Comportamento de *craving* por alimentos em população brasileira

Tese apresentada à Universidade Federal do Rio Grande do Norte, para obtenção do título de Doutor em Psicobiologia.

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Agatha Christie, em Autobiografia, 1977 (p.204).
RESUMO

O craving por alimentos pode ser definido como um desejo intenso de comer um tipo de alimento em particular. Trata-se de um comportamento bastante comum na população em geral. O presente trabalho se propôs a investigar o comportamento de craving por alimentos em população brasileira, validando questionários para este fim, além de pesquisar a relação do craving por alimentos com o estado de cromo no organismo. Como resultado, foi realizada a tradução, adaptação cultural e validação dos Food Cravings Questionnaire (State e Trait), da versão reduzida do dos Food Cravings Questionnaire-Trait e do Attitudes to Chocolate Questionnaire (ACQ), além do desenvolvimento e validação da versão brasileira do Food Craving Inventory. Foram identificadas influências do estágio de vida, sexo, adiposidade corporal e restrição dietética na ocorrência do craving por alimentos. Também foi encontrado que os indivíduos com níveis mais baixos de cromo plasmático apresentam maior craving por alimentos doces, o que foi concomitante a maior frequência de consumo deste tipo de comida e maior adiposidade corporal. Tomados em conjunto, esses resultados ajudam a traçar um amplo panorama sobre o comportamento de craving por alimentos e lançam fundamentos e indagações que motivam a condução de mais estudos sobre o assunto, buscando compreender melhor a questão e suas possíveis implicações clínicas.

Palavras-Chave: craving por alimentos; comportamento alimentar; validação; cromo; adiposidade; padrão alimentar.
ABSTRACT

Food craving can be defined as an intense desire to eat one type of food in particular. This is a fairly common behavior in the general population. This study aimed to investigate the behavior of craving for food in the Brazilian population, validating questionnaires for this purpose, in addition to searching the craving for food compared with chromium status in the body. As a result, we performed the translation, cultural adaptation and validation of the Food Cravings Questionnaire (State and Trait), and of the reduced version of dos Food Cravings Questionnaire-Trait and Attitudes to Chocolate Questionnaire (ACQ), and we also developed and validated the Brazilian version of the Food Craving Inventory. We identified influences of life stage, sex, body fatness and dietary restriction in the occurrence of food cravings. It was also found that individuals with lower levels of plasmatic chromium have increased craving for sweet foods, which was concomitant with increased frequency of consumption of such food and increased adiposity. Taken together, our results help to trace a broad overview on the craving behavior for food and cast foundations and questions that motivate to conduct more studies on the subject, seeking to better understand the issue and its possible clinical implications.

Key words: food cravings; eating behavior; validation; chromium; adiposity; dietary pattern.
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CONSIDERAÇÕES INICIAIS

A presente tese de doutorado está estruturada em sessões, em concordância com as normas do Programa de Pós-Graduação em Psicobiologia (PPgPsicbio) da Universidade Federal do Rio Grande do Norte.

A *Introdução geral* apresenta as principais características do comportamento de *eating* por alimentos, com ênfase nos aspectos investigados no presente trabalho, cujos objetivos gerais estão descritos na sessão *Objetivos*, bem como os artigos derivados de cada um deles.

Na sessão *Métodos* é feito um delineamento breve dos três estudos dos quais derivaram os resultados apresentados nesta tese.

A sessão *Artigos* foi escrita em língua inglesa e estruturada em subseções, majoritariamente formatadas de acordo com as normas das revistas a que serão submetidos os estudos ora apresentados. No entanto, para melhor compreensão, ainda que as normas dos periódicos dispusessem em contrário, as figuras e tabelas foram inseridas dentro do texto. O tamanho da fonte e espaçamento foram uniformizados de acordo a padronização do PPgPsicbio. A primeira metade dos artigos diz respeito, principalmente, ao desenvolvimento e/ou validação de instrumentos para avaliação de *eating* por alimentos no Brasil. Na segunda metade dos artigos o foco é a exploração das características deste comportamento na população brasileira.

A *Conclusão geral* sumariza de forma integrada as ideias e conclusões apresentadas nos artigos desenvolvidos neste trabalho. Nas *Referências* são listadas as referências utilizadas nas sessões de *Introdução geral, Métodos e Conclusão geral*. Por fim, está a sessão de *Apêndices e Anexos* nas qual, entre outras coisas, foram incluídos os instrumentos utilizados para avaliação do comportamento de *eating* por alimentos.
1 - INTRODUÇÃO GERAL
O craving por alimentos pode ser definido como um desejo intenso de comer um alimento ou grupo de alimentos em particular (Preedy, Watson, & Martin, 2011), o que é geralmente associado a expectativas positivas e engloba não apenas o desejo per se, mas também a intenção de realizá-lo (Araujo, Oliveira, Pedroso, Miguel, & Castro, 2008).

Trata-se portanto de um comportamento diferente da fome, tanto porque pode ocorrer mesmo em face a saciedade fisiológica quanto porque o desejo remete a uma memória ou padrão sensorial em particular (Marcia Levin Pelchat, Johnson, Chan, Valdez, & Ragland, 2004). Assim, podemos dizer que o craving por alimentos pode influenciar na quantidade e diversidade alimentar habitualmente consumida.

Apesar de ser relativamente comum na população, particularmente entre adultos jovens, não se sabe ao certo a etiologia do comportamento de craving por alimentos, embora seja sugerida uma etiologia multifatorial e maior prevalência em mulheres (100%) do que em homens (70%) (Hornes, Orloff, & Timko, 2014; Pelchat, 2002). Acredita-se que essa maior incidência entre o sexo feminino se deva, em parte, às alterações fisiológicas relativas ao ciclo menstrual (Hornes & Timko, 2011). Assim, de modo geral, é reportado um maior craving por chocolate e alimentos doces durante a fase lútea, independentemente do status ovulatório (Gorczyca et al., 2015).

Essa avaliação do comportamento de craving por alimentos geralmente é realizada por meio de questionários, que adotam principalmente duas vertentes: a avaliação do craving em geral ou direcionado para grupos específicos de alimentos.

São exemplos da primeira vertente o “Food Cravings Questionnaire–State (FCQ-S)” e o “Food Cravings Questionnaire–Trait (FCQ-T)”, foram desenvolvidos por Cepeda-Benito, Gleaves, Williams e Erath (2000) e buscam mensurar o craving por alimentos enquanto um construto multidimensional. Estes são, muito provavelmente, os instrumento mais utilizados para avaliar o craving por alimentos, embora suas estruturas não tenham se mantido constantes em muitas das adaptações para outros países (Innamorati et al., 2015; Meule & Kübler, 2012; Nijs, Franken, & Muris, 2007; Rodríguez-Martín & Molerio-Pérez, 2014). No entanto, uma grande vantagem
desses instrumentos é que permitem uma avaliação do craving por alimentos tanto como um estado psicológico transitório, em resposta a uma situação específica, como também enquanto um traço mais estável (Moreno, Rodríguez, Fernandez, Tamez, & Cepeda-Benito, 2008).

Um instrumento emblemático da segunda vertente é o Food Craving Inventory (FCI) (White & Grilo, 2005). Esse instrumento busca investigar a frequência de episódios de craving por alimentos em relação ao último mês transcorrido. Nos Estados Unidos e Inglaterra os alimentos que integram o instrumento estão agrupados em quatro categorias: ricos em gordura; muito doces; ricos em amido/carboidratos; fast foods gordurosos (Nicholls & Hulbert-Williams, 2013; White & Grilo, 2005). No entanto, diferenças marcantes foram encontradas entre inventários de países de língua inglesa e não inglesa (Lobera, Bolanos, Carbonero, & Blanco, 2010; Yen et al., 2010), e na própria magnitude da reação a um dado alimento (Osman & Sobal, 2006). As diferenças dizem respeito não apenas ao repertório de alimentos presente em cada categoria, bem como a própria definição das categorias, que parece variar, entre outras coisas, em virtude do hábito alimentar regional. Sobre isto, um exemplo bastante emblemático é a versão japonesa do FCI (Komatsu, 2008), estruturada em cinco categorias (Doces, Lanches, Comida Ocidental, Arroz e Sushi) bastante diferentes do instrumento original.

Apesar das limitações de cada método e na própria comparabilidade entre os diferentes países, esses questionários são uma estratégia valiosa no sentido de permitirem uma avaliação menos enviesada do craving por alimentos, permitindo identificar padrões e características associadas a ocorrência deste comportamento.

Por exemplo, é identificado um aumento na frequência e/ou intensidade de episódios de craving por alimentos quando da ocorrência de estados de humor negativos, como ansiedade, estresse e tristeza (Preedy et al., 2011). Nesses casos, o craving por alimentos pode estar associado ao comportamento de “comer emocional”, definido como o hábito de ingerir alimentos como uma tentativa de “aliviar” estados de humor depressivos e/ou tristes (Ventura, Santander, Torres, & Contreras, 2014). Inclusive, vem sendo sugerido que o aumento no craving por alimentos pode
ser um importante fator a ser observado no sentido de auxiliar no diagnóstico de pacientes com depressão atípica (Parker & Crawford, 2007).

Nos países de cultura ocidental, em sua maioria, os alimentos envolvidos no comportamento de craving são considerados altamente palatáveis, sendo energeticamente densos e ricos em gorduras e açúcares (De Jong, Vanderschuren, & Adan, 2012). Como o consumo deste tipo de alimento está intimamente ligado com a obesidade, um dos maiores problemas de saúde pública dos dias atuais, vem sendo suscitados questionamentos sobre qual seria o papel e relevância do craving por alimentos, neste cenário (Potenza & Grilo, 2014).

A constante exposição a pistas e contextos ambientais, que remetam ao consumo desses alimentos ricos em gorduras e açúcares, é outro fator que parece influenciar no aumento e intensidade de episódios de craving (Pla-Sanjuanelo et al., 2015), mesmo que os resultados variem de acordo com a duração e tipo de estímulo, e população investigados (Rodríguez-Martín & Meule, 2015). Sugere-se então que os alimentos altamente palatáveis induziriam a ativação de circuitos cerebrais envolvidos no sistema de recompensa, incluindo aumento da ativação psicomotora, num processo de neuroadaptação similar à exposição a drogas. Em longo prazo, isto poderia levar ao aparecimento de sinais de ansiedade e alterações de humor quando na ausência destes alimentos, embora essa não seja uma hipótese consensual (Havermans, 2011; Olszewski, Alsiö, Schiöth, & Levine, 2011). Um dos alimentos mais estudados em relação a esse processo é o chocolate, considerado o alimento "campeão" em episódios de craving por alimentos (Van Gucht, Soetens, Raes, & Griffith, 2014).

Também é relatado um aumento na frequência e intensidade com a qual os cravings acontecem quando da realização de restrições alimentares (Massey & Hill, 2012), ou em virtude de dietas extremamente monótonas (Marcia Levin Pelchat et al., 2004). Nestes dois casos, a própria condição “fazer dieta” ou “dieta monótona” é que parece aumentar a frequência dos cravings, sendo sugerido que a superação desse comportamento pode se relacionar com o sucesso de estratégias visando a perda ou manutenção de peso corporal (Hooper, Sandoz, Ashton, Clarke,
& McHugh, 2012). Também tem sido sugerido que as repetidas tentativas fracassadas de resistir ao craving por alimentos podem ser cruciais para a instauração de episódios de comer compulsivo e bulimia (Hormes et al., 2014; Meule, 2011; Van den Eynde et al., 2012); e ao maior consumo de lanches e/ou petiscos menos saudáveis (Marcia Levin Pelchat, 2009).

Em contrapartida, é observada uma diminuição nos episódios de craving por alimentos, em indivíduos sob acompanhamento nutricional para perda de peso, durante pelo menos seis meses (Anton et al., 2012; Gilhooly et al., 2007), bem como em pacientes submetidos a cirurgia bariátrica (Crowley et al., 2012; Cushing et al., 2015). Assim, embora inicialmente seja registrado um aumento no craving por alimentos em indivíduos que estão "fazendo dieta", em longo prazo há uma tendência a que haja uma diminuição nesse comportamento.

Uma diminuição no craving por alimentos também é identificada em resposta à suplementação com cromo (McLeod & Golden, 2000). Um dos principais trabalhos sobre o tema (Anton et al., 2008) investigou o efeito da suplementação com picolinato de cromo (1000 mcg/dia durante 8 semanas) em alguns aspectos do comportamento alimentar, incluindo o craving, em mulheres. Ao fim da intervenção, foi verificada uma diminuição no craving por alimentos ricos em gordura, carboidratos e açúcares.

O cromo é um mineral traço que atua no metabolismo de carboidratos, possivelmente participando da atividade do receptor/pós-receptor de insulina, melhorando o transporte de glicose na célula e aumentando a atividade dos transportadores tipo GLUT4, sensíveis à insulina. Sugere-se também uma possível atuação do cromo na estabilização da molécula da insulina, modificando sua ligação ao receptor celular. Alterações no estado de cromo, no organismo, podem levar a alterações no metabolismo da glicose no organismo, particularmente em relação à insulina e quadros hiperinsulinêmicos (Wiernsperger & Rapin, 2010). Nesta perspectiva, também é identificado um aumento no craving por alimentos em presença de alterações na sensibilidade à insulina, como no caso do diabetes (Preedy et al., 2011; Strachan, Ewing, Frier, Harper, & Deary, 2004) e da síndrome do ovário policístico (Farshchi, Rane, Love, & Kennedy, 2007).
No entanto, ainda não é possível definir a partir de que patamar o craving por alimentos deve ser classificado como excessivo ou configurar-se como um sinal de alerta, inclusive, porque o próprio significado fisiológico do craving por alimentos ainda permanece obscuro (Drewnowski & Bellisle, 2007). No entanto, reconhecidamente, o craving por alimentos é um importante componente do comer excessivo e de transtornos alimentares relativos a comportamentos aditivos, como bulimia e episódios de transtorno de compulsão alimentar periódica (Joyner, Gearhardt, & White, 2015).

Assim, embora o craving por alimentos seja bastante prevalente na população, e venha despertando cada vez mais o interesse da comunidade científica, não existem estudos que avaliem esse fenômeno no Brasil. Inclusive, a própria condução destes estudos é dificultada pela inexistência de instrumentos adequados e confiáveis, em português brasileiro, que permitam a mensuração e acompanhamento deste comportamento alimentar.
2 - OBJETIVOS
• Realizar a tradução e adaptação transcultural de questionários para avaliação do comportamento de craving por alimentos.

The Brazilian version of the Three-Factor Eating Questionnaire-R21: psychometric evaluation and scoring pattern

Brazilian version of Food Cravings Questionnaires: psychometric properties and sex differences

A short version of the Attitudes to Chocolate Questionnaire (ACQ-R11)

Exploring the structural and construct validity of the Brazilian Food Cravings Questionnaire-Trait-reduced (FCQ-T-r)

• Desenvolver e validar a versão brasileira do Food Craving Inventory.

Food Cravings among Brazilian population

• Pesquisar o craving por grupos de alimentos durante o estágio de vida adulto.

Not all adults are equal: changes in food cravings during adulthood in females

• Investigar o comportamento de craving por alimentos de acordo com o estado nutricional de cromo no organismo e padrão alimentar.

Dietary patterns and food cravings among Brazilian university students

Greater frequency of sweet/carbohydrate cravings in individuals presenting lower plasmatic chromium
Os resultados apresentados na presente tese de doutorado são concernentes a três estudos, cuja execução foi previamente aprovada por Comitês de Ética em Pesquisa com Seres Humanos da Universidade Federal do Rio Grande do Norte (Estudo 1/CAAE 07887612.7.0000.5537; Estudo 2/CAAE 07887612.7.0000.5537; Estudo 3/CAAE 27786914.6.0000.5568).

Segue uma breve descrição do desenho, procedimentos e instrumentos relativos a cada estudo, cujo detalhamento é realizado nos manuscritos que integram a seção de Artigos.

2.1- ESTUDO I: Elaboração do Inventário de Alimentos relacionados ao Craving

O Food Craving Inventory foi desenvolvido por White, Whisenhunt, Williamson, Greenway e Netemeyer (2002) e consiste de uma lista de alimentos que devem ser avaliados quanto a frequência com que foram alvo de episódios de craving. O arrolamento dos voluntários foi realizado pela divulgação do estudo em redes sociais e listas de e-mails.

Elaboração e adaptação cultural do FCI-Br

A partir da avaliação de dados do consumo e hábito alimentar brasileiro, foi proposta uma lista inicial de alimentos para elaborar um FCI-Br-piloto, conforme a metodologia utilizada para elaborar a versão japonesa do FCI (Komatsu, 2008).

O FCI-Br-piloto foi disponibilizado via plataforma Google Docs, durante 30 dias. Voluntários responderam ao instrumento e fizeram sugestões sobre outros alimentos que pudessem integrá-lo. Após avaliação das respostas, foi elaborada a versão 1 do FCI-Br.

A versão 1 foi disponibilizada na plataforma Google Docs, juntamente com perguntas de cunho sociodemográfico e sobre comportamento de craving por alimentos. Também foi aplicado o instrumento Marcadores do Consumo Alimentar (para indivíduos com 5 anos de idade ou mais) (Ministério da Saúde do Brasil, Secretaria de Atenção à Saúde, Departamento de Atenção
Básica, & Coordenação-Geral da Política de Alimentação e Nutrição, 2008), que investiga a frequência de consumo de 10 grupos de alimentos ou bebidas.

**Análise Estatística**

Para identificação da estrutura do FCI-Br foram realizadas Análises de Componentes Principais e Análise Fatorial Exploratória, utilizando o software FACTOR (versão 9.2) (Lorenzo-Seva & Ferrando, 2006).

### 2.2- ESTUDO 2: Adaptação e validação de instrumentos para avaliação do Craving por Alimentos

O “Food Cravings Questionnaire–State (FCQ-S)” e “Food Cravings Questionnaire–Trait (FCQ-T)”, desenvolvidos por Cepeda-Benito e colaboradores (Cepeda-Benito et al., 2000), mensuram o craving por alimentos enquanto estado e traço psicológico, respectivamente.

O *Attitudes to Chocolate Questionnaire* (ACQ), Benton, Greenfield and Morgan (Benton, Greenfield, & Morgan, 1998), tem por objetivo avaliar duas dimensões relativas ao consumo de chocolate: o craving e sentimentos negativos e de culpa.

**Tradução e adaptação cultural dos questionários sobre craving por alimentos**

Após solicitação por correio eletrônico, os autores dos instrumentos autorizaram a tradução dos instrumentos para o português brasileiro. A tradução (pelo método *back translation*) e a equivalência cultural dos questionários foram realizadas de acordo com a proposta das "Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures" (Beaton, Bombardier, Guillemin, & Ferraz, 2000).

**Validação dos questionários sobre avaliação do craving por alimentos**

A versões brasileiras dos questionários foram respondidas por estudantes da Universidade Federal do Rio Grande do Norte, nos campi das cidades de Natal, Santa Cruz, Caicó e Currais Novos.
O arrolamento dos voluntários foi realizado nas salas de aula e espaços de convivência da universidade. Os critérios gerais para inclusão no estudo foram: estar matriculado em um dos cursos da UFRN; ser brasileiro e ter idade mínima de 18 anos. Os critérios de exclusão foram: referir diagnóstico de transtorno alimentar, estar grávida e/ou amamentando.

Após serem orientados sobre o preenchimento das escalas, os voluntários registravam suas respostas e, por fim, participavam da avaliação antropométrica.

**Outras mensurações**

Para fins de validação de construto, foram aplicados a versão brasileira do *The Three Factor Eating Questionnaire* e a Escala de Humor de Brunel. Os participantes também responderam ao FCI-Br, desenvolvido no Estudo 1.

Para caracterização do padrão alimentar foi utilizado o instrumento “Marcadores do Consumo Alimentar (para indivíduos com 5 anos de idade ou mais)” (Ministério da Saúde do Brasil et al., 2008).

A avaliação antropométrica consistiu na verificação do peso e estatura. O peso foi aferido em balanças digitais portáteis (capacidade para até 150 kg) e estatura em estadiômetro com apoio em tripé (escala de 115 a 210 cm). As medidas foram realizadas em duplicata. Os voluntários estavam descalços, usando roupas leves, sem adornos ou objetos que pudessem interferir no resultado das medições.

**Análise Estatística**

Para validação dos questionários foram realizadas Análises de Componentes Principais e Análise Fatorial Exploratória (software FACTOR (versão 9.2) (Lorenzo-Seva & Ferrando, 2006)); bem como Análise Fatorial Confirmatória (software Mplus versão 6). Demais análises (correlação, comparação de grupos e agrupamento) foram realizadas no pacote estatístico SPSS (versão 20).
2.3- ESTUDO 3: Avaliação da relação entre o estado de cromo, glicemia/insulinemia e episódios de craving alimentar.

Buscando investigar uma possível relação entre o estado de cromo, episódios de craving alimentar, composição corporal e glicemia/insulinemia, foi feita a avaliação destas variáveis em um grupo de universitários autodeclarados saudáveis.

Para composição do universo amostral, foram utilizados os critérios de inclusão e exclusão definidos no Estudo 2, acrescidos de não referir uso de aparelho ortodôntico nos últimos três meses; não utilizar fármacos psicoativos ou suplementos vitamínico-minerais; e não referir diagnóstico de doenças relativas ao metabolismo da glicose ou transtornos psiquiátricos.

Avaliação do craving alimentar

Para avaliação do craving alimentar foram utilizados os instrumentos adaptados culturalmente nos Estudos 1 e 2, a saber: “Food Cravings Questionnaire–State (FCQ-S)” e “Food Cravings Questionnaire–Trait (FCQ-T)” (Cepeda-Benito et al., 2000); “Attitudes to Chocolate Questionnaire” (ACQ) (Benton et al., 1998), e o “Food Craving Inventory” (White et al., 2002).

Parâmetros bioquímicos

Para avaliação dos parâmetros bioquímicos foram coletados 12 mL de sangue de cada voluntário, no período da manhã, após jejum de 10-12 horas.

A glicose plasmática foi mensurada por método colorimétrico enzimático (glicose oxidase) e a insulina por ensaio enzimático quimioluminescente. A relação entre estas variáveis foi investigada utilizando o Quantitative insulín-responsividade check index (QUICKI) (Chen, Sullivan, & Quon, 2005).

A determinação da concentração de cromo foi feita em plasma, por espectrofotometria de absorção atômica, com forno de grafite.

Avaliação Nutricional
O hábito alimentar foi caracterizado utilizando-se o instrumento “Marcadores do Consumo Alimentar (para indivíduos com 5 anos de idade ou mais)” (Ministério da Saúde do Brasil et al., 2008).

A avaliação antropométrica destes respondentes consistiu na verificação do peso e da estatura. A determinação da gordura corporal foi realizada utilizando bioimpedância tetrapolar. Os voluntários abstiveram-se de atividades físicas e de bebidas alcoólicas, respectivamente, nas 12 e 24 horas precedentes ao exame.

**Análise Estatística**

Para avaliação dos dados foram realizadas, principalmente, análises tipo Generalized linear models, utilizando o software SPSS versão 20.0.
The Brazilian version of the Three-Factor Eating Questionnaire-R21: psychometric evaluation and scoring pattern

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Periódico: Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity

Situação do Manuscrito: Publicado

\textsuperscript{§} Participou da análise estatística e revisão geral do manuscrito.
RESUMO

Objetivo: O presente estudo intencionou avaliar as propriedades psicométricas e padrão de pontuação da versão brasileira do Three-Factor Eating Questionnaire-R21 (TFEQ-R21). Métodos: As informações foram coletadas de um população composta por 410 estudantes de graduação. A estrutura fatorial do TFEQ-R21 foi avaliada utilizando Análise Fatorial Confirmatória. Critérios de validade convergente e discriminante também foram verificados. Os padrões de pontuação foram identificados utilizando análise de cluster. Resultados: Segundo os índices de ajuste investigados, o modelo foi considerado adequado ($\chi^2 / gl = 2,24$; CFI = 0,97; TLI = 0,96; RMSEA = 0,05). Também houve adequabilidade quanto a validade discriminante e convergente. Foi identificada uma correlação positiva entre o Índice de Massa Corpórea e as dimensões de Restrição Cognitiva ($r_s = 0,449$, $p <0,001$) e Comer Emocional ($r_s = 0,112$, $p = 0,023$). A análise de cluster identificou três perfis de respondentes. O perfil "A" foi associado com peso adequado, o perfil "B" foi caracterizado por maiores pontuações na dimensão de Restrição Cognitiva e no perfil "C" foram agrupados os participantes que apresentaram maiores pontuações nas dimensões de Descontrole Alimentar e Comer Emocional. Conclusões: A versão brasileira do TFEQ-R21 apresentou propriedades psicométricas adequadas. Os padrões de resposta identificados oferecem uma promissora perspectiva de uso na prática clínica, em intervenções para perda de peso corporal.

Palavras-chave: comportamento alimentar; Three-Factor Eating Questionnaire; IMC; avaliação psicométrica.
The Brazilian version of the three-factor eating questionnaire-R21: psychometric evaluation and scoring pattern

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Abstract

Purpose This study aimed to evaluate the psychometric properties and scoring pattern of the Brazilian version of the three-factor eating questionnaire-r21 (TFEQ-R21).

Methods Data were collected from 410 undergraduate students. Confirmatory factor analysis was conducted to examine the factor structure of the TFEQ-R21. Convergent and discriminant validity also was assessed. Cluster analysis was performed to investigate scoring patterns.

Results In assessing the quality setting, the model was considered satisfactory ($\chi^2/df = 2.24$, CFI = 0.97, TLI = 0.96, RMSEA = 0.05). The instrument was also considered appropriate in relation to the discriminant and convergent validity. There was a positive correlation between body mass index and the dimensions of cognitive restraint ($r = 0.449$, $p < 0.001$) and emotional eating ($r = 0.112$, $p = 0.023$). Using cluster analysis three respondent profiles were identified. The profile “A” was associated with appropriate weight, the “B” was characterized by high scores in cognitive restraint dimension, and the cluster “C” focused individuals who had higher scores on the uncontrolled eating and emotional eating dimensions.

Conclusions The Brazilian version of TFEQ-R21 has adequate psychometric properties, and the identified response profiles offer a promising prospect for its use in clinical practice, in weight loss interventions.

Keywords Eating behavior · Three-factor eating questionnaire · BMI · Psychometrics

Introduction

In Brazil, approximately 48% of the population is overweight, and reducing this percentage by 2022 is one of the priorities of the national healthcare system. However, receiving and administering treatments for obesity is still a daily challenge for patients and healthcare professionals [1].

The difficulties include both the adhesion to and/or monitoring programs for weight loss and the maintenance of a clinically useful weight loss in the long term [2]. So, a better understanding of the behaviors associated with obesity appears to be essential to change this scenario.

From this perspective, the three factor eating questionnaire (TFEQ) was developed by Stunkard and Messick to assess cognitive restraint, disinhibition and susceptibility to hunger, in adults [3]. Originally consisting of 51 items, later studies have developed reduced and psychometrically improved versions of TFEQ, with 18 (TFEQ-18) [4], 21 (TFEQ-21) [5] and 29 items [6]. These reduced versions are quite similar, composed from the TFEQ-51 items and access three main eating behaviors: emotional eating (EE), uncontrolled eating (UE) and cognitive restraint (CR).

CR is characterized as the limitation (cognitive and self-imposed) of food intake in order to control body weight [7].
The UJE behavior is the tendency to lose control over eating when feeling hungry or when exposed to external cues (e.g., very palatable food), even in the absence of physiological hunger [5]. Finally, the EE scale measures the susceptibility to eat in response to emotional stress and negative mood states [8].

An important difference in the TFEQ elaboration process was the inclusion of obese and non-obese persons, in various contexts (e.g., free-eating and weight control programs) [3]. This improved the TFEQ applicability and interpretation as a useful tool for better understanding of body weight management issues, which was confirmed in later studies in large samples [4, 5, 9].

Currently, complete and reduced versions of the TFEQ have been used in studies in Swiss [5], German [6], British [10], Finnish [11], Spanish [12], Thai [13], French [9], Greek [14], American and Canadian populations, with consistent results. In Brazil, preliminary results indicate that there is great potential for using the TFEQ-21 version in nutrition oriented programs that focus on weight control [15].

Thus, the present study was designed to perform a confirmatory factor analysis of the Brazilian version of the TFEQ-21, aiming to evaluate its psychometric qualities and investigate possible scoring patterns.

Methods

The study sample consisted of 433 undergraduate students from the Federal University of Rio Grande do Norte who volunteered to participate after learning about the study through publicity. Before soliciting volunteers, the study was approved by the University Research Ethics Committee and informed consent was obtained from all of the individual participants. The criteria for inclusion in the study was proof of current age as 18 or older. Exclusion criteria included prior history of eating disorders, and being pregnant and/or breastfeeding.

The anthropometric evaluation consisted of measuring the height and weight of each participant and calculating the body mass index (BMI) [16]. Weight was estimated using a portable digital scale with 150 kg capacity and height was estimated using an anodized aluminum stadiometer with 210 cm capacity. All weight and height measurements were estimated twice and, in the case of any discrepancy, a third estimate was made.

The TFEQ-21 consisted of 21 items divided into three domains: CR: uncontrolled eating and emotional eating [4].

The average obtained from the sum of the questions for each domain was converted to a scale ranging from 0 to 100 [17]. As suggested by previous studies [6, 9, 18], the sample was dichotomized into lower and higher scores in each TFEQ dimensions, according to the medians obtained in this study. Participants in the study were also asked if they were on any kind of diet.

The confirmatory factor analysis (CFA) was conducted using Mplus software (version 6.0) and using the WLSMV (robust weighted least squares) method to estimate the model [19]. The fit quality was evaluated according to the following parameters: $\chi^2/df$ (excellent $\leq 3$, acceptable $<5$), CFI (excellent $\geq 0.96$, TLI (excellent $\geq 0.95$) and RMSEA (adequate $\leq 0.06$) [19, 20].

To evaluate convergent validity, the average variance extracted (AVE) was calculated, where values greater than or equal to 0.5 were considered satisfactory. The consistency of the scale was evaluated according to the compound reliability and Cronbach’s $\alpha$ criteria, whereby values greater than or equal to 0.70 were considered to be adequate. Discriminant validity was investigated from an evaluation of correlations between instrument dimensions (adequate $\leq 0.80$), as well as an evaluation of the AVE, the value of which must be greater than the square of the correlation between dimensions [21].

The results are presented as percentages, absolute and median values (interquartile range), as recommended [22]. The correlation between variables was investigated using Spearman’s correlation test; and the association between categorical variables by using Pearson’s Chi squared test. For comparisons between groups, Mann–Whitney and Kruskal–Wallis tests (with Bonferroni correction) were used.

Cluster analysis was performed in the Statistical Package for the Social Sciences (SPSS) program (version 20), using the K-means algorithm, suitable for large datasets. The K-means clustering process starts by selecting initial cluster centers used for a first round of classification [21, 23]. The observations are then successively reassigned on the basis of the Euclidean distance between the cases and the cluster centers [21]. Cluster affiliations can change in the course of the process, which is repeated until centroids do not significantly change location [23]. Clustering variables were the final scores of the three TFEQ dimensions. The K-means method was applied with the number of clusters varying from 2 to 4. Cluster solutions were evaluated based on the interpretability of the solution [23], the Davies–Bouldin index [24, 25] and the Calinski–Harabasz index [24, 25].

Results

The study sample consisted of 66.8% ($n = 274$) female and 33.2% ($n = 136$) male participants, with a mean age of 21.0 (SD = 3.1) years and BMI of 23.1 (4.6) kg/m². With respect to the total sample of volunteers, 31.0%
clusters. Cluster B was characterized by the highest proportion of dieters \( \chi^2 (2) = 37.246, \ p < 0.001 \) and individuals with high CR \( \chi^2 (2) = 246.376, \ p < 0.001 \). Cluster C was associated with individuals that presented high EE and UE, with higher scores on EE and UE when compared to clusters A and B.

**Discussion**

The results of the current study demonstrate that the 21-item three-factor structure of the Brazilian version of the TFEQ-R21 showed adequate internal consistency, convergent and discriminant validity. The results of CFA analyses indicates a good fit to the data, better than those found in the English (18 items) \[4\] and German (29 items) \[6\] versions. In addition, also Capelleri et al. \[4\] and Lofler et al. \[6\] studies, all items presented a load factor >0.40.

Another indication of the good quality of the Brazilian version of the TFEQ-R21 was the difference in scores when comparing those participants who report being or not being on a diet, only in relation to the CR scores. It should be noted that cognitive restriction behavior cannot be characterized merely by the “on a diet” response. According to Lowe et al. \[26\], restrained eaters are best characterized as “weight watchers” and, unlike dieters, do not restrict their food intake in relation to specific weight loss \[26\]. However, previous studies also found higher CR scores in self-declared dieters \[12, 27\] and a relationship between dietary restraint and self-reported dieting \[28\].

Consistent with other studies, a tendency of larger TFEQ scores was identified among females, compared to men \[4, 9, 13, 29, 30\]. It is well established that women generally have higher scores than men in questionnaires about eating behaviors \[7\]. According to the socio-cultural model of eating disorders, this could be due largely to the fact that women suffer greater social pressures...
regarding the maintenance of body weight in almost all cultures [31].

Correlations were found between BMI and the EE and CR dimensions, as in the Finnish sample [32]. Other studies have reported positive correlations between BMI and all dimensions of the TFEQ [9, 10], while others only between BMI and RC [5] or BMI and UE [27]. This variability in the relationship between BMI and TFEQ dimensions is due in part to the BMIs limited capacity an indicator of body fat percentage or central obesity [13, 33]. Another important point to explain BMI results is the intrinsic sample profile. Population characteristics such as age [30], prevalence of obesity and chronic diseases [4], socio cultural context [7], sexual rate [9, 11] and pregnancy [33], can act as modifiers of the association between BMI and eating behaviors evaluated by TFEQ.

Following the suggestions of the TFEQ authors [3], and considering the clinical applicability of the instrument, there is some value in building profiles that allow the categorization of respondents, which facilitates decision-making in clinical practice.

In the current study, according to TFEQ scores, it was possible to identify three respondent profiles. Cluster A was associated with adequate weight and lower TFEQ scores, compared to the other profiles. Cluster B was characterized by high scores in the CR dimension, while cluster C grouped individuals who had higher scores in EE and UE dimensions.

Although results of intervention studies suggest a relationship between weight loss and concomitant increase in CR scores [34, 35], in the long term this does not seem to occur and might be related to future weight gain [26]. Also, increased CR seems to predispose episodes of loss of control and excessive consumption of food, tending towards the occurrence of compulsive eating episodes [8, 36]. Thus, it seems reasonable to presume something like a "homeostatic pressure" that must be maintained by restrictive cognitive behavior. So when maintained at optimal levels, CR may be a good weight control indicator while very high levels can indicate excessive homeostatic pressure.

From this perspective, overweight individuals presenting scoring pattern type A (low scores in the three dimensions), could benefit from a small increase in CR scores, suggesting possible success of a "diet" approach (since dieting is associated with increased CR scores [26]).

On the other hand, overweight individuals from cluster B could be benefited by interventions which are not focused on restrictive/rigid dietary plans, but which are more qualitative. Sensory-based nutrition interventions [37] combined with increased physical activity appear to be viable alternatives to modulate body weight without exacerbating restrained eating behavior.

Long-term interventions, including both support group meetings and individual monitoring, as conducted in Batra et al. [38] study, appears to be a viable alternative for dealing with overweight in cluster C individuals (higher scores in dimensions EE and UE). Mindfulness-based interventions can also be useful [39]. However, it is extremely important to monitor/prevent a possible increase in CR scores.

Finally, an important point to note was the progressive increase in the EE scores in clusters A to B to C, which is in agreement with the assumption that EE behavior is positively related to CR and UE [4]. From this perspective, an emotional support and the development of skills to handle dysphoric mood states can be a great differential to achieve a healthy body weight [8].

Thus, our findings indicate that it is important to evaluate not only the individual scores of each dimension, but the combination or proportion of increased values score.

Although the population survey was only composed of undergraduate students, which constitutes the principal limitation of the study, our findings are consistent with previous research [5, 9, 13, 15, 29] and include information about actual dietary restraint. Furthermore, the use of measured anthropometric data, instead of weight and height self-reports, decreases potential biases.

The results presented here confirm the validity of the Brazilian version of the TFEQ-R21, which was considered adequate to assess the behaviors of CR, UE and EE. Also, the instrument discriminated between dieters and non-dieters.

The response patterns approach suggests a promising perspective about the interpretation of the TFEQ-R21 scores. However, a longitudinal follow-up is needed to check the stability of patterns identified in this study as well to assess how changes in eating habits affect and or are driven by these patterns. Thus, it is suggested that further studies are needed to better understand the behavior profiles obtained here, in order to facilitate the decision-making, as well as the development and monitoring of strategies to control body weight, in the context of clinical practice.

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**Compliance with ethical standards**

**Ethical approval** The research was approved by the Ethics in Research Committee from the Federal University of Rio Grande do Sul and all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.
Informed consent

Informed consent in writing was obtained from all individual participants included in the study.

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

References


Brazilian version of Food Cravings Questionnaires: psychometric properties and sex differences

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Periódico: Appetite


Situação do Manuscrito: Submetido

** Participou da análise estatística e revisão geral do manuscrito.
Resumo

Background: Os Food Cravings Questionnaires, State (FCQ-State) e Trait (FCQ-Trait), são comumente utilizados para avaliar o comportamento de craving por alimentos. Este estudo teve por objetivo desenvolver e validar a versão brasileira destes questionários e explorar potenciais diferenças entre os sexos na pontuação do FCQ-Trait. Métodos: Os dados foram coletados com estudantes universitários ($n = 611$). A estrutura dos questionários foi avaliada utilizando Análise Fatorial Confirmatória. A validade de construto também foi investigada. Resultados: O FCQ-State-Br e o FCQ-Trait-Br apresentaram boas propriedades psicométricas, além de adequados ajuste do modelo e consistência interna, tanto na população como um todo como por sexo. Foi observada uma conservação da estrutura original dos FCQs nas versões brasileiras dos instrumentos, o que foi corroborado pela boa performance destes quanto à validade discriminante e convergente. Os participantes com sobrepeso apresentaram um comportamento de craving por alimentos aumentado. Entre as mulheres, o aumento ocorreu na dimensão Culpa, enquanto nos homens o aumento foi verificado na dimensão Descontrolo. Adicionalmente, mulheres que seguiam algum tipo de dieta apresentaram pontuação mais alta na dimensão Culpa, comparadas com as que não adotavam tal prática. Conclusões: O FCQ-State-Br e do FCQ-Trait-Br foram considerados instrumentos válidos para avaliar o comportamento de craving por alimentos em população brasileira. Adicionalmente, os resultados sugerem que o craving por alimentos pode ser um importante aspecto a considerar no manejo clínico da obesidade, podendo requerer uma abordagem específica, de acordo com o sexo.

Palavras-chave: Craving por alimentos; Excesso de peso; Diferença sexual; Comportamento alimentar; Validação.
Abstract

**Background:** The Food Cravings Questionnaires, State (FCQ-State) and Trait (FCQ-Trait), are commonly used to assess food-craving behavior. This study aimed to develop and validate the Brazilian version of these questionnaires, and to explore potential sex differences in the trait version scores. **Methods:** Data were collected from \( n = 611 \) undergraduate students. Confirmatory factor analysis was conducted to examine the questionnaires structure, and construct validity was assessed. **Results:** The FCQ-State-Br and FCQ-Trait-Br presented good psychometric properties, adequate model fit, and internal consistence, in general and by gender. A conservation of original structure of FCQ-s was verified in the Brazilian versions. A good performance in the evaluations concerning the discriminant and convergent validity seem to corroborate these structures. Overweight individuals showed an increase in food-craving behavior. In females, this increase occurred in the guilt dimension, whereas in males, the increase was in the lack of control dimension. In addition, female dieters presented higher scores on the guilt dimension compared with female non-dieters. **Conclusions:** FCQ-State-Br and FCQ-Trait-Br constitute valid instruments for measuring food-craving behavior in the Brazilian population. Moreover, these findings suggest that food cravings may be an important aspect to be considered in clinical management of overweight individuals, and may require a sex-specific approach.

**Keywords:** Food cravings; Overweight; Sex differences; Eating behavior; Validation.
Introduction

Food cravings are quite frequent in the population and can be defined as an intense desire to eat a specific food that is difficult to resist, which can occur even in the absence of hunger, thus influencing food choice and intake (Preedy, Watson, & Martin, 2011).

This type of behavior can vary in different levels of intensity, being influenced by physiological factors (e.g., menstrual cycle, pregnancy, or nutritional imbalances) (Hormes & Timko, 2011; Yen et al., 2010), psychological factors (stress, anxiety, and depressive moods) (Almada & Silva, 2012; van Strien et al., 2013), and environmental stimuli, such as exposure to food considered appetizing (Almada & Silva, 2012; Rogers & Smit, 2000).

Alterations in the frequency or intensity of food-craving episodes may occur in specific situations, such as in the case of dieting (Martin et al., 2011; Massey & Hill, 2012), in bulimic (Van den Eynde et al., 2012) or bariatric surgery patients (Crowley et al., 2012; Cushing et al., 2014). This suggests that a better understanding of this behavior may be important for more successful strategies and clinical management of eating disorders or maintenance of body weight.

Many approaches have been proposed to evaluate the existence and intensity of food cravings, and among the most commonly used are the Food Cravings Questionnaires, developed by Cepeda-Benito et al. (2000). The validity of these instruments has been evaluated in several studies, with good results (Cepeda-Benito, Fernandez, & Moreno, 2003; Meule, Lutz, Vögele, & Kübler, 2012; Nijs, Franken, & Muris, 2007; Rodríguez-Martín & Molerio-Pérez, 2014).

The Food Cravings Questionnaire-State (FCQ-S) aims to investigate food craving as a psychological state that may occur, for example, in response to stressful events or hunger (Cepeda-Benito et al., 2000; Cepeda-Benito et al., 2000). Yet the Food Cravings Questionnaire-Trait (FCQ-T) was developed to identify patterns of occurrence and/or characteristics most often related with food-craving behavior, as a psychological trait, in individuals and populations (Cepeda-Benito et al., 2000; Moreno, Rodríguez, Fernandez, Tamez, & Cepeda-Benito, 2008).

In Brazil, there are no validated instruments to assess food-craving behavior. Thus, the
objective of this study was to validate and perform a psychometric evaluation of the Brazilian version of the Food Cravings Questionnaires, and to explore potential gender differences in the trait version scores.

Materials and Methods

Participants and procedures

The population of the study consisted of undergraduate students of the Federal University of Rio Grande do Norte (UFRN), recruited through personal contact, in three different university campuses.

The study protocol was approved by the Research Ethics Committee of UFRN (protocol number 06531412.4.0000.5537). The volunteers did not receive any compensation for their participation, and they signed informed consent statements.

The criteria for inclusion were being Brazilian and having a minimum age of 18 years. Exclusion criteria included pregnancy, lactation, and self-report of eating disorders.

Measurements

The FCQ-S consists of 15 questions, grouped into five dimensions: An intense desire to eat (Desire); anticipation of positive reinforcement that may result from eating (Pos R); anticipation of relief from negative states and feelings as a result of eating (Neg R); thoughts of preoccupation with food and lack of control over eating (Lack Co); and craving as part of the sensation of hunger, a physiological state (Hunger). Participants must answer each question related to what they are feeling at the moment, using a Likert scale of five points, the extremes of which are “(1) strongly disagree” and “(5) strongly agree” (Cepeda-Benito et al., 2000).

The FCQ-T consists of 39 questions, divided into nine dimensions: Anticipation of positive reinforcement that may result from eating (Pos R); anticipation of relief from negative states and feelings as a result of eating (Neg R); an intention and planning to consume food (Plan); environmental cues that may trigger food craving (Environ); thoughts or preoccupation
with food (Thoughts); craving as a physiological state (Hunger); possible lack of control over eating if food is being eaten (Lack Co); emotions that may be experienced before or during food cravings or eating (Emotion); and guilt that may be experienced because of cravings and/or giving in to them (Guilt). The answers are recorded on a Likert scale, ranging from “(1) never or not applicable” to “(6) Always,” referring to the frequency with each statement applies to the participant (Cepeda-Benito et al., 2000; Moreno et al., 2008).

To prepare the Brazilian version of the questionnaires, we used the back-translation method (Sousa & Rojjanasrirat, 2011). First, two bilingual people (GROUP A), whose native language was Portuguese, carried out the translation of the tools from English to Portuguese, independently. One of the translators of the group was an individual who was unaware of the purpose of the questionnaires and was not familiar with the study. Then, the two versions were unified into one. After that, another two bilingual people (GROUP B), whose native language was English, carried out the translation of the Portuguese questionnaires back into English. The result was satisfactory, and the first Portuguese version of the questionnaire was administered to a group of 30 students to face validation. Discrepancies were solved, and the Brazilian versions of the instruments were completed (FCQ-S-Br and FCQ-T-Br).

To assess the construct validity, we used the Three-Factor Eating Questionnaire-21 (TFEQ) and the Brunel Mood Scale (BRUMS).

The TFEQ aims to identify the behaviors of cognitive restraint, emotional eating, and uncontrolled eating (Cappelleri et al., 2009; Natacci & Ferreira Júnior, 2011). In this work, we used the TFEQ reduced version, consisting of 21 items, already validated to Brazilian Portuguese (Medeiros, Yamamoto, Pedrosa, & Hutz, 2016; Natacci & Ferreira Júnior, 2011).

The BRUMS scale consists of 24 items, grouped into six dimensions: tension, depression, anger, vigor, fatigue, and confusion. Participants rate “How are you feeling right now?” on a 5-point scale (0 = not at all to 4 = extremely) about each mood state described. This
instrument is considered adequate for the assessment of mood profiles, and has been validated to Brazilian Portuguese (Rohfs et al., 2008).

For validation purposes, the question “How long has it been since you last ate?” was added, and the responses were later converted into minutes. Participants also answered a question about current diets (yes/no).

The anthropometric evaluation consisted of measuring height (centimeters), using a stadiometer, and weight (kilograms), using a digital portable scale, and posterior body mass index (BMI) calculation (Organization., 1995). The participant was considered overweight when the BMI was equal to or greater than 25.0 kg/m².

**Data analysis**

Confirmatory factor analyses were performed on Mplus 6.0, and the parameters were estimated by WLSMV (robust weighted least squares) method, as recommended for categorical variables (Brown, 2015). Model fit was evaluated using comparative fit index (excellent ≥ 0.96), Tucker–Lewis index (excellent ≥ 0.95), and root mean square error of approximation (excellent ≤ 0.06; good ≤ 0.08; inadequate > 1.00) (Brown, 2015; Schreiber, Stage, King, Nora, & Barlow, 2006). Further, confirmatory factor analysis was conducted separately by sex.

The internal consistency of the instruments was assessed by using the standardized parameter Cronbach’s $\alpha$. The convergent validity was investigated by determination of average variance extracted (AVE) (adequate ≥ 0.50) and compound reliability (adequate ≥ 0.70), for each factor (Hair, Black, Babin, Anderson, & Tatham, 2009). The discriminant validity was considered adequate when the AVE for each factor was greater than its squared correlation with the other factors (Hair et al., 2009).

To examine the nomological validity of the questionnaires, the Spearman correlation test was performed between the FCQ-s scores and other variables. Differences between groups, in the craving questionnaires scores, were investigated by the Mann–Whitney test. Results are expressed as mean (standard deviation).
Discussion

The aim of this study was to validate the Brazilian version of the Food Craving Questionnaires. As reported in the original version, we obtained good psychometric properties and the internal consistence of the instruments varied between good and excellent. These findings remained constant even when the analyses were performed separately by sex, suggesting the stability and quality of the Brazilian versions.

In disagreement with other cross-cultural adaptations (Meule et al., 2012; Nijs et al., 2007; Rodríguez-Martín & Molerio-Pérez, 2014) and consistent with the early versions of the FCQ-s (Cepeda-Benito et al., 2000), there was a conservation of the questionnaires structures, five factors in the FCQ-State-Br and nine factors in the FCQ-Trait-Br. It is worth noting that this structural stability was preserved even in the evaluation by sex. Further, the performance of the instruments in the evaluations concerning the discriminant and convergent validities seem to corroborate these structures, indicating the absence of overlaps between the factor measures and a good construct reliability.

The original proposal of the FCQ-S aims to assess the craving associated with transient emotions and physiological states, such as hunger (Cepeda-Benito et al., 2000). Therefore, a strong indication of the nomological validity of the measured construct were the correlations among the FCQ-State-Br, the time without eating, and the negative mood states of BRUMS. Moreover, it is important to note that no correlation was found among FCQ-State-Br and scores and the BRUMS dimension relative to positive mood states (Vigor).

From this perspective, it has been reported that dysphoric mood states are related to the increase in food cravings, particularly foods with high content of sugar, fat, and carbohydrate (Cleobury & Tapper, 2014; Moreno-Dominguez, Rodríguez-Ruiz, Martín, & Warren, 2012; Müller, Dettmer, & Macht, 2008). In fact, the food-craving behavior is closely related to what we call “emotional eating,” defined as the habit of eating food (usually quite palatable and energy-
dense) as a way to deal with stress (Preedy et al., 2011), being a different construct than eating in response to positive emotions (van Strien et al., 2013).

The FCQ-Trait-Br showed a strong correlation \( (r > 0.50) \) with the dimensions of Uncontrolled Eating and Emotional Eating, evaluated by TFEQ. As expected, there was no correlation with the Cognitive Restraint dimension except for the FCQ-Trait-Br Guilt dimension. This result is consistent with the findings of Muller et al. (2008), who found a correlation between Guilt, Emotional Eating, and Restrained Eating, but not between Craving and Restrained Eating, when assessing the Attitudes to Chocolate Questionnaire.

Unlike what occurred in the FCQ-State assessment, no correlation was found between the measurements of food-craving behavior, whereas the trait and the time without eating, agrees with the premise of the authors of the instrument (Cepeda-Benito et al., 2000), regarding a lower influence of transient states on this type of behavior measured by the FCQ-Trait.

Further, in relation to construct validation, a higher score for females in the FCQ-Trait but not for the FCQ-State, compared with males, is consistent with another study (Cepeda-Benito et al., 2003). As suggested by the authors, it seems to confirm that the FCQ-State is less influenced by “trait” characteristics, such as sex. Such results corroborate the hypothesis that the questionnaires actually measure different aspects of the construct food craving, because there is always a tendency for females to achieve higher scores when compared with males in questionnaires related to eating behavior (Cleobury & Tapper, 2014; Preedy et al., 2011).

An increase of food craving was identified among overweight individuals and females who were on some kind of diet. Other studies have identified an increase in food cravings in individuals with increased BMI (Chao, Grilo, White, & Sinha, 2014; Joyner, Gearhardt, & White, 2015) or on diets (Massey & Hill, 2012; Van Gucht, Soetens, Raes, & Griffith, 2014), and this would be an important aspect to consider when monitoring and treating obesity (Anton et al., 2012; Martin et al., 2011; Potenza & Grilo, 2014). However, it is important to highlight that this increase in the craving behavior occurred in two distinct dimensions in males and in females.
In females, an increase in Guilt dimension, that may be experienced because of craving and/or giving in to them, was identified. It has been suggested that there is a conflict between the desire and the difficulty to resist the consumption of a particular food, such as chocolate, in response to craving, generating a sense of guilt for wanting and/or giving in to the “temptation” of consumption (Hornes, Orloff, & Timko, 2014; Rogers & Smit, 2000). In this perspective, it has been suggested that guilt feelings about food can be related to greater difficulties in losing weight (Kuijer & Boyce, 2014). Among men, the increase was due to possible lack of control over eating if food is being eaten, which could be more related to craving, as an indicator of possible trigger foods for overeating episodes, and, consequently, to a greater struggle to control body weight (Preedy et al., 2011).

These sex differences can be related to biological factors (e.g., hormonal profile) (Hornes & Timko, 2011; Yen et al., 2010), as well as cultural and social factors (Hornes et al., 2014; Preedy et al., 2011; Schösler, de Boer, Boersema, & Aiking, 2015), resulting in differences in the expression of eating behavior, which implies different patterns of answers between males and females (Leblanc, Bégin, Corneau, Dodin, & Lemieux, 2015). Nevertheless, the females’ scores in food cravings questionnaires are usually higher compared with the males’ scores (Preedy et al., 2011), and these differences can be potentially disguised when the sample is analyzed as a whole.

In this way, it is important to consider these aspects in the design and interpretation of studies about craving. A noticeable increase in food craving in overweight and dieting scenarios is emphasized, reinforcing the need for a better comprehension and elucidation of the meaning of this construct in the context of nutritional follow up.

The main limitation of this study was that the surveyed population was restricted to university students, recruited by convenience, which limits the potential for generalization of the results. However, a positive aspect is the equilibrate proportion between males and females participating in the study, which enabled us to investigate the adjustment of the questionnaires by sex and to perform intra-sex comparisons.
In summary, the adequate fit indices, good internal consistency, and results regarding the construct validation endorse the quality of the instruments validated in this study. Thus, the FCQ-State-Br and the FCQ-Trait-Br constitute valid instruments to measure the craving for food behavior as trait and state in the Brazilian population. The findings regarding increase food cravings in overweight scenarios and current diets reinforces the potential importance of this type of behavior in the context of dietary attention, which may require different strategies according to sex.

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Food cravings among Brazilian population

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Resumo

O presente estudo objetivou desenvolver e validar a versão brasileira do Food Craving Inventory (FCI-Br), realizando também uma caracterização preliminar deste comportamento na população brasileira. Os participantes (n = 453) responderam on-line a uma versão preliminar do instrumento. A análise fatorial exploratória revelou que a estrutura do FCI-Br era composta por 23 itens, organizados em três fatores: Lanches Gordurosos, Doces e Consumo Doméstico. Como um todo, a consistência do FCI-Br foi considerada adequada (α = 0,82), bem como de cada subescala. A aplicação do FCI-Br em 649 estudantes universitários mostrou adequabilidade do modelo desenvolvido, segundo a análise fatorial confirmatória ($\chi^2 / df = 2,82; CFI = 0,94; TLI = 0,93; RMSEA = 0,06$). Os itens com maior pontuação média foram o chocolate (3,14 ± 1,28; mulheres) e pão (2,94 ± 1,44, homens). Uma associação significativa foi observada entre o craving específico por Doces e os respondentes do sexo feminino. Homens obtiveram maiores pontuações que as mulheres na dimensão de Consumo Doméstico (p < 0,05). A maioria dos participantes referiu ter mais episódios de craving quando estava sozinho (68,0%; n = 391) e durante os horários da tarde (32,2%; n = 127) ou noite (43,8%; n = 173). Estes achados indicam que o FCI-Br apresenta propriedades psicométricas adequadas para avaliar o craving por grupos de alimentos específicos, em população brasileira. Os resultados também lançam luz sobre a importância de se considerar o contexto cultural quando da investigação de comportamentos alimentares.

Key words: craving por alimentos; comportamento alimentar; validação; população brasileira.
Abstract

The current study aims to develop and validate a Brazilian version of the Food Craving Inventory (FCI-Br), and perform a preliminary characterization of this behavior among Brazilian population. Participants (n = 453) responded to a preliminary form of the instrument online. Exploratory factor analysis revealed an FCI-Br having 23 items and three factors: High Fat, Sweet Food and Home Intake. The FCI-Br overall reliability was considered adequate (α = 0.82), as were each of the sub-scales. Application of the FCI-Br in a population of 649 university students demonstrated adequate psychometric properties of the model developed according to the Confirmatory factor analysis ($\chi^2 / df = 2.82$, CFI = 0.94; TLI = 0.93; RMSEA = 0.06). The food items receiving higher average scores were chocolate (3.14 ± 1.28; women) and bread (2.94 ± 1.44, men). A significant association was observed between the specific-craving for Sweet Foods and female respondents. Males scored higher than females in the Home Intake dimension (p < 0.05). Most participants reported experiencing more frequent episodes of food craving when alone (68.0%; n = 391) and during the afternoon (32.2%; n = 127) or evening (43.8%; n = 173) hours. The current findings indicate that the FCI-Br has adequate psychometric properties to measure craving behavior with respect to specific food groups in the resident population of Brazil. The results of this study also shed light on the importance of considering the cultural diversity of a population when investigating eating behaviors.

Key words: Food cravings; Eating behavior; Validation; Brazilian population
1-Introduction

Food craving is a relatively common behavior, especially among young adults[1,2]. From this perspective, one of the most used questionnaires used to evaluate food craving behavior is the Food Craving Inventory (FCI)[3], which assess cravings directed to specific foods.

Thus, by using the FCI, it is possible to identify possible patterns of foods and/or food groups that are more related to food cravings, allowing a new understanding of the context in which this behavior is expressed[4,5].

It has to be said that, depending on the cultural-gastronomic context, there may be significant differences in the types of craved foods and their relationship to other aspects of eating behavior[6]. It is suggested, therefore, that there are also regional and/or ethnic differences in the expression of food cravings. For example, although in many western countries there is a prevalence for craving chocolate[2], while in Japan the prevalent craving is for rice[7] and in Egypt it is for salty types of food[8].

For this reason, the creators of the Food Craving Inventory[3,5] recommend that, depending on the geographical location and cultural aspects/characteristics of the study population, adaptations/adjustments must be made to the instrument, mainly to avoid underestimating results.

Thus, the current study aims to develop and validate a Brazilian version of the Food Craving Inventory (FCI-Br), as well as perform a preliminary characterization of this behavior among the resident population of Brazil.

2-Materials and methods

2.1-Overview

The study protocol included three phases: Preliminary Study, Study 1 and Study 2. The purpose of the Preliminary Study was to define the food items that would compose the preliminary version of the FCI-Br. In the Study 1, the goal was to develop the FCI-Br and
explore food cravings behavior characteristics of the Brazilian population. Finally, in the Study 2, the validity of the instrument developed during the Study 1 was examined.

A Committee for Research Ethics approved the current study protocol and all of the participants signed informed consent statements or expressed their consent via an electronic platform. Inclusion criteria were having been born in, and living in Brazil at the time of data collection. Exclusion criteria included being younger than 18 years of age and/or not having fully completed the requested responses to the FCI-Br. Volunteers were recruited through research disclosure on the social network Facebook® and electronic mailing list (Preliminary Study and Study 1) or by personal approach in common areas of the university (Study 2). The study participants did not receive any sort of financial or academic compensation.

2.2 Preliminary Study

To elaborate the Brazilian version, an evaluation of the 25 food items included in the FCI second version[5] were performed. As a result were excluded 10 items (fried chicken, sausage, cinnamon rolls, fried fish, cookies, pancakes or waffles, chips, rolls, cereal, donuts and brownies) not considered to be representative of typical eating habits in Brazil.

Of the remaining food items, two were modified: the option biscuits was converted in two items (cookies and sandwich cookies), and sandwich bread was shortened to just "bread". Then, 19 new foods were included (açaí††, frosted cake, pastel‡‡, hot-dog, shrimp, barbecue, Coxinha§§, doce de leite***, feijoada†††, goiabada†††, lasagna, nutella/hazelnut cream, popsicle,

†† "Açaí in the bowl" is a dish made of frozen and mashed açaí palm fruit. It is served as a smoothie in a bowl or glass and is commonly topped with granola and banana, and/or mixed with other fruits and guaraná syrup. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/A%C3%A7%C3%ADa
‡‡ Brazilian Pastel consists of a half-circle or rectangle-shaped thin pastry crust with assorted fillings, fried in vegetable oil. The result is a crispy, brownish fried pie. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Pastel_%28food%29
*** Doce de Leite is a confection prepared by slowly heating sweetened milk to create a substance that derives its taste from the Maillard reaction, changing flavour and colour. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Dulce_de_leche
††† Brazilian Feijoada is prepared with black beans and a variety of salted pork or beef products. Feijão is the beans (not only black beans) prepared without the addition of the meat. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Feijoada#Brazilian_feijoada
popcorn, condensed milk pudding, quibe\textsuperscript{55}, salty packaged snacks, sushi/sashimi, sweet pie). Next, the food items list was subjected to a relevance evaluation by two nutritionists and a psychologist.

During 30 days this preliminary version of the FCI-Br was available via the internet using Google\textsuperscript{TM} Docs and were accessed by 259 volunteers (191 females and 68 males).

As the original version\cite{3}, the FCI-Br begins with a short definition of food cravings behavior, followed by the question “Over the past month, how often have you experienced a craving for the food listed below?”. Each of the foods listed was evaluated using a five point Likert scale ranging from: "(1) never" to "(5) almost every day". The total score of each FCI subscale was calculated by adding the scores obtained for each item that comprised it. Participants could also make suggestions of other frequently craved foods, which were not included in the preliminary FCI-Br.

After evaluating the answers, 9 food items (quibe, hot-dog, sushi/sashimi, Popsicle, popcorn, Nutella/hazelnut cream, frosted cake, rice and goiabada) were excluded. According to suggestions from the participants, two food items were renamed (barbecue/grilled meat and feijoada/beans) and 3 food items (brigadeiro \textsuperscript{****}, farofa \textsuperscript{****} and cheese) were added.

To be included in the FCI, the food item and/or its ingredients must be readily available throughout Brazil, without any notable seasonal fluctuations.

\section*{2.3-Study 1}

In this phase, the version of the FCI-Br developed during the preliminary study phase was made available on-line during 90 days, on the Google\textsuperscript{TM} Docs platform. The study sample

\textsuperscript{55} Quibe is a dish made of bulgur (cracked wheat), minced onions and finely ground lean beef with Middle Eastern spices (cinnamon, nutmeg, clove, allspice). The best-known variety is a torpedo-shaped fried croquette. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Kibbeh
\textsuperscript{****} Brigadeiro is a Brazilian delicacy made from condensed milk, powdered chocolate, butter and chocolate sprinkles to cover the outside layer. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Brigadeiro
\textsuperscript{****} Farofa is a toasted cassava flour mixture, though variants are made with manioc flour, and flavors can vary. In Wikipedia: The Free Encyclopedia. Retrieved from https://en.wikipedia.org/wiki/Farofa
consisted of 453 respondents (363 females and 90 males), with an average age of 28.9 ± 8.89 years and average Body Mass Index (BMI) of 24.2 ± 4.15 kg/m². Participants were from all the Brazilian political regions (6.6% Center-West Region; 3.5% North Region; 71.3% Northeast Region; 5.7% South Region; and 12.8% Southeast Region). Thus, the only state in the territory of Brazil without representation in the current study was Roraima.

Therefore, this sample was used to investigate the characteristics of craving behavior in Brazilian population. To this end, we added the question "At what time of the day do you usually experience food cravings?", where more than one response option (morning, afternoon and/or evening) could be selected. Volunteers were also asked "When you have an episode of food craving, usually you are..." (alone/accompanied).

The frequency of specific-cravings, whereby respondents who scored above the population average in only one dimension and below average in the others[3] was investigated.

Data on weight and height were provided by the participants and then used to calculate the body mass index (BMI). Socio-demographic information, including age and gender, was also collected.

**Data Analysis**

To develop the FCI-Br, we conducted a Parallel Analysis using Principal Component Analysis as the method for factors extraction and the mean eigenvalue criterion [9,10]. To generate the factor analysis solution, we performed a Principal Axis Factoring Analysis. To create a concise instrument, only factor loadings of 0.400 or greater were retained. Polychoric correlations and an oblique rotation (Promin k = 10) were used. The Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) and Bartlett’s test of sphericity were also calculated. Internal consistency was analysed using Cronbach’s α (> 0.70 adequate).

The Mann-Whitney U-test and the Kruskall-Wallis test (with Bonferroni correction) were used to perform group comparisons. Associations between categorical variables were assessed using the Pearson Chi square test, and Spearman’s correlations for continuous variables. All p-
values less than 0.05 were considered statistically significant. The results analyses are expressed in means (± Standard Deviation) and, if applicable, in medians.

2.4-Study 2
In order to validate the instrument developed during the Study 1 phase, presentational application of the FCI-Br was performed with a sample of students of the Federal University of Rio Grande do Norte. This sample consisted of 649 students, including 346 females (53.3%) and 303 males (46.7%), with an average age of 21.5 ± 4.02 years. Besides responding to the FCI-Br developed during the Study 1 phase, the students were also asked to answer the Brazilian version of the Food Cravings Questionnaires (Trait and State).

Data Analysis
Confirmatory factor analyses were performed using the WLSMV estimation method[11]. Model fit was evaluated based on four indicators of good overall fit: CFI and TLI (both adequate when > 0.90); RMSEA (excellent ≤ 0.060; acceptable ≤ 0.080), and the ratio $\chi^2$ to degree of freedom (adequate < 3.00)[11,12]. To assess the stability of the FCI-Br structure, as recommended by the authors of the original instrument[3,5], the analyses were also conducted separately for each gender sample.

The convergent validity was considered adequate when the standardized factor loadings of the items of a factor were greater than or equal to 0.50 and the Compound Reliability (CR) for each factor was greater than or equal to 0.70[13]. Given that the frequency of cravings for those food items identified as the most common targets of this behavior is usually related to food craving behavior in general[3], for the establishment of the convergent validity, the existence of a positive correlation between the subscales of the FCI-Br and the total score of the Brazilian version of Food Cravings Questionnaire-Trait (FCQ-Trait) was expected.

To examine discriminant validity, the Variance Extracted (VE) for each factor was compared with its squared correlation to the other factors (adequate when the AVE values was greater) [13]. We also performed a correlation test between subscales of the FCI-Br and the total
score of the Food Cravings Questionnaire-State (FCQ-State), for which we expected there to be an absence of any correlation because the FCQ-State assesses the food craving behavior in a very punctual way ("right now, at this very moment") [14,15].

P-values less than 0.05 were considered statistically significant. Results are expressed as mean ± standard deviation and, if applicable, in medians.

4-Discussion

The final version of the FCI-Br was composed of 23 food items distributed in three dimensions. The overall scale and subscales showed good internal consistency and adequate psychometric properties, which were corroborated by confirmatory factor analysis. In addition, the FCI-Br also showed satisfactory performance in the construct validity evaluations, and may be considered an appropriate instrument for measuring the behavioral construct of "food craving".

The structure of three factors for the FCI-Br was different from that of the original instrument[3] and similar to the FCI-Spanish version [16], also presenting three factors and without a specific group of foods rich in carbohydrates/starches in the FCI-Br. A brief review of the different versions[4,5,7,16] of the FCI shows that the dimension F2-Sweet Foods remains more constant compared to the other dimensions, which was also observed with the FCI-Br.

Females had the highest scores in Sweet Foods dimension, and the specific craving for sweet foods was also associated with the females group, which is consistent with the findings of studies that developed the British[4] and Spanish versions[16] of the FCI. Although a preference for sweet tasting food items is innate in humans, and usually associated with "hedonic reward"[17], this specific preference is notably greater in women[2,18], and which seems to also be strongly influenced by hormonal changes[19,20].

The High Fat dimension consists of eight food items that are mostly consumed as snacks, rather than as a main meal, and where a high amount of fat is its main feature. No differences
were observed between the sexes in the scores related to this dimension and, unlike the original instrument [3], no association was found between the specific craving for High Fat food items and obesity.

The food items grouped in the Home Intake dimension present different compositional characteristics, having in common the fact that they are usually consumed at home and/or as part of a main meal. Another interesting aspect in the evaluation of this dimension, was the scores being highest for males. About this, although females tend to present higher scores in instruments designed to assess eating behavior[2], men usually prefer salty flavors[18].

Overall, the percentage of specific-cravers was similar to that found in other versions of the instrument[3,4,7,16], as was the proportion of total explained variance.

According to what has been observed in other studies[2,21,22], chocolate is the most desired food item among females, while the desire for bread is more frequent among males. It should be noted that five particular food items were most desired by both sexes, varying only with respect to the order of ranking. These findings, combined with the results of the scores for each dimension, suggest that the FCI-Br manages to capture the gender-specific nuances of food craving expression, which can be valuable for better understanding of this behavior.

In addition, it should be noted that the food items receiving the highest scoring average in the FCI-Br (Study 1) form a very different pattern from that which was identified in other studies of Western cultures, where a predominance of food types like fast-food[4,16] and candy[5,16] was observed. Interestingly, in the present study, four of the five most craved food items belong to the Home Intake dimension. The only exception was chocolate.

One of the main components of food craving behavior is specificity. In other words, in order to mitigate this sensation it is necessary to meet a specified sensorial standard[2], activating brain areas relative to the memory[23]. The construction of these memories happens through gastronomic experiences, which although reflecting the peculiarities inherent to individual choices, are also widely permeated by the cultural, geo-biological and technological realities of
where a person lives[24–26]. Thus, despite having a large share of emblematic food items from Western culture, both the structure and the food items in the FCI-Br keeps important characteristics that are inherent to the eating habits of Brazilians. Moreover, the instrument developed here showed stability with respect to food items and factor structure, even when analyses were performed by treating each sex as an independent group.

In relation to time, the study participants reported that they experience food cravings more frequently at night or during the afternoon/evening hours, referring to the study of Plas-Sanjuangalo et al.[27] which identified the periods of afternoon/early evening and late evening/night as triggers or environmental paths that would favor the expression of binge craving behavior. Still, about this aspect it is important to note that there are circadian variations in glucose tolerance, which usually begins to diminish in the afternoon, lasting most of the night[28]. Since it has been suggested that insulin resistance is positively correlated with food craving[29], this seems to be a possible explanation for the increase of the food craving behavior at this time of day.

The literature[2,27,30] also points to more frequent episodes of food cravings when people are alone, which was also observed among participants in the Study 1 phase, although no differences were found in scores with application of the FCI-Br.

Although there are indications that an increase in food craving behavior is associated with obesity[31], in this study no correlation were observed between scores of the FCI-Br and BMI. From this perspective, it should be noted that an important limitation of the current study was the use of self-reported anthropometric measures, which can compromise the accuracy of BMI values calculated from these data[32].

In contrast, two strong points of the present study were the use of an online platform for development of the FCI-Br, which allowed for the participation of volunteers from throughout Brazil, and the substantial participation by men during the Study 2, making it possible to conduct
independent analyzes according to sex groups. These two factors contributed to minimizing bias in the definitions and grouping of food items that make up the FCI-Br.

In conclusion, the results of the current study support the suitability of the Brazilian version of the Food Craving Inventory (FCI-Br) to measure food craving behavior in relation to specific food groups, and demonstrates the potential of the instrument to be used both in research and clinical practice. The peculiarities inherent to food craving among Brazilians identified in this study reinforce the importance of considering the gastronomic and cultural context of the expression of this behavior and the need to consider this variable when conducting studies on the topic.

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A short version of the Attitudes to Chocolate Questionnaire (ACQ-R11)

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Resumo

Objetivo: Avaliar as propriedades psicométricas da versão brasileira do Attitudes to Chocolate Questionnaire (ACQ) e desenvolver uma versão refinada e breve do instrumento. Métodos: A amostra foi composta por 602 estudantes universitários. Análise fatorial confirmatória foi utilizada para avaliar os diferentes modelos de ACQ. Dados categóricos foram avaliados com o teste do qui-quadrado de Pearson. Resultados: Os índices de ajuste para o modelo com 2 fatores e 11 itens (ACQ-R11) foram considerados satisfatórios (CFI = 0,97; TLI = 0,96; RMSEA = 0,06; SRMR = 0,05) e a consistência interna do ACQ-R11 foi classificada como muito boa (α = 0,86). Adicionalmente, o ACQ-11R apresentou um ajuste melhor que as versões originais e mais extensas do instrumento (24 e 22 itens). Menores escores em ambas as escalas do ACQ-R11 foram associados a peso adequado, enquanto escores elevados em ambas as escalas foram associados ao excesso de peso (p < 0,001). Conclusões e implicações: O ACQ-R11 é um instrumento adequado para investigar comportamentos alimentares relativos ao chocolate, com bom potencial para ser utilizado na prática clínica e na pesquisa.

Palavras-chave: comportamento alimentar; Attitudes to Chocolate Questionnaire; excesso de peso; avaliação psicométrica; versão breve.
Abstract

Objective: To evaluate the psychometric properties of a Brazilian version of the Attitudes to Chocolate Questionnaire (ACQ) and to develop a refined and brief ACQ version. Methods: Data were collected from 602 university students. Confirmatory factor analysis was performed to evaluate ACQ models. Categorical data were evaluated by the Pearson Chi-Square test. Results: The fit statistics for the 2 factor-11-items model (ACQ-R11) were considered satisfactory (CFI = 0.97; TLI = 0.96; RMSEA = 0.06; SRMR = 0.05) and the internal consistency of the ACQ-R11 was very good (α = 0.86). The ACQ-11R provides a better fit than the original versions (24 and 22 items). Lower scores in both ACQ-R11 scales were associated with healthy weight and higher scores with overweight (p < 0.001). Conclusions and implications: ACQ-R11 is an appropriate instrument to investigate eating behaviors related to chocolate and good potential to be utilized in clinical practice and research.

Key words: eating behavior; Attitudes to Chocolate Questionnaire; overweight; psychometrics; brief questionnaire.
INTRODUCTION

Among western cultures, chocolate is frequently involved in episodes of food craving and widely referred to as a comfort food. However, although its consumption is obviously related to the activation of brain reward pathways, the hedonic response to chocolate does not necessarily correspond to the level of chocolate craving and consumption. Thus, it is suggested that the behavioral repertoire associated with chocolate is more complex than the simple response to a highly palatable food.

Moreover, chocolate intake may also be associated with feelings of guilt. This ambivalence between pleasure and guilt seems to be amplified in overweight patients, and it could be an important factor to be considered in treatments for weight body control.

The need to better understand eating behaviors associated with chocolate motivated the development of instruments such as the Orientation to Chocolate Questionnaire, the Chocolate specific version of the Food Cravings Questionnaire, and the Attitudes to Chocolate Questionnaire (ACQ). Among them, the ACQ is probably the most widely used and has been validated in studies with British, Canadian, Italian, Belgian, and German populations.

The original three factor ACQ model was designed to investigate negative feelings and guilt associated with chocolate intake; chocolate as a comfort food and craving for chocolate; and as a functional or pragmatic approach to chocolate consumption. However, subsequent studies suggest that a two-factor structure for the ACQ may be more appropriate.

Therefore, the present study aimed to examine psychometric properties of the Brazilian version of the ACQ and also to develop and validate a brief form of the ACQ.

METHODS
Participants

The current study was conducted with a sample of students from the Federal University of Rio Grande do Norte, Brazil. Participants were recruited by means of personal approach and/or divulgence of the research project in social spaces on campus. The criteria for inclusion in the study were: being at least 18 years old and not pregnant or lactating.

The proposal for this study was reviewed and approved by the institutional Research Ethics Committee and all of the participants provided informed consent.

Measures

The original version of The Attitudes to Chocolate Questionnaire\textsuperscript{11} consists of 24 items grouped in three dimensions: Craving and emotional eating (Craving); Negative consequences and guilt (Guilt); and Functional approach (Functional). Each statement is evaluated using a 100-mm visual analogue scale, where the left extreme represents "Not at all like me" and the right represents "Very much like me". The distance from the left point of the scale to the mark made by the respondent for each item was measured using a standard ruler. The total score for each dimension corresponds to the arithmetic mean of its item scores, which can vary from 0 to 100.

The Brazilian Portuguese version of the ACQ was developed by the back-translation method\textsuperscript{16}. Two bilingual translators (native Brazilian Portuguese speakers) translated the ACQ from English into Brazilian Portuguese. Then, another pair of bilingual translators (native English speakers, unfamiliar with the ACQ) translated the Portuguese version of the instrument back into English. These translations were compared and any discordance was resolved by discussing. Pilot testing of the ACQ-Br was performed with a group of 35 undergraduate students to evaluate understanding of the instructions, functioning of the response format and appropriateness of the items used in the instrument.

As suggested by previous studies\textsuperscript{13,15}, construct validity was investigated using a brief form of the Three factor eating questionnaire (TFEQ-21), already validated for Brazilian Portuguese\textsuperscript{17}. Thus, there is an expected correlation between the two scales of the ACQ and the TFEQ-21.
dimensions of Uncontrolled Eating (UE) and Emotional Eating (EE). The EE dimension evaluates overeating in response to dysphoric moods states and the UE dimension investigates overeating in response to external stimuli\textsuperscript{17,18}. An association between the Cognitive Restraint (CR) dimension of the TFEQ-21 and the Guilt dimension of the ACQ is also expected. The RC dimension measures the conscious restriction of food intake to avoid weight gain and/or changes in body shape\textsuperscript{1}.

Participants answered a question about the frequency of their chocolate cravings in the last month (from never [1] to almost every day [5]). Also regarding construct validity, a positive correlation between this variable and the Craving dimension was expected.

The height and weight of each participant was measured and recorded by trained assistants, as recommended\textsuperscript{19}. A BMI $\geq 25$ kg/m\textsuperscript{2} was considered to be overweight.

**Statistical analysis**

Confirmatory Factor Analysis (CFA) was performed to evaluate three versions of the ACQ: the original 3F-model/24 items\textsuperscript{11}; the 2F-model/22 items\textsuperscript{12}; and a short version of the ACQ. The indices used to test model fit were: Comparative Fit Index (CFI) (excellent $\geq 0.96$\textsuperscript{20}; adequate $\geq 0.90$\textsuperscript{21}); Tucker-Lewis Index (TLI) (excellent $\geq 0.95$\textsuperscript{20,22}; adequate $\geq 0.90$\textsuperscript{23}); Root Mean Square Error of Approximation (RMSEA) (excellent $\leq 0.06$; good $\leq 0.08$; inadequate $> 1.00$)\textsuperscript{24}; and the ratio $\gamma_2$ to degree of freedom (adequate $< 3.00$)\textsuperscript{20}. The parameters were estimated by maximum likelihood.

Internal consistency was analyzed using Cronbach’s $\alpha$ (adequate $> 0.70$). For group comparisons, the Mann–Whitney U-test was used. To assess relationships among variables, Spearman’s correlation tests were performed. Categorical data were evaluated by the Pearson Chi-Square test. Results are given as medians (range interquartile) and a p-value $< 0.05$ was considered statistically significant.
DISCUSSION

The first purpose of this study was to perform a Confirmatory Factor Analysis for a Brazilian version of the ACQ, evaluating the three (24 items) and two-factor models (22 items). The CFA results indicate a similar performance to other versions, and considered the version in question to be adequate\textsuperscript{13,14}. However, none of these models were an optimal fit to the data in our view, suggesting that the ACQ model needed some refinement, which was the second purpose of this study.

Although the two original models demonstrated comparable levels of fit, according to previous studies\textsuperscript{12,13}, the ACQ-21\textsuperscript{f}/22 items seems to have a more stable factor structure. Thus, this model was selected for modification. All adjustments were made in order to obtain a model that represented the best compromise between goodness of fit and parsimony.

Five items (6, 9, 15, 8 and 20) were excluded due presented very low standardized factor loadings ($< 0.50$)\textsuperscript{22}. Items 3 (I feel unattractive after I have eaten chocolate), 22 (I feel depressed and dissatisfied with life after eating chocolate) and 7 (The thought of chocolate often distracts me from what I am doing), were removed because they presented the most controversial interpretability/performance regarding their face validity. Items 23 (I often eat chocolate when I am bored) and 16 (If I resist the temptation to eat chocolate I feel more in control of my life) were considered redundant in a shortened ACQ and their exclusion had no impact on the overall fit. Finally, item 5 (I eat chocolate as a reward when everything is going really well for me) was excluded because it refers to a different construct than Craving and emotional eating. In fact, emotional eating refers to food intake that is associated with negative feelings (e.g. stress and anxiety)\textsuperscript{23}, which is different than eating related to celebration/pleasant moments\textsuperscript{5,24}.
All fit indices for the two-factor/11-item solution (ACQ-R11) were superior relative to the other solutions, considering both the results of this study and prior ones. The only caveat was for the ratio χ2 to degree of freedom results, which was slightly increased. However, it should be noted that χ2 based statistics tend to be increased in larger samples\textsuperscript{21,22}. The internal consistency of the ACQ-R11 was satisfactory and the results about construct validity were considered adequate. Furthermore, the scores of both the ACQ-R11 scales correlated strongly with their corresponding totals in the 2F-22 items model.

Taken together these findings suggest that the ACQ-R11 model could be better suited to the ACQ and provides a promising alternative measurement structure. Although the findings may be specific to the Brazilian population and cultural variability may be expected, the relative constancy of the ACQ psychometric evaluation results\textsuperscript{12-15} suggests possible good fit maintenance.

Another important result was the association between the highest scores in both the ACQ-R11 scales with overweight, as well as the lower scores with healthy weight. This finding is consistent with other studies\textsuperscript{6,14} and indicates the pertinence of assessing behaviors related to chocolate to develop more effective dietary approaches in the treatment of overweight conditions. For example, individuals with higher restrictive/guilt behavior related to chocolate could not benefit from weight management practices targeting chocolate restriction\textsuperscript{7}. In contrast, success in nutrition oriented interventions with overweight individuals classified as "Lowers" would probably be influenced little by chocolate exclusion or not.

The main limitation of the current study is that the results are based on a sample of young adults, which may limit the generality of our findings. Another limitation is that the actual dietary intake of chocolate was not evaluated.

Nonetheless, this study also has several strengths. First, the ACQ-11R provides a better fit than the other versions, considering both the results of this and prior studies\textsuperscript{12-15}. Second, the reduced version demands less time to be completed, making it more suitable for research and/or
clinical screening purposes. Third, we evaluated several ACQ models in a reasonably large sample of individuals. Finally, we found an association between ACQ scoring patterns and nutritional status, which can be helpful in developing interventions for overweight individuals.

**IMPLICATIONS FOR RESEARCH AND PRACTICE**

The results from this study suggest that the ACQ-R11 is an appropriate instrument to investigate eating behaviors related to chocolate, with adequate psychometric properties and good potential to be utilized in clinical practice.

Additional research is needed to examine the psychometric properties of the ACQ-R11 in a more heterogeneous sample, as well in a clinical context, and should also evaluate whether or not the employment of this instrument may be useful in improving treatments for obesity and related diseases.

Also, future research should include additional measures of adiposity (e.g. waist circumference) and the association of ACQ-R11 dimensions with anxiety disorders and depression, as suggested in previous studies.3,25

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Journal of Nutrition Education and Behavior: Authorship Guidelines

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**General manuscript preparation**

Manuscripts (including the main text, references, and figure legends) should be prepared in a 12-point typeface, double-spaced, and in a single column with 1-inch margins throughout.

Beginning with the Introduction, each manuscript page is numbered in the upper right-hand corner and each line of text is numbered consecutively. First-level headings are centered on the page, typed in uppercase, bolded letters, and followed by two blank lines. Second-level headings begin flush with the left margin, have each word capitalized and bolded, and are followed by one blank line. Third-level headings are only used in Research Articles.

Page and word limits exclude the abstract but include all other text, acknowledgments, tables, figures, and references. Manuscripts must not exceed word count limits or page limits.

**Research Briefs - 14 double-spaced pages (≤ 3,000 words)**

Research Briefs are (1) articles that describe development and validation of new measures and methods for research.

Structured abstracts for Research Briefs of 150 words or less include the following subheadings (verbatim), bolded and presented in the order shown here:

- **Objective:** Specifies the primary purpose or objective(s) of the study and/or hypotheses tested.

- **Methods:** Describes the basic research design, methods used to collect data, timing and sequence of intervention, and data collection.

- **Results:** Summarizes primary results reported in the manuscript, including the number of participants, direction of change, and variance and level of statistical significance for each quantitative result, as well as confidence intervals or effect sizes wherever appropriate.

- **Conclusions and Implications:** Specifies study conclusions directly supported by results reported in the abstract and specifies implications for research and practice or policy making when appropriate.

Research Briefs include the following major sections:
• Introduction: Concisely describes the issue addressed in the manuscript, explains its importance in relation to existing literature, describes the theoretical or conceptual foundation on which the study is based, states the objectives of the article, and specifies the hypotheses tested.

• Methods: Describes the research design, sampling methods, recruitment strategies, measurement instruments, methods used to test instruments for validity and reliability, data collection procedures, and statistical analyses in enough detail for replication. For general statistical guidelines, go to Guidelines for Statistical Methods for JNEB. It also specifies that the project was reviewed and approved by an Institutional Review Board (IRB) or similar human studies review board, with a full, expedited, or limited review and that written, oral, or implied consent and/or assent was obtained.

• Results: Outlines results clearly and systematically, mentioning or highlighting—but not duplicating—information displayed in tables, and specifies the direction and magnitude of each statistically significant difference reported. Carefully designed tables and figures are encouraged to showcase results.

• Discussion: Provides an in-depth interpretation of results reported, compares and discusses results in relation to those from similar studies reported in the literature and in relation to theory, outlines limitations of the study, describes how study limitations influence interpretation of results, and offers alternative explanations for the findings.

• Implications for Research and Practice: Specifies how researchers and practitioners, and policy makers when appropriate, could apply results to future work.

References

The reference list is double-spaced and numbered to correspond with citations in text. Reference style follows the system described in the American Medical Association Manual of Style, 10th edition, except that issue numbers are not included in journal references. MEDLINE abbreviations are used for periodical titles.
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• Methods: Describes the research design, sampling methods, recruitment strategies, measurement instruments, methods used to test instruments for validity and reliability, data collection procedures, and statistical analyses in enough detail for replication. For general statistical guidelines, go to Guidelines for Statistical Methods for JNEB. It also specifies that the project was reviewed and approved by an Institutional Review Board (IRB) or similar human studies review board, with a full, expedited, or limited review and that written, oral, or implied consent and/or assent was obtained.

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• Implications for Research and Practice: Specifies how researchers and practitioners, and policy makers when appropriate, could apply results to future work.

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Resumo

Objetivo: O craving por alimentos desempenha um papel importante na neurobiologia do comportamento alimentar, sendo positivamente associado com sentimentos negativos, transtornos alimentares e obesidade. Assim, esse estudo teve por objetivo avaliar as propriedades psicométricas da versão reduzida do Food Cravings Questionnaire-Trait-reduced (FCQ-Trait-r).

Métodos: Estudantes universitários (n = 505) responderam a versão completa do FCQ-T e ao Three Factor Eating Questionnaire, e tiveram sua altura e peso mensurados. Análise fatorial exploratória foi utilizada para avaliar a estrutura do FCQ-T-r. Resultados: O FCQ-Trait-r apresentou estrutura unifatorial e consistência interna satisfatória (α > 0.80). Uma correlação positiva foi observada entre o FCQ-Trait-r e a versão completa do instrumento. A pontuação do FCQ-Trait-r também se correlacionou positivamente com os comportamentos de comer emocional e descontrole alimentar. Nenhuma correlação foi encontrada entre o IMC e a pontuação do FCQ-Trait-r. A partir das características da nossa amostra, foram sugeridos pontos de corte para o FCQ-Trait-r, de acordo com o sexo dos participantes. Conclusão: Nossos resultados corroboram a validade da versão brasileira do FCQ-Trait-r, que parece ser uma alternativa viável para investigar o comportamento de craving por alimentos, particularmente em situações nas quais o tempo é limitado. Mais estudos são necessários para avaliar a validade desses resultados em outros estágios de vida e populações clínicas.

Palavras-chave: comportamento alimentar; psicometria; craving.
Abstract

**Objective:** Food cravings play an important role in the neurobiology of appetitive behavior, being positively associated with negative feelings, eating disorders and obesity. This study aimed to assess the psychometric properties of the Brazilian Food Cravings Questionnaire-Trait-reduced (FCQ-T-r), a short version of the most widely used measure of this behavior. **Methods:** Undergraduate students (n = 505) answered the complete version of the FCQ-T and the Three Factor Eating Questionnaire. Height and weight were also verified. Exploratory factor analyses were performed. **Results:** The FCQ-T-r presented a one factorial structure and satisfactory internal consistency ($\alpha > 0.80$). A positive correlation was observed between FCQ-T-r and original version scores. Also, FCQ-T-r scores were positively correlated with uncontrolled eating and emotional eating behaviors. No correlation was found between BMI and FCQ-T-r scores. According to our sample characteristics, we suggested specific FCQ-T-r cutoff points for the Brazilian population, considering males and females. **Conclusion:** Our results support the structure of the Brazilian adaptation of the FCQ-T-r, which seems to be a viable alternative to investigating food cravings, particularly in situations where there are time limitations. Further studies are needed to verify these results in other age ranges and clinical samples.

**Keywords:** eating behavior; psychometrics; craving
INTRODUCTION

Food craving is defined as an intense desire to consume a particular food item (or food group), which is difficult to resist[1,2]. Although not yet completely understood, it is believed that food craving has a multifactorial etiology and plays an important role in the neurobiology of appetitive behavior[1].

An increased intensity and frequency of food cravings in patients with eating disorders[3] and in response to dysphoric mood or emotional arousal can be frequently observed[1]. It has even been suggested that evaluating chocolate craving in states of emotional dysregulations can be very useful for the classification of atypical depressive syndrome[4].

The Food Cravings Questionnaire-Trait (FCQ-Trait) was developed[2] in order to assess the food craving behavior as a multidimensional construct and has been validated in several countries[5–7], including under clinical conditions[3]. This instrument consists of 39 items, grouped into 9 dimensions: Anticipation of positive reinforcement from eating; Anticipation of relief from negative states and feelings from eating; Intentions and plans to consume food; Cues that may trigger food cravings; Thoughts or preoccupation with food; Craving as hunger; Lack of control over eating; Emotions that may be experienced before or during food cravings or eating; and Guilt from cravings and/or giving into them[2,7].

Recently, the Food Cravings Questionnaire-Trait-reduced (FCQ-Trait-r)[8], an alternative that demands less time for completion than the full version, was developed. This is a desirable characteristic of clinical and research protocols, which often require multiple steps to be accomplished. Also, the FCQ-T-r presented satisfactory psychometric properties in studies conducted in German[8], Cuban[5], Italian[9] and American[10] populations.

Although the full version of the Food Cravings Questionnaire-Trait has already been validated for Brazilian Portuguese, so far there have been no studies using the reduced version.
Thus, the present study aimed to evaluate the psychometric properties and validity of the Brazilian version of the FCQ-T-r.

**METHODS**

**Participants**

The study sample consisted of 505 undergraduate students (50.1% males) recruited from the Federal University of Rio Grande do Norte, through divulgation of the research project on campus. The study proposal was approved by the local Ethics Committee. The inclusion criteria for participants were being Brazilian and 18 years of age or older. Exclusion criteria included any self reported diagnosis of chronic disease or eating disorders, and current dieting.

**Socio-demographic/anthropometric data**

Participants were asked to provide their age and gender, while their height and weight were measured by trained assistants. The body mass index (BMI) was calculated and a BMI ≥ 25 kg/m² was considered overweight.

**Measures**

**FCQ-Trait and FCQ-Trait-Reduced**

The Brazilian version of the Food Cravings Questionnaire-Trait (FCQ-Trait-Br) was applied. The FCQ-Trait-r is composed of 15 items from the original questionnaire. Responses were recorded on a Likert scale, ranging from "(1) never or not applicable" to "(6) Always", referring to the frequency with which each statement applies to the participant[2].

**Three Factor Eating Questionnaire (TFEQ)**

The Brazilian version of the TFEQ provides measures of three eating behaviors: Cognitive restraint, Emotional eating and Uncontrolled eating[11]. According to previous validation studies[3,10] moderate to strong correlations between FCQ-Trait-r scores and the
Emotional eating and Uncontrolled eating scales were expected. Regarding discriminant validity, no correlation was expected between FCQ-Trait-r scores and Cognitive restraint scale.

**Statistical Analysis**

Exploratory Factor Analysis (EFA) was performed with FACTOR (version 9.2) software[12]. The number of factors was determined with optimal implementation of Parallel Analysis (with the mean eigenvalue criterion[13]); and the factor extraction method was the Unweighted Least Squares. The Kaiser-Meyer-Olkin (KMO) and Bartlett's sphericity tests were evaluated to verify if the data were suitable for EFA. The internal consistency of the FCQ-Trait-r was assessed by standardized Cronbach’s α coefficient.

In order to examine the construct validity, Spearman correlations were performed between the FCQ-Trait-r scores and other variables. Group comparisons were performed using the Mann-Whitney test. Pearson Chi-square tests were used to verify associations between categorical variables. These procedures were performed using SPSS version 20. Results are expressed as means (standard deviations).

**DISCUSSION**

Similar to other studies[5,9,10], the reduced version of the Food Craving Questionnaire-Trait for the Brazilian population presented a one-factorial structure and good internal consistency (α ≥ 0.80). The item factor loadings ranged from 0.64 to 0.82, indicating that all items were strongly loaded in the dimension.

Just as the Italian FCQ-T-r[9], the Brazilian version was correlated with the original FCQ-Trait, as well as for each dimension separately.

The three scales of TFEQ were used to assess the construct validity of the FCQ-Trait-r. According to the literature[1,14], uncontrolled and emotional eating behaviors are correlated with food craving. For example, both emotional eating and food craving tend to increase in the context of emotional distress, whereas food craving and uncontrolled eating may be triggered by
environmental cues[1]. On the other hand, the Cognitive restraint construct, which refers to the conscious restriction of food intake aimed at controlling body weight, has little or no relationship to the food cravings concept[14]. Thus, the result of correlations observed between the TFEQ dimensions and FCQ-Trait-r scores is a good indication of construct validity for the later.

Another result that supports the TFEQ construct validity was the higher craving scores for females, which is also in line with previous studies[2,3,5,14].

However, a limitation of FCQ-Trait-r construct validity claim for the FCQ-Trait-r was its lack of correlation with BMI scores. A similar result was found by Hormes and Meule[10], in a study using the American version of FCQ-Trait-r. These authors[10] suggested that this finding may be due the relative youth and low prevalence of overweight individuals among the population studied, which is similar to the current study sample.

Another point to be considered is that the FCQ-Trait-r does not include items from the "Guilt" subscale of the original version, which was most strongly correlated with BMI in the present study. Thus, in spite of the evidence for the FCQ-Trait-r having good psychometric properties, this finding may be indicative of an important limitation for its use in predominantly young and healthy populations, compared to the FCQ-Trait complete version.

In order to better contextualize the results referring to FCQ-T-r scores, our findings were compared with similar studies. Thus, it was observed that the mean FCQ-Trait-r scores for the Brazilian version were lower than those applied to German[8] [M = 33.2 (11.3)/F = 39.5 (13.2); Age = 24.4 (5.6)] and Cuban[5] [M = 40.7 (17.6)/ F = 47.1 (20.4); Age = 32.6 (12.9)] populations.

These findings suggest that responder characteristics (e.g, home country and age) could have an influence on the FCQ-Trait-r scoring patterns, which is in agreement with the probable biopsychosocial etiology of food cravings[1]. They also indicate that it may be useful and pertinent to define specific cutoffs points, adapted to the specific characteristics of each
population. Thus, we suggest the median split as a cutoff point for the FCQ-Trait-r in Brazilian males (25.0) and females (30.5).

In summary, despite certain limitations, the present investigation provides evidence of the adequate structural and construct validity of the Brazilian version of the FCQ-Trait-r, which presented similar performance to versions applied in other languages[5,9,10]. Thus, the Brazilian FCQ-Trait-r seems to represent a viable alternative to investigating food cravings, particularly in situations where there are time limitations.

A present limitation of the current study and area for further research is the need to investigate the FCQ-T-r scores across different life stages and pathological conditions, such as eating disorders and depression.

REFERENCES


Revista Brasileira de Psiquiatria: Instruções aos Autores

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Comunicações breves: São manuscritos originais, porém mais curtos, abordando temas de interesse na área da psiquiatria, com resultados preliminares ou de relevância imediata. Esses artigos devem ter até 1.500 palavras, uma tabela ou figura e 15 referências.

Artigos originais, artigos de revisão, artigos de atualização e comunicações breves devem seguir o formato descrito a seguir.

Página 2: Deve conter um resumo estruturado com até 200 palavras, contendo as seguintes seções: Objetivo, Métodos, Resultados e Conclusão. Devem ser incluídas de três a cinco palavras-chave selecionadas a partir dos Descriptores em Ciência da Saúde (DeCS).

Texto principal: A Introdução deve ter entre uma e três páginas (não deve incluir uma revisão extensa da literatura) e deve finalizar com uma frase que anuncie claramente os objetivos do estudo. A seção de Métodos deve incluir informações detalhadas sobre o desenho do estudo, o ambiente de pesquisa, participantes, desfechos clínicos de interesse, análises estatísticas, registro de ensaio clínico, aprovação pelo comitê de ética e procedimentos de obtenção de consentimento informado (deve-se evitar referências a desenhos, métodos ou materiais descritos em outros artigos publicados). Os Resultados devem ser claros; não é permitida a repetição de dados no texto e em tabelas/figuras. A Discussão não deve incluir uma seção à parte chamada Conclusão; as conclusões do estudo devem ser apresentadas no último parágrafo do texto.

Lista de referências: As referências devem ser limitadas ao menor número possível e devem ser numeradas consecutivamente na ordem em que aparecem no texto, conforme o sistema Vancouver. As referências no texto, em tabelas e em legendas devem ser identificadas utilizando algarismos arábicos sobrescritos. Referências citadas apenas em tabelas ou figuras devem ser numeradas levando em consideração a primeira citação dos itens no texto. Artigos publicados eletronicamente, mas ainda não disponíveis em forma impressa, devem ser identificados por seu número de DOI. Os títulos das revistas devem ser abreviados conforme o Index Medicus.

Tabelas e figuras: Todas as figuras e tabelas devem esclarecer/complementar (e não repetir) o texto, e devem ser limitadas ao menor número possível. Todas as tabelas e figuras devem incluir legendas descritivas e a definição de abreviações utilizadas.
Not all adults are equal: changes in food craving during adulthood in females

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### Participou da análise estatística e revisão geral do manuscrito.
Resumo

**Objetivos.** A despeito de sua importância para o comportamento alimentar como um todo, pouco se sabe sobre a evolução do *craving* por alimentos ao longo da vida adulta, particularly durante a meia idade. Assim, o presente trabalho pretendeu explorar o craving por alimentos ao longo da vida adulta. **Métodos.** Trata-se de estudo transversal on-line conduzido com 227 adultos jovens (YA) e 100 indivíduos na meia idade (MA), todos do sexo feminino. As participantes responderam a um questionário sócio-econômico, a um questionário de frequência alimentar e ao Food Craving Inventory (FCI). **Resultados.** Foi identificada uma correlação positiva entre o índice de massa corporal (BMI) e as dimensões do FCI de Lanches Gordurosos e Consumo Doméstico, no grupo MA. A frequência de ingestão de *junk food* foi positivamente correlacionada com as dimensões do FCI de Lanches Gordurosos, Doces e Consumo Doméstico, no grupo YA. Uma interação bifatorial (estágio de vida e prática de dieta), controlada para o BMI, foi observada em relação aos escores das dimensões Lanches Gordurosos e Doces. **Discussão.** O craving por alimentos foi menor no grupo MA, comparado ao grupo YA. Outrossim, as implicações do craving por alimentos em alguns aspectos do comportamento alimentar precisam ser interpretados conforme o estágio de vida do grupo avaliado. Nossos achados podem ser úteis no desenvolvimento de estratégias clínicas mais apropriadas para o manejo do craving por alimentos, especialmente para indivíduos com excesso de peso.

**Palavras-chave:** estágios de vida, dieta, peso corporal, comportamento alimentar, ingestão alimentar
Abstract

Objectives. Despite its importance to appetitive behavior, little is known about food craving trends throughout adulthood, particularly during middle age. Thus, the present study aimed to explore food craving behavior during adulthood. Methods. A Cross-sectional Web-based survey was conducted with 227 Young Adults (YA) and 100 Middle Age (MA) subjects, all female. The participants were asked to answer socio-demographics questions, a food frequency questionnaire and fill out the Food Craving Inventory (FCI). Results. Positive correlations were identified between Body Mass Index (BMI) and FCI dimensions for High Fat and Home intake, in the MA group. The intake frequency of junk food was positively correlated with FCI dimensions for High Fat, Sweet Foods and Home intake, in the YA group. A two-factor interaction effect (age group and dieting status) were observed in scores for the High Fat and Sweet Food dimensions, controlled for BMI. Discussion. Food cravings were decreased in the MA group compared to YA. Furthermore, the implications of food cravings for some aspects of eating behavior must also be interpreted according to life stage. Our findings may be useful in the development of more appropriate interventions for clinical management of food craving, especially in overweight individuals.

Key Words: developmental age groups, dieting, body weight, eating behavior, food intake
INTRODUCTION

The strong desire to consume palatable food plays a central role in the development of overweight and appetitive behavior as a whole[1,2]. For this reason, there has been a notable increase in research on food cravings over the past 20 years[2].

Currently, it is well established that women experience food cravings with greater frequency and intensity compared to men. Also, changes in the presentation of food craving patterns can also be found in overweight subjects[1,2] and those with eating disorders[3,4] or under dietary restrictions, such as diets for weight control[5,6]. However, there are still many gray areas, for example, regarding the etiology and evolution/presentation of food cravings over a person’s lifetime[2].

Food cravings have been reported by individuals of virtually all ages and life stages[2]. Nevertheless, most studies seem to concentrate on young adults[7–10] and there are few studies evaluating food cravings at other life stages, such as childhood[11], adolescence[12] or elderly[13]. Also, to the best of our knowledge, no studies have considered the middle age group separately.

Therefore, the understanding of trends in long-term food cravings could be relevant in developing more effective strategies to combat and prevent obesity, and also in adopting healthier eating habits. Thus, the present study aimed to explore food craving behaviors during adulthood.

METHODS

The research form was a cross-sectional Web-based survey made available via Google™ Docs during the last quarter of 2014. Participants were recruited through disclosure of the project using the social network Facebook® and by means of an electronic mailing list.

The Institute of Medicine of the National Academies[14], divides adulthood into two life stage groups: Young Adulthood (19 through 30 years) and Middle Age (31 through 50 years). Inclusion criteria for the study was that participants be female, aged between 19 to 50 years, of Brazilian nationality and residing in Brazil during the study period. The last two criteria were
important because the participants had to be familiar with the food items used in the research protocol.

The participants were asked to answer socio-demographic questions, respond to a food frequency questionnaire and fill out the Food Craving Inventory (FCI). The research form takes approximately 15 minutes to be completed. Participants gave informed consent in a virtual format, and in accordance with the Federal University of Rio Grande do Norte Research Ethics Committee, which approved this study.

Participants completed the Brazilian version of the FCI (Cronbach’s $\alpha = .89$ in the present sample) by assessing the frequency of cravings for 23 different food items, grouped in three dimensions: High Fat, Sweet Foods and Home Intake. Participants marked their response on a rating scale ranging from 1 = “never” to 5 = “always/almost every day”. The FCI is frequently used in studies about food cravings, having already been validated for the Brazilian population.

The frequency of junk food intake was investigated using a subscale of the “Markers of Food Consumption” questionnaire [15], from the Brazilian Ministry of Health protocols. For this measure, the participants were asked how many days they ate each of the five food groups listed, according to a scale ranging from 0 = “none day in the last seven days” to 7 = “every day in the last seven days”.

Dieting status was assessed by the question “Currently, are you performing some kind of diet?” (yes/no). Body mass index was calculated based on self-reported measures.

Statistical analyses were performed using SPSS version 20.0, with the statistical significance level set at 0.05. Categorical data were evaluated by the Pearson Chi-Square test. Spearman’s rho correlation coefficient was used to study relationships between variables. Generalized Linear Models with log link function and gamma distribution were used to evaluate the effect of the life stage group and dieting status on FCI scores. The robust estimator was used to estimate covariance. The Sequential Sidak method was used to account for multiple
comparisons. Data are presented as means (standard deviations), absolute values and/or percentages.

**DISCUSSION**

We investigated differences in food cravings across adulthood. Overall, a decrease was observed in food cravings in the MA compared to the YA group.

Studies of other life stage groups suggest[11,16] that age-related reductions in food craving seems to be related to a decreased activation of brain areas involved in reward, while there is an increased recruitment in areas related to cognitive control and emotional regulation. This could be indicative of an increasing conscious reappraisal of food cravings during the aging process[16].

Cognitive reappraisal is an explicit and antecedent emotion regulation strategy whose purpose is to rethink a certain emotional situation, in order to change or reduce the emotional response in a future confrontation[17]. For example, in general, an increase in concerns about health [18] and chronic diseases[19] was observed in the MA group. Thus, individuals can begin to think about the long-term health implications of eating a specific fatty snack. As a result, a decrease in the intensity and frequency of future cravings for that fatty snack is expected. A finding that seems reinforce this hypothesis is the absence of differences between groups for the Home Intake scores. Once the foods listed in this dimension are not classified as junk food, any focus on reappraising “self-developed” food cravings is not expected.

From this perspective, a reduction in responses to craving[20], i.e., greater ability to “resist the temptation”[21], is also expected. Perhaps for this reason, unlike what was found in the YA group, correlations between the frequency intake for junk food and the FCI scores in the MA group were observed. A plausible possibility is that such greater engagement in food cravings reappraisal, as something that otherwise develops spontaneously during the ageing process, may also be “artificially” induced by dieting, as suggested by our results. Because this effect was only
observed in the YA group, there may be differences in the behavioral response to dieting between the life stage groups, or even a response ceiling.

Another point worth noticing is the beginning of decreased ovarian hormones, observed in late MA[22], which can also contribute to the age-related reductions in food cravings among females. However, this hormonal response is usually more related to the craving for sweet foods[23].

Regarding findings for the BMI, a decrease in energy expenditure and nutrient needs related to energy metabolism during adulthood has been observed[24]. This may be the explanation for a lack of correlation between the BMI and FCI scores in the YA group, and also because, even with a lower frequency intake for junk food, the MA group showed a greater prevalence for overweight individuals. However, a notable limitation of these results is the use of self-reported anthropometric measures, which tend to be underestimated by females and overweight people[25].

At least two other main limitations of the study should be addressed. First, the study sample consisted of female participants only. This was by design due to gender differences in food cravings[26], but at the same time it limits the generalizability of our results. A second possible limitation was the use of only one question to identify the individuals actively dieting, which may have been insufficient to properly characterize this group. Future research should consider these issues.

Despite these limitations, our findings provide important information about food cravings during adulthood. The magnitude and interpretation of food craving scores can be different, depending on the life stage group. In the YA group, higher FCI scores seems to indicate greater intake of unhealthy foods, which may imply increased risk for chronic diseases. In the MA group, there is a need to consider lower cutoff points for the FCI scores and a possible reappraisal of the chronic state of food craving, which is less susceptible to changes by “dieting” approaches. Our findings may be useful in the development of more appropriate
interventions for managing food cravings as well as in the design of future research on the subject in adult populations.

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Dietary patterns and food cravings among Brazilian university students

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Resumo

Objetivo: O propósito deste estudo foi investigar o craving por alimentos em diferentes padrões dietéticos, em uma população de estudantes universitários. Métodos de pesquisa e procedimentos: A população estudada consistiu de 261 homens e 275 mulheres. Os dados foram coletados utilizando as versões brasileiras do Food Craving Inventory, o Food Cravings Questionnaire-Trait e um questionário de frequência alimentar. Os itens do questionário de frequência alimentar foram agrupados em duas dimensões (Risco e Saudável) e os padrões dietéticos foram identificados por análise de agrupamentos (método Two-Step). Análises de modelos lineares generalizados foram realizadas para comparar as medidas de craving por alimentos entre os diferentes padrões dietéticos. Resultados: Três padrões dietéticos foram identificados. O padrão Prudente (n = 191; 35,6%) foi caracterizado pela maior frequência de consumo de alimentos saudáveis (p < 0,001). O padrão Transição (n = 255; 47,6%) apresentou a menor discrepância entre a pontuação dos grupos Risco e Saudável e razão Saudável/Risco maior que 1,0 [1,34 (0,57)]. No padrão Ocidental (n = 90; 16,8%) foi identificado a maior frequência de consumo de alimentos da dimensão Risco (p < 0,001). De maneira geral, as medidas de craving por alimentos foram maiores no padrão Ocidental, comparado aos padrões Prudente e Transição. Esta tendência ocorreu de forma mais consistente entre os homens. Conclusões: Os resultados do presente estudo sugerem que não apenas a frequência de consumo de junk food, mas também sua proporção em relação a alimentos considerados saudáveis, podem estar implicados no comportamento de craving por alimentos. Estes achados podem ser particularmente relevantes para o acompanhamento clínico de indivíduos com sobrepeso e obesidade.

Keywords: comportamento alimentar, diferenças sexuais, ingestão alimentar, junk food, análise de agrupamentos
Abstract

Objective: The purpose of this study was to investigate measures of food craving behavior across different dietary patterns, in a sample of Brazilian university students. Research Methods & Procedures: The sample consisted of 261 males and 275 females. Data were collected using the Food Craving Inventory, the Food Cravings Questionnaire-Trait and a food frequency questionnaire. The items in the food frequency questionnaire were grouped in two dimensions (Risk and Healthy) and dietary patterns were identified by cluster analysis (Two-Step method). Generalized linear models analyses were performed to compare measurements of food cravings across dietary patterns. Results: Three dietary patterns were identified. The Prudent pattern (n = 191; 35.6%) was characterized by a higher frequency of consumption for healthy foods (p < 0.001). The Transition pattern (n = 255; 47.6%) presented the lowest discrepancy between Risk and Healthy scores, and a mean ratio of Healthy/Risk scores higher than 1.0 [1.34 (0.57)]. Finally, the Western pattern (n = 90; 16.8%) showed a significantly higher frequency of food intake from the Risk dimension (p < 0.001). Overall, the measures of food cravings were higher in the Western group, compared to the Prudent and Transition patterns. This trend occurred more consistently among males. Conclusions: Results reported in this study suggest that not only the frequency of junk food intake, but also its proportion in relation to the intake frequency for food considered healthy, may be implicated in the food craving behavior. These findings should be particularly relevant to the clinical care of overweight and obese individuals.

Keywords: eating behaviour, sex differences, food intake, junk food, cluster analysis
Introduction

Food cravings are a widespread component of human eating behavior and can be defined as an intense desire to consume a particular food, whose sensorial properties are already known, even in the absence of hunger [1]. This behavior appears differently according to sex, being more frequent / intense among women [2,3]. However, the types of food being craved generally have similar characteristics, being highly palatable and rich in fats and sugars [1].

In the past two decades a growing interest in food cravings has been observed, due in large part to the possible relevance of this behavior to healthcare management of obesity [4,5]. Also, food cravings have been linked to addictive-like eating symptoms and binge eating episodes, and may play an important role in the clinical management of these disorders as well [6].

A large part of the studies on food cravings explore measures and / or anthropometric indicators of overweight conditions (particularly BMI) [1,7,8], eating disorder contexts [9,10] or dysphoric mood states [11,12]. However, information about food cravings and dietary intake are still relatively scarce. Just a small number of studies have addressed aspects related to food cravings and food intake, and generally are limited to the consumption of specific foods (e.g. chocolate [13,14]), often in experimental settings [15,16]. A limited perspective is also offered by the results of food craving assessments during dietary interventions [17,18], which can be biased by increased cognitive restraint [19,20]. Although useful and relevant, such approaches do not seem sufficient to draw a general picture of the relationship between food cravings and food intake, which cannot be decontextualized from food intake as a whole.

Foods are eaten in a variety of patterns that can be assessed in a number of ways. The dietary pattern approach provides a more global and less reductionist view of dietary intake, focusing on not just a single nutrient or food type, but on the whole dietary intake and their complex food combinations [21]. One of the most frequently used methods to identify dietary
patterns is the cluster analysis, which is usually applied to data obtained from food frequency questionnaires [22].

Traditionally, studies using the dietary pattern approach explore associations between a given dietary pattern and the risk of developing a particular disease or medical condition [23], such as hypertension [24] or coronary heart disease [25]. More recently, the relationship between dietary patterns and various facets of eating behavior have been investigated [26,27].

Thus, the main goal of this study was to investigate measures of food craving behavior across different dietary patterns, among university students.

**Participants and Methods**

**Study Design**

This was a cross-sectional study design, conducted by the means of convenient sampling of university students from the Federal University of Rio Grande do Norte, in Brazil. Eligible participants were adults presenting 18 years or older, that were requested to enroll in the study through personal approaches in campus social spaces. Exclusion criteria included: pregnancy, lactation and/or the self-reporting of some type of current dieting practice.

The study was approved by the institutional Research Ethics Committee and carried out in accordance with the Declaration of Helsinki. All participants provided a written informed consent. The research protocol was comprised of four sections: sociodemographic data, anthropometric evaluation, food cravings measures and dietary measures. All questionnaires were self-administered in a written format.

**Measures**

*Sociodemographic data and anthropometric evaluation*
Participants were asked to provide data on age, sex and current dieting status (yes/no). The data from 102 participants was excluded because they were on dieting.

The anthropometric evaluation was performed by a team of trained research assistants, following standardized procedures [28]. Height was verified using a tripod support stadiometer (measurement capacity of 115 to 210cm). Weight was measured using portable digital scales (capacity for 150kg). All of the measurements were taken in duplicate, and in the case of discrepancy between values, a third measurement was performed. Body mass index (BMI) was calculated as recommended and a BMI ≥ 25.0 kg/m² was considered to be overweight.

**Food cravings measures**

The Food Cravings Questionnaire Trait (FCQ-Trait) measures the intensity of the food craving experience, as a psychological trait, on a multidimensional level. The nine dimensions of the FCQ-Trait were: Anticipation of positive reinforcement that may result from eating (Pos Reinforcement); anticipation of relief from negative states and feelings as a result of eating (Neg Reinforcement); an intention and planning to consume food (Intention); environmental cues that may trigger food craving (Cues); thoughts or preoccupation with food (Thoughts); craving as a physiological state (Hunger); possible lack of control over eating if food is being eaten (Lack of Control); emotions that may be experienced before or during food cravings or eating (Emotion); and guilt from cravings and/or giving into them (Guilt). Participants rated how much each statement “would be true for you in general”. The answers are recorded using a 6-point Likert scale, ranging from “(1) never or not applicable” to “(6) Always”. Overall and dimension scores were calculated by summing the corresponding items scores. The FCQ-Trait was successfully validated for the Brazilian population and, the overall Cronbach’s alpha was 0.96 (dimensions alphas ranged from 0.77 to 0.90) for the present study sample.

**Food Craving Inventory**

The Food Craving Inventory (FCI) assesses the frequency of craving experiences for specific foods. Using a Likert scale ranging from 1 (never) to 5 (always/almost every day),
participants evaluated a list of food items and responded to the question “Over the past month, how often have you experienced a craving for the food?”. The Brazilian version of the FCI includes 23 food items, grouped in three dimensions: High Fat (pizza, pastel, bacon, salty packaged snacks, lasagna, sandwich/hamburger, Coxinha, French fries); Sweet Foods (cookies, doce de leite, chocolate, condensed milk pudding, candy, ice cream, brigadeiro, sweet pie, cake); and Home Intake (bread, barbecue/grilled meat, farofa, cheese, beans/feijoada, steak). In the current study, Cronbach’s alpha was 0.88 for the total score and ranged from 0.73 to 0.82 for the subscales, indicating adequate internal consistency.

**Dietary measures**

Eating habits were assessed using the Form of Food Intake Markers (version for individuals older than 5 years) (FIM5+)[29]. This instrument is used in the evaluation and monitoring of eating habits and health risks, and is recommended by the Ministry of Health in Brazil.

The FIM5+ is focused on the frequency of selected food group only and no information about portion size was included. The food groups listed in the FIM5+ included items related both to healthy habits (e.g. fruits) and items related to non-recommended eating habits (e.g. soft drinks). Information on eating habits was assessed based on the previous one-week period. Thus, the possible frequency of responses for food intake ranged from (1) *I have not eaten in the last seven days* to (8) *I ate every day in the last seven days.*

The food categories listed in the FIM5+ were grouped in two dimensions: Healthy and Risk. The Healthy dimension comprised five food groups: Raw salad, Milk and yogurt, Cooked vegetables, Fruits, and Beans. The Risk dimension included: Salty snacks, Sweets and chocolate, Fries and fried, Hamburger and sausages, and Soft drinks. The overall score for each dimension was calculated as the sum of all scores from the frequency of intake for the different good groups.
**Statistical analysis**

Sex comparison for food groups intake frequencies were performed using Mann-Whitney test. Dietary patterns were identified through a Two-Step cluster analysis procedure[30], which combines the principles of hierarchical and partitioning methods[31]. The optimal number of clusters was determined automatically, comparing different clustering solutions using the Bayesian Information Criterion. The silhouette measure of cohesion and separation were used to evaluate the clustering solution’s overall goodness-of-fit. Healthy and Risk dimension scores were used as input variables.

Generalized linear models analyses, using the log link function and gamma distribution, were performed to compare measurements of food craving across the dietary pattern clusters. Robust estimators were used to estimate the covariance. To explore significant interactions, *post-hoc* pairwise multiple comparisons were conducted using the Sequential Sidak method.

Associations between categorical variables were investigated using the Pearson Chi Square test. Statistical analyses were performed using IBM SPSS version 20.0 for Windows. Means (standard deviations), absolute values and/or percentages were used to describe the results. Significance level was fixed at 0.05.

**Discussion**

We evaluated measures of food craving from three different dietary patterns, which differ from each other with respect to the proportion of the frequency of intake for healthy and unhealthy foods.

Individuals grouped in the Western pattern presented the highest frequency of intake for unhealthy foods, which contain a large amount of sugar, fat and/or salt. These highly palatable foods are usually involved in food craving episodes [1]. Consistent with these findings, our results
showed that participants grouped in the Western pattern showed higher scores for measures of food craving, compared to the Transition and Prudent patterns overall.

Functional magnetic resonance imaging studies [32,33] have identified a food craving-specific activation of brain areas related to reward, reinforcement and taste memories, pleasure and the desire for food. Although cravings can be targeted on "healthy foods" [34,35], these brain circuitry activation patterns appear to be greater in response to high sweet-fat preparations that are also high in calories [36,37].

Thus, when consuming one of these highly palatable foods, cerebral reward pathways are activated, creating a pleasant memory of wellness [37]. During episodes of food craving, this memory will be evoked, resulting in a desire for foods that meet this specific sensory pattern. Once the food being craved is consumed, memory enhancement occurs, which may increase the intensity and frequency with which new episodes of food craving will occur.

In line with this perspective, our data indicate that the highest craving scores occurred among the participants who more frequently consumed junk food. That said, it is important to note that the greatest food craving scores in the Western group were observed not only with respect to specific foods, but also in the evaluation of food craving as a psychological trait. This finding fills a possible gap related to the craving for healthy food and others that were not part of the FCI, supporting the evidence regarding the role of the frequency of junk food intake in the expression of food craving behavior.

Similarly, previous studies identified associations between both the frequency of intake of high-fat-sweet food and cravings for these types of foods [38,39], and behaviors like food addiction and dietary intake of energy-dense foods [26,39]. Also, in animal models, "cafeteria diets" (consisting of foods such as chocolate and bacon) seem to increase hedonic hunger, causing a kind of food addictive behavior that eventually leads to obesity [40].

Thus, there seems to be a cycle in which as more of these hyper-palatable food items are consumed, the more they are craved, and consequently consumed. This is consistent with the
results of previous studies [4,17,18] that found a decrease in food craving during dietary interventions, after the decrease in junk food intake. In this context, it seems plausible to suggest that this system can also be strengthened by habituation.

Habit could be defined as a process that involves the repetition of automated, learned behaviors in response to cognitively associated cues [41]. During habit formation, activation of reward pathways associated with a specific response contributes to the consolidation of this habit [42,43]. Thus, faced with such a large number of cues in our current obesogenic environment [44], the likely automatic response will be junk food intake. In addition, the frequent repetition of a habit also causes it to be strengthened, which also applies to the case of eating habits [41,42]. Thus, long-term exposure to the Western dietary pattern could lead to high levels of craving for foods characteristic of this pattern, which helps to maintain eating habits.

On the other hand, healthy eating habits can act as a protective factor against junk food [45], which seems to be corroborated by our findings about the Prudent and Transition groups, which had lower scores for the measures of food craving. Once an individual has developed the habit of eating healthy foods, he or she tends to repeat this behavior. This also includes habitual actions that facilitate this choice [42], such as taking fruit for eating away from home or making healthy choices at the grocery store. Additionally, an increase in the frequency of consuming healthy foods could be related to a compensatory decrease in the frequency intake of foods from Risk dimension.

Since there was virtually no difference in the measures of food craving between the Prudent and Transition patterns, it seems reasonable to suppose that this "protective effect" from healthy eating habits may be related to a specific ratio of Healthy / Risk scores, not growing linearly, but perhaps in steps or levels. And maybe these levels are higher in females, compared to males, as our results seem to suggest. It must be emphasized that food craving in females is also heavily influenced by hormonal profile [46,47], which may decrease the influence of dietary patterns on this behavior.
Also, in this way, it is possible to hypothesize that from a certain threshold, increasing the proportion of healthy foods in a person's diet could break this "vicious cycle", gradually changing their dietary pattern.

A surprising and inconsistent result was the lowest score for the Transition group being for Home Intake from the FCI-Br, among females. This confusing finding may be due to the fact that the foods grouped in this dimension are not really junk food, but food that is typically consumed as a part of regular, main meals, complicating the interpretation of this result. However, further studies seem to be necessary to clarify this point.

Some potential limitations of the current study also warrant consideration. First, the convenience sampling approach resulted in participation by mainly young adults and may not be representative of the general population. Second, the cross-sectional study design precludes definitive conclusions about the causality of the results reported here. Third, this study did not assess the intake of specific nutrients, for example, fats and carbohydrates. Also, although the food frequency questionnaire used in this study assessed the subjects' food intake during an entire week, this approach focuses only on the frequency of consumption, not on the quantity of food consumed. However, it should be noted that the three dietary patterns identified in our study were similar to those found in other studies[27,25,48], including in the Brazilian population[24,49].

Another important strength of the current study includes the control of food craving measure confounders (age, BMI and sex), which is especially important considering the multifactorial nature of this behavior. Thus, despite some limitations, this study provides important data regarding the relationships between dietary patterns and food craving behavior, expanding our current understanding of the subject.

Conclusions
Taken together, our results suggest that not only the frequency of junk food intake, but also its proportion in relation to intake frequency of foods considered healthy, may be particularly important for the adequate management of food craving behavior.

Therefore, these findings should be relevant in the clinical care of overweight and obese individuals, providing subsides that can improve dietary counseling practices. Also, a systematic assessment of food craving behavior could be useful in identifying the need for possible adjustments during dietary interventions. Further research should use a longitudinal study design and a more detailed approach to evaluating dietetic intake, including quantitative measures of food, in addition to the frequency of intake.

Finally, the data reported here emphasizes the relevance of better understanding the relationship between dietary patterns and food craving behavior, to face the growing energy-dense global environment.

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Original Investigation (3000-5000 words including tables, figures and references). Original investigations are considered full-length applied (human) or basic (bench work) research reports. Manuscripts must be prepared in accordance with the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" developed by the International Committee of Medical Journal Editors (N Engl J Med 1991;324:424-428).

Formatting requirements: There are no strict formatting requirements but all manuscripts must contain the essential elements needed to convey your manuscript, for example Abstract, Keywords, Introduction, Materials and Methods, Results, Conclusions, Artwork and Tables with Captions. Divide the article into clearly defined sections. Figures and tables embedded in text.

Article structure: Subdivision - unnumbered sections

Introduction: State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods: Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference; only relevant modifications should be described.

Results: Results should be clear and concise.

Discussion: This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions: The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Abstracts should be no more than 250 words. The structured abstract for an original investigation should be organized as follows:

Objective: The abstract should begin with a clear statement of the precise objective or question addressed in the paper. If a hypothesis was tested, it should be stated.

Research Methods & Procedures: The basic design of the study and its duration should be described. The methods used should be stated, the statistical data/methods provided and referenced.

Results: The main results of the study should be given in narrative form. Measurements or other information that may require explanation should be defined. Levels of statistical significance should be indicated, including other factors crucial to the outcome of the study.

Conclusion(s): State only conclusions that are directly supported by the evidence and the implications of the finding.

Keywords: 5—7 key words or phrases should be provided which should be selected from the body of the text and not duplicate title words.
Greater frequency of sweet/carbohydrate cravings in individuals presenting lower plasmatic chromium

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Periódico: Appetite


Situação do Manuscrito: A ser submetido
Resumo

Estudos recentes têm mostrado uma diminuição no craving por carboidratos em resposta a suplementação com cromo, entre indivíduos com diabetes e transtornos de humor. O presente estudo teve como objetivo investigar o estado nutricional de cromo e a frequência de episódios de craving por doces/carboidratos em 135 adultos autodeclarados saudáveis. A população foi dividida em dois grupos, de acordo com a mediana de cromo plasmático (13,3 nmol/L): Menor (Menor-PC) e Maior (Maior-PC). O craving por alimentos foi avaliado utilizando o Food Craving Inventory (FCI) e o Food Cravings Questionnaire Trait (FCQ-Trait). A gordura corporal foi mensurada utilizando um aparelho de bioimpedância elétrica. De acordo com os parâmetros avaliados (QUICKI, glicose em jejum e insulina em jejum), nenhuma diferença foi identificada no entre os grupos Menor-PC e Maior-PC, em relação ao metabolismo da glicose. Entretanto, o grupo Menor-PC apresentou maiores pontuações no FCQ-Trait; maior frequência de craving por carboidratos/alimentos doces, maior frequência de ingestão do grupo Doces e maior quantidade de gordura corporal. De acordo com estes resultados, hipotetizamos que o melhor entendimento do papel do cromo na expressão do craving por carboidratos/alimentos doces pode ser potencialmente útil no manejo deste tipo de comportamento. Também, os resultados sugerem que o craving por carboidratos/alimentos doces pode ser um potencial marcador clínico do estado nutricional relativo ao cromo.

Palavras-chave: cromo, craving por alimentos, craving por carboidrato, gordura corporal, metabolismo de glicose
Abstract

Recent studies have shown a decrease in carbohydrate cravings in response to chromium supplementation among individuals with diabetes and mood disorders. The current study aimed to investigate the nutritional chromium status and frequency of sweet/carbohydrate cravings in 135 young and self-declared healthy individuals. The sample was divided in two groups according to the median split in levels of plasmatic chromium (13.3 nmol/L): Lower (Low-PC) and Higher (High-PC). Food cravings were assessed using the Food Craving Inventory (FCI) and the Food Cravings Questionnaire Trait (FCQ-Trait). Body fat was measured using a bioimpedance analyzer. According to the parameters evaluated (QUICKI, fasting glucose and insulin), no differences were found in glucose metabolism between Low-PC and High-PC groups. However, the Low-PC group showed higher scores on the FCQ-Trait; greater frequency of sweet/carbohydrate cravings and intake frequency of Sweet Foods; and higher percentages of body fat. According to these results, we hypothesize that a better understanding of the role of chromium in the expression of sweet/carbohydrate cravings may be potentially useful in the management of this type of behavior. Also, our data suggest that sweet/carbohydrate cravings may be potential clinical markers of chromium nutritional status.

Keywords: chromium, food craving, carbohydrate cravings, body fat, glucose metabolism
Introduction

Food craving is defined as an intense desire to eat one type of food in particular, encompassing expectations of a pleasurable experience and intended to fulfill desire [1]. In many contemporary human societies, craving for sweets/carbohydrates is one of the most common expressions of this behavior [2–4].

Some of the most studied aspects of sweet/carbohydrate cravings concern the role that this behavior plays in the development of obesity [5], overeating behaviors [6] and eating disorders such as bulimia [7]. More recently, the sweet/carbohydrate craving has been discussed in the context of depression [8] and glucose metabolism disorders [9,10], because an increase in the frequency and intensity of sweet/carbohydrate craving episodes under all of these conditions has been observed.

In this regard, the decrease in sweet/carbohydrate cravings which has been observed in diabetic patients supplemented with chromium picolinate is an interesting finding [11]. Furthermore, similar results have been reported in individuals diagnosed with mood disorders [12,13]. Chromium is a trace element that is widely distributed throughout the food, but generally in small concentrations [14]. Chromium acts on lipid and carbohydrate metabolism, probably potentiating the action of insulin and improving glucose tolerance [15].

However, although there are some promising hypotheses, mostly involving the role of chromium in improving insulin sensitivity [9,13], the mechanisms by which chromium supplements influence sweet/carbohydrate craving behaviors have not yet been clarified. Additionally, the few studies investigating such questions were developed on subjects already presenting certain health problems, such as diabetes [9] or depression [12], which may limit the generalizability of these results. Moreover, to our knowledge, no study has yet to investigate the chromium nutritional status concomitant to a sweet/carbohydrate craving assessment, before or after interventions.
In light of these findings, the main objective of the present study was to investigate the nutritional chromium status and the frequency of sweet/carbohydrate craving behavior in young and self-declared healthy individuals.

Materials and methods

Participants and setting

A cross-sectional survey was conducted using a convenience sample of 135 undergraduate students from the Federal University of Rio Grande do Norte, Brazil. Inclusion criteria included: being Brazilian and having a minimum age of 18 years. Participants with any of the following characteristics were excluded from the study: (1) pregnancy; (2) lactation; (3) self-report diagnosis of eating, psychiatric or glucose metabolism disorders; (4) use of antidepressant medications and/or vitamin-mineral supplements; (5) use of a fixed orthodontic appliance in the last three months. The later exclusion criterion was considered because orthodontic treatment causes chronic exposure and increases the amount of chromium in the body [16].

The Institutional Research Ethics Committee granted approval for this study prior to data collection. Participants were enrolled by means of personal approach at the university campus by a team of research assistants. No financial or other sort of incentives were provided to any participant in return for their participation in this study.

After written informed consent forms were obtained, the participants were required to complete the Food Cravings Questionnaire-Trait and provide socio-demographic information (e.g. age, sex). Next, the participants were instructed about the procedures to be followed for blood collection and body composition evaluation, which were performed approximately within a week of consenting to participation in the study. Finally, the participants were asked to complete the Food Craving Inventory and a food frequency questionnaire.
**Procedures, variables and instruments**

**Food Cravings Questionnaire-Trait**

As in the original instrument, the Brazilian version of the Food Cravings Questionnaire Trait (FCQ-Trait) contains 39 items and assesses nine dimensions of the food craving experience: anticipation of positive reinforcement (Pos Reinforcement); relief from negative mood states (Neg Reinforcement); intention to eat (Intention); environmental cues that trigger cravings (Cues); thoughts about food (Thoughts); craving as a physiological state (Hunger); possible lack of control of overeating (Lack of Control); emotions experienced before or during food cravings (Emotion); guilty feelings (Guilt). Participants were asked to rate how much each statement “would be true for you in general” using response categories which varied from “(1) never or not applicable” to “(6) Always”.

**Food Craving Inventory**

The Food Craving Inventory (FCI) investigates the frequency of the craving experience for specific foods over the past month using a Likert scale ranging from 1 (never) to 5 (always/almost every day).

The Brazilian version of the FCI is comprised of 23 items, grouped in three dimensions. In order to achieve greater generalization of the results in the current study, only the results of the FCI dimensions for High Fat (pizza, pastel, bacon, salty packaged snacks, lasagna, sandwich/hamburger, coxinha, French fries); and Sweet Foods (cookies, doce de leite, chocolate, condensed milk pudding, candy, ice cream, brigadeiro, sweet pie, cake) were used.

**Food Intake Markers**

The frequency of food intake was investigated using the Form of food intake markers (version for individuals older than 5 years) (FIM5+)[17], developed by the Ministry of Health in Brazil. Since food cravings are more related to unhealthy foods we selected five food groups (Salty snacks, Sweets and chocolate, French fries and fried foods, Hamburger and sausages, and Soft drinks) to be assessed in this study.
Thus, participants were required to answer, "How many days, in the last seven days, did you eat these food groups?" using a scale ranging from (1) I have not eaten anything from this food group in the last seven days to (8) I ate something from this food group every day, in the last seven days.

**Blood collection and biochemical measurements**

Blood samples were collected from the participants between 7:00 and 9:00 AM, the morning after a 10–12 hour overnight fast. The samples were collected in anticoagulant-free tubes and fasting serum glucose and insulin analyses were conducted on the same day that blood was collected. Serum glucose was evaluated by the enzymatic colorimetric method. Fasting serum insulin was determined by an electrochemiluminescence immunoassay method.

The quantitative insulin-sensitivity check index (QUICKI) was calculated from fasting glucose and insulin values according to the formula: \[ \text{QUICKI} = 1 / [\log \text{fasting insulin (µU/mL)} + \log \text{fasting glucose (mg/dL)}] \][18].

For chromium measures, blood samples were collected in tubes containing 30% sodium citrate as an anticoagulant. Blood samples were centrifuged and aliquots of plasma samples were stored at −20 °C until the time of analysis. Plasmatic chromium was measured by inductively coupled plasma mass spectrometry (ICP/MS).

**Body composition evaluation**

Body fat was measured by using a BIA 450 Bioimpedance Analyzer (Biodynamics), through the tetra polar surface electrode technique. Participants were instructed to avoid exercise and alcohol consumption, and also to maintain adequate fluid intake, during the 24 hour period prior to administering the test. To avoid bias due to possible changes in body fluid distribution, females who were menstruating, were re-scheduled for testing on another day.

Measurements were taken in a thermally controlled environment, with the participant relaxed and in a supine position for at least 5 minutes prior to blood sampling. One pair of sensor electrodes was placed on the participant’s hand and wrist, and the other pair on the foot and ankle, consistent with the measurement protocol recommended by the manufacturer.
Weight was measured with a digital scale and height was measured using a wall-mounted stadiometer. These data were entered manually into the bioimpedance analyzer software and used to calculate the Body Mass Index (BMI) of each participant. A team of trained research assistants performed all of the measurements.

Data analysis

Analyses were performed using the SPSS software (version 20.0 for Windows). Descriptive statistics were used to describe the demographic characteristics of the participants. Chi-square analyses were conducted to explore associations between categorical variables. Differences between subgroups were evaluated using a Generalized linear models analysis (log link function and gamma distribution) and robust estimators were used to estimate covariance. The data were presented as means (standard deviations) and results were considered significant when the p-value was < 0.05.

Discussion

The median value for plasmatic chromium levels in our sample of undergraduate students was quite similar to the values [mean 14.8 (20.7); median 9.70] reported for a recent study [19] of a population-based sample in Sweden, corroborating the appropriateness of the measures obtained for the current study groups.

At the present time, there are still many obscure points regarding metabolism and the maintenance of chromium in the body pool. However, existing evidence [20–23] appears to be sufficient enough to state that there is an increase in urinary chromium losses in response to intake of high glycemic index foods and/or increased insulin levels, regardless of the organic status of this mineral [20]. For this reason, it has been suggested that a diet rich in sugars and refined carbohydrates might compromise the optimal nutritional condition, depleting the stores of chromium.
In accordance with this premise, it was observed in the current study that individuals with lower plasmatic chromium levels also presented a higher intake frequency for foods like chocolate, cake, cookies and ice cream. Also, the Low-PC group presented higher scores for the measurement of food cravings, specifically with respect to cravings in the sweet/carbohydrate food category.

Sweet foods, especially if they are combined with fat, are generally considered to be remarkably palatable and are often associated with hedonic hunger and pleasure [24]. Because of such characteristics, sugary foods are perceived as comfort foods, for which craving and consumption increases in response to dysphoric mood states, as an attempt to relieve them [25,26]. It has even been suggested that this may be an evolved mechanism, subject to natural selection, that helps to maintain emotional balance in adverse situations [26]. However, these hedonic properties are also the basis upon which an addiction-like behavior, often called "sugar addiction", may be developed [27]. Thus, the activation of brain circuits that are related to the reward response from eating sugary foods can lead to increased sugar consumption, and increased cravings and urges for this type of food [27,28]. In this sense, it has been suggested that one of the ways in which chronic exposure to high-fat-high-sugar foods can modify eating behavior is by modulating the expression and/or activity of serotonergic pathways [29].

Indeed, the increased craving for carbohydrates can also be found in situations where there is a reduction in the availability of cerebral serotonin [26]. Serotonin is an indoleamine that acts as a neurotransmitter in the central nervous system [30]. Although it can be synthesized in various body tissues, serotonin cannot cross the blood brain barrier [31]. For this reason, the serotonin necessary for central nervous system function must be synthesized in the brain tissue itself, from the essential amino acid tryptophan [31,32]. In turn, although it is able to cross the blood brain barrier, tryptophan competes with other neutral large amino acids (NLAs) in the body pool, to enter the brain [33,34]. Meals rich in carbohydrates (particularly those with high glycemic index), promote an insulin response which increases the peripheral uptake of these
other amino acids, increasing the proportion of tryptophan in the blood, and hence, their availability to the brain for synthesizing serotonin[33].

In this context, it has been suggested that chromium could have a positive effect on the serotonergic pathways of the brain[35]. One of the best known hypotheses is that this process happens by the actuation of chromium in improving insulin sensitivity (including in brain[36]), thus improving NIAS uptake by muscle tissue and increasing the amount of tryptophan available to the brain for conversion into serotonin [12,35,36].

However, in the current study, with a sample of healthy young adults, no differences were found in the parameters related to carbohydrate metabolism (QUICKI, fasting glucose and insulin) between the Low-PC and High-PC groups. Regardless of their role in glucose metabolism, at least two other possibilities to explain the chromium effect in serotonergic response may be considered.

The 5HT3 family of serotonin receptors utilizes ligand gated non-selective cation channels as an intracellular signaling system, while families 5HT1, 5HT2, 5HT3, 5HT4 and 5HT7 use G-protein coupled inwardly rectifying potassium channel [37]. Thus, it has been suggested that there is a possible chromium effect in these potassium/cation channels, which would result in increased serotonin synthesis and release [38]. However, the exact mechanism of how this happens, as well as what serotonergic receptors would be effectively involved in this process, are not yet known.

Less incipiently, it has been demonstrated that chromium can act in promoting a down-regulation of the 5HT2A serotonin receptor subtype, thereby reducing its sensitivity [34,39]. This postsynaptic receptor participates in several intracellular signaling cascades in the central nervous system, including pathways involved in appetite regulation [40,41] and food reinforcement [42]. Thus, subjects with anorexia nervosa present a reduced density of 5HT2A [43] (even after recovery [44]) while a positive correlation was found between cerebral cortex 5-HT 2A binding and BMI [45,46].
From this perspective, the present study identified lower body fat in the High-PC group. An important point to note is that chromium can act on lipid metabolism by decreasing the expression of genes related to lipogenesis, which contributes to lipolysis [47,48]. In contrast, the Low-PC group presented a higher frequency of cravings and carbohydrate intake, as well as higher body fat.

Taken together, our results suggest that the chromium status of the body appears to play an important role in the expression of carbohydrate craving behavior, even in people who do not exhibit glucose metabolism disorders. This finding is supported [9,12,13] by previous studies reporting a decrease in carbohydrate cravings in response to chromium supplementation. According to our findings, we hypothesize that dietary chromium supplementation appears to be a promising option for breaking a probable chromium-carbohydrate cycle: increased high-glycemic carbohydrate intake increases chromium excretion, which could lead to increased carbohydrate cravings. This could be particularly important for individuals who are undergoing treatment for weight loss. However, as food cravings have a multifactorial etiology, including physiological, environmental and psychological aspects [1], an evaluation of plasmatic chromium would be critical in defining the applicability or validity of administering a chromium supplement, in each individual case.

It is important to highlight that our findings should be interpreted within the context of certain limitations. First, the sample was relatively small and comprises only young adults. Secondly, although the participants did not have diabetes or insulin resistance, they were not evaluated for hypoglycemia, a disorder in which there is also an increased craving for carbohydrates [49,50]. Thirdly, no assessment of the emotional state or mood profile of the participants was conducted, which could provide information to help in better interpreting our results. Finally, the cross-sectional study design precludes inferences about the causality of our findings. However, although new data is necessary before establishing definitive statements, our
findings are highly consistent with results reported in the literature and provide a valuable perspective on sweet/carbohydrate cravings and chromium nutritional status.

In conclusion, in the current investigation we found that individuals with lower plasmatic chromium showed greater sweet/carbohydrate cravings and intake frequency, higher body fat, but no changes in glucose metabolism. These results point to the need for additional studies designed to better understand the relationship between craving for sweets and the nutritional status of chromium, and suggest a possible role of serotonergic pathways in this scenario.

Future research should be conducted using a larger sample size, using a longitudinal approach, to clarify the chromium-carbohydrate cycle hypothesis. It would therefore be interesting to investigate how chromium affects food intake and appetitive behavior, exploring potential metabolic and molecular mechanisms, and serotonergic markers in particular.

From the obesity management point of view, correct lower chromium plasmatic levels could prove to be an important strategy for dealing with food craving episodes, that can hinder the success of weight loss programs. Additionally, while it is not possible to establish a cause and effect relationship, our data suggest that sweet / carbohydrate cravings may be a potential clinical marker of chromium nutritional status.

References


[14] Institute of Medicine of the National Academies. Dietary Reference Intakes: the essential


5 - CONCLUSÃO GERAL
No decorrer deste trabalho, o craving por alimentos foi discutido sob várias perspectivas, que trazem contribuições ao escopo de conhecimento científico sobre o tema. Uma contribuição particularmente importante do presente trabalho, para a comunidade científica brasileira que se dedica ao estudo do comportamento alimentar, foi a tradução, adaptação cultural e validação dos Food Cravings Questionnaire (State e Trait), da versão reduzida do FCQ-Trait e do Attitudes to Chocolate Questionnaire (ACQ), além do desenvolvimento e validação da versão brasileira do Food Craving Inventory. A disponibilização destes questionários permitirá a condução de futuros estudos sobre o tema e atende a uma lacuna detectada no início do planejamento desta tese. Outrossim, o processo de desenvolvimento destes instrumentos foi realizado em grupos de voluntários relativamente grandes, em consonância com os estudos internacionais a partir dos quais foram originalmente concebidos, além de terem sido cuidadosamente escrutinizados do ponto de vista estatístico, o que depõe a favor da qualidade do material obtido.

Na população brasileira, foi possível identificar a preservação de algumas características observadas em outros estudos internacionais, como maiores pontuações dos participantes do sexo feminino nos instrumentos para avaliação do craving por alimentos e correlação positiva entre o craving por alimentos e a adiposidade. No entanto, quando avaliamos a frequência do craving direcionada para grupos e/ou alimentos específicos, foi possível perceber que os resultados guardavam uma relação intrínseca com o hábito alimentar do brasileiro, cuja representação mais emblemática foi a dimensão Home Intake, do FCI-Br. Além disso, foi possível identificar o craving não apenas em relação a junk food, mas também direcionado a comidas que historicamente estão presentes no almoço do brasileiro e que também fazem parte de uma dieta nutricionalmente equilibrada, permitindo um vislumbre de uma faceta menos explorada da expressão deste comportamento.

Foi possível identificar, também, uma interface importante entre o comportamento de craving por alimentos e o padrão alimentar consumido. Os resultados sugerem a necessidade de investigar não apenas os alimentos reconhecidos como junk food e mais envolvidos com os
episódios de craving, mas também os alimentos considerados saudáveis, como frutas e verduras, cuja proporção pode ter um caráter protetor em relação ao craving aumentado, particularmente por alimentos doces e/ou gordurosos.

Para além de um comportamento isolado, o craving por alimentos parece ter relação com diferentes características, de forma uni ou bidirecional. Os resultados sobre a influência do estágio de vida, sexo, adiposidade corporal e restrição dietética na ocorrência do craving por alimentos, entre outras coisas, apontam para a necessidade de considerar que estes aspectos podem ter um provável impacto tanto sobre a generalização de conclusões quanto sobre a comparabilidade de estudos realizados em diferentes populações. Trata-se de um viés sobremaneira importante para a melhor interpretação de resultados relatos ao craving por alimentos, uma vez que boa parte dos estudos existentes foram desenvolvidos em populações predominantemente compostas por adultos jovens e com grande proporção de participantes do sexo feminino.

Um aspecto inovador do presente trabalho foi a investigação sobre o estado nutricional relativo ao cromo e o craving por alimentos. De acordo com as evidências encontradas, indivíduos com níveis mais baixos de cromo plasmático apresentam maior craving por alimentos doces, o que é combinado a maior frequência de consumo deste tipo de comida e maior adiposidade corporal. No entanto, ao contrário do que se esperava, não foram identificadas alterações no metabolismo glicêmico que suportassem esses achados, sugerindo a existência de outros mecanismos pelos quais o cromo pode influenciar na ocorrência do craving por alimentos.

Tomados em conjunto, nossos resultados ajudam a traçar um amplo panorama sobre o comportamento de craving por alimentos e lançam fundamentos e indagações que motivam a condução de mais estudos sobre o assunto, buscando compreender melhor a questão e suas possíveis implicações clínicas para os profissionais de saúde que lidam com acompanhamento dietético, transtornos alimentares e obesidade, em seu cotidiano.


Hormes, J. M., & Timko, C. A. (2011). All cravings are not created equal. Correlates of menstrual...


Meule, A., & Kübler, A. (2012). Food cravings in food addiction: the distinct role of positive


Pla-Sanjuanelo, J., Ferrer-García, M., Gutiérrez-Maldonado, J., Riva, G., Andreu-Gracia, A.,


1-Formulário para caracterização geral dos participantes

Nome (Ler na forma): _______________________________________________________

Sexo: ( ) feminino ( ) masculino Idade: _______________ E-mail: ____________ _____ Telefone: ____________

Curso: _______________ Campus: _______________ Você mora na mesma cidade na qual estuda? ( ) Sim ( ) Não

Com quem você mora a maior parte da semana? ____________________________________________

Onde você mora, a maior parte da semana, atualmente? Cidade: _______________ Estado: _____

Onde morou a maior parte da sua vida? Cidade: ______________________________ Estado: ______

Está fazendo alguma dieta, atualmente? ( ) SIM ( ) NÃO

Possui ou já possuia alguma destas doenças?
( ) Diabetes ( ) Hipertensão ( ) Anorexia
( ) Transtorno alimentar ( ) Hipoglicemia ( ) Nenhum destes.

Faz uso de medicamentos (inclusive contraceptivo oral)? ( ) SIM ( ) NÃO

Caso use algum medicamento, qual(is) é(isão)? Para quê?
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Escolaridade do Chefe da Família/Pessoa de Referência

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Serviços públicos na sua moradia:

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<td>Rua pavimentada/calçada</td>
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2-Escala de humor de Brunel (BRUMS)

Abaixo está uma lista de palavras que descrevem sentimentos.
Por favor, leia tudo com bastante atenção.
Em seguida, assinale, em cada linha, o quadrado que melhor descreve COMO VOCÊ SE SENTE AGORA. Tenha certeza de sua resposta para cada questão, antes de assinalar.
Escala:

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____ 1-Apavorado  ____ 14-Preocupado
____ 2-Animado    ____ 15-Com disposição
____ 3-Confuso    ____ 16-Infeliz
____ 4-Esgotado   ____ 17-Desorientado
____ 5-Deprimido  ____ 18-Tenso
____ 6-Desanimado ____ 19-Com raiva
____ 7-Irritado   ____ 20-Com energia
____ 8-Exausto    ____ 21-Cansado
____ 9-Inseguro   ____ 22-Mal-humorado
____ 10-Sonolento ____ 23-Alerta
____ 11-Zangado   ____ 24-Indeciso
____ 12-Triste    ____
____ 13-Ansioso   ____
3-Marcadores do consumo alimentar para indivíduos com 5 anos de idade ou mais

<table>
<thead>
<tr>
<th>ALIMENTO/BEBIDA</th>
<th>Não comi nos últimos 7 dias</th>
<th>1 dia nos últimos 7 dias</th>
<th>2 dias nos últimos 7 dias</th>
<th>3 dias nos últimos 7 dias</th>
<th>4 dias nos últimos 7 dias</th>
<th>5 dias nos últimos 7 dias</th>
<th>6 dias nos últimos 7 dias</th>
<th>Todos os últimos 7 dias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salada crua (alface, tomate, cenoura, pepino, repolho, etc.)</td>
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<tr>
<td>Legumes e verduras cozidos (abóbora, chuchu, brócolis, espinafre, etc.) (Não considerar batata e mandioca)</td>
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<tr>
<td>Frutas frescas ou salada de frutas</td>
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<td>Feijão</td>
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<td>Leite ou iogurte</td>
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<tr>
<td>Batata frita, batata de pacote e salgados fritos (coxinha, quibe, pastel, etc.)</td>
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<tr>
<td>Hambúrguer e embutidos (salsicha, mortadela, salame, presunto, linguiça, etc.)</td>
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<tr>
<td>Bolachas/biscoitos salgados ou salgadinhos de pacote</td>
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<tr>
<td>Bolachas/biscoitos doces ou recheados, doces, balas e chocolates (em barra ou bombom).</td>
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<tr>
<td>Refrigerante (não considerar os diet ou light)</td>
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Ministério da Saúde, 2008
4- Three-Factor Eating Questionnaire-R21

Esta seção contém declarações e perguntas sobre hábitos alimentares e sensação de fome. Leia cuidadosamente cada declaração e responda marcando a alternativa que melhor se aplica a você.

1. Eu deliberadamente consumo pequenas porções para controlar meu peso.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

2. Eu começo a comer quando me sinto ansioso.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

3. Às vezes, quando começo a comer, parece-me que não conseguiria parar.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

4. Quando me sinto triste, frequentemente como outros.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

5. Eu não como alguns alimentos porque eles me engordam.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

6. Estar com alguém que está comendo, me dá frequentemente vontade de comer também.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

7. Quando me sinto tenso ou estressado, frequentemente sinto que preciso comer.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

8. Frequentemente sinto tanta fome que meu estômago parece um poço sem fundo.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

9. Eu sempre estou com tanta fome, que me é difícil parar de comer antes de terminar toda a comida que está no prato.
   □ Totalmente verdade
   □ Verdade, na maioria das vezes
   □ Falso, na maioria das vezes
   □ Totalmente falso

10. Quando me sinto solitário (a), me consolo comendo.
     □ Totalmente verdade
     □ Verdade, na maioria das vezes
     □ Falso, na maioria das vezes
     □ Totalmente falso

11. Eu conscientemente me controlo nas refeições para evitar ganhar peso.
    □ Totalmente verdade
    □ Verdade, na maioria das vezes
    □ Falso, na maioria das vezes
    □ Totalmente falso

12. Quando sinto o cheiro de um bife grelhado ou de um pedaço succulento de carne, acho muito difícil evitar de comer, mesmo que eu tenha terminado de comer há muito pouco tempo.
    □ Totalmente verdade
    □ Verdade, na maioria das vezes
    □ Falso, na maioria das vezes
    □ Totalmente falso

13. Estou sempre com fome o bastante para comer a qualquer hora.
    □ Totalmente verdade
    □ Verdade, na maioria das vezes
    □ Falso, na maioria das vezes
    □ Totalmente falso
14. Se eu me sinto nervoso(a), tento me acalmar comendo.
☐ Totalmente verdade
☐ Verdade, na maioria das vezes
☐ Falso, na maioria das vezes
☐ Totalmente falso

15. Quando vejo algo que me parece muito delicioso, eu frequentemente fico com tanta fome que tenho que comer imediatamente.
☐ Totalmente verdade
☐ Verdade, na maioria das vezes
☐ Falso, na maioria das vezes
☐ Totalmente falso

16. Quando me sinto depressivo(a), eu quero comer.
☐ Totalmente verdade
☐ Verdade, na maioria das vezes
☐ Falso, na maioria das vezes
☐ Totalmente falso

17. O quanto frequentemente você evita “estocar” (ou se apropria de) comidas tentadoras?
☐ Quase nunca
☐ Raramente
☐ Frequentemente
☐ Quase sempre

18. O quanto você estaria disposto(a) a fazer um esforço para comer menos do que deseja?
☐ Não estou disposto(a)
☐ Estou um pouco disposto(a)
☐ Estou relativamente bem disposto(a)
☐ Estou muito disposto(a)

19. Você comete excessos alimentares, mesmo quando não está com fome?
☐ Nunca
☐ Raramente
☐ Às vezes
☐ Pela menos 1 vez por semana

20. Com qual frequência você fica com fome?
☐ Somente nos horários das refeições
☐ Às vezes entre as refeições
☐ Frequentemente entre as refeições
☐ Quase sempre

21. Em uma escala de 1 a 8, onde 1 significa nenhuma restrição alimentar, e 8 significa restrição total, qual número você daria para si mesmo?

[Imagem de uma escala de 1 a 8]

Comer tudo o que quiser e sempre que quiser

Limitar constantemente a ingestão alimentar, nunca “cadando”
5-FCQ–State- Food Cravings Questionnaire–State

Abaixo está uma lista de comentários feitos por pessoas, em relação a seus próprios hábitos alimentares.

No espaço à esquerda, escreva o número indicando o quando você concorda com o comentário AGORA, nesse exato momento. Algumas questões se referem a alimentos de uma forma geral, enquanto outras se referem ao desejo de comer alguns alimentos específicos. Por favor, responda a cada item da forma mais honesta possível.

<table>
<thead>
<tr>
<th>DISCORDO FORTEMENTE</th>
<th>DISCORDO</th>
<th>NEUTRO</th>
<th>CONCORDO</th>
<th>CONCORDO FORTEMENTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<th></th>
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</table>
| 1 | Neste momento, tenho uma vontade intensa de comer uma ou mais comidas específicas.  
| 2 | Neste momento, estou desejando uma ou mais comidas específicas.  
| 3 | Tenho um desejo urgente de comer, agora mesmo, uma ou mais comidas específicas.  
| 4 | Se eu pudesse comer uma ou mais comidas específicas, as coisas pareceriam perfeitas.  
| 5 | Se eu pudesse comer o que estou desejando, tenho certeza de que meu humor melhoraria.  
| 6 | Comer uma ou mais comidas específicas faria com que eu me sentisse maravilhosamente bem.  
| 7 | Se eu comesse alguma coisa, não me sentiria tão lento e preguiçoso.  
| 8 | Satisfazer meus desejos por comida farta com que eu me sentisse menos irritado e aborrecido.  
| 9 | Eu me sentiria mais alerta se pudesse satisfazer meu desejo de comer.  
| 10 | Se eu tivesse uma ou mais comidas específicas não ia conseguir parar de comê-las.  
| 11 | Meu desejo de comer (uma ou mais comidas específicas) parece me dominar.  
| 12 | Eu sei que vou só ficar pensando em uma ou mais comidas específicas até que eu finalmente consiga comê-las.  
| 13 | Estou com fome.  
| 14 | Se eu pudesse comer algo agora mesmo, meu estômago não se sentiria tão vazio.  
| 15 | Eu me sinto fraco quando não como.  

Quanto tempo faz que você comeu? _______________
6-FCQ–Trait - Food Cravings Questionnaire–Trait

Abaixo está uma lista de comentários feitos por pessoas, em relação a seus próprios hábitos alimentares. No espaço à esquerda, escreva o número indicando com que frequência com esses comentários seriam verdade para você. Por favor, responda a cada item da forma mais honesta possível.

<table>
<thead>
<tr>
<th>NUNCA (OU NÃO SE APLICA)</th>
<th>RARAMENTE</th>
<th>ÀS VEZES</th>
<th>GERALMENTE</th>
<th>FREQUENTEMENTE</th>
<th>SEMPRE</th>
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<tr>
<td>1</td>
<td>2</td>
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<td>4</td>
<td>5</td>
<td>6</td>
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</tbody>
</table>

1. Estar com alguém que está comendo geralmente me faz ficar com fome.
2. Quando tenho um desejo forte de comer algo, sei que não vou conseguir me controlar, uma vez que começar a comer, não consigo parar.
3. Frequentemente, quando compro algo que estou desejando, perco o controle e a acabo comendo demais.
4. Odeio o fato de não poder resistir à tentação de comer.
5. A vontade de comer uma determinada comida, invariavelmente, me faz pensar em como vou conseguir comer aquilo que estou desejando.
6. Sinto que é como se eu pensasse em comida o tempo inteiro.
7. Geralmente me sinto culpado por ficar desejando certos tipos de comida.
8. Às vezes me pego pensativo, preocupado com comida.
9. Eu como para me sentir melhor.
10. Às vezes, parece que as coisas ficam perfeitas quando como o que estou desejando.
11. Pensar nas minhas comidas preferidas me faz salivar.
12. Sinto um desejo intenso por determinados alimentos quando estou com o estômago vazio.
13. Sinto como se meu corpo pedisse pode certos tipos específicos de comida.
14. Fico com tanta fome que meu estômago parece um poço sem fundo.
15. Quando como aquilo que estou desejando, eu me sinto melhor.
16. Quando consigo comer o alimento que estou desejando eu me sinto menos deprimido.
17. Quando eu como a comida que estou desejando muito, eu me sinto culpado.
18. Sempre que eu começo a desejar uma determinada comida, começo a fazer planos para conseguir comê-la.
19. Comer me acalma.
20 Quando estou chateado, com raiva ou triste, eu tenho desejos por determinados alimentos.
21 Eu sinto que fico menos ansioso depois que eu como.
22 Quando consigo a comida que estou desejando, não consigo me controlar para não comê-la.
23 Quando estou desejando uma determinada comida, geralmente tento comê-la o mais imediatamente que eu puder.
24 Quando eu como as comidas que estou desejando, eu me sinto ótimo.
25 Não tenho força de vontade para resistir à minha vontade de comer alimentos que estou desejando muito.
26 Uma vez que começo a comer, tenho dificuldade de conseguir parar.
27 Não consigo parar de pensar em comer, não importa o quanto eu me esforce.
28 Gasto muito tempo pensando sobre qual será a próxima coisa que eu irei comer.
29 Se eu me deixo levar pela vontade de comer alguma coisa que estou desejando muito, perco todo o controle.
30 Quando eu estou estressado, fico desejando determinadas comidas.
31 Eu sonho acordado pensando em comida.
32 Quando estou desejando muito uma comida, fico só pensando em comer aquilo, até que finalmente consiga comer.
33 Se eu estou desejando uma comida, os pensamentos sobre isso ficam me consumindo.
34 Minhas emoções geralmente me fazem querer comer.
35 Sempre que vou a uma festa com comida, acabo comendo mais do que eu preciso.
36 É difícil, para mim, resistir à tentação de comer comidas apetitosas que estejam ao meu alcance.
37 Quando estou com alguém que está comendo demais, geralmente acabo comendo demais também.
38 Quando como, me sinto reconfortado.
39 Eu fico desejando determinadas comidas quando estou chateado.
7-FCQ–Trait - Food Cravings Questionnaire–Trait - Versão Reduzida

Abaixo está uma lista de comentários feitos por pessoas, em relação a seus próprios hábitos alimentares.
No espaço à esquerda, escreva o número indicando com que frequência com esses comentários seriam verdade para você. Por favor, responda a cada item da forma mais honesta possível.

<table>
<thead>
<tr>
<th>NUNCA (OU NÃO SE APLICA)</th>
<th>RARAMENTE</th>
<th>ÀS VEZES</th>
<th>GERALMENTE</th>
<th>FREQUENTEMENTE</th>
<th>SEMPRE</th>
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2 Quando tenho um desejo forte de comer algo, sei que não vou conseguir me controlar, uma vez que começar a comer, não consigo parar.

3 Frequentemente, quando como algo que estou desejando, perco o controle e a acabo comendo demais.

5 A vontade de comer uma determinada comida, invariavelmente, me faz pensar em como vou conseguir comer aquilo que estou desejando.

6 Sinto que é como se eu pensasse em comida o tempo inteiro.

8 Às vezes me pego pensativo, preocupado com comida.

18 Sempre que eu começo a desejar uma determinada comida, começo a fazer planos para conseguir comê-la.

20 Quando estou chateado, com raiva ou triste, eu tenho desejos por determinados alimentos.

25 Não tenho força de vontade para resistir à minha vontade de comer alimentos que estou desejando muito.

26 Uma vez que começo a comer, tenho dificuldade de conseguir parar.

27 Não consigo parar de pensar em comer, não importa o quanto eu me esforce.

29 Se eu me deixo levar pela vontade de comer alguma coisa que estou desejando muito, perco todo o controle.

32 Quando estou desejando muito uma comida, fico só pensando em comer aquilo, até que finalmente consiga comer.

33 Se eu estou desejando uma comida, os pensamentos sobre isso ficam me consumindo.

34 Minhas emoções geralmente me fazem querer comer.

36 É difícil, para mim, resistir à tentação de comer comidas apetitosas que estejam ao meu alcance.
8-Inventário Brasileiro de Alimentos Relacionados ao Craving

Para cada um dos alimentos listados a seguir, assinale a opção que você achar mais apropriada.

No último mês, qual a frequência com que você sentiu um desejo muito forte de consumir algum destes alimentos? Uma vontade específica, que só passa com esse alimento, e nenhum outro?

<table>
<thead>
<tr>
<th>NUNCA</th>
<th>RARAMENTE (UMA OU DUAS VEZES POR MÊS)</th>
<th>ALGUMAS VEZES</th>
<th>FREQUENTEMENTE (QUASE TODA SEMANA)</th>
<th>SEMPRE (PRATICAMENTE TODOS OS DIAS)</th>
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- Biscoito doce
- Pizza
- Doce de Leite
- Pastel
- Chocolate
- Bacon
- Pudim
- Salgadinho de pacote
- Pão
- Churrasco/Carne assada
- Farofa
- Doces tipo bala e pirulito
- Queijo
- Feijão/Feijoada
- Sorvete
- Lasanha
- Brigadeiro
- Sanduíche/Hamburguer
- Torta doce
- Bife
- Bolo
- Coxinha
- Batata Frita
8- Attitudes to Chocolate Questionnaire (ACQ-R11)

Marque na linha o quanto cada uma das afirmações se parece com aquilo que você sente ou faz, habitualmente.

Como chocolate para me animar quando estou deprimido(a)

Não parece nada comigo

Meu desejo de comer chocolate às vezes parece ser maior que eu

Não parece nada comigo

Frequentemente me sinto mal depois de comer chocolate

Não parece nada comigo

Depois de comer chocolate, frequentemente me arrependo de ter feito isso

Não parece nada comigo

Me sinto culpado(a) depois que como chocolate

Não parece nada comigo

O chocolate frequentemente atormenta meus pensamentos

Não parece nada comigo

Eu me sinto menos saudável depois que como chocolate.

Não parece nada comigo

Nada além de chocolate satisfaz meus desejos de comer chocolate

Não parece nada comigo

Muitas vezes eu continuo comendo chocolate mesmo quando já não quero mais.

Não parece nada comigo

Geralmente vou a uma loja comprar alguma coisa e acabo comprando chocolate

Não parece nada comigo

Gosto de me fazer um agradecimento com chocolate

Não parece nada comigo