



Cross-cultural adaptation and psychometric investigation of the palatable eating motives scale (PEMS) for a sample of Brazilian adults

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Abstract

Highly palatable foods and beverages can significantly stimulate appetite through the reward system leading to hedonic hunger. Investigating palatable food is important, especially in Brazil, which lacks this type of study based on psychometric instruments such as the Palatable Eating Motives Scale (PEMS). 1. To adapt the PEMS from English to Portuguese; 2. To evaluate the psychometric properties of the PEMS for a sample of young adults; 3. To verify the influence of sex, age, and body mass index (BMI) on motives for consuming highly palatable foods and drinks. The PEMS was cross-culturally adapted and translated into Portuguese. Psychometric properties included analyses of validity (factorial, convergent, discriminant, and external) and reliability. A hypothetically causal structural model was constructed to verify the relationship between individuals' characteristics and PEMS factors. 1031 people participated in the study [female = 61.6%, mean age = 25.5 (SD = 5.3) years]. A PEMS model proposed in Turkish contexts showed adequate adjustment to the sample. Females and younger individuals reported consuming highly palatable foods and drinks more frequently for Coping; Enhancement; and other reasons compared to males and older individuals. Individuals with a higher BMI indicated that they consumed these foods and drinks more frequently only for Coping. The Portuguese version of the PEMS was presented and the data obtained for the sample were valid and reliable. Sex, age, and BMI are important characteristics to investigate consumption of highly palatable foods and drinks.

Keywords Food · Palatable · Motivation · Validation · Psychometry

Introduction

Highly palatable foods and drinks are known to be high in fat, sugar, and/or salt and tend to be calorie dense (Ayşe et al., 2018; Boggiano, 2016; Burgess et al., 2014). The nutritional composition of these foods and drinks, which can be sweet or salty, significantly stimulates appetite through the reward system (Baik, 2021; Sinha, 2018).

Factors responsible for formulating the reward value of food include sensory perception, signals associated with food or the hedonic context (i.e., pleasure), individual characteristics (e.g., biological and psychological), the environment, and society (Beaver et al., 2006; Chen & Antonelli, 2020). The reward value assigned by the individual becomes responsible for anticipating the learned associations and guiding future food choices (Amin & Mercer, 2016), especially in the absence of hunger (Espel-Huynh et al., 2018).

Consumption of food or drink exclusively determined by pleasure is called hedonic hunger (Espel-Huynh et al., 2018). Previous studies (Cornell et al., 1989; Pandit et al., 2012; Sinha, 2018) have found that highly palatable foods can boost hedonic eating and stimulate excessive food consumption, both in animal models and in humans. This evidence must be emphasized because the current market has a wide variety of foods and drinks with these characteristics and are generally low cost, which facilitates access

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(Chen & Antonelli, 2020). Frequent or excessive consumption of these foods and drinks can generate several health problems, such as metabolic and cardiovascular diseases (Figlewicz, 2015); increase body fat (Pereira et al., 2005; Schroder et al., 2007); and amplify risk of disordered eating behavior (Espel-Huynh et al., 2018). Therefore, understanding the motivations that can lead to consumption of these foods (e.g., high palatability) is important to prevent diseases and to promote health, especially in countries like Brazil where 60% of the population is overweight or obese (National Health Survey, 2019) and there is high consumption of hyperpalatable foods (Moraes et al., 2023). Studies have found expressive rates of disordered eating behaviors related to emotions and disinhibition (Liboredo et al., 2021; Queiroz de Medeiros et al., 2019).

Burgess et al. (2014) emphasize that the choice and consumption of palatable foods and drinks can be strategies for coping with stressful emotions or situations, especially those with negative valence. Another important motivation is enhancement, which is consuming foods/drinks to obtain the pleasure generated by them. Social motivations can also be relevant and address the pursuit of these foods/ drinks to enhance a social experience. Moreover, these foods and beverages can be consumed for reasons related to conformity, to adapt to or feel adequate in a group. This intake as a way of dealing with or adapting to different life experiences can lead to excessive consumption, which can negatively affect psychological and physical health (Boggiano et al., 2017).

To investigate the motivations for the consumption of highly palatable foods and drinks, only one structured measurement instrument called Palatable Eating Motives Scale (PEMS) is currently available in the literature (Ayşe et al., 2018; Boggiano, 2016; Burgess et al., 2014). The PEMS was developed in 2014, in English, from the adaptation of the Drinking Motives Questionnaire-Revised (DMQ-R; Cooper, 1994; Cooper et al., 1992). Burgess et al. (2014) proposed the PEMS with twenty items distributed in four factors (Coping; Enhancement; Social; Conformity). Later, Boggiano (2016) presented a revised version of the PEMS, and Ayşe et al. (2018) culturally adapted the instrument for a Turkish sample (Ayşe et al., 2018). To date, the literature does not contain a Portuguese version of the PEMS; therefore, developing it is important to expand the use of this instrument in the Brazilian context and promote discussions about the motivations found for the consumption of palatable foods and drinks in different populations.

In addition, some studies have shown that individual characteristics can influence motivations for choosing and consuming palatable foods (Ayşe et al., 2018; Boggiano, 2016; Boggiano et al., 2017; Boggiano et al., 2015; Burgess et al., 2014). For example, the results presented by Boggiano

(2016) indicated that women reported consuming more palatable foods and drinks to cope with negative emotions and stress than men. Some works (Boggiano et al., 2017; Jiang et al., 2014) suggest that this result may be associated with different ways of perceiving and coping with conflicts and life situations. Regarding gender, Boggiano et al. (2017) found that high Body Mass Index (BMI) was associated with a greater frequency of consumption of palatable foods and drinks, especially for reasons of coping with emotions and the enhancement value generated by food. These results are in line with other studies found in the literature that demonstrated a relationship between BMI and the consumption of palatable foods (Ayşe et al., 2018; Boggiano, 2016; Burgess et al., 2014). The use of food as a way to cope and enjoy pleasure has been associated with individual maladaptive responses and binge eating behaviors (Boggiano et al., 2017). Another important characteristic is age. Bilici et al. (2020) found that younger individuals report consuming more palatable foods and drinks compared to older individuals, especially to socialize, deal with negative feelings, improve positive experiences, and due to external pressures, with the aim of adapting to the environment. The authors suggest that the choice and preference of this young population to spend time in gastronomic establishments may be an important factor that leads them to eat for these reasons.

In Brazil, evidence has shown that women have greater craving behaviors (Queiroz de Medeiros et al., 2019) and greater consumption of food based on stress compared to men (Santos et al., 2022). Furthermore, younger individuals with higher BMI have also reported greater emotional eating (Martins et al., 2020), which can lead to increased consumption of palatable foods. Strengthening such evidence in different population contexts in Brazil has helped direct future actions in food and nutrition, such as measures to tax and control the consumption of sugary drinks and hyperpalatable foods.

In view of the above, this work was conducted with three objectives: 1. To adapt the PEMS to present a Portuguese version; 2. To evaluate psychometric properties of the PEMS for a sample of Brazilian young adults; 3. To verify the influence of individual characteristics (i.e., sex, age, and BMI) on reasons for consuming highly palatable foods/drinks. Our hypotheses were that the Portuguese version of the PEMS will be well understood by the participants, and when applied to the Brazilian sample, it will produce valid and reliable data of motivations for consumption of highly palatable foods and drinks. Finally, we hypothesized that women, younger individuals, and those with a higher BMI will present different motivations for the consumption of these foods and drinks compared to men, older individuals, and those with a lower BMI.

Methods

Study design and participants

This is a cross-sectional study with a non-probabilistic sample design. The minimum sample size was calculated considering the need for 5 to 10 respondents per parameter in the model to be estimated (Hair et al., 2018). The largest factorial model of the PEMS to be tested has 44 parameters, and three independent variables (sex, age, and BMI) were added to the structural model. With a possible loss rate of 10%, the minimum sample size calculated was from 262 to 523 participants to meet the statistical analyzes.

Individuals between 18 and 35 years old who were able to read and answer the research questions on their own and who agreed and signed the Free and Informed Consent Form were invited to participate in the study. The exclusion criteria adopted were pregnant or breastfeeding women and individuals with total visual impairment.

To characterize the sample, information about sex (male/female), age (years), body weight (kg), height (m), and economic level was collected. The calculation of BMI and the classification of anthropometric nutritional status were performed according to the World Health Organization guidelines (De Onis et al., 2007; Organization, 2020). The Brazilian Economic Classification Criterion (ABEP, 2020) for 2021 was used to estimate the economic level of the participants, who were divided according to the estimated average gross monthly income of the family (high = R\$ 25,554.33; medium: R\$ 8460.39; low = R\$ 2417.04; very low = R\$ 719.81; 1 US dollar was equal to R\$ 5.24 in March 2023).

Instrument

To identify the reasons why highly palatable foods and drinks are consumed, the original PEMS model (Burgess et al., 2014) revised by Boggiano (2016) was used. The instrument has twenty items distributed in four factors (Coping: items 1, 4, 6, 15, and 17; Enhancement: items 7, 9, 10, 13, and 18; Social: items 3, 5, 11, 14, and 16; and Conformity: items 2, 8, 12, 19, and 20). The response scale to the items is a 5-point Likert-type scale (1: never/almost never to 5: almost always/always). The Coping factor refers to the intake of these foods as a way of dealing with negative emotions. The Enhancement factor deals with the act of ingesting these foods to enhance positive situations or for the immediate pleasure inherent to the foods, without being related to social situations. The Social factor refers to eating these foods to be sociable, i.e., to enjoy a social event with friends and family. The Conformity

factor deals with the act of ingesting these foods to adapt/adjust to a certain group, i.e., due to external pressure. Burgess et al. (2014) evaluated the factor validity of the four-factor PEMS model and indicated the adequate validity and reliability of the instrument applied to a sample of American university students. In 2016, Boggiano also investigated the factorial validity of PEMS in a sample of American university students, and in the process of cultural adaptation, item 15 of the instrument was changed to “*I consume these foods/beverages because they help me to reduce stress.*” The revised version showed adequate fit to the sample. PEMS also has a version in Turkish (Ayşe et al., 2018), which, after an exploratory analysis, resulted in the allocation of item 5 (“*I consume these foods/drinks to be sociable*”) in the Conformity factor (in the original version this item is in the Social factor). Ayşe et al. (2018) found adequate psychometric properties for the Turkish version in the sample of young adults in Istanbul.

Cross-cultural adaptation

At this stage of the study, the semantic, idiomatic, conceptual, and cultural equivalences were analyzed following the protocol of Beaton et al. (2002). Initially, the English version of the instrument presented by Boggiano (2016) was independently translated into Portuguese by four Brazilian experts in the areas of Nutrition and Psychometry. The translated versions were compared by the authors of this work, and a single Portuguese version was prepared. This version was backtranslated by an independent professional, native English speaker and with knowledge of the Brazilian language and culture. The backtranslation was compared to the revised version and its equivalence was attested. However, cultural adaptations were still necessary, as some foods are typical of each country/region. The adaptations were: ‘scones’ for ‘*biscoito recheado*’; ‘chips’ for ‘*batata frita, salgadinho, salgado e biscoito*’; ‘raisins’ and ‘trail mix’ for ‘*mix de castanhas*’. ‘Peanut butter’, ‘fried okra’ and ‘fried green tomatoes’ were excluded because they are foods that are not traditional in Brazilian culture. In addition, ‘*leite com achocolatado*’ and ‘cappuccino’ were added among the drinks consumed. After analyzing all equivalences and changes made, the experts judged that the Portuguese version was culturally appropriate and captured the proposed concept. This version of the PEMS was then tested in a pilot study ($n = 32$; women = 78.1%; mean age = 27.9 years and standard deviation [SD] = 7.0 years). No participant reported difficulty in filling in and/or understanding; therefore, this version was considered ready for use. Table 1 shows the Portuguese version of the PEMS developed in the present study.

Table 1 Portuguese version (and English version proposed by Boggiano, 2016) of the Palatable Eating Motives Scale (PEMS) and descriptive analysis of the responses given by the participants to the items

Portuguese Version and Revised Version [#]	Me	Md	Mo	SD	Sk	Ku
1. Eu consumo estes alimentos/bebidas para esquecer as minhas preocupações (I consume these foods/drinks to forget my worries)	2.03	2	1	1.16	1.10	0.29
2. Eu consumo estes alimentos/bebidas porque meus amigos ou familiares querem que eu coma estes alimentos ou beba essas bebidas (I consume these foods/drinks because my friends or family want me to eat these foods or drink these drinks)	1.51	1	1	0.84	1.91	3.68
3. Eu consumo estes alimentos/bebidas porque me ajudam a desfrutar/aproveitar uma festa (I consume these foods/drinks because it helps me to enjoy a party)	2.64	2	2	1.22	0.37	-0.99
4. Eu consumo estes alimentos/bebidas porque me ajudam quando eu me sinto deprimido(a) ou nervoso(a) (I consume these foods/drinks because it helps me when I feel depressed or nervous)	2.31	2	1	1.32	0.71	-0.73
5. Eu consumo estes alimentos/bebidas para ser sociável (I consume these foods/drinks to be sociable)	1.79	1	1	1.02	1.28	0.91
6. Eu consumo estes alimentos/bebidas para me animar quando estou de mau humor (I consume these foods/drinks to cheer up when I am in a bad mood)	2.39	2	2	1.30	0.65	-0.76
7. Eu consumo estes alimentos/bebidas porque eu gosto da Sensação (I consume these foods/drinks because I like the feeling)	3.21	4	4	1.37	-0.19	-1.32
8. Eu consumo estes alimentos/bebidas para que os outros não me provoquem ou gozem de mim porque eu não como ou bebo estes alimentos/bebidas (I consume these foods/drinks so that others won't kid or tease me about not eating or drinking them)	1.14	1	1	0.51	4.50*	22.87*
9. Eu consumo estes alimentos/bebidas porque é excitante/emocionante (I consume these foods/drinks because it's exciting)	1.96	1	1	1.26	1.13	0.06
10. Eu consumo estes alimentos/bebidas para me sentir eufórico (a) (I consume these foods/drinks to get "high-like" or euphoric feelings)	1.45	1	1	0.91	2.20	4.30
11. Eu consumo estes alimentos/bebidas porque torna os encontros sociais mais divertidos (I consume these foods/drinks because it makes social gatherings more fun)	2.16	2	1	1.20	0.87	-0.24
12. Consumo estes alimentos/bebidas para me integrar num grupo que gosto (I consume these foods/drinks to fit in with a group I like)	1.55	1	1	0.97	1.95	3.18
13. Eu consumo estes alimentos/bebidas porque me fornecem uma sensação agradável (I consume these foods/drinks because it gives me a pleasant feeling)	3.00	3	2	1.36	0.03	-1.29
14. Eu consumo estes alimentos/bebidas porque eles melhoram as festas e as celebrações (I consume these foods/drinks because it improves parties and celebrations)	2.45	2	2	1.30	0.55	-0.92
15. Eu consumo estes alimentos/bebidas porque me ajudam a reduzir o estresse (I consume these foods/drinks because it helps to lower my stress)	2.44	2	1	1.36	0.57	-0.95
16. Eu consumo estes alimentos/bebidas para comemorar uma ocasião especial com meus amigos ou familiares (I consume these foods/drinks to celebrate a special occasion with friends or family)	3.11	3	2	1.26	0.00	-1.17
17. Eu consumo estes alimentos/bebidas para esquecer os meus problemas (I consume these foods/drinks to forget about my problems)	1.94	1	1	1.22	1.18	0.27
18. Eu consumo estes alimentos/bebidas porque é divertido (I consume these foods/drinks because it's fun)	2.21	2	1	1.29	0.80	-0.56
19. Eu consumo estes alimentos/bebidas para que os outros gostem de mim (I consume these foods/drinks to be liked by others)	1.10	1	1	0.45	5.24*	31.00*
20. Eu consumo estes alimentos/bebidas para não me sentir excluído(a) (I consume these food/drinks so I won't feel left out)	1.12	1	1	0.45	5.01*	30.43*

Response options for all items: 1=never/almost never, 2=sometimes, 3=half the time, 4=most of the time, 5=almost always/always. Me=mean, Md=median, Mo=mode, SD=standard deviation, Sk=skewness, Ku=kurtosis. The numbering of the items was preserved according to the original proposal. [#]Version revised by Boggiano composed of 4 factors: Coping (items: 1, 4, 6, 15, and 17), Enhancement (items: 7, 9, 10, 13 and 18), Social (items: 3, 5, 11, 14 and 16), Conformity (items: 2, 8, 12, 19, 20)

Ethical procedures and aspects

Technical-administrative employees, professors, and students from a public university in the state of São Paulo, Brazil, were invited to participate in the study (non-probabilistic convenience sample). Invitations were done through emails, social networks, and personal requests. Then,

snowball sampling was adopted, where participants indicated new individuals to participate in the research. Individuals who agreed to participate in the study completed, using pen and paper, a demographic questionnaire and the Portuguese version of the PEMS. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and were approved in June 2019 by the Human

Research Ethics Committee of a Faculty in Brazil (C.A.A.E.: 11469719.1.0000.5426). All participants read and signed the Free and Informed Consent Form.

Data analysis

Initially, descriptive statistics (mean, median, mode, standard deviation, skewness, and kurtosis) were performed to verify the distribution of responses given to the PEMS items. The absolute values of skewness and kurtosis were evaluated and considered adequate when less than 3 and 7, respectively, indicating adequate psychometric sensitivity of the items (Marôco, 2014). The original model (Burgess et al., 2014) and the Turkish model (Ayşe et al., 2018) of PEMS were investigated according to their validity and reliability for the present study sample. Factorial, convergent, and discriminant validities were performed to verify the construct validity. Confirmatory Factor Analysis (CFA) was performed with the robust Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator. Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) with 90% confidence interval (CI) and Standardized Root Mean Square Residual (SRMR) were the indexes employed (Hu & Bentler, 1999; Marôco, 2014). Model fit was considered acceptable if CFI and TLI ≥ 0.90 , RMSEA ≤ 0.10 and SRMR < 0.08 . The factor loading (λ) of each item was estimated and values ≥ 0.40 were adequate (Hair et al., 2018). Modification indices (MI), calculated from the Lagrange Multipliers (LM), were inspected, and when LM > 11 , potential adjustments were analyzed (Marôco, 2014).

Convergent validity was analyzed based on the average variance extracted (AVE), and values ≥ 0.50 were considered adequate (Fornell & Larcker, 1981; Hair et al., 2018; Marôco, 2014). The discriminant validity was estimated by correlational analysis between the PEMS factors (two by two). When the AVE values of both correlated factors were greater than the square of the correlation between them, the discriminant validity was determined (Fornell & Larcker, 1981; Marôco, 2014).

To verify the reliability of the PEMS factors, the ordinal coefficient alpha (α) and the coefficient omega (ω) of each were estimated (Dunn et al., 2014; Marôco, 2014). Values of α and $\omega \geq 0.70$ were considered adequate.

Furthermore, validity based on external measures was investigated. The correlation coefficient of the PEMS factors and the factor “Self-efficacy in Emotion- and Stress-Related Eating” of the Eating and Appraisal due to Emotion and Stress (EADES) Questionnaire were evaluated. EADES was used because it is an instrument that aims to assess the influence of emotions and stress on eating. The version used in the present study was previously adapted for the Brazilian population and was considered valid and

reliable for the sample (see Santos et al., 2022). Moreover, the authors of EADES indicated different factorial models adjusted for the female and male samples. Therefore, to compare between the instruments, the female and male PEMS samples were also separated (only for this analysis). To interpret the results, higher scores on PEMS factors indicate greater consumption of highly palatable foods and for the factor “Self-efficacy in Emotion- and Stress-Related Eating” indicate less self-efficacy and more emotional eating. We expect to find a significant correlation between the two instruments since they present a theoretical approximation.

An invariance test was performed – using the PEMS fitted factorial model – across sexes aiming to evaluate whether the operationalization of the instrument was equivalent (i.e., with similar theoretical meanings) between females and males. For that, the multigroup analysis was performed. The difference in CFI (Δ CFI) was verified among configural, metric, and scalar models comparing two by two. Strong invariance was attested when the reduction in CFI values was < -0.01 (Cheung & Rensvold, 2002).

Finally, a structural equation modeling was performed to estimate the influence of the independent variables: sex (1 = male; 2 = female), age (years), and BMI (kg/m^2) for each PEMS factor (dependent variables: Coping; Enhancement; Social; Conformity). For that, a hypothetically causal structural model was built, and the trajectories (β) were analyzed using the z-test. Adjustment of the models was verified from the values of the CFI, TLI, RMSEA, and SRMR indices as described above. A 5% significance level was adopted. Nonsignificant trajectories ($p < 0.05$) were eliminated from the final model (Marôco, 2014).

The analyzes were performed in the R program (R Core Team, 2019) with the packages ‘lavaan’ (Rosseel, 2012) and ‘semTools’ (Jorgensen et al., 2018).

Results

A total of 1045 individuals participated in the study; however, 14 (1.3%) did not respond to all PEMS items and were excluded from the analyses. Therefore, the final sample consisted of 1031 individuals (women = 61.6%) with a mean age of 25.5 (SD = 5.3) years. Most of the individuals had an adequate weight for their height and received the classification of medium economic level. Details about the characterization of the sample are in Table 2.

The descriptive statistics of the responses given to the PEMS items are in Table 1. Inappropriate values of skewness and/or kurtosis were observed in items 8, 19, and 20, indicating the lack of psychometric sensitivity, which could bias the analyzes; therefore, these items were excluded

Table 2 Sample characterization ($n = 1031$)

Feature	Sample	
	Female	Male
BMI (kg/m ²) mean ± standard deviation	25.34 ± 5.24	25.74 ± 5.29
Anthropometric nutritional status (%)		
Underweight	2.4	1.8
Normal weight	62.4	42.8
Overweight	25.2	40.8
Obesity	10.0	14.6
Economic level* (%)		
High	23.2	32.3
Medium	62.0	50.4
Low	14.4	17.3
Very low	0.4	–

BMI Body Mass Index, *Average monthly income: high=R\$ 25,554.33; medium: R\$ 8460.39; low=R\$ 2417.04; very low=R\$ 719.81. 1 US dollar was equal to R\$ 5.24 reais in March 2023

from the subsequent steps. For the factor loadings, all items presented adequate values, both for the original model ($\lambda = 0.55-0.92$) and for the Turkish model ($\lambda = 0.57-0.92$).

After exclusion of items 8, 19, and 20, both the original and Turkish models presented a good fit to the sample, but Turkish model achieved better indices (see Table 3 and Fig. 1). Convergent validity was considered adequate for all factors ($AVE > 0.50$). On the other hand, the discriminant validity was refuted between the factors Conformity and Social in the original ($AVE = 0.51/0.55$; $r^2 = 0.78$) and Turkish models ($AVE = 0.54/0.62$; $r^2 = 0.61$) and between the factors Enhancement and Social in the original model ($AVE = 0.63/0.55$; $r^2 = 0.60$). The other factors presented adequate discriminant validity. Except for the Conformity factor ($\alpha = 0.63$; $\omega = 0.59$) in the original model, all factors presented adequate reliability values in both models. For the validity based on external measures, all PEMS factors presented a significant correlation ($p < 0.001$) with the EADES factor named “Self-efficacy in Emotion- and Stress-Related Eating.” These results were observed for both the female sample ($r = 0.74$; 0.15) and the male sample ($r = 0.70$;

0.22). The highest correlations with this factor were found in the Coping and Enhancement factors (female sample: $r = 0.74$; 0.40 ; male sample: $r = -0.70$; 0.32), which confirms their theoretical construction. Finally, the Turkish fitted model showed a strong invariance across female and male groups (CFI values of the models: configural = 0.965 ; metric = 0.965 ; scalar = 0.967 ; $\Delta CFI < -0.01$), confirming equivalence among these groups.

Table 4 presents the results referring to the structural model considering the PEMS Turkish model fitted for the present study. Some trajectories were not significant ($p > 0.05$) and were excluded. Sex and age significantly influenced three of the four PEMS factors (Coping, Enhancement, and Social). Women and younger individuals indicated that they consume palatable foods and drinks more often due to Copying, Enhancement, and Social reasons compared to men and older adults. For BMI, individuals with higher BMI scored higher only for the Coping factor. The goodness-of-fit indices found in the final structural model were adequate (CFI = 0.97 ; TLI = 0.97 ; SRMR = 0.06 ; RMSEA = 0.068 [CI90% = $0.064-0.073$]).

Discussion

The present study carried out a cross-cultural adaptation of the PEMS into Portuguese, estimated the psychometric properties of the instrument for the sample of young Brazilian adults, and tested a structural model to verify the relationship between individual characteristics and the concepts evaluated by the instrument. The Portuguese version of PEMS produced valid and reliable data when using a Turkish factor model, which is configured differently from the original. Furthermore, we found that women, younger individuals, and those with a higher BMI consume highly palatable foods and drinks more frequently motivated by negative emotions, such as worries, problems, and stress than men, older individuals, and those with lower BMI. Women and younger individuals also indicated that they were more motivated to consume these foods and drinks for pleasure and to enhance a social experience. Our results collaborate

Table 3 Psychometric indicators of the Palatable Eating Motives Scale (PEMS) for a sample of Brazilian adults ($n = 1031$)

Model	λ	CFI	TLI	SRMR	RMSEA	IC90% RMSEA	AVE	α	ω
Original	0.57–0.96	0.95	0.94	0.11	0.094	0.090–0.098	0.55–0.77	0.85–0.94	0.78–0.86
Original Adjusted*	0.54–0.92	0.96	0.95	0.07	0.099	0.094–0.104	0.51–0.77	0.63–0.94	0.59–0.79
Turkish	0.60–0.92	0.96	0.95	0.10	0.084	0.080–0.089	0.61–0.77	0.85–0.94	0.79–0.86
Turkish Adjusted*	0.57–0.92	0.96	0.96	0.06	0.088	0.084–0.093	0.54–0.77	0.76–0.94	0.71–0.86

CFI Comparative Fit Index, TLI Tucker-Lewis Index, SRMR Standardized Root Mean Square Residual, RMSEA Root Mean Square Error of Approximation, 90%CI RMSEA 90% confidence interval, AVE average extracted variance, α ordinal alpha coefficient, ω omega coefficient. *without items 8, 19, and 20

Fig. 1 Factorial model of the Palatable Eating Motives Scale (PEMS) fitted for a Brazilian sample based on a model found in a Turkish context. Note. The Turkish model was produced by Ayşe et al. (2018) and is composed of 4 factors: Coping (items: 1, 4, 6, 15, and 17), Enhancement (items: 7, 9, 10, 13 and 18), Social (items: 3, 11, 14 and 16), Conformity (items: 2, 5, 8, 12, 19, 20). Items 8, 19, and 20 were excluded to present study, as they showed inappropriate values of skewness and/or kurtosis

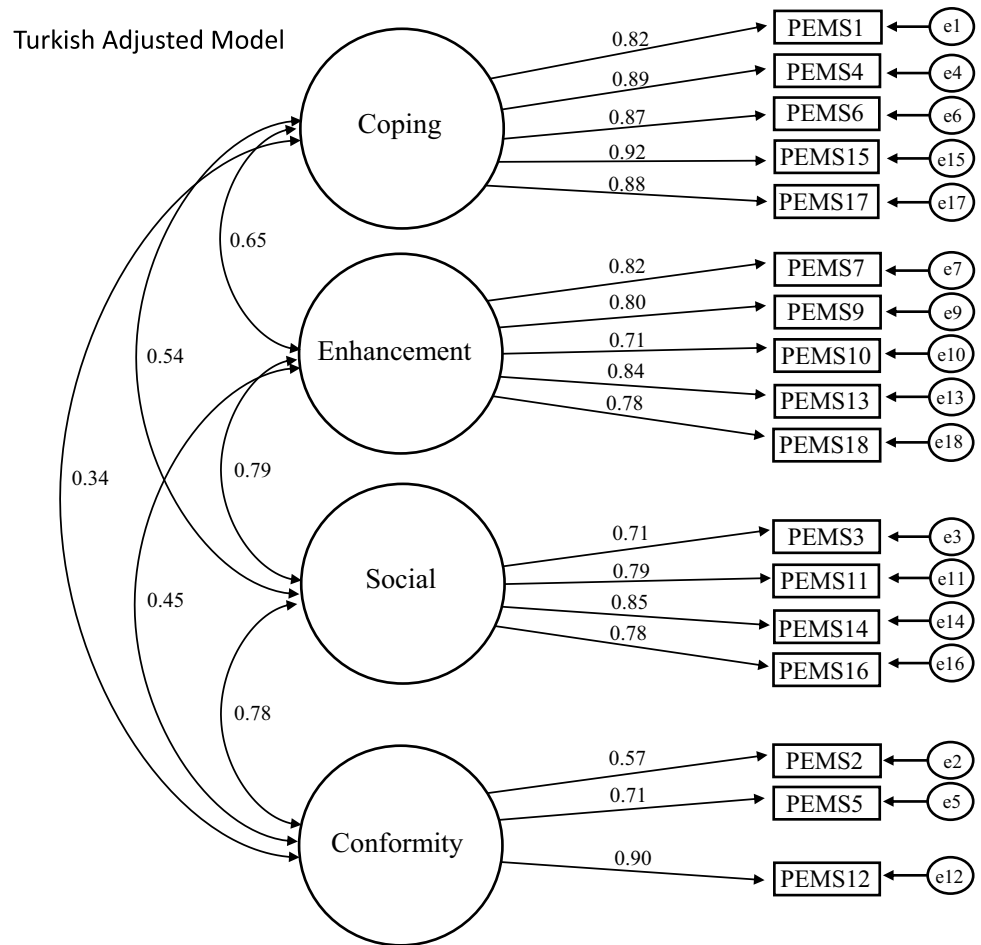


Table 4 Influence of demographic variables on reasons for consuming palatable food/drinks

Variable	Structural model					
	Initial			Final		
Independent → Dependent	β	SE	p	β	SE	p
Age → Coping	0.572	0.057	<0.001*	0.572	0.057	<0.001*
Age → Coping	-0.045	0.005	<0.001*	-0.045	0.005	<0.001*
BMI → Coping	0.255	0.038	<0.001*	0.255	0.038	<0.001*
Age → Enhancement	0.203	0.057	<0.001*	0.203	0.057	<0.001*
Age → Enhancement	-0.033	0.005	<0.001*	-0.033	0.005	<0.001*
BMI → Enhancement	0.067	0.038	0.082	-	-	-
Age → Social	0.118	0.052	0.023*	0.118	0.052	0.023*
Age → Social	-0.019	0.005	<0.001*	-0.019	0.005	<0.001*
BMI → Social	0.021	0.035	0.553	-	-	-
Age → Conformity	-0.035	0.046	0.442	-	-	-
Age → Conformity	-0.001	0.004	0.771	-	-	-
BMI → Conformity	0.009	0.031	0.771	-	-	-

β standardized estimate. SE standard error, *p < 0.05. The dependent variables represent the factors of the Palatable Eating Motives Scale (PEMS) factor model adjusted for the Brazilian sample

with future actions – especially in Brazilian contexts – to investigate and identify reasons that can lead individuals to consume palatable foods and drinks. The individual

characteristics found indicate the groups that are more vulnerable, which may guide professionals to formulate more assertive strategies and protocols.

In the process of evaluating the psychometric properties of the PEMS, among the twenty items of the instrument, three did not present adequate psychometric sensitivity. These items are part of the Conformity factor (i.e., ingesting palatable foods and drinks due to external pressure) and more than 90% of the participants answered that they “never/almost never” ingest these foods and drinks due to external pressure, which indicates that, for the Brazilian sample, the social pressure to eat this type of food does not seem to be important enough to generate sufficient concern for them to consume it. Our speculation about this finding is that currently consuming foods considered “healthy” (e.g., those low in calories and rich in nutrients) has become important in society and has been associated with health and “permitted” or “good” food, unlike palatable foods, which carry an image associated with “bad” or “forbidden” food. Thus, consuming palatable foods and drinks to fit into a group may seem contradictory in society, with pressure to consume foods considered “healthy” is more likely. This result emphasizes the importance of investigating the psychometric properties of PEMS in different populations, since culture can play an important role in consumption and dietary patterns (Gomez et al., 2019).

In the investigation of psychometric properties, the Turkish factor model obtained better fits to Brazilian data, in agreement with Ayşe et al. (2018) who claim that the content of item 5 (“*I consume these foods/drinks to be sociable*”) seems to better reflect the Conformity factor than the Social factor. Although the word “sociable” is present in the item, in our view, the term seems to be more related to the need to fit into the environment than to improve the experience of a social event. Ayşe et al. (2018) suggest that in some cultures, food plays an important social role and rejected food when offered could be considered impolite. Therefore, the item may be closer to the theory of the Conformity factor (Ayşe et al., 2018). In addition, the factor loading of this item was higher in the Turkish model, which strengthens the maintenance of this item in this factor. We also observed that convergent validity was adequate for all PEMS factors and discriminant validity was refuted for Conformity vs. Social. Boggiano et al. (2017) suggested that these factors tend to be correlated as they represent the motivation to consume food from external impulses. Although they deal with different concepts, both involve the socialization process, which may explain this finding. For the validity based on external measures, the results indicated a significant correlation between the PEMS factors and the EADES factor “Self-efficacy in Emotion- and Stress-Related Eating,” which suggests a theoretical approximation between the concepts in the instruments. Furthermore, we observed that the correlation was higher for the factors Coping and Enhancement of PEMS, which strengthens our theory that indicates that these factors refer to the consumption of food based on emotions, whether

they have a positive or negative valence. Burgess et al. (2014) also investigated the association between PEMS and instruments that assess eating behavior. The authors found a significant association between PEMS factors and binge eating scales (Binge Eating Scale–BES) and food addiction (Yale Food Addiction Scale–YFAS). The reliability of our results is indicated because they agree with those presented by Boggiano (2016) and Ayşe et al. (2018), indicating that PEMS factors are able to consistently measure motivations for palatable eating.

For the hypothetical model, we found that sex influenced three of the four factors evaluated by the PEMS. In our sample, women reported consuming palatable foods and drinks more frequently for Coping, Enhancement, and Social reasons than men. The literature contains evidence that women are more likely to use food in an attempt to deal with emotions and as a way of obtaining pleasure through food (Camilleri et al., 2014; Dietrich et al., 2014). Furthermore, in line with our findings, Boggiano (2016) reported that American women also had higher scores for the Coping factor (Boggiano, 2016). The results found can be supported by the fact that the choice and consumption of food is part of a social construction (Franchi, 2012), and considering that sex plays an important role in society (Gomez et al., 2019), it can exert a strong influence on the eating behavior of people. In this sense, the motivations for food consumption are expected to be variable in different cultures and populations, which reinforces the need to investigate different samples.

Younger individuals had higher scores for the factors Coping, Enhancement, and Social. These results corroborate those presented by Bilici et al. (2020) and Abdella et al. (2019), who report that age seems to be an important factor in individuals’ eating behavior. According to studies, emotional eating and craving for sweet foods are higher among younger individuals. Advancing age is accompanied by an increase in the ability to regulate emotions and in coping strategies (Abdella et al., 2019) that can help reduce eating behaviors aimed at self-regulation of emotions and life difficulties. Furthermore, we speculate that social events tend to decrease with advancing age; therefore, older individuals become less susceptible to consuming these foods and drinks for social reasons.

Our results indicated that BMI also seems to be an important variable for the Coping factor, as individuals with higher BMI use highly palatable foods and drinks as a resource to face emotions and situations considered negative, which agrees with the literature (Ayşe et al., 2018; Boggiano, 2016; Burgess et al., 2014). Reichenberger et al. (2018) report that studies have found a positive relationship between negative emotions and overeating, and they suggest that this relationship is associated with an inadequate way of coping with emotions and life difficulties. This result highlights the importance of identifying individuals who have such

behaviors to help promote alternative coping strategies to reduce the impact of emotions and situations considered negative on people's eating behavior. Furthermore, we encourage health professionals to broaden their views on the multiple factors that can influence individual food consumption so that they can promote more integrative nutritional interventions.

Limitations and strengths

Among the limitations of this study, we highlight that the non-probabilistic sample does not allow inferring cause-and-effect relationships, and the non-representative sample makes it unfeasible to generalize the results for all Brazil, which is a large country with different regions and cultures. Another limitation refers to the fact that the PEMS assesses the motivations for choosing and consuming highly palatable foods and drinks; however, the motivation may not lead to the actual consumption of food, and caution is required regarding the conclusions or hypotheses raised. Despite these limitations, we highlight the strengths of the study. Food is a complex process that can be guided by biological, sociocultural, and psychological factors; therefore, these must be considered when identifying and evaluating people's eating behavior. The PEMS is an interesting instrument for clinical and academic settings, as it allows the assessment of individual motivations to choose and eat palatable foods and drinks. The produced Portuguese version and the factor model indicated as the most adequate could be useful for future evaluations in the Brazilian context, allowing the comparison of data from this culture with others. The PEMS is a short instrument, which makes its use possible in environments such as those related to the assessment of people's physical and mental health, enabling comparisons and reflections aimed at the reasons presented for the consumption of palatable foods and drinks in different contexts and samples.

Conclusion

The Portuguese version of the PEMS was well understood by Brazilian adults and the data obtained were valid and reliable for the sample; thus, this instrument could be useful to assess the reasons for consuming highly palatable foods and drinks by individuals with characteristics similar to those of the sample studied. Women, younger individuals, and those with a higher BMI were characteristic groups that ate more highly palatable foods and drinks motivated by negative emotions, such as worries, problems, and stress, compared to men, older individuals, and those with a lower BMI. Furthermore, women and younger individuals were also more

motivated to consume these foods/drinks for pleasure and to improve a social experience compared to men and older individuals. The results of the present study can help future studies and clinical protocols aimed at developing a more targeted care plan to improve people's eating, thus producing healthy, balanced, sustainable eating patterns that are appropriate to the sociocultural context.

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Author contributions P.C.S, W.R.S, and J.A.D.N.C. participated in the conception and design of the study. All authors contributed to the analysis and interpretation of data. P.C.S. wrote the first version of the manuscript. W.R.S., J.M. and J.A.D.B.C revised the final version of the manuscript for publication.

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Data availability Anonymized data and analysis are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate The study was conducted according to the guidelines laid down in the Declaration of Helsinki and were approved in June 2019 by the Human Research Ethics Committee of a Faculty in Brazil (C.A.A.E.: 11469719.1.0000.5426). All participants read and signed the Free and Informed Consent Form.

Conflict of interest The authors have no conflict of interest to declare.

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