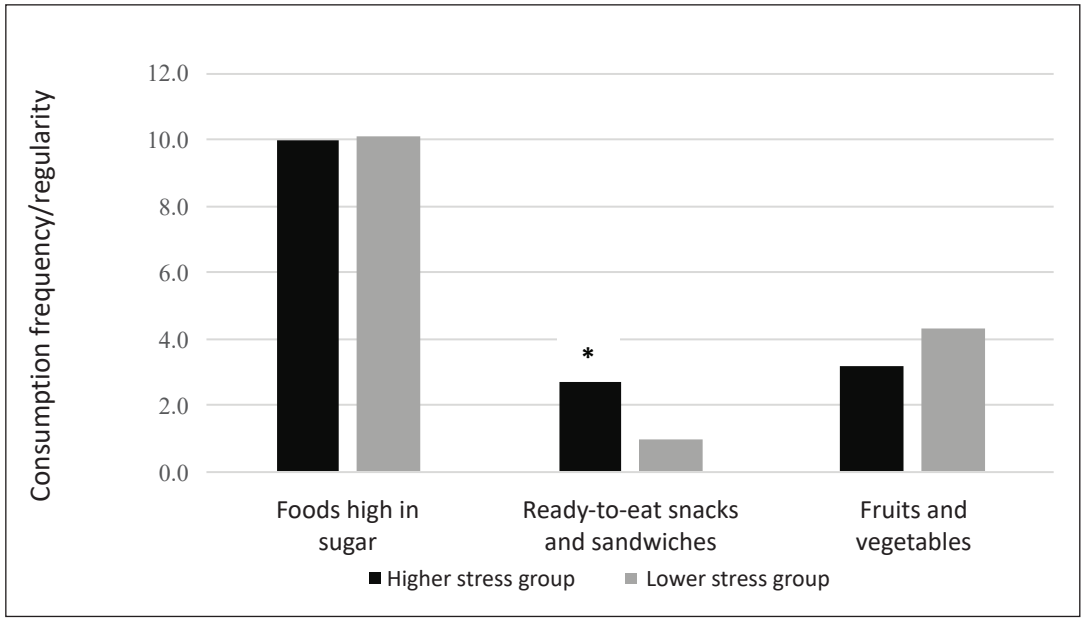

Figure 1. Frequency/regularity (number of times when the food has been consumed) of consumption of foods of the groups: (1) foods high in sugar, (2) fast food type ready-to-eat snacks and sandwiches and (3) fruits and vegetables among groups with higher and lower stress, according to the PSS score tertiles. *: p = 0.03**.**

Stress and eating behavior

It was observed that students with higher levels of stress had higher scores for the EE and UE eating behaviors. For the CR behavior there was no difference between the groups (Table 1).

Correlations

For the total sample, a positive and significant correlation was observed between the level of stress and emotional eating behavior ($r = 0.37$, $p = 0.04$). A positive correlation was also seen between the scores of cognitive restraint eating behavior and body weight ($r = 0.37$, $p = 0.04$) and between the consumption frequency/regularity (number of times the foods were consumed) of foods rich in sugar and total energy consumption ($r = 0.38$, $p = 0.03$) and body weight ($r = 0.40$, $p = 0.02$).

For the other parameters of food intake, eating behavior and anthropometric assessment evaluated, significant correlations were not observed.

Discussion

Students with higher levels of perceived stress had higher scores for the eating habits of emotional eating and uncontrolled eating. Furthermore, a positive correlation between stress and emotional eating was also obtained. These findings indicate that in situations of stress, food choices are more determined by emotional factors, associated with the difficulty of controlling the amount ingested. These behaviors can occur as a coping and reversal strategy, albeit temporary, of this negative emotion.

The role that food plays in every individual's life goes beyond the nutritional aspect. When facing stress, we often use food not to meet physiological and nutritional needs but to seek psychological comfort and as a deliberate strategy to change temperament and humor.[19,20] As a rule, in view of stress situations food choices are redirected to higher palatability foods, especially those high in sugar and fat (such as sweets) with a concomitant reduction in the consumption of fresh foods such as fruits and vegetables. Findings in the literature that point to positive associations between the consumption of foods rich in carbohydrates and fats, especially sweets in general, and stress levels are common.[6,7,11,19-22]

Increased consumption of foods high in sugar as an attempt to relieve stress and improve mood may be related to the physiological response resulting from the consumption of such food. Hedonic mechanisms are intimately involved since sugar intake is related to a strong feeling of pleasure.[23] This is because carbohydrates increase the serum levels of serotonin, an important neurotransmitter in the central nervous system that is responsible for feelings of pleasure and is involved in the modulation of various aspects of mood.[9,24,25]

Qualitative food consumption showed a higher frequency of fast food type ready-to-eat snacks and sandwiches for students with higher stress. Liu et al.[20] have also found a higher frequency of consumption of fast food type ready-to-eat snacks and sandwiches for Chinese university with higher stress. Al Ansari et al.[21] have found a positive association between stress levels and the consumption of snacks and fast food for university students in the United Kingdom. These findings corroborate the influence of stress on individual food choices. Foods such as snacks and fast food are highly palatable and the preference for this type of food in view of stressful situations can occur in an attempt to face this negative emotion.

However, for the consumption of foods high in sugar, no differences were found between the groups, which is distinguished from most frequently observed results in the literature, which point to the increase in consumption of foods high in sugar and fat in the presence of stress.[6,7,11,19-22] Such foods are also known as comfort food because they evoke a pleasant and comfortable psychological state.[26] However, it is important to consider that studies with results similar to ours have already been described in the literature. Pollard et al.,[27] analyzing college students of both genders before and during the school tests period (a situation of low and high stress, respectively), have found no significant differences in food consumption in view of higher stress situations. Other authors have also found no influence of stress on food consumption, especially when it came to male participants.[4,28,29]

The individuals' attraction for certain foods is the result of the combination of physiological and psychological needs[26] and there are several factors involved in the process of food choices. Decisions about what, how much and when to eat involve complex neural processabilities and are influenced by issues such as food culture, display, variety, availability, individual previous experience, personal factors such as gender, income and age, physiological intake consequences, among others.[30] The absence of stress influence on food consumption observed in some work brings up the importance of not disregarding these other factors role in eating behavior. In the specific case of college students, factors such as ease, convenience and cost are important determinants for food consumption.

Although not highlighted as a general objective of the work, we can not disregard the findings related to students' food intake as a whole. University undergraduate students' dietary pattern is of low quality, in view of the more regular consumption of foods rich in sugars to the detriment of fruit and vegetables. College students are mostly the main responsible ones for caring for their food. Added to this are the busy routine and academic requirements inherent in university life. As a result, food choices seem to displace to food that is easily accessible, has low cost and is of rapid preparation.

Conclusions

The main findings of the study show that students with higher stress levels had higher scores for eating habits of emotional eating and uncontrolled eating and most often the consumption of fast food type ready-to-eat snacks and sandwiches. However, there was no difference in the frequency of consumption of foods high in sugar or quantitative food intake between the groups.

Far from exhausting the discussion on this issue and considering that college students are particularly prone to stress, it is worthwhile to highlight the importance of studies that go deeper in the psychological phenomena involved in the relationship between stress and food intake so that specific food and nutrition education programs can be developed.

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