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Relationships Between Three Eating Behaviors and Nine Motives for Food Choices Among Brazilian Adults: A Structural Equation Model

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Abstract

We examined the relationships between three eating behaviors and nine motives underlying food choices made by Brazilian adults. Using participant responses to the short version of the Three-Factor Eating Questionnaire and the Food Choice Questionnaire, we investigated eating behaviors (cognitive restriction, uncontrolled eating, and emotional eating) and motives for food choices (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern). We used a structural equation model to test relationship pathways (β), with eating behaviors as independent variables and motives for food choices as dependent variables. Participants were 1297 individuals (69.5% female) with a mean age of 25.0 years (*SD* = 5.8). We confirmed the validity and reliability of the questionnaires in this sample. Restrictive eating behavior was significantly related to motives of health (β = .415),

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mood (β = .127), natural content (β = .364), weight control (β = .681), and ethical concern (β = .161). Emotional eating behavior was related to motives of mood (β = .277), health (β = −.137), and natural content (β = −.136). Uncontrolled eating behavior was related to motives of convenience (β = .226), sensory appeal (β = .121), price (β = .153), and familiarity (β = .090). We believe these findings can now help design future research and clinical interventions for managing people's risky eating behaviors and promoting beneficial food choices.

Keywords
eating behavior, food choice, motives, questionnaire, structural equation modeling, Brazil, adults, cognitive restriction, uncontrolled eating, emotional eating

Introduction

Eating behavior encompasses a broad array of activities related to eating (e.g., the physical and social context in which one eats, how often one eats, when one eats, and signs of abnormal eating). Studying eating behavior is challenged by many associated concepts and terminologies, including pre-ingestion of foods, cultural and societal considerations, personal experience, actual food intake, and post-ingestion factors. Reducing eating behavior only to *"what* is eaten*"* can promote only vague scientific understanding, leading to inconsistent comparative findings that fail to consider critical variables (Marijn Stok et al., 2018). As eating behavior is multidimensional, its proper study should include considerations of its complex dimensions (Alvarenga et al., 2021; Silva et al., 2018).

The assessment of eating behavior can be carried out in different ways, but the use of psychometric instruments has been a promising strategy, since these tools can track affective, cognitive, and/or behavioral aspects of eating (Alvarenga et al., 2021; Delormier et al., 2009). Among the different instruments developed to date, the following ones stand out: the Dutch Eating Behavior Questionnaire (DEBQ; (Van Strien et al., 1986), the Adult Eating Behavior Questionnaire (AEBQ; (Hunot et al., 2016), the Self-Regulation of Eating Behavior Questionnaire (SREBQ; (Kliemann et al., 2016), and the shortened version of the Three-Factor Eating Questionnaire (TFEQ-18; (Karlsson et al., 2000). Of these the TFEQ has been employed to investigate three eating behaviors: cognitive restraint (i.e., conscious control of food intake, often associated with low-calorie diets aimed at losing weight), emotional eating (i.e., a desire to eat in response to certain emotional triggers instead of innate biological hunger), and uncontrolled eating (i.e., difficulty in food regulation with excessive appetite, as well as external eating cues that trigger hunger cravings). Previous Brazilian studies (Martins et al., 2021a, Martins et al., 2021b; Silva et al., 2018) have supported the validity of the TFEQ-18 to investigate eating behaviors in different contexts.

A further concept that deserves attention in the context of eating behavior is food choice. Food choice has long been investigated, and it now has a consistent definition (Marijn Stok et al., 2018) as a complex process that mainly encompasses the stages of acquisition, preparation, and consumption of foods/beverages. This process can be influenced by intrinsic (e.g., taste and odor) and extrinsic (e.g., price and origin) characteristics of food, as well as factors related to a consumers' personal-states (e.g., health and mood) and group-state (e.g., culture and socioeconomic status). Food choice can occur in conscious and subconscious ways, as it is embedded in the wider activities of people's daily lives (Blake et al., 2021; Sobal et al., 2006).

Assessing food choice involves methods that address personal attitudes that occur before food reaches the mouth. Again, well developed and established psychometric instruments can be useful for this purpose, with such current examples as The Eating Motivation Survey (TEMS; (Renner et al., 2012), the Sustainable Food Choice Questionnaire (SUS-FCQ; Verain et al., 2021), and the Food Choice Questionnaire (FCQ; Steptoe et al., 1995). The FCQ is a classic instrument that is commonly used in many parts of the world (Cunha et al., 2018) to examine the relative importance of reasons thought to be important in food choices grouped into nine motives: health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern. The premise of this instrument is that there are motives that affect people's food choices, including, for example, sensory characteristics (e.g., appearance, taste, and smell), nutritional quality (e.g., amount of vitamins, minerals, protein, and fiber) and food functionality (e.g., to help promote health, to deal with stress, and to help with weight control).

According to Sobal et al. (2006) people construct their food choices in different ways, actively selecting what, when, where, with whom and how to eat. The relationship between food choice and food intake has been studied, with prior research showing that *what* is eaten is driven by food selection, which is a specific type of behavior (Kourouniotis et al., 2016; Souza et al., 2020). As eating behavior is multidimensional, each dimension can play a role in the different motives for food choice. For example, excessive food consumption may be related to the sensory characteristics of food, such as smell and taste (Kourouniotis et al., 2016), the practice of restrictive diets may lead to the selection of low-calorie foods (Zhang et al., 2021), and emotional triggers may explain how food choice can be a coping mechanism during times of stress, depression, or boredom (Canetti et al., 2002; Dressler & Smith, 2013). Analyzing how eating behaviors are related to food choice motives can help researchers and clinicians develop effective interventions to foster positive eating attitudes (Sob et al., 2023).

For a holistic understanding of a range of eating behavior determinants, connections between nutrition science and other fields of science (e.g., psychology, sociology, and behavioral economics) can be useful (Blake et al., 2021). In the health context, a goal of behavioral sciences has been to produce evidence of non-biological eating motives, including biopsychosocial-cultural influences. Similarly, past researchers have used techniques such as structural equation modeling for identifying relative strengths of

relationships between latent behaviors (i.e., behaviors not directly observed, but manifested from a set of self-reported intentional actions (Kline, 2016; Marôco, 2021). Using assessment instruments, such as the TFEQ-18 and FCQ, to build a structural model could elucidate the relative strengths of relationships between variables of eating behavior and those associated with food choice decision-making. To our knowledge, this structural analysis has not yet been conducted in a Brazilian context, and we expect it to provide useful insights for policymakers and health specialists designing education campaigns and clinical interventions to address maladaptive eating behaviors (Blake et al., 2021; Veiga et al., 2021).

We aimed, in this study, to examine the relationships between three eating behaviors and nine different motives underlying Brazilian's food choices. We hypothesized that cognitive restriction, emotional eating, and uncontrolled eating would be significantly related to food choice motives (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern). For example, we expected people who restrict their diets to place more importance on weight control when choosing foods, individuals who engage in emotional eating to place more importance on their mood when choosing foods, and people who cannot limit their food intake and have extreme sensitivity to external stimuli to place more importance on convenience when choosing foods.

Method

Study Design

In this cross-sectional study, we used quantitative data. We recruited enough participants for the number of observations per estimated parameter to reach a ratio of 10:1 (Hair et al., 2019). Since the model we chose to evaluate included 120 parameters (i.e., 21 TFEQ-18 + 72FCQ +27 pathways), we estimated a need for at least 1200 participants. Assuming an attrition rate of 5%, common in cross-sectional studies, we sought a sample size of at least 1264 participants (including individuals of both sexes, i.e., male and female) for adequate statistical power.

Participants

A total of 1297 participants completed the survey items (396 men, 901 women; *M*age = 25.0 years, *SD* = 5.8; 81.3% single, 17% married, 1.6% divorced, and .1% widowed). Most participants were students (49%) or had paid work (42.3%), and the others reported that they did not have an occupation (8.7%). Participants were mostly of middle economic status (52.6%, average household income in USD: $1498.21 – exchange rate in September 2023 was 1 USD = 4.86 BRL), followed by high status (27.5%, $4128.72), low status (19.1%, $461.82), and very low status (.8%, $156.52). The participants' average body mass index (BMI) was 24.3 kg/m^2 (*SD* = 4.7) and most

were of normal weight (61.3%), followed by some who were overweight (23.5%), obese (11.3%), and underweight (3.9%).

Individuals were initially recruited from a public university in the state of São Paulo in Brazil, and we then used the snowball technique to reach and recruit more participants. As the study was conducted before the COVID-19 pandemic, data were collected face-to-face. The inclusion criteria were being over 18 years old, literate, and able make personal decisions about what to eat. The exclusion criteria were women who were pregnant, breastfeeding, or had recently (within the last nine months) given birth, people suffering from blindness, and individuals who reported having a clinical condition that could affect their normal food intake. A questionnaire was previously administered to each prospective participant to determine their eligibility to participate in the study.

To recruit participants, four trained researchers promoted the study by word-of-mouth and through professional (e.g., email) and social (e.g., *Instagram*) networks. People interested in the study went to a designated place at the university, received detailed information about the study, and gave their signed written informed consent before participating. They completed all survey items, using paper-and-pencil, in approximately 10 minutes, during which time a researcher was continuously available to answer any queries. Data collection occurred between August 2018 and December 2019, and all individuals participated freely, without incentive or reward. Ethical procedures were followed in accordance with the Helsinki Declaration; and the study was approved by the Institutional Review Board (IRB) of the São Paulo State University (C.A.A.E.: 88600318.3.0000.5416). The study was conducted outside the United States. Our institution's IRB exempts studies for deidentified secondary data analysis.

Measures

Participants' Characteristics. We developed a questionnaire to elicit information of relevance about the participants: age, sex (male; female), marital status (single; married; divorced; widowed), occupation (none; student; paid work), weight and height. Participants self-reported their weight and height to allow a calculation of their BMI and to obtain their anthropometric nutritional status according to World Health Organization (WHO) guidelines. Self-reported weight and height are measurements commonly used in cross-sectional studies, as they are highly correlated with actual measurements (Davies et al., 2020). We also used items to classify participants' economic status according to the criteria of the Brazilian Market Research Association (ABEP, www.abep.org/criterio-brasil).

Three-Factor Eating Questionnaire (TFEQ-18). The TFEQ-18 was developed by Karlsson, et al. (2000) to investigate three dimensions (cognitive restriction, emotional eating, and uncontrolled eating) considered to be inherent to people's eating behavior. This instrument has 18 items (e.g., cognitive restraint: *"I deliberately take small helpings as*

a means of controlling my weight"; uncontrolled eating: *"I am always hungry enough to eat at any time"*; emotional eating: "*When I feel anxious, I find myself eating"*), which were completed by participants using a *Likert*-type response format with 17 items ranging from 1 (definitely false) to 4 points (definitely true) and 1 item ranging from 1 (no restraint in eating, i.e., eating whatever you want, whenever you want it) to 8 points (total restraint, i.e., constantly limiting food intake and never "giving in"). To see all TFEQ-18 response formats, see Table 1 in Martins et al. (2021b). Higher score (calculated for each dimension) suggests risky eating behavior. The participants completed the Brazilian Portuguese version of the TFEQ-18 (Martins et al., 2021b). Brazilian studies (Martins et al., 2021a, Martins et al., 2021b; Silva et al., 2018) have provided psychometric support for the TFEQ-18 (e.g., Comparative Fit Index and Tucker–Lewis Index >.93, Root Mean Square Error of Approximation <.08, factor loadings >.45, and ordinal alpha coefficients >.86).

Food Choice Questionnaire. The FCQ was developed by the Steptoe et al. (1995) to investigate perceived influences on people's food choices from nine distinct motives: health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern. The FCQ has 36 items, which were completed by participants using a 4-point *Likert*-type response format (1 = *not at all important*; 4 = *very important*). All items included the same initial statement: *"It is important to me that the food I eat on a typical day…"*, e.g., *"…comes from countries I approve of politically"; "…has the country of origin clearly marked"; "…is packaged in an environmentally friendly way"* (these are the three items of the ethical concern motive). Higher scores (calculated for each motive) suggest greater importance for the motive. The participants completed the Brazilian Portuguese version of the FCQ (Heitor et al., 2015). The FCQ has been used in different contexts (Markovina et al., 2015), with support from Brazilian studies (da Silva et al., 2022; Heitor et al., 2019) that have shown its adequate validity (e.g., Comparative Fit Index and Tucker–Lewis Index >.95, Root Mean Square Error of Approximation <.08, factor loadings >.65, and average variance extracted >.50) and reliability (e.g., test-retest reproducibility >.76; ordinal alpha coefficients >.85).

Data Analysis. There were no missing data, as the participants were instructed to complete all items on the questionnaires. We found values lower than 3 for

Table 1. Psychometric Indicators of the Three-Factor Eating Questionnaire-18 (TFEQ-18) and Food Choice Questionnaire (FCQ) for Sample.

Factorial model	RMSEA [90%CI]	CFI	TLI	λ	α	ω
TFEQ-18 (3 correlated factors)	.07 [.06–.07]	.96	.95	.53–.89	.84–.90	.79–.88
FCQ (9 correlated factors)	.06 [.06–.07]	.96	.96	.72–.94	.81–.93	.82–.93

Note. RMSEA [90% CI]: root mean square error of approximation with confidence interval of 90%, CFI: Comparative Fit Index, TLI: Tucker-Lewis Index, λ: factorial loading (interval), α: ordinal alpha coefficient (interval), ω: omega coefficient (interval).

skewness and 7 for kurtosis in our analysis of the answers given to the questionnaire items. There was no severe violation of data normality (Hair et al., 2019; Marôco, 2021). We verified the factorial validity and internal reliability of the questionnaires for our sample by testing the original factor model of the TFEQ-18 (3 correlated factors) and the FCQ (9 correlated factors) using Confirmatory Factor Analysis (CFA). As recommended by Anastasi (1988) and described by Marôco (2021), CFA is adequate for psychometric instruments with a theoretical model defined a priori. The Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator was used to compute the goodness-of-fit indices in CFA. The indices used were: Root Mean Square Error of Approximation (RMSEA <.08) with 90% confidence interval (90%CI), Comparative Fit Index (CFI >.95), and the Tucker-Lewis Index (TLI >.95), as these are the most employed (Kline, 2016; Marôco, 2021). The factor loadings of items of the questionnaires were analyzed, with values greater than .50 indicating adequacy. The reliability was evaluated using ordinal alpha (α) and omega (ω) coefficients, with values greater than .70 indicating adequacy (Gadermann et al., 2012; Zumbo et al., 2007). Furthermore, invariance tests for the factorial model of each instrument were performed across sex (female vs. male) and weight status (normal vs. overweight/obese) of the participants. We used multi-group analysis with CFI difference (ΔCFI) for this purpose. The results were evaluated by comparing CFI values of the configural (factor loadings), metric (thresholds), and scalar (residuals) models. A difference equal or lower than .01 in CFI represents a good indicator of factorial invariance, i.e., operational equivalence between groups (Cheung & Rensvold, 2002).

To assess the relationships between the eating behaviors and the motives underlying participants' food choices we built a structural model and tested it using structural equation modeling. In the structural model, we used the original factor model confirmed via CFA for each instrument. The independent variables were the TFEQ-18 factors (i.e., cognitive restriction, emotional eating, and uncontrolled eating), and the dependent variables were the FCQ factors (i.e., health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern). In the structural model, we included individual item loadings on the latent factor, rather than calculating the average of the items within each factor. Using the WLSMV estimator, the goodness-of-fit indices of the structural model were calculated and the values were analyzed with RMSEA <.08 and CFI and TLI >.95 indicating adequacy (Hair et al., 2019; Hu & Bentler, 1999). The estimates (β) were evaluated stepwise, first for all pathways (complete model). Each pathway was analyzed using the critical ratios of z and a statistical significance level of 5% (Marôco, 2021). Only significant β were kept in the final model – named refined.

Descriptive analyses were performed using the Statistical Package for the Social Sciences (SPSS, 27.0; IBM Corp, Armonk, NY) and we performed psychometric analysis using the MPLUS, version 8.3 (Muthén and Muthén, Los Angeles, CA, USA).

Results

Table 1 shows the indicators for the evaluation of psychometric properties of the TFEQ-18 and FCQ in this sample. The factorial validity of both instruments was confirmed by the goodness-of-fit indices found. The factor loadings were adequate as they were greater than .50. Furthermore, we found adequate reliability coefficients for both instruments. With regards to invariance, the factorial models of the instruments exhibited invariance across male and female (FCQ: CFI configural = .964, CFI metric = .964, CFI scalar = .963; ΔCFI metric – configural = 0, ΔCFI scalar – metric = −.001/ TFEQ-18: CFI configural = .918, CFI metric = .918, CFI scalar = .915; ΔCFI metric – configural = 0, ΔCFI scalar – metric = −.003) and across normal weight and overweight/obese (FCQ: CFI configural = .964, CFI metric = .964, CFI scalar = .964; ΔCFI metric – configural = 0, ΔCFI scalar – metric = 0/TFEQ-18: CFI configural = .920, metric = .918, scalar = .910; ΔCFI metric – configural = −.002, ΔCFI scalar – metric = −.008) guaranteeing that the dimensionality of the constructs is equivalent across groups.

Figure 1 shows the complete structural model built to examine the relationships between the eating behaviors and the motives underlying participants' food choices. In this model, some pathways were significant and others not. Cognitive restriction was not significantly related to motives of convenience, sensory appeal, and price. Emotional eating was not significantly related to motives of convenience, sensory appeal, price, weight control, familiarity, and ethical concern. Uncontrolled eating was not significantly related to motives of health, mood, natural content, weight control, and ethical concern. All these pathways were eliminated, and a refined model was obtained, which is presented in Figure 2.

Our findings revealed that the greater the cognitive restriction, the more foods were chosen for motives of health, mood, natural content, weight control, and ethical concern. We also observed that the greater the emotional eating, the more foods were chosen for motives of mood and less for health and natural content. Furthermore, we found that the greater the uncontrolled eating, the more foods were chosen for motives of convenience, sensory appeal, price, and familiarity.

Table 2 shows correlations between factors of each questionnaire. Most were significant, except between cognitive restriction and uncontrolled eating, which was expected according to the literature (Martins et al., 2021b). We also found correlations between TFEQ-18 and FCQ that were low and significant (ranging from −.114 to .198) and non-significant (ranging from −.079 to .062).

Discussion

While many researchers have investigated people's food intake to promote health, modifying dietary patterns has not been a simple task; it depends on understanding behaviors that govern food choices. Thus, we investigated the relationships between eating behaviors and motives underlying Brazilians' food choices. We found

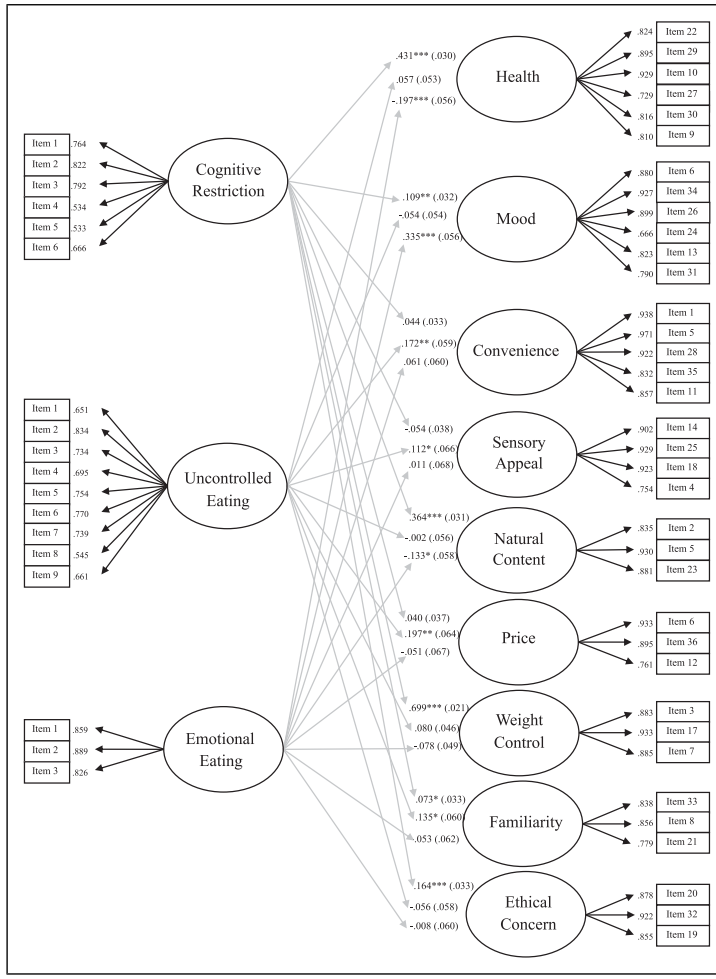

Figure 1. Relationships between Cognitive Restriction, Emotional Eating, and Uncontrolled Eating and Motives Underlying Brazilians' Food Choices (Complete Model).

Note. Goodness-of-fit indices of the complete model (all the pathways): Root Mean Square Error of Approximation = .046 (90% confidence interval = .044–.047), Comparative Fit Index = .963, Tucker-Lewis Index = .959. Cognitive constraint, uncontrolled eating, and emotional eating are the correlated dimensions of the Three-Factor Eating Questionnaire (TFEQ-18) and the numbering assigned to each item is as shown by Martins et al. (2021b). Health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern are the correlated motives of the Food Choice Questionnaire (FCQ) and the numbering assigned to each item is as shown by Heitor et al. (2015). Circles represent latent variable and rectangles manifest variable. Black arrows represent factor loading (λ) of the item (all $p < .05$). Gray arrows represent the standardized beta pathway and the value in parentheses is the standard error. ***$p < .001$, **$p < .01$, *$p < .05$.

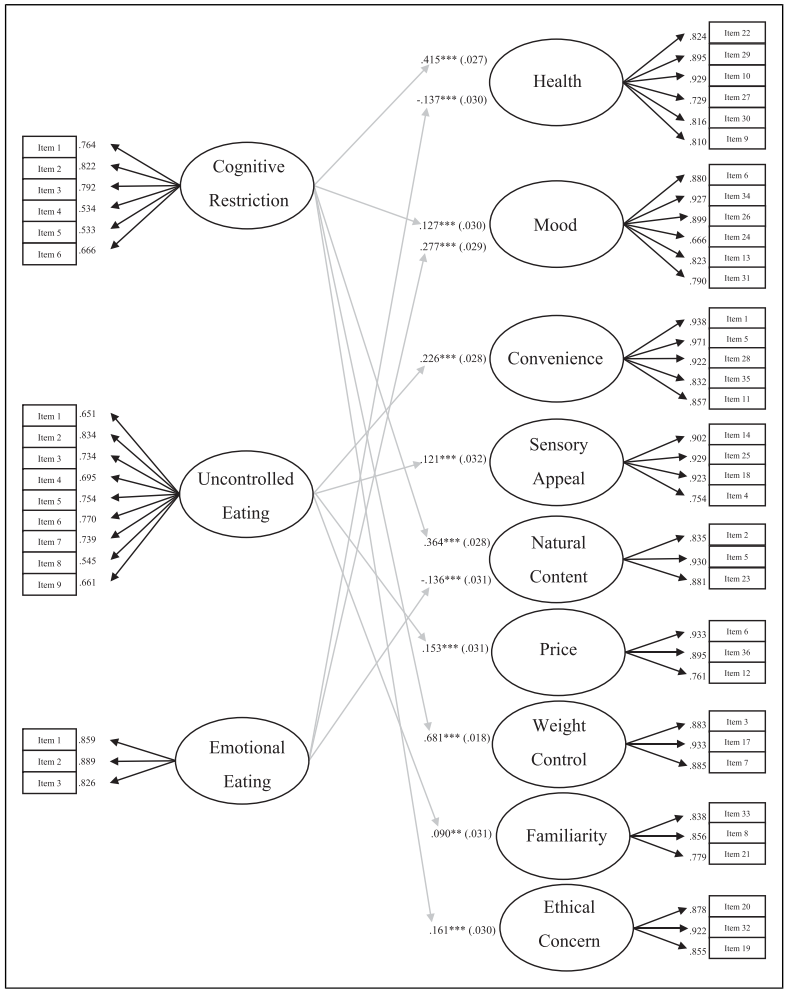

Figure 2. Relationships between Cognitive Restriction, Emotional Eating, and Uncontrolled Eating and Motives Underlying Brazilians' Food Choices (Refined Model).

Note. Goodness-of-fit indices of the refined model (only significant pathways): Root Mean Square Error of Approximation = .042 (90% confidence interval = .041–.044), Comparative Fit Index = .968, Tucker-Lewis Index = .966. Cognitive constraint, uncontrolled eating, and emotional eating are the correlated dimensions of the Three-Factor Eating Questionnaire (TFEQ-18) and the numbering assigned to each item is as shown by Martins et al. (2021b). Health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern are the correlated motives of the Food Choice Questionnaire (FCQ) and the numbering assigned to each item is as shown by Heitor et al. (2015). Circles represent latent variable and rectangles manifest variable. Black arrows represent factor loading (λ) of the item (all $p < .05$). Gray arrows represent the standardized beta pathway and the value in parentheses is the standard error. ***$p <$ .001, **$p < .01$.

Table 2. Correlation Matrix Between Instrument Factors of the Three-Factor Eating Questionnaire-18 (TFEQ-18) and Food Choice Questionnaire (FCQ).

TFEQ-18 factors	1	2	3	4	5	6	7	8	9	10	11	12
1. Cognitive restriction	1	**.161**	−.023	—	—	—	—	—	—	—	—	—
2. Emotional eating	—	1	**.751**	—	—	—	—	—	—	—	—	—
3. Uncontrolled eating	—	—	1	—	—	—	—	—	—	—	—	—
FCQ factors												
4. Health	**.395**	−.079	**−.106**	1	**.476**	**.134**	**.215**	**.653**	**.224**	**.509**	**.263**	**.473**
5. Mood	**.169**	**.313**	**.195**	—	1	**.258**	**.337**	**.355**	**.239**	**.372**	**.393**	**.428**
6. Convenience	.049	**.198**	**.217**	—	—	1	**.360**	**.097**	**.497**	**.269**	**.344**	**.154**
7. Sensory appeal	−.056	**.086**	**.121**	—	—	—	1	**.196**	**.342**	**.208**	**.410**	**.228**
8. Natural content	**.341**	**−.071**	**−.114**	—	—	—	—	1	**.265**	**.565**	**.282**	**.608**
9. Price	.024	**.104**	**.157**	—	—	—	—	—	1	**.429**	**.292**	**.243**
10. Weight control	**.683**	**.104**	−.003	—	—	—	—	—	—	1	**.502**	**.512**
11. Familiarity	.060	.062	**.093**	—	—	—	—	—	—	—	1	**.499**
12. Ethical concern	**.165**	−.022	**−.068**	—	—	—	—	—	—	—	—	1

Note. Values in bold are significant ($p < .05$).

that different motives for food choice were related to eating behaviors of restriction, emotion, and/or lack of control. For this reason, investing solely in changing food intake to promote health and well-being does not seem to be an optimal strategy. As many different factors influence food intake, a more complex analysis is necessary.

Our results showed that, when making food choices, greater cognitive restriction was associated with higher importance attributed to motives of health and natural content. This relationship was also found in earlier literature (GBD 2017 Diet Collaborators, 2019), e.g., restricting ultra-processed foods to reduce the risk of chronic non-communicable diseases (Canella et al., 2014). However, abrupt restrictions and choices based only on the nutritional components of food may not guarantee health (Jacquier et al., 2012). Zhang et al. (2021) reported that suppression of food thoughts in restrained eaters increases their choice of unhealthy foods. Food can impact people's health (GBD 2017 Diet Collaborators, 2019), but it represents sociocultural identity (Dai et al., 2022; Jones, 2007; Steptoe et al., 1995). Thus, proper diets can be encouraged, but inflexible and obsessive behaviors should not be encouraged, as these can cause psychosocial difficulties.

Additionally, when choosing foods, we found that participants who presented emotional eating behavior placed less importance on motives of health and natural content. In general, both negative and positive emotions may be associated with highly palatable foods (e.g., high-carbohydrate and high-fat meals), and this helps explain others' findings of lower importance for health and natural content in the participants' food choices (AlAmmar et al., 2020; Turner et al., 2010). Negative emotions often influence food choice and increase intake of foods with attractive sensory characteristics (e.g., ice cream) to reduce emotional discomfort. However, this is not a hard and fast rule, as negative emotions can also lead to reducing intake (e.g., reducing coffee to help alleviate symptoms of agitation) or obtaining functional effects from foods (e.g., high-tryptophan foods to help alleviate depression symptoms). For positive emotions, people may display self-regulation when eating, but, in some cases, they may choose to consume specific foods (e.g., cake) as a reward to increase the intensity of the positive feeling (AlAmmar et al., 2020; Canetti et al., 2002; Gibson, 2006; Macht, 2008). While anyone can experience emotional eating at some point, it should not become a frequent behavior. To help people improve nutrition, clinical help may be needed to better manage emotions.

Participants who presented behaviors of cognitive restriction *and* emotional eating placed greater importance on mood when choosing foods. Shen et al. (2020) corroborated these findings in an American sample, when they found that emotional eating mediated associations between perceived stress and food choice based on mood. Mantau et al. (2018) found, in a European sample, that restrained eaters engaged in emotional eating; and, when they were in a negative mood state, they chose supposedly unhealthy foods. This finding is in line with our results and suggests that restrictive and emotional eating behavior can occur simultaneously and can influence people's food choice based on mood state. Thus, restrained eaters should seek support in learning to

regulate their emotions (e.g., mindfulness training) and will need to control their impulses during food acquisition so that mood is not a strong food choice determinant.

As expected, we found that participants who presented restrictive eating behavior placed greater importance on weight control when choosing foods. This finding is also supported by other literature, as clinical interventions have helped reduce energy consumption to promote weight loss (Clarke & Best, 2017, 2019; Jallinoja et al., 2014; Wardle et al., 2004). However, this finding should be interpreted with caution. While reducing energy consumption and increasing caloric expenditure promotes good health status results (Green et al., 2022; Schaumberg et al., 2016), this approach is potentially harmful if people adopt restricted, extreme, and obsessive behaviors that become clinically significant from the standpoint of physical and mental disorders (Dulloo & Montani, 2015; Jacquet et al., 2020). Much has been written about healthy eating and optimal weight, but the overvaluation of aesthetic standards and healthiness has contributed to alterations in eating behaviors (Dos Santos Quaresma et al., 2021; Kristjansdottir et al., 2019) that may neglect important other life goals such as physical and social well-being (Delormier et al., 2009). It is important that people adopt adaptive eating behaviors that are not entirely defined by a normal weight-to-height ratio.

The association between cognitive restriction and ethical concerns when choosing food might be seen as a secondary outcome related to the type of food consumption, with some types rendering greater global appeal for the production of sustainable healthy diets (Alsaffar, 2016; Biasini et al., 2021; Blake et al., 2021; Perignon et al., 2017; United Nations, 2015). Our cognitively restricted participants tended to endorse item 19 of the FCQ ("*Is packaged in an environmentally friendly way"*). Restrictive eaters generally chose unprocessed or minimally processed foods that produce less solid waste that is widely known to harm the environment. Another example is based on the content of items 20 (*"Comes from countries I approve of politically"*) and 32 (*"Has the country of origin clearly marked"*) of the FCQ, linking restrictive eating behavior to more selective concern with food-related political issues (Clarke & Best, 2017). Ethical concern has been found to be the least important motive when compared to other motives for choosing food (Cunha et al., 2018; Veiga et al., 2021), perhaps highlighting a need for greater societal awareness of production and disposal of food packaging. Of note, the items included in the FCQ to assess these ethical concerns do not address all of the possible content that may be important in this dimension, such as animal welfare (Lindeman & Vaananen, 2000).

Regarding uncontrolled eating, we observed that the higher the frequency of this behavior, the more importance the participants placed, when choosing foods, on convenience. While this might be interpreted as practically related to people's contemporary lifestyles, in which there is insufficient perceived time for purchasing and preparing foods, (Garcia et al., 2010) which may negatively affect the nutritional quality of the diet, another interpretation is that food selection is simply based on attempts to eat something that is not boring (Moynihan et al., 2015), perhaps with the same diminished nutritional quality. This finding might also elucidate the significant relationship between greater uncontrolled eating and the greater importance of

familiarity when making food choices. Uncontrolled eaters may prefer foods that they already know and are perceived as exciting or tastier (Bryant et al., 2019; Masterson et al., 2019). To intervene, it is important to encourage people to set aside time for purchasing ingredients, preparing meals at home, and increasing the availability of foods that promote health, such as fresh fruits, nuts, and whole-grain breads.

We observed that the higher the frequency of uncontrolled eating behavior, the more importance the participants placed, when choosing foods, on sensory appeal and price. When a food has attractive sensory characteristics (e.g., good taste), uncontrolled eaters may have difficulty avoiding it, and this may contribute to poor diet quality (Kourouniotis et al., 2016) and disordered eating. Our findings corroborate the results of Turner et al. (2010) who found that uncontrolled eating is related to mood-evoking stimuli, and this may lead to increased consumption of palatable foods. The consumption of foods with such characteristics is increasing all over the world, including in Brazil. Programs focusing on self-regulation and conscious control (e.g., encompassing mindful eating) may be needed to manage uncontrolled eating.

Our discovery of a relationship between greater uncontrolled eating and greater importance of price did not support our initial hypothesis that uncontrolled eaters would attach less importance to price when choosing foods. Prior research has shown that low-income consumers place more importance on price when selecting foods (Blake et al., 2021; Puddephatt et al., 2020; Steenhuis et al., 2011). But, in our study, most participants were of a middle socioeconomic class, and income may not have influenced our results as much as in these prior studies.

Limitations and Directions for Further Research

Our cross-sectional design limited our ability to make cause-and-effect inferences from these data. Also, although our sample was large, it was not fully representative of the Brazilian population. It included more female than male participants, and there were predominantly literate individuals. Future investigators might take precautions to study a more representative group, and there would be value in comparing different groups to better understand how males and females or participants of different social classes might compare to one another in these associations. Of course, there are other eating behaviors (e.g., intuitive eating) and other motives for food choices (e.g., pleasure) that might also be studied in future research as well.

Implications for Research and Practice

As seen, more attention should be paid to emotional, restrictive, and uncontrolled eaters, as their food choices can be related to different motives, all of which reflect on food intake. In general, we found varied associations between all the motives underlying food choices that we investigated and the specific eating behaviors we studied. These findings may guide future research, and health professionals and policymakers might be able to apply different interventions for improving food selection when these

interventions are better directed towards the combination of eating behaviors and food choice motives that are most closely associated. The particular eating behaviors and motives we studied were heavily influenced by the strong psychometric properties of the questionnaires we used (i.e., TFEQ-18 and FCQ), and these choices are more apt to produce accurate and useful results than would be the case with weaker assessment techniques. Structural equation modeling best maintained the latent nature of the variables, as it considered each item's factor loading, allowing a more accurate estimate of the factor variance than computing an average score. We believe that this methodological strategy and our large participant sample were study strengths.

Conclusion

The eating behaviors we studied were significantly related to motives underlying participants' food choices. The eating behavior of cognitive restriction was positively related to food chosen on the basis of motives of health, mood, natural content, weight control, and ethical concerns. Emotional eating behavior was positively related to food choices based on the motive of mood, and this association was negative for motives of health and natural content. Finally, uncontrolled eating behavior was positively related to food choices based on motives of convenience, sensory appeal, price, and familiarity. Researchers and clinicians can use the findings of this study to develop educational and interventional strategies aimed at modifying specific maladaptive eating behaviors that contribute to a more conscious food choice and a better-tailored food intake.

Author Contributions

Wanderson R. Silva collected the data, performed the statistical analysis, and wrote the first draft of the article. Eric B. Ferreira contributed to the critical review of the article and data analysis. Sinézio I. da Silva Júnior revised the first version of the article and updated the literature review. Micaela A. Teodoro contributed to the revision of the first version of the article and formatting of the manuscript for submission to the journal. João Marôco and Juliana A. D. B. Campos contributed to the conception and design of the study and critical review of the article. All authors have approved the final version of the manuscript and agree to be responsible for ensuring issues related to the accuracy or integrity of any part of the work.

Declaration of Conflicting Interests

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Ethical Statement

Ethical Approval

The study was approved by the Institutional Review Board (IRB) of the São Paulo State University (C.A.A.E.:88600318.3.0000.5416). The study was conducted outside the United States. Our institution's IRB exempts studies for deidentified secondary data analysis.

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