



UNIVERSIDADE ESTADUAL DE CAMPINAS
FACULDADE DE ENGENHARIA DE ALIMENTOS

HELENA DORIA RIBEIRO DE ANDRADE PREVIATO

**ASSOCIATION AMONG FOOD NEOPHOBIA, CRAVING FOR SWEETS AND USE
OF FOOD AS REWARD AND PLEASURE WITH NUTRITIONAL STATUS AND
FOOD CHOICES IN ADOLESCENTS**

**ASSOCIAÇÃO ENTRE NEFOBIA ALIMENTAR, CRAVING POR DOCES E USO
DO ALIMENTO COMO RECOMPENSA E PRAZER COM ESTADO NUTRICIONAL
E ESCOLHAS ALIMENTARES EM ADOLESCENTES**

CAMPINAS

2018

HELENA DORIA RIBEIRO DE ANDRADE PREVIATO

**ASSOCIATION AMONG FOOD NEOPHOBIA, CRAVING FOR SWEETS AND USE
OF FOOD AS REWARD AND PLEASURE WITH NUTRITIONAL STATUS AND
FOOD CHOICES IN ADOLESCENTS**

**ASSOCIAÇÃO ENTRE NEOFOBIA ALIMENTAR, *CRAVING* POR DOCES E USO
DO ALIMENTO COMO RECOMPENSA E PRAZER COM ESTADO NUTRICIONAL
E ESCOLHAS ALIMENTARES EM ADOLESCENTES**

Thesis presented to the Faculty of Food Engineering of the University of Campinas in partial fulfillment of the requirements for the degree of Doctor in Food and Nutrition in the area of Consumption and Quality of Food.

Tese apresentada à Faculdade de Engenharia de Alimentos da Universidade Estadual de Campinas como parte dos requisitos exigidos para a obtenção do título de Doutora em Alimentos e Nutrição, na área de Consumo e Qualidade de Alimentos.

Supervisor/Orientador: Prof. Dr. Jorge Herman Behrens

ESTE EXEMPLAR CORRESPONDE À VERSÃO FINAL
DA TESE DEFENDIDA PELA ALUNA HELENA DORIA
RIBEIRO DE ANDRADE PREVIATO, E ORIENTADA
PELO PROF. DR. JORGE HERMAN BEHRENS

CAMPINAS

2018

Agência(s) de fomento e nº(s) de processo(s): CNPq, 140397/2014-0

Ficha catalográfica
Universidade Estadual de Campinas
Biblioteca da Faculdade de Engenharia de Alimentos
Márcia Regina Garbelini Sevillano - CRB 8/3647

P929a Previato, Helena Doria Ribeiro de Andrade, 1982-
Associação entre neofobia alimentar, *craving* por doces e uso do alimento como recompensa e prazer com estado nutricional e escolhas alimentares em adolescentes / Helena Doria Ribeiro de Andrade Previato. – Campinas, SP : [s.n.], 2018.

Orientador: Jorge Herman Behrens.

Tese (doutorado) – Universidade Estadual de Campinas, Faculdade de Engenharia de Alimentos.

1. Neofobia alimentar. 2. Adolescentes. 3. Estado nutricional. 4. Adiposidade. I. Behrens, Jorge Herman. II. Universidade Estadual de Campinas. Faculdade de Engenharia de Alimentos. III. Título.

Informações para Biblioteca Digital

Título em outro idioma: Association among food neophobia, craving for sweets and use of food as reward and pleasure with nutritional status and food choices in adolescents

Palavras-chave em inglês:

Food neophobia

Adolescents

Nutritional status

Adiposity

Área de concentração: Consumo e Qualidade de Alimentos

Titulação: Doutora em Alimentos e Nutrição

Banca examinadora:

Jorge Herman Behrens [Orientador]

Cinthia Baú Betim Cazarin

Eliane Garcia Rezende

Elke Stedefeldt

Cristiane Ramos Voorpostel

Data de defesa: 06-03-2018

Programa de Pós-Graduação: Alimentos e Nutrição

COMISSÃO EXAMINADORA

Prof. Dr. Jorge Herman Behrens - Orientador
FEA-UNICAMP

Profa. Dra. Cinthia Baú Betim Cazarin - Membro Titular
FEA-UNICAMP

Profa. Dra. Eliane Garcia Rezende - Membro Titular
FANUT – UNIFAL

Profa. Dra. Elke Stedefeldt - Membro Titular
CEDESS-UNIFESP

Profa. Dra. Cristiane Ramos Voorpostel - Membro Titular
Pesquisadora - Campinas

A Ata da Defesa com as respectivas assinaturas dos membros da Comissão Examinadora encontra-se no processo de vida acadêmica do aluno.

DEDICATÓRIA

Aos meus pais, Fábio e Beatriz, por acreditarem no meu sonho e contribuírem para que ele se tornasse realidade.

AGRADECIMENTOS

Ao meu orientador, Prof. Dr. Jorge Herman Behrens, por todos os ensinamentos transmitidos no decorrer desta trajetória e principalmente pelo grande exemplo pessoal e profissional. Muito obrigada pela oportunidade e por me abrir as portas da UNICAMP.

À coordenação, aos professores e aos funcionários do Programa de Pós-Graduação em Alimentos e Nutrição da Faculdade de Engenharia de Alimentos da UNICAMP e, em especial, a Cidinha por todo o auxílio durante o doutorado.

Aos professores membros da banca examinadora de doutorado e da banca de qualificação pelas valiosas contribuições para esta pesquisa.

Aos coordenadores do Instituto Federal por permitirem a realização deste trabalho e, principalmente, aos alunos que aceitaram participar da pesquisa.

Às amigas do Laboratório de Serviço de Alimentação pelo convívio e pela troca de experiências e conhecimentos durante todos esses anos. Em especial à Adriana pela atenção e disponibilidade em ajudar sempre que necessário.

Ao Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) pelo suporte financeiro.

À UNICAMP pelo ensino de qualidade e pela oportunidade de me formar como pesquisadora em uma das melhores universidades do país. Minha enorme gratidão.

Aos meus pais Fábio e Beatriz por todo o apoio, motivação e incentivo durante todos esses anos. À minha irmã Mariana e aos meus sobrinhos Ramon e Rafael pelas alegrias e descontrações.

Ao Edmo pelo companheirismo durante toda esta jornada.

Enfim, a todos que de alguma maneira contribuíram para a realização desta tese.

Muito Obrigada!

RESUMO

O comportamento alimentar é influenciado pela interação entre fatores fisiológicos, sociais, culturais, emocionais e sensoriais. Nesse contexto, destacam-se dois tipos de atitudes em relação aos alimentos – a recusa em experimentar alimentos novos e o intenso desejo por determinado tipo ou grupo de alimento como, por exemplo, os doces. Tais atitudes antagônicas, relacionadas, principalmente a fatores sensoriais e hedônicos, refletem nas escolhas e preferências alimentares e, conseqüentemente, na formação de hábitos de consumo. O presente trabalho teve como objetivo verificar a neofobia alimentar, o *craving* por doces, o uso do alimento como recompensa e prazer e sua associação com o estado nutricional e as escolhas alimentares de adolescentes. Primeiramente, realizou-se uma revisão narrativa sobre os determinantes da neofobia alimentar e sua influência nas escolhas alimentares. Após a revisão, a escala de neofobia alimentar (ENA) foi traduzida e validada para o português. A versão brasileira da ENA provou ser conceitualmente equivalente ao instrumento original, sem diferença entre os itens das versões em inglês e português ($P > 0,05$) e com alta reprodutibilidade para avaliar a neofobia alimentar (alfa de Cronbach = 0,916). Posteriormente, foi realizado um estudo transversal com 132 adolescentes, de 15 a 19 anos, matriculados em cursos técnicos do Instituto Federal de Poços de Caldas, MG, Brasil. Foram coletados dados sociodemográficos, alimentares, antropométricos e de composição corporal dos adolescentes entre outubro e dezembro de 2015. Apenas 15,9% dos adolescentes foram classificados com alta neofobia alimentar, enquanto a maioria apresentou nível moderado a elevado de *craving* por doces (69,7%), uso do alimento como recompensa (67,4%) e prazer (73,5%). Além disso, o *craving* por doces foi associado com excesso de peso, omissão de refeição, inatividade física e consumo de doces ($P < 0,05$). O uso do alimento como recompensa foi associado com adiposidade, inatividade física, falta de interesse em buscar informação sobre alimentos e, ainda, consumo de doces ($P < 0,05$). O uso do alimento como prazer foi associado à inatividade física, falta de interesse em buscar informação sobre alimentos, consumo de doces e refrigerantes ($P < 0,05$). Houve maior grau de *craving* por doces, uso do alimento como prazer e maior percentual de gordura corporal no sexo feminino. Em relação ao estado nutricional, 81,8% dos adolescentes eram eutróficos, 10,6% apresentavam sobrepeso e 7,6% eram obesos. Por fim, a maioria

dos adolescentes apresentou consumo inadequado de frutas (87,9%) e hortaliças (93,9%). Como conclusão, verificou-se que este estudo contribuiu para validar a versão em português da ENA que será uma ferramenta útil para medir a neofobia alimentar na população brasileira. Contudo, são necessários estudos no Brasil para investigar a presença de neofobia alimentar na população e analisar seu impacto no comportamento alimentar. O presente trabalho também contribuiu para compreender a associação entre os fatores relacionados ao gosto com o estado nutricional e as escolhas alimentares na adolescência. Entretanto, mais pesquisas são necessárias para melhor explorar essa relação com os hábitos alimentares e a obesidade. Isso permitirá a proposição de orientações nutricionais e motivacionais direcionadas a escolhas alimentares mais saudáveis na adolescência.

Palavras-chave: Neofobia alimentar; Adolescentes; Estado nutricional; Adiposidade.

ABSTRACT

Food behavior is influenced by the interaction of physiological, social, cultural, emotional and sensory factors. In this context, it is worth emphasizing two types of attitudes toward food – the avoidance to try new foods, and the intense desire for a specific type or group of food as sugar foods. Such antagonistic attitudes related to sensory and hedonic characteristics reflect in food choices and preferences. The present study aimed to evaluate food neophobia, craving for sweets, using food as reward and pleasure, and their association with nutritional status and eating choices among adolescents. A narrative review was carried out on food neophobia determinants' and its influence on food choices. After this revision, the Food Neophobia Scale (FNS) was translated and validated into Portuguese. The Brazilian version of FNS proved to be conceptually equivalent to the original instrument, with no difference between the English and Portuguese versions ($P > 0.05$) and with high reproducibility (Cronbach's alpha = 0.916). Subsequently, a cross-sectional study was conducted with 132 teenagers aged 15 to 19 enrolled in technical courses at the Federal Institute of Poços de Caldas, MG, Brazil. Socio-demographic, food behavior, anthropometric and body composition data were collected between October and December 2015. Only 15.9% of the adolescents were classified with high food neophobia, while the majority had moderate to high levels of craving for sweets (69.7%), using food as reward (67.4%) and pleasure (73.5%). Craving for sweets was associated with overweight, meal omission, physical inactivity and sweets intake ($P < 0.05$). Using food as reward was associated with adiposity, physical inactivity, lack of interest in information about food and, also, consumption of sweets ($P < 0.05$). Using food as pleasure was associated with physical inactivity, lack of interest in information about food, consumption of sweets and soft drinks ($P < 0.05$). In addition, there was a higher degree of craving for sweets, using food as pleasure and percentage of body fat among female individuals. Regarding the nutritional status, 81.8% of the teenagers were eutrophic, 10.6% were overweight and 7.6% were obese. Finally, the majority of teenagers presented inadequate fruits (87.9%) and vegetables intake (93.9%). As a conclusion, this study contributed to validate the Portuguese version of the FNS, which will be a useful tool to measure food neophobia in the Brazilian population. However, more research is needed in Brazil to investigate the food neophobia and its impact on food behavior among different age

group. The present work also contributed to a better understanding of the association among the factors related to taste (craving for sweets, reward and pleasure) with nutritional status and food choices in adolescence. However, further research is still needed to better explore this relationship with eating habits and obesity. This will allow the proposition of nutritional and motivational orientations directed to healthier food choices in adolescence.

Keywords: Food neophobia; Adolescents; Nutritional status; Adiposity.

Sumário

1. INTRODUÇÃO GERAL	12
2. OBJETIVOS	15
2.1 OBJETIVO GERAL.....	15
2.2 OBJETIVOS ESPECÍFICOS.....	15
3. CAPÍTULO 1	16
Determinants of food neophobia and its influence on dietary choice: A Narrative Review	16
4. CAPÍTULO 2	30
Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese	30
5. CAPÍTULO 3	45
Taste-related factors and food neophobia: Are they associated with nutritional status and teenagers' food choices?.....	45
6. CAPÍTULO 4	67
Nutritional status and food pattern among teenagers.....	67
7. DISCUSSÃO GERAL	84
7. CONCLUSÃO GERAL	88
8. REFERÊNCIAS	90
9. APÊNDICES E ANEXOS	94

1. INTRODUÇÃO GERAL

O comportamento alimentar humano é determinado por uma combinação de fatores fisiológicos, antropológicos, sociais, econômicos, culturais, emocionais e sensoriais (ROININEN; LAHTEENMAKI; TUORILA, 1999; PREVIATO; BEHRENS, 2016). Dentre esses, vem ganhando destaque os fatores relacionados ao gosto (*taste related factors* – *craving* por doces, recompensa e prazer) (ROININEN; LAHTEENMAKI; TUORILA, 1999) devido à sua influência nas escolhas e preferências alimentares (WEINGARTEN & ELSTON, 1990; PLINER; HOBDEN, 1992), uma vez que as pessoas comem, não apenas pela fome fisiológica ou ausência de saciedade, mas pelo prazer (fome hedônica), pelo desejo e também pela recompensa relacionada ao prazer de comer determinado alimento ou grupo de alimentos (ROININEN; LAHTEENMAKI; TUORILA, 1999; PRESCOTT, 2012; HOERTEL; WILL; LEIDY, 2014). Além disso, as pessoas evitam comer ou experimentar novos alimentos em decorrência da neofobia alimentar, um tipo de comportamento caracterizado pelo receio e recusa de experimentar alimentos desconhecidos ou não familiares, ou seja, diferentes do padrão habitual de consumo (PLINER; HOBDEN, 1992).

Portanto, na presente pesquisa trabalhou-se com a hipótese de que a neofobia alimentar, o *craving* por doces e o uso do alimento como recompensa e prazer podem contribuir para escolhas inadequadas na adolescência como baixo consumo de frutas e hortaliças e elevado consumo de alimentos hipercalóricos. Sabe-se que o *craving* por doces pode contribuir para o padrão alimentar obesogênico em adolescentes, uma vez que estimula a ingestão de alimentos de alta densidade calórica (FORMAN et al., 2013; MARTIN et al., 2008; CHAO et al., 2014) contribuindo para baixa variedade e qualidade da dieta. Todavia, é importante ressaltar que não basta apenas estar disposto a experimentar novos alimentos (neofilia alimentar), e sim adotar um padrão habitual de consumo de frutas e hortaliças e com baixa ingestão de alimentos ricos em açúcares e gorduras para promover a saúde e prevenir a obesidade e outras doenças crônicas não transmissíveis (DCNTs) (MUNIZ et al., 2013; NCD, 2016).

A transição nutricional, caracterizada pelo aumento da prevalência de sobrepeso, é uma preocupação crescente na área de saúde pública, visto que a

obesidade é um fator de risco significativo para doenças cardiovasculares, hipertensão e diabetes mellitus (STROEBELE; CASTRO, 2004), especialmente em relação a crianças e adolescentes. A adolescência é um período cheio de mudanças psicossociais e corporais (SAITO, 1993; ALBANO; SOUZA, 2001a) que conduzem os adolescentes a novos modos de comportamento (ALBANO; SOUZA, 2001a). Os hábitos e preferências alimentares geralmente são desenvolvidos durante a infância e adolescência (ARANCETA et al., 2013), dependendo basicamente de estímulos familiares e ambientais (PRESCOTT, 2012). Diferentemente da criança, o adolescente tem mais autonomia para realizar suas escolhas alimentares e por isso é mais susceptível a influências do ambiente em que está inserido (CAMBRAIA, 2004). Nesse contexto, o hábito alimentar do adolescente precisa ser investigado, de maneira profunda e detalhada, uma vez que esse é um período de alta demanda nutricional e, por isso, o processo adequado de nutrição desempenha um importante papel para o desenvolvimento desse grupo etário (ALBANO; SOUZA, 2001b; CAROBA; SILVA, 2005).

Pesquisas demonstram que as inadequações dietéticas, comuns na adolescência, como a omissão de refeições, o alto consumo de alimentos hipercalóricos ricos em açúcares e gorduras e baixo consumo de frutas e hortaliças podem contribuir para o desenvolvimento e/ou agravamento do sobrepeso e da obesidade nos adolescentes (TOJO; LEIS; QUEIRO, 1991; ESCRIVÃO et al., 2000). As tendências mundiais de transição nutricional apontam um padrão dietético rico em gorduras e açúcares, com baixo consumo de carboidratos complexos e fibras associado a um estilo de vida sedentário (FRANCISCH et al., 2000; CAROBA; SILVA, 2005), enquanto a ingestão de frutas e hortaliças tem sido apontada como um fator protetor para a ocorrência de obesidade (ENES; SLATER, 2010).

Estudos sobre os fatores relacionados aos aspectos sensoriais e psicológicos como a neofobia alimentar, o *craving* por doces, a recompensa e o prazer são necessários para compreender melhor o complexo processo de escolha alimentar na adolescência e contribuir para a prevenção de doenças associadas a padrões alimentares desequilibrados nutricionalmente. Nesse caso, o entendimento de todos esses fatores como determinantes do comportamento alimentar é essencial para enfrentar o desafio de motivar os adolescentes para a adoção de uma alimentação mais equilibrada e propor ações de prevenção da obesidade (tanto do ponto de vista

de carências como de excessos nutricionais) a partir de políticas públicas, estratégias e orientações específicas para motivar novas práticas alimentares.

É importante destacar que o presente estudo caracteriza-se por originalidade e relevância, uma vez que é o primeiro no Brasil que avalia a neofobia alimentar e os fatores relacionados ao sabor na adolescência. Isso lança luz sobre uma área relativamente pouco pesquisada e ajuda a obter uma melhor compreensão dos fatores subjacentes às escolhas alimentares nesse grupo. Além disso, foi feita a tradução e a validação da escala de neofobia alimentar (ENA) para o português (PREVIATO; BEHRENS, 2015). Portanto, esta pesquisa investigou a neofobia alimentar, o *craving* por doces e o uso do alimento como recompensa e prazer e sua associação com o estado nutricional e as escolhas alimentares de adolescentes estudantes de curso técnico do município de Poços de Caldas/MG/Brasil. Os resultados poderão contribuir para uma abordagem mais global no acompanhamento alimentar e nutricional de adolescentes, considerando os vários aspectos relacionados à escolha alimentar nesse grupo etário. Assim, novas formas de intervenções e orientações alimentares junto aos adolescentes são necessárias com a finalidade de contribuir para a adoção de um padrão alimentar mais saudável.

2. OBJETIVOS

2.1 OBJETIVO GERAL

Verificar a associação entre neofobia alimentar, *craving* por doces e uso do alimento como recompensa e prazer com o estado nutricional e as escolhas alimentares de adolescentes do município de Poços de Caldas, MG.

2.2 OBJETIVOS ESPECÍFICOS

- Traduzir e validar o instrumento *Food Neophobia Scale (FNS)* para o português;
- Medir o grau de neofobia alimentar, *craving* por doces, uso do alimento como recompensa e prazer entre os adolescentes;
- Avaliar o estado nutricional dos adolescentes por dados antropométricos e de composição corporal;
- Avaliar o consumo alimentar por meio de um questionário de frequência alimentar;
- Avaliar a associação entre a neofobia alimentar e os fatores relacionados ao sabor (*craving* por doces, uso do alimento como recompensa e prazer) com o estado nutricional, o gênero e o estilo de vida.
- Avaliar a associação entre a neofobia alimentar e os fatores relacionados ao sabor (*craving* por doces, uso do alimento como recompensa e prazer) com o consumo alimentar de frutas, hortaliças, doces e refrigerantes;

3. CAPÍTULO 1

Determinants of food neophobia and its influence on dietary choice: A Narrative Review

Helena Dória Ribeiro de Andrade Previato & Jorge Herman Behrens

Este capítulo corresponde ao artigo de revisão que será submetido à revista *Advances in Nutrition - An International Review Journal*.

ABSTRACT

Food neophobia is defined as a reluctance to eat novel or unfamiliar foods. This personality trait is commonly measured by the Food Neophobia Scale developed in English and validated for several languages to assess this food attitude in different cultures. This behavior influences on food choices and in this review, we outline the main factors determinants of food neophobia and how it relates to eating habits and dietary quality. A bibliographic review was carried out without restriction of date in the Latin American and Caribbean Literature in Health Sciences (LILACS), International Literature in Health Sciences (PubMed) and Scientific Electronic Library Online (SciELO) databases between October 2016 and April 2017. The main factors investigated in relation to food neophobia were age, gender, genetics, environmental influences, sensory characteristics and emotions. As a result we found that food neophobia is associated with age, heritability, high bitter taste sensibility, urbanization, negative emotions and poor diet quality, particularly low intake of fruits and vegetables. Future studies are necessary to establish the causes of food neophobia as well as its relationship with food behavior in adolescents, adults and elderly. Finally, exposure to diverse food combined with the elicitation of positive emotions may contribute to the willingness of healthier food habits.

Keywords: Food neophobia; Determinants; Dietary choices; Emotions.

Introduction

Food neophobia is defined as an unwillingness to try novel and unknown foods¹. It is different from picky eating which refers to avoidance familiar but disliked foods². Food neophobia it is often measured by the Food Neophobia Scale (FNS), a ten-item questionnaire originally developed in English by Pliner and Hobden (1992)¹ to evaluate the presence of neophobic behavior and its relationship with food choices.

The FNS has been used in many studies to characterize the behavior of consumers in relation to unfamiliar foods³⁻⁶. The FNS was already translated into different languages and cultures as German, French, Spanish, Swedish, Finish and Portuguese⁷⁻¹¹. Besides, the FNS was also adapted for children¹² and to the fruit and vegetable domain¹³.

Evolutionarily, food neophobia is a natural protection mechanism that helps protecting the individual against unknown risks such as toxins in foods and whose presence is mainly signaled by bitter taste. For our species, the food variety is fundamental to obtain nutrients essential to life. However, the need for variety makes us more susceptible to poisoning or intoxication by ingesting something that is not edible. In this line, the senses work to alleviate this dilemma especially by means of taste and olfaction. We naturally tend to reject bitterness and sourness, in a lesser extent, and if our olfactory cells recognize extremely unpleasant odors, we do not even bring the food to the mouth. This is the omnivore's dilemma¹⁴. On the other hand, neophilia or the willingness to taste new and unfamiliar foods results in finding additional sources of food, offering advantages in certain food environments^{15,2}. However, nowadays, food is usually safe and the protective effect of food neophobia may not be advantageous and is still associated with lower dietary quality².

Humans vary widely in food neophobia level according to several determinants such as age, gender, urbanization, culture, food practices, sensory preferences and genetic factors^{5,16-18}. The heritability for food neophobia was estimated for the first time in humans by Knaapila et al. (2007)¹⁹, corresponding to 66% in Finish families and in British female twins. In terms of sensory terms, supertasters with high sensibility to bitterness are more prone to refuse novel foods than neophilic individuals¹⁸. Therefore, despite being a typical behavior in childhood, neophobia

may prevail in adults as a result of the interaction of genetic and environmental factors.

Food neophobia has been also investigated due to the emotional complexity of decisions related to food choices^{20,21}. So, this behavior has aroused the curiosity of researchers, since it can affect preferences and consequently the variety and quality of the diet^{22,5,8}. Several studies have shown that food neophobia is correlated to low intake of fruits and vegetables, and consequently poor overall diet quality^{23,24,2}.

Thus, attempts to a better understanding of food neophobia as an influential factor in diet is essential to propose interventions aimed at healthier eating habits²⁵. Therefore, the aim of the present review was to investigate the principal factors determinants of food neophobia and its influence on human food choices.

Methods

A bibliographic review was carried out, without restriction of date, in the Latin American and Caribbean Literature in Health Sciences (LILACS), International Literature in Health Sciences (PubMed) and Scientific Electronic Library Online (SciELO), Web of Science, Scopus and Food Science and Technology Abstracts (FSTA) databases between October 2016 and April 2017. The following keywords were used: food neophobia, determinants, food choices and dietary habits. The criteria for inclusion of the studies were surveys conducted with humans of both genders and without age restriction. Exclusion criteria were: research with pregnant women, vegetarians and individuals with food restrictions, duplicate articles and experimental animal studies.

Results and Discussion

Fifty-one studies were included in this narrative review. The potentials determinants of food neophobia found were age, gender, genetics, environmental influences, sensory characteristics and emotions. In addition, it was also investigated the food neophobia influence's on dietary choices. These articles fall within the areas of food behavior, food pattern and nutrition.

Food neophobia and age

Studies have shown that food neophobia decreases with age until adulthood^{26,17}. In a chronological way, children less than 24 months old present low levels of food neophobia²⁷, especially if they are only breastfed, since breast-milk's taste is very pleasant to the baby¹⁸. However, food neophobia increases after weaning with a peak between 2 and 6 years of age when children become more active^{28,17}. In this case, it is possible to understand food neophobia during childhood through the omnivore's dilemma perspective, since this behavior is assumed as an evolutionary mechanism to protect the individual from eating potential toxic food¹⁴. As children exploit novel foods – as omnivores – they have a cue of which foods are safe (sweet and salty) or potentially harmful (bitter or sour)¹⁵. Thus, food neophobia decreases during childhood²⁹ and at the beginning of adolescence as a result of repeated exposure to new foods^{26,30}, whereas in adulthood it remains relatively stable^{31,30,17}.

A possible explanation for the reduction of food neophobia during childhood and mainly in adolescence is the continuous increase of food exposure associated to the large supply of food by the industry¹⁵. For Dovey et al. (2008)¹⁷, the low level of food neophobia in younger individuals is due the increase of new food markets over the last century. So, with a high food repertoire during adolescence, they will express less neophobia because fewer foodstuffs will be novel to them¹⁷. In line, other studies have shown low level of food neophobia in adolescents^{15,32,26}.

It is suggested that food neophobia can be stabilized from adolescence onwards³⁰ or according to other authors, it decrease until early adulthood^{9,33}. So, food neophobia tends to gradually decrease throughout childhood, adolescence and adulthood as an adaptive mechanism for survival and reproduction, since humans have different nutritional requirements that can only be obtained from a varied diet^{34,17}.

In contrast, older people may present an increase in food neophobia^{5,17} and a possible explanation is that older individuals could be more resistant to adopting new eating habits, since they already have their own dietary pattern. In addition, they avoid unfamiliar foods that could cause illness and gastric discomfort¹⁷. The aged have reduction of senses, showing weaker abilities to detect food odors¹⁷. So, neophobia in older people could also be a mechanism evolutionary of avoidance

potential food hazards. However, more studies about food neophobia among seniors are required since they are relatively scarce.

Food neophobia, gender, environmental and genetic influence

In addition to age, it has been proposed that gender, among other factors, can be related to food neophobia, although results of studies on this topic are still controversial. Several reports have shown no gender difference in food neophobia among children^{35,24,36}, adolescents^{37,38,15} (Pelchat & Pliner, 1995; Cooke & Wardle, 2005; Roßbach et al., 2016) and young adults^{39,6,11}. On the other hand, it was evidenced higher food neophobia among boys as well as more neophobic behavior in children's fathers than in mothers²⁶. Some reports are controversial, pointing out higher neophobia in men^{5,40}, or women being more neophobic than men⁴¹ and, still, no gender difference³⁹. A factor to be considered is that in most cultures women usually buy and cook food, which increases their familiarity with various types of food and may contribute to the lower degree of neophobia among women.

Moreover, it has been suggested that an association between food neophobia and gender in adolescence may be age-dependent¹⁵ or interact with other variables which require more research into sex effects on food neophobia¹⁷. In addition, the perception of the own body and body weight gain, especially in adolescents girls are factors that must be considered⁴². Female may be possibly more open to healthy eating choices including fruits and vegetables, which, in turn, are often avoided by food neophobic individuals^{43,44}. This would possibly explain the decreasing FNS in adolescent girls associated with increasing age¹⁵.

However, there are other factors besides sex that could lead to food neophobia. The urbanization and cultural diversity may affect food neophobia as shown in a study in which rural children were more neophobic than urban ones⁴⁵. Another study showed that individuals from rural areas showed a greater degree of distrust regarding new foods when compared with urban individuals³. However, not only being in a rural environment may increase food neophobia, but also the access to urban practices is also important¹⁷.

In this line, environmental influences such as parental food neophobia, social economic status and education level also affect food neophobia¹⁷. Several studies have suggested that food neophobia is familiar, reflecting similarities in the home

environment as parental behaviors and diets⁴⁶. Parents with a more varied diet had children with low food neophobia^{47,46}. Another issue concerns to the act of cooking at home, which can help children to try new foods. Besides, breastfed children are familiar with the flavors of foods eaten by the mother, which, in turn, affects the flavor of her breast milk¹⁷.

Correlations between parents and child may also reflect genetic factors⁴⁶, since food neophobia is a personality trait with substantial genetic contribution¹⁷. A study in Finland and the UK found that about two thirds of the variation in food neophobia was attributable to genetic factors, at least in female individuals¹⁹. Another study with young children pointed out 72% of chance in inheriting the trait of avoidance new foods⁴⁶. This heritability estimate was similar to other study with children (78%) and adults (69%)^{48,19}. Genetic variations in the expression of taste receptors and in number of taste buds reflect in variations to food perception resulting in food neophobia or neophilia¹⁸. So, the way an individual perceives food is very particular, especially the supertasters due to genetically determined sensitivity to bitterness. Studies using substances such as PROP (6-n propylthiouracil) and PTC (phenylthiocarbamide) have shown that neophobics perceive these substances more bitter than non neophobics^{49,50}. Moreover, food neophobic adults with high sensitivity to PROP consume a limited set of foods due the reluctance of try bitter food⁴⁹.

In conclusion, there is a complex interaction between gender and food neophobia that need more in-depth studies to gain a clearer understanding on the effect of sex on food neophobia or if other variables may interact such as age, genetics, degree of urbanization and cultural characteristics¹⁷.

Food neophobia, dietary choices and emotions

Several studies have reported that food neophobia is associated with low intake of fruit and vegetables in children^{43,30,2,24}. Negative correlations between food neophobia and vegetable intake have also been showed in adults and elderly^{51,7}. Another research reported a negative relationship between food neophobia and healthy food consumption among Scottish adolescents⁵². Similarly, low neophobic children showed more pleasure in eating fruits and vegetables compared to high neophobic⁵³.

Commonly, food neophobia may restrict the variety, quantity and energy content of the diet. In this context, food neophobia in childhood was associated with less healthful food preferences and low dietary quality⁵⁴. In addition, a study reported lower energy intake for neophobic children⁵⁵. However, food neophobia may also increase energy intake, since neophobics may have low intake of fruit and vegetables and may replace these items to more energy-dense foods². It was shown that neophobic children had poor dietary quality due to low variety of fruits and vegetables and high energy intake from discretionary foods⁵⁶. A German study observed little impact of neophobia on adolescent's food habits¹⁵. On the other hand, a study conducted in the German- and French-speaking parts of Switzerland showed negative correlation among food neophobia, variety diet and consumption of vegetables, salad, poultry and fish⁷. Evidences suggested that adults are more food neophobic in relation to foods of animal origin such as meats⁵⁷. Therefore, associations with different food groups should be further investigated to better understand the role of food neophobia in the overall dietary quality¹⁵, since food neophobia may contribute to a poor diet and predispose neophobic individuals to overweight².

In fact, the natural aversion to bitter taste has protective implications against the consumption of potentially toxic substances². However, a negative consequence of considering bitter taste as a sign of potential toxicity is that individuals, principally food neophobic, reject levels of bitterness that are not necessarily toxic or harmful to the human species¹⁸. Some individuals not only have aversion to bitter taste but also tend to be extremely sensitive to it and this may contribute to the rejection of foods such as fruits and vegetables from the citrus and the brassicaceae family as cabbage and turnip which have beneficial nutritional properties¹⁷. Thus, the identification of the strategies that reverse the rejection to these types of these foods is important in improving healthier food habits¹⁷.

Generally, food is rejected for several reasons beside taste such as texture, low exposure or unfamiliarity and negative emotions associated with exposure. In this context, the aversion to bitter taste is not entirely absolute in food neophobia since preference for bitter foods can be developed by frequent exposures to food and, especially, by positive experiences related to consumption of these foods¹⁸. It demonstrates how essential is to understand the role of emotions in food neophobia and consequently in dietary choices.

To neophobic individuals, food decisions have an important emotional component that results in a complex process of food choice or avoidance novel foodstuff²¹. So, another point to be investigated is the involvement of emotion in food neophobia⁵², since the neophobic behavior is related to feelings of disgust and/or fear. Disgust and negative facial expressions were related to bitter foods or potentially harmful items⁵⁸. In addition, it has been reported that subjects who attribute a feeling of disgust to unfamiliar foods are likely to be more neophobic⁵⁸. Moreover, neophobia to a particular food can be reinforced from a negative experience with the initial exposure. Thus, if the food creates an expectation of bitterness from previously experienced bitter foods or is emotionally associated with negatives feelings as disgust, it will certainly be rejected¹⁷. In this line, parental pressure to consume foods has been associated to high levels of food neophobia⁵⁹⁻⁶². A parent or caregiver who exerts pressure to children to consume an unfamiliar food may be affecting their emotional state leading to attribution of negative feelings towards the novel food even in the future. Consequently, later presentations of the food may be associated to pressure and the children will be less willing to try new foods⁶³.

In this context, it is suggested that novel food should be presented in a positive way without pressure highlighting how enjoyable is to prepare and consume them. Studies have reported that foods positively highlighted tend to be more accepted^{64,31,37} and neophobic behavior tends to be substantially reduced when the exposure to a specific food is processed as a positive experience¹⁷. Therefore, food exposure associated to a positive experience and emotion may lead a reduction of the aversion and increase the acceptance of novel foods.

So, there are several factors related to food neophobia such as emotions, age, heredity, taste sensibility and environmental characteristics. Regarding sex, studies are still controversial since sex may be dependent of other factors determinants of food neophobia.

Conclusion

Food neophobia is a behavior that allowed the survival of omnivores by avoiding potentially toxic foods. Nowadays, however, the reluctance to eat unfamiliar foods can be harmful to human being, since it restricts diet in variety and quality.

Continuous and mainly positive exposure to novel food may contribute to willingness to try unfamiliar food and consequently to a greater variety and diet quality.

Although this personality trait has been extensively studied in children, its relationship with eating behavior in adolescents, adults and elderly are not yet well established, which opens new frontiers for further researches with different age groups to get a better understanding of the causes of food neophobia and its effect in dietary habits.

Acknowledgements

This research was supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

References

- [1] Pliner P, Hobden K. Development of a scale to measure the trait of food neophobia in humans. *Appetite* 1992;19:105–20.
- [2] Knaapila AJ, Sandell MA, Vaarno J, Hoppu U, Puolimatka T, Kaljonen A, Lagström H. Food neophobia associates with lower dietary quality and higher BMI in Finnish adults. *Public Health Nutr* 2014;18(12):2161–71.
- [3] Bäckström A, Pirttilä-Backman AM, Tuorila H. Willingness to try new foods as predicted by social representation and attitude and trait scales. *Appetite* 2004;43:75–83.
- [4] Ritchey PN, Frank RA, Hursti UK, Tuorila H. Validation and cross-national comparison of the food neophobia scale (FNS) using confirmatory factor analysis. *Appetite* 2003;40(2),163–73.
- [5] Tuorila H, Lähteenmäki L, Pohjalainen L, Lotti L. Food neophobia among the Finns and related responses to familiar and unfamiliar foods. *Food Qual Prefer* 2001;12:29–37.
- [6] Barcellos MD, Aguiar LK, Ferreira GC, Vieira LM. Willingness to try innovative food products: a comparison between British and Brazilian consumers. *Braz Adm Rev* 2009;6(1):50–61.

- [7] Siegrist M, Hartmann C, Keller C. Antecedents of food neophobia and its association with eating behavior and food choices. *Food Qual Prefer* 2013;30:293–8.
- [8] Fernández-Ruiz V, Claret A, Chaya C. Testing a Spanish-version of the Food Neophobia Scale. *Food Qual Prefer* 2013;28:222–5.
- [9] Koivisto UK, Sjärdén PO. Food and general neophobia in Swedish families: parent-child comparisons and relationships with serving specific foods. *Appetite* 1996; 26:107–18.
- [10] Tuorila H, Andersson AE, Martikainen A, Salovaara H. Effect of product formula, information and consumer characteristics on the acceptance of a new snack food. *Food Qual Pref* 1998;9:313–20.
- [11] Previato HDRA, Behrens JH. Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese. *Nutr Hosp* 2015;32(2):925–30.
- [12] Pliner P. Development of measures of food neophobia in children. *Appetite* 1994;23:147–63.
- [13] Hollar D, Paxton-Aiken A, Fleming P. Exploratory validation of the fruit and vegetable neophobia instrument among third- to fifth-grade students. *Appetite* 2013;60:226–30.
- [14] Rozin P, Vollmecke TA. Food Likes and Dislikes. *An Rev Nutr* 1986;6:433–56.
- [15] Roßbach S, Foterek K, Schmidt I, Hilbig A, Alexy U. Food neophobia in German adolescents: Determinants and association with dietary habits. *Appetite* 2016;101:184–91.
- [16] Flight I, Leppard P, Cox DN. Food neophobia and associations with cultural diversity and socio-economic status amongst rural and urban Australian adolescents. *Appetite* 2003;41:51–9.
- [17] Dovey TM, Staples PA, Gibson EL, Halford JCG. Food neophobia and 'picky/fussy' eating in children: a review. *Appetite* 2008;50(2-3):181–93.
- [18] Prescott J. *Taste Matters. Why We Like the Foods We Do.* Reaktion Books: London, UK, 2012. 208p.

- [19] Knaapila A, Tuorila H, Silventoinen K, Keskitalo K, Kallela M, Wessman M, Peltonen L, Cherkas LF, Spector TD, Perola M. Food neophobia shows heritable variation in humans. *Physiol Behav* 2007;91(5): 573–8.
- [20] Moreau P, Lehamann DR, Markman AB. Entrenched knowledge structures and consumer response to new products. *J Mark Res* 2001;38(1):14–29.
- [21] Barrena R, Sánchez M. Neophobia, personal consumer values and novel food acceptance. *Food Qual Prefer* 2012; 27(1):72–84.
- [22] Raudenbush B, Frank RA. Assessing food neophobia: the role of stimulus familiarity. *Appetite* 1999;32:261–71.
- [23] Howard AJ, Mallan KM, Byrne R, Magarey A, Daniels LA. Toddlers' food preferences. The impact of novel food exposure, maternal preferences and food neophobia. *Appetite* 2012;59(3):818–25.
- [24] Tadeo AR, Villena BP, Urquidez-Romero R, Vidana-Gaytan ME, Caston MJP, Berruezo GR, Martinez-Lacuesta EG. Neofobia alimentaria: impacto sobre los hábitos alimentarios y aceptación de alimentos saludables en usuarios de comedores escolares. *Nutr Hosp* 2015;31(1):260–8.
- [25] Previato HDRA, Behrens JH. Why is it so Important to Understand Food Neophobia as a Determinant of Food Choice? *Nutr Food Technol Open Access* 2016;2(4)1.
- [26] Koivisto Hursti U, Sjöden PO. Food and general neophobia and their relationship with self-reported food choice: familial resemblance in Swedish families with children of ages 7-17 years. *Appetite* 1997;29(1):89–103.
- [27] Cashdan E. A sensitive period for learning about food. *Human Nature* 1994;5(3):279–91.
- [28] Addessi E, Galloway AT, Visalberghi E, Birch LL. Specific social influences on the acceptance of novel foods in 2–5-year-old children. *Appetite* 2005;45:264–271.
- [29] Rigal N. L'exposition répétée permet-elle de dépasser la néophobie alimentaire? Application chez des enfants français soumis à des produits salés [Reduction of food neophobia as a result of repeated exposure? A study with French children exposed to salty foods]. *Europ Rev Ap Psyc* 2005;55:43–50.

- [30] Nicklaus S, Boggio V, Chabanet C, Issanchou S. A prospective study of food variety seeking in childhood, adolescence and early adult life. *Appetite* 2005;44(3):289–97.
- [31] McFarlane T, Pliner P. Increased willingness to taste novel foods: Effects of nutrition and taste information. *Appetite* 1997;28:227–38.
- [32] Cho MS, Kim M, Cho W. Relationships of adolescent's dietary habits with personality traits and food neophobia according to family meal frequency. *Nut Res Pract* 2014;8(4):476–81.
- [33] Rigal N, Frelut ML, Monneuse MO, Hladik CM, Simmen B, Pasquet P. Food neophobia in the context of a varied diet induced by a weight reduction program in massively obese adolescents. *Appetite* 2006;46:207–14.
- [34] Raynor HA, Epstein LH. Dietary variety energy regulation and obesity. *Psychol Bull* 2001;127(3):325–41.
- [35] Cooke L, Wardle J, Gibson EL. Relationship between parental report of food neophobia and everyday food consumption in 2-6-year-old children. *Appetite* 2003;41:205-6.
- [36] Laureati M, Bergamaschi V, Pagliarini E. Assessing childhood food neophobia: Validation of a scale in Italian primary school children. *Food Qual Pref* 2015;40:8–15.
- [37] Pelchat ML, Pliner P. Try it. You'll like it. Effects of information on willingness to try novel foods. *Appetite* 1995;24:153–66.
- [38] Cooke LJ, Wardle J. Age and gender differences in children's food preferences. *Brit J Nutr* 2005;93(5):741–6.
- [39] Nordin S, Broman DA, Garvill J, Nyroos M. Gender differences in factors affecting rejection of food in healthy young Swedish adults. *Appetite* 2004;43: 295–301.
- [40] Marcelino AS, Adam AS, Couronne T, Köster EP, Sieffermann JM. Internal and external determinants of eating initiation in humans. *Appetite* 2001;36:9–14.
- [41] Frank RA, Van der Klaauw N. The contribution of chemosensory factors to individual differences in reported food preferences. *Appetite* 1994;22:101–23.

- [42] Story M, Neumark-Sztainer D, French S. (2002). Individual and environmental influences on adolescent eating behaviors. *J Am Diet Assoc* 2002;102(3):40–51.
- [43] Galloway AT, Lee Y, Birch LL. Predictors and consequences of food neophobia and pickiness in young girls. *J Am Diet Assoc* 2003;103:692–8.
- [44] Cooke LJ, Wardle J, Gibson EL, Sapochnik M, Sheiham A, Lawson M. Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. *Public Health Nutr* 2004;7(2):295–302.
- [45] Flight I, Leppard P, Cox DN. Food neophobia and associations with cultural diversity and socio-economic status amongst rural and urban Australian adolescents. *Appetite* 2003;41(1):51–9.
- [46] Faith MS, Heo M, Keller KL, Pietrobelli A. Child Food Neophobia Is Heritable, Associated with Less Compliant Eating, and Moderates Familial Resemblance for BMI. *Obesity* 2013;21:1650–5.
- [47] Falciiglia GA, Pabst S, Couch S, Goody C. Impact of parental food choices on child food neophobia. *Child Health Care* 2004;33:217–25.
- [48] Cooke LJ, Haworth CM, Wardle J. Genetic and environmental influences on children's food neophobia. *Am J Clin Nutr* 2007;86:428–33.
- [49] Pasquet P, Oberti B, El Ati J, Hladik CM. Relationships between threshold-based PROP sensitivity and food preferences of Tunisians. *Appetite* 2002;39: 167–73.
- [50] Monneusea MO, Rigal N, Frelut ML, Hladik CM, Simmen B, Pasquet P. Taste acuity of obese adolescents and changes in food neophobia and food preferences during a weight reduction session. *Appetite* 2008;50:302–7.
- [51] Knaapila A, Silventoinen K, Broms U, Rose RJ, Perola M, Kaprio J, Tuorila HM. Food Neophobia in Young Adults: Genetic Architecture and Relation to Personality, Pleasantness and Use Frequency of Foods, and Body Mass Index-A Twin Study. *Behav Genet* 2011;41:512–21.
- [52] MacNicol SAM, Murray SM, Austin EJ. Relationships between personality, attitudes and dietary behavior in a group of Scottish adolescents. *Pers Ind Dif* 2003;35(8):1753–64.
- [53] Mustonen S, Oerlemans P, Tuorila H. Familiarity with and affective responses to foods in 8–11-year-old children. The role of food neophobia and parental education. *Appetite* 2012;58(3):777–80.

- [54] Falciiglia GA, Couch SC, Gribble LS, Pabst SM, Frank R. Food neophobia in childhood affects dietary variety. *J Am Diet Assoc* 2000;100(12):1474–81.
- [55] Cooke L, Carnell S, Wardle J. Food neophobia and mealtime food consumption in 4–5 year old children. *Int J Behav Nutr Phys Act* 2006;3(14):1–6.
- [56] Perry RA, Mallan KM, Koo J, Mauch CE, Daniels LA, Magarey AM. Food neophobia and its association with diet quality and weight in children aged 24 months: a cross sectional study. *Int J Behav Nutr Phys Act* 2015;12(13):1–8.
- [57] Pliner P, Pelchat ML. Neophobia in humans and the special status of foods of animal origin. *Appetite* 1991;16(3):205–18.
- [58] Martins Y, Pliner P. Human food choices: An examination of the factors underlying acceptance/rejection of novel and familiar animal and nonanimal foods. *Appetite* 2005;45:214–24.
- [59] Fisher JO, Mitchell DC, Smiciklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *J Am Diet Assoc* 2002;102:58–64.
- [60] Galloway AT, Fiorito LM, Francis LA, Birch LL. 'Finish your soup': Counterproductive effects of pressuring children to eat on intake and affect. *Appetite* 2006;46:318–23.
- [61] Galloway AT, Fiorito LM, Lee Y, Birch LL. Parental pressure, dietary patterns and weight status among girls who are "picky/fussy" eaters'. *J Am Diet Assoc* 2005;105:541–8.
- [62] Wardle J, Carnell S, Cooke L. Parental control over feeding and children's fruit and vegetable intake: How are they related? *J Am Diet Assoc* 2005;105:227–32.
- [63] Pliner P, Loewen ER. Temperament and food neophobia in children and their mothers. *Appetite* 1997;28:239–54.
- [64] Martins Y, Pelchat PL, Pliner P. 'Try it; it's good and it's good for you': Effects of taste and nutrition information on willingness to try novel foods. *Appetite* 1997;28:89–102.

4. CAPÍTULO 2

Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese

Helena Dória Ribeiro de Andrade Previato & Jorge Herman Behrens

Este capítulo corresponde ao artigo publicado na Revista *Nutrición Hospitalaria* em 2015¹.

Abstract

Introduction: The Food Neophobia Scale (FNS), originally developed in English, has been widely used in different studies to assess the individual's willingness to try new foods. However, a process of translation and cultural adaptation is required to enable the use of FNS in other countries.

Objective: To translate and to validate the FNS into Brazilian Portuguese.

Methods: The FNS was translated into Brazilian Portuguese by three English teachers independently and back-translated into English by other three professionals. After that, both the English and Brazilian Portuguese FNS versions were administered to a sample of 40 graduate students of the University of Campinas, São Paulo, Brazil, between September and October 2014. The reproducibility between the instruments was assessed by the intra-class correlation coefficient (ICC). The internal reliability of the scale was evaluated by Cronbach's Alpha coefficient. The FNS total score ranged from 10-70 and the respondents were classified as food neophilic (≤ 16.4), neutral (16.5-38.5) and food neophobic (≥ 38.6).

Results: The ICC between the items of the original FNS and the Brazilian FNS ranged between 0.266 and 0.815 ($P < 0.05$). The total score of the FNS was 0.903 ($p < 0.001$). Cronbach's alpha coefficient was 0.916. Most respondents were classified as neutral (72.5%), other 10% as neophilics, and only 17.5% as neophobics.

¹ Previato HDRA, Behrens JH. Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese. *Nutr Hosp* 2015; 32(2): 925-930. (DOI:10.3305/nh.2015.32.2.9108)

Conclusion: The Brazilian version of the FNS proved to be an adequate and reliable tool to measure food neophobia. Yet, further research is required to investigate the presence of food neophobia in Brazilian population and to analyse its impact on food behaviour.

Keywords: Food Neophobia, Consumer Behaviour, Nutrition, Brazil.

Traducción y Validación de la Escala de Neofobia Alimentaria (ENA) para el Portugués de Brasil

Resumen

Introducción: La Escala de Neofobia Alimentaria (ENA), desarrollada originalmente en lengua inglesa, ha sido ampliamente utilizada en diferentes estudios para evaluar el deseo individual de probar nuevos alimentos. Sin embargo, es necesario un proceso de traducción y adaptación cultural para permitir su uso en otros países.

Objetivo: Traducir y validar la ENA en portugués brasileño.

Métodos: La escala fue traducida al portugués, de forma independiente, por tres profesores de inglés, siendo traducido al revés al inglés por otros tres profesionales del sector. Se administraron estas traducciones a una muestra de 40 estudiantes de posgrado de la Universidad de Campinas, São Paulo, Brasil, entre septiembre y octubre de 2014. La reproducibilidad entre los instrumentos se evaluó por medio del coeficiente de correlación intraclass (CCI). La confiabilidad interna de la escala se evaluó por medio del coeficiente alfa de Cronbach. La puntuación total de la ENA varió 10-70 y los individuos fueron clasificados con neofilia alimentaria ($\leq 16,4$), neutralidad (16,5-38,5) y neofobia alimentaria ($\geq 38,6$).

Resultados: El CCI entre los ítems de la versión original y traducida se situó entre 0.266 y 0.815 ($p < 0,05$) y la puntuación total de la ENA fue 0,903 ($p < 0,001$). El coeficiente alfa de Cronbach fue 0,916. La mayoría de los encuestados fuer clasificada como neutral (72,5%), el otro 10% como neofilia y sólo el 17,5% con la neofobia alimentaria.

Conclusiones: La versión brasileña de la ENA resultó ser una herramienta adecuada y confiable para medir la neofobia alimentaria. No obstante, se necesitan investigaciones futuras para evaluar la presencia de la neofobia alimentaria de la población brasileña y para analizar su impacto en la conducta alimentaria.

Palabras clave: Neofobia alimentaria, Comportamiento del consumidor, Nutrición, Brasil.

Abbreviations

ICC: Intraclass correlation coefficient

FNS: Food Neophobia Scale

Introduction

Food neophobia is the fear of novel or unfamiliar foods¹. Particularly common among toddlers and young children, it is most related to the bitter and sour tastes and considered an evolutionary reminiscence, since it would be advantageous to avoid eating potentially poisonous (bitter) or decayed (sour) foods².

Different factors seem to play a role in food neophobia. Alley and Potter³ estimate that about two-thirds of the variation in food neophobia is due to genetics, but, in spite of being a typical children's behavioral trait, neophobia may prevail until adulthood as a result of environmental factors such as cultural food practices, socio-demographic characteristics, lifestyle, education and ageing^{4,5,6,2}. According to Pliner and Hobden¹ knowledge and personal experience influence interest in trying new foods, so subjects exposed to diverse cultures might be less food neophobic⁵.

In the last years, the neophobic behavior has been investigated because it can impact food preferences^{7,4}, affecting the quality and variety of the diet^{8,9,10}. Thus, understanding the factors influencing food choices, and particularly, food neophobia, is important for education programs intended to promote healthier eating habits⁴.

Food neophobia is assessed by the Food Neophobia Scale (FNS), primarily developed in English by Pliner and Hobden¹ for the purpose of measuring food behaviors (Table I). This is a self-administrated, 10-item questionnaire in which a high mean score, obtained by summing the individual item scores measured on a Likert scale (ranging from strongly disagree to strongly agree), represents less willingness to try new or unfamiliar foods (neophobia), while a lower mean score indicates more willingness to try novel foods (neophilia)¹.

Table I
Food Neophobia Scale

1. I am constantly sampling new and different foods.*
2. I don't trust new foods.
3. If I don't know what is in a food, I won't try it.
4. I like foods from different countries.*
5. Ethnic food looks too weird to eat.
6. At dinner parties, I will try a new food.*
7. I am afraid to eat things I have never had before.
8. I am very particular about the foods I will eat.
9. I will eat almost anything.*
10. I like to try new ethnic restaurant.*

* Reversed item.

The FNS was originally developed and validated using a sample of Canadian graduate students¹ and to be used in cross-cultural studies, its psychometric properties need to be tested in different languages¹¹, which, in turn, will reflect cultural differences.

Translations of the FNS have been reported in the literature, such as in Swedish¹², Finnish¹³, Spanish⁸, European Portuguese¹¹, German and French⁹. Validation studies needed to be performed to assess the properties of the translated FNS before the scale could be considered an appropriate instrument for food neophobia measurement. Moreover, in all these translations, some words or complete scale items were changed or even deleted to make the scale comprehensive and then applicable to the other cultural contexts^{4,14,5,9}.

In spite of the recent translation made in Portugal¹¹, the FNS deserves a Brazilian version, since lexical, semantical and syntactical differences of the Portuguese language come up in the lusophone countries, especially considering Brazilian Portuguese, which, besides its Indo-European root, bears the marks of indigenous people, Africans and immigrants of various origins^{15,16,17}. In this sense, it is necessary a process of translation and validation followed by a cultural adaptation of a Brazilian Portuguese version for the FNS, which will enable the use of the scale with Brazilian people.

This work aimed to translate and validate the Food Neophobia Scale into Brazilian Portuguese. The Brazilian version of the FNS will contribute not only in

studies on local eating preferences, but it will also help researchers in cross-cultural studies or in the development of educational strategies to motivate consumers to modify food choices and try unfamiliar or novel foods.

Material and Methods

FNS translation into Brazilian Portuguese

The translation of the FNS into Brazilian Portuguese was performed independently by three English teachers fluent both in Portuguese and English. Subsequently, the Portuguese versions were translated back into English by other three English teachers, in a process called back-translation¹⁸ aimed to verify the congruence of the translation, that is, conceptual and linguistic equivalence of the original instrument¹⁹. Final, minor adjustments were made in order to obtain the Brazilian version.

To assess the equivalence of the translated version to the original scale, a group of 40 graduate students, fluent both in English and Portuguese, answered the scales with a one-week interval between them¹⁸. The sample size was based on the recommendations of Ohrbach et al.²⁰. The study was conducted at the State University of Campinas (UNICAMP), Campinas, São Paulo, Brazil, between September and October 2014. Respondents were randomly assigned to two groups with 20 subjects each, according to the recommendations of Prieto¹⁸. The first group received the Portuguese version firstly and then the original English scale, while the second group received at first the English followed by the translated version.

The original and translated FNS consisted of 10 items that were measured using a 7-point Likert scale (1=strongly disagree, 2=moderately disagree, 3=slightly disagree, 4=neither agree, nor disagree, 5=slightly agree, 6=moderately agree, 7=strongly agree).

Statistical Analysis

The reproducibility between the measurements of the two scales was assessed by the intraclass correlation coefficient (ICC), which is an assessment of consistency of the measurements made by the different respondents²¹. Cutoff points

were established as perfect agreement (0.8-1.0), substantial agreement (0.61-0.80), moderate agreement (0.41-0.60), fair agreement (0.21-0.40), discrete agreement (0-0.20) and poor agreement (<0.001).

Cronbach's Alpha (α) was calculated as an internal consistency estimate of reliability the FNS, being it considered: great (>0.80), good (>0.70) and acceptable (0.60-0.70)²².

Individual total scores were obtained by summing the values of each scale item, corresponding to the values 1-7 and totaling 10-70 points. The scores for items 1, 4, 6, 9 and 10 (Table II) were reversed since these items correspond to neophilia rather than neophobia. Thus, the higher the total individual score, the greater the level of food neophobia¹ and according to Olabi et al.²³, taking into account the mean value in the FNS of 27.5 and its related standard deviation (± 11.1), individuals showing scores ≤ 16.4 were classified as neophilic; those between 16.5-38.5 were considered neutral and those above 38.6, neophobic.

Statistical analyzes were performed using the Predictive Analytics Software (PASW) Statistics GradPack version 12.0²⁴.

Ethical Aspects

The study was conducted according to the principles of the Declaration of Helsinki and Resolution 466/2012 of the National Health Council²⁵. All respondents signed a consent form to participate in the study and the research protocol was approved by the Ethics Committee of the University of Campinas (CAAE 30884314.6.0000.5404).

Results

Thirty female and ten male subjects (N=40) participated in the study. Age varied from 21 to 51 years (mean = 29.6 ± 6.9 YO), within the mean age range of the Brazilian population according to the last census²⁶.

Table 2 shows that, regarding of the reproducibility of the 10 scale items, the Wilcoxon test revealed that only item 8 (*I am very particular about the foods I will eat / Eu sou muito exigente em relação aos alimentos que eu escolho para comer*) showed a significant difference (P=0.039) between the responses of the original

scale in English and the translated version into Portuguese. However, a careful look at the individual responses showed that 15 out of the 40 participants (37.5%) gave the same scores to item 8 in two versions of the FNS. As stated in the work of Vidigal et al.¹⁹, a limitation of the Wilcoxon test is that, when the difference between the scores is zero, they are not used in the statistical calculation, and this may have contributed to the non-reproducibility of data related to item 8.

The analysis of the ICC, considering the 10 items of the English and the Portuguese scales, showed that all correlations were significantly higher than zero, ranging from 0.266 and 0.815 ($P < 0.05$). Despite the significant difference in item 8 responses, according the Wilcoxon test ($P = 0.039$), the ICC showed a moderate agreement between the two scales (ICC = 0.564, $P < 0.05$) for this item.

Therefore, these data demonstrate that the translated version was conceptually equivalent to the original FNS, since there was no significant difference between the two versions total score ($P > 0.05$). Moreover, the intraclass correlation coefficient between the total sum of the two scales showed almost perfect agreement (ICC = 0.903; $P < 0.001$).

Table II

Statistical comparison between the scale items of the original Food Neophobia Scale (FNS) and the translated version in Brazilian Portuguese (N = 40 respondents)

<i>Pair</i>	<i>Language</i>	<i>Scale items</i>	<i>Mean Scores ± SD</i>	<i>Wilcoxon Test P</i>	<i>ICC</i>
1	E	I am constantly sampling new and different foods.*	2.7 ± 1.6	0.209	0.753
	P	Eu estou constantemente experimentando alimentos novos e diferentes.*	2.9 ± 1.8		
2	E	I don't trust new foods.	2.5 ± 1.4	0.887	0.525
	P	Eu não confio em novos alimentos.	2.4 ± 1.5		
3	E	If I don't know what is in a food, I won't try it.	3.3 ± 1.9	0.987	0.729
	P	Se eu não sei o que contém um alimento, eu não experimento.	3.2 ± 1.9		
4	E	I like foods from different countries.*	2.0 ± 1.2	0.625	0.677
	P	Eu gosto de comidas de diferentes países.*	2.1 ± 1.3		
5	E	Ethnic food looks too weird to eat.	2.9 ± 1.5	0.109	0.266
	P	Comidas de outros países parecem muito estranhas para serem consumidas.	2.4 ± 1.4		
6	E	At dinner parties, I will try a new food.*	2.6 ± 1.6	0.087	0.612
	P	Em eventos sociais, eu experimento novos alimentos.*	2.3 ± 1.6		
7	E	I am afraid to eat things I have never had before.	2.5 ± 1.5	0.085	0.526
	P	Eu tenho receio de comer alimentos que eu nunca experimentei antes.	2.9 ± 1.9		
8	E	I am very particular about the foods I will eat.	3.8 ± 1.9	0.039**	0.564
	P	Eu sou muito exigente em relação aos alimentos que eu escolho para comer.	2.1 ± 1.4		
9	E	I will eat almost anything.*	2.8 ± 1.9	0.098	0.691
	P	Eu como praticamente de tudo.*	2.4 ± 1.7		
10	E	I like to try new ethnic restaurant.*	2.4 ± 1.5	0.132	0.815
	P	Eu gosto de experimentar novos restaurantes de comidas de outros países.*	2.2 ± 1.5		

FNS: Food Neophobia Scale; SD: standard deviation; ICC: intraclass correlation coefficient; E: English; P: Portuguese; *Reversed Item; ** statistically significant difference (P<0.05). Each scale item has a seven-point Likert response set: (1 = strongly disagree; 4 = neither agree, nor disagree; 7 = strongly agree).

Regarding the reliability the translated version, considering the responses of 40 participants of this study, the calculated Cronbach's alpha coefficient reached 0.916, which demonstrates high reliability of the scale to measure food neophobia.

The mean neophobia score measured by the Brazilian FNS was 27.5 (± 11.1) and respondents were classified as neophilics (10.0%), neutral (72.5%) and neophobic (17.5%).

Discussion

The translated version of the FNS proved to be a reliable psychometric instrument to assess food neophobia in Brazil, since the ICC between the total sum of the items of the scale was very high, 0.903 ($P < 0.001$) confirming the reliability of the scale. In the translation of FNS into Spanish, the ICC found was 0.84, confirming stability and internal reliability of the translated scale⁸.

Most studies analyze the internal consistency of the FNS adapted to other languages. In this study, the Cronbach's alpha for FNS translated into Brazilian Portuguese was 0.916. Similar results were found by Siegrist et al.⁹ in the validation of FNS for the German ($\alpha = 0.79$) and French ($\alpha = 0.82$). The same was showed at the adaptation of FNS into Spanish ($\alpha = 0.82$)⁸. Cronbach's alpha coefficient is the most widely used test to measure the reliability of the instrument translated¹⁹. Therefore, it is possible to affirm that all items can be included in the final Brazilian Portuguese version of the Food Neophobia Scale, whose translation into Portuguese was considered reliable and reproducible, allowing its use in research with Brazilian individuals.

Table III shows the versions of the FNS in Brazilian and European Portuguese. Although they are grammatically quite similar, the Brazilian FNS substituted the word *ethnic* by an equivalent expression, that is, *comida de outros países* (food from other countries). The European Portuguese version also made this change, but maintained the expression *ethnic restaurants*¹¹.

Table III

Comparison of the translated FNS into Brazilian and European Portuguese versions of the FNS

Item	Brazilian Portuguese	European Portuguese**
1	Eu estou constantemente experimentando alimentos novos e diferentes.	Estou constantemente a experimentar alimentos novos e diferentes.
2	Eu não confio em novos alimentos.	Não confio em alimentos novos.
3	Se eu não sei o que contém um alimento, eu não experimento.	Se não souber o que está num alimento/comida, eu não experimento.
4	Eu gosto de comidas de diferentes países.	Gosto de alimentos/comidas de diferentes países.
5	Comidas de outros países parecem muito estranhas para serem consumidas.	Os alimentos/comidas de outros países parecem muitos estranhos para se comer.
6	<i>Em eventos sociais</i> , eu experimento novos alimentos.*	<i>Em jantares de festa</i> , eu costumo experimentar novos alimentos/comidas.
7	Eu tenho receio de comer alimentos que eu nunca experimentei antes.	Receio experimentar coisas que nunca comi antes.
8	Eu sou muito exigente em relação aos alimentos que eu escolho para comer.	Sou muito exigente com os alimentos/comidas que vou comer.
9	Eu como praticamente de tudo.	Eu como quase de tudo.
10	Eu gosto de experimentar novos <i>restaurantes de comidas de outros países</i> .*	Eu gosto de experimentar novos <i>restaurantes étnicos</i> (cozinha internacional).

* Italicized expressions highlight the most significant differences between the translations.

** Paupério et al. (2014)¹¹.

In the study of Ritchey et al.¹⁴, the word *ethnic* was replaced with *foreign*. At the Finnish version of the FNS, validated by Tuorila et al.⁴, the term *ethnic foods/restaurants* was translated to *foods/restaurants from other countries*, similar to the Brazilian FNS. In Switzerland, the expression *ethnic restaurants* was changed to

*places, where foods from other cultures are served*⁹. Finally, in Australia, the term *ethnic* was removed from the FNS items because it is not widely used in this country⁵. Thus, the word *ethnic* must be used in different contexts by various cultures, since food habits reflect the beliefs, attitudes and views on life of each population²⁷.

Brazil is a multicultural nation characterized by gastronomic diversity due the mix of Indigenous, African and Portuguese culinary habits incorporated by the local populations since the colony period started in the 16th century. From the 19th century on, as a result of the independence from Portugal and the territorial expansion, immigrants from Europe and Asia brought new and different food practices, which end up being adopted in the local habits, particularly in the major urban areas^{28,6,29}. Therefore, the concept of ethnic has been diluted in the society as there was a great ethnic mix and diffusion of different cultural habits, including food. Brazil is famous for a great gastronomic variety indeed⁶.

Regarding the expression *particular about* in item 8 (Table III), it was translated into *exigente (demanding)* in both Portuguese versions of the FNS. Tuorila et al.⁴ and Ritchey et al.¹⁴ interpreted *particular about* as *finicky*, which describes a person who likes things only when they correct in every detail. Independently from any translation, individual agreement with item 8 demonstrates an avoidant behavior towards food. Tuorila et al.⁴ reported that item 8 may reflect some interest caused by dietary restrictions rather than to food neophobia. For Ritchey et al.¹⁴, item 8 relates more to some type of health concern, while Koivisto and Sjödén¹² reported that it may not clearly express food neophobia. Therefore, the isolated evaluation of item 8 is not an adequate parameter to measure food neophobia, but it is better used to assess aspects related to health care.

Despite the FNS have already been translated into European Portuguese¹¹, it was possible to observe that the Brazilian version differs from the version of Portugal in some words, phrases and verb tense. This must be taken into consideration because apparently subtle changes can influence the interpretation and questionnaire response and consequently the food neophobia analysis. Moreover, the scale validation with Brazilian postgraduate students was a differential of this study and although the subjects showed lower food neophobia, the scale can be used in other studies in Brazil in order to assess the food neophobia.

Although food neophobia is a personal trait, cultural and socio-economic factors influence the willingness to consume novel or unfamiliar foods⁴. People living in urban areas would have lower food neophobia in comparison to rural people⁵. Besides, high educational status contributes to food neophilia, since greater knowledge of cultural cuisines and the possibility of eating in restaurants provide less aversion to unfamiliar food⁶. Therefore the experience with different foods decrease neophobia¹. This was evidenced in this study, once the respondents – university students – live in one of the largest Brazilian cities and have high educational background, which helps to explain their low level of food neophobia. Another study conducted in Brazil with graduate students living mainly in urban areas showed that only 11.5% of the respondents presented food neophobia⁶.

Finally the Brazilian version of the Food Neophobia Scale add a new dimension to studies on eating habits of the population, since the concept of food neophobia is virtually unknown among local professionals in the fields of nutrition and food science and technology. Neophobia is a personality trait that manifests itself differently depending on people's age, socioeconomic and educational level and degree of urbanization. Although Brazil is imminently an urban country - 80% of the population living in urban areas - and still young, the great regional heterogeneity must be taking into account and it is manifested not only in the availability of food, but also in cultural aspects of the society. Thus, assessment of food neophobia, combined with other measures on food preferences will help health professionals, food authorities and companies to develop public policies and educational strategies aimed at specific groups like children, youngsters, adults and seniors.

Future studies should focus on different aspects of food neophobia, for example neophobia in relation to different classes of animal products, vegetable and produced by microbiological processes. As FNS addresses general neophobia, which is a weakness in the method, other important issues related to food choices must now be addressed, such as the consumer search for convenience, which favors processed and ready-to-eat products, and, on the other hand, food technology neophobia, since it is notorious the rejection of modern technologies like genetic engineering and food irradiation.

So there is research horizon on eating habits in Brazil and Latin America and the FNS translated into Brazilian Portuguese will improve the quality of national as well as cross-cultural studies.

Acknowledgements

We acknowledge the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for financial support.

References

- [1] Pliner P, Hobden K. Development of a scale to measure the trait of food neophobia in humans. *Appetite*. 1992;19:105-20.
- [2] Prescott J. Taste Matters. Why We Like the Foods We Do. Reaktion Books: London, UK. 2012. 208p.
- [3] Alley TR, Potter KA. Food Neophobia and Sensation Seeking. Handbook of Behavior, Food and Nutrition. Springer. 2011; 707-24.
- [4] Tuorila H, Lähteenmäki L, Pohjalainen L, Lotti L. Food neophobia among the Finns and related responses to familiar and unfamiliar foods. *Food Quality and Preference*. 2001;12: 29-37.
- [5] Flight I, Leppard P, Cox DN. Food neophobia and associations with cultural diversity and socio-economic status amongst rural and urban Australian adolescents. *Appetite*. 2003; 41, 51-9.
- [6] Barcellos MD, Aguiar LK, Ferreira GC, Vieira LM. Willingness to try innovative food products: a comparison between British and Brazilian consumers. *Brazilian Administration Review*. 2009; 6(1), 50-61.
- [7] Raudenbush B, Frank RA. Assessing food neophobia: the role of stimulus familiarity. *Appetite*. 1999; 32, 261-71.
- [8] Fernández-Ruiz V, Claret A, Chaya C. Testing a Spanish-version of the Food Neophobia Scale. *Food Quality and Preference*. 2013; 28, 222-5.
- [9] Siegrist M, Hartmann C, Keller C. Antecedents of food neophobia and its association with eating behavior and food choices. *Food Quality and Preference*. 2013; 30, 293-8.

- [10] Tadeo AR, Villena BP, Urquidez-Romero R, Vidana-Gaytan ME, Caston MJP, Berruezo GR, et al. Neofobia alimentaria: impacto sobre los hábitos alimentarios y aceptación de alimentos saludables en usuarios de comedores escolares. *Nutrición Hospitalaria*. 2015;31(1):260-268.
- [11] Paupério A, Severo M, Lopes C, Moreira P, Cooke L, Oliveira A. Could the Food Neophobia Scale be adapted to pregnant women? A confirmatory factor analysis in a Portuguese sample. *Appetite*. 2014; 75, 110-6.
- [12] Koivisto UK, Sjärdén PO. Food and general neophobia in Swedish families: parent-child comparisons and relationships with serving specific foods. *Appetite*. 1996; 26, 107-18.
- [13] Tuorila H, Andersson AE, Martikainen A, Salovaara H. Effect of product formula, information and consumer characteristics on the acceptance of a new snack food. *Food Quality and Preference*. 1998; 9, 313-20.
- [14] Ritchey PN, Frank RA, Hursti UK, Tuorila H. Validation and cross-national comparison of the food neophobia scale (FNS) using confirmatory factor analysis. *Appetite*. 2003; 40, 163-73.
- [15] Azevedo M. Vernacular Features in Educated Speech in Brazilian Portuguese. *Hispania*. 1989; 72(4):862-72.
- [16] Mattos e Silva RV. (Org). Para a história do Português Brasileiro. Primeiros estudos. v. II, Primeiros Estudos, 2 tomos. São Paulo: Humanitas/Fapesp. 2001.
- [17] Bagno M. Português ou brasileiro? Um convite à pesquisa. São Paulo: Parábola Editorial. 2001. 182 p.
- [18] Prieto AJ. A method for translation of instruments to other languages. *Adult Education Quarterly*. 1992; 43(1), 1-14.
- [19] Vidigal MCTR, Minim VPR, Moreira RT, Pires ACS, Ferreira MAM, Gonçalves ACA, et al. Tradução e validação para a língua portuguesa da escala de neofobia em relação à tecnologia de alimentos: food technology neophobia scale. *Ciência Rural*. 2014; 44(1), 174-80.
- [20] Ohrbach R, Bjorner J, Jezewski M, John MT, Lobbezoo F. Guidelines for establishing cultural equivalency of instruments. New York: University at Buffalo. 2009. 59p.

- [21] Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977; 33, 159-74.
- [22] Money A, Babin B, Hair Junior JF, Samouel P. Fundamentos de métodos de pesquisa em administração. Porto Alegre: Bookman Companhia. 2005. 472p.
- [23] Olabi A, Najm NEO, Baghdadi OK, Morton JM. Food neophobia levels of Lebanese and American college students. *Food Quality and Preference*. 2009; 20, 353-62.
- [24] *Predictive Analytics SoftWare (PASW Statistics GradPack)*. Version 12.0. [Computer program]. Chicago: SPSS Inc.; 2006.
- [25] Brasil. Conselho Nacional de Saúde. Resolução nº 466, de 12 de dezembro de 2012.
- [26] IBGE - Brazilian Institute of Geography and Statistics. (2010). Censo 2010. Available at: <http://censo2010.ibge.gov.br/>. Accessed in 14 March 2015.
- [27] Bleil SI. O Padrão Alimentar Ocidental: considerações sobre a mudança de hábitos no Brasil. *Cadernos de Debate*. 1998; 1, 1-25.
- [28] Souza MDCA, Hardt PP. Evolução dos hábitos alimentares no Brasil. *Revista Brasil Alimentos*. 2002; 15, 32-39.
- [29] Corção M. The influence of Portuguese cuisine taste on History of food in Brazil by Câmara Cascudo. *Estudos Históricos*. 2012; 25(50), 408-25.

5. CAPÍTULO 3

Taste-related factors and food neophobia: Are they associated with nutritional status and teenagers' food choices?

Helena Dória Ribeiro de Andrade Previato & Jorge Herman Behrens

Este capítulo corresponde ao artigo publicado na Revista *NUTRITION* em 2017².

ABSTRACT

Objective: The aim of this study was to evaluate the association of taste-related factors (craving for sweets, using food as a reward and pleasure) and food neophobia with nutritional status and food intake among teenagers.

Methods: This was a cross-sectional study with 132 teenagers aged 15–19 years old. Food behavior, anthropometrics, body composition and lifestyle measurements were obtained and analyzed.

Results: Craving for sweets was associated with overweight, adiposity, meal skipping, physical inactivity and sweets intake ($P < 0.05$). Reward was linked to adiposity, physical inactivity, lack of interest in information about food and sweets intake ($P < 0.05$). Pleasure was associated with physical inactivity, lack of interest in information about food, sweets and soft drink intake ($P < 0.05$). Teenage girls had a higher craving for sweets (22.88 ± 4.77) and pleasure scores (21.50 ± 3.82), body fat (25.33 ± 6.60), meal skipping (63.2%) and physical inactivity (64.7%) than their male counterparts ($P < 0.05$). There was no association among food neophobia and nutritional status and food intake.

Conclusion: The results of the present study indicate that, in contrast to food neophobia, taste-related factors can be associated with body fat and inadequate food choices in teenagers. However, this was a cross-sectional study and further cohort studies should be performed for in-depth investigation of a causal relationship between the findings of this research.

² de Andrade Previato HDR, Behrens JH. Taste-related factors and food neophobia: Are they associated with nutritional status and teenagers' food choices? *Nutrition* (2017), (DOI:10.1016/j.nut.2017.05.006)

Keywords: Craving for sweets; Food neophobia; Skinfold thicknesses; Overweight; Teenagers.

Introduction

Food choice is a complex phenomenon influenced by diverse factors of a physiological, cultural and socioeconomic nature, although the sensory characteristics of foods—taste in particular—play a major role [1].

The sense of taste, the primary function of which in human evolution is the recognition of food nutrients and potential hazards, determines atavistic preferences for sweet foods (energy sources) and rejection of bitterness, a marker of potentially poisonous substances (e.g., alkaloids) [2]. Humans eat not only for hunger, but also for pleasure and as a reward [1,2,5], so that innate taste preferences associated with learning allow people to automatically respond hedonically to foods the taste of which makes them be perceived as nutritious, and thus avoid potentially risky ones. This atavistic mechanism helps to explain why some people have a strong desire for sugary food [3] which, in turn, may lead to overconsumption of candies and sugar-sweetened beverages [6–9]. Sugary foods trigger hedonic and emotional responses [10]. Sweetness palatability is mediated by the same opioid systems in the brain that are related to pain control and highly rewarding activities [2]. In this sense, the activation of the opioid system by mere exposure to sweet tasty substances produces a sensation of pleasure and motivates the craving for sweets even in the absence of hunger [2].

Another factor that may influence food choices is the food neophobia (FN), an atavistic mechanism particularly evident in toddlers and small children, but which may persist until adulthood [4]. In children, FN is the fear of taste, particularly bitterness, that makes them avoid unfamiliar foods, while in adults it evolves into a fear of flavors [2] which may affect diet variety [4,11] with possible nutritional and health consequences. However, the level of food neophobia may be lower in adolescence due to the increase of exposure to novel foods [4]. Studies about food neophobia are scarce in Brazil and it justifies the need of investigation of this phenomenon in order to get a better understanding of the complex mechanism of food choice.

Like in other developing countries, Brazilian youths have shown a high intake of foods that are high in fat, sugar and salt and poor in fiber, micronutrients and

phytochemicals [9]. In addition, overweight in adolescence is a growing public health concern [5] since obesity is a significant risk factor for cardiovascular diseases, hypertension and diabetes mellitus [12]. Due to the increasing overweight and inadequate food habits among adolescents, it is essential to study the factors that influence and determine food choices, as well as their associations.

In this regard, we hypothesized that taste-related factors may contribute to obesogenic food patterns in teenagers, since they stimulate energy-dense food intake, while low FN may not lead to a poorly varied diet. Therefore, the aim of the present study was to investigate the association of taste-related factors (craving for sweets, reward and pleasure) and food neophobia with nutritional status and food choices among Brazilian teenagers.

Materials and methods

Study population

A cross-sectional study was performed with 132 teenagers (68 girls and 64 boys, aged 15 to 19 years old, 16.27 ± 1.09 years old), from a public school in the city of Poços de Caldas, State of Minas Gerais, Brazil. The study was approved by the ethics committee of the University of Campinas, São Paulo State, Brazil (official reference no. 48065215.3.0000.5404). In accordance with the principals of the Declaration of Helsinki, subjects were initially informed about the objectives of the present study and each participant provided a written informed consent to participate in the research. Subjects less than 18 years of age received a consent form to be signed by their parents while those above 18 signed their own. No cash payment was made.

Anthropometric and body composition measurements

Body weight and body fat percentage (BF%) were measured using a bipolar bioimpedance scale (Tanita® BF-683W Illinois, USA) with a maximum capacity of 136kg. Values greater than 30% for females and 25% for males were considered high [13]. Height was measured with a stadiometer (Altuxata®, Belo Horizonte, Brazil) with scale in centimeters and an accuracy of 0.1cm. Nutritional status was

determined by body mass index (BMI) for age according to the WHO classification [14]. Triceps, biceps, subscapular, supra-iliac and abdominal skinfold thicknesses (STs) were measured with a skinfold caliper with an accuracy of 0.1 mm (Lange®, Beta Technology, California, USA) according to previously established protocol [15].

Taste Attitude Scale (TAS)

We used the Brazilian version of the Taste Attitude Scale (TAS) [16] of the Health and Taste Attitudes Questionnaire [1]. The TAS consists of three subscales: 1) craving for sweet foods; 2) Food as a reward; and 3) pleasure [1]. Agreement with each scale item was measured on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

The subscales were divided into three segments established by cut-off points. Thus, the respondents were classified as showing low (< 33rd percentile), moderate (\geq 33rd percentile and < 66th percentile) and high (\geq 66th percentile) degrees of craving for sweets, using food as reward and for pleasure [1]. In terms of the scores, respondents were classified as having a high level of craving for sweets at a score \geq 24, high reward at a score \geq 22, and high pleasure at a score \geq 23.

Food Neophobia Scale (FNS)

FN was measured with the Brazilian version of the FNS [17], originally developed in English by Pliner & Hobden [4]. The FNS consists of 10 statements scored by means of a 7-point Likert scale (strongly disagree to strongly agree). The total score was calculated by summing up the scores for each item resulting in a total score varying from 12 to 69 points. The FN classification was made according to the mean value of 33.4 and its related standard deviation (\pm 10.60) [18,17] so that respondents with scores \leq 22.8 were classified as low neophobia (or neophilia), those between 22.9 to 39.9 were considered neutral, and those \geq 44 as high neophobia.

Food intake

Daily intake of sweets, soft drinks, fruits and vegetables were evaluated according to 1 time, 2 times and 3 times or more per day, according to a validated questionnaire [19].

Eating habits and participation in physical activities

Subjects were asked if they skip meals, look for information about food or engage in physical activity.

Statistical analyses

The Shapiro-Wilks test was used to test for normal distribution of scaled data and comparisons between means were made by Student's *t*-test and Analysis of Variance. Frequencies were calculated for categorical data and chi-squares or Fisher's exact test was performed to check for significant differences. Statistical analyses were performed using the *Predictive Analytics* Software (PASW) Statistics GradPack (version 17.0, Chicago, IL,USA) [20] and a 5% significance level was admitted.

Results

Subjects' profile

Most teenagers showed moderate to high levels of cravings for sweets (69.7%), using food as a reward (67.4%) and for pleasure (73.5%). As shown in Table 1, female participants showed significantly higher scores for craving for sweets ($P < 0.001$), pleasure ($P = 0.005$) and TAS ($P < 0.001$).

A low level of FN was observed since only 15.9% of subjects were classified as food neophobic while 14.4% were food neophilic and 69.7% were considered neutral (neither neophilic nor neophobic) with sex difference not being significant ($P > 0.05$).

Triceps, biceps, subscapular, supra-iliac and abdominal STs and BF% were higher among females ($P < 0.05$; Table 1).

According to nutritional status, the total sample of teenagers consisted of 81.8% (n = 108) with a normal weight and 18.2% (n = 24) being overweight or obese. Regarding adiposity, 83.3% (n = 110) were classified as having an adequate level of BF% and 16.7% (n = 22) with a high level of BF%.

Female teenagers reported that they skipped meals more frequently (P = 0.002) and engaged in less physical activity (P = 0.001; Table 1).

Table 1: Food attitude, anthropometric measures, body composition and lifestyle data of the teenagers (N = 132).

	Total	Males	Females	P*
	Mean ± SD	Mean ± SD	Mean ± SD	
Craving for Sweets Score	20.95 ± 5.65	18.89 ± 5.81	22.88 ± 4.77	< 0.001
Reward Score	18.40 ± 5.37	17.70 ± 5.12	19.06 ± 5.55	0.148
Pleasure Score	20.64 ± 3.72	19.72 ± 3.39	21.50 ± 3.82	0.005
Taste Attitude Scale (TAS)	59.98 ± 11.20	56.31 ± 10.37	63.44 ± 10.91	< 0.001
FNS Score	33.40 ± 10.59	33.91 ± 10.16	32.93 ± 11.04	0.597
BMI (kg/m²)	22.29 ± 4.19	22.50 ± 4.54	22.09 ± 3.84	0.573
Triceps ST (mm)	15.49 ± 6.24	12.47 ± 5.57	18.33 ± 5.48	< 0.001
Biceps ST (mm)	8.69 ± 5.23	7.43 ± 4.93	9.88 ± 5.27	0.007
Subscapular ST (mm)	13.11 ± 5.98	11.32 ± 5.40	14.81 ± 6.05	0.001
Supra-iliac ST (mm)	16.01 ± 8.04	13.34 ± 8.30	18.52 ± 6.96	< 0.001
Abdominal ST (mm)	17.75 ± 7.36	15.13 ± 7.81	20.22 ± 5.98	< 0.001
BF% (BIA)	20.32 ± 8.68	15.14 ± 7.47	25.33 ± 6.60	< 0.001
		n (%)		P**
Meal Skipping				
Yes	66(50)	23(35.9)	43(63.2)	0.002
No	66(50)	41(64.1)	25(36.8)	
Physical Activity				
Yes	72(54.5)	48(75.0)	24(35.3)	0.001
No	60(45.5)	16(25.0)	44(64.7)	
Food Information Search				
Yes	73(55.3)	32(50.0)	41(60.3)	0.234
No	59(44.7)	32(50.0)	27(39.7)	

SD: standard deviation; * Student *t*-test; **Chi-square test; BMI: body mass index; ST: skinfold thickness; BF%: body fat percentage; BIA: bioelectrical impedance analysis.

Association with nutritional status and lifestyle

As shown in Table 2, scores for craving for sweets was significantly associated with BF% ($P < 0.05$). BF%, triceps, biceps, subscapular, supra-iliac and abdominal STs were significantly greater among subjects with high cravings for sweets ($P < 0.05$). Supra-iliac and abdominal STs were greater in the high reward group ($P < 0.05$). In regard to the pleasure scores, no significant differences in body composition measures were observed ($P > 0.05$). The FN score increased with age since teenagers aged 15 to 16 years old had a mean score of 31.76 (± 9.24) and those between 17 to 19 years old had a score of 36.36 (± 12.23) ($P < 0.05$; data not shown).

Additionally, craving for sweets was associated with overweight or obesity, BF%, meal skipping and physical inactivity ($P < 0.05$; Fig. 1), while reward and pleasure were associated with physical inactivity and a lack of interest in searching for information about food ($P < 0.05$; Fig. 2).

Table 2: Associations between craving for sweets, reward and pleasure scores and body composition among teenagers (N = 132).

	Craving for Sweets				Reward				Pleasure			
	Low	Moderate Mean \pm SD	High	P*	Low	Moderate Mean \pm SD	High	P*	Low	Moderate Mean \pm SD	High	P*
BMI	21.47 \pm 3.14	22.75 \pm 4.86	22.55 \pm 4.20	0.324	21.86 \pm 3.76	22.55 \pm 4.82	22.46 \pm 3.83	0.707	22.71 \pm 4.16	22.32 \pm 4.06	21.90 \pm 4.42	0.695
BF% (BIA)	16.04 \pm 7.23 ^a	22.72 \pm 8.37 ^b	21.55 \pm 8.98 ^b	0.001	18.74 \pm 8.04	20.65 \pm 9.38	21.62 \pm 8.38	0.309	20.44 \pm 7.28	19.38 \pm 9.53	21.42 \pm 8.64	0.519
Triceps ST	12.39 \pm 5.69 ^a	16.85 \pm 5.69 ^b	16.82 \pm 6.40 ^b	0.001	14.18 \pm 6.59	15.61 \pm 5.86	16.76 \pm 6.16	0.172	16.42 \pm 6.11	15.04 \pm 6.74	15.28 \pm 5.69	0.579
Biceps ST	6.69 \pm 4.50 ^a	8.77 \pm 4.96 ^{a,b}	10.46 \pm 5.60 ^b	0.004	7.35 \pm 4.51	8.85 \pm 5.27	9.94 \pm 5.69	0.078	8.26 \pm 4.81	9.02 \pm 5.83	8.60 \pm 4.82	0.796
Subscapular ST	10.63 \pm 4.28 ^a	14.34 \pm 6.59 ^b	14.03 \pm 6.04 ^b	0.006	11.92 \pm 5.86	13.96 \pm 6.97	13.34 \pm 4.49	0.252	13.63 \pm 6.01	13.34 \pm 6.89	12.37 \pm 4.57	0.615
Supra-iliac ST	12.60 \pm 7.05 ^a	17.51 \pm 8.00 ^b	17.46 \pm 8.15 ^b	0.005	13.55 \pm 7.52 ^a	16.84 \pm 8.23 ^{a,b}	17.65 \pm 7.90 ^b	0.045	17.43 \pm 7.67	15.60 \pm 8.39	15.35 \pm 7.89	0.470
Abdominal ST	13.91 \pm 6.72 ^a	19.10 \pm 7.06 ^b	19.78 \pm 7.03 ^b	<0.001	15.33 \pm 6.63 ^a	18.11 \pm 7.58 ^{a,b}	19.96 \pm 7.20 ^b	0.015	18.18 \pm 6.65	18.25 \pm 8.22	16.73 \pm 6.74	0.556

BF%: body fat percentage; BIA: bioelectrical impedance analysis; BMI: body mass index; ST: skinfold thickness.

Different letters indicate statistically significant differences between groups ($p < 0.05$) in Tukey *post hoc* test. *Analyses of variance.

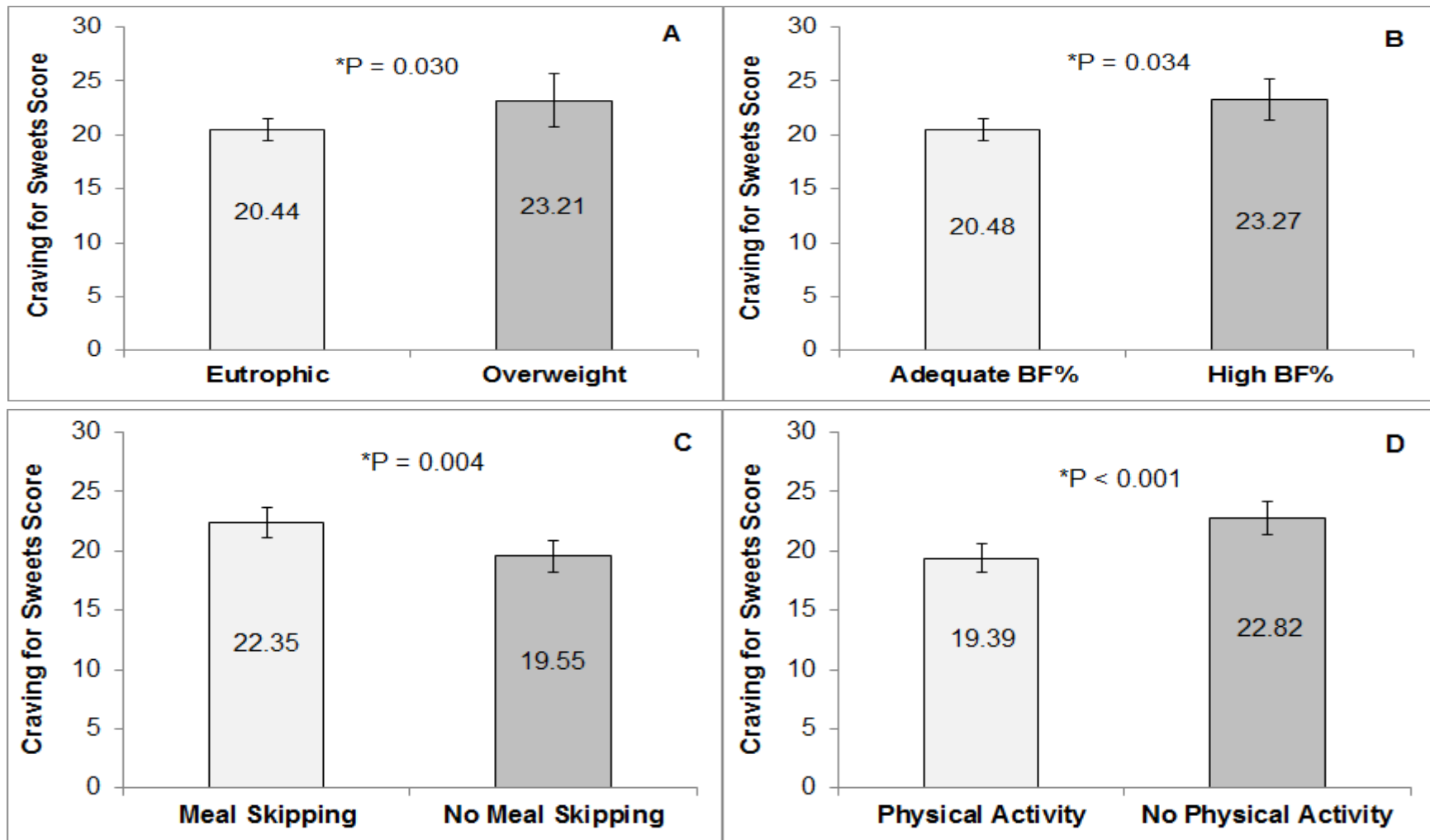


Fig. 1. Craving for sweets score versus nutritional status (A), body fat percentage (BF%) (B), meal skipping (C) and physical activity data (D), n = 132. Data are presented as mean and standard error. *Student's *t*-test.

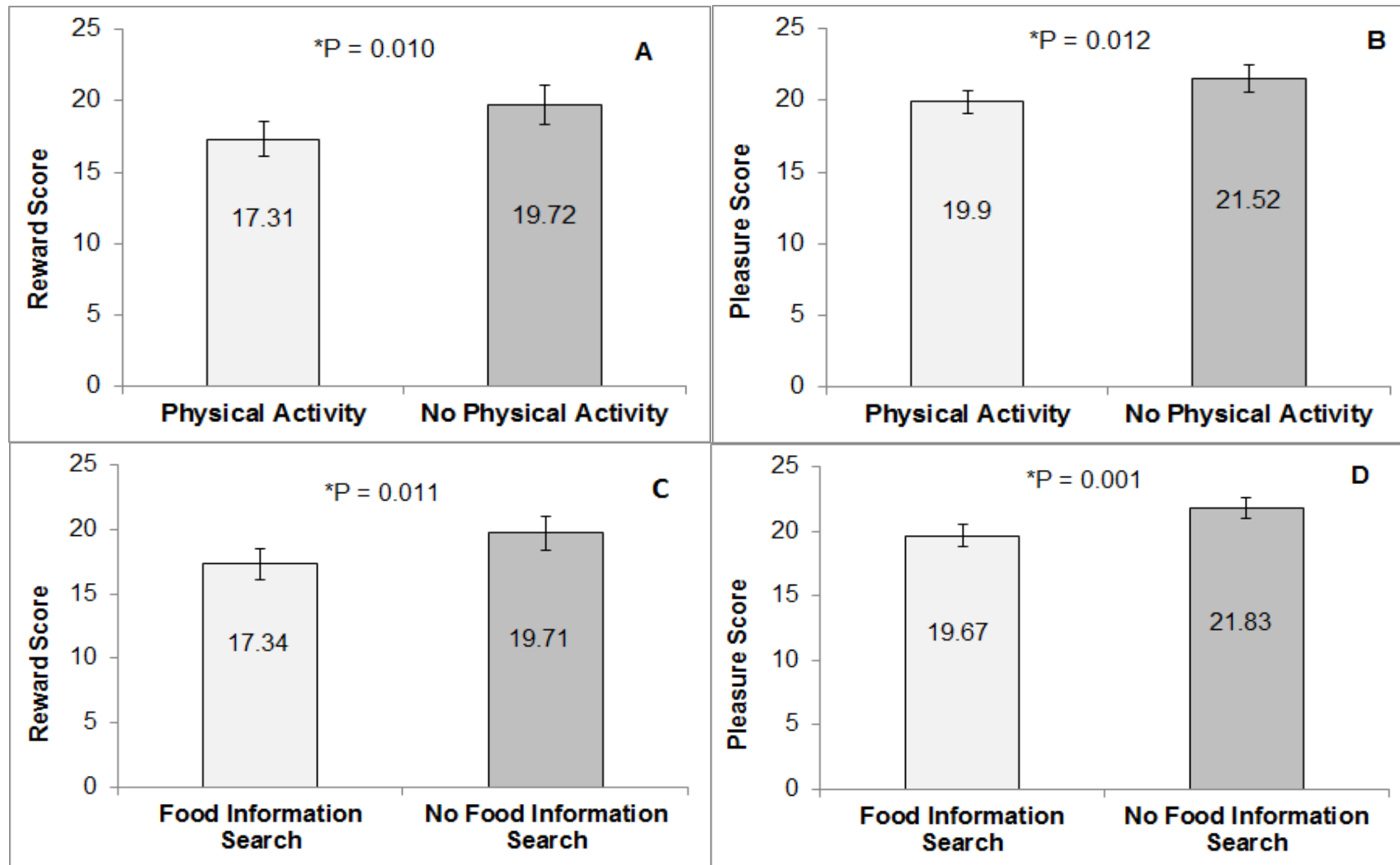


Fig. 2. Reward and pleasure scores versus physical activity (A, B) and food information search (C, D), respectively; $n = 132$. Data are presented as mean and standard error. *Student's t -test.

Association with food choice

The craving for sweets and using food as a reward scores were significantly higher among individuals with inadequate daily sweets intake ($P < 0.05$; Fig. 3). The pleasure score was higher among teenagers with both higher sweets and soft drink intakes ($P < 0.05$; Fig. 3). There was no association of the FN score with these food intakes ($P > 0.05$; data not shown). Finally, most teenagers had an inadequate consumption of fruits (87.9%) and vegetables (93.9%) regardless of craving, reward, pleasure and FN levels ($P > 0.05$; data not shown).

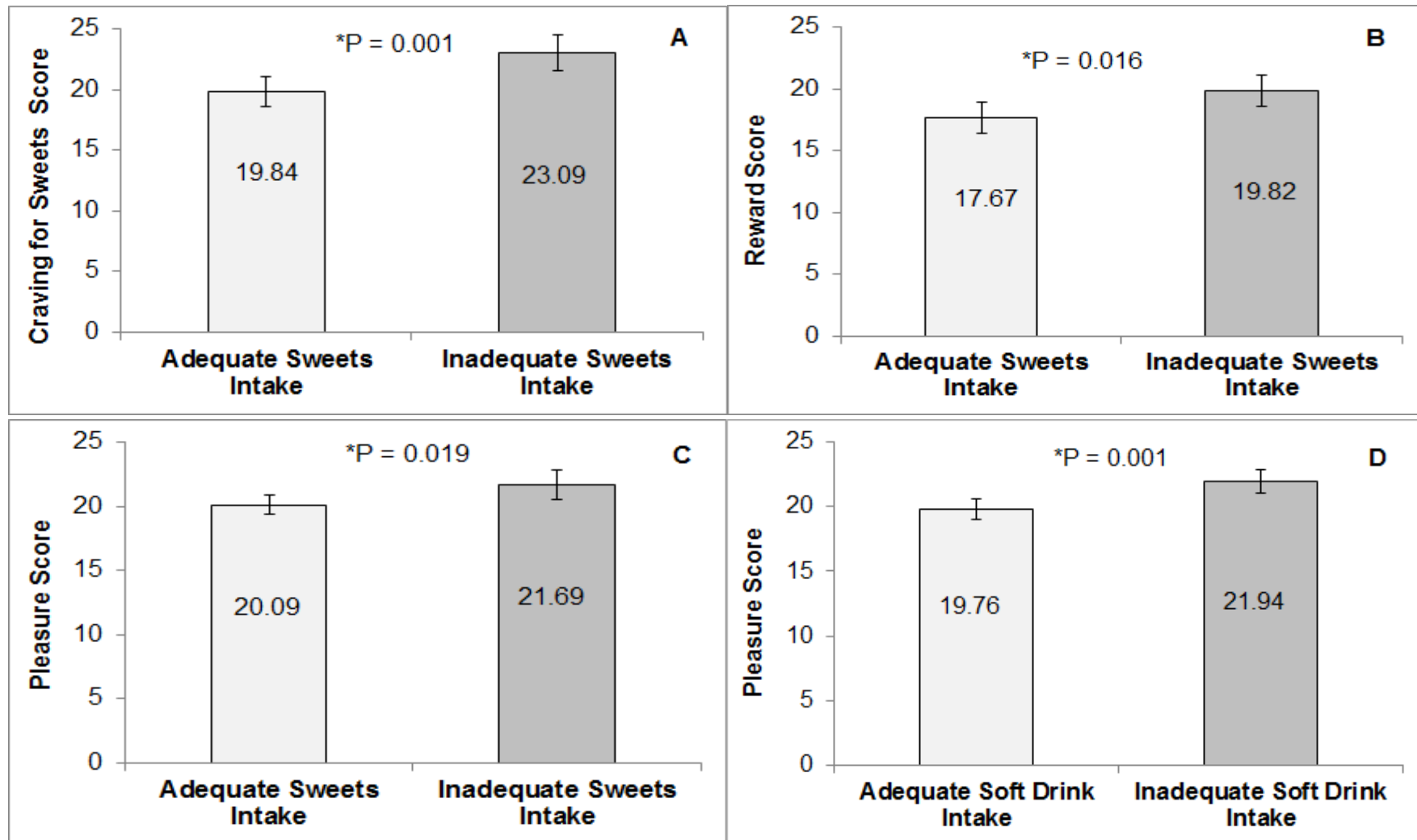


Fig. 3. Craving for sweets (A), reward (B) and pleasure scores (C) associations with sweets intake, and pleasure score association with soft drink intake (D); $n = 132$. Data are presented as mean and standard error. *Student's t test.

Discussion

In this study there were associations of craving for sweets with overweight, adiposity, meal skipping, physical inactivity and sweets intake ($P < 0.05$). We also observed that using food as a reward was linked to adiposity, physical inactivity, lack of interest in the search for information about food and sweets intake. Additionally, pleasure was associated with physical inactivity, lack of interest in searching for food information, sweets and soft drink intakes. Our study also showed gender differences in relation to cravings for sweets, pleasure, meal skipping, physical inactivity and BF, which can predispose female teenagers to a higher risk of obesity. Globally, the weight gain epidemic among teenagers requires effective action to prevent obesity and chronic diseases such as diabetes and hypertension [21]. It is estimated that by 2025 global obesity prevalence will reach 21% of females and 18% of males [22]. The findings presented herein are in line with this forecast since female teenagers appear to be more at risk of becoming overweight than males.

To our knowledge, studies about cravings for sweets, reward and pleasure in adolescence are scarce. However, a recent study in the US showed associations of cravings for sweet snacks and sugary drinks with TV exposure among non-Hispanic adolescents [23], while Latin American adolescents showed a stronger association of cravings for sweet snacks and sweetened drinks with mobile phone messaging. It suggests that the high use of technology may boost the consumption of candies and snacks which, in turn, are directly associated with cravings.

According to existing literature, a craving for sweets is more common in females [24,2,3]. For example, a study showed that female students had greater cravings for chocolate than male students [3] and this may be explained by a complex system of biological and sociological factors that contribute to gender differences regarding food cravings [24]. Besides, girls seem to be more emotional and more pleasure eaters than boys [10].

Craving for sweets contributes to weight gain [25] and a high-sugar diet has been linked not only to obesity but also to chronic health conditions like diabetes and heart disease [26]. Particularly with respect to Brazilian teenagers, sugar intake above recommendations was identified, which can lead to overweight and high adiposity [27]. Moreover, the low level of physical activity may also lead to increased

BF and adiposity [28]. In relation to our study, a possible explanation of the association between the taste attitudes' factors (cravings for sweets, reward and pleasure) and physical inactivity is that people who do not engage in exercise seem to focus more on hedonic characteristics than on the nutritional aspects of food. However, these associations should be investigated in further research for a better understanding of this kind of behavior in adolescence. In addition, cohort studies should be done to evaluate the causation of obesity and high adiposity in adolescents, since most of the studies are cross-sectional, which not allow verifying causal relation, just associations, as we observed in our study.

Another study showed that breakfast intake reduced food cravings in female adolescents [5]. Along this line, the association between cravings for sweets and meal skipping in our study may be due to hormonal and physiological changes of prolonged fasting which increases the desire for and intake of sweets in the following meals during the day [5].

Similar to the present results, a craving for sweets was associated with the excessive consumption of this type of food by adolescents [29]. It is suggested that frequent sugar intake could rearrange neural circuits of reward and pleasure [30], making the individual look for sugary foods to get pleasure and consequent positive emotions that increase the motivation to consume these foods over again [31]. Thus, sugar intake becomes rewarding [32] and it stimulates a preference and desire for sweet food [33]. Consequently, hedonics might be more important than nutrition for some individuals [2] and this helps to explain why reward and pleasure eaters do not care about looking for information about food, as we demonstrated in our results.

Finally, the taste scale used in the present study is a good predictor of attitudes toward hedonic characteristics such as taste and pleasure [34].

Food neophobia (FN) in teenagers

To our knowledge, this was the first study in Brazil that evaluated FN among teenagers and we observed that FN in both female and male teenagers was low with a mean value of 33.4. This result is similar to those of other studies in Germany (31.0), Korea (33.0) and Sweden (32.9) [35–37] which indicates a low level of FN among adolescents in general [35]. However, there are still few studies that

investigate the role of FN in adolescence food habits [35] and perhaps teenagers from urban areas all over the world tend not to have a food neophobic behavior. Previous studies with Brazilian young adults found that between 11.5% and 17.5% of the subjects were neophobic, indicating that FN might be low among Brazilians [17,38].

Despite the low degree of food neophobia observed in the present study, this is a subject that still deserves further investigation. Other factors may influence food behavior [1] including the refusal to try different foods for varied reasons [4]. Even being willing to try different types of food, a non-neophobic person may have a less diverse and, therefore, less nutritious diet. So, from studies on food neophobia associated with other behavioral measurements it is possible to trace factors that contribute to an inadequate diet.

Similar to other studies with teenagers, we could not find gender differences [35,37], but our results indicated an increase of FN with age. Studies showed that FN decreases during childhood [39] and at the beginning of adolescence [40,37], whereas in adulthood it remains stable [40]. A possible explanation for our results is that older individuals could be more resistant to adopting new eating habits, since age is an important determinant of FN and preferences are more influenced by educational and cultural factors with increasing age [35]. In our study, FN was not associated with body weight and adiposity and similar results have already been shown for children [41,42]. However, FN was directly associated with underweight and adiposity in German adolescents, though prospective studies are still needed to clarify these associations [35].

We observed that most teenagers reported a low intake of fruits and vegetables independent of the FN level; this is in accordance with previous studies in the country [43,44]. Food neophobic children have less variety in diet and as a consequence, a lower fruit and vegetable intake [45–47]. In contrast, a study conducted with German adolescents showed little impact of FN on their dietary pattern [35]. This can be attributed to the low level of FN in the study sample and the wide variety in the food supply in Germany [35].

In our study there was no association between FN and the consumption of fruits and vegetables which, in turn, has been shown to be low in Brazil [48]. In this sense, we attribute the low consumption of fruits and vegetables to eating habits that

favor the consumption of sweets for reasons of palatability, convenience, access and cost. Therefore, further research is needed to clarify the role of FN in teenagers' dietary habits since the existing literature has mostly focused on children. In addition, food neophobic behavior can be specific to certain types of foods—not a general food neophobia—and even to novel processing technologies like genetic engineering and irradiation [17].

Limitations and strengths

The present study had certain limitations due to its cross-sectional design. As a result, we cannot prove that the reported associations reflect a cause-and-effect relation which is only determined by prospective studies. Another factor is the small sample size which limits generalization of our data. Besides, adolescence comprises the age group of 10 to 19 years and it can be difficult to make comparisons with other studies conducted with adolescents of different ages.

On the other hand, an important strength of our study is that the taste-related factors and the FN were measured with validated questionnaires [16,17] aimed to gain understanding of the factors that influence food choices. Our findings, besides reinforcing the international trend of low FN among teenagers, demonstrated that measures of craving, reward and pleasure are more efficient methods to discriminate food behaviors and their association with the nutritional status of the researched population.

Conclusion

This study contributed to a better understanding of the association among taste-related psychological factors (cravings for sweets, reward and pleasure) with nutritional status and food choices in adolescence. An insignificant association among FN and nutritional status and food intake was observed. This would be explained by the cultural diversity and the degree of urbanization in southeastern Brazil.

Future studies should still explore the determinants of taste-related factors and FN among adolescents from other Brazilian regions as well as other age groups (e.g,

children, young and middle-aged adults, and seniors) taking into account regional differences across the country.

Considering the set of hedonic, sensory, emotional, physiological, educational and cultural factors involved in food choices, it is important to analyze this complex system that determines food behavior. Finally, cohort studies should be conducted to investigate the cause-and-effect relationship between inadequate dietary choices and obesity. It will allow for the proposition of nutritional and motivational orientations towards healthy eating habits in adolescence.

Acknowledgments

The authors thank the National Counsel of Technological and Scientific Development (CNPq) for their financial support.

References

- [1] Roininen K, Lähteenmäki L, Tuorila H. Quantification of consumer attitudes to health and hedonic characteristics of food. *Appetite* 1999;33(1):71–88.
- [2] Prescott J. *Taste Matters. Why We Like the Foods We Do*. London: Reaktion Books; 2012, p. 1– 208.
- [3] Weingarten HP, Elston C. The phenomenology of food cravings. *Appetite* 1990;15:231–46.
- [4] Pliner P, Hobden K. Development of a scale to measure the trait of food neophobia in humans. *Appetite* 1992;19:105–20.
- [5] Hoertel HA, Will MJ, Leidy HJ. A randomized crossover, pilot study examining the effects of a normal protein vs. high protein breakfast on food cravings and reward signals in overweight/obese “breakfast skipping”, late-adolescent girls. *Nutr J* 2014;13:1–8.
- [6] Forman EM, Hoffman KL, Juarascio AS, Butryn ML, Herbert JD. Comparison of acceptance-based and standard cognitive-based coping strategies for craving sweets in overweight and obese women. *Eat Behav* 2013;14(1):64–8.
- [7] Martin CK, O’neil PM, Tollefson G, Greenway FL, White MA. The association between food cravings and consumption of specific foods in a laboratory taste test. *Appetite* 2008;51(2):324–6.

- [8] Chao A, Grilo CM, White MA, Sinha R. Food cravings, food intake, and weight status in a community-based sample. *Eat Behav* 2014;15:478–82.
- [9] Louzada ML, Baraldi LG, Steele EM, Martins AP, Canella DS, Moubarac JC, et al. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. *Prev Med* 2015;81:9–15.
- [10] Cornil Y, Chandon P. Pleasure as an ally of healthy eating? Contrasting visceral and Epicurean eating pleasure and their association with portion size preferences and wellbeing. *Appetite* 2016;104:52–9.
- [11] Tuorila H, Lähteenmäki L, Pohjalainenb L, Lottib L. Food neophobia among the Finns and related responses to familiar and unfamiliar foods. *Food Qual Pref* 2001;12:29–37.
- [12] Stroebele N, De Castro JM. Effect of Ambience on Food Intake and Food Choice. *Nut* 2004;20:821–38.
- [13] Williams DP, Going SB, Lohman TG, Harsha DW, Srinivasan SR, Webber LS, et al. Body fatness and risk for elevated blood pressure, total cholesterol, and serum lipoprotein ratios in children and adolescents. *Am J Public Health* 1992;82:358–63.
- [14] World Health Organization. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for height and body mass index-for-age: methods and development. Geneva, World Health Organization; 2006.
- [15] Durnin JVGA, Rahaman MM. The assessment of the amount of fat in the human body from measurements of skinfold thickness. *Br J Nutr* 1967;21:1–9.
- [16] Koritar P, Philippi ST, Alvarenga MS, Santos B. Adaptação transcultural e validação para o português da Escala de Atitudes em Relação ao Sabor da Health and Taste Attitude Scale (HTAS). *Ciênc Saúde Col* 2014;19(8):3573–82.
- [17] Previato HDRA, Behrens JH. Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese. *Nutric Hosp* 2015;32(2):925–30.
- [18] Olabi A, Najm NEO, Baghdadi OK, Morton JM. Food neophobia levels of Lebanese and American college students. *Food Qual Pref* 2009;20:353–62.
- [19] Mendes LL, Campos SF, Malta DC, Bernal RTI, de Sá NNB, Meléndez G. Validade e reprodutibilidade de marcadores do consumo de alimentos e bebidas

- de um inquérito telefônico realizado na cidade de Belo Horizonte (MG), Brasil. *Rev Bras Epidemiol* 2011;14(1)Supl.:80–9.
- [20] Predictive Analytics Software (*PASW Statistics GradPack*). Version 12.0. [Computer program]. Chicago: SPSS Inc.; 2006.
- [21] Landis AM, Parker KP, Dunbar SB. Sleep, Hunger, Satiety, Food Cravings, and Caloric Intake in Adolescents. *J Nurs Scholarsh* 2009;41(2):115–23.
- [22] NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *The Lancet* 2016;387:1377–96.
- [23] Borgogna N, Lockhart G, Grenard JL, Barrett T, Shiffman S, Reynolds KD. Ecological Momentary Assessment of Urban Adolescents' Technology Use and Cravings for Unhealthy Snacks and Drinks: Differences by Ethnicity and Gender. *J Acad Nutr Diet* 2015;115(5):759–66.
- [24] Hallama J, Boswell RG, DeVito EE, Kober H. Gender-related Differences in Food Craving and Obesity. *Yale J Biol Med* 2016;89(2):161–73.
- [25] White MA, Whisenhunt BL, Williamson DA, Greenway FL, Netemeyer RG. Development and Validation of the Food Craving Inventory. *Obes Res* 2002;10(2):107–14.
- [26] Barclay AW, Petocz P, McMillan-Price J, Flood VM, Prvan T, Mitchell P, et al. (2008) Glycemic index, glycemic load, and chronic disease risk—a meta-analysis of observational studies. *Am J Clin Nutr* 2008;87:627–37.
- [27] Colucci AC, Cesar CL, Marchioni DM, Fisberg RM. Factors associated with added sugars intake among adolescents living in São Paulo, Brazil. *J Am Coll Nutr* 2012;31(4):259–67.
- [28] Polacow VO, Lancha Junior AH. Dietas Hiperglicídicas: Efeitos da Substituição Isoenergética de Gordura por Carboidratos Sobre o Metabolismo de Lipídios, Adiposidade Corporal e Sua Associação com Atividade Física e como Risco de Doença Cardiovascular. *Arq Bras Endocrinol Metab* 2007;51(3):389–400.
- [29] Grenard JL, Stacy AW, Shiffman S, Baraldi AN, MacKinnon DP, Lockhart G, et al. Sweetened drink and snacking cues in adolescents. A study using ecological momentary assessment. *Appetite* 2013;67:61–73.

- [30] Spangler R, Wittkowski KM, Goddard NL, Avena NM, Hoebel BG, Leibowitz SF. Opiate-like effects of sugar on gene expression in reward areas of the rat brain. *Mol Brain Res* 2004;124(2):134–42.
- [31] Sawaya AL. Alimentos ricos em açúcar, gordura e sal induzem à hiperfagia e ao vício alimentar. In: Sawaya AL, Leandro CG, Waitzberg DL, editores. *Fisiologia da nutrição na saúde e na doença. Da biologia molecular ao tratamento*. São Paulo: Atheneu; 2013b.
- [32] Sawaya AL, Filgueiras A. “Abra a felicidade”? Implicações para o vício alimentar. *Est Avanç* 2013;27(78):53–70.
- [33] Drewnowski A, Almiron-Roig E. Human Perceptions and Preferences for Fat-Rich Foods. In: Montmayeur JP, le Coutre J, editors. *Fat Detection: Taste, Texture, and Post Ingestive Effects*. Boca Raton (FL): CRC Press/Taylor & Francis; 2010. Chapter 11.
- [34] Roininen K, Tuorila H, Zandstra EH, Graaf C de, Vehkalahti K, Stubenitsky K, et al. Differences in health and taste attitudes and reported behavior among Finnish, Dutch and British consumers: a cross-national validation of the Health and Taste Attitude Scales (HTAS). *Appetite* 2001;37:33–45.
- [35] Roßbach S, Foterek K, Schmidt I, Hilbig A, Alexy U. Food neophobia in German adolescents: Determinants and association with dietary habits. *Appetite* 2016;101:184–91.
- [36] Cho MS, Kim M, Cho W. Relationships of adolescent's dietary habits with personality traits and food neophobia according to family meal frequency. *Nut Res Pract* 2014;8(4):476–81.
- [37] Koivisto Hursti U, Sjoden PO. Food and general neophobia and their relationship with self-reported food choice: familial resemblance in Swedish families with children of ages 7-17 years. *Appetite* 1997;29(1):89–103.
- [38] Barcellos MD, Aguiar LK, Ferreira GC, Vieira LM. Willingness to try innovative food products: a comparison between British and Brazilian consumers. *Braz Adm Rev* 2009;6(1):50–61.
- [39] Rigal N. L'exposition répétée permet-elle de dépasser la néophobie alimentaire? Application chez des enfants français soumis à des produits salés [Reduction of food neophobia as a result of repeated exposure? A study with French children exposed to salty foods]. *Europ Rev Ap Psyc* 2005;55:43–50.

- [40] Nicklaus S, Boggio V, Chabanet C, Issanchou S. A prospective study of food variety seeking in childhood, adolescence and early adult life. *Appetite* 2005;44(3):289–97.
- [41] Lumeng JC, Cardinal TM, Sitto JR, Kannan S. Ability to taste 6-n-propylthiouracil and BMI in low-income preschool-aged children. *Obes* 2008;16:1522–8.
- [42] Faith MS, Heo M, Keller KL, Pietrobelli A. Child Food Neophobia Is Heritable, Associated with Less Compliant Eating, and Moderates Familial Resemblance for BMI. *Obes* 2013;21(8):1650–5.
- [43] Muniz LC, Zanini RV, Schneider BC, Tassitano RM, Feitosa WMN, González-Chica DA. Prevalência e fatores associados ao consumo de frutas, legumes e verduras entre adolescentes de escolas públicas de Caruaru, PE. *Ciênc Saúde Col* 2013;18(2):393–404.
- [44] Campos VC, Bastos JL, Gauche H, Boing AF, Assis MAA. Fatores associados ao consumo adequado de frutas, legumes e verduras em adultos de Florianópolis. *Rev Bras Epidemiol* 2010;13(2):352–62.
- [45] Falcioglia GA, Couch SC, Gribble LS, Pabst SM, Frank R. Food neophobia in childhood affects dietary variety. *J Am Diet Assoc* 2000;100(12):1474–81.
- [46] Knaapila A, Silventoinen K, Broms U, Rose RJ, Perola M, Kaprio J, et al. Food Neophobia in Young Adults: Genetic Architecture and Relation to Personality, Pleasantness and Use Frequency of Foods, and Body Mass Index-A Twin Study. *Behav Genet* 2011;41:512–21.
- [47] Tadeo AR, Villena BP, Urquidez-Romero R, Vidana-Gaytan ME, Caston MJP, Berruezo GR, et al. Neofobia alimentaria: impacto sobre los hábitos alimentarios y aceptación de alimentos saludables en usuarios de comedores escolares. *Nutric Hosp* 2015;31(1):260–8.
- [48] Andrade SC, de Azevedo Barros MB, Carandina L, Goldbaum M, Cesar CL, Fisberg RM. Dietary quality index and associated factors among adolescents of the state of Sao Paulo, Brazil. *J Pediatr* 2010;156(3):456–60.

6. CAPÍTULO 4

Nutritional status and food pattern among teenagers

Helena Dória Ribeiro de Andrade Previato & Jorge Herman Behrens

Este capítulo corresponde ao artigo que será submetido à Revista de Nutrição.

ABSTRACT

Objective: To evaluate the anthropometric measurements, body composition and food intake of teenagers enrolled in a public school in Minas Gerais, Brazil.

Methods: From 132 teenagers aged 15 to 19 years old, anthropometric measurements, body composition, food intake and physical activity practice were obtained. We performed Student's *t*-test, X^2 or Fisher's exact tests and Pearson's correlation. For statistical analyzes a α -level of 0.05 was considered.

Results: Regarding the nutritional status, 81.8% of the teenagers were eutrophic, 10.6% were overweight and 7.6% were obese. Female teenagers had higher values of body fat analyzed by skinfold thickness, fat mass, fat mass index and body fat percentage while male had higher lean mass evaluated by fat-free mass and fat-free mass index ($p < 0.05$). For both genders, it was observed low intake of fruits and vegetables and daily intake of sweets, soda, salt snacks and fast food like sandwiches and pizza. Only 54.5% of teenagers reported practicing sports and there was association between sedentary lifestyle with higher intake of sweets and soft drink.

Conclusions: Differences in body composition between genders justify using several methods of nutritional evaluation in adolescence. Still, teenagers repeat the same inadequate eating behavior of their group. So, multidisciplinary actions in group are needed to motivate changes in teenagers' food pattern and lifestyle.

Key-words: Nutritional assessment; body fat; food pattern; physical activity; adolescence.

Introduction

Overweight among adolescents is increasing considerably [1]. According to a meta-analysis of cross-sectional studies, obesity is present in 14.1% of Brazilian adolescents [2] and this has raised the concern of researchers and health professionals due to the comorbidities related to obesity such as hyperlipidemias, hypertension, heart disease, diabetes, among others diseases [3-5].

Besides overweight, high adiposity levels can be harmful since it can lead to metabolic disorders and also obesity in adulthood [3,6]. The body mass index (BMI) is the most used measure to determine overweight and obesity, but it does not allow the evaluation of body fat distribution [7].

In adolescence, anthropometric measurements and body composition differs according to gender, sport activity and food pattern [8]. Thus, the use of several nutritional assessment methods is needed for a more accurate adiposity evaluation and preventing diseases related to overweight. Still, body fat distribution has more influence than total body weight in the risk factors related to obesity [9-11].

The growing epidemic of overweight can be related to environmental and behavioral factors [12]. Food habits and preferences are usually developed during childhood and adolescence [13] depending basically on familiar and environmental stimuli [14], and the adoption of inadequate eating habits and low levels of physical activity can lead to a positive energy balance, weight gain and high adiposity [15,16,12].

On the other hand, adequate food habits are central for a satisfactory growth of adolescents and a high quality diet rich in nutrients can promote health and reduce the risk of overweight and chronic non-communicable diseases [17,8]. Therefore, it is essential to investigate teenagers' food habits to propose nutritional strategy for prevention and control the overweight and high body fat.

So, the aim of this study was to evaluate anthropometric measurements, body composition and food intake of teenagers.

Materials and methods

Experimental design

A cross-sectional study was conducted with adolescents, aged 15–19 years old (YO), attending public school in Poços de Caldas, Minas Gerais, Brazil. The exclusion criteria adopted in our study were the presence of one or more factors as: food allergies, dietary restrictions, eating disorders, vegetarianism, gestation, breastfeeding and disease that demands dietary modifications like diabetes, hypertension and kidney disease.

The project was approved by the Ethics Committee of the University of Campinas, São Paulo State, Brazil (reference No. 48065215.3.0000.5404). The study was conducted in accordance with the principals of the Declaration of Helsinki and started after the written consent of the adolescents above 18 YO or the legal guardians of participants less than 18 YO.

Anthropometric and body composition assessments

Body weight and body fat percentage were measured using a bipolar bioimpedance scale (Tanita® BF-683W Illinois, USA). Height was measured with a stadiometer (Altuxata®, Belo Horizonte, Brazil) with scale in centimeters. Body mass index (BMI) was calculated by the quotient between body weight and square height (kg/m^2) and the nutritional status was defined by BMI for age according to WHO classification: normal weight (3th \leq BMI \leq 85th); overweight (85th $<$ BMI \leq 97th); and obesity (BMI $>$ 97th) [18]. Waist circumference (WC) was measured using a 1.5m inelastic and flexible tape with 0.01m interval. Values of WC above the 90th percentile specific for age and gender were considered high [19]. Triceps, biceps, subscapular and suprailiac skinfold thickness (ST) were measured using a skinfold caliper (Lange®, Beta Technology, California, USA) with precision of 0.1mm in triplicate [20]. Sum of 4 skinfold thickness (S4ST) – triceps, biceps, subscapular and suprailiac – was calculated and expressed in millimeter. Waist-to-height ratio (WHtR) was obtained by dividing WC (cm) by height (cm) [21]. Conicity Index (C Index) was determined by measuring weight, height and WC using the following mathematical equation: $\text{WC (m)} / 0.109 \sqrt{[\text{Weight (kg)} / \text{Height (m)}]}$ [22]. Regarding body fat percentage (BF%), values greater than 25% for boys and 30% for girls were classified as high [23]. Bipolar bioimpedance scale (Tanita® BF-683W Illinois, USA)

was also used to determine the amount in kg of fat mass (FM) and fat-free mass (FFM). Fat mass index (FMI) was calculated by dividing fat mass (kg) by height squared (m^2) and fat-free mass index (FFMI) was estimated by dividing lean mass (kg) by height squared (m^2) [24].

Food Intake

Dietary variables were collected through a food frequency questionnaire (FFQ) validated [25]. Frequencies of consumption were categorized in never/almost never, once to 2 times a week, 3 to 4 times per week, 5 to 6 times per week or every day of the week. In addition, daily intake of sweets, soft drinks, fruits and vegetables were evaluated in 1 time, 2 times and 3 times or more per day [25]. Fruits and vegetables frequency was dichotomized in less than 3 times and 3 or more times per day [26], according to the recommendations of the Food Guide for the Brazilian Population [27].

Demographic, socioeconomic and sports practice variables

The investigated variables were age, gender, parental schooling, socioeconomic level of the family and sports practice. The family income classification was based on the Brazilian Association of Research Companies (ABEP) survey [28].

Statistical Analyses

Shapiro-Wilks test was used to assess the normal distribution of data. Variables with normal distribution were presented as mean \pm standard deviation and comparison between groups were performed by Student's *t*-test. Frequencies (%) were calculated for categorical data and Chi-square or Fisher's exact tests were used to evaluate differences between groups. Pearson's correlation test was performed to verify association among variables. For statistical analyzes we used the software

PASW (*Predictive Analytics Software Statistics GradPack*, version 17.0, Chicago) and α -level of 0.05 was considered.

Results

A total of 132 teenagers participated in the research, being 51% females (n=68) and 49% males (n=64), with mean age of 16.27 ± 1.09 years old. The sample consisted of 81.8% eutrophic, 10.6% overweight and 7.6% obese individuals.

Female teenagers had significantly higher mean values of S4ST, FM, FMI, BF% compared to male group, while male had higher mean values of body mass, height, WC, C Index, FFM, FFMI ($p < 0.05$). Comparing groups, there were no statistical differences among BMI for age, WHtR, nutritional status, socioeconomic status and parental education ($p > 0.05$). In addition, only 54.5% of teenagers practiced sports and female reported less physical activity practice than male ($p < 0.001$).

Table I shows anthropometric, body composition and socioeconomic characteristics of the study population stratified by sex.

Table I: Anthropometric, body composition and socioeconomic characteristics of teenagers 15-19 years (n = 132).

Variables	Female (n=68)	Male (n=64)	p*
Body mass (kg)	58.48±13.06	68.40±14.98	<0.001
Height (m)	1.61±0.07	1.74±0.62	<0.001
BMI for age (kg/m ²)	22.09±3.84	22.50±4.54	0.573
Waist circumference (cm)	69.09±8.82	73.90±10.69	0.005
Sum of 4 skinfold thickness (mm)	61.53±20.54	44.55±22.16	<0.001
Waist-to-height ratio	0.42±0.04	0.42±0.05	0.741
Conicity Index	1.06±0.04	1.08±0.07	0.014
Fat mass (kg)	15.43±7.56	11.20±8.75	0.003
Fat mass index (kg/m ²)	5.85±2.61	3.64±2.83	<0.001
Fat-free mass (kg)	43.05±6.69	57.19±7.82	<0.001
Fat-free mass index (kg/m ²)	16.35±1.60	18.77±2.16	<0.001
Bipolar body fat (%)	25.33±6.60	15.14±7.47	<0.001
Nutritional status	n(%)	n(%)	p[†]
Eutrophic	54(80.6)	54(83.0)	0.784
Overweight	9(13.4)	5(7.7)	
Obesity	4(6.0)	6(9.3)	
Sport practice			
Yes	24(35.3)	48(75.0)	0.001
No	44(64.7)	16(25.0)	
Socioeconomic status			
A	9(13.2)	8(12.5)	0.821
B	39(57.4)	40(62.5)	
C	20(29.4)	16(25.0)	
Parental education			
Graduation	19(27.9)	15(23.4)	0.249
Complete high school	27(39.7)	22 (34.4)	
Incomplete high school/Complete elementary school	18(26.5)	26 (40.6)	
Incomplete elementary	4(5.9)	1(1.6)	

SD: standard deviation; * Student *T* test; [†]Chi-square's Test or Fisher Exact; BMI: body mass index.

Pearson's correlations among BF% and independent variables are shown in table II. It was observed a high positive association with FM, FMI, BMI, WC, WHtR

and body mass and a moderate positive correlation with C Index, S4ST, FFM, FFMI ($p < 0.05$; Table II).

Table II: Correlation among body fat percentage with sociodemographic, antropometric and body composition in teenagers.

Independent Variables	Body fat (%)	
	Female	Male
Weight (kg)	0.769*	0.832*
Height (cm)	0.225	0.288
BMI (kg/m ²)	0.856*	0.815*
Waist circumference (cm)	0.816*	0.855*
Sum 4 STs (mm)	0.647*	0.752*
Waist-to-height ratio	0.811*	0.823*
Conicity Index	0.539*	0.597*
Fat mass (kg)	0.930*	0.962*
Fat mass Index (kg/m ²)	0.952*	0.949*
Fat-free mass (kg)	0.450*	0.518*
Fat-free mass index (kg/m ²)	0.513*	0.457*

* $P < 0.05$

Regarding food intake pattern, 87.9% of teenagers had low intake of fruits and 93.9% reported inadequate vegetables consumption, with no statically difference between male and female individuals ($p > 0.05$). In addition, 87.7% of the sample reported at least once time per day sweets intake as chocolate, cake, ice-cream and other deserts and 75% take soda and processed juices. We also observed that 62.9% of teenagers consume chewing gum, 52.3% eat salty snacks and 53.1% consume fast food as sandwiches and pizza daily.

Table III shows the eating food pattern of teenagers. There was no statically difference between food intake and gender ($p > 0.05$; Table III). We also observed no difference in food consumption according to nutritional status, parental schooling and family income (data not shown).

Table III: Daily pattern of food items intake by teenagers.

Food Items	Female	Male	
Fruits		n(%)	p*
Low/ Inadequate Intake	58(86.6)	58(89.2)	0.639
Adequate Intake	9(13.4)	7(10.8)	
Vegetables			
Low Intake	64(95.5)	60(92.3)	0.489
Adequate Intake	3 (4.5)	5(7.7)	
Sweets			
Daily Intake	61(91.0)	57(87.7)	0.376
Rarely Intake	9(6.0)	8(12.3)	
Soft drink			
Daily Intake	50(74.6)	49(75.4)	0.502
Rarely Intake	17(25.4)	16(24.6)	
Candies and chewing gum			
Daily Intake	42(62.7)	41(63.1)	0.104
Rarely Intake	25(37.3)	24(36.9)	
Fast food			
Daily Intake	36(53.7)	39(60.0)	0.139
Rarely Intake	31(46.3)	26(40.0)	
Salt snacks			
Daily Intake	37(55.2)	32(49.2)	0.454
Rarely Intake	30(44.8)	33(50.8)	

*Chi-square's Test or Fisher Exact

Teenagers who practice physical activity reported that they rarely or never eat sweets (45.8% vs 26.7%; $p=0.015$) and drink soda (61.6% vs 36.7%; $p=0.018$) in comparison with the sedentary subjects (data not shown).

Discussion

The prevalence of overweight and obesity in adolescents has increased worldwide and it represents a severe public health problem both in developed and in developing countries [29]. Among other interurrences, overweight can increase the risk of metabolic and psychological disorders, besides be a predictor of obesity in

adulthood [6]. In this study, the frequency of both overweight and obesity among teenagers was 18.2%, which was in accordance with studies conducted with Brazilian adolescents [31,12]. It is essential to investigate the nutritional status of adolescents, since overweight individuals present a higher risk of developing hypertension, dyslipidemia and type 2 diabetes [30].

Our results showed differences in anthropometry and body composition between genders. In teenagers, nutritional assessment measures varies widely since it depends on gender, age, ethnicity, height, sport practice and food pattern [32,12]. In our study, female adolescents presented higher values of body fat determined by bipolar bioimpedance and sum of skinfold thickness. Male had higher values of body mass, WC, C Index and variables related to lean mass as FFM and FFMI. In addition, girls were more sedentary than male which may contribute to increase adiposity and reduction of lean mass.

Body fat is highly related to chronic non-communicable diseases, that is why it is important to evaluate adiposity in teenagers. So, the present study also analyzed the association between BF% with anthropometric and body composition measurements. For both genders, the BF% was correlated to some variables that estimate total and central body fat as C Index and WHtR.

WHtR is a useful technique that considers the proportion of central fat by the individual's height and C Index can be used as an alternative method to assess abdominal fat distribution in adolescents [33]. In this context, using different methodologies for the assessment of body fat is essential to a better nutritional diagnosis, preventing fat-related diseases and promoting health in adolescence [31]. In this sense, we reinforce the idea that in addition to the basic measure of obesity widely described in the literature such as BMI, other measures should be used, as we did in this study, for a better and more accurate diagnosis of nutritional status in adolescents.

In general, female subjects have more BF and male have higher values WC due to morphological, anatomical and hormonal characteristics which may also predispose them to an even greater increase in such measures. However, besides phenotypic differences, changes in body composition and adiposity profile in adolescence may be influenced by poor eating habits and reduced physical activity [34, 31]. Our results showed that 46% of teenagers do not practice sports besides

the school's physical education classes. Another Brazilian recent research reported that 56% of adolescents between 15 and 17 years old don't practice physical activity by lack of interest [35]. Low level of physical activity may contribute to obesity and adiposity due to low body energy expenditure which leads to the accumulation of total and central body fat [36]. In addition, in the present study, we observed association between sedentary lifestyle with higher sweets and soft drink intake. It shows the importance of stimulating healthy life style through the practice of physical activity associated with improved food habits.

Still regarding food pattern, teenagers reported an inadequate intake of some food groups. Similar to our results, several studies with Brazilian adolescents have shown eating habits characterized by frequent consumption of sugars, soft drinks and snacks, and low intake of fruits and vegetables [37-40]. This obesogenic food pattern is harmful, since it can lead to overweight and other related diseases in adolescence and adult life [41]. In addition, proper nutrition is essential to ensure growth and development of adolescents. Therefore, food consumption's evaluation is important to identify risk behavior for obesity and prevent chronic non-communicable diseases [39]. Teenagers constitute a nutritionally vulnerable group, considering their increased nutritional requirements, inadequate food pattern and high susceptibility to environmental influences [42,39]. Motivation for food consumption is tightly influenced by learning and memory mechanisms related to food experiences [43]. In this line, social and environmental factors contribute to the motivational process of feeding and influence directly the preferences and eating habits [43].

As noted, we observed the same type of food behavior among teenagers independently of gender, nutritional status, parental schooling or family income, thus highlighting a consumption repetition in this group. This is an important confirmation that may help to better understanding the eating practices in adolescence and proposition of behavioral change working in group and not only with isolated subject. So, multidisciplinary actions are necessary for promotion of healthy food pattern, considering the individuality of each one, but within a social and environmental context in which the adolescent is inserted. Therefore, working with the set of emotional, educational and cultural factors involved in teenager's food choice, it will be possible to propose motivational orientations for healthy eating practices in adolescence [44].

Limitations

This study has some limitations. Our sample consists of adolescents from a specific Brazilian region, which limits the inference of our results to other populations. In addition, cross-sectional study does not allow proving that associations are causal. So, longitudinal research is needed to determine cause-effect relation among food behavior, sedentary life style and obesity.

In addition, scientific literature about other measures of nutritional assessment in adolescence - instead of BMI classified by WHO 2006 - is relatively scarce in Brazil. Thus, more studies are needed to establish and standardize cutoff points to evaluate parameters for determination of central obesity and adiposity in Brazilian teenagers' population.

Another point of our study was the non-evaluation of sexual maturation which is an important parameter to complement the nutritional status analyses of adolescents. Still, we used food frequency questionnaire which presents as limitations the fact of being dependent on the memory of the interviewer contributing to loss of information due to forgetfulness or omission of some food or food group intake. In addition, the dietary survey did not evaluate the quantity of food consumed in grams or milliliters, which makes it impossible to quantitatively analyze the food portions and also macronutrients such as calories, carbohydrates, proteins, lipids, vitamins and minerals. However, all instrument of dietary analysis have advantages and also limitations, since assessing the human eating behavior dimension is a complex work, requiring the use of appropriate techniques for the individuals accurately report their eating behavior.

Conclusion

Our study corroborates a tendency of nutritional transition, low sport practices and inadequate food pattern among teenagers. Thus, education strategies should be conducted to modify this obesogenic life style.

It was also verified association among anthropometric and body composition variables with body fat percentage. Thus, we reinforce the importance to use several

methods of nutritional evaluation in adolescence due the differences between genders.

Food pattern did not differ among subjects, independently of nutritional status, body fat and sociodemographic characteristics, showing a reproduction of eating practice by the group. Teenagers tend to repeat the same eating behavior of the group in which they are inserted. This is an important confirmation that may help to a better understanding the food choices in adolescence. In addition, it will allow propose eating behavioral change with actions in group and not only with an individual isolated.

Finally, more studies are needed in order to explore the determinants of food pattern in adolescence and its relation with overweight and high body fat. Future research should assess eating practices in social contexts such as school and family environments to help understanding teenagers' food behavior.

Funding

Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgements

We thank the schools the adolescents for participating in the study and the CNPq for project financing.

References

- [1] Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico (Vigitel). Brasília: MS; 2016.
- [2] Aiello AM, Marques de Mello L, Souza Nunes M, Soares da Silva A, Nunes A. Prevalence of Obesity in Children and Adolescents in Brazil: A Meta-analysis of Cross-sectional Studies. *Curr Pediatr Rev* 2015;11(1):36-42.
- [3] Johnson WD, Kroon JJ, Greenway FL, Bouchard C, Ryan D, Katzmarzyk PT. Prevalence of Risk Factors for Metabolic Syndrome in Adolescents: National

- Health and Nutrition Examination Survey (NHANES), 2001-2006. Prevalence of risk factors for metabolic syndrome in adolescents: National Health and Nutrition Examination Survey (NHANES), 2001-2006. *Arch Pediatr Adolesc Med* 2009; 163: 371–7.
- [4] Lee YS. Consequences of childhood obesity. *Ann Acad Med Singapore* 2009; 38: 75–7.
- [5] Enes CC & Slater B. Obesity in adolescence and its main determinants. *Rev Bras Epidemiol* 2010;13(1):163–71.
- [6] NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *The Lancet* 2016;387:1377–96.
- [7] Magalhães EIS, Sant’Ana LFR, Priore SE, Franceschini SCC. Waist circumference, waist/height ratio, and neck circumference as parameters of central obesity assessment in children. *Rev Paul Pediatr* 2014;32(3):273–82.
- [8] Coelho LG, Cândido APC, Machado-Coelho GLL, de Freitas SN. Food habits and risk of cardiovascular disease in schoolchildren from Ouro Preto, Minas Gerais. *Rev Nutr* 2015;28(2):133–42.
- [9] Peltz G, Aguirre MT, Sanderson M, Fadden MK. The role of fat mass index in determining obesity. *Am J Hum Biol* 2010;22: 639–47.
- [10] Bahadori B, Uitz E, Tonninger-Bahadori K, Pestemer-Lach I, Trummer M, Thonhofer R, Brath H, Schaflinger E. Body composition: the fatfree mass index (FFMI) and the body fat mass index (BFMI) distribution among the adult Austrian population – results of a cross-sectional pilot study. *Int J Body Compos Res* 2006;4:123–8.
- [11] Eissa MA, Dai S, Mihalopoulos NL, Day RS, Harrist RB, Labarthe DR. Trajectories of fat mass index, fat free-mass index, and waist circumference in children: Project HeartBeat. *Am J Prev Med* 2009;37 Suppl. 1:S34–9.
- [12] Coelho LG, Cândido APC, Machado-Coelho GLL, de Freitas SN. Association between nutritional status, food habits and physical activity level in schoolchildren. *J Pediatr* 2012;88(5):406–12.

- [13] Aranceta J, Pérez-Rodrigo C, Ribas L, Serra-Majem LI. Sociodemographic and lifestyle determinants of food patterns in spanish children and adolescents: The enKid study. *Eur J Clin Nutr* 2003; 57(Suppl.1):40–4.
- [14] Prescott J. *Taste Matters. Why We Like the Foods We Do*. London: Reaktion Books; 2012, p. 1– 208.
- [15] Mendonça CP, dos Anjos LA. Dietary and physical activity factors as determinants of the increase in overweight/obesity in Brazil. *Cad Saude Publica*. 2004;20:698-709.
- [16] Nunes MM, Figueiroa JN, Alves JG. Overweight, physical activity and foods habits in adolescents from different economic levels, Campina Grande (PB). *Rev Assoc Med Bras*. 2007;53:130-4.
- [17] Tak NI, Te Velde SJ, Singh AS, Brug J. The effects of fruit and vegetable promotion intervention on unhealthy snacks during mid-morning school breaks: Results of the Dutch Schoolgruiten Project. *J Hum Nutr Diet* 2010; 23(6):609–15.
- [18] World Health Organization. *WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for height and body mass index-for-age: methods and development*. Geneva, World Health Organization; 2006.
- [19] Mederico M, Paoli M, Zerpa Y, Briceño Y, Gómez-Pérez R, Martínez JL, Nolis Camacho N, Cichetti R, Molina Z, Mora Y, Valeri L. Valores de referencia de la circunferencia de la cintura e índice de la cintura/cadera en escolares y adolescentes de Mérida, Venezuela: comparación con referencias internacionales. *Endocrinol Nutr* 2013;60(5):235–42.
- [20] Durnin JVGA, Rahaman MM. The assessment of the amount of fat in the human body from measurements of skinfold thickness. *Br J Nutr* 1967;21:1–9.
- [21] Cintra IP, Passos MAZ, dos Santos LC, Machado HC, Fisberg M. Waist-to-Height Ratio Percentiles and Cutoffs for Obesity: A Cross-sectional Study in Brazilian Adolescents. *J Health Popul Nutr* 2014;32(3):411–9.
- [22] Valdez R. A simple model-based index of abdominal adiposity. *J Clin Epidemiol* 1991; 44 (9):955–6.

- [23] Williams DP, Going SB, Lohman TG, Harsha DW, Srinivasan SR, Webber LS, et al. Body fatness and risk for elevated blood pressure, total cholesterol, and serum lipoprotein ratios in children and adolescents. *Am J Public Health* 1992;82:358–63.
- [24] VanItallie TB, Yang UM, Heymsfield SB, Funk RC, Boileau RA. Height-normalized indices of the body's fat-free mass and fat mass: potentially useful indicators of nutritional status. *Am J Clin Nutr* 1990;52:953–9.
- [25] Mendes LL; Campos SF; Malta DC; Bernal RTI; de Sá NNB; Velásquez-Meléndez G. Validade e reprodutibilidade de marcadores do consumo de alimentos e bebidas de um inquérito telefônico realizado na cidade de Belo Horizonte (MG), Brasil. *Rev Bras Epidemiol* 2011; 14(1) Supl.: 80–9.
- [26] Souza AM; Bezerra IN; Cunha DB; Sichieri R. Avaliação dos marcadores de consumo alimentar do VIGITEL (2007-2009). *Rev Bras Epidemiol* 2011; 14(1) Supl.: 44–52.
- [27] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Guia alimentar para a população brasileira / Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Atenção Básica. 2ª edição. Brasília: Ministério da Saúde, 2014. 156 p.
- [28] Associação Brasileira de Empresas de Pesquisa (ABEP). Critério Brasil de Classificação Econômica. 2014; 1-6.
- [29] Godoy-Matos A, Guedes EP, Souza LL, Martins MF. Management of obesity in adolescents: state of art. *Arq Bras Endocrinol Metab* 2009;53(2): 252–61.
- [30] Pêgo-Fernandes PM, Bibas BJ, Deboni M. Obesity: the greatest epidemic of the 21 st century? *Sao Paulo Med J.* 2011; 129(5):28–34.
- [31] Oliveira PM, Silva FA, Oliveira RMS, Mendes LL, Netto MP, Candido APC. Association between fat mass index and fat-free mass index values and cardiovascular risk in adolescents. *Rev Paul Pediatr* 2016;34(1):30–7.
- [32] Vieira AC, Alvarez MM, Marins VM, Sichieri R, Veiga GV. Accuracy of different body mass index reference values to predict body fat in adolescents. *Cad Saude Publica.* 2006;22:1681–90.

- [33] Beck CC, Lopes AS, Pitanga FJG. Anthropometric Indicators as Predictors of High Blood Pressure in Adolescents. *Arq Bras Cardiol* 2011;96(2):126–33.
- [34] Jessup A, Harrell JS. The metabolic syndrome: look for it in children and adolescents, too! *Clin Diabetes* 2005;23: 26–32.
- [35] Pesquisa Nacional por Amostra de Domicílios (PNAD). Práticas de esporte e atividade física: 2015/ IBGE, Coordenação de Trabalho e Rendimento. - Rio de Janeiro: IBGE, 2017. 80p.
- [36] Polacow VO, Lancha Junior AH. Dietas Hiperglicídicas: Efeitos da Substituição Isoenergética de Gordura por Carboidratos Sobre o Metabolismo de Lipídios, Adiposidade Corporal e Sua Associação com Atividade Física e como Risco de Doença Cardiovascular. *Arq Bras Endocrinol Metab* 2007;51(3):389–400.
- [37] Fisberg M, Bandeira CRS, Bonilha EA, Halpern G, Hirschbruch MD. Hábitos alimentares na adolescência. *Pediatr Mod* 2000; 36: 766–70.
- [38] Kazapi IM, Pietro PFD, Avancini SRP, Freitas SFT, Tramonte VLCCG. Consumo de energia e macronutrientes por adolescentes de escolas públicas e privadas. *Rev Nutr* 2001;14(S1):27–33.
- [39] Leal GVS, Philippi ST, Matsudo SMM, Toassa EC. Consumo alimentar e padrão de refeições de adolescentes, São Paulo, Brasil. *Rev Bras Epidemiol* 2010;13(3):457–67.
- [40] Andrade SC, de Azevedo Barros MB, Carandina L, Goldbaum M, Cesar CL, Fisberg RM. Dietary quality index and associated factors among adolescents of the state of Sao Paulo, Brazil. *J Pediatr* 2010;156(3):456–60.
- [41] Veiga GV, Cunha AS, Sichieri R. Trends in overweight among adolescents living in the poorest and richest regions of Brazil. *Am J Public Health* 2004; 94:1544–8.
- [42] World Health Organization. Nutrition in adolescence: issues for the health sector: issues in adolescent health and development. Geneva; 2005.
- [43] Cambraia 2004. Psychobiological aspects of feeding behavior. *Rev Nutr* 2004; 17(2):217–25.

- [44] Andrade Previato HDR, Behrens JH. Taste-related factors and food neophobia: Are they associated with nutritional status and teenagers' food choices? *Nutrition* 2017; 42:23–9.

7. DISCUSSÃO GERAL

A neofobia alimentar é caracterizada pela recusa em experimentar alimentos novos e desconhecidos (PLINER; HOBDEN, 1992), sendo altamente prevalente na primeira infância, porém, diminui na adolescência e mantém-se estável na vida adulta (KOIVISTO HURSTI; SJÖDEN, 1997; DOVEY et al., 2008). Existem vários fatores potencialmente determinantes da neofobia alimentar como idade, gênero, fatores ambientais, sensoriais, genéticos e emocionais (KNAAPILA et al., 2007; DOVEY et al., 2008). Evolutivamente, esse tipo de comportamento protegia os humanos, onívoros por natureza, contra alimentos tóxicos e nocivos (ROZIN; VOLLMECKE, 1986), enquanto a neofilia alimentar resultava em fontes alimentares adicionais (ROßBACH et al., 2016). No entanto, atualmente, a neofobia alimentar está associada a uma menor qualidade e variedade da dieta (KNAAPILA et al., 2014). Portanto, é essencial investigar a neofobia alimentar e seus determinantes para promover hábitos alimentares mais saudáveis e prevenir doenças associadas a dietas inadequadas.

A versão brasileira da Escala de Neofobia Alimentar (ENA) provou ser equivalente ao instrumento original *Food Neophobia Scale* (FNS), uma vez que não houve diferença estatisticamente significativa ($P < 0,05$) entre os itens das versões em inglês e em português, e, também, entre o escore total das duas versões. A escala apresentou alta reprodutibilidade para avaliar a neofobia alimentar, uma vez que o coeficiente de correlação intra-classe (CCI) entre a soma total das duas versões mostrou concordância quase perfeita (CCI=0,903). Este resultado foi semelhante ao encontrado na tradução do instrumento FNS para o espanhol, cujo valor de CCI foi de 0,840 (FERNÁNDEZ-RUIZ; CLARET; CHAYA, 2013). Em relação à confiabilidade da versão traduzida da ENA, o coeficiente alfa de Cronbach foi de 0,916, demonstrando alta confiabilidade da escala para medir a neofobia alimentar. Resultados semelhantes foram encontrados na validação e tradução do instrumento FNS para o idioma alemão ($\alpha=0,79$), francês ($\alpha=0,82$) e espanhol ($\alpha=0,82$) (SIEGRIST; HARTMANN; KELLER, 2013; FERNÁNDEZ-RUIZ; CLARET; CHAYA, 2013). Portanto, pode-se afirmar que a versão traduzida da ENA para o português possui confiabilidade e reprodutibilidade, permitindo sua utilização em pesquisas com indivíduos brasileiros (PREVIATO; BEHRENS, 2015).

Ainda, foi encontrado baixo grau de neofobia alimentar (17,5%) entre os adultos estudantes de pós-graduação que participaram da pesquisa de validação da ENA para o português (PREVIATO; BEHRENS, 2015). Esse resultado foi semelhante a outro estudo conduzido no Brasil em que apenas 11,5% dos adultos foram classificados com neofobia alimentar (BARCELLOS et al., 2009).

Essa foi a primeira pesquisa no Brasil que avaliou a neofobia alimentar na adolescência, e os resultados foram similares aos estudos internacionais que vem mostrando baixo comportamento neofóbico entre adolescentes (ROßBACH et al., 2016; CHO; KIM; CHO, 2014; KOIVISTO HURSTI; SJÖDÉN, 1997). Na presente pesquisa, 15,9% dos adolescentes foram classificados com alta neofobia alimentar.

A baixa neofobia alimentar no Brasil pode ser reflexo da ampla diversidade de alimentos e também da influência de culturas alimentares de diferentes países que contribuíram na formação da sociedade. Entretanto, é importante ressaltar que mesmo com a grande variedade de alimentos como frutas e hortaliças no Brasil, a presente pesquisa observou baixo consumo desses alimentos pelos adolescentes em consonância com uma tendência nacional que vem mostrando constante redução do consumo de tais gêneros alimentícios (ANDRADE et al., 2010).

Portanto, esta questão comportamental acaba sendo mais profunda, uma vez que não basta apenas experimentar novos alimentos, ou seja, alimentos diferentes do consumo habitual, mas, experimentar e criar um hábito alimentar diversificado. Logo, vários fatores devem ser considerados, visto que o comportamento alimentar humano é determinado por uma série de interações biológicas, antropológicas, culturais, socioeconômicas, psicológicas, emocionais e sensoriais (PREVIATO; BEHRENS, 2016). Assim, por mais que o indivíduo esteja disposto a experimentar novos alimentos, existem outras variáveis que influenciam as práticas alimentares.

Em relação aos aspectos sensoriais e emocionais ligados as escolhas alimentares, evidenciou-se associação do consumo de doces com *craving* por doces, uso do alimento como recompensa e prazer. Sabe-se que o consumo de doces atua no sistema opioide gerando prazer e emoções positivas que aumentam a motivação para consumir esses alimentos (SAWAYA, 2013). Assim, além de estimular o sistema de recompensa, o consumo de doces também estimula o desejo e a preferência por este tipo de alimento (DREWNOWSKI; ALMIRONG, 2010).

O *craving* por doces foi associado com o excesso de peso e de adiposidade, além de omissão de refeição e inatividade física ($P < 0,05$). Também se observou que o uso do alimento como recompensa foi associado à adiposidade, inatividade física e falta de interesse na busca de informações sobre alimentos ($P < 0,05$), assim como o prazer foi associado à inatividade física e falta de interesse na busca de informações sobre os alimentos ($P < 0,05$). Isso demonstra que as características hedônicas podem ser mais importantes do que as informações nutricionais (PRESCOTT, 2012) e a preocupação com alimentação e prática de atividade física quando se come exclusivamente por prazer, recompensa ou *craving*. Tais associações podem contribuir tanto para o ganho de peso quanto para o alto percentual de gordura corporal. Outro achado importante apresentado é que o *craving* por doces, a adiposidade, a omissão de refeição e a inatividade física foi maior no sexo feminino. Isso pode predispor as adolescentes a um risco maior de obesidade, uma vez que o consumo aumentado de alimentos hipercalóricos ricos em açúcares e gorduras associados a escolhas alimentares inadequadas e ao sedentarismo são fatores de risco para o ganho de peso.

Além disso, devido às diferenças antropométricas e de composição corporal entre adolescentes dos gêneros feminino e masculino, foi necessário o uso de vários métodos para complementar a avaliação do estado nutricional dos adolescentes. Nesse estudo foi observada uma correlação positiva e significativa entre percentual de gordura corporal e IMC, índice de gordura, somatório de dobras cutâneas, circunferência da cintura, razão cintura altura e índice de conicidade ($P < 0,05$), demonstrando que, além do IMC que é a ferramenta mais utilizada em estudos de avaliação antropométrica (GOMES; ANJOS; VASCONCELOS, 2010), outros métodos devem ser utilizados para uma análise mais eficiente da composição corporal de adolescentes.

Em relação à prática esportiva, os resultados mostraram que além das meninas serem mais sedentárias que os meninos, 46% dos adolescentes em geral não praticavam esportes, corroborando uma pesquisa recente realizada no Brasil em que metade dos adolescentes relatou não praticar nenhum tipo de exercício físico (PNAD, 2017). O baixo nível de atividade física pode contribuir para a obesidade e adiposidade (POLACOW; LANCHETA JUNIOR, 2007). Além disso, no presente estudo, observamos associação entre o estilo de vida sedentário com maior consumo de

doces e refrigerantes. Isso mostra a importância de estimular o estilo de vida saudável através da prática esportiva, melhorando assim os hábitos alimentares dos adolescentes.

Sobre o padrão alimentar, os adolescentes relataram uma ingestão inadequada de alguns grupos de alimentos, sendo semelhante aos resultados de outros estudos com adolescentes brasileiros mostrando hábitos alimentares caracterizados pelo consumo frequente de doces, refrigerantes e *fast food*, e baixa ingestão de frutas e hortaliças (FISBERG et al., 2000; KAZAPI et al., 2001; LEAL et al., 2010; ANDRADE et al., 2010).

É importante ressaltar que os adolescentes constituem um grupo nutricionalmente vulnerável, considerando seu alto requerimento nutricional, padrão alimentar inadequado e alta susceptibilidade às influências ambientais (WHO, 2005; LEAL et al., 2010). Nesse sentido, observamos o mesmo tipo de comportamento alimentar entre os adolescentes, independentemente de gênero, estado nutricional, escolaridade parental ou renda familiar, destacando assim uma repetição de consumo nesse grupo etário. Esta é uma confirmação importante que pode ajudar a compreender melhor as práticas alimentares na adolescência e propor mudanças comportamentais trabalhando em grupo e não isoladamente com cada indivíduo, considerando que os fatores sociais e ambientais exercem uma grande influência no processo motivacional das escolhas alimentares (CAMBRAIA, 2004).

Por isso, a análise do comportamento alimentar deve possibilitar a conscientização seguida de sensibilização e motivação para adoção de novos hábitos e escolhas alimentares mais adequadas do ponto de vista nutricional, mas, também levando em consideração a importância do prazer da alimentação e da individualidade na percepção de gostos e sabores. Somente a partir dessa análise mais completa e profunda do comportamento alimentar humano será possível propor medidas de intervenção alimentar com resultados mais eficientes e duradouros.

7. CONCLUSÃO GERAL

A realização da presente tese de doutorado possibilitou validar a Escala de Neofobia Alimentar para a língua portuguesa e, assim, disponibilizar este instrumento para investigações sobre a neofobia alimentar no Brasil.

Ainda, o presente estudo mostrou baixa prevalência de neofobia alimentar entre os participantes da pesquisa. Isso pode refletir um padrão brasileiro tendendo à neofilia alimentar, visto que, de uma forma geral, o hábito alimentar da população brasileira é caracterizado por grande diversidade de alimentos e influência de culturas alimentares internacionais. Além disso, a escolaridade dos participantes e o fato desta pesquisa ter sido realizada na região sudeste e em área urbana também podem ter contribuído para um baixo grau de neofobia alimentar.

Outra conclusão dessa tese foi que a maioria dos adolescentes apresentou nível considerável de *craving* por doces e uso do alimento como recompensa e prazer. Além disso, o *craving* por doces, a recompensa e o prazer foram associados com alteração de peso ou composição corporal, escolhas alimentares inadequadas e estilo de vida sedentário. Nesse contexto, a influência de fatores emocionais e a busca do prazer sensorial associados à falta de atividade física e de interesse em informações sobre alimentação podem contribuir para escolhas de alimentos de alta densidade calórica, ricos em açúcares e gorduras, e, conseqüentemente, para o ganho de peso e adiposidade.

É importante destacar que apesar da maioria dos adolescentes ser classificada com eutrofia, houve uma prevalência expressiva de excesso de peso e de adiposidade corporal. Nesse sentido, o presente estudo mostrou que o uso de vários parâmetros para avaliação antropométrica e de composição corporal de adolescentes se faz necessário devido às diferenças anatômicas e morfológicas entre os gêneros. Além disso, em consonância com estudos anteriores que vem demonstrando uma inadequação do consumo de frutas e hortaliças no Brasil, a maioria dos adolescentes apresentou baixo consumo de tais alimentos, além de repetirem o mesmo tipo de comportamento alimentar do grupo.

Portanto, diante de um cenário brasileiro de transição nutricional, padrão alimentar inadequado e baixo nível de atividade física, pesquisas futuras de caráter transversal e longitudinal devem ser realizadas em diferentes regiões do Brasil para avaliar a influência dos fatores determinantes das escolhas alimentares como a

neofobia alimentar, o *craving* por doces, a recompensa e o prazer e seu impacto na formação do hábito alimentar, utilizando um número maior de adolescentes e também outros grupos etários como adultos e idosos. Dessa maneira, será possível entender de uma forma mais abrangente as causas e os efeitos do comportamento alimentar e, assim, propor orientações nutricionais eficientes, levando em consideração as particularidades de cada indivíduo e do grupo populacional ao qual está inserido, priorizando a qualidade nutricional da dieta e também o prazer sensorial e emocional da alimentação.

8. REFERÊNCIAS

ALBANO, R.D.; SOUZA, S.B. Estado nutricional de adolescentes: “risco de sobrepeso” e “sobrepeso” em uma escola pública do Município de São Paulo. **Caderno de Saúde Pública**, v.17, n.4, p. 941-947, 2001 a.

ALBANO, R.D.; SOUZA, S.B. Ingestão de energia e nutrientes por adolescentes de uma escola pública. **Jornal de Pediatria**, v. 77, n. 6, p.512-516, 2001 b.

ANDRADE, S.C.; DE AZEVEDO BARROS, M.B.; CARANDINA, L.; GOLDBAUM, M.; CESAR, C.L.; FISBERG, R. M. Dietary quality index and associated factors among adolescents of the state of Sao Paulo, Brazil. **Jornal de Pediatria**, v. 156, n. 3, p.456-460, 2010.

ARANCETA, J.; PÉREZ-RODRIGO, C.; RIBAS, L.; SERRA-MAJEM, L.I. Sociodemographic and lifestyle determinants of food patterns in spanish children and adolescents: The enKid study. **European Journal of Clinical Nutrition**, v. 57, Suppl. 1, p. 40-44, 2003.

BARCELLOS, M. D.; AGUIAR, L. K.; FERREIRA, G. C.; VIEIRA, L. M. Willingness to try innovative food products: a comparison between British and Brazilian consumers. **Brazilian Administration Review**, v. 6, n. 1, p. 50-61, 2009.

CAMBRAIA, R. P. B. Psychobiological aspects of feeding behavior. **Revista de Nutrição**, v. 17, n. 2, p. 217-225, 2004.

CAROBA, D. C. R.; SILVA, M. V. Consumo alimentar de adolescentes matriculados na rede pública de ensino de Piracicaba - SP. **Segurança Alimentar e Nutricional**, v. 12, n. 1, p. 55-66, 2005.

CHAO, A.; GRILO, C. M.; WHITE, M. A.; SINHA, R. Food cravings, food intake, and weight status in a community-based sample. **Eating Behaviors**, v. 15, p. 478-482, 2014.

CHO, M. S.; KIM, M.; CHO, W. Relationships of adolescent's dietary habits with personality traits and food neophobia according to family meal frequency. **Nutrition Research Practice**, v. 8, n. 4, p. 476-481, 2014.

DOVEY, T. M.; STAPLES, P. A.; GIBSON, E. L.; HALFORD, J. C. G. Food neophobia and 'picky/fussy' eating in children: a review. **Appetite** v. 50, n. 2-3, p.181-193, 2008.

DREWNOWSKI, A.; ALMIRON-ROIG, E. **Human Perceptions and Preferences for Fat-Rich Foods**. In: Montmayeur JP, le Coutre J, editors. Fat Detection: Taste,

Texture, and Post Ingestive Effects. Boca Raton (FL): CRC Press/Taylor & Francis; Chapter 11, 2010.

ENES, C. C.; SLATER, B. Obesidade na adolescência e seus principais fatores determinantes. **Revista Brasileira de Epidemiologia**, v. 13, n. 1, p.163-171, 2010.

ESCRIVÃO, M. A. M. S.; OLIVEIRA, F. L. C.; TADDEI, J. A. A. C.; LOPES, F. A. Obesidade exógena na infância e adolescência. **Jornal de Pediatria**, v. 76, n. 3, p. 305-310, 2000.

FERNÁNDEZ-RUIZ, V.; CLARET, A.; CHAYA, C. Testing a Spanish-version of the Food Neophobia Scale. **Food Quality and Preference**, v. 28, p. 222-225, 2013.

FISBERG, M.; BANDEIRA, C. R. S.; BONILHA, E. A.; HALPERN, G.; HIRSCHBRUCH, M. D. Hábitos alimentares na adolescência. **Pediatria Moderna**, v. 36, p. 766-770, 2000.

FORMAN, E. M.; HOFFMAN, K. L.; JUARASCIO, A. S.; BUTRYN, M. L.; HERBERT, J. D. Comparison of acceptance-based and standard cognitive-based coping strategies for craving sweets in overweight and obese women. **Eating Behaviors**, v. 14, n. 1, p. 64-68, 2013.

FRANCISCHI, R. P. P.; PEREIRA, L. O.; FREITAS, C. S.; KLOPPER, M.; SANTOS, R. C.; VIEIRA, P.; LANCHÁ JÚNIOR, A. H. Obesidade: atualização sobre sua etiologia, morbidade e tratamento. **Revista de Nutrição**, v. 13, n. 1, p.17-28, 2000.

GOMES, F. S.; ANJOS, L. A.; VASCONCELOS, M. T. L. Antropometria como ferramenta de avaliação do estado nutricional coletivo de adolescentes. **Revista de Nutrição**, v. 23, n. 4, p. 591-605, 2010.

HOERTEL, H. A.; WILL, M. J.; LEIDY, H. J. A randomized crossover, pilot study examining the effects of a normal protein vs. high protein breakfast on food cravings and reward signals in overweight/obese “breakfast skipping”, late-adolescent girls. **Nutrition Journal**, v. 13, n. 80, p. 1-8, 2014.

KAZAPI, I. M.; PIETRO, P. F. D.; AVANCINI, S. R. P.; FREITAS, S. F. T.; TRAMONTE, V. L. C. G. Consumo de energia e macronutrientes por adolescentes de escolas públicas e privadas. **Revista de Nutrição**, v. 14, Suppl. 1, p. 27-33, 2001.

KNAAPILA, A. J.; SANDELL, M. A.; VAARNO, J.; HOPPU, U.; PUOLIMATKA, T.; KALJONEN, A.; *et al.* Food neophobia associates with lower dietary quality and higher BMI in Finnish adults. **Public Health Nutrition**, v. 18, n. 12, p. 2161-2171, 2014.

KNAAPILA, A.; TUORILA, H.; SILVENTOINEN, K.; KESKITALO, K.; KALLELA, M.; WESSMAN, M.; et al. Food neophobia shows heritable variation in humans. **Physiology & Behavior**, v. 91, n. 5, p. 573-578, 2007.

KOIVISTO HURSTI, U.; SJÖDEN, P. O. Food and general neophobia and their relationship with self-reported food choice: familial resemblance in Swedish families with children of ages 7-17 years. **Appetite**, v. 29, n. 1, p. 89-103, 1997.

LEAL, G. V. S.; PHILIPPI, S. T.; MATSUDO, S. M. M.; TOASSA, E. C. Consumo alimentar e padrão de refeições de adolescentes, São Paulo, Brasil. **Revista Brasileira de Epidemiologia**, v. 13, n. 3, p. 457-467, 2010.

MARTIN, C. K.; O'NEIL, P. M.; TOLLEFSON, G.; GREENWAY, F. L.; WHITE, M. A. The association between food cravings and consumption of specific foods in a laboratory taste test. **Appetite**, v. 51, n. 2, p. 324-326, 2008.

MUNIZ, L. C.; ZANINI, R. V.; SCHNEIDER, B. C.; TASSITANO, R. M.; FEITOSA, W. M. N.; GONZÁLEZ-CHICA, D. A. Prevalência e fatores associados ao consumo de frutas, legumes e verduras entre adolescentes de escolas públicas de Caruaru, PE. **Ciência & Saúde Coletiva**, v. 18, n. 2, p. 393-404, 2013.

NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. **The Lancet**, v. 387, p. 1377-1396, 2016.

PESQUISA NACIONAL POR AMOSTRA DE DOMICÍLIOS (PNAD). **Práticas de esporte e atividade física: 2015/ IBGE**, Coordenação de Trabalho e Rendimento. - Rio de Janeiro: IBGE, 2017. 80p.

PLINER, P.; HOBDEN, K. Development of a scale to measure the trait of food neophobia in humans. **Appetite**, v. 19, p. 105-120, 1992.

POLACOW, V. O.; LANCHÁ JUNIOR, A. H. Dietas Hiperglicídicas: Efeitos da Substituição Isoenergética de Gordura por Carboidratos Sobre o Metabolismo de Lipídios, Adiposidade Corporal e Sua Associação com Atividade Física e como Risco de Doença Cardiovascular. **Arquivo Brasileiro de Endocrinologia & Metabologia**, v. 51, n. 3, p. 389-400, 2007.

PRESCOTT J. **Taste Matters. Why We Like the Foods We Do**. Reaktion Books: London, UK, 2012. 208p.

PREVIATO, H. D. R. A.; BEHRENS, J. H. Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese. **Nutrición Hospitalaria**, v. 32, n. 2, p. 925-930, 2015.

PREVIATO, H. D. R. A.; BEHRENS, J. H. Why is it so Important to Understand Food Neophobia as a Determinant of Food Choice? **Nutrition and Food Technology: Open Access**, v. 2, n. 4, p. 1, 2016.

ROININEN, K.; LAHTEENMAKI, L.; TUORILA, H. Quantification of consumer attitudes to health and hedonic characteristics of food. **Appetite**, v. 33, n. 1, p. 71-88, 1999.

ROZIN, P.; VOLLMECKE, T. A. Food Likes and Dislikes. **Annual Review of Nutrition**, v. 6, p. 433-456, 1986.

ROßBACH, S.; FOTEREK, K.; SCHMIDT, I.; HILBIG, A.; ALEXY, U. Food neophobia in German adolescents: Determinants and association with dietary habits. **Appetite**, v. 101, p.184-191, 2016.

SAITO, I. M. **Nutrição**. In: Medicina do Adolescente (V. Coates, org.), p. 37-50, São Paulo: Editora Sarvier. 1993.

SAWAYA, A. L. **Alimentos ricos em açúcar, gordura e sal induzem à hiperfagia e ao vício alimentar**. In: SAWAYA, A. L. et al. (Ed.) Fisiologia da nutrição na saúde e na doença. Da biologia molecular ao tratamento. São Paulo: Atheneu; 2013.

SIEGRIST, M.; HARTMANN, C.; KELLER, C. Antecedents of food neophobia and its association with eating behavior and food choices. **Food Quality and Preference**, v. 30, p. 293-298, 2013.

STROEBELE, N.; DE CASTRO, J. M. Effect of Ambience on Food Intake and Food Choice. **Nutrition**, v. 20, p. 821-838, 2004.

TOJO, R.; LEIS, R.; QUEIRO, T. Nutrición en el adolescente. Factores de riesgo biopsicosociales. **Anales Espanoles de Pediatria**, v. 35, n. 46, p. 74-83, 1991.

WEINGARTEN, H. P.; ELSTON, C. The phenomenology of food cravings. **Appetite**, v. 15, p. 231-246, 1990.

WORLD HEALTH ORGANIZATION (WHO). **Nutrition in adolescence: issues and challenges for the health sector: issues in adolescent health and development**. Geneva; 2005.

9. APÊNDICES E ANEXOS

APÊNDICE I - CONVITE AOS ALUNOS

Prezados alunos (as),

Vimos convidá-los a participar de uma pesquisa de caráter científico a realizar-se com os alunos do IFSULDEMINAS de Poços de Caldas/MG

A pesquisa envolve avaliação nutricional e avaliação do consumo alimentar e será realizada no 2º semestre de 2015, no próprio Instituto.

Os alunos que concordarem em participar da pesquisa deverão assinar um termo de consentimento. No caso de alunos menores de 18 anos, os pais ou responsáveis deverão assinar o termo de consentimento.

Os pesquisadores se comprometem a manter em sigilo a identificação e todas as informações prestadas pelo participante.

Desde já agradecemos por sua atenção e colaboração ao contribuir com suas informações para o êxito desta pesquisa. Estamos à disposição para qualquer esclarecimento.

Atenciosamente,

Prof. Dr. Jorge Herman Behrens – Coordenador

Helena Dória Ribeiro de Andrade Previato - Pesquisadora

APÊNDICE II - TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Título da pesquisa: Neofobia alimentar e sua associação com escolhas alimentares e estado nutricional em adolescentes

Responsáveis: Helena Dória Ribeiro de Andrade Previato e Jorge Herman Behrens

Número do CAAE: 48065215.3.0000.5404

Você está sendo convidado a participar como voluntário de uma pesquisa. Este documento, chamado Termo de Consentimento Livre e Esclarecido, visa assegurar seus direitos como participante e é elaborado em duas vias, uma que deverá ficar com você e outra com o pesquisador.

Por favor, leia com atenção e calma, aproveitando para esclarecer suas dúvidas. Se houver perguntas antes ou mesmo depois de assiná-lo, você poderá esclarecê-las com o pesquisador. Se preferir, pode levar este Termo para casa e consultar seus familiares ou outras pessoas antes de decidir participar. Se você não quiser participar ou retirar sua autorização, a qualquer momento, não haverá nenhum tipo de penalização ou prejuízo.

Justificativa e objetivos:

Estudos sobre neofobia alimentar e estado nutricional na adolescência são necessários para a promoção da saúde a partir da prevenção de doenças associadas a padrões alimentares desequilibrados nutricionalmente.

O objetivo desse estudo é investigar a presença de neofobia alimentar e sua influência nas escolhas alimentares e no estado nutricional de adolescentes.

Procedimentos:

Participando do estudo você está sendo convidado a: preenchimento de questionário e avaliação nutricional.

Preenchimento de questionário: você responderá um questionário com dados pessoais e de consumo alimentar. As questões são simples e de fácil compreensão. O tempo aproximado será 50 minutos.

Avaliação Nutricional: serão tomadas as medidas de peso, estatura, circunferência da cintura e percentual de gordura corporal. O tempo aproximado será 10 minutos.

Essas atividades serão realizadas no IFSULDEMINAS Campus Poços de Caldas.

Desconfortos e riscos:

Como possível desconforto, você terá que dispendir seu tempo para participar do estudo. O tempo será de aproximadamente 60 minutos (em que você irá responder um questionário e passará por avaliação do estado nutricional) durante o período em que estiver no IFSULDEMINAS Campus Poços de Caldas/MG. Não há riscos previsíveis.

Você **não** deve participar deste estudo se apresentar: alergias alimentares; restrições alimentares; transtornos alimentares; doença que demande modificações dietéticas como diabetes, doença cardiovascular, doença renal. Ainda, se for vegetariano, gestante ou se estiver amamentando. Pois, isso pode interferir no comportamento alimentar pesquisado.

Benefícios:

Como benefício de participar dessa pesquisa, você terá acesso ao seu diagnóstico nutricional e de comportamento alimentar e receberá orientações nutricionais.

Rubrica do pesquisador: _____ Rubrica do participante ou responsável: _____

Acompanhamento e assistência:

Após o término do estudo, será feita uma apresentação com resultados obtidos e orientações nutricionais específicas para os participantes do estudo.

Sigilo e privacidade:

Você tem a garantia de que sua identidade será mantida em sigilo e nenhuma informação será dada a outras pessoas que não façam parte da equipe de pesquisadores. Na divulgação dos resultados desse estudo, seu nome não será citado.

Ressarcimento:

O estudo será feito durante o horário de estudo no IFSULDEMINAS Campus Poços de Caldas. Todos os procedimentos serão gratuitos e não haverá nenhum tipo de remuneração pela participação.

Contato:

Em caso de dúvidas sobre o estudo, você poderá entrar em contato com os pesquisadores:
 Helena Dória Ribeiro de Andrade Previato: helenapreviato@hotmail.com.br
 Prof. Dr. Jorge Herman Behrens: behrens@fea.unicamp.br
 Faculdade de Engenharia de Alimentos - Unicamp. Depto. de Alimentos e Nutrição. Rua Monteiro Lobato, 80, CEP 13083-862, Campinas-SP. Tel: (19) 3521-4077.

Em caso de denúncias ou reclamações sobre sua participação e sobre questões éticas do estudo, você pode entrar em contato com a secretaria do Comitê de Ética em Pesquisa (CEP) da UNICAMP das 08:30hs às 13:30hs e das 13:00hs as 17:00hs na Rua: Tessália Vieira de Camargo, 126; CEP 13083-887 Campinas – SP; telefone (19) 3521-8936; fax (19) 3521-7187; e-mail: cep@fcm.unicamp.br

Consentimento livre e esclarecido:

Após ter recebido esclarecimentos sobre a natureza da pesquisa, seus objetivos, métodos, benefícios previstos, potenciais riscos e o incômodo que esta possa acarretar, aceito participar:

Nome do (a) participante: _____

_____ Data: ____/____/____.

(Assinatura do participante ou nome e assinatura do seu responsável LEGAL)

Responsabilidade do Pesquisador:

Asseguro ter cumprido as exigências da resolução 466/2012 CNS/MS e complementares na elaboração do protocolo e na obtenção deste Termo de Consentimento Livre e Esclarecido. Asseguro, também, ter explicado e fornecido uma via deste documento ao participante. Informo que o estudo foi aprovado pelo CEP perante o qual o projeto foi apresentado. Comprometo-me a utilizar o material e os dados obtidos nesta pesquisa exclusivamente para as finalidades previstas neste documento ou conforme o consentimento dado pelo participante.

_____ Data: ____/____/____.

(Assinatura do pesquisador)

Rubrica do pesquisador: _____ Rubrica do participante ou responsável: _____

APÊNDICE III - QUESTIONÁRIO ESTRUTURADO

Número do Questionário: _____
 ____/____/____

Data: _____



Universidade Estadual de Campinas
 Faculdade de Engenharia de Alimentos
 Programa de Pós-Graduação em Alimentos e Nutrição



Dados Pessoais

1. Nome: _____
2. Data de Nascimento: _____ Idade: _____ Sexo: () Masculino () Feminino
3. Endereço _____
 Cidade/Estado: _____ () zona urbana () zona rural
 Telefone : _____ E-mail: _____
4. Curso: _____ Ano: _____
5. Assinale a quantidade dos itens abaixo que você possui em casa (casa dos pais):

Banheiros	() 0	() 1	() 2	() 3	() 4 ou +
Empregados domésticos	() 0	() 1	() 2	() 3	() 4 ou +
Automóveis	() 0	() 1	() 2	() 3	() 4 ou +
Microcomputador	() 0	() 1	() 2	() 3	() 4 ou +
Lava louça	() 0	() 1	() 2	() 3	() 4 ou +
Geladeira	() 0	() 1	() 2	() 3	() 4 ou +
Freezer	() 0	() 1	() 2	() 3	() 4 ou +
Lava roupa	() 0	() 1	() 2	() 3	() 4 ou +
DVD	() 0	() 1	() 2	() 3	() 4 ou +
Micro-ondas	() 0	() 1	() 2	() 3	() 4 ou +
Motocicleta	() 0	() 1	() 2	() 3	() 4 ou +
Secadora roupa	() 0	() 1	() 2	() 3	() 4 ou +

Para responder a questão 6, considere: Fundamental I = primário (1ª a 4ª série); Fundamental II = ginásio (5ª a 8ª série); Médio = 1º ao 3º colegial; Superior = faculdade

6. Grau de instrução do chefe de família:
 - () Analfabeto, Fundamental I incompleto
 - () Fundamental I completo / Fundamental II incompleto
 - () Fundamental II completo / Médio incompleto
 - () Médio completo / Superior incompleto
 - () Superior completo
 - () Não sabe
7. Sua casa possui: Água encanada () Sim () Não Rua pavimentada () Sim () Não
8. Número de membros da família que residem no domicílio: _____
9. Você tem alguma alergia alimentar? () Não () Sim
 Qual(is): _____
10. Você pratica atividade física regular? () Não () Sim
 Qual(is): _____
11. Você costuma “pular” alguma refeição diária? () Não () Sim
 Se sim, qual(is): () café da manhã () almoço () jantar
 Com que frequência?
 () nunca () 1 a 2 dias por semana () 3 a 4 dias por semana () 5 a 6 dias por semana
 () todos os dias (inclusive sábado e domingo)
12. Você procura informações sobre alimentos e alimentação? () Não () Sim

Se SIM, onde você procura?

- Internet Revistas Amigos Família Livros Profissionais de saúde
 Outros _____

Questionário

Q1. Em quantos dias da semana, você costuma comer pelo menos um tipo de verdura ou legume (alface, tomate, couve, cenoura, chuchu, berinjela, abobrinha – não vale batata, mandioca ou inhame)?

- nunca
 quase nunca
 1 a 2 dias por semana
 3 a 4 dias por semana
 5 a 6 dias por semana
 todos os dias (inclusive sábado e domingo)

Q2. Qual é a frequência do consumo de verduras e legumes em um dia comum?

- nenhuma
 1 vez por dia
 2 vezes por dia
 3 ou mais vezes por dia

Q3. Em quantos dias da semana você costuma tomar suco de frutas natural?

- nunca
 quase nunca
 1 a 2 dias por semana
 3 a 4 dias por semana
 5 a 6 dias por semana
 todos os dias (inclusive sábado e domingo)

Q4. Qual é a frequência do consumo de suco de frutas natural em um dia comum?

- nenhuma
 1 vez por dia
 2 vezes por dia
 3 ou mais vezes por dia

Q5. Em quantos dias da semana você costuma comer frutas?

- nunca
 quase nunca
 1 a 2 dias por semana
 3 a 4 dias por semana
 5 a 6 dias por semana
 todos os dias (inclusive sábado e domingo)

Q6. Qual é a frequência do consumo de frutas em um dia comum?

- nenhuma
 1 vez por dia
 2 vezes por dia
 3 ou mais vezes por dia

Qual(is) fruta(s) você consome? _____

Q7. Em quantos dias da semana, você costuma comer pelo menos um tipo de doce como: chocolate, sonho, biscoito recheado, bolo, doces, sorvetes, outras sobremesas?

- nunca
 quase nunca
 1 a 2 dias por semana
 3 a 4 dias por semana
 5 a 6 dias por semana
 todos os dias (inclusive sábado e domingo)

Q8. Qual é a frequência do consumo de doce como: chocolate, sonho, biscoito recheado, bolo, doces, sorvetes, outras sobremesas em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Q9. Em quantos dias da semana, você costuma consumir balas e chicletes?

- nunca
- quase nunca
- 1 a 2 dias por semana
- 3 a 4 dias por semana
- 5 a 6 dias por semana
- todos os dias (inclusive sábado e domingo)

Q10. Qual é a frequência do consumo de balas e chicletes em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Q11. Em quantos dias da semana, você costuma comer pelo menos um tipo de snacks salgados como salgadinho tipo chips e biscoitos salgados?

- nunca
- quase nunca
- 1 a 2 dias por semana
- 3 a 4 dias por semana
- 5 a 6 dias por semana
- todos os dias (inclusive sábado e domingo)

Q12. Qual é a frequência do consumo de snacks salgados como salgadinho tipo chips e biscoitos salgados em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Q13. Em quantos dias da semana, você costuma comer fast food como hambúrguer, pizza e batata frita?

- nunca
- quase nunca
- 1 a 2 dias por semana
- 3 a 4 dias por semana
- 5 a 6 dias por semana
- todos os dias (inclusive sábado e domingo)

Q14. Qual é a frequência do consumo de fast food como hambúrguer, pizza e batata frita em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Q15. Em quantos dias da semana, você costuma consumir pelo menos um tipo de bebida como refrigerantes e sucos prontos?

- nunca
- quase nunca
- 1 a 2 dias por semana
- 3 a 4 dias por semana
- 5 a 6 dias por semana

todos os dias (inclusive sábado e domingo)

Q16. Qual é a frequência do consumo de bebidas como refrigerantes e sucos prontos em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Q17. Em quantos dias da semana, você costuma consumir pelo menos um tipo de bebida alcoólica como: cerveja, vodka, rum, whisky e pinga?

- nunca
- quase nunca
- 1 a 2 dias por semana
- 3 a 4 dias por semana
- 5 a 6 dias por semana
- todos os dias (inclusive sábado e domingo)

Q18. Qual é a frequência do consumo de bebidas alcoólicas em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Q19. Em quantos dias da semana, você costuma beber água?

- nunca
- quase nunca
- 1 a 2 dias por semana
- 3 a 4 dias por semana
- 5 a 6 dias por semana
- todos os dias (inclusive sábado e domingo)

Q20. Qual é a frequência do consumo de água em um dia comum?

- nenhuma
- 1 vez por dia
- 2 vezes por dia
- 3 ou mais vezes por dia

Qual a sua opinião sobre **o sabor** dos alimentos e bebidas descritos no quadro abaixo. *Marque apenas 1 opção para cada questão.*

	muito agradável	moderadamente agradável	um pouco agradável	nem agradável nem desagradável	um pouco desagradável	moderadamente desagradável	muito desagradável
Alface, tomate, couve, cenoura, chuchu, berinjela, abobrinha							
Frutas							
Suco de frutas natural							
Chocolate, sonho, biscoito recheado, bolos, doces, sorvetes e outras sobremesas							
Balas e chicletes							
Salgadinhos tipo chips e biscoitos salgados							
Hambúrguer, pizza e batata frita							
Refrigerantes e sucos prontos							
Bebida alcoólica							
Água							

Assinale o quanto você **concorda ou discorda** das questões abaixo (Marque apenas 1 opção para cada questão).

	Discordo muito	Discordo moderadamente	Discordo ligeiramente	Não concordo nem discordo	Concordo ligeiramente	Concordo moderadamente	Concordo totalmente
1) Estou constantemente experimentando alimentos novos e diferentes							
2) Eu não confio em novos alimentos							
3) Se eu não sei o que contém um alimento, eu não experimento							
4) Eu gosto de comidas de diferentes países							
5) Comidas de outros países parecem muito estranhas para serem consumidas							
6) Em eventos sociais, eu experimento novos alimentos							
7) Eu tenho receio de comer alimentos que eu nunca experimentei antes							
8) Eu sou muito exigente em relação aos alimentos que eu escolho para comer							
9) Eu como praticamente de tudo							
10) Eu gosto de experimentar novos restaurantes de comidas de outros países							

Assinale o quanto você **concorda ou discorda** das questões abaixo (Marque apenas 1 opção para cada questão).

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente
1) Eu frequentemente tenho muita vontade (fissura) de comer chocolate.					
2) Eu frequentemente tenho muita vontade (fissura) de comer doces.					
3) Eu frequentemente tenho muita vontade (fissura) de comer sorvete.					
4) Na minha opinião, é estranho que algumas pessoas tenham muita vontade (fissura) de comer chocolate.					
5) Na minha opinião, é estranho que algumas pessoas tenham muita vontade (fissura) de comer doces.					
6) Na minha opinião, é estranho que algumas pessoas tenham muita vontade (fissura) de comer sorvete.					
7) Eu me recompenso comprando algo bem gostoso para comer.					
8) Eu me dou ao luxo de comprar algo realmente delicioso para comer.					
9) Quando estou me sentindo “pra baixo” eu quero me animar com algo bem gostoso para comer.					
10) Eu evito me recompensar com comida.					
11) Na minha opinião, usar a comida para se confortar é se iludir.					
12) Eu tento evitar comer comidas gostosas, quando estou me sentindo “pra baixo”.					
13) Eu não acredito que a comida deva ser sempre uma fonte de prazer.					
14) A aparência da comida não faz diferença pra mim.					
15) Para mim é importante comer comidas gostosas tanto durante a semana como nos finais de semana.					
16) Quando como, eu me concentro em aproveitar o sabor da comida.					
17) Eu termino minha refeição mesmo quando eu não gosto do sabor da comida.					
18) Uma parte essencial do meu final de semana é comer comidas gostosas.					

ANEXO I – Parecer do Comitê de Ética em Pesquisa da UNICAMP

COMITÊ DE ÉTICA EM
PESQUISA DA UNICAMP -
CAMPUS CAMPINAS

**PARECER CONSUBSTANCIADO DO CEP****DADOS DO PROJETO DE PESQUISA**

Título da Pesquisa: Neofobia alimentar e sua associação com escolhas alimentares e estado nutricional em adolescentes.

Pesquisador: Helena Dória Ribeiro de Andrade Previato

Área Temática:

Versão: 1

CAAE: 48065215.3.0000.5404

Instituição Proponente: Faculdade de Engenharia de Alimentos

Patrocinador Principal: MINISTERIO DA CIENCIA, TECNOLOGIA E INOVACAO

DADOS DO PARECER

Número do Parecer: 1.207.294

**COMITÊ DE ÉTICA EM
PESQUISA DA UNICAMP -
CAMPUS CAMPINAS**



Continuação do Parecer: 1.207.294

Projeto Detalhado / Brochura Investigador	PROJETO CEP DETALHADO.pdf	07/08/2015 16:03:00		Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE.pdf	07/08/2015 16:06:45		Aceito
Folha de Rosto	FOLHA DE ROSTO.pdf	07/08/2015 15:55:33		Aceito
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_P ROJETO 551713.pdf	07/08/2015 16:56:15		Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

CAMPINAS, 31 de Agosto de 2015

**Assinado por:
Renata Maria dos Santos Celeghini
(Coordenador)**

ANEXO II – Autorização da Editora da Revista Nutrição Hospitalária para inclusão do artigo “Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese” na presente tese de doutorado.

- ÓRGANO OFICIAL DE LA SOCIEDAD ESPAÑOLA DE NUTRICIÓN PARENTERAL Y ENTERAL (SENPE)
- ÓRGANO OFICIAL DEL CENTRO INTERNACIONAL VIRTUAL DE INVESTIGACIÓN EN NUTRICIÓN (CIVIN)
- ÓRGANO OFICIAL DE LA SOCIEDAD ESPAÑOLA DE NUTRICIÓN (SEN)
- ÓRGANO OFICIAL DE LA FEDERACIÓN LATINO AMERICANA DE NUTRICIÓN PARENTERAL Y ENTERAL (FELANPE)
- ÓRGANO OFICIAL DE LA FEDERACIÓN ESPAÑOLA DE SOCIEDADES DE NUTRICIÓN, ALIMENTACIÓN Y DIETÉTICA (FESNAD)

Nutrición Hospitalaria

DIRECTOR: J. M. CULEBRAS-FERNÁNDEZ

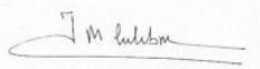
*De la Real Academia de Medicina y Cirugía de Valladolid
jesus@culebras.eu*

Jesús M Culebras, Director de NUTRICION HOSPITALARIA hasta diciembre 2015

AUTORIZA

que se incluya el artículo "Previato HDRA, Behrens JH.T Translation and Validation of the Food Neophobia Scale (FNS) to the Brazilian Portuguese. Nutr Hosp 2015;32(2):925–30." en la Tesis Doctoral de Helena Previato.

Para que así conste,



Fdo.: Jesús M. Culebras
25 de Noviembre 2015

ANEXO III – Declaração da Elsevier para inclusão do artigo “Taste-related factors and food neophobia: Are they associated with nutritional status and teenagers’ food choices?” na presente tese de doutorado.

Dear Ms. Previato:

As an Elsevier journal author, you retain the right to include the article in a thesis or dissertation (provided that this is not to be published commercially) whether in full or in part, subject to proper acknowledgment; see <https://www.elsevier.com/about/our-business/policies/copyright/personal-use> for more information. As this is a retained right, no written permission from Elsevier is necessary.

If I may be of further assistance, please let me know.

Best of luck with your doctoral thesis and best regards,
Hop

Hop Wechsler

Permissions Helpdesk Manager

ELSEVIER | Global E-Operations Books

+1 [215-239-3520](tel:215-239-3520) office

h.wechsler@elsevier.com

ELSEVIER

Personal use

Authors can use their articles, in full or in part, for a wide range of scholarly, non-commercial purposes as outlined below:

- Use by an author in the author's classroom teaching (including distribution of copies, paper or electronic)
- Distribution of copies (including through e-mail) to known research colleagues for their personal use (but not for Commercial Use)
- Inclusion in a thesis or dissertation (provided that this is not to be published commercially)
- Use in a subsequent compilation of the author's works
- Extending the Article to book-length form
- Preparation of other derivative works (but not for Commercial Use)
- Otherwise using or re-using portions or excerpts in other works

These rights apply for all Elsevier authors who publish their article as either a subscription article or an open access article. In all cases we require that all Elsevier authors always include a full acknowledgement and, if appropriate, a link to the final published version hosted on Science Direct.