THANISE SABRINA SOUZA SANTOS

**NKTS, SOFIE e ESQUADA: escalas para avaliar o conhecimento nutricional, as
motivações para escolhas alimentares e a qualidade da dieta com aplicação da
Teoria de Resposta ao Item**

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*A minha mãe que sempre acreditou nos meus sonhos,
me apoiando em cada novo desafio.*

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À professora Betzy por acreditar no meu trabalho e confiar a mim um cartão de embarque para uma pesquisa metodológica que no início tínhamos muitas dúvidas e que fomos construindo um pouco a cada dia.

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Crie vínculo com pessoas e não com os itens do questionário.

(FERRETTI-REBUSTINI, 2019)¹

¹ Informação fornecida pela Prof.^a Dr.^a Renata Eloah de Lucena Ferretti-Rebustini durante a disciplina ENC 5940 – Métodos Psicométricos da Pesquisa em Saúde, São Paulo, 2019.

APRESENTAÇÃO

Sempre que eu pensava no doutorado, eu não tinha dúvidas que gostaria de cursá-lo no Programa de Pós Graduação em Nutrição em Saúde Pública, seguindo uma linha metodológica para desenvolvimento de um melhor instrumento de avaliação dietética.

Em 2013, saí de Viçosa-MG, ainda durante o meu mestrado, para uma viagem de 13 horas dentro de um ônibus com destino a São Paulo. Eu teria uma primeira reunião com a professora Betzabeth Slater. Foi uma conversa que cumpriu dois objetivos: retirar as dúvidas sobre as análises estatísticas do mestrado e demonstrar o meu interesse em fazer o doutorado. Eu gostaria de participar do processo seletivo de 2013 para iniciar o doutorado assim que defendesse o mestrado, no início de 2014. Entretanto, a professora Betzabeth não tinha disponibilidade para me orientar. Eu teria que esperar um ano.

Sim, eu esperei. Em 2014, então, retornei algumas vezes em SP para o processo seletivo. Entretanto, não obtive resultado positivo. Não foi fácil aceitar nem compreender o que tinha acontecido. Mas eu queria fazer o meu doutorado na FSP/USP com orientação da professora Betzabeth Slater. Então, informei à professora sobre o resultado negativo, mas que ainda mantinha o interesse. Ela me disse que quando se fecha uma porta é porque irão abrir várias outras. Ela me disse ainda que o processo de doutorado agora era de fluxo contínuo. Ou seja, a espera não seria por mais um ano.

Retornei para SP outras vezes para conversar com ela e muitas destas, de bate e volta BH ↔ SP. Ela comentou sobre as ideias que estava tendo para o meu doutorado para o desenvolvimento de um instrumento que poderia ser usado em qualquer lugar, em qualquer faixa etária; e que eu teria que viajar para Florianópolis-SC.

Com muitos pontos de interrogação sobre o projeto, aceitei o desafio, me inscrevi no processo seletivo e, em agosto de 2015, iniciei o doutorado. O projeto que enviei para o processo seletivo foi se tornando mais claro com o passar dos meses: propor uma escala para avaliar a qualidade da dieta (ESQUADA) considerando as recomendações do Guia Alimentar para População Brasileira, publicado em 2014 – GAPB-2014. A professora Betzabeth Slater agora era a Betzy. Em 2016, Florianópolis deixou de ser um destino de toda semana e passou a ser

minha moradia por um semestre. O coração ficou pequeno com a distância de casa, mas o período que frequentei a UFSC foi de muito aprendizado. Eu me aprofundi nas análises da Teoria de Resposta ao Item (TRI) e na parceria com o professor Dalton e seus alunos, bem como com a Professora Maria Alice, que passou a ser co-orientadora do meu doutorado.

O ano de 2016 foi muito importante também por outros motivos. A qualificação foi um ponto norteador para a construção da ESQUADA e eu embarquei na análise qualitativa. A CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) lançou o edital de doutorado sanduíche e eu me vi fazendo as malas para passar seis meses fora do Brasil.

Assim, em 2017, eu fui para Zaragoza, na Espanha, para mergulhar em outra cultura e com o grupo de pesquisa do professor Luis Moreno. A ideia inicial foi propor uma escala para avaliar motivações para as escolhas alimentares (SOFIE) a partir de um questionário utilizado no estudo HELENA (*Healthy Lifestyle in Europe by Nutrition in Adolescence*). Entretanto, as parcerias de trabalho proporcionaram propor, também, uma escala para avaliar o conhecimento nutricional (NKTS) com base em outro questionário também utilizado no estudo HELENA.

Metade do doutorado já tinha passado e a ESQUADA exigia minha atenção. Com o retorno da Espanha finalizei a análise qualitativa e embarquei na coleta de dados *online* e, também, na análise destes dados.

Nestes quatro anos do doutorado, muitas portas foram abertas, eu cresci como pessoa, estudante e pesquisadora. Assim, apresento aqui a tese, produto do doutorado. Ela é composta pelas evidências que indicam a ausência de métodos para avaliar, com precisão, o conhecimento nutricional, as motivações para as escolhas alimentares e a qualidade da dieta e justificam a proposta de novos instrumentos. Em seguida, são apresentados os objetivos e a metodologia utilizada. Os resultados e as discussões estão organizados considerando os artigos científicos elaborados:

Artigo 1: Proposta de uma escala de avaliação do conhecimento nutricional (NKTS) com aplicação da Teoria de Resposta ao Item e estudo das associações dos escores com consumo alimentar e concentração de biomarcadores nutricionais em adolescentes europeus.

Artigo 2: Proposta de uma escala de avaliação da motivação de saúde para as escolhas alimentares (SOFIE) com aplicação da Teoria de Resposta ao Item e

estudo das associações dos escores com consumo alimentar e concentração de biomarcadores nutricionais em adolescentes europeus.

Artigo 3: Análise da relevância, clareza e compreensão dos itens para avaliar a qualidade da dieta.

Artigo 4: Definição e caracterização do conjunto final de itens da ESQUADA com aplicação da Teoria de Resposta ao Item.

A síntese das contribuições dos artigos científicos e conclusão da tese estão apresentadas em conclusões e considerações finais.

RESUMO

SANTOS, Thanise Sabrina Souza. **NKTS, SOFIE e ESQUADA: escalas para avaliar o conhecimento nutricional, as motivações para as escolhas alimentares e a qualidade da dieta com aplicação da Teoria de Resposta ao Item**. 2019. 225f. Tese (Doutorado em Nutrição em Saúde Pública) – Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, 2019.

Introdução – O estudo do conhecimento nutricional, das motivações para as escolhas alimentares e da qualidade da dieta traz informações importantes para o controle das crescentes prevalências de excesso de peso e doenças crônicas. Apesar da eficiência das estratégias de controle depender de uma escala de boa qualidade, se desconhece a precisão das escalas existentes ou estas não estão em acordo com recomendações vigentes. **Objetivo** – Desenvolver escalas para avaliar o conhecimento nutricional, a motivação de saúde para escolhas alimentares e a qualidade da dieta com aplicação da Teoria de Resposta ao Item (TRI). **Métodos** - Para desenvolver as escalas de conhecimento nutricional (NKTS) e motivação de saúde para as escolhas alimentares (SOFIE) foram utilizados questionários já existentes e utilizados no estudo HELENA, uma investigação multicêntrica da União Europeia: *Nutritional Knowledge Test* (NKT) e *Food Choices and Preferences* (FCP). Para desenvolver a escala de qualidade da dieta (ESQUADA) foi desenvolvido um questionário, baseado no Guia Alimentar para a População Brasileira e cuja relevância e compreensão foram estudadas a partir das sugestões de nutricionistas, em grupos focais, e adolescentes e jovens adultos brasileiros, em um questionário *online*. Para cada escala, a dimensionalidade dos itens foi estudada separadamente pela análise fatorial exploratória. A TRI foi aplicada para identificar os itens com melhor discriminação da informação de interesse, bem como localizá-los nos diferentes níveis do *continuum* e calcular os escores dos indivíduos. Foi verificada a associação entre os escores de NKTS e SOFIE com consumo de alimentos e biomarcadores nutricionais, avaliados no estudo HELENA. Para construir as escalas foram utilizados BILOG-MG versão 3, GGUM 2004 e o R. As sugestões dos nutricionistas foram analisadas no MAXQDA versão 12. As sugestões dos adolescentes e jovens adultos e a caracterização das escalas foram realizadas no Microsoft Office Excel versão 2013. O estudo das associações foi realizado no Stata

versão 14. **Resultados** – A análise fatorial e a TRI indicaram que onze itens do NKT e dezesseis itens do FCP avaliam adequadamente o conhecimento nutricional e a motivação de saúde para as escolhas alimentares, compondo, respectivamente, NKTS e SOFIE. NKTS identifica indivíduos com conhecimento nutricional básico, adequado e avançado. SOFIE classifica indivíduos com baixa, indiferente e alta motivação de saúde para as escolhas alimentares. Os escores de NKTS e SOFIE associaram positivamente com marcadores de alimentação saudável. Em relação à ESQUADA, os nutricionistas consideraram os itens relevantes para avaliar a qualidade da dieta, mas indicaram a necessidade de alterar a escrita de alguns, bem como de suas alternativas de resposta. Todos os itens foram facilmente compreendidos por adolescentes e adultos jovens. A análise fatorial e a TRI reteram 25 itens para a ESQUADA, possibilitando identificar cinco níveis de qualidade da dieta. **Conclusão** - NKTS, SOFIE e ESQUADA, respectivamente, apresentaram medidas acuradas do conhecimento nutricional, das motivações de saúde para as escolhas alimentares e da qualidade da dieta, permitindo caracterizar seus diferentes níveis. Outros estudos podem analisar a relação entre ESQUADA e marcadores de consumo alimentar, bem como selecionar as escalas desenvolvidas para avaliação em outras populações.

Palavras-chave: Alimentação. Psicometria. Pesquisa qualitativa. Teoria de resposta ao item.

ABSTRACT

SANTOS, Thanise Sabrina Souza. **NKTS, SOFIE and ESQUADA: scales to evaluate the nutritional knowledge, the motivations influencing food choices, and the quality of diet using the Item Response Theory**. 2019. 225f. Tese (Doutorado em Nutrição em Saúde Pública) – Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, 2019.

Introduction – The study of the nutritional knowledge, the motivations to food choices, and the diet quality provides important information to control the increasing prevalences of overweight and chronic diseases. Although the effectiveness of the control strategies depends on a good quality scale, the accuracy of existing scales is unknown or these scales are not in line with current recommendations. **Objective** – This thesis aimed to develop scales to evaluate the nutritional knowledge, health motivation influencing food choices, and diet quality using the IRT analysis. **Methods** – Due to develop the scales of the nutritional knowledge (NKTS) and health motivation to food choices (SOFIE), questionnaires already used in the HELENA study, a European multicenter research, were used: Nutritional Knowledge Test (NKT) and Food Choices and Preferences (FCP). Due to develop the scale of diet quality (ESQUADA), a questionnaire, based on the Food Guide for the Brazilian Population, was created. The relevance and laypersons' comprehension of this questionnaire were studied based on the suggestions from: nutritionists using focus groups' discussions and Brazilian adolescents and young adults using an online questionnaire. The dimensionality of the items was analysed separately using the exploratory factor analysis for each scale. The IRT analysis was applied to identify the items with the best discrimination of the information of interest, as well as to locate them at the different levels of the continuum and to calculate the IRT scores. The association between IRT scores, food consumption and nutritional biomarkers was analyzed around NKTS and SOFIE. The softwares BILOG-MG version 3, GGUM 2004, and R were used to construct the scales. The nutritionists' suggestions were analyzed in MAXQDA version 12. The laypersons' suggestions and the characterization of each scale level were performed in Microsoft Office Excel version 2013. The study of association was performed in Stata version 14. **Results** – Factor

analysis and IRT analysis indicated that eleven items from NKT and sixteen items from FCP adequately evaluate the nutritional knowledge and health motivation influencing food choices and compose NKTS and SOFIE, respectively. NKTS identifies individuals with basic, adequate, and advanced nutritional knowledge. SOFIE classifies individuals with low, indifferent, and high health motivation influencing food choices. The scores from NKTS and SOFIE were positively associated with healthy food markers. Regarding the ESQUADA, the nutritionists considered the items relevant to assess the quality of diet. However, they indicated the need to change the writing of some items as well as their response options. Adolescents and young adults easily understood all items. The factor analysis and IRT analysis retained 25 items in ESQUADA, possibiliting to identify five levels of diet quality. **Conclusion** - NKTS, SOFIE, and ESQUADA, respectively, presented accurate measures of nutritional knowledge, health motivation to food choices, and quality of diet, allowing the characterization of their different levels. Other studies may analyze the relationship between ESQUADA and food consumption, as well as select the developed scales to evaluate these latent traits in other populations.

Keywords: Eating. Psychometric. Qualitative research. Item response theory.

LISTA DE ABREVIATURAS E SIGLAS

AHEI: *Alternate Healthy Eating Index* (Índice de Alimentação Saudável Alternativo)

CAPES: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior

DCNT: Doenças Crônicas Não Transmissíveis

DIF: *Differential Item Functioning* (Comportamento Diferencial do Item)

ESQUADA: Escala de qualidade da dieta

FCP: *Food Choices and Preferences* (Preferências e Escolhas Alimentares)

GAPB-2008: Guia Alimentar para População Brasileira; versão publicada em 2008

GAPB-2014: Guia Alimentar para População Brasileira; versão publicada em 2014

HEI: *Healthy Eating Index* (Índice de Alimentação Saudável)

HELENA: *Healthy Lifestyle in Europe by Nutrition in Adolescence* (Estilo de Vida Saudável na Europa de acordo com a Nutrição na Adolescência)

IQD: Índice de Qualidade da Dieta

IQD-GAD: Índice de Qualidade da Dieta - Guia Alimentar Digital

IQD-R: Índice de Qualidade da Dieta Revisado

IQR: *Healthy Meal Index* (Índice da Qualidade da Refeição)

NKT: *Nutritional Knowledge Test* (Teste de Conhecimento Nutricional)

NKTS: *Nutritional Knowledge Test Scale* (Escala de Avaliação do Conhecimento Nutricional)

PeNSE: Pesquisa Nacional de Saúde do Escolar

PNS: Pesquisa Nacional de Saúde

POF: Pesquisa de Orçamentos Familiares

SOFIE: *Scale of evaluation of food choices* (Escala de Avaliação das Motivações de Saúde para as Escolhas Alimentares)

TRI: Teoria de Resposta ao Item

VIGITEL: Vigilância dos Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico

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1. EVIDÊNCIAS QUE MOTIVARAM O ESTUDO DO CONHECIMENTO NUTRICIONAL, DAS MOTIVAÇÕES PARA AS ESCOLHAS ALIMENTARES, DA QUALIDADE DA DIETA E DOS INSTRUMENTOS DE MEDIDA

Este tópico da tese apresenta as evidências teóricas que motivaram o estudo de instrumentos de medida do conhecimento nutricional, das motivações para as escolhas alimentares e da qualidade da dieta diante das crescentes prevalências de excesso de peso e Doenças Crônicas Não Transmissíveis (DCNT). O perfil epidemiológico e nutricional atual é descrito brevemente, demonstrando a necessidade por estratégias que estimulem um melhor conhecimento sobre os nutrientes, uma maior motivação da saúde para a escolha de um alimento e não de outro, bem como uma melhor qualidade da dieta. Este tópico também apresenta a relevância de usar instrumentos de qualidade psicométrica para obter informações precisas e a necessidade de desenvolver uma medida mais acurada e coerente com as recomendações de alimentação vigentes.

1.1. Contexto epidemiológico e nutricional

Na atualidade, o excesso de peso é descrito como um importante problema de saúde pública em nível mundial em diferentes faixas etárias. São crescentes as prevalências de excesso de peso entre crianças e adolescentes (NCD-RisC, 2017; WHO, 2004), refletindo no aumento dos indicadores de DCNT e fatores de risco ainda na infância e adolescência. Além deste desenvolvimento precoce, este quadro tende permanecer na vida adulta (OLIVEIRA et al., 2009; WHO, 2004).

O aumento nas prevalências de obesidade relaciona-se com maiores taxas de mortalidade por doenças correlacionadas ao excesso de peso. Doenças cardiovasculares e diabetes são as principais causas de morte entre os indivíduos obesos (ASHKAN et al., 2017). Diante desta tendência crescente nas prevalências de obesidade, é necessária uma adequada assistência de promoção à saúde e proteção contra as DCNT (LESSA, 2004). Não apenas a saúde da população, mas, também, o contexto cultural, social e econômico do país apresenta reflexos deste quadro epidemiológico e nutricional (COUTINHO; GENTIL; TORAL, 2008). A obesidade resulta em uma menor qualidade de vida geral, maior incidência de

DCNT, afastamento do emprego, redução da renda e maiores gastos médicos (SU et al., 2015).

As políticas públicas assumem papel importante para promoção da saúde e prevenção e tratamento de seus agravos em todas as fases da vida. Neste sentido, o plano de ações globais da Organização Mundial de Saúde para a prevenção e o controle de doenças não transmissíveis em 2013 – 2020 propõe o fim do crescimento no número de casos de diabetes e obesidade, 25% de redução na mortalidade por doenças cardiovasculares, câncer, diabetes e doenças respiratórias crônicas e 25% de redução na prevalência de hipertensão (WHO, 2013).

A alimentação é um importante fator de risco para o excesso de peso (POSKITT, 2009) e, quando inadequada, relaciona-se com o desenvolvimento de DCNT devido à alta densidade energética; ao maior tamanho das porções; ao baixo conteúdo em fibras, micronutrientes e fitoquímicos; ao conteúdo em gorduras de má qualidade (gordura saturada e *trans*); à alta carga glicêmica; e, aos aromas intensos (LUDWIG, 2011).

Alimentos tradicionais e regionais têm sido substituídos por hábitos ocidentalizados e globalizados não apenas no Brasil, mas, também, em populações de diversos países ao redor do mundo. A forma com que diversas populações combinam os alimentos em suas refeições cotidianas resulta em hábitos alimentares mais tradicionais, mais ocidentalizados ou ainda mesclas de alimentos tradicionais com produtos processados ou ultraprocessados (HU, 2002). E, a indústria de alimentos tem explorado as vulnerabilidades biológicas, fisiológicas, sociais e econômicas dos indivíduos de forma a favorecer a preferência por seus produtos (ROBERTO et al., 2015).

A alimentação não se restringe apenas ao consumo de nutrientes e não segue um padrão fixo, variando de pessoa para pessoa, de um dia para outro, entre estações do ano, entre diferentes épocas do mês, entre diferentes idades e sexo. Isso já é suficiente para dificultar uma avaliação do consumo (PEREZ RODRIGO, 1995). A melhor compreensão da relação entre alimentação e DCNT ainda é um desafio para a Nutrição.

Diferentes fatores influenciam as escolhas alimentares dos indivíduos, como: a cultura alimentar; as normas sociais; as companhias enquanto come; o estado emocional dos indivíduos; o sabor dos alimentos; os benefícios dos alimentos para a saúde; o conhecimento sobre alimentação e nutrição; a conveniência do consumo; o

preço dos alimentos; o efeito dos alimentos na saciedade; o *marketing*; a segurança alimentar e; a sustentabilidade (CUNHA et al., 2018; BRASIL, 2012; FOTOPOULOS et al., 2009; CONTENTO et al., 2006; STEPTOE et al., 1995).

Existem, portanto, diferentes abordagens para avaliar a alimentação, variando conforme a natureza dos dados, o método escolhido e as vias de entrada (se em nível de disponibilidade, aquisição ou práticas - domésticas ou individuais). O pesquisador pode optar por investigar o que os indivíduos relatam fazer, suas opiniões ou valores (POULAIN; PROENÇA, 2003), garantindo a precisão destas informações com a aplicação de escalas cujas evidências de validação sejam conhecidas. Enquanto a avaliação da qualidade da dieta permite extrair o que os indivíduos relatam comer, o estudo das motivações para as escolhas alimentares indica possíveis influências para seleção de um alimento e não de outro. Já a avaliação do conhecimento nutricional permite investigar o quanto o indivíduo sabe sobre nutrientes e suas funções.

1.2. Conhecimento nutricional

Um maior conhecimento nutricional não garante que os indivíduos tenham escolhas alimentares mais saudáveis (SPRONK et al., 2014; POULAIN; PROENÇA, 2003). Por outro lado, promover o conhecimento nutricional pode melhorar a saúde e os hábitos alimentares dos indivíduos (SPRONK et al., 2014; SICHERT-HELLERT et al., 2011). A literatura científica tem mostrado uma relação positiva entre conhecimento nutricional e o consumo de frutas e hortaliças (MÖTTELI et al., 2016; SPRONK et al., 2014) e negativa com bebidas açucaradas (SPRONK et al., 2014).

Os questionários para avaliar o conhecimento nutricional geralmente incluem perguntas sobre o conhecimento dos guias alimentares, fontes e funções dos nutrientes, mitos em alimentação, bem como relação entre alimentação e doenças (SPRONK et al., 2014). As perguntas são geralmente do tipo certo ou errado, múltipla escolha ou discursivas (SPRONK et al., 2014; PARMENTER; WARDLE, 2000). Entretanto, se observa uma lacuna na literatura científica em relação a instrumentos de qualidade para uma avaliação acurada do nível de conhecimento nutricional da população.

Spronk e colaboradores (2014) e Parmenter e Wardle (2000) indicam uma necessidade em melhorar a qualidade dos instrumentos existentes ou desenvolver

novas medidas, de forma a aumentar a eficácia das políticas públicas de saúde e nutrição. Parmenter e Wardle (2000) apresentam algumas orientações para a avaliação dos questionários existentes que investigam o conhecimento nutricional de indivíduos e populações, bem como para a construção de uma nova medida do constructo. Entretanto, estas orientações não diferem muito das dispostas para construção de escalas de diferentes constructos (FURR; BACHARACH, 2014; DEVELLIS, 2017).

Parmenter e Wardle (2000) ainda recomendam uma atenção especial para as orientações de preenchimento dos questionários de forma a evitar que os respondentes se sintam pressionados com a aplicação de um ‘teste’ para investigar o nível de conhecimento nutricional. Para garantir a qualidade das respostas, estes autores orientam apresentar instruções que estimulem o preenchimento de todo o questionário e a fidedignidade das respostas. Além disso, eles apontam que se o objetivo é estudar a relação entre conhecimento nutricional e consumo alimentar, os itens do questionário devem sustentar esta associação.

1.3. Motivações para as escolhas alimentares

O estudo sobre as escolhas alimentares permite acessar informações a um nível de valores para escolher um alimento e não outro (SMITH; CUNNINGHAM-SABO, 2013; POULAIN; PROENÇA, 2003). Cultura, normas, conhecimento, sabor e saúde são alguns dos fatores que podem motivar as escolhas alimentares (CUNHA et al., 2018; FOTOPOULOS et al., 2009; CONTENTO et al., 2006). Entretanto, estes fatores podem variar entre diferentes alimentos, sendo que a escolha de um alimento pode estar associada a um motivo específico. Por exemplo, escolher a salada e não o sanduíche pode se justificar pelo maior estímulo e preocupação com a saúde. Por outro lado, as motivações também podem variar entre refeições. Assim, as escolhas dos alimentos consumidos no jantar podem ser mais influenciadas pela saúde do que no almoço (CONTENTO et al., 2006).

Apesar do conhecimento do que motiva a escolha ser relevante para uma maior efetividade das atividades de educação nutricional (CONTENTO et al., 2006), os questionários existentes, ao considerarem os vários fatores que influenciam as escolhas alimentares, apresentaram diferenças quanto às suas dimensões devido a

uma mudança de paradigma com o passar do tempo, bem como às diferenças culturais (CUNHA et al., 2018; FOTOPOULOS et al., 2009).

Uma alternativa para avaliar as motivações para as escolhas alimentares é concentrar-se em um fator específico, abrangendo as características da população e os objetivos do estudo (CUNHA et al., 2018). Neste sentido, o questionário pode avaliar apenas uma das motivações para as escolhas alimentares, por exemplo, a saúde. Apesar da preocupação com a saúde ser um fator importante para a seleção de alimentos mais saudáveis, ela não é o principal motivador para a escolha de determinado alimento (CUNHA et al., 2018; CONTENTO et al., 2006). Uma avaliação concentrada apenas no fator saúde pode promover uma melhor compreensão de como e quanto ela motiva a seleção de um alimento e não de outro.

1.4. Qualidade da dieta

Diante das mudanças nos padrões alimentares e do crescimento na incidência de obesidade e DCNT associadas com a alimentação, a análise por nutrientes, que se destacou na prevenção das deficiências nutricionais, tem se mostrado insuficiente para o controle do perfil epidemiológico atual. As inter-relações entre nutrientes e compostos bioativos não nutrientes refletem em efeitos na saúde distintos daqueles resultantes de suas atividades biológicas isoladas (KANT et al., 2000). Assim, muitos pesquisadores em epidemiologia nutricional têm analisado o consumo alimentar de indivíduos e populações na forma de combinações alimentares buscando encontrar possíveis efeitos destas diferentes combinações na saúde e prevenção de DCNT (HU, 2002).

Diante disso, as orientações de promoção da saúde e prevenção de doenças não devem se sustentar em um modelo fixo de alimentação saudável, mas considerar a complexidade do ato de se alimentar, com influências sociodemográficas, culturais, afetivas e sensoriais (BRASIL, 2014; BEM-SHALON; FOX; NEWBY, 2012). Alimentos não saudáveis podem ser consumidos em dias atípicos e não serem parte do costume alimentar de um indivíduo, que em outros dias tem um consumo saudável. O consumo em dia atípico não desqualifica a qualidade da dieta, que considera a frequência de consumo de alimentos saudáveis e não saudáveis (BEM-SHALON; FOX; NEWBY, 2012).

Dentre os instrumentos que usam esta abordagem voltada para as combinações alimentares, têm sido utilizados marcadores de consumo (BRASIL, 2015a) e índices para avaliação da qualidade da dieta. Estes índices variam conforme o objetivo em avaliar a adequação aos guias alimentares e às recomendações nutricionais, metodologia de construção dos componentes, bem como a facilidade de aplicação e análise (ARVANITI; PANAGIOTAKOS, 2008; WAIJERS; FESKENS; OCKÉ, 2007).

O Índice de Alimentação Saudável (HEI, do inglês: *Healthy Eating Index*) se baseou no guia alimentar americano e na pirâmide alimentar americana, incluindo adequação ao número de porções recomendadas para cereais, vegetais, frutas, leite e carnes; percentuais de consumo de gordura total e gordura saturada para ingestão total de energia; consumo de colesterol e sódio; e variedade da dieta (KENNEDY et al., 1995). Apesar dos diferentes componentes, o HEI apresenta limitações ao não diferenciar cereais refinados dos integrais e não incluir fibras, gorduras poliinsaturadas e peixes (ARVANITI; PANAGIOTAKOS, 2008; WAIJERS; FESKENS; OCKÉ, 2007).

A versão alternativa do HEI, conhecida por AHEI (do inglês: *Alternate Healthy Eating Index*) buscou suprir pontos falhos na medida original, alterando os componentes e a metodologia de pontuação. O AHEI é composto por 9 componentes, incluindo o consumo de vegetais, frutas, oleaginosas e soja, fibras, gorduras trans e álcool, além das razões entre consumo de carne vermelha e carne branca e entre consumo de gordura poliinsaturada e gordura saturada, bem como o componente multivitamínico (MACCULLOUGH et al., 2002). As alterações incorporadas no AHEI melhoraram a relação entre a pontuação total e fatores de risco para DCNT (ARVANITI; PANAGIOTAKOS, 2008).

O Índice de Aderência ao Guia Alimentar Americano de 2005 (do inglês: *2005 Dietary Guidelines for Americans Adherence Index*) buscou refletir as mudanças deste guia e melhor identificar indivíduos com consumo excessivo de alimentos com maior densidade energética. Este índice inclui onze itens para verificar a aderência às recomendações de energia, incluindo calorias vazias provenientes de óleos, gorduras e açúcares de adição e ultraprocessados, e nove itens para verificar a aderência às recomendações nutricionais para escolhas saudáveis (FOGLI-CAWLEY et al., 2006).

O Índice da Qualidade da Refeição (IQR; do inglês: *Healthy Meal Index*) buscou avaliar a qualidade nutricional das refeições de cantinas, se baseando nas recomendações para alimentos e nutrientes e permitindo a visualização do planejamento das refeições. O IQR tem como componentes: frutas e vegetais; gordura total e qualidade da gordura; e, grãos integrais e batatas (LASSEN et al., 2010).

O Índice da Qualidade de Bebidas (do inglês: *Healthy Beverage Index*) foi desenvolvido para verificar a qualidade de todas as bebidas ingeridas e determinar os padrões de ingestão que estão associados à melhor saúde. Este índice se baseou nas recomendações de energia e de quantidades de bebidas, compreendendo dez componentes: água; café e chás não adoçados; leites com menos gordura; bebidas *diet*; sucos naturais; bebidas alcoólicas; leite integral; bebidas adoçadas; energia total das bebidas consumidas; e, consumo total de bebidas, em mililitros (DUFFEY; DAVY, 2015).

No Brasil, o Índice de Qualidade da Dieta (IQD), adaptado à pirâmide alimentar brasileira, compreende dez componentes: grupos de alimentos (cereais, pães tubérculos e raízes; verduras e legumes; frutas; leite e produtos lácteos; carnes, ovos e feijão), gordura total, gordura saturada, colesterol, sódio e variedade da dieta. Os autores entendiam que estes componentes poderiam caracterizar uma alimentação saudável, permitindo classificar a qualidade da dieta em 'inadequada', 'necessita modificação' e 'saudável' (FISBERG et al., 2004).

Em 2008, com a publicação do Guia Alimentar para a População Brasileira - GAPB-2008 (BRASIL, 2008), existiu a necessidade de revisão do IQD, originando o Índice de Qualidade da Dieta Revisado (IQD-R). Ele compreende componentes (1) baseados no consumo de alimentos (fruta total; fruta integral; vegetais totais; vegetais - verde escuros e alaranjados - e leguminosas; cereais totais; cereais integrais; leite e derivados; carnes, ovos e leguminosas); (2) baseados na ingestão de nutrientes (sódio e gordura saturada); e, (3) baseados no consumo de nutrientes (valor energético proveniente da ingestão de gordura sólida, saturada e *trans*, álcool e açúcar de adição) e no grupo de óleos, gorduras e sementes oleaginosas (óleo, oleaginosas e gordura de peixe). O IQD-R ajustou o número de porções de alimentos recomendado pelo GAPB-2008, bem como a recomendação de sódio, pela ingestão energética (1000 calorias por dia). Os componentes de valor

energético se baseiam na recomendação para o valor energético total consumido pelo indivíduo (PREVIDELLI et al., 2011).

O Índice de Qualidade da Dieta - Guia Alimentar Digital (IQD-GAD) também considerou o número recomendado de porções ajustado pela ingestão energética (1000 calorias por dia), dividindo os doze grupos de alimentos em dois blocos maiores conforme relação com moderação ou adequação da dieta. A pontuação de cada componente foi definida conforme consumo de acordo ou não com a recomendação do Guia Alimentar Digital (CAIVANO; DOMENE, 2013).

Diante do interesse por desenvolver índices de qualidade, a literatura científica tem indicado que quando a relação entre doença e alimentação já está bem estabelecida, abordagens *a priori*, baseadas em recomendações, como o IQD, são mais vantajosas do que aquelas *a posteriori*. Porém, elas podem incluir incertezas na seleção dos componentes individuais do escore e subjetividade na definição dos pontos de corte (HU, 2002). No IQD, por exemplo, os componentes contribuem com o mesmo peso na pontuação total (ASSUMPÇÃO et al., 2012; WAIJERS; FESKENS; OCKÉ, 2007). Consequentemente, o IQD tem apresentado menores associações com variáveis independentes em comparação com cada componente do índice separadamente (ARVANITI; PANAGIOTAKOS, 2008). Em avaliação da confiabilidade e validade do IQD-R e IQD-GAD, foram observadas fracas correlações entre os escores dos componentes e a pontuação final (ANDRADE et al., 2013; CAIVANO; DOMENE, 2013). Mesmo assim, os autores consideram que estes índices são confiáveis e válidos para avaliar e monitorar a qualidade da dieta de brasileiros (ANDRADE et al., 2013; CAIVANO; DOMENE, 2013).

Os índices de qualidade da dieta existentes são dependentes de uma análise prévia de inquéritos dietéticos, como recordatório de 24 horas e questionário de frequência. Esta análise, por sua vez, além de demandar mais recursos, pode resultar em dados de consumo imprecisos devido ao não controle da variabilidade intra-individual inerente à alimentação (ARVANITI; PANAGIOTAKOS, 2008). Aqueles índices cujos componentes se voltam para a ingestão de um nutriente específico podem, também, dificultar o desenvolvimento de políticas públicas, bem como de atividades de educação nutricional (ARVANITI; PANAGIOTAKOS, 2008). Segundo Waijers, Feskens e Ocké (2007), um índice que tem como finalidade a promoção da saúde deveria se orientar por alimentos em vez de nutrientes.

Percebe-se que os índices de qualidade da dieta se concentram no aspecto nutricional da alimentação, ora olhando para adequação do consumo de nutrientes ou grupos de alimentos, ora combinando estas duas abordagens, conforme conhecimento da época em que foram desenvolvidos. Além disso, existe uma subjetividade na definição da pontuação total e de cada componente, o que tem refletido na observação de resultados questionáveis (ALKERWI, 2014; WAIJERS; FESKENS; OCKÉ, 2007). Surge, portanto, uma necessidade de ampliar o conceito de qualidade da dieta para além da adequação às recomendações de consumo de nutrientes e alimentos (ALKERWI, 2014; CERVATO; VIEIRA, 2003).

Em um olhar mais holístico, a qualidade da dieta é estudada em sua complexidade considerando quatro dimensões (ALKERWI, 2014):

- a) Nutricional: considera os aspectos de diversidade, adequação e moderação da dieta, bem como sua densidade nutricional, seu perfil antiinflamatório e sua capacidade antioxidante;
- b) Sociocultural: considera o preparo, a apresentação e o consumo dos alimentos, bem como o hábito de comer em companhia e a influência de crenças ou grupos para seleção dos alimentos;
- c) Organoléptica: considera a aparência e o sabor dos alimentos a partir da avaliação da percepção dos indivíduos;
- d) Segurança alimentar: considera o estoque, a manipulação e o preparo dos alimentos para garantir a segurança alimentar em seus aspectos químicos e microbiológicos. Neste sentido, a avaliação do consumo de lanches de rua ou feitos em casa, a presença de aditivos ou toxinas nos alimentos consumidos podem exemplificar a avaliação a qualidade da dieta em seu aspecto de segurança alimentar.

Uma medida de qualidade da dieta que busca cobrir suas diferentes vertentes não tem como foco uma avaliação precisa da adequação às recomendações nutricionais de consumo. Além de considerar esta multidimensionalidade, esta medida deve ser de fácil manuseio, apresentar perguntas para alimentação habitual dos indivíduos, fornecer o escore final, bem como ser de fácil compreensão, resposta e interpretação (por exemplo, propor pontos de corte de interpretação para diferentes níveis de qualidade da dieta) (GALLUP, 2016).

Em seu aspecto nutricional, é fundamental que uma medida de qualidade da dieta inclua o consumo de alimentos relacionados com as DCNT, como: frutas e

vegetais, grãos integrais, legumes, oleaginosas e alimentos ultraprocessados (como carnes processadas, bebidas açucaradas, salgadinhos de pacote e macarrão instantâneo). A avaliação do consumo destes alimentos, por sua vez, é consistente com o reconhecimento de sistemas alimentares sustentáveis. Já a avaliação do consumo de carnes, ovos, leite e óleos vegetais apresenta-se menos relevante para uma medida de qualidade da dieta do que dos primeiros grupos mencionados, considerando os efeitos controversos para saúde e para o meio ambiente (GALLUP, 2016).

Em relação ao aspecto sociocultural, a qualidade da dieta relaciona-se com outros atributos da alimentação como frequência, regularidade e omissão de refeições e lanches; estrutura das refeições; local onde a refeição é realizada; companhia durante a refeição e, realização de atividades simultâneas à refeição (LEECH et al., 2015; POSKITT, 2009).

A avaliação do aspecto organoléptico da qualidade da dieta considera a avaliação da percepção (ALKERWI, 2014). Entretanto, um instrumento que se propõe refletir a qualidade da dieta não deve apresentar perguntas sobre percepção (GALLUP, 2016). Sendo assim, apesar de ser uma importante dimensão da qualidade da dieta, entende-se que o aspecto organoléptico deve ser avaliado separadamente em uma medida de autopercepção.

1.5. Novo Guia Alimentar para a População Brasileira

Conforme mencionado anteriormente, os guias alimentares orientam a construção dos índices de avaliação da qualidade da dieta (ARVANITI; PANAGIOTAKOS, 2008; WAIJERS; FESKENS; OCKÉ, 2007). No Brasil, em 2014, o Ministério da Saúde publicou uma nova versão do Guia Alimentar para a População Brasileira (GAPB-2014) em substituição à versão anterior (GAPB-2008). O GAPB-2014 considera a alimentação mais do que apenas a ingestão de nutrientes, incorporando recomendações quanto às maneiras de comer (considerando a regularidade e atenção ao comer, o ambiente onde são realizadas as refeições e a companhia ao preparar os alimentos e comer) e às combinações de alimentos (BRASIL, 2014).

O GAPB-2008 se baseia na classificação dos alimentos orientada pela pirâmide dos alimentos, que propõe oito grupos conforme a característica nutricional

(BRASIL, 2008) e foi referência para elaboração do IQD-R (PREVIDELLI et al., 2011). Entretanto, a abordagem da pirâmide é controversa e inconsistente ao reunir em um mesmo grupo alimentos com perfil nutricional e impactos na saúde diferentes. No grupo das carnes, por exemplo, estão agrupadas tanto carnes frescas quanto carnes processadas. Estes alimentos, porém, têm qualidades diferentes devido ao nível de processamento (MONTEIRO et al., 2010). Este aspecto não tem importância apenas para a classificação dos alimentos, mas, também, porque o seu consumo pode estar relacionado a outras práticas alimentares inadequadas (COSGROVE; FLYNN; KIELY, 2005).

Diante deste contexto de questionamento da metodologia para classificar os alimentos, o GAPB-2014 se baseou na NOVA classificação que considera o objetivo e a extensão do processamento (BRASIL, 2014; MONTEIRO et al., 2010) e incorporou um olhar mais amplo da alimentação (BRASIL, 2014). Surge, assim, a necessidade de propor instrumentos de medida coerentes com este novo paradigma apresentado no GAPB-2014.

Três anos após a publicação do GAPB-2014 foi publicada uma escala para autoavaliação da alimentação em coerência com as recomendações alimentares vigentes, incluindo perguntas sobre escolhas alimentares, modos de comer, organização doméstica para o preparo das refeições e planejamento das refeições diárias (BRASIL, 2019; GABE; JAIME, 2019).

1.6. Desenvolvimento de instrumentos

Frente às diferentes abordagens para avaliar a alimentação, o pesquisador tem o desafio de escolher o instrumento que melhor se adequa aos seus objetivos de investigação. Assim, esta escolha deve se orientar pelas características e limitações da coleta de dados, pela teoria que embasa o fenômeno de interesse e, também, pelas evidências psicométricas deste instrumento (FURR; BACHARACH, 2014).

Na ausência de um instrumento que avalie o constructo de interesse, ou seja, o fenômeno que se deseja medir, o pesquisador deve se dedicar ao desenvolvimento de um novo questionário de maneira a garantir que a medida seja relevante e precisa. Após a definição do construto a ser avaliado, por exemplo: conhecimento nutricional, motivações de saúde para escolhas alimentares ou

qualidade da dieta, deve-se propor um conjunto de itens e opções de resposta que reflitam o fenômeno estudado, sem redundância e com uma escrita compreensível para a população alvo (DEVELLIS, 2017). Nesta etapa de desenvolvimento dos questionários, devem ser elaborados itens não apenas com o maior número possível de informações, mas, principalmente, que estas sejam válidas e confiáveis e respondam à pergunta do estudo (RODRIGUES et al., 2013).

Apesar da bagagem teórica que está por trás do desenvolvimento de um instrumento, não é possível afirmar que ele reflita totalmente o constructo de interesse. Para isso, é necessário o estudo do quão válido ele é em relação ao que se propõe medir (FURR; BACHARACH, 2014; DEVELLIS, 2017).

1.7. Validação de instrumentos

Em um olhar mais geral, a validação de um instrumento pode ser definida como a acurácia que ele mede o constructo que se propõe medir (VIOQUE LÓPES, 2006; NELSON; BINGHAM, 1997). Entretanto, o processo de validar um instrumento é complexo. Tradicionalmente, os estudos de validação são delineados de maneira a identificar três tipos de validade do novo instrumento: conteúdo, critério e constructo (PASQUALI, 2009; POLIT; BECK; HUNGLER, 2004). Neste modelo ortogonal de validação, a validade de conteúdo é entendida como o estudo da extensão que os itens refletem o fenômeno avaliado a partir da revisão por especialistas da área. A validade de critério corresponde à análise do grau em que o instrumento novo identifica o fenômeno em comparação quando este é avaliado por um padrão ouro. Já a validade de constructo é entendida como o estudo do grau em que o instrumento novo reflete as relações teóricas do fenômeno com outras variáveis (DEVELLIS, 2017; PASQUALI, 2009; POLIT; BECK; HUNGLER, 2004).

Em uma perspectiva mais abrangente, a validade de constructo é considerada como o conceito central dos estudos de validação. Diferente do modelo ortogonal (DEVELLIS, 2017; PASQUALI, 2009; POLIT; BECK; HUNGLER, 2004), nesta perspectiva, o estudo da validade de um instrumento se organiza em um modelo pentagonal. Ou seja, para o estudo da validade de um instrumento novo ou já existente, o pesquisador deve reunir as cinco evidências de validação que apoiam o seu uso, apresentadas a seguir (FURR; BACHARACH, 2014):

- a) Conteúdo do teste: compreende o estudo dos itens do instrumento por especialistas da área, que avaliam relevância e representação do constructo;
- b) Processo de resposta: compreende o estudo dos processos envolvidos para responder ao instrumento, por exemplo, leitura das instruções e progresso entre os itens;
- c) Estrutura interna do teste: compreende o estudo da relação entre os itens e as dimensões do instrumento. O instrumento deve ser aplicado a um grupo de indivíduos da população de interesse e suas respostas são analisadas usando a análise fatorial para identificar os itens e dimensões que vão compor o instrumento final;
- d) Consequências do uso: compreende o estudo de fatores que possam influenciar as respostas aos itens, bem como interpretações dos escores. Neste sentido, deve ser estudado se algum item apresenta comportamento diferente considerando diferentes características dos indivíduos, como sexo e idade, ou grupos, como profissionais de saúde;
- e) Associação com outras variáveis: compreende o estudo dos padrões de associações entre o escore obtido com o instrumento e outras variáveis, que indiquem o mesmo constructo (validade convergente; que pode ser concorrente ou preditiva) ou constructo diferente (validade divergente).

O modelo pentagonal complementa o ortogonal de maneira a contribuir para a qualidade dos estudos de validação e acurácia dos instrumentos propostos. A seguir, é apresentada uma breve comparação entre os três tipos de validade abarcados no modelo ortogonal e as cinco evidências de validação consideradas no modelo pentagonal (Quadro 1). O modelo pentagonal entende 'Estrutura interna do teste' e 'Associações com outras variáveis' como duas evidências diferentes da validade. O estudo da 'Estrutura interna do teste' busca identificar qual o conjunto de final itens que compõe o instrumento. Diferente do modelo ortogonal, que compara o fenômeno medido pelo instrumento proposto e por um padrão ouro, o modelo baseado nas cinco evidências se baseia no estudo das associações entre fenômeno e outras variáveis. Percebe-se ainda que, no modelo pentagonal, o 'Processo de resposta' e as 'Consequências do uso' são protocoladas como etapas de uma validação, destacando a importância de se considerar as características dos respondentes durante o estudo da validade de um instrumento. Muitas vezes o

termo ‘validade aparente ou de fase’ é utilizado em estudos que avaliam o grau que os respondentes interpretam o instrumento e/ou julgam se ele mede o que se propõe a medir. Entretanto, percepções individuais e de não especialistas não devem sustentar o estudo da validade de um instrumento. A não expressão direta do fenômeno pode ser objetivo do pesquisador ou inerente ao fenômeno e nem por isso resulta na não validade do instrumento (DEVELLIS, 2017).

Quadro 1: Comparação entre os modelos de validação ortogonal e pentagonal.

Modelo ortogonal	Modelo pentagonal
Validação de conteúdo	Conteúdo do teste
Validação de critério	
Validação de constructo	Estrutura interna do teste
	Associação com outras variáveis
	Processo de resposta
	Consequências do uso

Fonte: Próprio autor.

Conforme exposto, a evidência da estrutura interna do conjunto de itens é investigada usando a análise fatorial (DEVELLIS, 2017; FURR; BACHARACH, 2014), que permite conhecer a relação entre estes itens e identificar a organização deles em uma ou mais dimensões do constructo (DEVELLIS, 2017; FURR; BACHARACH, 2014; HAIR et al., 2009).

Duas teorias de medidas orientam a análise da estrutura interna: a Teoria Clássica dos Testes e a Teoria de Resposta ao Item (TRI). Enquanto a Teoria Clássica dos Testes identifica a relação entre os itens e as dimensões do instrumento a partir da análise fatorial (exploratória e confirmatória) e índices de consistência interna, a TRI complementa os resultados da análise fatorial exploratória com um estudo centrado em cada item, sem relevar os escores totais. Desta forma, a partir de um conjunto de respostas, possibilita criar uma escala de medida para traços latentes ou habilidades, ou seja, características que não podem ser observadas diretamente, mas podem ser mensuradas a partir de variáveis secundárias (itens). Assim, pode-se dizer que os traços latentes se manifestam a partir dos itens (FURR; BACHARACH, 2014; ARAÚJO; ANDRADE; BORTOLOTTI, 2009; PASQUALI, 2009; ANDRADE; TAVARES; VALLE, 2000). Como exemplos de

traços latentes da área da saúde pública cujas escalas de medida se basearam na TRI, tem-se a segurança alimentar familiar, qualidade de vida e o letramento em saúde (GOMES et al., 2018).

A Teoria de Resposta ao Item apresenta modelos acumulativos e de desdobramento conforme o tipo de resposta (cumulativa ou não) e de item (dicotômico ou politômico) (ARAÚJO; ANDRADE; BORTOLOTTI, 2009). Os modelos acumulativos pressupõem que as descrições dos itens são progressivas e cumulativas, permitindo que características do traço latente descritas em um nível inferior estejam contidas no superior. Assim, a partir do escore final de um indivíduo, é possível prever quais itens ele terá mais chances de selecionar ou não (BORTOLOTTI et al., 2013; CECCATO et al., 2008). Já nos modelos de desdobramento, a análise pressupõe que os indivíduos selecionam a opção de resposta que ele mais se identifica. Sendo assim, a partir do escore final de um indivíduo, é possível prever quais itens ele concorda (BORTOLOTTI et al., 2013; ARAÚJO; ANDRADE; BORTOLOTTI, 2009).

A análise centrada em cada item realizada na TRI ocorre a partir das estimativas de três parâmetros dos itens: discriminação, dificuldade ou localização e acerto casual. O parâmetro de discriminação indica a qualidade de cada item em discriminar indivíduos com diferentes níveis do traço latente; o parâmetro de dificuldade identifica a localização das categorias de resposta de cada item em todo o *continuum* de traço latente e; o parâmetro de acerto casual indica a probabilidade de resposta correta ao acaso para cada item (ANDRADE; TAVARES; VALLE, 2000).

O uso da TRI apresenta algumas vantagens em relação à Teoria Clássica dos Testes. Na TRI, os parâmetros dos itens bem como o escore de uma variável latente são estimados de maneira independente das características do conjunto de respondentes e itens respondidos, respectivamente (NGUYEN et al., 2014; YANG; KAO, 2014; BORTOLOTTI et al., 2013; ARAÚJO; ANDRADE; BORTOLOTTI, 2009). Portanto, a partir do escore total é possível elaborar intervenções ajustadas ao perfil individual de compreensão, bem como, acompanhar a evolução desta medida quando a escala for aplicada em diferentes momentos (CECCATO et al., 2008). Além disso, enquanto a Teoria Clássica dos Testes calcula o escore total a partir da soma das respostas corretas, a TRI se baseia em modelos de probabilidade de resposta conforme o nível do traço latente (NGUYEN et al., 2014; BORTOLOTTI et al., 2013).

A análise da estrutura interna do instrumento deve ser complementada com a análise de um possível comportamento diferencial do item (DIF; do inglês: *Differential Item Functioning*) dependendo das características dos respondentes, como sexo e idade. Ou seja, a análise se a probabilidade de escolher uma dada opção de resposta deste item com DIF é diferente entre indivíduos com mesmo escore, mas de sexos diferentes (FURR; BACHARACH, 2014). Para confirmar a evidência de validação quanto às consequências do uso e ser possível realizar comparações entre os escores de indivíduos com diferentes características, o item que apresenta DIF deve ser excluído do conjunto final (TERESI; FLEISHMAN, 2007).

Outra evidência de validade do instrumento compreende investigar o grau que ele se relaciona com outras variáveis, ou seja, avaliar se a associação entre o escore obtido com o instrumento proposto e outras variáveis está ou não de acordo com a teoria (FURR; BACHARACH, 2014). Por exemplo, um pesquisador sabe que maior conhecimento nutricional pode promover melhores hábitos alimentares (MÖTTELI et al., 2016; SPRONK et al., 2014). De maneira a buscar evidências de validação do seu questionário sobre conhecimento nutricional, este pesquisador pode comparar os escores de conhecimento nutricional com indicadores de consumo alimentar. Diante dos erros de medida dos inquéritos alimentares, este pesquisador pode complementar a análise do consumo com o estudo da concentração de marcadores bioquímicos no sangue (NELSON, 1997). Entretanto, é importante ponderar os fatores que também interferem na precisão destes parâmetros no sangue como as interações entre genes e nutrientes (JENAH et al., 2009).

Conforme foi exposto, avaliar o conhecimento nutricional, as escolhas alimentares motivadas pela saúde e a qualidade da dieta tem suas peculiaridades, sendo necessários instrumentos que permitam obter uma avaliação precisa. Entende-se que para gerar evidências desta acurácia, além do referencial teórico utilizado no desenvolvimento dos instrumentos, deve-se investigar se o entrevistado compreende o que está sendo-lhe questionado, bem como selecionar os itens que melhor se relacionam com o traço latente de interesse. A Teoria de Resposta ao Item tem se apresentado como uma boa estratégia para esta seleção dos itens em diferentes áreas do conhecimento, complementando e aprimorando as informações

fornecidas pela Teoria Clássica dos Testes. Por fim, para fortalecer o uso do instrumento proposto, é importante estudar as relações entre o escore e outras variáveis relacionadas com o traço latente.

2. OBJETIVOS

2.1. *Objetivo geral*

- Desenvolver e validar escalas para avaliar o conhecimento nutricional, as motivações de saúde para as escolhas alimentares e a qualidade da dieta de adolescentes e jovens adultos europeus e brasileiros com aplicação da Teoria de Resposta ao Item.

2.2. Objetivos específicos

- Desenvolver uma escala de avaliação do conhecimento nutricional (NKTS) baseada no questionário NKT com aplicação da TRI.
- Avaliar as associações entre os escores da escala NKTS e o consumo de alimentos e concentração de marcadores bioquímicos de adolescentes europeus.
- Desenvolver uma escala de avaliação das motivações de saúde para as escolhas alimentares (SOFIE) baseada no questionário FCP com aplicação da TRI.
- Avaliar as associações entre os escores da escala SOFIE e o consumo de alimentos e concentração de marcadores bioquímicos de adolescentes europeus.
- Elaborar itens para avaliar a qualidade da dieta de adolescentes e jovens adultos brasileiros.
- Avaliar a pertinência e compreensão dos itens sobre qualidade da dieta com nutricionistas, adolescentes e jovens adultos brasileiros.
- Desenvolver uma escala de avaliação da qualidade da dieta (ESQUADA) de adolescentes e jovens adultos brasileiros com aplicação da TRI.

3. METODOLOGIA

Os questionários utilizados para desenvolver as escalas de avaliação do conhecimento nutricional (SICHERT-HELLERT et al., 2011; DIEHL, 1999) e das motivações de saúde para as escolhas alimentares (GONZÁLEZ-GROSS et al., 2013) foram desenvolvidos e utilizados no HELENA (*Healthy Lifestyle in Europe by Nutrition in Adolescence*), estudo transversal e multicêntrico. Dez cidades, de nove países europeus, participaram: Viena (Áustria), Gent (Bélgica), Lille (França), Dortmund (Alemanha), Atenas e Iráclio (Grécia), Pécs (Hungria), Roma (Itália), Zaragoza (Espanha) e Estocolmo (Suécia). O estudo HELENA foi realizado entre outubro de 2006 e dezembro de 2007 com a participação de 3528 adolescentes com 12,5 a 17,49 anos de idade (MORENO et al., 2008).

Para a escala de qualidade da dieta, diante da ausência de um questionário coerente com as recomendações do GAPB-2014, esta tese envolveu a elaboração dos itens para a ESQUADA. Participaram da análise da relevância, clareza e compreensão destes itens, 35 nutricionistas e 112 adolescentes e jovens adultos brasileiros. A seleção dos itens finais da ESQUADA envolveu a participação de 2059 adolescentes e jovens adultos brasileiros entre março e abril de 2018.

As cinco evidências de validação, apresentadas em ‘Evidências que motivaram o estudo do conhecimento nutricional, das motivações para as escolhas alimentares, da qualidade da dieta e dos instrumentos de medida’, orientaram a metodologia aplicada nesta tese. Em relação à NKTS e SOFIE, esta tese se concentrou no estudo da estrutura interna e associações dos escores com consumo de alimentos e biomarcadores nutricionais. Em relação à ESQUADA, esta tese inclui o estudo do conteúdo do teste, processo de resposta, da estrutura interna e consequências do uso (Quadro 2).

Quadro 2: Evidências de validação analisadas das escalas para avaliar o conhecimento nutricional, as motivações de saúde para as escolhas alimentares e a qualidade da dieta.

Evidências de validação	NKTS	SOFIE	ESQUADA
Conteúdo do teste			X
Processo de resposta			X
Estrutura interna do teste	X	X	X
Consequências do uso			X
Associação com outras variáveis	X	X	

NKTS: *Nutritional Knowledge Test Scale* (Escala de avaliação do conhecimento nutricional). SOFIE: *Scale of evaluation of food choices* (Escala de avaliação das motivações de saúde para as escolhas alimentares). ESQUADA: Escala de qualidade da dieta.

3.1. Escala para avaliar o conhecimento nutricional

O *Nutritional Knowledge Test* (NKT) é um questionário previamente validado seguindo os preceitos da Teoria Clássica dos Testes e que foi aplicado no estudo HELENA. O NKT contém 23 itens de múltipla escolha sobre ‘ingestão energética e metabolismo’, ‘conteúdo nutricional’, ‘doces e saúde bucal’, ‘conhecimento nutricional’ e ‘termos especiais e definições’. Cada item apresenta quatro opções de resposta, inclusive ‘não sei’, com apenas uma correta (SICHERT-HELLERT et al., 2011; DIEHL, 1999). Para uso no estudo HELENA, foi realizada a tradução e retrotradução do NKT para língua oficial de cada um dos nove países participantes (ILIESCU et al., 2008).

De forma a complementar e aprimorar a medida do conhecimento nutricional fornecida pelo NKT com base apenas na análise do percentual de respostas corretas, foram analisadas as respostas a este questionário por adolescentes participantes do estudo HELENA com aplicação da TRI.

3.1.1. Análise da estrutura interna do conjunto de itens

Após a exclusão daqueles indivíduos que responderam menos do que 75% do questionário, ou seja, que responderam menos do que dezoito itens do NKT, também foram excluídos aqueles respondentes que erraram ou acertaram todos os

itens. A estrutura interna do conjunto de itens foi inicialmente analisada no software Stata versão 14 usando as informações da análise fatorial com estimação por componentes principais.

Em seguida, foi realizada a análise da correlação bisserial entre os itens e o traço latente (conhecimento nutricional) para verificar a consistência interna dos itens e associação ao escore bruto (CECCATO et al., 2008; SOARES, 2005; ANDRADE; TAVARES; VALLE, 2000). Na sequência, foram estimados os parâmetros de discriminação, dificuldade e acerto casual pela TRI usando o modelo logístico de três parâmetros. Aqueles itens com estimação adequada foram mantidos na análise e considerados para o cálculo dos escores e construção da escala NKTS (RODRIGUES et al., 2013). Estas análises foram realizadas no software BILOG-MG versão 3.

3.1.2. Análise da associação entre escore de conhecimento nutricional e outras variáveis

Para verificar as evidências de associação da medida de conhecimento nutricional fornecida pela TRI com consumo alimentar e marcadores bioquímicos procedeu-se com a análise de regressão linear de modelos mistos. Os escores foram considerados como variável independente no modelo, uma vez que um maior conhecimento nutricional pode levar a um consumo alimentar mais saudável, bem como uma melhor concentração de biomarcadores nutricionais. O centro de pesquisa foi considerado como intercepto aleatório, pois os dados estavam organizados de maneira hierárquica a partir desta variável. Idade, sexo, educação materna, nível socioeconômico, estado nutricional e ingestão energética foram consideradas covariáveis com efeito fixo. Estas análises foram realizadas no software Stata versão 14.

Para melhor representação de todas as etapas de construção da NKTS foi elaborado um fluxograma (Figura 1).

Figura 1: Fluxograma da construção da NKTS.

Fonte: Próprio autor.

HELENA: *Healthy Lifestyle in Europe by Nutrition in Adolescence*. NKTS: *Nutritional Knowledge Test Scale*.

3.2. Escala para avaliar as motivações de saúde para as escolhas alimentares

O *Food Choices and Preferences* (FCP) é um questionário cujas evidências de conteúdo foram previamente analisadas e que foi aplicado no estudo HELENA (GONZÁLEZ-GROSS et al., 2013; GILBERT et al., 2008). Este questionário tem 166 itens para avaliar atitudes e opiniões de adolescentes sobre escolhas e preferências alimentares, alimentação e saúde. Todos os itens são de múltipla escolha, sendo possível escolher mais de uma opção de resposta em alguns itens (GONZÁLEZ-GROSS et al., 2013). Para uso no estudo HELENA, foi realizada a tradução e retrotradução do FCP para língua oficial de cada um dos nove países participantes do estudo HELENA (ILIESCU et al., 2008).

Para estudar a estrutura interna dos itens do FCP e identificar aqueles melhor relacionados com o traço latente (motivações de saúde para escolher os alimentos), foram analisadas as respostas a este questionário por adolescentes participantes do estudo HELENA com aplicação da TRI.

3.2.1. *Análise da estrutura interna do conjunto de itens*

Inicialmente, foram excluídos aqueles indivíduos que não completaram o questionário FCP. Na sequência, a estrutura interna foi analisada usando a análise fatorial com estimação por componentes principais para identificar aqueles itens com melhor relação com motivações de saúde para as escolhas alimentares (RODRIGUES et al., 2013). Estas análises foram realizadas no software Stata versão 14.

Considerando a limitação do software utilizado para as análises da TRI, foram selecionados aleatoriamente 2000 adolescentes dentre aqueles que completaram o questionário. Na sequência, foram estimados os parâmetros de discriminação e localização do item no *continuum* usando o modelo logístico de desdobramento graduado generalizado. Aqueles itens com estimação adequada foram mantidos na análise e considerados para o cálculo dos escores e construção da escala SOFIE (RODRIGUES et al., 2013). Estas análises foram realizadas no software GGUM 2004.

3.2.2. *Análise da associação entre escore de motivações de saúde para escolhas alimentares e outras variáveis*

Para verificar as evidências de associação da medida de motivações de saúde para escolhas alimentares fornecida pela TRI com consumo alimentar e marcadores bioquímicos procedeu-se com a análise de regressão linear de modelos mistos. Neste sentido, os escores foram considerados como variável independente no modelo, uma vez que, quanto mais a saúde é motivadora para as escolhas alimentares, mais saudável pode ser o consumo alimentar e maior pode estar a concentração de biomarcadores nutricionais. O centro de pesquisa foi considerado como intercepto aleatório, pois os dados estavam organizados de maneira hierárquica a partir desta variável. Idade, sexo, educação materna, nível socioeconômico, estado nutricional e ingestão energética foram consideradas covariáveis com efeito fixo. Estas análises foram realizadas no software Stata versão 14.

Para melhor representação de todas as etapas de construção da SOFIE foi elaborado um fluxograma (Figura 2).

Figura 2: Fluxograma da construção da SOFIE.

Fonte: Próprio autor.

HELENA: *Healthy Lifestyle in Europe by Nutrition in Adolescence*. SOFIE: *Scale of evaluation of food choices*.

3.3. Escala para avaliar a qualidade da dieta

3.3.1. Desenvolvimento do conjunto de itens

Foi realizada a leitura do GAPB-2014 (BRASIL, 2014) para identificar suas recomendações e criar os objetivos dos itens de avaliação da qualidade da dieta (APÊNDICE A). A partir dos objetivos foram elaborados os itens e suas respectivas opções de resposta (APÊNDICE B).

Para melhor representar as características do traço latente (qualidade da dieta) (GALLUP, 2016; ALKERWI, 2014) em coerência com as recomendações do GAPB-2014 (BRASIL, 2014), foram desenvolvidos itens relacionados às práticas alimentares e ao consumo alimentar. Foi adotado o referencial teórico de Poulain & Proença (2003) para definição de práticas alimentares, que incluem, por exemplo: frequência das refeições e lanches, local de consumo dos alimentos e companhia enquanto come. Foi utilizada a NOVA classificação dos alimentos, que considera a extensão e objetivo do processamento para classificar os alimentos em (MONTEIRO et al., 2016; BRASIL, 2014; MONTEIRO et al., 2010):

- Alimentos in natura ou minimamente processados: este grupo inclui alimentos submetidos a um processamento mínimo com objetivo de preservação e para torná-los mais disponíveis, seguros e palatáveis;
- Ingredientes culinários processados: este grupo compreende substâncias extraídas dos alimentos do grupo anterior ou da natureza e consumidas como itens de preparações culinárias.
- Alimentos processados: este grupo inclui produtos fabricados com a adição de ingredientes culinários a alimentos *in natura* ou minimamente processados com propósito de aumentar a durabilidade ou modificar o sabor;
- Alimentos ultraprocessados: este grupo é composto por formulações industriais feitas com substâncias, aditivos, antioxidantes, estabilizantes e conservantes para criar produtos duráveis, acessíveis, convenientes e atrativos, *ready to eat* e *ready to heat*.

A escrita dos itens se baseou em uma revisão dos questionários de pesquisas nacionais, como: Pesquisa Nacional de Saúde do Escolar (PeNSE) (IBGE, 2012), Pesquisa de Orçamentos Familiares (POF) (IBGE, 2011), Vigilância dos Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (VIGITEL) (BRASIL, 2015b) e Pesquisa Nacional de Saúde (PNS) (IBGE, 2013). Além de uma escrita clara, não ambígua e com expressões positivas (DEVELLIS, 2017), foram apresentados alguns exemplos/marcas de alimentos e/ou preparações para melhor identificação do que era questionado.

A definição das alternativas de resposta teve como orientação as recomendações do GAPB-2014 (BRASIL, 2014). De maneira a representar em frequência semanal as recomendações do GAPB-2014 para ‘fazer’ (por exemplo, ‘prefira comer, sempre que possível, comer em companhia’ e ‘evitar’ (por exemplo, ‘evitar o consumo de alimentos ultraprocessados’) foram estabelecidas as seguintes relações (Quadro 3):

Quadro 3: Conversão das recomendações do Guia Alimentar para População Brasileira publicado em 2014 para frequência semanal.

Recomendações	Frequência semanal
Fazer.	Regular (5 dias ou mais na semana) ¹
Evitar.	2 dias ou menos na semana ²

¹ LEVI, R. B. et al. (2009). ² COUTO, S. F. et al. (2014).

3.3.2. Análise do conteúdo do teste

Nutricionistas que trabalhavam na área da saúde pública foram convidados para participar de grupos focais com o objetivo de avaliar os itens quanto à pertinência para medir a qualidade da dieta, à coerência com as recomendações do GAPB-2014 e à clareza da escrita para adolescentes e jovens adultos (FURR; BACHARACH, 2014). Devido à extensão do questionário, os grupos focais foram organizados para abordar três temas: (1) práticas alimentares, (2) consumo de alimentos in natura ou minimamente processados e ingredientes culinários e (3) consumo de alimentos processados e ultraprocessados. Cada tema foi discutido em dois grupos focais. Cada nutricionista participou de apenas um grupo focal. Todos os nutricionistas que participaram dos grupos focais assinaram o Termo de Consentimento Livre e Esclarecido (APÊNDICE C).

Um entrevistador mediou a interação entre os participantes dos grupos focais, estimulando o diálogo entre eles (GASKELL, 2002). Para orientar a mediação foi desenvolvido um guia de perguntas (APÊNDICE D). E, para auxiliar com as anotações de pontos-chaves das discussões, bem como expressões não verbais, cada grupo focal foi conduzido com a presença de um observador (LIAMPUTTONG; EZZY, 2005). Os grupos focais foram realizados em círculos com um pequeno lanche e água disponibilizados ao centro (TRAD, 2009).

Os diálogos foram gravados e transcritos posteriormente por dois pesquisadores no Microsoft Office Word versão 2013. As sugestões dos nutricionistas foram extraídas das transcrições, utilizando a análise de conteúdo exploratória no software MAXQDA versão 12, e consideradas para melhorar a relevância dos itens quanto à qualidade da dieta e a clareza para leitura e compreensão por adolescentes e jovens adultos. Neste sentido, os itens foram ora alterados ora excluídos do conjunto. Além disso, também foi considerada a sugestão de inclusão de algum item.

3.3.3. Análise do processo de resposta

3.3.3.1. Organização e apresentação dos itens

Após analisar as sugestões dos nutricionistas e considerando o número de itens desenvolvido excessivo para um indivíduo responder sem perder a concentração e mantendo a qualidade da resposta, os itens foram organizados de forma que não fosse necessário que cada indivíduo respondesse a todos os itens, mas garantisse que cada item tivesse o mesmo número de respostas. Assim, foi utilizada a análise de blocos incompletos balanceados para disposição dos itens em mini-questionários (MENEGON, 2013; BEKMAN, 2001; ANDRADE; TAVARES; VALLE, 2000; KLEIN; FONTANIVE, 1995). Os pesquisadores dividiram o total de itens (It) em treze pequenos conjuntos (t) com quatro itens cada (k) usando a função aleatória do Microsoft Office Excel versão 2013 e considerando o objetivo do item em avaliar práticas alimentares ou consumo. Estas informações quanto ao número de pequenos conjuntos ($t=13$) e o número de itens em cada pequeno conjunto ($k=4$) foram utilizadas para calcular a fração do questionário que cada respondente recebe (Fu), o número de repetições de cada t em toda análise (r), o número de mini-questionários (b), o número de itens em cada mini-questionário (Ic) e o número de pequenos conjuntos em cada mini-questionário (Ib) utilizando as equações abaixo (BEKMAN, 2001) e considerando λ uma constante igual a dois:

$$\lambda = \frac{r(k-1)}{(t-1)} \quad b = \frac{t \times r}{k} \quad Fu = \frac{k}{t} \quad It = \frac{Ic}{Fu} \quad Ib = \frac{Ic}{k}$$

Diante destas informações seguiu-se com a análise de blocos incompletos balanceados no pacote *crossdress* no software R para extrair os pequenos conjuntos de itens (t) de cada mini-questionário (b). Em seguida, as ordens de apresentação dos pequenos conjuntos e dos itens propriamente foram alteradas em cada mini-questionário usando a função aleatória do Microsoft Office Excel versão 13 de forma a evitar algum prejuízo na qualidade de resposta.

Após esta organização, foram criados questionários de coleta *online* na plataforma *Survey Monkey* e compartilhados nas redes sociais *Facebook* e *Instagram* (MENEGON, 2013; GALANTE, 2004; PASQUALI, 2009; PASQUALI,

1998) utilizando um link com apresentação aleatória dos mini-questionários. Além dos itens sobre qualidade da dieta, os questionários *online* incluíram questões para identificação e caracterização socioeconômica dos respondentes:

- a) Informações obrigatórias:
  - Termo de Consentimento Livre e Esclarecido;
  - Nome, data de nascimento e sexo;
  - Nacionalidade e local de residência (cidade, país);
  - Escolaridade e profissão.
- b) Informação opcional: E-mail.

3.3.3.2. *Estudo da compreensão do conjunto de itens*

Para cada item sobre qualidade da dieta foi questionado ao respondente se ele entendeu o que foi perguntado, apresentando as seguintes opções de resposta (CONTI et al., 2010):

- a) Não entendi nada (0);
- b) Entendi só um pouco (1);
- c) Entendi mais ou menos (2);
- d) Entendi quase tudo, mas tive algumas dúvidas (3);
- e) Entendi quase tudo (4);
- f) Entendi perfeitamente e não tenho dúvidas (5).

As respostas a esta pergunta sobre o entendimento do item foram analisadas, sendo considerado um item com baixa compreensão aquele que apresentasse maior percentual de resposta para as três primeiras opções: (0), (1) e (2). Os itens com menor compreensão foram alterados considerando, também, o que o respondente escreveu sobre o que não entendeu ou não ficou claro no item (CONTI et al., 2010; PASQUALI, 2009).

Participaram deste estudo da compreensão dos itens, indivíduos com características semelhantes da população do estudo principal, ou seja: brasileiros, com 15 a 50 anos de idade e que residiam no Brasil. Além disso, procurou-se ter uma amostra representativa de diferentes níveis do traço latente (qualidade da dieta).

O estudo de compreensão do conjunto de itens foi realizado em fevereiro de 2018 paralelamente ao piloto de forma a identificar possíveis dificuldades com o uso

da plataforma *Survey Monkey*, erros no questionário, bem como necessidade de alterar a estratégia de coleta de dados.

3.3.4. Análise da estrutura interna do conjunto de itens

3.3.4.1. Estratégia de coleta de dados

Após o estudo piloto, foram consideradas as necessidades de alteração na escrita dos itens e dos critérios de inclusão e exclusão, de forma que apenas brasileiros, com 15 a 50 anos de idade e residentes no Brasil respondessem ao questionário. A alteração dos critérios foi necessária, pois o uso das redes sociais poderia promover a divulgação do questionário para brasileiros não residentes no Brasil.

Foi criada uma cópia dos questionários de coleta *online* na plataforma *Survey Monkey*, sendo excluída a pergunta sobre o entendimento dos itens e feitas as alterações. Em março de 2018, para a coleta de dados efetiva, os questionários foram compartilhados nas redes sociais *Facebook* e *Instagram*, redes de e-mail e página de comunicação interna da Universidade de São Paulo utilizando um link com apresentação aleatória dos mini-questionários.

3.3.4.2. População do estudo

Para desenvolver a escala, foi necessário que indivíduos com diferentes níveis de qualidade da dieta respondessem ao conjunto de itens, ou seja, foi necessário garantir que a amostra fosse representativa do traço latente. Assim, durante a coleta foi avaliada a necessidade de direcionar a aplicação dos itens para indivíduos com determinado nível de qualidade da dieta ainda pouco representado por aqueles que já tinham respondido aos questionários *online*. Neste sentido, foi feita uma coleta em escolas públicas do Estado de São Paulo, mediante autorização do Secretário Estadual (ANEXO A), utilizando o laboratório de informática e com a presença de um pesquisador.

3.3.4.3. Criação da escala de qualidade da dieta

As respostas foram exportadas da plataforma *Survey Monkey* para o Microsoft Office Excel versão 2013. Como os indivíduos não responderam a todos os itens, foi necessária uma organização do banco de dados. O item sem resposta foi considerado como 'item não apresentado'. As categorias de resposta foram numericamente identificadas de '1' a '5' conforme relação com a qualidade da dieta, considerando os extremos '1' para aquela categoria relacionada com o seu menor nível e '5' para aquela relacionada com o seu maior nível.

Após a organização do banco de dados e exclusão daqueles indivíduos que responderam nenhum ou apenas um item de qualidade da dieta, foi analisada a estrutura interna do conjunto de itens no pacote *mirt* do software R a partir da análise fatorial de informação completa e da Teoria de Resposta ao Item. Enquanto a análise fatorial identificou os itens que pertenciam a mesma dimensão do traço latente (qualidade da dieta) (RODRIGUES et al., 2013; SOARES, 2005), a TRI estimou os parâmetros de discriminação e localização do item no *continuum* de qualidade da dieta, bem como os escores. Foram considerados para a construção da escala ESQUADA apenas aqueles itens com estimação adequada dos parâmetros (RODRIGUES et al., 2013).

3.3.5. Análise das consequências do uso

Entre indivíduos com 15 a 50 anos de idade, sexo e idade são características que podem influenciar a probabilidade de escolher uma dada opção de resposta a um item sobre qualidade da dieta. O comportamento diferencial dos itens foi verificado conforme sexo e idade dos respondentes no pacote *mirt* do software R. O item com comportamento diferencial foi excluído do conjunto final (TERESI; FLEISHMAN, 2007).

Para melhor representação de todas as etapas de construção da ESQUADA foi elaborado um fluxograma (Figura 3). Este estudo foi aprovado pelo Comitê de Ética de Pesquisas com Seres Humanos da Faculdade de Saúde Pública/USP (ANEXO B).

Figura 3: Fluxograma da construção da ESQUADA.

Fonte: Próprio autor.

GAPB-2014: Guia Alimentar para População Brasileira de 2014. ESQUADA: Escala de Qualidade da Dieta.

4. RESULTADOS E DISCUSSÃO

Os resultados e discussão estão apresentados em quatro artigos, a seguir:

4.1. Artigo 1- Proposta de uma escala de avaliação do conhecimento nutricional (NKTS) com aplicação da Teoria de Resposta ao Item e estudo das associações do escore com consumo alimentar e concentração de biomarcadores nutricionais em adolescentes europeus

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ABSTRACT

Objectives: To analyse the Nutritional Knowledge Test (NKT) using the Item Response Theory (ITR) analysis and to assess the construct validity of the Nutritional Knowledge Scale (NKTS) and its associations with adolescent food group consumption and nutritional biomarkers.

Design: Cross-sectional study.

Setting: Multi-centre investigation conducted in 10 European cities.

Subjects: 3,215 adolescents (aged 12•5–17•5 years) who completed over 75% of the NKT.

Results: The factor analysis indicated that the NKT can be analysed with a one-dimensional model. Eleven out of 23 items from the NKT presented adequate parameters and were selected to be included in the NKTS. Nutrition knowledge was positively associated with fruits, cereals, dairies, pulses, meat and eggs, and fish consumption as well as with blood concentrations of vitamin C, beta-carotene, *n*-3 fatty acids, holo-transcobalamin, cobalamin, and folate; nutrition knowledge was negatively associated with intake of olives and avocado, alcohol, and savoury snacks.

Conclusions: The NKTS assessed nutritional knowledge adequately and it is proposed as a new tool to investigate this subject in future studies.

KEYWORDS: knowledge, nutrition, diet, psychometrics, scales.

INTRODUCTION

Unhealthy diet contributes to nutrition- and obesity-related diseases, such as heart disease, cancer, and type 2 diabetes⁽¹⁾. One strategy to improve overall health and dietary habits is to increase knowledge about nutrition. Adolescence is a period in life during which nutritional education can help adolescents to establish healthy eating and maintain it throughout life^(2,3).

Nutritional knowledge is usually evaluated in healthy adolescents⁽³⁻⁵⁾ with the classical test theory⁽²⁾, based on the sum of correct answers from a true/false or multiple-choice questionnaire⁽³⁻⁵⁾. The Nutritional Knowledge Test (NKT) was used in the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study, a cross-sectional and multicentre investigation. The HELENA study explored the level of

nutritional knowledge among European adolescents and its potential determinants based on the percentage of correct answers⁽³⁾.

The classical test approach has some limitations. The characteristics of each item may vary across different populations. Thus, the validation of the questionnaire should be analysed again^(2,6). Item Response Theory (IRT) analysis provides information on the discrimination and difficulty of each item across different levels of the latent trait. The information of items remains constant even if the analyses are performed in other samples. In this regard, the IRT analysis allows selecting items with a better distinction of the latent trait and acknowledges the level of the construct required by each item. Moreover, IRT scores are not only estimated from the sum of the correct answers but calculated based on a probabilistic model. Besides, IRT scores are also independent of the considered set of items⁽⁶⁾.

Therefore, the IRT analysis may refine the measurement provided by the NKT, selecting items that better discriminate adolescent nutritional knowledge while characterising the ability inherent on each level. IRT scores calculated could also improve studying the relationship between nutritional knowledge and adolescent food intake and biomarkers. Thus, the objectives of the present study were: (i) to analyse the NKT based on ITR analysis; and (ii) to assess the construct validity of the Nutritional Knowledge Scale (NKTs) and its associations with adolescent food group consumption and nutritional biomarkers. To address these objectives, nutritional knowledge was considered the latent trait on the IRT analysis encompassing energy metabolism, nutrient contents, oral health, food knowledge, and nutritional terms.

METHODS

Study design and subjects. The HELENA study is a cross-sectional, multicentre investigation conducted in 10 European cities: Vienna (Austria), Gent (Belgium), Lille (France), Dortmund (Germany), Athens and Heraklion (Greece), Pécs (Hungary), Rome (Italy), Zaragoza (Spain), and Stockholm (Sweden)⁽⁷⁾. Between October 2006 and December 2007, the HELENA study was carried out in a random cluster sample of 3,528 European adolescents between 12•5 and 17•49 years old and stratified by geographical location, age, and socioeconomic level. To guarantee this stratification, school, and class of adolescents by age group were considered. Overall, ten schools and 15-20 classes (350-400 students) were selected in each city. The eligibility of each class within the selected schools was based on at least 70% of students

agreeing to participate in the HELENA study. Blood samples were then obtained by randomly selecting one-third of the adolescents ($n = 1,089$) from the total sample⁽⁷⁾.

Exclusions from the HELENA study were performed *a posteriori* when adolescents presented simultaneous participation in another clinical trial; were < 12.5 or ≥ 17.5 years old; and/or had an acute infection less than one week before inclusion in the study. To process the IRT analyses, a total of 222 adolescents who did not complete more than 75% of the NKT on the first run of the test were excluded. In addition, 91 adolescents providing 100% of the answers as either right or wrong were also excluded from the current analyses because of the non-variability of the latent trait, which could affect the development of the NKTS. In total, 313 adolescents did not meet the inclusion criteria for the current analyses. Therefore, the final sample was comprised of 3,215 adolescents.

However, a different sample size was considered in the analyses. Those adolescents who had no information on dietary assessment and did underreport energy intake were excluded using the Goldberg et al. approach^(8,9). This approach defines the minimum reasonable value of energy consumption that is compatible with energy balance, considering the level of physical activity^(8,9). In total, 487 adolescents underreported energy intake. Moreover, for the mixed model linear regression analyses, adolescents had to provide complete information on the corresponding confounding factors (age, gender, socioeconomic level, maternal education level, centre, and Body Mass Index – BMI). The final sample on the mixed model linear regression analyses with consumption of food groups and biomarkers as the outcome variables included 1,623 adolescents. The final sample for the mixed model linear regression analyses with biomarkers as the outcome variable included 609 adolescents.

In each of the participating countries, the corresponding institution approved the HELENA study protocol and all participants and both parents or guardians provided their written consent^(7,10). Each participant was identified anonymously using a specific coding system which was included on the questionnaires and blood samples⁽¹⁰⁾.

The study design is further explained in Figure 1.

Figure 1: Study design flow chart.

NKT, Nutritional Knowledge Test; NKTS, Nutritional knowledge scale.

Sociodemographic characteristics. Socioeconomic status was evaluated with a self-reported questionnaire that collects data on living conditions, family structure, employment status of parents, parental occupation, and educational level⁽¹¹⁾. The Family Affluence Scale (FAS) index was calculated based on this questionnaire and it was used as an indicator of adolescents' material affluence (reflecting number of bedrooms, cars, and computers possessed by the family and internet access in their home). The scale ranged from 0 to 8 and was dichotomized into 'low familial wealth' (0–4) and 'high familial wealth' (5–8). Maternal education level was categorized in 'primary education', 'lower secondary education', 'higher secondary education,' and 'university degree'⁽¹²⁾.

Dietary assessment. Diet of participants was considered to assess the construct validity of the NKTS and its associations with adolescent food intakes. In the HELENA study, dietary intake data were collected using the validated HELENA-DIAT by two non-consecutive computerized 24-hour recalls, including weekdays and

Sundays. The second assessment was performed within two weeks after the first one⁽¹³⁾. Adolescents autonomously selected all the consumed foods and beverages from a food list that included six 'meal occasions'. Some questions were presented to respondents to help them remember what they ate the day before. Some slides were presented for each food selected detailing the portion sizes^(13,14). In addition, a self-administered food frequency questionnaire was applied. This questionnaire included 15 items and seven weekly response categories ranging from 'never' to 'more than once a day every day'⁽¹³⁾. Both dietary assessment methods were administered during school time with the assistance of trained nutritionists.

Data from 24-hour recalls regarding foods and beverages were expressed as grams and millilitres per day, respectively, and organized into food groups. Furthermore, to remove the effect of day-to-day variability and random error in the 24-hour recalls, the individual usual food intake from these recalls was estimated using the multiple source method. This statistical modelling technique considers information from the food frequency questionnaire as a covariate of the two 24-hour recalls⁽¹⁵⁾.

In the present study, the foods groups that emerged from the 24-hour recalls were categorized into 15 food groups according to their similarity in nutritional content and health-related characteristics. These categories are: vegetables (excluding potatoes); fruits; vegetables (excluding potatoes) and fruits; sweets (including carbonated/soft/isotonic drinks, cakes, biscuits, chocolate, and other sugar products); cereals (including potatoes); nuts and seeds; vegetable oils; olives and avocado; alcohol; dairy products (including milk and yogurt); pulses; meats and eggs; fish; savoury snacks (including chips, salty biscuits, crackers, and popcorn); and water.

Anthropometric measurements. Weight was measured with an electronic scale (model SECA 861), precision 0.1 kg. Height was measured with participants barefoot in the Frankfort plane using a telescopic height-measuring instrument (model SECA 225), precision 0.1 cm, ranging from 70 to 200 cm. Both measurements were taken at the same time by trained staff⁽¹⁶⁾.

The BMI (kg/m²) was calculated as weight (in kilograms) divided by the square of height (in meters). The values of BMI were categorized into 'thinness', 'normal

weight', 'overweight', and 'obesity' considering the reference values for BMI in adults^(17,18).

Biochemical analysis. Blood concentration was considered to assess the construct validity of the NKTS and its associations with adolescent nutritional biomarkers. In the HELENA study, the blood collection was performed after a 10-hour overnight fast following a standardized protocol and up to two weeks apart from the NKT. A handling and transportation system was developed to guarantee the quality assurance and stability of blood samples⁽¹⁹⁾.

Out of all the biomarkers analysed in the HELENA study, vitamin C, beta-carotene, *n*-3 fatty acids, cobalamin, and folate presented a strong correlation with nutrient intake and were included in the present analyses. Blood concentration of vitamin C, beta-carotene, and *n*-3 fatty acids presented a strong correlation with fruits, vegetables, and *n*-3 fatty acids, respectively⁽¹³⁾. *Trans* fatty acids were also considered due to their association with nutrition- and obesity-related diseases⁽²⁰⁾. Folate (plasma and erythrocyte) and cobalamin were measured by a competitive immunoassay (Immulite 2000, DPC Biermann GmbH, Bad Nauheim, Germany). Beta-carotene and vitamin C were analysed by high-performance liquid chromatography (Sykam Gilching, Germany) using UV detection (UV-Vi 205, Merck Darmstadt, Germany). Fatty acids concentrations were determined by capillary gas chromatography (Model 3900) after extraction performed by thin-layer chromatography. The total amount of fatty acids was obtained from the percentage area by integrating the area under the peak and dividing it by the total area for all fatty acids. The labels *n*-3 and *trans* include all these types of fatty acids identified during blood analyses. Holo-transcobalamin was measured by a microparticle enzyme immunoassay (Active B₁₂ Axis-Shield Limited, Dundee, Scotland, United Kingdom) with the use of AxSym (Abbott Diagnostics, Abbott Park, IL, USA)^(13,19).

To measure plasma folate, cobalamin, and vitamin C (previously stabilized with metaphosphoric acid) the blood sample was collected in heparinized tubes, transported in dry ice and centrifuged within 30 minutes. The serum sample for fatty acids determination was also centrifuged within 30 minutes, stored at -80°C, and transported on dry ice as soon as possible. The serum sample for beta-carotene was stabilized with a synthetic antioxidant. For erythrocyte folate analysis, the whole blood was diluted in prepared ascorbic acid and incubated in the dark before storing

it at -80°C. To measure holo-transcobalamin, blood was collected in evacuated tubes without anticoagulant and then the aliquot was stored at -80°C until its transport to the laboratory^(13,19).

Nutritional knowledge assessment. Nutritional knowledge was evaluated with the NKT, a validated questionnaire designed by a nutritional psychologist⁽²¹⁾. The NKT contains 23 multiple-choice items encompassing concepts related to energy intake and metabolism, nutrient contents, sweeteners and oral health, food knowledge, and special terms and definitions. This test was designed for those who did not receive any nutritional education program in the past. Each item offers four possible answers, including a 'don't know' category, but only one answer category is correct. Furthermore, the NKT comprises common misconceptions as well as easy items in order to motivate individuals to answer the test. In the HELENA study, the NKT was completed by students during class with the supervision of the research team^(3,21,22).

Statistical analysis. The dimensionality of the NKT was analysed by factor analysis with estimation of the principal component analysis and varimax orthogonal rotation. The use of one-dimensional model was acceptable if the first principal component explained 20% or more of the total variance⁽²³⁾.

The biserial coefficient was calculated for each item to indicate the correlation behind the correct answer to items and the level of nutritional knowledge. Items with a negative biserial coefficient were excluded from the analyses⁽²⁴⁾.

A one-dimensional logistic model of the three parameters was used to calculate the probability of a person to correctly answer an item, with a given nutritional knowledge level. This model is represented by the following equation⁽²⁴⁾:

where:

θ_j – IRT score of a person j ;

$P(U_{ij}=1|\theta_j)$ – probability of a person j with an ability θ_j to correctly answer an item i ;

D – scale constant factor and equal to 1.7;

c_i – guessing parameter of item i ;

a_i – discrimination parameter of item i ;

b_i – difficulty parameter of item i .

The discrimination parameter (a_i) indicates the quality of an item to discriminate people with different levels of nutritional knowledge. Items with higher

values on this parameter presented better discrimination. The difficulty parameter (b_i) identifies the point on the scale in which the probability to answer correctly was higher or equal to $(1 + c_i)/2$ ⁽²⁴⁾. Finally, the guessing parameter (c_i) indicates the probability that someone gives the right answer by chance with values equal or above to zero and equal or below to one ($0 \leq c_i \leq 1$)⁽²⁵⁾.

All parameters (a_i , b_i , and c_i) were estimated by marginal maximum likelihood with a maximum number of 20 quadrature points, 50 EM cycles, 10 Newton interactions, and convergence criterion equal to 0.01. These parameters estimates were analysed with the corresponding standard error (Supplementary material, Table 1). Items with discrimination parameter (a_i) values below or equal to 0.70 were considered as having less discrimination and were excluded from further analyses. The estimation of the parameters mentioned above was repeated only for items with adequate discrimination. To control the lack of identification of the model, b_i and IRT scores were estimated on a scale with mean equal to 0 and standard deviation equal to 1 by the expected *a posteriori* method⁽²⁵⁾. Empirical reliability, a precision measure analogous to Cronbach alpha, was calculated to analyse the reliability of the NKTS. Besides the empirical reliability, the test information curve was analysed to identify the accuracy of the measurement along the NKTS.

The probability of the correct answer for each item was calculated across IRT scores. The item was located at the level of the correct answer probability when it was higher or equal to $(1 + c_i)/2$. Some levels were grouped into the same range of nutritional knowledge according to the technical similarity between items. This step was performed by two nutritionists (T.S.S.S. and C.J.) using Microsoft Excel® version 2010.

To analyse of the associations between IRT scores and demographic, socioeconomic, and health characteristics, Kolmogorov-Smirnov tests were carried out to test the normality in the distribution of the studied variables and guide further analyses. Chi-square tests were performed to evaluate differences between demographic, socioeconomic, and BMI categories with NKTS levels. Mixed-model linear regression analyses were performed to assess the construct validity of NKTS and its associations with nutritional knowledge, food group consumption, and biomarkers. The IRT scores were included as the independent variable. To explore

these associations, analyses were carried out separately for the NKTS (considering only items with adequate IRT parameters) and for all items in the original NKT (calculating all IRT scores although there were items with inadequate IRT parameters). Food groups and biomarkers variables were included separately in the model with the outcome variable, and centre was included as the random intercept. Age, gender, maternal education, FAS index, BMI, and energy intake were entered as covariates in the model. Statistical significance was set at a P value < 0.05 .

Analyses were performed Stata statistical software, version 14,⁽²⁶⁾ and BILOG-MG, version 3⁽²⁷⁾.

RESULTS

As suggested by the factor analysis, the first principal component explained 46% of the total variance (Supplementary material, Figure 1). None of the items presented a negative biserial coefficient (Supplementary material, Table 1). Twelve items presented low discrimination of nutritional knowledge and were excluded from further analyses. Biserial coefficient and IRT parameters (a_i , b_i , and c_i) of the remaining items are described in Table 1.

The estimation of the IRT parameters was completed with 11 EM cycles and three Newton interactions. Along the nutritional knowledge continuum, the item '*A breakfast merely consisting of bread, jam, and butter does not contain enough...*' presented the lowest discrimination parameter ($a_i = 0.88$). On the other hand, the item '*The ingredients list found on food items may contain a number of different terms for sugar. Which row lists three terms for special types of sugar?*' had the highest discrimination parameter ($a_i = 1.65$).

The item '*Marcel has been playing with a ball all afternoon. During this time Kevin has been sitting at home watching television. Which of the following statements is most applicable?*' had the lowest difficulty parameter ($b_i = -2.13$), suggesting that energy expenditure is a relatively easy concept for the adolescents. The item '*Which row lists three terms for energy-free sweeteners?*' presented the highest difficulty parameter ($b_i = 1.50$), suggesting that advanced nutritional terms were the most difficult ones to be identified by the HELENA adolescents.

All items presented low values of guessing parameters ranging from 0.01 to 0.09. In the studied sample, NKTS scores varied from -0.83 to 0.83 . NKTS showed

a good empirical reliability (0.69) and presented more accurate information between IRT scores, ranging from -1.0 to 1.0 (Figure 2).

Table 1: Biserial coefficient and discrimination, difficulty and guessing parameters of IRT and their standard errors from the Nutritional Knowledge Scale (N = 3,215).

Items	Correct answer	Biserial	a_i^a (SE)	b_i^b (SE)	c_i^c (SE)
Marcel has been playing with a ball all afternoon. During this time Kevin has been sitting at home watching television. Which of the following statements is most applicable?	Marcel burns more energy than Kevin	0•44	1•22 (0•09)	-2•13 (0•13)	0•02 (0•03)
Which row lists three dishes that have all been prepared using very little fat?	Boiled egg, boiled potatoes, steamed fish	0•37	0•91 (0•06)	-1•13 (0•09)	0•02 (0•02)
Which substance is good for your teeth?	Fluoride	0•39	0•91 (0•07)	-0•66 (0•10)	0•02 (0•03)
Bread, cake, pasta, potatoes, and rice contain mainly...	Carbohydrates	0•45	1•17 (0•13)	-0•19 (0•16)	0•09 (0•07)
Dieticians use the American term 'junk food' to describe certain foods. What do they mean by this?	Foods that contain a lot of energy but are of very little nutritional value	0•41	0•98 (0•07)	-0•18 (0•07)	0•02 (0•02)
What effect does the fibre contained in our food have on the human body?	It stimulates the process of digestion	0•51	1•32 (0•09)	0•02 (0•06)	0•02 (0•02)
The ingredients list found on food items may contain a number of different terms for sugar. Which row lists three terms for special types of sugar?	Dextrose, fructose, maltose	0•56	1•65 (0•11)	0•19 (0•04)	0•01 (0•01)
A breakfast merely consisting of bread, jam, and butter does not contain enough...	Protein	0•38	0•88 (0•08)	0•35 (0•12)	0•03 (0•04)
Which row lists three foods that contain a lot of vitamin C?	Peppers, cabbage, citrus fruit	0•40	0•98 (0•10)	0•48 (0•11)	0•04 (0•04)
What is the other commonly used term for energy?	Joule	0•41	1•08 (0•11)	0•96 (0•08)	0•03 (0•03)
Which row lists three terms for energy-free sweeteners?	Aspartame, saccharin, cyclamate	0•45	1•28 (0•14)	1•50 (0•08)	0•01 (0•01)

SE, Standard Error. ^a Discrimination parameter. ^b Difficulty parameter. ^c Guessing parameter.

Figure 2: Nutritional knowledge scale information curve (N = 3,215).

The test information curve is shown in solid line. The standard error curve is shown in dotted line.

Results from the mixed model linear regression analysis with food groups consumption as the outcome variable and NKTS scores as the independent variable are shown in Table 2. Nutritional knowledge was positively associated with consumption of fruits, cereals, dairy products, pulses, meats and eggs, and fish and was negatively associated with intake of olives and avocado, alcohol, and savoury snacks.

Results from the mixed model linear regression analysis with the concentration of biomarkers as the outcome variable and NKTS scores as the independent variable are presented in Table 3. Nutritional knowledge was positively associated with blood concentrations of vitamin C, beta-carotene, *n*-3 fat acids, holo-transcobalamin, cobalamin, and folate. Additionally, both of mixed model linear regression analyses presented similar results when IRT scores were calculated for all items of the original NKT that presented low discrimination of nutritional knowledge (Supplementary material, Tables 2 and 3) and when the number of cigarettes consumed was included as a covariate (data not shown).

Table 2: Mixed model analyses between food groups intake (g/d) and IRT scores from the Nutritional Knowledge Scale among European adolescents adjusted by age, gender, maternal education, FAS index, and energy intake (n = 1,623).

Food groups	β^a	95% CI ^b	<i>P</i> value
Vegetables	-33•03	-78•88, 12•81	0•16
Fruits	109•75	30•53, 188•96	0•01*
Fruits and vegetables	83•58	-9•17, 176•33	0•08
Sweets	-98•80	-338•44, 140•83	0•42
Cereals	114•42	51•77, 177•06	<0•001*
Nuts and seeds	-4•25	-11•41, 2•91	0•24
Olives and avocado	-6•19	-11•60, -0•79	0•02*
Vegetable oils	-2•21	-9•10, 4•67	0•53
Alcohol	-160•41	-237•06, -83•77	<0•001*
Dairy products	401•06	233•18, 568•93	<0•001*
Pulses	32•29	9•88, 54•69	<0•01*
Water	293•82	-122•91, 710•55	0•17
Fish	39•91	21•46, 58•36	<0•001*
Meats and eggs	150•28	96•12, 204•45	<0•001*
Savoury snacks	-14•85	-27•40, -2•30	0•02*

^a Fixed effects estimates. ^b 95% confidence interval. * Significant *P* values. Centre was used as the random intercept.

Table 3: Mixed model analyses between concentration of biomarkers and IRT scores from the Nutritional Knowledge Scale among European adolescents adjusted by age, gender, maternal education, FAS index, BMI, and energy intake (n = 609).

Concentration biomarkers	β^a	95% CI ^b	P value
Vitamin C (mg/L)	10•90	5•68, 16•12	<0•001*
Beta-carotene (ng/mL)	476•05	179•56, 772•54	0•002*
<i>n</i> -3 fatty acids (%)	5•09	2•89, 7•29	<0•001*
<i>n</i> -3 fatty acids (μ mol/L)	155•21	71•34, 239•08	<0•001*
Holo-transcobalamin (pmol/L)	66•22	11•23, 121•22	0•02*
Cobalamin (pmol/L)	539•86	335•23, 744•49	<0•001*
Plasma folate (nmol/L)	42•24	25•37, 59•11	<0•001*
Erythrocyte folate (nmol/L)	1253•45	648•63, 1858•27	<0•001*
<i>Trans</i> fatty acids (μ mol/L)	1•20	-•01, 2•41	0•05

^a Fixed effects estimates. ^b 95% confidence interval. * Significant P values. Centre was used as the random intercept.

NKTS scores were categorized in three different levels to facilitate their interpretation: basic, adequate, and advanced. The basic level (IRT scores below -0•5) included knowledge about energy expenditure and ingredients from recipes. This level comprises the items: *‘Marcel has been playing with a ball all afternoon. During this time Kevin has been sitting at home watching television. Which of the following statements is most applicable?’* and *‘Which row lists three dishes that have all been prepared using very little fat?’*. The adequate level (IRT scores from -0•5 to 1•0) included knowledge about nutrients from foods and their role on health. This level presents the items: *‘Which substance is good for your teeth?’*; *‘Bread, cake, pasta, potatoes, and rice contain mainly...’*; *‘Dieticians use the American term ‘junk food’ to describe certain foods. What do they mean by this?’*; *‘What effects does the fibre contained in our food have on the human body?’*; *‘The ingredients list found on food items may contain a number of different terms for sugar. Which row lists three terms for special types of sugar?’*; *‘A breakfast merely consisting of bread, jam, and butter does not contain enough...’* and *‘Which row lists three foods that contain a lot of vitamin C?’*. The advanced level (IRT scores above or equal to 1•0) included knowledge about basic and advanced nutritional terms. This last level contains the

items: *'What is the other commonly used term for energy?'* and *'Which row lists three terms for energy-free sweeteners?'*. Therefore, a person who shows a nutritional knowledge level below -0.5 would have knowledge on energy expenditure and ingredients from recipes. On the other side, a person with a nutritional knowledge level above or equal to 1, would present advanced nutritional knowledge, such as knowledge of energy expenditure, nutrients from foods and their role on health, ingredients from recipes, and advanced nutritional terms.

The demographic and socioeconomic characteristics of participants are described in Table 4. Girls, older adolescents, whose mothers had a university education, and those with a high FAS index presented higher nutritional knowledge.

Table 4: Demographic and socioeconomic characteristics of European adolescents by Nutritional Knowledge Scale categories (N = 3,215).

	n (%)	n (%)			<i>P</i> value ^a
		Basic 376 (11•7)	Adequate 1912 (59•5)	Advanced 927 (28•8)	
Age (years)					<0•001*
12•5-13•99	1022 (31•8)	161 (42•8)	656 (34•3)	205 (22•1)	
14-14•99	795 (24•7)	99 (26•3)	482 (25•2)	214 (23•1)	
15-15•99	783 (24•4)	65 (17•3)	457 (23•9)	261 (28•2)	
16-17•49	615 (19•1)	51 (13•6)	317 (16•6)	247 (26•6)	
Gender					0•04*
Male	1526 (47•5)	183 (48•7)	936 (49•0)	407 (43•9)	
Female	1689 (52•5)	193 (51•3)	976 (51•0)	520 (56•1)	
FAS (n = 3,044)					<0•001*
Low	1397 (45•9)	198 (57•7)	852 (47•1)	347 (38•8)	
High	1647 (54•1)	145 (42•3)	955 (52•9)	547 (61•2)	
Maternal education (n = 3,072)					<0•001*
Primary	252 (8•2)	43 (12•5)	168 (9•2)	41 (4•6)	
Lower secondary	819 (26•7)	104 (30•2)	533 (29•0)	182 (20•4)	
Higher secondary	966 (31•4)	100 (29•1)	568 (31•0)	298 (33•4)	
University degree	1035 (33•7)	97 (28•2)	566 (30•8)	372 (41•7)	
Centre					<0•001*
Athens	272 (8•5)	80 (21•3)	149 (7•8)	43 (4•6)	
Dortmund	422 (13•1)	55 (14•6)	290 (15•2)	77 (8•3)	
Gent	322 (10•0)	28 (7•4)	196 (10•3)	98 (10•6)	
Heraklion	245 (7•6)	59 (15•7)	154 (8•1)	32 (3•5)	
Lille	243 (7•6)	35 (9•3)	189 (9•9)	19 (2•0)	
Pécs	376 (11•7)	29 (7•7)	199 (10•4)	148 (16•0)	
Rome	293 (9•1)	21 (5•6)	195 (10•2)	77 (8•3)	
Stockholm	292 (9•1)	36 (9•6)	173 (9•0)	83 (9•0)	
Vienna	383 (11•9)	24 (6•4)	174 (9•1)	185 (20•0)	
Zaragoza	367 (11•4)	9 (2•4)	193 (10•1)	165 (17•8)	
BMI					0•01*
Thinness	193 (6•0)	28 (7•4)	109 (5•7)	56 (6•0)	
Normal weight	2280 (70•9)	248 (66•0)	1346 (70•4)	686 (74•0)	
Overweight	561 (17•4)	67 (17•8)	347 (18•1)	147 (15•9)	
Obesity	181 (5•6)	33 (8•8)	110 (5•8)	38 (4•1)	

FAS, Family Affluence Scale. BMI, Body Mass Index. ^a Likelihood Ratio *P* value.

* Significant *P* values.

DISCUSSION

When evaluating if the NKT assessed nutritional knowledge, the factor analysis indicated that the first principal component explained 46% of the total variance. Therefore, an one-dimensional logistic model of three parameters was applied to develop the NKTS^(23,24).

The original NKT only calculated the percentage of correct answers⁽³⁾; in this way, adolescents with different nutritional knowledge levels could get the same score⁽²⁸⁾. The IRT analysis complements the classical approach as it calculates the scores and the pattern of correct answers by comparing the difficulty of each item⁽²⁹⁾.

Twelve items from the original NKT presented low discrimination of nutritional knowledge and thus were excluded. The NKTS provides a high-quality tool to assess nutritional knowledge, as it includes items with the best discrimination of nutritional knowledge. In addition, results from the mixed model linear regression analyses presented similar associations between food groups consumption and nutritional biomarkers in two different approaches: when considering the NKTS (IRT scores calculated from 11 items) or the original NKT (IRT scores calculated from all 23 items). One of the benefits of using a lower number of items is the accuracy of participants' responses, as large periods for questionnaire completion tend to increase fatigue and boredom⁽³⁰⁾. Therefore, the reduction in the number of items on the questionnaire may improve the quality of answers and decrease the time of completion. This aspect is important for epidemiologic researchers working with large sample sizes and assessing information in a short period of time.

Besides this refinement of the NKT, by selecting the items that best discriminated nutritional knowledge, all items maintained on the NKTS presented adequate guessing parameters. If an item presented a high value concerning the guessing parameter, it should be excluded from the final questionnaire, because guessing is influenced by a high probability of correct answers⁽²⁴⁾. Therefore, adequate guessing parameters may confirm the precision of the NKTS. In this regard, the IRT analyses improved the quality of nutritional knowledge assessment.

In addition to the reduced number of items and greater accuracy of the measurement, the current analysis confirmed the construct validity of the NKTS. The mixed model linear regression analysis confirmed that nutritional knowledge is positively associated with the consumption of healthy foods and an appropriate profile of nutritional biomarkers. The NKTS scores were positively associated with

intake of fruits, cereals, dairies, pulses, meat and eggs, and fish as well as with blood concentrations of vitamin C, beta-carotene, *n*-3 fatty acids, holo-transcobalamin, cobalamin, and folate; on the other hand, nutritional knowledge was negatively associated with consumption of olives and avocado, alcohol, and savoury snacks. A recent study on Japanese children and their guardians also observed a positive association between nutritional knowledge and healthy food consumption⁽³¹⁾. Among adolescents, some studies have demonstrated that nutritional knowledge is related to a higher overall variety of food^(32,33), higher serum retinol, and lower intakes of total fat and added sugars⁽³³⁾. Finally, considering the challenges to obtain accurate food intakes, the positive associations between NKTS scores and nutritional biomarkers improved the results from the mixed model linear regression analysis with food groups' consumption as the outcome variable. Despite the non-expected negative association with intakes of olives and avocado ($p < 0.05$), our results highlight the importance of acquiring nutritional knowledge as a strategy to improve dietary habits among adolescents.

After calculating IRT scores, the next step was to describe the nutritional knowledge in each NKTS level. Based on this description, it may be possible to better assess what adolescents know about nutrition and in which items they may have more difficulties⁽²⁹⁾. The basic level includes knowledge about energy expenditure and ingredients from recipes. Individuals who are classified on this level would correctly answer to the item with the lowest difficulty level: *'Marcel has been playing with a ball all afternoon. During this time Kevin has been sitting at home watching television. Which of the following statements is most applicable?'* ($b_i = -2 \cdot 13$). The item *'Which row lists three terms for energy-free sweeteners?'* presented the highest difficulty parameter ($b_i = 1 \cdot 50$), suggesting that advanced nutritional terms were the most difficult to be identified by adolescents of the HELENA study. This item would probably be answered correctly by those adolescents on the advanced level and with NKTS scores higher than 1.50. Therefore, the identification of the NKTS levels in the studied individuals may improve the strategic direction of scientific interventions and policymaking.

This description makes it possible to determine the proportion of individuals on each NKT level. In this regard, adolescents from Heraklion and Lille presented the lowest NKTS scores. In agreement with a previous study that evaluated the NKT⁽³⁾, the scores from the NKTS significantly increased in adolescents that were older in

age, female, and whose mothers had more education. Moreover, the positive associations between NKTS scores and socioeconomic level are consistent with previous research. A population-based study indicated a linear association between nutritional knowledge and socioeconomic level in urban and rural regions in Iraq⁽³⁴⁾. Finally, in the current study, NKTS scores were negatively associated with BMI among thin and obese adolescents. However, the relationship between nutritional knowledge and nutritional status is not well known in the literature. The previous study evaluating the NKT⁽³⁾ and other studies have demonstrated no significant associations in adolescents and adults^(35,36). However, it is important to mention that these studies used the classical test theory, and therefore, their results may not be accurate.

The test information curve indicated that the NKTS is more precise within medium scores. For this reason, it is necessary to include new items measuring other levels of knowledge. In future studies, the item parameters could be maintained and new items included in the NKTS. This could be possible using computerized adaptive testing which allows calculating more precise estimates and creating a flexible questionnaire making it less burdensome for respondents⁽³⁷⁾.

The current analysis aimed to evaluate the NKT based on the ITR analysis and assess the construct validity of the developed NKTS and its associations with food consumption and nutritional biomarkers in adolescents. The factor analysis confirmed that the NKT assessed nutritional knowledge. However, if we were evaluating nutritional knowledge in other populations, the classical approach would not be applicable by using the original NKT. The IRT analysis complemented the classical test approach, identifying those items with better discrimination and the location of each item on the continuum. Additionally, IRT analysis added the characterization of each nutritional knowledge level. Results from the mixed model linear regression analysis confirmed the validity of the NKTS endorsing its use on epidemiological studies. Furthermore, due to the invariance on the estimation of the IRT parameters, the NKTS can be applied to other populations such as adolescents and adults from different countries⁽²⁸⁾. When analysing NKTS scores in other populations it will be necessary that participants answer some or all of the eleven items. Moreover, to calculate these scores, it is important to consider the IRT parameters calculated in the current study. In addition, IRT scores can be applied to further studies in continuous or categorical forms.

Limitations and strengths. One limitation of this study concerns the cross-sectional design which does not allow pointing out causal inferences. Besides, the missing values reduced the sample size to the IRT analysis, but it was large enough to estimate IRT parameters and detect associations between IRT scores and both food intake and nutritional biomarkers. The HELENA study did not assess information on supplement intake that may affect the results from the mixed model linear regression analyses, with the concentration of biomarkers as the dependent variable. The dietary assessment was based in self-reporting which may affect the precision of the information, although the HELENA DIAT software includes some questions to help adolescents remember what they ate the day before. However, the study has some strengths; the stratified nature of the sampling increased the precision of the data that may differ across strata. The standard procedures used to collect all measurements throughout the cities and the analyses were controlled by several confounding factors. Furthermore, the development of the NKTS was based on statistical analyses that solve the limitations of the classical test approach previously described. In this regard, the use of the NKTS may generate new and promising research partnership, and after its standardization, researchers can apply this new method to assess nutritional knowledge in different studies and populations.

CONCLUSIONS

The IRT analysis selected those items from the NKT which presented better nutritional knowledge discrimination. The NKTS provides a more precise assessment of the latent trait with a short and high-quality pool of items. The mixed model linear regression analysis confirmed the validity of the NKTS indicating positive associations between the NKTS and healthy food consumption as well as nutritional biomarkers. The NKTS is proposed as a new instrument to assess nutritional knowledge in Europe and other parts of the world.

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SUPPLEMENTARY MATERIAL

Table 1: Biserial coefficient, IRT parameters estimates and the standard errors of all items from Nutritional Knowledge Test (N = 3,215).

Items	Correct answer	Biserial	a_i^a (SE)	b_i^b (SE)	c_i^c (SE)
Marcel has been playing with a ball all afternoon. During this time Kevin has been sitting at home watching television. Which of the following statements is most applicable?	Marcel burns more energy than Kevin	0•44	1•16 (0•08)	-2•21 (0•13)	0•02 (0•03)
Which row lists three dishes that have all been prepared using very little fat?	Boiled egg, boiled potatoes, steamed fish	0•40	0•94 (0•06)	-1•11 (0•09)	0•01 (0•02)
Which substance is good for your teeth?	Fluoride	0•39	0•90 (0•06)	-0•68 (0•11)	0•02 (0•02)
Which row lists three types of edible fish?	Codfish, turbot, carp	0•31	0•69 (0•05)	-0•34 (0•14)	0•02 (0•03)
Which of the following fast-food menus contains the most nutrients?	Hamburger with salad and orange juice	0•33	0•70 (0•05)	-0•28 (0•12)	0•01 (0•02)
Dieticians use the American term 'junk food' to describe certain foods. What do they mean by this?	Foods that contain a lot of energy but are of very little nutritional value	0•39	0•92 (0•06)	-0•19 (0•08)	0•01 (0•02)
What is another name for the coating that develops on teeth when one eats a lot of sweets?	Plaque	0•32	0•67 (0•05)	-0•17 (0•12)	0•01 (0•02)
Bread, cake, pasta, potatoes, and rice contain mainly...	Carbohydrates	0•40	1•13 (0•13)	-0•14 (0•23)	0•11 (0•06)
What effect does the fibre contained in our food have on the human body?	It stimulates the process of digestion	0•47	1•20 (0•08)	0•02 (0•07)	0•01 (0•02)

SE, Standard Error. ^a Discrimination parameter. ^b Difficulty parameter. ^c Guessing parameter.

Table 1: Biserial coefficient, IRT parameters estimates and the standard errors of all items from Nutritional Knowledge Test (N = 3,215) (continuation).

Items	Correct answer	Biserial	a_i^a (SE)	b_i^b (SE)	c_i^c (SE)
What can consuming large amounts of salt result in or aggravate?	High blood pressure	0•29	0•58 (0•05)	0•13 (0•13)	0•01 (0•02)
The ingredients list found items may contain a number of different terms for sugar. Which row list three terms for special types of sugar?	Dextrose, fructose, maltose	0•54	1•55 (0•09)	0•20 (0•05)	0•01 (0•01)
A breakfast merely consisting of bread, jam, and butter does not contain enough...	Protein	0•41	0•91 (0•07)	0•30 (0•12)	0•02 (0•03)
Which row lists three foods that contain a lot of vitamin C?	Peppers, cabbage, citrus fruit	0•41	1•00 (0•10)	0•45 (0•15)	0•03 (0•04)
Which of the following statements about sugar is correct?	Sugar only provides energy	0•29	0•55 (0•05)	0•55 (0•18)	0•02 (0•02)
What is the other commonly used term for energy?	Joule	0•36	1•00 (0•11)	1•03 (0•13)	0•03 (0•03)
Which one of the following types of mineral water would be the healthiest?	Mineral water with a high Mg content	0•32	0•62 (0•06)	1•23 (0•15)	0•01 (0•02)
Which row lists three terms for energy-free sweeteners?	Aspartame, saccharin, cyclamate	0•46	1•29 (0•10)	1•46 (0•08)	0•01 (0•01)
How much salt should one consume per day in addition to that contained in the foods eaten?	None at all	0•30	0•62 (0•06)	1•68 (0•17)	0•01 (0•02)
How many cubes (teaspoons) of sugar are there in a can (0•33l) of coke or lemonade?	Approximately twelve cubes (seven teaspoons)	0•27	0•51 (0•07)	2•04 (0•28)	0•02 (0•03)
How long must one swim in order to burn the amount of energy contained in a single chocolate?	Approximately 10 min	0•23	0•40 (0•06)	2•13 (0•42)	0•03 (0•04)

SE, Standard Error. ^a Discrimination parameter. ^b Difficulty parameter. ^c Guessing parameter.

Table 1: Biserial coefficient, IRT parameters estimates and the standard errors of all items from Nutritional Knowledge Test (N = 3,215) (continuation).

Items	Correct answer	Biserial	a_i^a (SE)	b_i^b (SE)	c_i^c (SE)
A small bag of roasted peanuts (125g) contains as much energy...	As a whole lunch meal	0•25	0•45 (0•06)	2•40 (0•32)	0•02 (0•02)
Raw minced meat should be stored in the refrigerator for a maximum of...?	Half a day	0•20	0•73 (0•23)	3•78 (0•51)	0•08 (0•02)
How many cubes (teaspoons) of sugar are there in a bottle of ketchup (250ml)?	Approximately twenty-three cubes (fourteen teaspoons)	0•25	0•54 (0•12)	4•15 (0•53)	0•02 (0•02)

SE, Standard Error. ^a Discrimination parameter. ^b Difficulty parameter. ^c Guessing parameter.

4.2. Artigo 2 - Proposta de uma escala de avaliação das motivações de saúde para as escolhas alimentares (SOFIE) com aplicação da Teoria de Resposta ao Item e estudo das associações do escore com consumo alimentar e concentração de biomarcadores nutricionais em adolescentes europeus

“A new measure of health motivation influencing food choices and its association with food intakes and nutritional biomarkers in European adolescents”: submetido na revista Public Health Nutrition (fator de impacto: 2,48; estrato A1 na área de concentração Saúde Coletiva - Qualis Capes).

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ABSTRACT

Objective: To develop a scale to assess health motivation influencing food choices and to explore its performance in the associations with food intakes and nutritional biomarkers.

Design: Psychometric study using cross-sectional self-report questionnaires and nutritional biomarkers.

Setting: Multicenter investigation conducted in ten European cities.

Participants: 2,954 adolescents who were included in the HELENA study and completed the Food Choices and Preferences (FCP) questionnaire.

Results: 19 out of 124 items of the FCP questionnaire were in the same dimension. Sixteen presented adequate parameters for the Scale of evaluation of Food choices (SOFIE). The scores were positively associated with the intakes of cereals, dairy products, meats and eggs, and fish as well as with blood concentrations of vitamin C,

beta-carotene, *n*-3 fatty acids, cobalamin, holo-transcobalamin and folate; scores were negatively associated with the intakes of nuts and seeds, alcohol and savory snacks.

Conclusions: SOFIE can improve the assessment of the motivation influencing food choices based on items with the best performance and is proposed as a new measure to health-related studies.

KEYWORDS: health; food; choice behavior; psychometrics; biomarkers

INTRODUCTION

Worldwide, epidemiological studies show high prevalence of overweight and unhealthy lifestyles in children and adolescents^(1,2). The food environment plays an important role in this context, with an impact on young people health⁽³⁾.

While the dietary assessment investigates foods and nutrients intakes, the study of food choices confines to the selection of foods and does not reach what foods are eaten⁽⁴⁾. Furthermore, the assessment of food choices has to consider the different factors motivating the selection of one food or another, such as taste, familiarity and/or health⁽⁵⁾.

In order to investigate the food choices of adolescents motivated by health, researchers from the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study developed the Food Choices and Preferences (FCP) questionnaire based on the focus groups' discussions with European adolescents concerning their insights about healthy eating and lifestyle, food choices, and preferences^(6,7). This questionnaire has been analysed based on a classic approach that takes into account the percentage of answers; however, this analysis focused on specific topics of FCP⁽⁸⁾. In this regard, there is a need to obtain a more detailed information about health motivation influencing food choices.

The Item Response Theory (IRT) analysis has been suggested as an approach to measure attitudes and abilities complementing the classical analysis underlying the percentage of responses. The IRT analysis provides the discrimination of the latent trace for each item of the questionnaire and considers the proximity between the individuals and the items to calculate the scores⁽⁹⁻¹¹⁾. However, the use of the IRT analysis is relatively recent in the evaluation of food attitudes^(12,13),

especially when considering the proximity factor between individuals and the studied items.

For these reasons, we aimed (i) to develop a scale to assess health motivation influencing food choices using an Unfolding Model of the IRT; and (ii) to explore the performance of the scale in the associations with food intakes and nutritional biomarkers. In order to assess these objectives, the motivation influencing food choices was considered the latent trace in the current analysis.

MATERIALS AND METHODS

Study design and subjects. The HELENA study is a cross-sectional, multi-centre investigation in 10 European cities of more than 100,000 habitants: Vienna (Austria), Gent (Belgium), Lille (France), Dortmund (Germany), Athens and Heraklion (Greece), Pécs (Hungary), Rome (Italy), Zaragoza (Spain) and Stockholm (Sweden)⁽¹⁴⁾. It was carried out in a random cluster sample of 3528 European adolescents aged 12•5 – 17•5 years, stratified for geographical location, age and socio-economic status. Overall, ten schools and 15-20 classes (350-400 students) were selected in each centre of investigation. At the selected schools, the eligibility of each class was based on the percentage of students who agreed to participate in the HELENA study equal to at least 70%. From the total sample, it was decided to obtain blood samples in a random selected group of one third of the adolescents (n=1089).

Exclusions from the study were carried out *a posteriori* when the adolescents presented simultaneous participation in another clinical trial; aged < 12•5 or ≥ 17•5 years; and/or acute infection less than one week before inclusion. Those adolescents who completed the FCP questionnaire were included (n=2954) for the factor analysis. To estimate the IRT parameters a random sample of 2000 adolescents was selected in accordance to the maximum number of respondents for analyses in the GGUM software. No differences were observed between those who participated in the current analyses and those who did not, except for their age; those adolescents included in the current analyses are older than the whole sample (Supplementary material, table 1). For the mixed models linear regression analyses, those adolescents who had information on dietary intake and did not underreport energy intake (n=1082), using Goldberg and collaborators approach^(15,16), were included. Moreover, the adolescents from whom blood samples were obtained (n=444), were included to investigate biomarkers and food choices associations.

Food choices assessment. Food choices were evaluated with the FCP questionnaire (Supplementary material, figure 1) based on information from focus groups that were previously conducted in five European countries: Belgium, Hungary, Spain, Sweden and UK⁽⁶⁻⁸⁾. The FCP questionnaire was administered in the classroom to investigate adolescent attitudes and opinions about food choices, preferences, healthy eating and lifestyles^(6,17).

The FCP questionnaire presented 166 questions with different response's models, but 161 of them required to select only one answer. To develop a scale to assess health motivation influencing food choices using the IRT analysis, those questions with more than one possible answer and those with a non-hedonic scale were excluded ($n = 42$), remaining 124 questions for the present analyses. In the FCP questionnaire, the questions were displayed in three sections⁽⁶⁾. From those sections, the following subsections presented the criteria to be included in the present study:

- (1) Opinions about food choices, preferences, diet and health, with subsection 1.1 'The opinions about food choices, preferences and healthy eating' (7-point hedonic scale);
- (2) Choices and preferences of snack foods and drinks, with subsections 2.1 'How much the adolescent liked each food and drink from a popular list of snack foods and drinks' (5-point hedonic scale) and 2.2 'How healthy the adolescent perceived each of those food and drink to be' (5-point hedonic scale);
- (3) Important influences on food choices and preferences, with subsection 3.1 'The important influences on food choices at breakfast, main meal and snacks' (5-point hedonic scale).

Sociodemographic characteristics. Socioeconomic status was evaluated with a self-reported questionnaire that collects data on living conditions, family structure, employment status and parental occupation, and educational level⁽¹⁸⁾. The Family Affluence Scale index was calculated based on this questionnaire and it was used as an indicator of the adolescents' material affluence. The scale ranged from 0 to 8 and was dichotomized into: 'low familial wealth' (0–4) and 'high familial wealth' (5-8). The maternal education levels were categorized in 'primary education', 'lower secondary education', 'higher secondary education' and 'university degree'⁽¹⁹⁾.

Dietary assessment. Dietary intake was assessed by two non-consecutive computerized 24-h recalls, including weekdays and Sundays and using the HELENA-Dietary Intake Assessment Tool (HELENA-DIAT). The second 24-h recall was administered two weeks after the first was completed⁽²⁰⁾. Both 24-h recalls were completed at the school setting and trained nutritionists assisted the students when required. Adolescents autonomously selected all the consumed foods and beverages from a food list that included six 'meal occasions'. Some questions were presented to respondents to help them to remember what they ate the day before⁽²¹⁾.

In order to remove the effect of day-to-day variability and random error in 24-h recalls, the individual usual food intake was estimated with the multiple source method⁽²²⁾. This analysis takes into consideration the information from the food frequency questionnaire as a covariate of the two 24-h dietary recalls. This food frequency questionnaire was designed in the Healthy Behaviour in School-aged Children study⁽²³⁾ and includes fifteen items and seven response categories ranging from 'never' to 'more than once a day, every day'⁽²⁰⁾.

Foods and beverages consumption was expressed as grams and millilitres per day, respectively. Fifteen food groups were computed according to similarity in nutritional content and health related characteristics: (i) vegetables (excluding potatoes); (ii) fruits; (iii) vegetable (excluding potatoes) and fruits; (iv) sweets (including carbonated/soft/isotonic drinks, cakes, biscuits, chocolate and other sugar products); (v) cereals; (vi) nuts and seeds; (vii) vegetable oils; (viii) olives and avocado; (ix) alcohol; (x) dairy products (including milk and yogurt); (xi) pulses; (xii) meats and eggs; (xiii) fish; (xiv) savoury snacks (including chips, salty biscuits, crackers and pop corns) and (xv) water.

Body composition. Weight was measured by the use of an electronic scale (model SECA 861), precision 0.1 kg. Height was measured with participants barefoot in the Frankfort plane using a telescopic height-measuring instrument (model SECA 225), precision 0.1 cm, and range 70-200 cm. All measurements were taken by trained staff⁽²⁴⁾.

Body Mass Index (BMI) was calculated as weight (in kilograms) divided by the square of height (in meters) (kg/m^2). The values of BMI were categorized in

‘thinness’, ‘normal weight’, ‘overweight’ and ‘obesity’, using the BMI-cut offs defined by Cole et al.^(25,26).

Analysis of biomarkers in blood. The blood collection was performed at a time after 10 hours of overnight fast following a standardized protocol. A handling and transport system was developed to guarantee the quality assurance and stability of the fresh blood samples⁽²⁷⁾.

Folate (plasma and erythrocyte) and cobalamin were measured by competitive immunoassay (Immunolite 2000, DPC Biermann GmbH, Bad Nauheim, Germany). Beta-carotene and vitamin C were analysed by high performance liquid chromatography (Sykam, Gilching, Germany) using UV detection (UV-Vis 205; Merck Darmstadt, Germany). *N*-3 and *trans* fatty acids concentration were determined by capillary gas chromatography (Model 3900) after extraction performed by thin layer chromatography. Holo-transcobalamin was measured by micro particle enzyme immunoassay (Active B₁₂; Axis-Shield Limited, Dundee, UK) with the use of an AxSym analyser (Abbott Diagnostics, Abbott Park, IL, USA)^(20,27).

Data analysis. The dimensionality of the FCP questionnaire was analysed by factor analysis using the principal components analysis with varimax orthogonal rotation. Those items that presented unidimensionality were maintained for further analyses. The conformability was based on the communality of the items derived from the two retained factors. One item was excluded when communality was lower than 0.30, indicating that these two retained factors represent less than 30% of its variation^(11,28). The factor analysis was repeated only with items with adequate communality and factor loadings above 0.40. In addition, the first factor had to explain 20% or more of the total variance⁽²⁹⁾.

To perform the IRT analysis with the estimation of the IRT parameters, the generalized graded unfolding model (GGUM) was used. This model allows measures of the proximity of the individual to the item and can be represented by a single-peaked response function indicating that the agreement with an item will be higher when the proximity of the individual to the item is lower^(11,28). Regarding health motivation influencing food choices, an individual with low motivation and another one with high motivation, they both would present a high disagreement with the studied item. For example, for the item ‘*What is your opinion about: you feel well*

informed about what are healthy foods? that presents seven possible responses (from strongly disagree to strongly agree), both individuals may think that they are not informed enough about healthy foods, and therefore, the distance between the item and the individuals will be large in both cases.

The GGUM is represented by the following equation:

$$P(Z_i = z | \theta_j) = \frac{\exp\left[\alpha_i \left(z(\theta_j - \delta_i) - \sum_{k=0}^z \tau_{ik}\right)\right] + \exp\left[\alpha_i (M - z)(\theta_j - \delta_i) - \sum_{k=0}^z \tau_{ik}\right]}{\sum_{v=0}^H \left[\exp\left[\alpha_i \left(v(\theta_j - \delta_i) - \sum_{k=0}^v \tau_{ik}\right)\right] + \exp\left[\alpha_i \left((M - v)(\theta_j - \delta_i) - \sum_{k=0}^v \tau_{ik}\right)\right] \right]}$$

where:

Z_i = an observable response to item i ;

$z = 0, 1, 2, \dots, C$, where $z = 0$ corresponds to the strongest level of disagreement;

θ_j = the location of individual n on the continuum of motivation influencing food choices;

α_i = discrimination parameter of item i ;

δ_i = the location of the item i on the continuum of motivation influencing food choices;

τ_{ik} = the relative location of the subjective response category threshold k on the continuum relative to a given item i ;

M = the number of subjective response categories minus 1.

Y_i = a subjective response to item i ;

$y = 0, 1, 2, 3, \dots, M$, where $y = 0$ corresponds to the strongest level of disagreement from below the item whereas $y = M$ corresponds to the strongest level of disagreement from above the item;

The α_i indicates the variation of a subjective response category between the items while the score changes along the continuum. Items with higher values for this parameter present a lower probability of change across categories when there is a low variation of the score. The δ_i is estimated in the same scale of the parameter of location of the individual (θ_j) and it indicates if someone is located down or above the location of the item. The τ_{ik} indicates the range of subjective responses for each item. The individual scores were obtained using a Bayesian estimation method: the Expected a Posteriori (EAP), with the *a priori* distribution⁽¹⁰⁾.

All IRT parameters (α_i , δ_i and τ_{ik}) were estimated by Marginal Maximum Likelihood with $N(0,1)$ *a priori* distribution with mean equal to zero and standard error equal to one. The estimates were analyzed with the corresponding standard error. Items with high δ_i standard errors and with overlapping of the item characteristic curve were re-categorized. Those items that remained with high δ_i standard errors after the re-categorization and with low values for α_i were excluded for further analyses.

Fifty quadrature points were used equally spaced between -4 and +4 with P value lower than 0.001 for the convergence. For each pair of θ_j and δ_i , a signed difference was calculated and this difference was divided into homogenous groups of size $n = 100$.

The range of scores from health motivation influencing food choices between which individuals are most likely to agree with the latter category was assessed from the following equation $\Delta \pm \text{TAU}$ of the last category. Item fit was assessed using unweighted mean squared error (outfit) and weighed mean squared error (infit). Items that presented these statistics not equal or close to one were excluded⁽³⁰⁾. Two nutritionists (TSSS and CJ) did the characterization of each scale level.

To explore the associations between the IRT scores and the demographic, socioeconomic and health characteristics and food intakes, the Kolmogorov-Smirnov tests were carried out to test the normality in the distribution of the studied variables and to guide further analyses. Chi-square tests were performed to evaluate differences between demographic, socioeconomic and BMI categories with each scale level. Mixed-model linear regression analyses were used to verify associations between food group intakes, nutritional biomarkers and IRT scores (as continuous data). Food groups and biomarkers variables were included separately in the model and center of investigation was included as the random intercept. Age, gender, maternal education, Family Affluence Scale index, BMI and energy intake were entered as covariates in the model.

The analyses were carried out with the statistical software package STATA Version 14.0 and GGUM 2004 software^(11,31).

RESULTS

As suggested by the factor analysis, the items from the three sections of the FCP questionnaire did not present unidimensionality. Nevertheless, some items presented low values of communality and factor loadings. Items referring to the subsection 2.1 (*How much the adolescent liked each food and drink from a popular list of snack foods and drinks*) were excluded from further analyses as they were grouped in a different factor when compared with the other sections.

The factor analysis was repeated for the subsections 1.1 (*The opinions about food choices, preferences and healthy eating*); 2.2 (*How healthy the adolescent perceived each of those foods and drinks*); and 3.1 (*The important influences on food choices at breakfast, main meal and snacks*). Only some items of the subsection 3.1 presented adequate values of communality and factor loadings. In addition, none of the items from other subsections presented adequate values of communality and factor loadings.

The aforementioned analyses indicated that the items from subsections 2.1 (*How much the adolescent liked each food and drinks from a popular list of snack foods and drinks*) and 3.1 (*Important influences on food choices at breakfast, main meal and snacks*) measure a latent trace other than health motivation influencing food choices. The factor analysis was repeated for the other two subsections (1.1 and 2.2). Nineteen items (seven from the 1.1 subsection and twelve from the 2.2 subsection) presented adequate communality and factor loadings and explained 22% of the total variance.

These nineteen items were analysed with GGUM (Supplementary material, table 2). Sixteen of these items presented adequate IRT parameters and respective standard errors for the final Scale of evaluation of Food choices (SOFIE). The questions are displayed in supplementary material, figure 2.

The IRT parameters (α_i , δ_i and τ_{ik}), range of scores and values for outfit and infit of the remaining items are described in table 1 in d_i increasing order. The item 'What is your opinion about: the food you eat at home is healthy?' presented the highest value for discrimination parameter ($\alpha_i = 2.09$). Individuals who presented SOFIE scores between -0.23 and 2.07 were more likely to agree on this item. The item 'What is your opinion about: you enjoy fruit and vegetables?' presented the lowest value for discrimination parameter ($\alpha_i = 0.53$) and the highest value for δ_i ($\delta_i =$

1.75). Individuals who presented SOFIE scores between 1.36 and 2.15 were more likely to agree moderately on this item. The characteristic curves for these two items are displayed in figures 1 and 2, respectively.

Figure 1: Item characteristic curve for item ('I agree that food I eat at home is healthy.') with the highest discrimination parameter ($\alpha_i = 2.09$) ($n=2000$).

Prob., Probability. Theta, IRT scores. z0: item characteristic curve from the category 1. z1: item characteristic curve from the category 2. z2: item characteristic curve from the category 3.

Figure 2: Item characteristic curve for item ('I agree a lot that I enjoy fruit and vegetables.') with the lowest discrimination parameter ($\alpha_i = 0.53$) and highest parameter of the location of the item ($\delta_i = 1.75$) ($n=2000$).

Prob., Probability. Theta, IRT scores. z0: item characteristic curve from the category 1. z1: item characteristic curve from the category 2. z2: item characteristic curve from the category 3. z3: item characteristic curve from the category 4.

Table 1: Total number of categories, generalized graded unfolding model item parameters estimates, range of scores, outfit and infit for each item from the SOFIE scale (n = 2000).

Item	N _{cat}	α_i (SE)	δi (SE)	τ_{i2}	τ_{i3}	τ_{i4}	τ_{i5}	Range	Outfit	Infit
<i>How healthy you perceived ...</i>										
Chocolate milk	4 ^a	1•13 (0•07)	-0•11 (0•03)	-2•38	-1•16	-0•53	-	-0•64; 0•43	1•11	1•09
Cheese products (e.g. cheddar, brie, cheese strings)	4 ^a	1•18 (0•07)	-0•03 (0•03)	-2•48	-1•66	-1•31	-	-1•33; 1•28	1•36	1•27
Sandwiches, toasties and pannini	4 ^a	1•13 (0•07)	-0•02 (0•03)	-2•21	-1•26	-0•19	-	-0•21; 0•17	1•16	1•12
Cereal bars	4 ^a	1•18 (0•08)	-0•01 (0•03)	-2•52	-2•09	-1•24	-	-1•25; 1•23	1•30	1•22
Yoghurt and yoghurt products	5 ^b	1•18 (0•07)	0•01 (0•03)	-2•93	-2•43	-1•64	-0•27	-0•27; 0•28	1•19	1•16
Bowl of cereal	4 ^c	1•40 (0•08)	0•03 (0•03)	-1•95	-1•43	-0•16	-	-0•13; 0•19	1•15	1•14
Juices	5 ^b	1•06 (0•07)	0•04 (0•03)	-2•74	-2•07	-1•85	-0•61	-0•57; 0•65	1•26	1•22
Bread and toast	4 ^a	1•46 (0•09)	0•05 (0•03)	-2•61	-1•81	-0•98	-	-0•93; 1•03	1•30	1•24
Milk	4 ^c	1•30 (0•08)	0•08 (0•03)	-2•43	-2•27	-1•08	-	-1•00; 1•16	1•24	1•24
Tea	3 ^d	0•86 (0•07)	0•20 (0•05)	-2•27	-1•89	-	-	-1•69; 2•09	1•18	1•14
Pasta dishes	3 ^d	0•84 (0•06)	0•25 (0•05)	-1•67	-1•09	-	-	-0•83; 1•34	1•09	1•07

N_{cat}: number of categories. SE, Standard Error. ^a: Very unhealthy; unhealthy; indifferent; healthy. ^b: Very unhealthy; unhealthy; indifferent; healthy; very healthy. ^c: Unhealthy; indifferent; healthy; very healthy. ^d: Unhealthy; indifferent; healthy. ^e: Disagree; indifferent; agree. ^f: Disagree; indifferent; slightly agree; moderately agree. α_i : discrimination parameter of item i. δi : the location of the item i on the attitude continuum. τ_{i1} : equal to zero for all items. τ_{i2} : Difference between subjective categories from the category 2. τ_{i3} : Difference between subjective categories from the category 3. τ_{i4} : Difference between subjective categories from the category 4. τ_{i5} : Difference between subjective categories from the category 5. Range= Delta±TAU of the last category.

Table 1: Total number of categories, generalized graded unfolding model item parameters estimates, range of scores, outfit and infit for each item from the SOFIE scale (n = 2000) (continuation).

Item	N _{cat}	α_i (SE)	δ_i (SE)	τ_{i2}	τ_{i3}	τ_{i4}	τ_{i5}	Range	Outfit	Infit
<i>What is your opinion about...</i>										
The food you eat at home is healthy	3 ^e	2.09 (0.14)	0.92 (0.04)	-3.09	-1.14	-	-	-0.23; 2.07	0.84	0.83
Your diet is healthy	3 ^e	1.68 (0.12)	0.96 (0.05)	-2.92	-0.60	-	-	0.36; 1.57	0.89	0.89
You like the food your parents prepare at home	4 ^f	0.62 (0.05)	1.01 (0.11)	-5.55	-2.03	-0.94	-	0.06; 1.95	0.96	0.97
You feel well informed about what are health foods	3 ^e	0.90 (0.07)	1.12 (0.10)	-4.47	-1.09	-	-	0.03; 2.22	0.95	0.95
You enjoy fruit and vegetables	4 ^f	0.53 (0.05)	1.75 (0.26)	-5.94	-3.45	-0.39	-	1.36; 2.15	0.94	0.94

N_{cat}: number of categories. SE, Standard Error. ^a: Very unhealthy; unhealthy; indifferent; healthy. ^b: Very unhealthy; unhealthy; indifferent; healthy; very healthy. ^c: Unhealthy; indifferent; healthy; very healthy. ^d: Unhealthy; indifferent; healthy. ^e: Disagree; indifferent; agree. ^f: Disagree; indifferent; slightly agree; moderately agree. α_i : discrimination parameter of item i. δ_i : the location of the item i on the attitude continuum. τ_{i1} : equal to zero for all items. τ_{i2} : Difference between subjective categories from the category 2. τ_{i3} : Difference between subjective categories from the category 3. τ_{i4} : Difference between subjective categories from the category 4. τ_{i5} : Difference between subjective categories from the category 5. Range= Delta±TAU of the last category.

The items presented adequate values for outfit (range from 0.84 to 1.30) and infit (range from 0.83 to 1.27). The adequate overall adjustment of the observed average values for the expected average values can be observed in figure 3.

Figure 3: Average observed versus expected estimative of food choices scores (n=2000).

Theta – Delta = IRT scores - parameter of the location of the item.

The SOFIE was categorized in three levels, namely: low (1), indifferent (2), and high (3). The level (1) includes items about how healthy the adolescent perceived chocolate milk, cheese products, sandwiches/toasts/panini, cereal bars, yoghurt/yoghurt products, bowl of cereal and juices. The level (2) includes items about how healthy the adolescent perceived bread/toast, milk, tea and pasta dishes. The level (3) includes items about the opinions about feed at home, individual diet, information about health foods and food preferences. So, the individuals who moderately agree on item '*What is your opinion about: you enjoy fruit and vegetables?*' (those with scores between 1.36 and 2.15) were more likely to present high health motivation in order to choose foods. The individuals who perceived tea as healthy (those with scores between -1.69 and 2.09) were more likely to present indifferent health motivation when choosing foods. The SOFIE medium scores are less informative than those SOFIE scores in the low and high levels (Figure 4).

Figure 4: Test information curve from Scale of Evaluation to Food Choices (n=2000).

Demographic and socioeconomic characteristics of the participants on the three levels of SOFIE are displayed in table 2. Girls and those adolescents with high Family Affluence Scale index and mothers with university education presented high health motivation when choosing foods.

The results of the mixed model linear regression analyses, with food groups consumption, as the dependent variable, are shown in table 3. The SOFIE scores were positively associated with intakes of cereals, dairy products, meats and eggs, and fish, and were negatively associated with intakes of nuts and seeds, alcohol and savory snacks ($p < 0.05$).

The results of the mixed model linear regression analyses, with biomarkers, as the dependent variable, are displayed in table 4. The SOFIE scores were positively associated with the concentration of vitamin C, beta-carotene, *n*-3 fatty acids, cobalamin, holo-transcobalamin and folate (plasma and erythrocyte) ($p < 0.05$). These results were similar when the number of cigarettes was included as covariate (data not shown).

Table 2: Demographic and socioeconomic characteristics and body mass index according to food choices scores groups among European adolescents (n = 2000).

	N (%)	N (%)			P value
		Unhealthy 1053 (52•7)	Indifferent 639 (32•0)	Healthy 308 (15•4)	
Age (years)					0•971 ^b
12•5-13•99	602 (30•1)	315 (29•9)	188 (29•4)	99 (32•1)	
14-14•99	517 (25•8)	263 (25•0)	181 (28•3)	73 (23•7)	
15-15•99	487 (24•4)	268 (25•5)	161 (25•2)	58 (18•8)	
16-17•49	394 (19•7)	207 (19•7)	109 (17•1)	78 (25•3)	
Sex					0•001 ^{a*}
Male	938 (46•9)	491 (46•6)	329 (51•5)	118 (38•3)	
Female	1062 (53•1)	562 (53•4)	310 (48•5)	190 (61•7)	
FAS					<0•001 ^{a*}
Low	834 (44•0)	476 (47•9)	256 (42•3)	102 (34•1)	
High	1063 (56•0)	517 (52•1)	349 (57•3)	197 (65•9)	
Maternal education					0•001 ^{a*}
Primary	139 (7•3)	87 (8•6)	42 (6•9)	10 (3•4)	
Lower secondary	466 (24•4)	248 (24•6)	144 (23•6)	74 (25•2)	
Higher secondary	641 (33•5)	356 (35•4)	200 (32•8)	85 (28•9)	
University degree	665 (34•8)	316 (31•4)	224 (36•7)	125 (42•5)	

FAS, Family Affluent Scale. BMI, Body Mass Index. ^a: Likelihood Ratio. ^b: Linear-by-Linear Association. *P value < 0•05.

Table 2: Demographic and socioeconomic characteristics and body mass index according to food choices scores groups among European adolescents (n = 2000) (continuation).

	N (%)	N (%)			P value
		Unhealthy 1053 (52.7)	Indifferent 639 (32.0)	Healthy 308 (15.4)	
Centre					<0.001 ^{a*}
Athens	208 (10.4)	125 (11.9)	74 (11.6)	9 (2.9)	
Dortmund	232 (11.6)	85 (8.1)	105 (16.4)	42 (13.6)	
Gent	191 (9.6)	122 (11.6)	52 (8.1)	17 (5.5)	
Heraklion	173 (8.6)	105 (10.0)	61 (9.5)	7 (2.3)	
Lille	190 (9.5)	112 (10.6)	54 (8.5)	24 (7.8)	
Pécs	162 (8.1)	120 (11.4)	36 (5.6)	6 (1.9)	
Rome	218 (10.9)	108 (10.3)	74 (11.6)	36 (11.7)	
Stockholm	202 (10.1)	75 (7.1)	34 (5.3)	93 (30.2)	
Vienna	300 (15.0)	144 (13.7)	99 (15.5)	57 (18.5)	
Zaragoza	124 (6.2)	57 (5.4)	50 (7.8)	17 (5.5)	
BMI					0.421 ^b
Thinness	116 (5.8)	63 (6.0)	41 (6.4)	12 (3.9)	
Normal	1420 (71.0)	720 (68.4)	481 (75.3)	219 (71.1)	
Overweight	355 (17.8)	205 (19.5)	93 (14.6)	57 (18.5)	
Obesity	109 (5.4)	65 (6.2)	24 (3.8)	20 (6.5)	

FAS, Family Affluent Scale. BMI, Body Mass Index. ^a: Likelihood Ratio. ^b: Linear-by-Linear Association. *P value < 0.05.

Table 3: Mixed model analyses between food groups' intakes (g/d) and food choices scores among European adolescents adjusted by age, gender, maternal education, Family Affluent Scale and energy intake (n = 1082).

Food groups' intake	β	95% CI	<i>P</i> value
Vegetables	-22•25	-78•05;33•55	0•43
Fruits	95•85	-0•76;192•47	0•05
Vegetables and fruits	74•74	-40•47;189•95	0•20
Sweets	-194•30	-493•80;105•20	0•20
Cereals	120•26	42•84;197•69	0•002*
Nuts and seeds	-8•43	-16•45;-0•41	0•040*
Vegetable oils	-0•09	-8•54;8•36	0•98
Olives and avocado	-6•27	-13•11;0•57	0•07
Alcohol	-157•92	-250•50;-65•35	0•001*
Dairy products	464•95	259•16;67•70	<0•001*
Pulses	18•88	-5•93;43•70	0•14
Water	242•80	-268•30;753•90	0•35
Meats and eggs	131•15	63•6;198•69	<0•001*
Fish	46•26	23•66;68•87	<0•001*
Savory snacks	-19•38	-35•69;-3•06	0•020*

*P value < 0•05. Centre used as the random intercept.

Table 4: Mixed model analyses between biomarkers and food choices scores among European adolescents adjusted by age, gender, maternal education, Family Affluent Scale, body mass index and energy intake (n = 444).

Biomarkers	β	95% CI	P value
Vitamin C (mg/L)	10•50	4•60;16•40	0•001*
Beta Carotene (ng/mL)	384•03	57•85;710•21	0•021*
EPA + DHA (%)	4•68	2•27;7•09	<0•001*
EPA + DHA (μ mol/L)	117•44	22•75;212•14	0•015*
Holo-transcobalamin (pmol/L)	69•03	14•22;123•84	0•014*
Cobalamin (pmol/L)	516•52	280•28;752•77	<0•000*
Plasma Folate (nmol/L)	37•23	19•52;54•94	<0•001*
Erythrocyte Folate (nmol/L)	1152•07	535•43;1768•72	<0•001*
<i>Trans</i> fatty acids (μ mol/L)	0•54	-0•80;1•87	0•429

EPA: eicosapentaenoic acid. DHA: Docosahexaenoic acid. *P value < 0•05. Centre used as the random intercept.

DISCUSSION

The present study developed a scale to assess health motivation influencing food choices (SOFIE) applying an unfolding model of the IRT to the FCP questionnaire in adolescents. The factor analysis indicated that more than one factor explained the total variance from the subsections analysed. Nineteen items from the subsections about the opinions on food choices, preferences and healthy eating (1.1) and how healthy the adolescent perceived each of those foods and drinks (2.2) showed the unidimensionality assumption for the GGUM^(11,28,29). Some previously developed questionnaires^(32,33) have evaluated the motivation influencing food choices based on multidimensional approaches. Our results indicate that the SOFIE covers one dimension of the continuum improving the particular evaluation of the health motivation to choose foods.

Regarding the IRT analyses, the accuracy of the estimates of the item parameters depends on the responses to each category⁽³⁴⁾. For these reasons, two items were excluded, because they presented a low frequency of response to the disagree category and therefore, higher standard errors: ‘*What is your opinion about: what you eat now will have a big impact on your future health?*’ and ‘*What is your*

opinion about: if there is the option to choose a whole grain version of a food, you will choose it?. The item *'How healthy you perceived water?'* was excluded because it had a high frequency of response on the unhealthy categories and therefore, it was not possible to apply the re-categorization of the item responses. Sixteen items assessed health motivation influencing food choices accurately. Moreover, the SOFIE does not present extreme values for the parameter of location of the item (δ_i), varying from -0.11 to 1.75. No extremes values of τ_{ik} and δ_i can confirm the accuracy of the estimates⁽¹¹⁾.

The item *'What is your opinion about: you enjoy fruit and vegetables?'* presented the lowest discrimination parameter (α_i) and the largest location (δ_i) of the item. However, this item remained in the SOFIE because of its importance for evaluating health motivation influencing food choices in this specific population. The lowest discrimination (α_i) and the largest location (δ_i) of this item indicate the difficulty to evaluate the food practices related to fruits and vegetables intakes. Some adolescents may think wrongly that they have a healthy diet and an adequate consumption of these foods⁽³⁵⁾, when they are not reaching the corresponding dietary recommendations stated as grams per day and daily number of servings⁽³⁶⁾. Another possibility is that adolescents' answers are influenced by social desirable responses⁽³⁷⁾. Furthermore, the current study failed to find an association between fruits and vegetables intakes and the SOFIE scores ($P > 0.05$), confirming the difficulty to evaluate the food practices related to these intakes. A recent study indicated that adolescents have a greater motivation to choose unhealthy snacks even when they have eaten healthy foods or when there is a high availability of healthy foods at home⁽³⁸⁾.

The item *'What is your opinion about: the food you eat at home is healthy?'* presented the highest value for discrimination parameter ($\alpha_i = 2.09$). This item is important to the continuum of the motivation influencing food choices. Individuals who agreed on this item were more likely to choose healthy food options. With respect to foods eaten at home, the scientific literature indicates that the more frequent the family meals, the better the diet quality and this may be associated with a healthy nutritional status of the youth⁽³⁹⁾. In this regard, adolescents with the best socioeconomic status and maternal education also presented high health motivation when choosing foods. Therefore, considering the parental influence on adolescents'

food choices, it is noteworthy the importance to strengthen family healthy food choices.

The SOFIE scores presented an adequate adjustment with more accurate estimates in the low and high levels (Figures 3 and 4). Therefore, IRT analyses improved the assessment of health motivation influencing food choices. The formerly used approaches were restricted to the classical test theory^(8,40). The IRT has some advantages in comparison with the classical approach, which only assess the percentage of responses for each item. Although the current analysis indicated differences on demographic and socioeconomic characteristics across the SOFIE levels, the IRT parameters and scores are independently estimated of the sample characteristics⁽⁴¹⁾. Moreover, the IRT distributes items based on the continuum of the motivation influencing food choices, which allows categorizing responses on low or high motivation⁽⁴¹⁾. In this context, the SOFIE allows to know the food attitudes influenced by the adolescents' health motivation.

The assessment of associations between the SOFIE scores and other determinants of health indicate that health motivation might guide to healthy food intakes. In the current study, the mixed model linear regression analyses indicated that the SOFIE scores were positively associated with intakes of cereals, dairy products, meat and eggs and fish, and with the concentrations of vitamin C, beta-carotene, *n*-3 fatty acids, cobalamin, holo-transcobalamin and folate. The SOFIE scores were positively associated with all biomarkers analyzed but only with a few food groups. In the study sample, intakes of fruits, vegetables and fish have also been correlated with the blood concentrations of vitamin C, beta-carotene and *n*-3 fatty acids⁽²⁰⁾. Therefore, the associations between SOFIE scores and blood concentrations of nutritional biomarkers, in addition to food intake, improve the knowledge of health motivation influencing food choices and factors associated.

The SOFIE scores were negatively associated with intakes of nuts and seeds ($P<0.05$). This negative association was not expected because of the relationship between nuts intakes and the reduction of cardiovascular risk⁽⁴²⁾. This result may indicate that other factors may motive the food choices rather than health.

As previously reported, hunger and taste are some of the most important motivations at breakfast⁽⁸⁾. Moreover, it has been established that the reasons why adolescents choose the first food to eat in the morning may vary along the day. When adolescents select usual school lunch, they prefer taste than healthy options at

the first selected food (59%), although taste motivation reduced at the selection of the third food (41%). In contrast, the motivation in order to select the foods by reasons related to health increased from the first selected food (8%) to the third selected food (24%)⁽⁵⁾. Health may not be the main motivation when the adolescents choose what they eat. It is necessary to highlight the importance of assessing accurately the health motivation influencing food choices when developing public health policies. The SOFIE may help to identify individuals with lower health motivation when choosing foods and guide the interventions.

Limitations and strengths. The limitations of this study include the inherent limitation of the GGUM 2004 software, regarding the maximum number of respondents for analysis, equal to 2000. In addition, the cross-sectional nature of our study cannot be used to establish causation between food intakes and/or nutritional biomarkers with motivation influencing food choices or vice versa. The study has also several strengths. The estimation of the item parameters and scores presented low standard errors, indicating the accuracy of the estimates. The use of the IRT analyses allows including new items in the SOFIE, based on the items parameters calculated in the present analyses. The GGUM may provide new insights to evaluate motivation influencing food choices and the SOFIE can be presented as a new approach to evaluate the health motivation.

CONCLUSIONS

The SOFIE scores, obtained by an unfolding model of the IRT can improve the assessment of motivation influencing food choices. The remained items have the best discrimination performance to investigate the attitudes presented by the individuals with low, indifferent or high health motivation. The associations between SOFIE scores and food intakes and nutritional biomarkers indicate that health motivation may influence healthy food intakes. This is very important for the planning and effectiveness of public policies promoting healthy food choices. SOFIE is proposed as a new measure to further study on health motivation influencing food choices.

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SUPPLEMENTARY MATERIAL

Table 1: Demographic and socioeconomic characteristics and body mass index according to participation in current analysis.

	N (%)	N (%)		<i>P</i> value ^a
		Not participated 954 (32.3)	Participated 2000 (67.7)	
Age (years) (n=2954)				0.009*
12.5-13.99	947 (32.1)	345 (36.2)	602 (30.1)	
14-14.99	754 (25.5)	237 (24.8)	517 (25.8)	
15-15.99	690 (23.4)	203 (21.3)	487 (24.4)	
16-17.49	563 (19.1)	169 (17.7)	394 (19.7)	
Sex (n=2954)				0.897
Male	1383 (46.8)	445 (46.6)	938 (46.9)	
Female	1571 (53.2)	509 (53.4)	1062 (53.1)	
FAS (n=2787)				0.181
Low	1250 (44.9)	416 (46.7)	834 (44.0)	
High	1537 (55.1)	475 (53.3)	1062 (56.0)	
Maternal education (n=2803)				0.313
Primary	213 (7.6)	74 (8.3)	139 (7.3)	
Lower secondary	698 (24.9)	232 (26.0)	466 (24.4)	
Higher secondary	911 (32.5)	270 (30.3)	641 (33.5)	
University degree	981 (35.0)	316 (35.4)	665 (34.8)	

FAS, Family Affluent Scale. BMI, Body Mass Index. ^a Likelihood Ratio. *P value < 0.05.

Table 1: Demographic and socioeconomic characteristics and body mass index according to participation in current analysis (continuation).

	N (%)	N (%)		<i>P</i> value ^a
		Not participated 954 (32•3)	Participated 2000 (67•7)	
Center (n=2954)				<0•001*
Athens	290 (9•8)	82 (8•6)	208 (10•4)	
Dortmund	334 (11•3)	102 (10•7)	232 (11•6)	
Gent	285 (9•6)	94 (9•9)	191 (9•6)	
Heraklion	254 (8•6)	81 (8•5)	173 (8•6)	
Lille	282 (9•5)	92 (9•6)	190 (9•5)	
Pécs	240 (8•1)	78 (8•2)	162 (8•1)	
Rome	287 (9•7)	69 (7•2)	218 (10•9)	
Stockholm	307 (10•4)	105 (11•0)	202 (10•1)	
Vienna	394 (13•3)	94 (9•9)	300 (15•0)	
Zaragoza	281 (9•5)	157 (16•5)	124 (6•2)	
BMI (n=2954)				0•339
Thinness	187 (6•3)	71 (7•4)	116 (5•8)	
Normal	2083 (70•5)	663 (69•5)	1420 (71•0)	
Overweight	518 (17•5)	163 (17•1)	355 (17•8)	
Obesity	166 (5•6)	57 (6•0)	109 (5•4)	

FAS, Family Affluent Scale. BMI, Body Mass Index. ^a Likelihood Ratio. *P value < 0•05.

Table 2: Total number of categories for nineteen items, generalized graded unfolding model item parameters estimates, outfit and infit for each item from Food Choices and Preferences questionnaire in Healthy Lifestyle in Europe by Nutrition in Adolescent study (n = 2000).

Item	N _{cat}	α_i (SE)	δ_i (SE)	τ_{i2}	τ_{i3}	τ_{i4}	τ_{i5}	Outfit	Infit
<i>How healthy you perceived ...</i>									
Chocolate milk	4 ^a	1•11 (0•07)	-0•11 (0•03)	-2•39	-1•16	-0•53	-	1•12	1•09
Cheese products (e.g. cheddar, brie, cheese strings)	4 ^a	1•16 (0•07)	-0•01 (0•03)	-2•49	-1•66	-1•31	-	1•35	1•25
Sandwiches, toasties and pannini	4 ^a	1•11 (0•07)	-0•01 (0•03)	-2•22	-1•26	-0•18	-	1•14	1•11
Cereal bars	4 ^a	1•16 (0•08)	0•03 (0•03)	-2•52	-2•09	-1•25	-	1•30	1•21
Yoghurt and yoghurt products	5 ^b	1•21 (0•07)	0•05 (0•03)	-2•91	-2•41	-1•64	-0•28	1•20	1•16
Juices	5 ^b	1•10 (0•07)	0•06 (0•03)	-2•71	-2•05	-1•83	-0•61	1•26	1•20

N_{cat}, number of categories. SE, Standard Error. ^a: Very unhealthy; unhealthy; indifferent; healthy. ^b: Very unhealthy; unhealthy; indifferent; healthy; very healthy. ^c: Unhealthy; indifferent; healthy; very healthy. ^d: Unhealthy; indifferent; healthy. ^e: Disagree; indifferent; agree. ^f: Disagree; indifferent; agree a lot; completely agree. ^g: Strongly disagree; moderately disagree; slightly disagree; indifferent; slightly agree; moderately agree; strongly agree. α_i : discrimination parameter of item i. δ_i : the location of the item i on the attitude continuum. τ_{i0} : Difference between subjective categories from the category 1. τ_{i1} : equal to zero for all items. τ_{i2} : Difference between subjective categories from the category 2. τ_{i3} : Difference between subjective categories from the category 3. τ_{i4} : Difference between subjective categories from the category 4. τ_{i5} : Difference between subjective categories from the category 5.

Table 2: Total number of categories for nineteen items, generalized graded unfolding model item parameters estimates, outfit and infit for each item from Food Choices and Preferences questionnaire in Healthy Lifestyle in Europe by Nutrition in Adolescent study (n = 2000) (continuation).

Item	N _{cat}	α_i (SE)	δi (SE)	τ_{i2}	τ_{i3}	τ_{i4}	τ_{i5}	Outfit	Infit
<i>How healthy you perceived ...</i>									
Bread and toast	4 ^a	1.45 (0.09)	0.07 (0.03)	-2.62	-1.82	-0.98	-	1.32	1.23
Bowl of cereal	4 ^c	1.41 (0.08)	0.07 (0.03)	-1.95	-1.44	-0.16	-	1.18	1.14
Milk	4 ^c	1.38 (0.08)	0.12 (0.03)	-2.40	-2.23	-1.07	-	1.26	1.22
Tea	3 ^d	0.89 (0.07)	0.26 (0.05)	-2.26	-1.87	-	-	1.19	1.14
Pasta dishes	3 ^d	0.84 (0.06)	0.27 (0.05)	-1.68	-1.09	-	-	1.09	1.07
Water	5 ^b	0.92 (0.10)	0.54 (0.09)	-4.00	-2.68	-	-	1.10	1.11
<i>What is your opinion about...</i>									
The food you eat at home is healthy	3 ^e	1.88 (0.12)	0.95 (0.05)	-3.22	-1.18	-	-	0.83	0.85

N_{cat}, number of categories. SE, Standard Error. ^a: Very unhealthy; unhealthy; indifferent; healthy. ^b: Very unhealthy; unhealthy; indifferent; healthy; very healthy. ^c: Unhealthy; indifferent; healthy; very healthy. ^d: Unhealthy; indifferent; healthy. ^e: Disagree; indifferent; agree. ^f: Disagree; indifferent; agree a lot; completely agree. ^g: Strongly disagree; moderately disagree; slightly disagree; indifferent; slightly agree; moderately agree; strongly agree. α_i : discrimination parameter of item i. δi : the location of the item i on the attitude continuum. τ_{i0} : Difference between subjective categories from the category 1. τ_{i1} : equal to zero for all items. τ_{i2} : Difference between subjective categories from the category 2. τ_{i3} : Difference between subjective categories from the category 3. τ_{i4} : Difference between subjective categories from the category 4. τ_{i5} : Difference between subjective categories from the category 5.

Table 2: Total number of categories for nineteen items, generalized graded unfolding model item parameters estimates, outfit and infit for each item from Food Choices and Preferences questionnaire in Healthy Lifestyle in Europe by Nutrition in Adolescent study (n = 2000) (continuation).

Item	N _{cat}	α_i (SE)	δ_i (SE)	τ_{i2}	τ_{i3}	τ_{i4}	τ_{i5}	Outfit	Infit
<i>What is your opinion about...</i>									
Your diet is healthy	3 ^e	1•57 (0•11)	1•00 (0•05)	-3•02	-0•62	-	-	0•88	0•88
You like the food your parents prepare at home	4 ^f	0•61 (0•05)	1•02 (0•11)	-5•61	-2•06	-0•96	-	0•96	0•97
You feel well Informed about what are health foods	3 ^e	0•90 (0•07)	1•15 (0•11)	-4•51	-1•12	-	-	0•95	0•96
You enjoy fruit and vegetables	4 ^f	0•56 (0•05)	1•97 (0•34)	-6•00	-3•63	-0•65	-	0•93	0•94
What you eat now will have a big impact on your future health.	7 ^g	0•48 (0•06)	1•98 (0•55)	-7•30	-1•81	-	-	0•98	0•98
If there is the option to choose a whole grain version of a food, you will choose it	7 ^g	0•35 (0•04)	4•08 (3•91)	-5•97	-3•84	-	-	0•96	0•96

N_{cat}, number of categories. SE, Standard Error. ^a: Very unhealthy; unhealthy; indifferent; healthy. ^b: Very unhealthy; unhealthy; indifferent; healthy; very healthy. ^c: Unhealthy; indifferent; healthy; very healthy. ^d: Unhealthy; indifferent; healthy. ^e: Disagree; indifferent; agree. ^f: Disagree; indifferent; agree a lot; completely agree. ^g: Strongly disagree; moderately disagree; slightly disagree; indifferent; slightly agree; moderately agree; strongly agree. α_i : discrimination parameter of item i. δ_i : the location of the item i on the attitude continuum. τ_{i0} : Difference between subjective categories from the category 1. τ_{i1} : equal to zero for all items. τ_{i2} : Difference between subjective categories from the category 2. τ_{i3} : Difference between subjective categories from the category 3. τ_{i4} : Difference between subjective categories from the category 4. τ_{i5} : Difference between subjective categories from the category 5.

ANCILLARY MATERIAL

Figure 1: Food Choices and Preferences Questionnaire.

Food Choices and Preferences Questionnaire

In this questionnaire we would like to know about your food choices and preferences. **Your opinions are very important to us!** This questionnaire gives you an opportunity to tell us what you think about issues surrounding food choice and the factors that influence these choices.

There are 3 sections within the questionnaire. In total, it should only take about 15 minutes to complete the questionnaire. Please take your time and read all questions carefully. You may answer the questions using the scales or categories provided.

Section 1 – Your opinions about food choices, preferences, diet and health

Q1.1 Using the scale provided, please rate your level of agreement for each of the following statements. It is important that you read each statement carefully.

I think that my diet is healthy						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
The taste of a food is very important to me						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
Snacking is a necessary part of a healthy diet						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
I enjoy eating fruit and vegetables						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
I tend to eat whatever my friends are eating						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
Food I eat at home is healthy						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
I choose my own snacks						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆
I like the food I eat when I am out with my friends						
Strongly disagree ⬇	Moderately disagree ⬇	Slightly disagree ⬇	Neither agree nor disagree ⬇	Slightly agree ⬆	Moderately agree ⬆	Strongly agree ⬆

The taste of food is more important to me than the healthiness of the food

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

I often try foods that I see advertised in the media (TV, magazines etc.)

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

A high fat food tastes better than the lower fat version

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

Food I eat at school (in the canteen) is healthy

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

I often skip breakfast

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

Healthy foods don't fill me up

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

Most snack foods that I eat are healthy

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

I feel well informed about what are healthy foods

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

Most healthy foods don't taste very nice

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

I have little choice over what I eat at home

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

I worry about what I eat because I don't want to gain weight

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

Sugar-reduced products taste better than the 'regular' version

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

I like the food my parents prepare at home

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

If there is the option to choose a low fat version of a food, I will choose it

Strongly disagree 1	Moderately disagree 2	Slightly disagree 3	Neither agree nor disagree 4	Slightly agree 5	Moderately agree 6	Strongly agree 7

What I eat now will have a big impact on my future health

Strongly disagree 4	Moderately disagree 4	Slightly disagree 4	Neither agree nor disagree 4	Slightly agree 4	Moderately agree 4	Strongly agree 4

Food I eat when I am out with my friends is healthy

Strongly disagree 4	Moderately disagree 4	Slightly disagree 4	Neither agree nor disagree 4	Slightly agree 4	Moderately agree 4	Strongly agree 4

I like the food prepared at the school canteen

Strongly disagree 4	Moderately disagree 4	Slightly disagree 4	Neither agree nor disagree 4	Slightly agree 4	Moderately agree 4	Strongly agree 4

If there is the option to choose a whole grain version of a food, I will choose it

Strongly disagree 4	Moderately disagree 4	Slightly disagree 4	Neither agree nor disagree 4	Slightly agree 4	Moderately agree 4	Strongly agree 4

Information regarding healthy eating is difficult to put into practice

Strongly disagree 4	Moderately disagree 4	Slightly disagree 4	Neither agree nor disagree 4	Slightly agree 4	Moderately agree 4	Strongly agree 4

Q1.2. On a regular school day, when do you usually snack (select all that apply)

- ☐ I snack in the morning
- ☐ I snack in the afternoon
- ☐ I snack when I get home after school
- ☐ I snack in the evening (after dinner)
- ☐ I snack regularly throughout the day
- ☐ I don't snack

Q1.3 At the weekend, when do you usually snack (select all that apply)

- ☐ I snack in the morning
- ☐ I snack in the afternoon
- ☐ I snack in the evening (after dinner)
- ☐ I snack regularly throughout the day
- ☐ I don't snack

Q1.4 What are your reasons for snacking? (select all that apply)

- ☐ I feel bored
- ☐ I feel stressed
- ☐ I feel happy
- ☐ I feel alone
- ☐ I feel sad
- ☐ I feel hungry
- ☐ I feel tired
- ☐ I need some energy
- ☐ I'm craving something salty/savoury e.g. crisps
- ☐ I'm craving something sweet e.g. cookies or chocolate
- ☐ I snack out of habit
- ☐ I snack for a treat
- ☐ I snack because I missed a meal
- ☐ I'm socialising with my friends
- ☐ None of the above

Q1.5 What would you say is your main reason for snacking? (please select one)

- ☐ I feel bored
- ☐ I feel stressed
- ☐ I feel happy
- ☐ I feel alone
- ☐ I feel sad
- ☐ I feel hungry
- ☐ I feel tired
- ☐ I need some energy
- ☐ I'm craving something salty/savoury e.g. crisps
- ☐ I'm craving something sweet e.g. cookies or chocolate
- ☐ I snack out of habit
- ☐ I snack for a treat
- ☐ I snack because I missed a meal
- ☐ I'm socialising with my friends
- ☐ None of the above

Q1.6 During the week, where do you usually receive or purchase your **lunch** (please select one)

- ☐ I get my lunch at the school restaurant/canteen
- ☐ I bring my lunch from home
- ☐ I go home for lunch
- ☐ I go and buy my lunch from the local shop
- ☐ I go and buy my lunch from a fast food shop or restaurant
- ☐ I don't eat lunch

Q1.7 During a typical school day, how often do you eat 'outside' of school, e.g. at a fast food restaurant, food from the local shop, etc. (please select one)

- ☐ Every day
- ☐ 2-4 times a week
- ☐ Once a week
- ☐ 1-3 times per month
- ☐ Less than once a month
- ☐ Never

Q1.8 The following shows various sources of information regarding healthy eating and lifestyle. Select the sources of information that you feel are trustworthy (select all that apply).

- ☐ Adverts (TV/Radio)
- ☐ Adverts (Press/Magazines)
- ☐ My parents/guardian
- ☐ Internet
- ☐ School/my teachers
- ☐ My coach/trainer
- ☐ My friends
- ☐ My doctor
- ☐ None of the above

Section 2 – Choices and preferences of SNACK foods and drinks

Q2.1 Snacks are defined as any foods that are eaten between meals. The following shows a list of foods that adolescents in different countries have mentioned are popular to **SNACK** on.

For each snack food item listed, please identify:

- how much you like the food item (from dislike strongly to like strongly)
- how often you eat this as a snack (either 'never', 'sometimes' or 'often')

Food Item	How much do you like this food item?					Do you eat this as a snack?
Fresh fruit	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Vegetables (e.g. celery, carrots, tomatoes etc.)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Dried fruits (eg. raisins)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Nuts, peanuts, seeds (e.g. sunflower, pumpkin)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Yoghurt / yoghurt products	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Cheese products (e.g. cheddar, brie, cheese strings)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Sweets / candy	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Chocolate / chocolate bars / turó rudi	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Biscuits / cookies	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Cakes / muffins / pastries	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Crisps / tortilla chips	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Crackers / rice cakes / salty sticks	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Popcorn	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Meat based snacks (e.g. meat sticks)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐

Food Item	How much do you like this food item?					Do you eat this as a snack?
Bread / toast	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Bowl of cereal	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Oatmeal / porridge	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Cereal bars	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Sandwiches / toasties / pannini	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Pizza	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Hamburgers	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Hot Dogs / sausage rolls	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
French fries	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Pasta dishes	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Pasta snack products e.g. Pot Noodles	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐

Q2.2 We would also like to know what you think about these popular drinks. Please respond as above, for this list of **drink items**.

Drink Item	How much do you like this drink item?					Do you drink this?
Coffee	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Tea	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Milk	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Cocoa drink (e.g. chocolate milk or hot chocolate)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Fizzy drinks / soft drinks (e.g. coke, sprite)	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Fruit juice / fruit smoothies	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐
Water	Dislike strongly ☐	Dislike slightly ☐	Neither like nor dislike ☐	Like slightly ☐	Like strongly ☐	Never ☐ Sometimes ☐ Often ☐

Q2.3 For the same list of food and drink items, please identify how healthy you perceive each food/drink item to be.

Food Item	What do you think about the healthiness of the food?				
Fresh fruit	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Vegetables (e.g. celery, carrots, tomatoes etc.)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Dried fruits (eg. raisins)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Nuts, peanuts, seeds (e.g. sunflower, pumpkin)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Yoghurt / yoghurt products	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Cheese products (e.g. cheddar, brie, cheese strings)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Sweets / candy	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Chocolate / chocolate bars / turó rudi	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Biscuits / cookies	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Cakes / muffins / pastries	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Crisps / tortilla chips	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Crackers / rice cakes / salty sticks	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Popcorn	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Meat based snacks (e.g. meat sticks)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Bread / toast	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Bowl of cereal	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Oatmeal / porridge	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Cereal bars	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Sandwiches / toasties / pannini	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Pizza	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Hamburgers	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Hot Dogs / sausage rolls	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
French fries	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Pasta	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Pasta snack products e.g. Pot Noodles	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐

Drink Item	What do you think about the healthiness of the drink?				
Coffee	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Tea	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Milk	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Cocoa drink (e.g. chocolate milk or hot chocolate)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Fizzy drinks / soft drinks (e.g. coke, sprite)	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Fruit juice / fruit smoothies	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐
Water	Very unhealthy ☐	Slightly unhealthy ☐	Neither healthy nor unhealthy ☐	Slightly healthy ☐	Very healthy ☐

Section 3 – Important influences on food choices and preferences

The following shows a list of things that may have an influence on what you eat for breakfast, lunch, dinner and snacks. Please rate the importance of each influence, separate for each meal occasion.

Q3.1 How strong of an influence do the following factors have on your choice of foods at BREAKFAST?

(e.g. how much influence do 'your friends' have on your choice of foods for BREAKFAST etc.)

Your parents or guardian	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
School environment	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The taste of the food	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Concern for your health	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Your friends	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The food is readily available	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The food is easy to prepare	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
How hungry you are	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Price of the food	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Your habits or daily routine	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Other, e.g. medical reasons (please specify): _____	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐

Q3.2 Thinking about a typical weekday, other than breakfast, which is your **MAIN MEAL** of the day? (please select ONE)

- ☐ Lunch (mid-day meal) ☐ Other (please state) _____
- ☐ Dinner (evening meal)

Q3.3 Where do you usually eat this **MAIN MEAL**? (please select ONE)

- ☐ At home ☐ Other (please state) _____
- ☐ At school

Q3.4 Thinking about your **MAIN MEAL**, how strong of an influence do the following factors have on your choice of foods for this **main meal**?

(e.g. how much influence do 'your friends' have on your choice of foods for your **main meal** etc.)

Your parents or guardian	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
School environment	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The taste of the food	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Concern for your health	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Your friends	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The food is readily available	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The food is easy to prepare	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
How hungry you are	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Price of the food	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Your habits or daily routine	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Other, e.g. medical reasons (please specify): _____	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐

Q3.5 Snacks are defined as any foods you would eat between meals (some examples were seen in Section 2). How strong of an influence do the following factors have on your choice of **SNACK FOODS**?

(e.g. how much influence do 'your friends' have on your choice of foods for SNACKS etc.)

Your parents or guardian	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
School environment	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The taste of the food	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Concern for your health	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Your friends	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The food is readily available	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
The food is easy to prepare	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
How hungry you are	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Price of the food	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Your habits or daily routine	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐
Other, e.g. medical reasons (please specify): _____	No influence ☐	Slight influence ☐	Moderate influence ☐	Strong influence ☐	Very strong influence ☐

THANK YOU for your participation!

Figure 2: Items from the Scale of evaluation of Food choices (n = 2000).

Health-related food choices determinants questionnaire

1. Is your diet healthy?
☐ Disagree ☐ Indifferent ☐ Agree
2. Do you enjoy fruit and vegetables?
☐ Disagree ☐ Indifferent ☐ Slightly agree ☐ Moderately agree
3. Is the food you eat at home healthy?
☐ Disagree ☐ Indifferent ☐ Agree
4. Do you feel well informed about what are health foods?
☐ Disagree ☐ Indifferent ☐ Agree
5. Do you like the food your parents prepare at home?
☐ Disagree ☐ Indifferent ☐ Slightly agree ☐ Moderately agree
6. How healthy do you think yoghurt and yoghurt products are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy
7. How healthy do you think cheese products (e. g. cheddar, brie, cheese strings) are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
8. How healthy do you think chocolate is?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
9. How healthy do you think bread and toast are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
10. How healthy do you think bowl of cereal is?
☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy
11. How healthy do you think cereal bars are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
12. How healthy do you think sandwiches, toasties and pannini are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
13. How healthy do you think pasta dishes are?
☐ Unhealthy ☐ Indifferent ☐ Healthy
14. How healthy do you think tea is?
☐ Unhealthy ☐ Indifferent ☐ Healthy
15. How healthy do you think milk is?
☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy
16. How healthy do you think juices are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy

4.3. Artigo 3 - Análise da relevância, clareza e compreensão dos itens propostos para a escala de avaliação da qualidade da dieta (ESQUADA)

“Qualitative and quantitative analysis of the relevance, clarity, and comprehensibility of the Scale of Quality of Diet (ESQUADA)”: submetido nos Archivos Latinoamericanos de Nutrición (fator de impacto: 0,427; estrato B2 na área de concentração Saúde Coletiva - Qualis Capes).

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ABSTRACT

The study of the diet quality should include not just the nutritional adequacy but also incorporate the multidimensional understanding and the current dietary recommendations. This study aimed to evaluate the relevance, clarity, and comprehensibility of the Scale of Quality of Diet (ESQUADA). Nutritionists' perspectives about the relevance and clarity of the items were evaluated through focus groups between November and December 2016. An exploratory content analysis investigated the themes that emerged from the focus groups, which were organized in a structured codebook. Two reviewers applied it to the data. Inter-rater reliability was analyzed by the kappa coefficient. The coding was analyzed using the frequencies and central aspects of the sub-themes. Laypersons' comprehension of the items was evaluated using a question regarding whether they understood each item in online questionnaire in February 2018. Descriptive statistics investigated the comprehensibility of each item. The reviewers presented adequate reliability on coding the data. Three themes emerged from the data considering the nutritionists' suggestions. The theme ITEM RELEVANCE indicated that the items assessed diet quality while considering sociocultural influences. However, the nutritionists

suggested attention was needed to how some items were expressed and their response options. Of relevance, the themes ITEM CLARITY and CLARITY OF ALTERNATIVES primarily encompassed discussions regarding item text (44%) and discrimination of alternatives (24%). The study of the comprehensibility indicated that all items were readily understood. These results support the relevance of the ESQUADA for evaluating quality of diet as well the comprehensibility of all the items by individuals uneducated in public health.

KEYWORDS: surveys and questionnaires, dietary guidelines, psychometric, comprehension, qualitative research

RESUMEN

El estudio de la calidad de la dieta debe incluir la adecuación nutricional además sus dimensiones y las recomendaciones dietéticas actuales. Este estudio evaluó la relevancia, claridad y comprensibilidad de la Escala de Calidad de la Dieta (ESQUADA). Las perspectivas de los nutricionistas sobre la relevancia y claridad de los ítems se evaluaron en grupos focales entre noviembre y diciembre de 2016. Un análisis de contenido exploratorio investigó los temas que surgieron de los grupos. Estos temas fueron ordenados en un libro de códigos estructurado. Dos revisores lo aplicaron a los datos. La fiabilidad inter-evaluadores fue analizada por el coeficiente kappa. La codificación se analizó utilizando las frecuencias y aspectos centrales de los subtemas. La comprensión de los ítems por personas sin conocimientos de nutrición se evaluó mediante una pregunta sobre el entendimiento de cada ítem en uno cuestionario online in febrero de 2018. Las estadísticas descriptivas investigaron la comprensibilidad de cada ítem. Los revisores presentaron adecuada fiabilidad en la codificación de los datos. Tres temas surgieron de los datos. El tema RELEVANCIA DEL ÍTEM indicó que los ítems evaluaron la calidad de la dieta mientras consideraban las influencias socioculturales. Sin embargo, los nutricionistas sugirieron la necesidad de atención en el texto de algunos ítems y sus opciones de respuesta. Los temas CLARIDAD DEL ÍTEM y CLARIDAD DE LAS OPCIONES abarcaron principalmente las discusiones sobre el texto del ítem (44%) y la discriminación de las opciones (24%). El estudio de la comprensibilidad indicó que todos los ítems se entendían fácilmente. Estos resultados apoyan la relevancia de

ESQUADA para evaluar la calidad de la dieta e la comprensión de todos los ítems por personas sin conocimientos de nutrición.

PALABRAS CLAVE: encuestas y cuestionarios, guías alimentarias, psicometría, comprensión, investigación cualitativa

INTRODUCTION

Obesity and related diseases have been described as important public health problems with increasing prevalence in Brazil^(1,2). Unhealthy diets contribute to this epidemiological status^(3,4).

In Brazil, the quality of diet has been evaluated using the Healthy Eating Index and the Revised Diet Quality Index⁽⁵⁾. These indices only focus on nutrient intake, which is insufficient to assess the complexity of the diet.

To comprehensively evaluate diet, it is necessary to extend the concept of quality of diet beyond nutritional adequacy^(6,7). Quality of diet should encompass healthy and unhealthy foods, where meals are eaten, and habitual activities that take place during mealtime^(7,8).

Accordingly, the 2014 Dietary Guidelines for the Brazilian Population (DGBP)⁽⁷⁾ are based on a broad understanding of diet, incorporating recommendations for ways to eat and suitable food combinations. The guidelines also adopted the NOVA food classification, which considers industrial food-processing⁽⁹⁾.

Public health research requires an easy-to-use instrument that comprehensively considers the quality of diet and the current dietary guidelines. Thus, the current study reported the initial stages of development of the Scale of Quality of Diet (ESQUADA), which evaluates diet considering the different settings that influence eating according to the DGBP. The present study focused on assessment of the relevance, clarity, and comprehensibility of the items of the ESQUADA.

MATERIAL AND METHODS

Development of the ESQUADA was guided by recommendations for psychometric studies. The first step is a theoretical analysis of the survey items, discussing their content with experts, and assessing how laypersons interpret the items. The second step assesses the validity and accuracy of the items⁽¹⁰⁾. Note that

the term “item” was adopted to refer to “questions.” Additionally, the current analysis concentrated on the first step, namely qualitative and quantitative study of the relevance, clarity, and comprehensibility of each item of the ESQUADA. A subsequent study will assess the accuracy of the items for the assessment of the quality of diet (manuscript in development).

Item Development

The DGBP was the theoretical reference for item development⁽⁷⁾. The response options were based on dietary recommendations^(7,9). Three nutritionists (TSSS, BSV, and MAAA) developed 56 items between January and November 2016.

Item Content

Nutritionists working in public health fields were invited to participate in focus group discussions at the School of Public Health (University of São Paulo – USP) and at the Nutrition Department of the Federal University of Santa Catarina. This study aimed to assess the relevance and clarity of the developed items. The invitation was sent by email or telephone with the possibility of the recipient referring other nutritionists who might participate^(11,12). The nutritionists were reminded of the focus group by the research team, the day before the group was scheduled. Each nutritionist agreed to participate in the study by signing a consent form, and completed a questionnaire that collected personal information.

Item Comprehensibility

After considering the nutritionists’ suggestions, Brazilian adolescents and adults were invited to complete the questionnaire in February 2018, in order to study the comprehensibility of the items. All participants were Brazilian, lived in Brazil, were 15 to 50 years old, and signed an online consent form.

Focus Groups

Considering the objective to discuss the relevance and clarity of all items, the focus groups were organized as per three topics: (1) food practices, (2) unprocessed or minimally processed foods and processed culinary ingredients, and (3) processed and ultra-processed foods. The number of focus groups was defined by the

saturation criterion^(11,12). Six focus groups were held between November and December 2016. Therefore, each topic was discussed in two different focus groups.

An interviewer mediated the interactions among the participants and encouraged dialogue among them. Each focus group was conducted in the presence of an observer, who assisted with annotating the principal points of the discussions and relevant expressions of the participants. The interviewer and the observer were trained in focus group methods, and the script was previously pilot tested^(11,12).

Participants were asked to introduce themselves to others and to try to express their opinions aloud in turn. Furthermore, some examples were presented of unprocessed or minimally processed foods, processed culinary ingredients, processed foods, and ultra-processed foods, to help the participants understand the NOVA food classification.

Each of the focus groups was composed of six to eight nutritionists and carried out in an easily accessible and neutral environment⁽¹¹⁾. The groups were conducted in an atmosphere of conversation and trust so that the nutritionists would feel free to share their opinions. The discussions were guided by a semi-structured script. Some probing questions were also used to encourage discussions regarding the inclusion, exclusion, or change in the expression of the items. The discussions were audiotaped and subsequently transcribed⁽¹²⁾.

Online Questionnaire

To reduce the tedium associated with answering an extensive questionnaire, and measurement bias, the items were organized in booklets using a balanced incomplete blocks (BIB) design⁽¹³⁾ using the package *crossdress* in R software. The booklets were loaded on the Survey Monkey platform and named in ascending order. The booklets were accessed through one link that organized the presentation of each booklet in ascending order. This link was shared in social media.

Each item was accompanied by an extra question that evaluated whether the participants understood the item. This question presented the following response options: *I did not understand anything; I understood a little; I understood more or less; I understood almost everything, but I had some doubts; I understood almost everything; I understood perfectly, and I had no doubts*⁽¹⁴⁾. Besides the items that addressed the quality of diet and item comprehensibility, the booklets also included items that collected sociodemographic data.

Data Analysis

Exploratory content analysis was used to investigate the themes and sub-themes that emerged from the focus groups' data⁽¹⁵⁾. The transcripts were read extensively by two authors (TSSS and PMS) to become familiar with the data and to identify emerging themes. Separately, they completed a first exploratory coding of the data, using excerpts as units of analysis. From those initial codes, a structured codebook was created to organize and characterize each sub-theme⁽¹⁵⁾.

The transcripts and the codebook were imported into the MAXQDA version 12 software package, which assisted the analysis. Two authors (TSSS and MRC) independently applied the codebook to excerpts of the transcripts. Coding agreement was analyzed using the kappa coefficient for inter-rater reliability, as calculated using GraphPad software. Agreement was considered almost perfect when the kappa coefficient was larger than 0.8⁽¹⁶⁾. Differences in the coding were discussed until the coders reached consensus. The number and frequency of excerpts coded were also calculated. Each sub-theme was described in terms of central and peripheral aspects and the range of meanings in the data were identified.

To evaluate the comprehensibility of the items, responses to the extra question regarding the individuals' understanding were inspected. The items with the highest frequency of response for the first three categories (*I did not understand anything*, *I understood a little*, and *I understood more or less*) were rewritten⁽¹⁴⁾.

The Ethics Committee on Human Research at the Faculty of Public Health approved the study protocol (number 1.943.099).

RESULTS

Six focus groups were conducted to allow discussions among the experts regarding the 56 items. These items are listed in Figure 1. The session duration ranged from 99 to 160 minutes. The focus groups included 35 nutritionists (ranging from four to eight participants per group) with a median age of 30 years (range: 23 to 71 years), 33 of whom were female.

Figure 1: Items evaluated by nutritionists on focus groups, São Paulo, Brazil, 2016–2017.

Items
How many days do you have breakfast in a week?
What kind of foods do you usually eat at breakfast?
How many days do you have lunch in a week?
What kind of foods do you usually eat at lunch?
How many days do you have dinner in a week?
What kind of foods do you usually eat at dinner?
Do you usually eat with family, friends, or colleagues at least once a day?
How many days do you replace lunch or dinner with sandwiches, pizza, or other snacks in a week?
Do you usually cook food to eat at meals such as lunch or dinner?
Do you usually eat at restaurants (such as self-service or executive-service) or you carry home-made food for lunch or dinner away from home?
Do you usually eat ready-to-heat foods, instant noodles, powdered soups, or other easy-to-prepare foods when you are at home?
Where do you usually buy fruits and vegetables?
Do you usually snack between meals?
Do you usually choose the largest portion of food if there is a small difference in price?
Do you usually cook with friends or family?
Do you usually eat while watching TV, using a computer, studying, or reading?

Figure 1: Items evaluated by nutritionists on focus groups, São Paulo, Brazil, 2016–2017 (continuation).

Items
What place at home do you usually eat?
How many days do you eat oats or whole-wheat flour or use these foods in recipes in a week?
How many days do you eat rice with beans in a week?
How many days do you eat raw vegetables, or as ingredients in cooked dishes such as soups, in a week?
How many days do you eat fruits or fruit salads in a week?
How many days do you eat skimmed or semi-skimmed milk in a week?
Do you usually remove the fat or skin when you eat beef, pork, or chicken?
How do you usually eat beef, pork, or chicken?
How do you usually eat fish?
How many days do you eat boiled, scrambled, or fried eggs or omelet in a week?
How many days do you eat cakes, breads, or homemade cookies in a week?
How many days do you eat Brazil nuts, cashew nuts, walnuts, or peanuts without salt or sugar in a week?
When do you usually drink water?
When do you usually drink coffee or tea?
When do you usually add sugar, honey, molasses, or “rapadura” in drinks such as coffee, tea, milk or juice?
When do you usually add salt in ready-to-eat foods (such as salads or cooked foods)?
How many days do you use vegetable oil or olive oil to prepare food in a week?
How many days do you use butter (such as Tirolez®, Itambé®, or Aviação®) to prepare food in a week?

Figure 1: Items evaluated by nutritionists on focus groups, São Paulo, Brazil, 2016–2017 (continuation).

Items
When do you usually add vegetable oil or olive oil in cooked food?
When do you usually add butter (such as Tirolez®, Itambé®, or Aviação®) in cooked food?
How many days do you eat foods with peas, corn, palm hearts, pickles, olives, or vegetable mixtures?
How many days do you drink alcoholic beverages (such as beer, cider, or wine) in a week?
How many days do you add cheeses (such as mozzarella or fresh cheese) to food in a week?
How many days do you eat industrialized cakes and cookies in a week?
How many days do you eat sweets (such as chocolate, ice cream, bubble gum, or candies) in a week?
How many days do you drink spirits (such as brandy, whiskey, vodka, or rum) in a week?
How many days do you use ready-made sauces (such as tomato, white, wood, barbecue, Italian, and cheese sauces) in a week?
How many days do you add ketchup or mustard in foods (such as sandwiches, salty foods, or potato chips) in a week?
How many days do you eat snacks (such as fried or salted snacks, sandwiches, hot dogs, or pizza) in a week?
How many days do you eat breakfast cereals (such as Sucrilhos®, All Bran®, Corn Flakes®, and Crunch®) and industrialized cereal bars in a week?
How many days do you eat packaged snacks or packaged French fries in a week?
How many days do you drink soft drinks or juices (such as Del Valle®, Maguary®, Sufresh®, Mid®, and Taeq®) in a week?
How many days do you use seasoning (such as Knorr®, Sazon®, and Maggi®) in a week?
How many days do you eat breads (such as baguette, sandwich, and hot dog) in a week?

Figure 1: Items evaluated by nutritionists on focus groups, São Paulo, Brazil, 2016–2017 (continuation).

Items
How many days do you use margarine, mayonnaise, non-fresh milk cream, or vegetable cream to prepare foods such as salads, sauces for pasta or pies, or stroganoff in a week?
How many days do you add margarine to breads and biscuits or put non-fresh milk cream or whipped cream on fruit in a week?
How many days do you eat fruit jams in syrup or industrialized jellies in a week?
How many days do you take non-natural yogurt and dairy drinks (such as Toddynho®) in a week?
How many days do you add cream cheese, Polenguinho®, or industrialized pâté to ready-made food in a week?
How many days do you eat mortadella, salami, turkey breast, ham, or nuggets in a week?

Three themes (ITEM RELEVANCE, ITEM CLARITY, and CLARITY OF ALTERNATIVES) and nine sub-themes emerged through the analysis (Figure 2). The results of the inter-rater reliability analysis are shown in Table 1. The kappa coefficient indicated almost perfect agreement for all sub-themes. The sub-theme “*Need to change the text or order of the alternatives*” had the lowest inter-rater reliability (0.88).

Figure 2: Description of the sub-themes that emerged though exploratory content analysis, São Paulo, Brazil, 2016–2017.

Sub-themes	Description
ITEM RELEVANCE	
Relationship between eating behavior and consumption	Whether the item was relevant for addressing the relationship between eating behavior and food consumption based on quality of diet.
Characteristics of food habits	Whether the item was relevant for addressing the characteristics of the habitual food consumption of the individual. This relevance was also indicated for items not present in the questionnaire.
Marketing influence	Whether the item was relevant for addressing the influence of food packaging or marketing on feeding behavior.
ITEM CLARITY	
Need to change the item text	Whether the item needed to be written more clearly, considering the variety of meanings of the words and their comprehensibility, and the requirement that they did not imply the correct answer.
Need to include a new item	Whether a new item was needed or whether a current item should be split into multiple items to improve clarity.
Difficulty with NOVA food classification	Whether the item was unclear because of difficulties for individuals in identifying foods according to the NOVA food classification.
Difficulty in reaching the objective	Whether the item did not reach the objective proposed or was not sufficiently clear to reach it.
ALTERNATIVE CLARITY	
Need to include alternatives with better discrimination	Whether the response alternatives needed to be changed to permit better discrimination of eating practices, by adding detail and/or separating the options presented.
Need to change the text or order of the alternatives	Whether the item text or order of the alternatives should be changed for clarity, logic, or to facilitate more fluent reading.

Table 1: Absolute and relative frequencies and kappa coefficients with respective 95% confidence intervals for each sub-theme identified in focus groups, São Paulo, Brazil, 2016–2017.

Sub-themes	n	%	k	95% CI
ITEM RELEVANCE				
Relationship between eating behavior and consumption	56	5.77	0.96	0.91–1.00
Characteristics of food habits	18	1.86	1.00	1.00–1.00
Marketing influence	6	0.62	1.00	1.00–1.00
ITEM CLARITY				
Need to change the item writing	430	44.33	0.91	0.88–0.95
Need to include a new item	47	4.85	0.98	0.93–1.00
Difficulty with NOVA food classification	12	1.24	1.00	1.00–1.00
Difficulty in reaching the objective	38	3.92	0.97	0.92–1.00
ALTERNATIVE CLARITY				
Need to include alternatives with a better discrimination	236	24.33	0.92	0.88–0.96
Need to change the writing or order of the alternatives	127	13.09	0.88	0.82–0.94

k: kappa coefficient. 95% CI: 95% confidence interval of kappa coefficient.

ITEM RELEVANCE was composed of three sub-themes. The sub-theme “*Relationship between eating behavior and consumption*” considered that eating behavior might indicate the quality of diet. Regarding the item about breakfast, a related excerpt showed the item’s relevance to the relationship between eating breakfast and the quality of diet: “*It already indicates that he organized the meal and reserved a time to eat...It already is an indicator of quality.*” This sub-theme ranged from discussions about item relevance to discussions about the relevance of the questionnaire.

The sub-theme “*Characteristics of food habits*” primarily referred to item relevance for evaluating the habitual food consumption patterns of individuals, as reflected in a quote: “*It is a very important item because they consume a lot of*

cookies.” This sub-theme ranged from opinions about the importance of the item for food consumption trends to discussions about the relevance of item as an indicator of healthy eating. For instance, a quote related to milk consumption independent of the fat content was as follows: *“...I believe that when the issue is healthy eating, milk usually is associated [with it] a lot...they replaced milk with artificial juices or soda. So, I also agree that you should take out if it is full-fat or not...So, drinking milk is an indicator of healthy eating...”*

The sub-theme *“Marketing influence”* focused on the effect of marketing on the quality of diet. The sub-theme’s range encompassed the item’s relevance for the study of the probable marketing influence on buying large portions of healthy and unhealthy foods, as in this quote: *“They always think about the advantages. It is cheaper! They do not think about the quality.”*

ITEM CLARITY was discussed in terms of four sub-themes. The sub-theme *“Need to change the item’s expression”* identified the excerpts about the need to write differently in order to guarantee better clarity. This was characterized primarily by discussions regarding poor comprehensibility of technical terms, as can be seen in a quote: *“...they will not know what unnatural yogurt is...”* The sub-theme’s range encompassed this need to change the terms presented in the item (including local terms or the way the item was expressed), such as in a quote related to the item “Do you usually choose the largest portion of food if there is a small difference in price?” (*“...between a medium or large pizza, if the price difference is small, would you choose the large one?”*).

The sub-theme *“Need to include a new item”* focused on the discussions about the need for new items, including the suggestion to include an item addressing the number of meals because of its relationship with daily eating practices: *“And the item about how many meals a person eats? It would also be an interesting question...”* The sub-theme’s range also included advice for dividing the items considering the culinary use of the foods, as in this quote: *“...they never know any ingredients in the recipes. Maybe separating these items regarding what they use at the time of consumption and creating another about what they use in culinary preparations...maybe it would make it easier for them.”*

The sub-theme *“Difficulty with NOVA food classification”* was predominately characterized by reports indicating potential difficulty for the respondents in discriminating the foods according to the NOVA food classification and urging the

item to be clarified without using technical terms (*"I do not think you have to use the word 'processed' because...it's very technical nomenclature. So, I think if you want to facilitate the understanding of the person I think you have to avoid this kind of word."*). In contrast, this sub-theme was peripherally exemplified by encouraging the use of the term "processed," as can be seen in this quote: *"But to stimulate the use of this nomenclature we should use it in research."*

The sub-theme *"Difficulty in reaching the objective"* focused on discussions of items that did not address their objectives (*"...if the objective is to check whether he adds salt or not on prepared food, the item is not related..."*). This sub-theme also identified comments that an item did not clearly achieve its objective, as in this quote: *"To check the habit of snacking. It is not necessarily that the snacking term in the question means goodies (cookies, candy, etc.)...he will not understand that it is necessarily goodies."* Finally, this sub-theme ranged from incoherence between the item expression and the proposed objective, to a lack of clarity in writing for younger respondents, thus making it difficult for the item to reach its objective.

CLARITY OF ALTERNATIVES was discussed in terms of two sub-themes. The sub-theme *"Need to include alternatives with a better discrimination"* was primarily characterized by suggestions to include response options to better discriminate eating practices (*"So, I'm also in doubt regarding whether to put none or one day...you do not know if he never eats (breakfast) or eats at least once a week...you cannot differentiate..."*). In contrast, the sub-theme's range encompassed whether to include response options unable to discriminate healthy from unhealthy consumption. This is peripherally exemplified by the quote: *"...maybe I have one suggestion: 'yes, but I do not know the kind of preparation'...maybe you would have more mistakes...I believe it is better to show this option..."*

The sub-theme *"Need to change the text or order of the alternatives"* focused on suggestions related to the expression of the response options, as can be seen in the quote: *"I think that the option 'No' could be substituted for: I do not usually do breakfast. So, you have to write more clearly."* This sub-theme also identified suggestions to change the order of the response options. Finally, the sub-theme's range also included suggestions to use the same response alternatives in similar items (*"...because if you follow the logic, you ask about a month or week...I think that this logic is consistent if you use the same response options for all the items."*).

This qualitative approach was based on the suggestions of the experts. In summary, the nutritionists highlighted that the items evaluated the quality of diet while considering its sociocultural influences. They also identified items that were not related to quality of diet and should be excluded. In addition to the study of the relevance of the items, the nutritionists underlined the importance of item wording and suggested changes to improve comprehensibility.

The 56 items presented to the nutritionists were changed considering the results from the exploratory content analysis. The principal changes were to the sub-themes *“Need to change the text or order of the alternatives”* (13.09%), *“Need to include alternatives with better discrimination”* (24.33%), and *“Need to change the item text”* (44.3%). In addition to the changes to the text, the nutritionists also suggested excluding nine items because of their irrelevance to the study of eating practices, as in this example: *“it is very difficult to collect specific information about culinary ingredients if we do not explore the recipes...people do not know who cooks for them...which ingredients he/she uses.”* They suggested dividing two items by the food characteristics and including another two items to address the consumption of ultra-processed meals, and the addition of processed culinary ingredients.

The remaining 52 items were organized into thirteen booklets and loaded onto the Survey Monkey platform. Considering only complete responses, 112 individuals (63%) contributed by assessing the comprehensibility of the items. The characteristics of these individuals are shown in Table 2. Most of them were female (77%) and had no university education (51%). No item's highest frequency of response was within the first three categories of the extra question. In general, the respondents highlighted some errors in the text and suggested using local terms and examples in the items.

Table 2: Characteristics of participants in the study of item comprehension, São Paulo, Brazil, 2018 (N = 112).

Characteristics	n	%
Age		
≤ 18 years	36	32
> 18 and ≤ 30 years	41	37
> 30 years	35	31
Gender		
Female	86	77
Male	26	23
Education		
Basic	1	0.9
Incomplete Primary	2	1.8
Complete Primary	5	4.5
Incomplete High School	20	17.9
Complete High School	16	14.3
Incomplete University Degree	13	11.6
Complete University Degree	38	33.9
Master	8	7.1
PhD	9	8
Region		
North	1	0.9
Northeast	1	0.9
Midwest and Distrito Federal	1	0.9
South	6	5.4
Southeast	103	91.9

DISCUSSION

One of the steps when developing research questionnaires should be contacting a group of experts on the subject to evaluate to what extent the questionnaire addresses the construct⁽¹⁰⁾. While developing the ESQUADA, nutritionists were invited to discuss the items' relevance to the study of quality of diet and the items' clarity in order to improve the comprehensibility of the items by adolescents and adults.

The invitation to participate in focus groups was extended to nutritionists with professional experience related to public health. They worked in clinics, and universities with or without research projects. The focus groups allowed the participants to exchange their points of view in a conversational atmosphere⁽¹⁷⁾. Moreover, the experience in public health yielded rich interactions regarding which items were relevant or irrelevant for studying quality of diet, and what changes were needed to assess it and to improve the comprehensibility of the ESQUADA. The ideas were coded using exploratory content analysis. The quality of this coding was confirmed by the almost perfect inter-rater reliability.

Consistent with international evidence and the DGBP, the items presented to the experts were developed based on a multidimensional understanding of the quality of diet^(6,7). The sub-theme *“Relationship between eating behavior and consumption”* encompassed the nutritionists’ opinions about the relevance of the contextual characteristics of eating and meal regularity because of their relationship with the quality of consumption. This discussion is consistent with the studies that have identified an association between inattentive eating and greater consumption⁽¹⁸⁾.

The experts also highlighted the relevance of investigating companionship while eating and cooking. Although the trend toward not cooking regularly exists, individuals who spend more time cooking the meals at home have a healthier eating and less frequently use fast-food restaurants⁽¹⁹⁾. Besides the association with healthier eating⁽¹⁹⁾, the frequency of consuming home-cooked meals is positively associated with better health⁽²⁰⁾. Therefore, these points reinforce the relevance of studying the regularity of cooking one’s meals.

Furthermore, the sub-theme *“Relationship between eating behavior and consumption”* highlighted the irrelevance of some items that assessed the use of oils, fats, and instant seasonings. The nutritionists indicated the difficulty of assessing their usual use when preparing foods because of the greater frequency of eating out⁽²¹⁾. Therefore, these items were excluded. In contrast, one item was newly added that encompassed the addition of salt, olive oil, or vinegar to the food after it was served.

The nutritionists also suggested excluding the item about the consumption of homemade breads or biscuits (prepared without using ready-made mixes). In addition to the reduction in the customary preparation of foods at home, they

indicated the indiscriminate use of the term “homemade” in food labels. The use of the term “homemade,” or similar was more frequent in the labels of ultra-processed foods, such as cake mixes and breads⁽²²⁾. Furthermore, consumers related that these terms might mislead them when attempting to select a food⁽²³⁾. Finally, the nutritionists affirmed that the item noted would not discriminate quality of diet because the term “homemade” could refer to foods either prepared at home or commercially. This item was also excluded from the pool of items.

In addition to studying the relevance of the items, the focus groups discussed the clarity of the items. The sub-theme “*Need to change the item text*” was the most frequent (44.3%) related to improving how the items were expressed. The frequency of this sub-theme indicates the importance of clarity to the quality of the questionnaire. When developing instruments, researchers must consider how best to express items to improve their comprehensibility⁽²⁴⁾. In the current analysis, the nutritionists also contributed to improving how the items were expressed, in accordance with their professional experience. In this sense, the experts underlined the need to improve the evaluation of fruit intake by splitting the item in two: one item considering only fruit intake and another regarding consumption of natural juices.

Some suggestions concerned the inclusion of self-exclusion response options to better discrimination of eating practices. The experts indicated that the individuals must be able to identify the option that accurately represents their eating practices to provide a correct answer. The response options must range along the construct of interest. Otherwise, misinterpretations based on the data could distort the conclusions and future recommendations⁽²⁵⁾. Therefore, the response options were changed to better discriminate the variety and frequency of eating practices.

Considering all the suggestions, 52 items remained on the questionnaire. In addition to concerns regarding the length of the questionnaire on the quality of answers, the comprehensibility of the questions was important⁽²⁴⁾. After considering the suggestions of the nutritionists, the comprehensibility of each item was directly assessed by the naïve population. Because of their good understanding, no items were excluded, highlighting the effectiveness of the focus groups in enhancing the clarity of the items.

The limitations of this study are primarily related to the lowest number of nutritionists in one of the six focus groups. However, the interviewer encouraged discussion while not directly participating in the discussions. Additionally, the study of

item comprehensibility did not investigate whether the individuals experienced difficulties in using the online questionnaire. The study also has strengths. Both the interviewer and the observer were trained in the use of focus groups, and the script was pilot tested with nutritionists. The selection of participants with different professional experience in public health yielded rich interactions. The experts were helped to feel more confident with the NOVA food classification by the presentation of some examples of foods. Furthermore, the focus groups provided important discussions regarding quality of diet that improved the pool of items, and the study of the comprehensibility of the items collected the opinions of a naive population with respect to public health.

CONCLUSION

This study reported discussions regarding the items proposed for a new tool to evaluate quality of diet. The focus groups provided important information improving the content of the ESQUADA. A sample of adolescents and adults directly assessed their understanding of the tool, and the results suggested a clear understanding of the items. These results indicated adequate relevance and comprehensibility of the items for evaluating quality of diet. Therefore, the ESQUADA is ready for further research regarding its accuracy for assessing quality of diet. Finally, this study highlights the advantages of using a qualitative approach to assess experts' suggestions when developing research questionnaires.

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CONFLICT OF INTEREST: none.

SUPPLEMENTARY MATERIAL

Box 1: Description of the sub-themes that emerged through exploratory content analysis, São Paulo, Brazil, 2016–2017.

Sub-themes	Description
ITEM RELEVANCE	
Relationship between eating behavior and consumption	Whether the item was relevant for addressing the relationship between eating behavior and food consumption based on quality of diet.
Characteristics of food habits	Whether the item was relevant for addressing the characteristics of the habitual food consumption of the individual. This relevance was also indicated for items not present in the questionnaire.
Marketing influence	Whether the item was relevant for addressing the influence of food packaging or marketing on feeding behavior.
ITEM CLARITY	
Need to change the item text	Whether the item needed to be written more clearly, considering the variety of meanings of the words and their comprehensibility, and the requirement that they did not imply the correct answer.
Need to include a new item	Whether a new item was needed or whether a current item should be split into multiple items to improve clarity.
Difficulty with NOVA food classification	Whether the item was unclear because of difficulties for individuals in identifying foods according to the NOVA food classification.
Difficulty in reaching the objective	Whether the item did not reach the objective proposed or was not sufficiently clear to reach it.
ALTERNATIVE CLARITY	
Need to include alternatives with better discrimination	Whether the response alternatives needed to be changed to permit better discrimination of eating practices, by adding detail and/or separating the options presented.
Need to change the text or order of the alternatives	Whether the item text or order of the alternatives should be changed for clarity, logic, or to facilitate more fluent reading.

4.4. Artigo 4 - Definição e caracterização do conjunto final de itens da ESQUADA com aplicação da Teoria de Resposta ao Item

“ESQUADA: a new tool to measure the quality of diet in line with the 2014 Food Guidelines for Brazilian Population”: será submetido após avaliação e aprovação da tese pela banca examinadora.

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ABSTRACT

Diet quality indexes have been developed to improve the dietary assessment and have to be easy-to-use. The Item Response Theory (IRT) may provide a more precise measure of the quality of diet. This study aimed to develop the Diet Quality Scale (ESQUADA) in line with the 2014 Dietary Guidelines for Brazilian Population (2014-DGBP) using the IRT analysis. Items were developed in line with the current Brazilian dietary recommendations and were previously analysed by experts and laypersons. Items were organized in booklets and shared in social media and emails. The factor analysis studied the dimensionality of the items and the IRT guided the selection of those with the best discrimination of the quality of diet and the development of ESQUADA. There were also investigated the adjustment of the model and the differential item functioning. Of the 52 items on the questionnaire, 25 of them adhered to the acceptable requirements to develop ESQUADA with five ranges of the quality of diet. The model presented an excellent adjustment and no item presented a differential functioning. Finally, ESQUADA is presented as a new tool to evaluate the quality of diet of Brazilian adolescents and adults, consistent with the 2014-DGBP.

KEYWORDS: questionnaire, dietary guidelines, food quality, psychometric, scales

INTRODUCTION

Unhealthy diets have been contributed to increase the prevalence of obesity and related diseases^(1,2). Diet quality indexes have been developed to improve the dietary assessment⁽³⁻⁵⁾. In addition to the current dietary guidelines, scientific recommendations display that the indexes have to consider the multidimensional setting of the quality of diet and be easy-to-perform to individuals and researchers as well⁽⁶⁾. In Brazil, the diet quality indexes are complex and time-demanding, underlying the use of 24-hour recalls or food frequency questionnaires⁽⁷⁾, and not reach the current food guidelines⁽⁸⁾.

Additionally, the indexes already developed have a subjective definition of the thresholds and scores, setting a same weight to the items although the health-related results^(4,9). The Item Response Theory (IRT) adds informations to the classical approach regarding the characteristics of each item in the questionnaire and calculates the scores basing on a probabilistic model⁽¹⁰⁾.

Given this, Public Health requires a new tool to evaluate the quality of diet consistent with the current guidelines, and provide an accurate measure to further studies. The current analysis aimed to develop the Diet Quality Scale (ESQUADA) in line with the 2014 Food Guidelines for Brazilian Population using the IRT analysis and.

METHODS

The items' set

The 2014 Food Guidelines for Brazilian Population was the theoretical reference used to define the objectives of each item of the questionnaire. These Guidelines present a broad look at Food and Nutrition, highlighting the foods, their combinations and the ways of eating⁽⁸⁾. To determine the options of response, we considered the recommendation for foods that should be consumed regularly or that should be avoided^(8,11,12). The items set was previously analyzed by nutritionists, adolescents and adults in order to evaluate the relevance, clarity and comprehension of each item of the questionnaire⁽¹³⁾. After considering their suggestions, the final item set included in the current analysis encompassed fifty-two items (Supplementary material, Figure 1).

Study design and subjects

The present study is a methodological investigation conducted in the online environment. Between March 2018 and April 2018, this study was carried out in a sample of Brazilian adolescents and adults living in Brazil and with 15 to 50 years. To develop the scale, the sample has to encompass all characteristics of the latent trace, that is, the sample should embrace the different levels of the quality of the diet. Therefore, while the questionnaire was answered, the data were partially evaluated to direct its disclosure to individuals with a supposed level of the quality of diet that is still little represented.

In order to reduce the boredom on answering an extensive questionnaire, the items were organized in thirteen booklets using the Balanced Incomplete Blocks (BIB) design⁽¹⁴⁾ through the package *crossdress* on R software. The order of the items was changed to minimize the influence of the position and boredom on the quality of responses. The booklets were inserted on the Survey Monkey platform and named in ascending order. These booklets were accessed by only one link that organized the presentation of each one in ascending order too. Besides of the items about the quality of the diet, the booklets also presented items regarding the sociodemographic characteristics such as name; date of birth; gender; education; and the country and the city where the individuals born. The link to assess the questionnaire was released in mailing lists; social media, such as Facebook, Whatsapp, and Instagram; and internal communication network of the University of São Paulo. All individuals signed the online consent form.

Of the 2,373 individuals who accepted to answer the questionnaire, 270 were excluded because they did not answer the mandatory information regarding the country where they were born and live. Moreover, those who did not answer the items regarding the eating practices or answered only one were also excluded to further analyses. Other 33 individuals assessed the questionnaire more than one time and the duplication was excluded from the data. So, the final sample included 2,059 individuals.

Data analyses

The dimensionality of the items' set was analyzed by the full-information factor analysis using the package *mirt* on R software. The use of one-dimensional model was acceptable if the first factor explained 20% or more of the total variance⁽¹⁵⁾. The commonality was assessed indicating the explained variance by the factor for each

item. Items with a commonality lower than 0.2 and factor loadings lower than 0.3⁽¹⁶⁾ were excluded of the analysis.

The graded response model was used to calculate the probability of a person to choose the second or posterior category from each item, with a given diet quality level. This model is represented by the following equation⁽¹⁷⁾:

$$P_{i,k}(\theta_j) = \frac{1}{1 + e^{-a_i(\theta_j - b_{i,k})}} - \frac{1}{1 + e^{-a_i(\theta_j - b_{i,k+1})}}$$

where:

θ_j – IRT score of a person j ;

$P_{i,k}(\theta_j)$ – probability of a person j , when answering the item i , choose the category k or a greater;

a_i – discrimination parameter of item i ;

$b_{i,k}$ – location parameter of the category k of the item i , with $b_{i,2} \leq b_{i,3} \leq b_{i,4} \leq \dots$

The discrimination parameter (a_i) indicates the quality of the item to discriminate people with different levels of diet quality. Items with higher values of this parameter presented better discrimination⁽¹⁰⁾. All parameters (a_i and b_i) were estimated by the marginal maximum likelihood method considering a convergence criterion equal to 0.001. To control the lack of identification of the model, the parameter b_i and the IRT scores were estimated in a scale with mean equal to zero and standard deviation equal to one⁽¹⁸⁾.

Items with discrimination parameter (a_i) values below or equal to 0.70 were considered with less discrimination and were excluded for further analyses⁽¹⁹⁾. The estimation of the IRT parameters was repeated only with items with adequate discrimination. The parameter b_i should range since -3 to +3⁽¹⁸⁾. These estimates were also analyzed with the corresponding standard error. Items with high b_i standard errors and with overlapping on the Item Characteristic Curve (ICC) were re-categorized. Those items with remained high b_i standard errors after the re-categorization and low values for a_i were excluded for further analyses.

The adjustment of the model was evaluated underlying the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMSR), the Comparative Fit Index (CFI) and the Tucker–Lewis Index (TLI)^(20,21). The goodness-of-fit was confirmed when the RMSEA and SRMSR were less or equal

to 0.05 and the CFI and TLI were higher than 0.90⁽²²⁾. The accuracy of the ESQUADA was also analyzed by Test Information Curve (TIC). Finally, the empirical reliability, a measure analogous to Cronbach's α , was calculated to analyse the reliability of the ESQUADA.

Considering that age and gender may influence the probability of the individual j to choose the category k or a greater of the item i - $P_{i,k}(\theta_j)$, the differential item functioning (DIF) was studied across age and gender. In this sense, the full-information maximum-likelihood multiple group analysis was performed using the package *mirt* on R software. The P value lower than 0.05 was adopted as the level of significance. The DIF detection was also assessed comparing the differences in the TIC underlying age and gender⁽²³⁻²⁵⁾. Items that demonstrated DIF were excluded to ESQUADA.

The probability to choose the second or posterior category was calculated across the IRT scores for each item. The item was located at the level where this probability was higher or equal to 0.5. Some levels were grouped in the same range of the diet quality according to technical similarity between the items. In order to describe each range, those items with better discrimination ($a_i \geq 1.00$) were considered anchors. This step was performed using Microsoft Excel version 2013 by three nutritionists (TSSS, MAAA, and BSV). Moreover, to improve the interpretability of the ESQUADA⁽¹⁰⁾, the IRT scores estimated in a scale with mean equal to zero and standard deviation equal to one were transformed to a scale with mean equal to two-hundred fifty and standard deviation equal to fifty.

The project was approved by the Ethics Committee on Human Research at Faculty of Public Health (protocol number 1.943.099).

RESULTS

The characteristics of the individuals who were included on the current analyses are described in table 1. Most of them aged eighteen to thirty (48.1%); were women (69.7%); had not complete university degree (58.1%); and lived in southeast region (78.6%). The questionnaire was answered between six to eight minutes.

The commonalities, factor loadings, and discrimination parameter of the fifty-two items considered in the current analysis were described in supplementary material (Figure 1). These items explained 0.20 of the total variance, but fifteen items

were excluded because of the low values of commonalities, factor loadings, and discrimination parameter (including I06, I17, I18, I19, I20, I23, I26, I27, I28, I30, I33, I34, I38, I45, and I49).

The analyses were repeated without the aforementioned items and with the categorization of items presenting high b_i standard errors and with overlapping on the ICC. However, twelve items offered low values of commonalities, factor loadings, and discrimination parameter and were excluded (including I05, I07, I10, I12, I14, I15, I16, I29, I35, I37, I39, and I47). The remaining twenty-five items met the inclusion criteria and were considered to ESQUADA explaining 0.34 of total variance. The estimation of the IRT parameters was finished with twenty EM cycles. The commonalities, factor loadings, and IRT parameters of these items are displayed in Table 2. In this regard, the further results are concentrated on the twenty-five items that adhered to acceptable requirements.

Along the continuum, the item about where the individuals usually get fruits and/or vegetables presented the lowest discrimination parameter ($a_i = 0.786$). The item *'When you are in home, do you usually eat instant noodles, powdered soups, ready-to-heat meals, and/or fast-food burgers?'* had the highest discrimination parameter ($a_i = 2.237$).

The item *'Do you usually eat breakfast cereals and/or cereal bars?'* had the lowest location parameter ($b_i = -3.738$), suggesting that these foods are consumed more frequently on the lowest level of the quality of the diet. The items *'Do you usually eat Brazil nuts, cashew nuts, and/or walnuts?'* ($b_i = 3.080$) and *'Do you usually eat whole rice and/or whole pasta?'* ($b_i = 2.932$) presented the highest location parameters, suggesting that individuals, who frequently consume nuts, cashews, whole rice, and whole pasta, have the highest level of the quality of diet.

Table 1: Characteristics of the adolescents and adults who participated on the development of the Diet Quality Scale (ESQUADA). São Paulo, Brazil, 2018 (N = 2,059).

Characteristics	n	%
Age		
≤ 18 years	531	25.8
> 18 and ≤ 30 years	991	48.1
> 30 years	537	26.1
Gender (n = 1,944)		
Female	1,355	69.7
Male	589	30.3
Education (n = 1,944)		
Basic	6	0.3
Incomplete Primary	33	1.7
Complete Primary	32	1.7
Incomplete High School	618	31.8
Complete High Scholl	96	4.9
Incomplete University Degree	344	17.7
Complete University Degree	414	21.3
Master	266	13.7
PhD	135	6.9

Table 1: Characteristics of the adolescents and adults who participated on the development of the Diet Quality Scale (ESQUADA). São Paulo, Brazil, 2018 (N = 2,059) (continuation).

Characteristics	n	%
State (n = 1,944)		
Alagoas	2	0.1
Amazonas	2	0.1
Bahia	10	0.5
Ceará	8	0.4
Distrito Federal	19	1.0
Espírito Santo	19	1.0
Goiás	19	1.0
Mato Grosso	3	0.1
Mato Grosso do Sul	8	0.4
Minas Gerais	208	10.7
Paraná	54	2.8
Paraíba	44	2.3
Pará	6	0.3
Pernambuco	44	2.3
Piauí	29	1.5
Rio Grande do Norte	2	0.1
Rio Grande do Sul	118	6.1
Rio de Janeiro	107	5.5
Rondônia	1	0.05
Roraima	1	0.05
Santa Catarina	38	1.9
Sergipe	3	0.1
São Paulo	1,193	61.4
Tocantins	6	0.3
Region (n = 1944)		
North	16	0.8
Northeast	142	7.3
Midwest and Distrito Federal	49	2.5
South	210	10.8
Southeast	1527	78.6

Table 2: Commonalities, factor loadings, and discrimination and location parameters of the Item Response Theory and the respective standard errors from the Diet Quality Scale (ESQUADA) (N = 2,059).

Items	Commonalities	Loadings	a (SE)	b1 (SE)	b2 (SE)	b3 (SE)
I01-Do you usually eat at breakfast?	0.364	0.603	1.288 (0.154)	-0.637 (0.090)	-	-
I02-What kind of foods do you usually eat at breakfast?	0.241	0.491	0.959 (0.125)	-1.673 (0.198)	-0.108 (0.098)	-
I03-Do you usually have lunch?	0.264	0.514	1.021 (0.202)	-2.750 (0.427)	-	-
I04-What kind foods do you usually eat at lunch?	0.372	0.610	1.309 (0.343)	-3.457 (0.662)	-	-
I08-Do you usually replace lunch or dinner' meal to snacks? (Consider the examples of snacks: pizza, Hot Hit®, Hot Pocket®, X-salad, X-egg, Mc Donald's®, Bob's®, Subway®, industrialized 'escondidinho', industrialized stroganoff, or industrialized lasagna.).	0.264	0.514	1.020 (0.114)	-3.429 (0.356)	-1.937 (0.195)	0.521 (0.101)
I09-Do you usually cook or help to prepare of foods at meals from lunch and dinner? (Consider help to prepare of foods: washing, cutting, and/or cooking foods.).	0.206	0.454	0.868 (0.132)	-0.245 (0.111)	-	-
I11-Where you or someone in your household usually buy fruits and/or vegetables?	0.176	0.419	0.786 (0.107)	0.304 (0.117)	2.305 (0.294)	-
I13-"Take the largest portion of potato chips paying only US\$1.00 more." In situations like the example, do you usually pick the largest portion of the food by paying a little extra?	0.239	0.489	0.954 (0.127)	0.457 (0.108)	-	-

SE: Standard Error. a: Discrimination parameter. b1: Difficulty parameter of the category 1.

b2: Difficulty parameter of the category 2. b3: Difficulty parameter of the category 3.

Note: This table presents a free translation of the items. That is, their original writing is in Portuguese; the writing presented in this table was not submitted to a cross-cultural adaptation.

Table 2: Commonalities, factor loadings, and discrimination and location parameters of the Item Response Theory and the respective standard errors from the Diet Quality Scale (ESQUADA) (N = 2,059) (continuation).

Items	Commonalities	Loadings	a (SE)	b1 (SE)	b2 (SE)	b3 (SE)
I21-Do you usually eat whole rice and/or whole pasta?	0.261	0.511	1.011 (0.110)	-0.029 (0.095)	1.278 (0.145)	2.932 (0.298)
I22-Do you usually eat oats, quinoa, and/or rye?	0.476	0.690	1.624 (0.163)	-0.027 (0.068)	1.291 (0.106)	2.494 (0.196)
I24-Do you usually eat raw and/or cooked vegetables? (Do not consider the consumption of cassava, potatoes, and yams.).	0.414	0.643	1.429 (0.147)	-2.069 (0.176)	-0.771 (0.089)	0.599 (0.087)
I25-Do you usually eat fruits? (Do not consider the consumption of juice.).	0.295	0.544	1.102 (0.118)	-2.622 (0.254)	-0.768 (0.105)	0.888 (0.117)
I31-Do you usually eat Brazil nuts, cashew nuts, and/or walnuts?	0.362	0.601	1.281 (0.139)	-0.409 (0.084)	1.075 (0.114)	3.080 (0.291)
I32-What do you usually drink when you are thirsty?	0.200	0.448	0.852 (0.171)	-2.743 (0.475)	-	-
I36-Do you usually eat industrialized cakes or cookies (bought ready)? (Also consider those made with ready mixtures.).	0.276	0.525	1.050 (0.117)	-0.863 (0.118)	1.601 (0.164)	-
I40-Do you usually eat industrialized ketchup, mustard and/or mayonnaise (bought ready)?	0.199	0.446	0.849 (0.117)	-2.249 (0.286)	1.759 (0.236)	-
I41- Do you usually eat bought ready snacks (such as fried/roasted snacks, fast-food burgers, hot dogs, and/or industrialized pizza)? (Consider the examples of fast-food burgers: X-salad, X-egg, Hot Hit, Hot Pocket®, Mc Donald's®, Bob's® or Subway®.).	0.429	0.655	1.476 (0.153)	-2.853 (0.248)	-1.286 (0.111)	1.339 (0.118)
I42-Do you usually eat breakfast cereals and/or industrialized cereal bars? (Consider the examples of breakfast cereals: Sucrilhos®, Nescau Cereal®, Corn Flakes®, Crunch® or All Bran®.).	0.165	0.407	0.758 (0.127)	-3.738 (0.582)	-0.824 (0.164)	-

SE: Standard Error. a: Discrimination parameter. b1: Difficulty parameter of the category 1.

b2: Difficulty parameter of the category 2. b3: Difficulty parameter of the category 3.

Note: This table presents a free translation of the items. That is, their original writing is in Portuguese; the writing presented in this table was not submitted to a cross-cultural adaptation.

Table 2: Commonalities, factor loadings, and discrimination and location parameters of the Item Response Theory and the respective standard errors from the Diet Quality Scale (ESQUADA) (N = 2,059) (continuation).

Items	Commonalities	Loadings	a (SE)	b1 (SE)	b2 (SE)	b3 (SE)
I43- Do you usually eat chips (such as Ruffles®, Cheetos®, Elma Chips®, Doritos®, Pringles®, or microwave popcorn)?	0.448	0.670	1.535 (0.158)	-3.117 (0.287)	-1.979 (0.164)	0.439 (0.073)
I44-Do you usually drink soda and/or juice (powder juices or those on boxes, can, or bottle)? (Consider the examples: Del Valle®, Maguary®...).	0.514	0.717	1.749 (0.162)	-0.430 (0.071)	0.863 (0.084)	-
I46-Do you usually eat industrialized syrup to ice cream, industrialized jellies, milk sweet, hazelnut cream, such as Nutella®, and/or condensed milk?	0.317	0.563	1.160 (0.133)	-1.891 (0.188)	1.118 (0.133)	-
I48-Do you usually drink chocolate drinks (such as Toddynho®)?	0.494	0.703	1.682 (0.187)	-1.608 (0.133)	-0.156 (0.068)	-
I50- Do you usually eat mortadella, salami, meat-flavored industrialized pates, turkey breast, and/or ham?	0.344	0.586	1.231 (0.123)	-1.607 (0.149)	0.906 (0.107)	-
I51- Do you usually eat nuggets/steak (industrialized breaded chicken), sausage, and/or industrialized burgers (bought ready)?	0.558	0.747	1.912 (0.199)	-2.471 (0.191)	-1.560 (0.113)	0.319 (0.066)
I52- When you are in home, do you usually eat instant noodles, powdered soups, ready-to-heat meals, and/or fast-food burgers? (Consider the examples such as Nissin®...).	0.633	0.796	2.237 (0.212)	-2.292 (0.158)	-1.473 (0.097)	0.134 (0.060)

SE: Standard Error. a: Discrimination parameter. b1: Difficulty parameter of the category 1.

b2: Difficulty parameter of the category 2. b3: Difficulty parameter of the category 3.

Note: This table presents a free translation of the items. That is, their original writing is in Portuguese; the writing presented in this table was not submitted to a cross-cultural adaptation.

The ESQUADA presented an excellent adjustment (RMSEA=0.01, SRMSR=0.02, CIF=0.99, and TLI=0.99) with the best accuracy close to the mean (Figure 1) and an adequate empirical reliability (0.70). No item presented a

differential functioning neither across age nor gender. The Figure 2 exemplifies the absence of DIF when performed by gender; that is, there was no difference on the Test Information Curve underlying the DIF analyses by gender.

Figure 1: The Test Information Curve of the Diet Quality Scale (ESQUADA) (N = 2,059).

Figure 2: The differential item functioning analysis by gender on the Test Information Curve (N = 1,944).

1: Female curve. 2: Male curve. θ – IRT score. $I\theta_j$ – Information of the IRT score.

For interpretation, ESQUADA was categorized in five ranges (Figure 3). The range 'I' (IRT scores lower or equal to 150) is composed by the items regarding what kind of foods were eating at lunch, replacement of meals, and consumption of fruits and ultra-processed foods. The range 'II' (IRT scores higher than 150 and lower or equal to 200) includes the items about the replacement of meals and the consumption of fruits, vegetables and ultra-processed foods. The range 'III' (IRT scores higher than 200 and lower or equal to 275) encompasses the items underlying the usual breakfast; consumption of vegetables, ultra-processed beverages, oats, quinoa, rye, whole rice or pasta, nuts, or walnuts; and non-consumption of some ultra-processed foods. The range 'IV' (IRT scores higher than 275 and lower or equal to 375) is composed by the items regarding the non-replacement of meals; the consumption of fruits, vegetables, oats, quinoa, rye, whole rice or pasta, nuts, or walnuts; and the non-consumption of ultra-processed foods. Finally, the range 'V' (IRT scores higher than 375) holds the items about the consumption of oats, quinoa, rye, whole rice or pasta, nuts, or walnuts.

Figure 3: Short description of the ranges from the Diet Quality Scale (ESQUADA).

Ranges	Mean equal to zero and standard deviation equal to one	Mean equal to two-hundred fifty and standard deviation equal to fifty	Short description
I	Lower or equal to -2	Lower or equal to 150	- At lunch, the individuals usually eat homemade snacks or complete meal (including rice, beans, meat or salad). Before the range 'I', they usually eat foods such as instant noodles, snacks or fast-food burgers. - The individuals usually eat ultra-processed on one or two days a week. Before the range 'I', they usually eat these foods on two or more days a week. - The individuals usually eat ultra-processed foods in-home on one or two days a week. Before the range 'I', they usually eat these foods in-home on two or more days a week. - The individuals usually replace meals to snacks on one to two days a week. Before the range 'I', they usually replace meals to snacks on three or more days a week. - The individuals usually eat fruits on less than one day a week. Before the range 'I', they do not usually eat fruits.
II	Higher than -2 and lower or equal to -1	Higher than 150 and lower or equal to 200	- At lunch, the individuals keep usually eating homemade snacks or complete meal (including rice, beans, meat or salad). - The individuals usually eat ultra-processed foods on less than one day a week. - The individuals usually eat ultra-processed foods in-home on less than one day a week. - The individuals usually eat raw or cooked vegetables on less than one day a week. Before the range 'II', they do not usually eat vegetables. - The individuals usually replace meals to snacks on less than one day a week. - The individuals usually eat fruits on one to four days a week.

Figure 3: Short description of the ranges from the Diet Quality Scale (ESQUADA) (continuation).

Ranges	Mean equal to zero and standard deviation equal to one	Mean equal to two-hundred fifty and standard deviation equal to fifty	Short description
III	Higher than -1 and lower or equal to 0.5	Higher than 200 and lower or equal to 275	- At lunch, the individuals keep usually eating homemade snacks or complete meal (including rice, beans, meat or salad). - The individuals do not usually eat some ultra-processed foods. - The individuals do not usually eat ultra-processed foods in-home. - The individuals usually eat raw or cooked vegetables on one to four days a week. - The individuals usually have breakfast on at least one day a week. Before the range 'III', they do not have breakfast. - The individuals usually drink sugar-sweetened beverages on less than one day a week. Before the range 'III', they usually drink these beverages on more than one day a week. - The individuals usually eat oats, quinoa, rye, nuts, walnuts, whole rice or whole pasta on less than one day a week. Before the range 'III', they do not usually eat these foods. - The individuals keep usually replace meals to snacks on less than one day a week. - The individuals keep usually eat fruits on one to four days a week.
IV	Higher than 0.5 and lower or equal to 2.5	Higher than 275 and lower or equal to 375	- At lunch, the individuals keep usually eating homemade snacks or complete meal (including rice, beans, meat or salad). - The individuals do not usually eat ultra-processed foods. - The individuals keep do not usually eat ultra-processed foods in-home. - The individuals usually eat raw or cooked vegetables and fruits on five or more days a week. - The individuals keep usually have breakfast on at least one day a week. - The individuals usually eat oats, quinoa, rye, nuts, walnuts, whole rice or whole pasta on one to four days a week. - The individuals do not usually replace meals to snacks.

Figure 3: Short description of the ranges from the Diet Quality Scale (ESQUADA) (continuation).

Ranges	Mean equal to zero and standard deviation equal to one	Mean equal to two-hundred fifty and standard deviation equal to fifty	Short description
V	Higher than 2.5	Higher than 375	- At lunch, the individuals keep usually eating homemade snacks or complete meal (including rice, beans, meat or salad). - The individuals keep do not usually eat ultra-processed foods. - The individuals keep do not usually eat ultra-processed foods in-home. - The individuals keep usually eat raw or cooked vegetables and fruits on five or more days a week. - The individuals keep usually have breakfast on at least one day a week. - The individuals usually eat oats, quinoa, rye, nuts, walnuts, whole rice or whole pasta on five or more days a week. - The individuals keep do not usually replace meals to snacks.

DISCUSSION

The items' set aimed to evaluate the quality of diet, underlying its different aspects^(8,26). A previous study assessed the relevance, clarity and comprehensibility of each item⁽¹³⁾ in accordance to the recommendations for psychometric studies⁽²⁷⁾. The current analysis concentrated on the study of the selection of items that had better represent the quality of diet.

The full-information factor analysis indicated that of the fifty-two items analysed, twenty-five of them explained 0.34 of the total variance using a one-dimension model. The reduction in the number of items improved the total explained variance and the quality of items in ESQUADA, considering the best discriminations of the quality of diet. The current analysis indicated that these items comprised the different characteristics of the quality of diet in a one-dimensional model. In this regard, the items about consumption of unprocessed and ultra-processed foods; habits of replacing the meal to snacks (I08) and home-cooking (I09); and the local where buy fruits and vegetables (I11), respectively, exemplified the nutritional, sociocultural, and food safety characteristics.

The items regarding the usual breakfast (I01), the usual lunch (I03), and what kind of foods are usually consumed at these meals (I02 and I04) adequately

discriminate the quality of diet and were maintained in ESQUADA. However, the items toward the usual dinner (I05) and what kind of foods are usually consumed at dinner (I06) were excluded of the final item' set. The lower discrimination suggested that these items around the dinner are not good indicators of the quality of diet. For example, individuals who stated unusual dinner (suggesting a low quality of diet) also had dietary practices that suggest low as well as high diet quality, such as non-consumption or usual consumption of vegetables (data not shown). So, the identification of both unhealthy and healthy dietary practices between who usually have not dinner may decrease the item' discrimination of the quality of diet. The opposite behaviors made impossible to recognize the food pattern among those who did not normally eat at night. As already described in the scientific literature, the individuals usually replace the meal at dinner to in-home or away-from-home snacks⁽²⁸⁾. Because of the nutrient-focus recommendations, the restrictive dietary trends and the nutritional messages spreading by the common sense⁽²⁹⁻³¹⁾, people believe that snack is the best option to eat at dinner. Although vegetables were more expected to be consumed at traditional dinner than at snacks options, the non-consumption of a meal at night does not indicate an unhealthy food choice. Homemade snacks (including those prepared with processed foods such as breads and cheese, and non-including ready-to-eat or ready-to-heat products) may be a healthy alternative when there is no time to cook traditional meals or individuals prefer to eat snacks than meals at dinner. Finally, the informations regarding the usual dinner are not a good indicators of the quality of diet and the IRT analyses confirm it suggesting the exclusion of the items (I05 and I06).

Other items were also related to lunch or dinner. Regarding the item about having lunch or dinner with family, friends, and/or colleagues (I07), the IRT analyses also indicated its exclusion because of the low discrimination of the quality of diet. Nowadays people have eaten alone on day-by-day because of the changes on the characteristics of the houses, time, and foods^(32,33) and have been accompanied while eating in leisure time⁽³²⁾. In order to improve the quality of diet among adolescents, favorable parenting practices (such as parenting modeling and home availability and accessibility) positively influenced fruit and vegetable consumption independently of the family meal frequency⁽³⁴⁾. Even though the healthy options were positively related to share meal frequency, unhealthy foods as well were eaten by individuals who frequently eat with others⁽³⁵⁾. The eating practice around sharing

meals with friendly people was also observed in individuals who reported unhealthy as well as healthy consumption. In the current analysis, data not shown suggested that the individuals who frequently shared meals presented a broad response patterns; for example: usual consumption of eat instant noodles, powdered soups, ready-to-heat meals or fast-food burgers, vegetables, and fruits. Besides what types of foods are eaten, gender; age; the setting where the meal is shared (in-home or out-of-home); the presence of children or non-family members (friends or colleagues); the context (day by day or festive days); and the social roles may influence this relation^(32,35). While family members seek eating together on nighttime and weekends, either coworkers or friends have lunch together when there is a convergence in their routine. In turn, sharing meal is also a time of conversation and relax, strengthening the sense of belonging to a group. However, hierarch differences among family members as well as coworkers can decrease the mealtime or change what foods are shared⁽³²⁾. Therefore, sharing meals were related to healthy and unhealthy eating practices. This range decreased the discrimination of the item on assessing the quality of diet and its subsequent exclusion of the final items' set.

The development of ESQUADA also concerned on the relationship between cooking and helping on preparing of foods at meals from lunch or dinner and the quality of diet (I09). Cooking or helping to prepare foods at least one day a week adequately discriminated the quality of diet ($a_i = 0.868$). Insofar people have cooked at home in few times⁽³⁶⁾, the customary preparation on at least one day a week might indicated the attention to a better dietary, arranging some time to cook amid the working multiple jobs routine. This is a good point improving the quality of diet as inasmuch as when people have eaten alone on day-by-day⁽³³⁾, they have not cooked and usually consumed ready-to-heat foods and ready-to-eat foods⁽³²⁾. In this regard, the item about cooking or helping on preparing of food at lunch or dinner was maintained in the final items' set. In turn, the item assessing the customary cooking with friends or family at leisure moments (I14) was unable to discriminate the quality of diet and was excluded from ESQUADA. This exclusion is underlying the symbolism that these moments are a time of interaction with friends when they want to explore foods not present in their daily routine, such as those cooked in-home⁽³²⁾.

As also aforementioned that people are cooking at home in few times⁽³⁶⁾ as well as they are often eating out-of-home^(37,38), ESQUADA presented an item regarding the usual lunch or dinner outside home in day-by-day at self-service,

executive or school restaurants (I10). Snack bars and restaurants are locals where Brazilians frequently buy foods to consume away from home such as meals, soft drinks, alcoholic beverages, and fast-foods⁽³⁷⁾. Although most of these foods is ultra-processed⁽³⁹⁾, recent scientific literature indicated that is feasible to consume healthy options outside home⁽⁴⁰⁾. However, the current analysis indicated the exclusion of the aforementioned item, suggesting that the item's writing did not clearly state the kind of foods in evaluation. The variety of either healthy and unhealthy foods that is available in self-service, executive or school restaurants might confused the individuals while reading this item. Finally, considering the discrimination parameter as a quality indicator of the items⁽¹⁰⁾, these results suggest the need to improve this item's writing in further studies.

Despite the evidence that unhealthy food consumption while viewing television alone or with company is inadequate⁽⁴¹⁻⁴³⁾, the item about the habit of doing other activities whilst having lunch or dinner (I15) was not sensitive enough to discriminate an adequate diet and was therefore excluded from the final set. Other studies support this low sensitivity. The mindless eating because of the non-attention on what is eating during TV viewing did not explain the changes in body adiposity over time in the Australian cohort⁽⁴⁴⁾. A multi-centre European investigation indicated that higher energy-dense food products consumption while having the TV on at mealtime was more frequent in those individuals who watch TV for more than 2 hours per day⁽⁴⁵⁾. Besides the decreasing on Brazilian adolescents eating during the TV viewing⁽⁴⁶⁾, they reported having more lunch than snacks while watching TV⁽⁴⁷⁾. These results may indicate that individuals are also consuming traditional meals rather than unhealthy snacks while TV viewing or other screens' use. So, the relation between eating whilst viewing TV and the wide quality of diet corroborate to the lower discrimination of the item. Moreover, the different activities presented in the item (watch television, use the computer or cell phones, study, read, and other) as well as the focus on lunch and dinner may have influenced on item's quality, decreasing the discrimination of the quality of diet.

Other two items possibly related to the habit of doing other activities while having lunch or dinner were also excluded, including the items regarding between-meal snacking (I12) and the place at home where the individuals usually have lunch or dinner (I16). While the place at home indicated the socioeconomic characteristics of Brazilian family instead of the quality of diet⁽⁴⁸⁾, the between-meal snacking might

influence in energy regulation in both direction: adequating as well as extrapolating the energy intake. In this sense, it is not possible to affirm that snacking is always associated with poor quality of diet. The investigation of the usual snacking should delve into both foods choices and circumstances of eating^(49,50). The previous study indicated a good comprehensibility of these items by naïve individuals⁽¹³⁾, suggesting that they associated the term 'snacking' with uncontrolled eating instead of the consumption of only unhealthy foods. However, these items did not adhere to acceptable requirements to maintain them in the final set. Finally, in future studies, other items (per exemple, assessing what kind of snacks) might be included in ESQUADA using the equalization technique of the IRT analysis⁽¹⁰⁾.

Some items proposed to ESQUADA has based in other Brazilian research such as the Surveillance System of Risk and Protection Factors for Chronic Diseases by Telephone Survey (VIGITEL)⁽⁵¹⁾, National Survey of School Health (PeNSE)⁽⁵²⁾, and Brazilian Family Budgets Survey (POF)⁽⁵³⁾. As well as VIGITEL, PeNSE, and POF⁽⁵¹⁻⁵³⁾, ESQUADA presented items about the replacement of lunch or dinner-meals to snacks (I08), removal of the fat or skin of meats (beef, pork, or chicken) (I17), and consumption of beans (I23). Although the consumption of meats with visible fat is a risk for abdominal adiposity in adults⁽⁵⁴⁾, the item assessing the removal of the visible fat (I17) was unable to capture the quality of diet and was excluded from the final set. Moreover, even though beans are one of foods representing the Brazilian dietary pattern^(8,40), the current analysis indicate that their consumption is not a good indicator of the quality of diet. Data not shown indicated that both individuals who usually consumed or not beans pick the largest portion of foods by paying a little extra and usually consume or not vegetables. Therefore, this wide of healthy and unhealthy eating practices decreased the capability of the item about the consumption of beans (I23) to discriminate the quality of diet with its exclusion from ESQUADA.

As VIGITEL, PeNSE, and POF⁽⁵¹⁻⁵³⁾, ESQUADA also included items regarding the consumption of vegetables (I24), fruits (I25), and fruits juices (I26). Beyond the concerning on their consumption, ESQUADA also assess the place where individuals (or someone in their household) acquire fruits and/or vegetables (I11). The items about the consumption of vegetables (I24), fruits (I25), and the local of purchasings (I11) adhered to requirements. Worldwide, the consumption of vegetables and fruits is a relevant point to dietary and is a strategy of the global plan for the prevention and

control of noncommunicable diseases⁽⁵⁵⁾. The DGBP recommends preferring fruits than natural juice fruits as well as buy foods at places where there are a variety of fresh foods⁽⁸⁾. In addition to the study of the consumption of vegetables and fruits, the local where individuals acquire these foods might indicate the diet quality. In Brazil, albeit of the preference to use supermarket⁽⁵⁶⁾, purchases in street fairs, small markets, and small farmers were related with decreasing in the ultra-processed foods consumption⁽⁵⁷⁾.

The current analysis resulted in the exclusion of items about the addition of sugars (I18) and salt (I19) to foods or drinks, and about the addition of salt, olive oil or vinegar to the salad served in plate (I20). These items aimed to investigate the adding of processed culinary ingredients to foods because of this usual addition might be related to the excessive consumption of sugar and salt. In Brazil, most of the individuals who consumed fruit juice or soda pointed that they added sugar to the drinks⁽⁵⁸⁾. The DGBP recommends the consumption of sugars, salt, and oil in small quantities⁽⁸⁾. Instead of the importance in the prevention of noncommunicable diseases⁽⁵⁵⁾, adding sugars, salt and oil on foods was unable to indicate the diet quality. Individuals who add or not these processed culinary ingredients in foods or beverages sometimes replace meals to snacks and usually eat fruits or vegetables (data not shown). This wide of both healthy and unhealthy eating practices might indicate that these items are not good indicators of the quality of diet instead of there are evidences that individuals should avoid excessive intakes.

The exclusion of items regarding the consumption of meats (I28) and fish (29) was mainly substantiated in the response options. These items presented the following alternatives: *"I do not eat meat/fish"*, *"I eat fried meat/fish"*, *"Sometimes I eat"*, *"I eat on one or two days in the week"*, *"I eat on three or four days in the week"*, and *"I eat on five or more days in the week"*. These options were unable to encompass the recommendations from the DGBP underlying the decreasing in consumption of meats/fish, with preference to those grilled, baked or stewed, as well as the advice from the psychometrics that the response options must range along the latent trait⁽⁵⁹⁾. Regarding the meat consumption, the excessive as well as the no consume are not recommended, making difficult to include this indicator in diet quality indices⁽⁴⁾. Besides the exclusion of items addressing the consumption of meat and fish, the IRT analysis also indicated the exclusion of the item about the consumption of eggs (I30). This item considered different preparations of eggs:

boiled, scrambled, fried, or omelets. This range encompassed eighter healthy and unhealthy options to eat eggs. That is, the item' writing was inadequate to study the quality of diet, resulting in its exclusion from the final set. Furthermore, considering that is possible to include new items in ESQUADA⁽¹⁰⁾, future studies might investigate other strategies to write these items and their response options in order to add the evaluation of the consumption of meat, fish and eggs in this new tool proposed to evaluate the quality of diet in line with the DGBP.

While the DGBP recommends to pay attention to the signs of thirst⁽⁸⁾, ESQUADA aimed to investigate what kind of beverage the individuals drink when they are thirst: water, natural fruit juice, artificial fruit juice or sugar-sweetened beverage (including artificial fruit juice, soft drink, commercial teas or commercial flavored water) (I32). This item presented adequate discrimination of the quality of diet, with low value of the location parameter, suggesting that individuals identify thirst with the consequent intake of water at low levels of the latent trait. Noteworthy, the response to the signs of thirst entails to avoid the consequences of the dehydration on mood, well-being and health⁽⁶⁰⁾. Although the current analysis did not aim to quantified the intake of water in milliliters or cups, this intake was positively associated with healthy diet⁽⁶⁰⁻⁶²⁾ and was negatively associated with a lower obesity incidence⁽⁶¹⁾. Finally, the presence of this item in ESQUADA highlights its relevance on the assessment of the quality of diet.

Apart from the intake of water, ESQUADA also assess the consumption of milk (I27), processed alcoholic beverage (I34), ultra-processed alcoholic beverage (I38), sugar-sweetened beverage (including artificial fruit juice, soft drink, commercial teas or commercial flavored water; I44), yogurt (I47), and chocolate drinks (I48). The current analysis indicated the exclusion of the items regarding the consumption of milk, alcoholic beverage, and yogurt. Coffee, tea, and fruit juice were the beverages most consumed among Brazilians. Nevertheless the lowest frequency of consumption, soft drink and alcoholic beverage presented the biggest portion size among the drinks more consumed in Brazil and positive association with excess weight⁽⁵⁸⁾. According to recent recommendations to diet quality indices⁽⁶⁾, ESQUADA assessed the consumption underlying the frequency and did not investigate the portion size. The lower frequency of consumption of milk, alcoholic beverage and yogurt⁽⁵³⁾ might get difficult the identification of the quality of diet, resulting in the exclusion of the respected items⁽⁷⁾. The exclusion of items regarding dairy products

may also endorse in the relation between health and the content of lactose and fat⁽⁴⁾. Finally, although the importance to study the intake of alcoholic beverage instead of its processing, this customary is frequently related to leisure time in Brazil. In this sense, the items regarding the consumption of alcoholic beverages may put together drinks related to different eating practices and effects to health.

Items about the consumption of canned foods (I33) and cheeses (I35) were also excluded from ESQUADA. Inasmuch as these foods are unusually consumed by Brazilians^(53,63), the low frequency of their consumption and the inability of the response options to encompass this consumption may yield the exclusion of these items on the IRT analysis^(4,64).

Of the twenty-five items on ESQUADA, eleven of them directly assess the ultra-processed foods consumption. Whilst the items about the consumption of ultra-processed foods show a good discrimination of the quality of diet, the item which investigates the consumption of breakfast cereals and cereal bars (I42) had the lowest location parameter ($b_i = -3.738$), suggesting that these foods are consumed more frequently on the lowest level of the quality of diet. In line with scientific literature, these results highlight that ultra-processed foods are usually consumed by adolescents as well as adults and are associated with an unhealthy dietary nutritional profile^(53,63). Noteworthy, the usual consumption of ultra-processed foods has been stimulated by the marketing strategies such as the use of some terms at the food labels⁽⁶⁵⁾. In this sense, ESQUADA included an item assessing the marketing influence to choose the biggest size of the portions of fast foods (I13). Furthermore, the current analysis stated the exclusion of the items about the consumption of sauces (I39), breads (I45), and pates (I49). These exclusions highlighted the relation between the belief that the consumption of some ultra-processed foods is in line with a healthy dietary and their usual intake.

Besides including items with the best discrimination of the quality of diet, ESQUADA presents an accurate measure of the latent trace underlying adequate adjustment of the model and the reliability as well. The Test Information Curve shedded lights the measure error across the scale, suggesting that ESQUADA is more accurate between the scores -2 and +2. Furthermore, the DIF analysis suggests the validity of the measure in different samples⁽⁶⁴⁾; that is, ESQUADA measures the quality of diet in the same manner across individuals with different age and gender. Finally, a qualitative approach may delve into the meaning of the latent

trace and the items with food-experts as well as naïve individuals⁽⁶⁶⁾. In this sense, the absence of the differential performance across age and gender highlights the previous qualitative study of the clarity of items from ESQUADA⁽¹³⁾.

Therefore, ESQUADA is presented as a new tool to accurately evaluate the quality of diet in further studies, considering the parameters calculated in the current studies. The researchers can apply the IRT scores in continuous or categorical forms. In addition, they can include new items in ESQUADA in order to reach other points which are not in the current items' set⁽¹⁰⁾.

Considering the description of ESQUADA, the quality of diet increases while the individuals usually have breakfast and lunch, and do not usually replace meals to snacks. On the range 'I', when the individuals start to eat homemade snacks or full meal at lunch, they usually replace meals to snacks and eat ultra-processed foods on one or two days a week. However, they usually have breakfast only from the range 'III' that is characterized by a decreasing in these replacement and consumption of ultra-processed foods. These discussions underlie that the usual breakfast indicate a better quality of diet than the usual lunch. The scientific literature has stated the importance of the breakfast to overall health and dietary^(67,68). This might be exemplified by the development of a specific index assessing the breakfast quality for Brazilian population⁽⁶⁹⁾. However, this index focus on the nutrient and foods-group recommendations and is based on the classical test theory, with a subjective score system. ESQUADA looks to the usual breakfast in a broad analysis of the quality of diet, considering its nutritional and sociocultural settings as well as its scoring is endorsed on probabilistic model.

As noted, the quality of diet increases while the consumption of ultra-processed foods gets less frequent. The individuals not consume some of them in the same range ('III') where they start to eat whole rice (I21), oats (I22), and nuts (I31). They only not consume any kind of ultra-processed foods at the last ranges ('IV' and 'V') where the consumption of unprocessed or minimally processed foods is incorporate to eating practices. These results indicate the complexity to evaluate the quality of the diet. In the median ranges, individuals accumulate healthy and unhealthy eating practices. In this sense, the IRT analysis delved into the item characteristics regarding the discrimination of each item⁽¹⁰⁾, resulting in the selection of the best pool of items to evaluate the quality of diet.

One limitation of the present study concerns the unidimensionality assumption of a multidimensional construct. Despite items addressed the sociocultural setting of the quality of diet, we aware that the twenty-five items are more related to food consumption. Moreover, the current analysis indicated the need for recategorization of some response options because of the low number of respondents who choice them. However, the sample size was large enough for accurately estimate the IRT parameters. The study has other strengths; ESQUADA was endorsed in the current food guidelines and in a more robust statistical analysis selecting items with the best discrimination of the quality of diet and enabling to identify the eating practices across the continuum.

CONCLUSION

In accordance to the current recommendations to develop diet quality indexes, ESQUADA did not aim to objective assess the food and nutrients intakes, but to study the eating practices in line with the 2014-DGBP. The exclusion of items about having lunch or dinner with family or friends or eating beans or meats did not counter their advantages to health and the current food guidelines. Likewise, the IRT analysis enabled the selection of the best indicators of the quality of diet. In this regard, items about having breakfast, the local where people get fruits and vegetables, the habit to cook foods, and the consumption of fruits, vegetables and ultra-processed foods exemplified items from the final set. Furthermore, the IRT analysis provided a more accurate measure of the quality of diet, detailing the eating practices in different levels of the quality of diet. Further studies may assess the associations between the IRT scores and other health-related variables.

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SUPPLEMENTARY MATERIAL

Figure 1: The Food Guidelines' recommendations, aims, commonalities, factor loadings and discrimination parameter of all fifty-two items considered to develop the Diet Quality Scale (ESQUADA) (N = 2,059).

Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Eat with regularity and attention and have breakfast at similar times.	To study the habit of having breakfast.	I01- Do you usually eat at breakfast?	0.357	0.600	1.269 (0.131)
	To study the food combination on breakfast.	I02-What kind of foods do you usually eat at breakfast?	0.293	0.542	1.097 (0.128)
Eat with regularity and attention and have lunch at similar times.	To study the habit of having lunch.	I03-Do you usually have lunch?	0.299	0.547	1.112 (0.178)
	To study the food combination on lunch.	I04-What kind of foods do you usually eat at lunch?	0.275	0.524	1.048 (0.237)
Eat with regularity and attention and have dinner or night snack at similar times.	To study the habit of having dinner or night snack.	I05-Do you usually have dinner or night snack?	0.097 ₁	0.312	0.558 ³ (0.096)
	To study the food combination on dinner or night snack.	I06-What kind of foods do you usually eat at dinner or night snack?	0.020 ₁	0.140 ²	0.242 ³ (0.130)
Prefer to eat, whenever possible, with others such as family, friends or colleagues from work or school.	To study the habit of eating accompanied.	I07- Do you have lunch or dinner with family, friends, and/or colleagues?	0.113 ₁	0.334	0.609 ³ (0.097)
Plan the use of the time to give adequate time to food.	To study the habit of replacing meals to snacks.	I08-Do you usually replace lunch or dinner' meal to snacks? (Consider the examples of snacks: pizza, X-egg...).	0.274	0.524	1.046 (0.110)

h^2 : Communality. a_i : discrimination parameter. ¹ Items with low commonalities. ² Items with low factor loadings. ³ Items with low discrimination parameter. NV: negative value. Note: This figure presents a free translation of the items. That is, their original writing is in Portuguese; the writing presented in this figure was not submitted to a cross-cultural adaptation.

Figure 1: The Food Guidelines' recommendations, aims, commonalities, factor loadings and discrimination parameter of all fifty-two items considered to develop the Diet Quality Scale (ESQUADA) (N = 2,059) (continuation).

Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Try to develop, practice, and share culinary skills.	To study the habit of preparing foods.	I09-Do you usually cook or help to prepare of foods at meals from lunch and dinner? (Consider help to prepare of foods: washing, cutting, and/or cooking foods.).	0.188	0.434	0.820 (0.104)
Try to eat in clean, comfortable, and quiet places where there is no incentive to unlimited food consumption. When out of the house, prefer places that serve freshly meals.	To study the habit of eating real food when eating lunch or dinner out of the house.	I10-When you have lunch or dinner out of the house in day-by-day, do you usually eat at self-service, executive, and/or school restaurants?	0.135 ¹	0.367	0.672 (0.096)
Prefer fruits and vegetables of the crop and locally cultivated.	To study the local where fruits and vegetables are usually bought to own and family consumption.	I11-Where you or someone in your household usually buy fruits and/or vegetables?	0.166	0.407	0.759 (0.101)
Eat with regularity and attention. Avoid nibbling between meals.	To study the habit of nibbling between meals.	I12-Do you usually nibbling?	0.075 ¹	0.273	0.483 ³ (0.091)
Try to eat in clean, comfortable, and quiet places where there is no incentive to unlimited food consumption.	To study the habit of picking the largest portion of the food when the price of it is a little higher than the price of the smaller portion such as "Take the largest portion of potato chips paying only US\$1.00 more."	I13-"Take the largest portion of potato chips paying only US\$1.00 more." In situations like the example, do you usually pick the largest portion of the food by paying a little extra?	0.233	0.483	0.939 (0.123)

h^2 : Communality. a_i : discrimination parameter. ¹ Items with low commonalities. ² Items with low factor loadings. ³ Items with low discrimination parameter. NV: negative value. Note: This figure presents a free translation of the items. That is, their original writing is in Portuguese; the writing presented in this figure was not submitted to a cross-cultural adaptation.

Figure 1: The Food Guidelines' recommendations, aims, commonalities, factor loadings and discrimination parameter of all fifty-two items considered to develop the Diet Quality Scale (ESQUADA) (N = 2,059) (continuation).

Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Try to share the household activities that precede or succeed the eating meals. Try to develop, practice, and share culinary skills.	To study the habit of cooking with friends or family.	I14-Do you usually cook with friends and/or family in leisure moments?	0.090 ¹	0.300	0.535 ³ (0.096)
Eat with regularity and attention. Always eat slowly and enjoy what you are eating without engaging in any other activity.	To study the habit of eating while watching TV, use computer or cell phone, study, or read.	I15-Do you usually watch television, use the computer or cell phones, study, read, and/or do other activities while you have lunch or dinner?	0.157	0.396	0.734 (0.104)
Try to eat in clean, comfortable, and quiet places where there is no incentive to unlimited food consumption.	To study the place at home where the individual eat.	I16-What place at home do you usually have lunch or dinner?	0.146 ¹	0.382	0.704 (0.106)
Fat meat should be prepared baked, grilled, or sautéed. Chicken should be consumed without the skin.	To study the habit of taking the fat or skin out the meats.	I17-Do you usually take the fat or skin out of the meats (such as beef, pork, and/or chicken)?	0.074 ¹	0.272 ²	0.481 ³ (0.099)
Use sugar in small amounts.	To study the habit of sweetening foods.	I18-Do you usually add sugar, honey, molasses, or "rapadura" in coffee, tea, milk, and/or juices?	0.044 ¹	0.210 ²	0.366 ³ (0.090)
Use salt in small amounts to season the foods. Use natural seasonings (such as onion, garlic, laurel, and others).	To study the habit of adding salt to the ready foods.	I19-Do you usually add salt to the foods on your plate after you have served your lunch or dinner?	0.058 ¹	0.240 ²	0.421 ³ (0.118)

h^2 : Communality. a_i : discrimination parameter. ¹ Items with low commonalities. ² Items with low factor loadings. ³ Items with low discrimination parameter. Note: This figure presents a free translation of the items. That is, their original writing is in Portuguese; the writing presented in this figure was not submitted to a cross-cultural adaptation.

Figure 1: The Food Guidelines' recommendations, aims, commonalities, factor loadings and discrimination parameter of all fifty-two items considered to develop the Diet Quality Scale (ESQUADA) (N = 2,059) (continuation).

Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Use salt and vegetable oil in small amounts to season the foods. Use natural seasonings (such as onion, garlic, laurel, and others).	To study the habit of adding seasonings to salad.	I20-Do you usually add salt, olive oil, and/or vinegar to the salad on your plate after you have served your lunch or dinner?	0.042 ¹	0.206 ²	0.359 ³ (0.097)
Prefer less processed versions of cereals.	To study the habit of eating whole cereals such as rice or pasta.	I21-Do you usually eat whole rice and/or whole pasta?	0.281	0.530	1.065 (0.112)
	To study the habit of eating whole cereals such as oats, quinoa or rye.	I22-Do you usually eat oats, quinoa, and/or rye?	0.468	0.684	1.596 (0.152)
Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of eating beans that is a marker of healthy eating.	I23- Do you usually eat beans?	0.025 ¹	0.159 ²	0.274 ³ (0.098)
Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods. Healthy foods such as vegetables are alternatives to replace and reduce the red meat consumption.	To study the habit of eating vegetables that is a marker of healthy eating.	I24-Do you usually eat raw and/or cooked vegetables? (Do not consider the consumption of cassava, potatoes, and yams.).	0.486	0.697	1.654 (0.158)
Prefer whole fruits than natural fruit juices.	To study the habit of eating fruits that is a marker of healthy eating.	I25-Do you usually eat fruits? (Do not consider the consumption of juice.).	0.363	0.603	1.286 (0.123)

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Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Prefer whole fruits than natural fruit juices.	To study the habit of drinking natural fruit juices.	I26-Do you usually drink natural fruit juice? (Do not consider the powder juices and those on box, can, and/or bottle.).	0.057 ¹	0.240 ²	0.420 ³ (0.098)
Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of drinking milk that is a marker of healthy eating.	I27-Do you usually drink milk? (Do not consider milk or beverages based on soy, rice, oats, and/or almonds.).	0.011 ¹	0.107 ²	0.183 ³ (0.182)
Reduce the consumption of red meats. Prefer lean meats on grilled, roasted, or stewed preparations.	To study the habit of eating non-fried meats.	I28-Do you usually eat grilled, cooked, stewed, and/or baked meat? (Consider beef, pork, or chicken.).	0.010 ¹	0.100 ²	0.169 ³ (NV)
Fish are excellent substitutes for red meats and can be prepared baked, grilled, stewed, cooked or used as ingredients in other culinary preparations.	To study the habit of eating non-fried fish.	I29-Do you usually eat grilled, cooked, stewed, and/or baked fish?	0.137 ¹	0.370	0.679 (0.105)
Eggs are good substitutes to red meats.	To study the habit of eating eggs.	I30-Do you usually eat boiled, scrambled or fried eggs, and/or omelets?	0.111 ¹	0.333	0.601 ³ (0.092)
Nuts are excellent options for snacks. However, limit the consumption of nuts when they are added with salt or sugar.	To study the habit of eating nuts.	I31-Do you usually eat Brazil nuts, cashew nuts, and/or walnuts?	0.361	0.601	1.279 (0.127)

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Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Pay attention on the first signs of thirst.	To study the habit of drinking water.	I32-What do you usually drink when you are thirsty?	0.222	0.470	0.908 (0.177)
Limit the consumption of processed foods. Consume them in small quantities as ingredients of culinary preparations or as part of meals based on unprocessed or minimally processed foods.	To study the habit of eating processed canned foods.	I33-Do you usually eat canned foods (such as peas, corn, palm hearts, pickles and/or olives)?	0.015 ¹	0.124 ²	0.213 ³ (0.154)
Limit the consumption of processed foods.	To study the habit of drinking processed alcoholic beverages.	I34-Do you usually drink cider, wine, and/or beer?	0.0951	0.309	0.5523 (0.099)
Cheeses should be consumed in small quantities as part or accompaniment of culinary preparations based on unprocessed or minimally processed foods.	To study the habit of eating cheeses.	I35-Do you usually eat cheeses? (Do not consider cheese-flavored industrialized pates such as curd cheese, Polenguinho®, and/or Catupiry®.).	0.1451	0.387	0.714 (0.099)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods. Avoid having these products readily available.	To study the habit of eating ultra-processed cakes or cookies.	I36-Do you usually eat industrialized cakes or cookies (bought ready)? (Also consider those made with ready mixtures.).	0.260	0.510	1.008 (0.108)

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Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods. Avoid having these products readily available.	To study the habit of eating ultra-processed sweets.	I37-Do you usually eat sweets (such as chocolate, ice cream, flan, pudding, gelatin, bubble gum, lollipops, and/or candies)?	0.1021	0.319	0.5473 (0.103)
Avoid the consumption of ultra-processed foods.	To study the habit of drinking ultra-processed alcoholic beverages.	I38-Do you usually drink whiskey, vodka, and/or rum?	0.0231	0.1532	0.2643 (0.154)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of eating ready sauces.	I39-Do you usually eat industrialized sauces (bought ready)? (Consider the ready sauces such as tomato, white, wood, barbecue, Italian, for salads, or those based on cheese.).	0.1381	0.372	0.682 (0.094)
	To study the habit of eating ketchup, mustard, or mayonnaise.	I40-Do you usually eat industrialized ketchup, mustard, and/or mayonnaise (bought ready)?	0.183	0.428	0.805 (0.113)

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Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of eating ready snacks.	I41- Do you usually eat bought ready snacks (such as fried/roasted snacks, fast-food burgers, hot dogs, and/or industrialized pizza)? (Consider the examples of fast-food burgers: X-salad, X-egg...).	0.361	0.601	1.280 (0.130)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods. Avoid having these products readily available.	To study the habit of eating ultra-processed sweets.	I42-Do you usually eat breakfast cereals and/or cereal bars? (Consider the examples of breakfast cereals: Sucrilhos®...).	0.164	0.405	0.754 (0.122)
	To study the habit of eating chips.	I43- Do you usually eat chips (such as Ruffles®, Cheetos®, Elma Chips®, Doritos®, Pringles®, or...)?	0.442	0.665	1.515 (0.151)
	To study the habit of drinking soda or artificial juices.	I44-Do you usually drink soda and/or juice (powder juices or those in boxes, can, and/or bottle)? (Consider the examples: Del Valle®, Maguary®,....).	0.502	0.708	1.708 (0.148)

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Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of eating ultra-processed breads.	I45- Do you usually eat white and/or whole-grain industrialized breads? (Consider the examples: sandwich bread, slice-bread, or hot dog bread.).	0.0221	0.1492	0.2563 (0.109)
	To study the habit of eating ultra-processed sweets.	I46-Do you usually eat industrialized syrup to ice cream, industrialized jellies, milk sweet, hazelnut cream, such as Nutella®, and/or condensed milk?	0.316	0.562	1.156 (0.129)
Dairy drinks or sweetened yogurts added with dyes and flavorings should be avoided.	To study the habit of eating ultra-processed yogurts.	I47- Do you usually drink flavored-industrialized dairy drinks and/or yogurts?	0.1091	0.331	0.5963 (0.097)
	To study the habit of drinking chocolate drinks.	I48-Do you usually drink chocolate drinks (such as Toddynho®)?	0.472	0.687	1.609 (0.165)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of eating cheese-flavored pates.	I49- Do you usually eat cheese-flavored industrialized pates (such as curd cheese, Polenguinho® or Catupiry®)?	0.0321	0.1792	0.3103 (0.098)

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Food Guidelines' recommendations	The aim of item	Items	h^2	Factor loadings	a_i (SE)
Avoid the consumption of ultra-processed foods. Prefer unprocessed or minimally processed foods and culinary preparations than ultra-processed foods.	To study the habit of eating ultra-processed meats.	I50- Do you usually eat mortadella, salami, meat-flavored industrialized pates, turkey breast, and/or ham?	0.328	0.573	1.189 (0.118)
		I51- Do you usually eat nuggets/steak (industrialized breaded chicken), sausage, and/or industrialized burgers (bought ready)?	0.516	0.718	1.756 (0.195)
Avoid the consumption of ultra-processed foods. Plan the use of the time to give adequate time to food.	To study the habit of eating ultra-processed foods at home.	I52- When you are in home, do you usually eat instant noodles, powdered soups, ready-to-heat meals, and/or fast-food burgers? (Consider the examples such as Nissin®, Cup Noodles®, Vono®,...).	0.610	0.781	2.131 (0.195)

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5. CONCLUSÕES E CONSIDERAÇÕES FINAIS

Conforme a apresentação na introdução, a alimentação é um determinante do quadro epidemiológico mundial da atualidade, marcado pela incidência de obesidade e doenças crônicas não transmissíveis associadas. Esta tese foi motivada pela preocupação com a qualidade dos instrumentos utilizados nos estudos, cujas informações são extraídas para a produção dos indicadores e elaboração das estratégias e planos de ação. Diante desta motivação, procurou-se apresentar instrumentos de qualidade psicométrica para avaliar o conhecimento, as motivações e o comer. São apresentadas as escalas de avaliação do conhecimento nutricional (NKTS; APÊNDICE E); das motivações de saúde para as escolhas alimentações (SOFIE; APÊNDICE F); e da qualidade da dieta (ESQUADA; APÊNDICE G) em adolescentes e jovens adultos europeus e brasileiros.

O conhecimento nutricional de adolescentes europeus participantes do estudo HELENA foi avaliado com um questionário previamente validado (NKT). As respostas ao NKT eram até então analisadas considerando apenas um percentual de respostas corretas. A Teoria de Resposta ao Item apresentou-se como uma possibilidade de análise para aprofundar o estudo da estrutura interna dos itens que compõem o NKT. Desta forma, foi possível selecionar as perguntas do NKT que melhor identificam o conhecimento nutricional, bem como propor uma interpretação dos escores totais.

Apesar de não existir um método padrão ouro para avaliação do conhecimento nutricional, a literatura científica tem indicado que um melhor conhecimento pode refletir em uma alimentação de melhor qualidade. Sendo assim, o artigo 1 publicado na *Public Health Nutrition*, além de apresentar uma análise da estrutura interna do NKT com aplicação da TRI, buscou reunir as evidências de associação dos escores de conhecimento nutricional com consumo alimentar e concentração de marcadores nutricionais no sangue.

A TRI indicou que alguns itens do NKT não apresentam boa discriminação do conhecimento nutricional e permitiu construir a NKTS, que localiza itens e indivíduos em uma mesma medida. Ou seja, com a NKTS é possível caracterizar o nível de conhecimento nutricional dos indivíduos considerando o seu escore final. Por sua vez, a análise das associações evidenciou a validade da NKTS para avaliar o

conhecimento nutricional. Indivíduos com maiores escores apresentaram uma alimentação mais saudável, considerando inquéritos alimentares (recordatório 24 horas e questionário de frequência), bem como concentração sanguínea de marcadores nutricionais.

Portanto, a NKTS apresenta-se assim como um instrumento curto e preciso para avaliar o conhecimento nutricional dos indivíduos. E, considerando que a TRI pressupõe que as características dos itens sejam independentes das características dos respondentes, sugere-se aplicação da NKTS em outras populações.

O estudo HELENA também avaliou as escolhas e preferências alimentares dos adolescentes europeus com aplicação do questionário FCP. Apesar de ter o seu conteúdo estudado previamente, até o momento não se conhecia a estrutura interna dos itens presentes no FCP. Assim, as análises com base na análise fatorial e Teoria de Resposta ao Item se apresentaram como alternativa para identificar os constructos considerados no FCP, bem como, propor uma medida que avança em relação a então análise baseada no percentual de respostas.

Assim como para conhecimento nutricional, não existe método padrão ouro para avaliar as motivações para as escolhas alimentares. Porém, quando a saúde é um importante motivador para a escolha de um alimento e não de outro, espera-se uma alimentação mais saudável. Assim, o artigo 2 submetido na *Public Health Nutrition*, além de propor uma escala com aplicação da TRI, buscou investigar a associação dos escores de motivações de saúde para as escolhas alimentares com consumo alimentar e concentração de marcadores nutricionais no sangue.

As análises indicaram que os itens do FCP avaliam escolhas alimentares, bem como preferências alimentares. Considerando o objetivo em propor uma escala para avaliar as escolhas alimentares, a análise da estrutura interna reteve itens relacionados com as motivações de saúde para as escolhas alimentares. Após a análise com a TRI, dezesseis itens atenderam aos critérios pré-definidos, possibilitando a criação da escala SOFIE. A análise das associações evidenciou a validade da escala para avaliar as motivações de saúde para as escolhas alimentares. Aqueles indivíduos que são mais motivados pela saúde para escolher os alimentos apresentaram uma alimentação mais saudável.

A SOFIE apresenta-se, então, como um instrumento para avaliar com precisão os níveis de motivações de saúde para os indivíduos escolherem os alimentos em outros estudos. Desta maneira, a informação do quanto eles são

motivados pela saúde para as escolhas alimentares pode orientar as estratégias de educação nutricional. E, uma vez que existem outras influências para os indivíduos escolherem um alimento e que elas variam entre os tipos de alimentos, conhecer o quanto estas escolhas são influenciadas pela saúde pode melhorar a eficácia das estratégias, bem como aumentar as chances de manutenção dos bons hábitos alimentares.

Em relação à qualidade da dieta, no Brasil, ela era até então avaliada com índices que seguiam as recomendações do Guia Alimentar para População Brasileira do ano de 2008. Diante da publicação de uma nova versão no ano de 2014 com um paradigma da alimentação diferente da versão anterior, surge uma necessidade de propor um instrumento para avaliar a qualidade da dieta dos brasileiros em coerência com o GBP-2014. A proposição desta nova medida foi apresentada nesta tese em dois artigos (3 e 4). O artigo 3 se concentrou no estudo do conteúdo dos itens propostos com uma análise qualitativa das sugestões levantadas por nutricionistas quanto à relevância e clareza dos itens e do processo de resposta com a investigação da compreensão dos itens por adolescentes e jovens adultos. Já o artigo 4 buscou apresentar o conjunto final de itens após análise fatorial e Teoria de Resposta ao Item.

Os nutricionistas indicaram que os itens são relevantes para avaliar a qualidade da dieta em coerência com o GBP-2014, captando a relação entre comportamento e consumo alimentar, as características do hábito alimentar recente, bem como a influência do *marketing*. Entretanto, os nutricionistas destacaram algumas alterações necessárias para maior representação do constructo. Eles pontuaram também a necessidade de alterar a escrita dos itens e alternativas de respostas para uma melhor clareza para adolescentes e jovens adultos. Esta preocupação com a escrita refletiu na boa compreensão dos itens pelos respondentes.

As análises apresentadas no artigo 4 indicaram que entre os itens propostos, vinte e cinco deles avaliam adequadamente a qualidade da dieta, incluindo aqueles sobre os hábitos de: tomar café da manhã; substituir refeições por lanches; cozinhar; e, comer frutas, hortaliças, cereais integrais e alimentos ultraprocessados. Ao final do artigo foi apresentada uma proposta de categorização dos escores, mas também é possível aplicar a ESQUADA e analisar os escores de maneira contínua.

Percebe-se, portanto, que ESQUADA, além de considerar o novo paradigma de alimentação que orientou o GAPB-2014, se baseia na TRI para melhor seleção dos itens, bem como definição não subjetiva do escore final. A ESQUADA é apresentada como um novo instrumento para estudos epidemiológicos que buscam estudar a qualidade da dieta e suas associações com saúde e doença em brasileiros.

Apesar de NKTS, SOFIE e ESQUADA medirem constructos diferentes, é possível fazer um elo entre os itens que compõem as três escalas. Por exemplo, enquanto a SOFIE mostra que aqueles indivíduos, que concordam moderadamente com o item sobre gostar de frutas e hortaliças, apresentam uma alta motivação de saúde para escolher os alimentos, a ESQUADA mostra que o costume de comer estes alimentos em, no mínimo, cinco dias na semana está presente entre aqueles indivíduos com maiores níveis de qualidade da dieta (IV e V). Entre os adolescentes europeus, porém, maiores escores na escala SOFIE não se associaram com maior consumo de frutas e hortaliças, considerando dois dias de recordatório 24 horas. Observa-se que os itens sobre frutas e hortaliças relacionaram-se com maiores escores de SOFIE e ESQUADA, seja porque os indivíduos gostam destes alimentos ou por terem o costume de consumi-los.

Em relação aos alimentos ultraprocessados, observa-se que aqueles indivíduos que acreditam que barrinhas de cereais e sanduíches são saudáveis apresentam uma baixa motivação de saúde para as escolhas alimentares. E, aqueles indivíduos que sabem os nutrientes que estão presentes nos alimentos e suas relações com a saúde apresentam maiores escores na escala NKTS. Indivíduos com maiores escores seja na escala SOFIE ou na NKTS apresentaram menor consumo de snacks (como salgadinhos de pacote). Já a avaliação da ESQUADA, por sua vez, indica que o consumo ultraprocessados em pelo menos um dia semana caracteriza as práticas alimentares dos indivíduos com menor nível de qualidade da dieta (I). Percebe-se que os alimentos ultraprocessados se relacionaram com os menores níveis dos três construtos, seja porque os indivíduos acreditam que são saudáveis, desconhecem seus nutrientes, ou porque têm costume de consumir.

Ao olhar a comida de casa, SOFIE indica que indivíduos, que moderadamente acreditam que os alimentos que comem em casa são saudáveis, estão no nível superior da escala (alta motivação). Este item apresentou a melhor discriminação na

SOFIE. A NKTS, por sua vez, investigou as habilidades culinárias dos indivíduos mediante a identificação de preparações com menor quantidade de gordura, sendo que os indivíduos que sabem os ingredientes das receitas apresentam conhecimento nutricional básico. A ESQUADA também inclui itens voltados para o consumo em casa: hábito de cozinhar ou ajudar no preparo dos alimentos para o almoço ou jantar e hábito de comer ultraprocessados em casa (macarrão instantâneo, sopas em pó, refeições prontas e hambúrguer tipo *fast food*). O consumo destes alimentos em casa em pelo menos um dia na semana caracteriza o nível de pior qualidade da dieta (I). Percebe-se que a comida em casa se relaciona com maiores escores nas escalas SOFIE e ESQUADA, seja porque indivíduos acreditam que é saudável ou porque têm costume de cozinhar.

Se por acaso se entende que as escalas não avaliam algum aspecto importante do traço latente, a Teoria de Resposta ao Item permite que novos itens possam ser incluídos nas escalas em estudos futuros. As análises apresentadas nesta tese mostram aspectos da validade de NKTS, SOFIE e ESQUADA na avaliação dos seus traços latentes. Entretanto, é importante pontuar que as evidências de validação devem ser continuamente estudadas de maneira a investigar se possíveis mudanças no entendimento dos traços latentes estariam afetando a validade das escalas.

Uma outra consideração relevante envolve a aplicabilidade das escalas em populações com características diferentes daquelas que geraram as evidências de validação. Os escores calculados pela TRI são independentes das características dos respondentes, o que permite a aplicação da escala em outras populações com mesma precisão de medida. Mesmo com este suporte da análise estatística, o pesquisador que pretende usar uma das três escalas deve se perguntar se o entendimento teórico do traço latente é o mesmo na população de interesse. Por exemplo, a NKTS se concentra nos conceitos e funções dos nutrientes, bem como efeito na saúde dos indivíduos. Já a ESQUADA, ao se basear no novo paradigma de alimentação que orientou o GAPB-2014, não tem este foco no nutriente, mas nas maneiras de comer e combinações de alimentos. Assim, é questionável a aplicação da NKTS no Brasil à luz do referencial vigente para alimentação nacional. De qualquer forma, para aplicar NKTS, SOFIE e/ou ESQUADA em outras populações, o pesquisador deve, em primeiro momento, avaliar a necessidade de tradução e/ou adaptação transcultural.

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APÊNDICES

APÊNDICE A – Definição dos objetivos dos itens para avaliar a qualidade da dieta de acordo com as recomendações do Guia Alimentar para População Brasileira, publicado em 2014.

- Itens relacionados com práticas alimentares

RECOMENDAÇÕES DO GUIA ALIMENTAR PARA POPULAÇÃO BRASILEIRA	OBJETIVOS DE AVALIAÇÃO DOS ITENS
Comer com regularidade e atenção. Fazer as refeições diárias em horários semelhantes.	Verificar o costume de realizar café da manhã, almoço e jantar. Verificar a combinação de alimentos no café da manhã, almoço e jantar.
Prefira comer, sempre que possível, em companhia, com familiares, amigos ou colegas de trabalho ou escola.	Verificar o costume de comer acompanhado.
Planejar o uso do tempo para dar à alimentação o espaço que ela merece.	Verificar o costume de substituir refeições (tipo café da manhã, almoço e jantar) por lanches.
Procure desenvolver, exercitar e partilhar habilidades culinárias.	Verificar o costume de preparar a sua refeição.
Procure comer em locais limpos, confortáveis e tranquilos e onde não haja estímulos para o consumo de quantidades ilimitadas de alimentos. Dar preferência, quando fora de casa, a locais que servem refeições feitas na hora.	Verificar o costume de comer 'comida de verdade' mesmo quando almoça ou janta fora de casa.
Evitar o consumo de alimentos ultraprocessados. Planejar o uso do tempo para dar à alimentação o espaço que ela merece.	Verificar o costume de comer ultraprocessados em casa.
Dê preferência por frutas, legumes e verduras da safra e cultivados localmente.	Verificar o local de costume para comprar frutas e hortaliças.
Comer com regularidade e atenção. Evite beliscar nos intervalos das refeições.	Verificar o costume de 'beliscar' nos intervalos das refeições.
Procure comer em locais limpos, confortáveis e tranquilos e onde não haja estímulos para o consumo de quantidades ilimitadas de alimentos.	Verificar o costume de escolher a maior porção quando o preço desta é um pouco maior do que o preço da porção menor.
Procure compartilhar também as atividades domésticas que antecedem ou sucedam o consumo de refeições. Procure desenvolver, exercitar e partilhar habilidades culinárias.	Verificar o costume de cozinhar com amigos ou familiares.
Comer com regularidade e atenção. Coma sempre devagar e desfrute o que está comendo, sem se envolver em outra atividade.	Verificar o costume de comer enquanto assiste à televisão, usa computador/celular, estuda ou lê.
Procure comer em locais limpos, confortáveis e tranquilos e onde não haja estímulos para o consumo de quantidades ilimitadas de alimentos.	Verificar o ambiente da casa onde se come.

- Itens relacionados com consumo alimentar

ALIMENTOS IN NATURA OU MINIMAMENTE PROCESSADOS	
RECOMENDAÇÕES DO GUIA ALIMENTAR PARA POPULAÇÃO BRASILEIRA	OBJETIVOS DE AVALIAÇÃO DOS ITENS
Preferir as versões menos processadas dos cereais.	Verificar o costume de comer cereais integrais (tipo aveia, quinoa, centeio, farinha de trigo integral).
Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de comer arroz com feijão.
Alimentos muito saudáveis, as hortaliças são alternativas para substituir e reduzir consumo das carnes vermelhas.	Verificar o costume de comer hortaliças.
Preferir frutas inteiras em vez de sucos naturais.	Verificar o costume de comer frutas.
Leite e iogurtes naturais podem ser mais adequados para adultos quando em versões sem gordura ou com menos gordura.	Verificar o costume de beber leite com quantidade reduzida de gorduras.
Cortes mais gordos devem ser preparados assados, grelhados ou refogados. Carnes de aves devem ser consumidas sem a pele.	Verificar o costume de retirar gordura/pele das carnes.
Reduzir o consumo de carnes vermelhas, priorizando cortes magros e preparações grelhadas, assadas ou ensopadas.	Verificar o costume de comer carnes não fritas.
Pescados são excelentes substitutos das carnes vermelhas, podendo ser preparados assados, grelhados, ensopados, cozidos ou usados como ingredientes de outras preparações culinárias.	Verificar o costume de comer peixes não fritos.
Ovos são bons substitutos das carnes vermelhas.	Verificar o costume de comer ovos.
Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de comer bolos, roscas, pães ou biscoitos feitos em casa sem usar massas prontas.
Castanhas e nozes são excelentes opções para pequenas refeições, devendo limitar consumo quando adicionadas de sal e açúcar.	Verificar o costume de comer castanhas.
Atentar aos primeiros sinais de sede.	Verificar o costume de beber água.
Café e chás são opções para ingestão de líquidos, mas devem ser consumidos de preferência sem açúcar ou com mínima quantidade possível.	Verificar o costume de beber café ou chá entre as refeições.

INGREDIENTES CULINÁRIOS PROCESSADOS	
RECOMENDAÇÕES DO GUIA ALIMENTAR PARA POPULAÇÃO BRASILEIRA	OBJETIVOS DE AVALIAÇÃO DOS ITENS
Utilizar açúcar em pequenas quantidades.	Verificar o costume de adoçar os alimentos prontos antes de experimentá-los.
Utilizar sal em pequenas quantidades para temperar os alimentos. Usar temperos naturais (cebola, alho, louro, entre outros).	Verificar o costume de adicionar sal nos alimentos prontos antes de experimentá-los.
Utilizar óleo vegetal em pequenas quantidades para criar preparações culinárias.	Verificar o costume de usar gorduras não saturadas no preparo dos alimentos.
Utilizar gorduras em pequenas quantidades para criar preparações culinárias.	Verificar o costume de usar gorduras saturadas no preparo dos alimentos.
Utilizar óleo vegetal em pequenas quantidades no tempero dos alimentos.	Verificar o costume de adicionar óleo vegetal ou azeite nos alimentos prontos.
Utilizar gorduras em pequenas nos alimentos.	Verificar o costume de adicionar manteiga ou banha nos alimentos prontos.

ALIMENTOS PROCESSADOS	
RECOMENDAÇÕES DO GUIA ALIMENTAR PARA POPULAÇÃO BRASILEIRA	OBJETIVOS DE AVALIAÇÃO DOS ITENS
Limitar o uso de alimentos processados, consumindo-os em pequenas quantidades, como ingredientes de preparações culinárias ou como parte de refeições baseadas em alimentos in natura ou minimamente processados.	Verificar o costume de comer alimentos enlatados processados.
Limitar o consumo de alimentos processados.	Verificar o costume de beber bebidas alcoólicas processadas.
Queijos devem ser consumidos em pequenas quantidades como parte ou acompanhamento de preparações culinárias com base em alimentos in natura ou minimamente processados.	Verificar o costume de comer queijos.

ALIMENTOS ULTRAPROCESSADOS	
RECOMENDAÇÕES DO GUIA ALIMENTAR PARA POPULAÇÃO BRASILEIRA	OBJETIVOS DE AVALIAÇÃO DOS ITENS
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados. Evitar ter estes produtos ao alcance das mãos.	Verificar o costume de comer de bolos e biscoitos ultraprocessados.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados. Evitar ter estes produtos ao alcance das mãos.	Verificar o costume de comer guloseimas ultraprocessadas.
Evitar o consumo de alimentos ultraprocessados.	Verificar o costume de beber bebidas alcoólicas ultraprocessadas.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de usar molhos prontos.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de adicionar <i>catchup</i> ou mostarda aos alimentos.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de comer lanches.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados. Evitar ter estes produtos ao alcance das mãos.	Verificar o costume de comer salgadinhos de pacote ou batata frita.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados. Evitar ter estes produtos ao alcance das mãos.	Verificar o costume de beber refrigerante ou sucos artificiais.
Evitar o consumo de alimentos ultraprocessados. Usar temperos naturais (cebola, alho, louro, entre outros).	Verificar o costume de usar temperos prontos.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de comer pães ultraprocessados.

Evitar o consumo de alimentos ultraprocessados.	Verificar o costume de usar gorduras ultraprocessadas no preparo dos alimentos.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de adicionar gorduras e doces ultraprocessados aos alimentos prontos.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de comer doces ultraprocessados.
Bebidas lácteas ou iogurtes adoçados e adicionados de corantes e saborizantes devem ser evitados.	Verificar o costume de comer lácteos ultraprocessados.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de adicionar lácteos ou patês ultraprocessados aos alimentos prontos.
Evitar o consumo de alimentos ultraprocessados. Preferir sempre alimentos in natura ou minimamente processados e preparações culinárias a alimentos ultraprocessados.	Verificar o costume de comer carnes ultraprocessadas.

APÊNDICE B - Conjunto de itens para avaliar a qualidade da dieta apresentado para avaliação dos nutricionistas quanto à pertinência e clareza.

Itens relacionados às práticas alimentares
1. Você costuma realizar o café da manhã em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de realizar o café da manhã.
2. O que você costuma comer no café da manhã na maior parte das vezes?   (a) Eu não costumo realizar o café da manhã (b) Eu combino alimentos como bolos e biscoitos industrializados e sucos prontos (c) Eu costumo beber água, suco, leite, chá ou café (d) Eu combino alimentos como café, leite, pão e fruta   Objetivo: Verificar a combinação de alimento no café da manhã.
3. Você costuma almoçar em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de almoçar.
4. O que você costuma comer no almoço na maior parte das vezes?   (a) Eu não costumo almoçar (b) Eu combino alimentos como salgados, sanduíches, refrigerantes e sucos prontos (c) Eu combino alimentos como arroz, feijão, carne e salada   Objetivo: Verificar a combinação de alimentos no almoço.
5. Você costuma jantar em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de jantar.
6. O que você costuma comer no jantar na maior parte das vezes?   (a) Eu não costumo jantar (b) Eu combino alimentos como salgados, sanduíches, refrigerantes e sucos prontos (c) Eu combino alimentos como arroz, feijão, carne e salada   Objetivo: Verificar a combinação de alimentos no jantar.
7. Você costuma comer em companhia de familiares, colegas ou amigos pelo menos uma vez por dia?   (a) Sim (b) Não   Objetivo: Verificar o costume de comer acompanhado.
8. Você costuma substituir a refeição do almoço ou jantar por sanduíches, salgados, pizza ou outros lanches em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de substituir refeições (tipo café da manhã, almoço e jantar) por lanches.
9. Você costuma cozinhar os alimentos para você comer em refeições como almoço e jantar?   (a) Sim, na maior parte das vezes eu lavo, pico e cozinho os alimentos para mim. (b) Não, outra pessoa da casa (como esposa, marido, irmão (ã), pai ou mãe) cozinha para mim (Esta pessoa lava, pica e cozinhar os alimentos para mim.). (b) Não, empregada doméstica cozinha para mim (Esta pessoa lava, pica e cozinhar os alimentos para mim.). (c) Não, eu compro comida pronta ou semi-pronta (Eu tenho que apenas colocar para aquecer ou assar.).   Objetivo: Verificar o costume de preparar a sua refeição.

10. Você costuma comer em <i>self service</i> ou serviço prato feito/executivo ou na marmita trazida de casa quando você almoça ou janta fora de casa?   (a) Sim (b) Não   Objetivo: Verificar o costume de comer ‘comida de verdade’, mesmo quando almoça ou janta fora de casa.
11. Você costuma comer alimentos comprados congelados, macarrão instantâneo (miojo), sopas em pó ou outras comidas de fácil preparo quando você está em casa?   (a) Sim (b) Não   Objetivo: Verificar o costume de comer ultraprocessados em casa.
12. Onde você costuma comprar frutas, legumes e verduras na maior parte das vezes?   (a) Em feiras livres, hortas urbanas e feiras de alimentos orgânicos (b) Em quitandas e sacolões (c) Em supermercados e hipermercados   Objetivo: Verificar o local de costume para comprar frutas e hortaliças.
13. Você costuma beliscar entre as refeições?   (a) Sim (b) Não   Objetivo: Verificar o costume de ‘beliscar’ nos intervalos das refeições.
14. Você costuma escolher a maior porção dos alimentos se a diferença no preço for pequena?   (a) Sim (b) Não   Objetivo: Verificar o costume de escolher a maior porção quando o preço desta é um pouco maior que o preço da porção menor.
15. Você costuma cozinhar com amigos ou familiares?   (a) Sim (b) Não   Objetivo: Verificar o costume de cozinhar com amigos ou familiares.
16. Você costuma comer enquanto assiste televisão, usa computador, estuda ou lê?   (a) Sim (b) Não   Objetivo: Verificar o costume de comer enquanto assiste à televisão, usa computador/celular, estuda ou lê.
17. Em qual ambiente da casa você costuma comer?   (a) Na cozinha ou na sala de jantar (b) No quarto ou na sala de televisão   Objetivo: Verificar o ambiente da casa onde se come.

Itens relacionados ao consumo de alimentos <i>in natura</i> ou minimamente processados
18. Você costuma consumir aveia ou farinha de trigo integral ou usar estes alimentos como ingredientes de receitas em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de comer cereais integrais (tipo aveia, quinoa, centeio, farinha de trigo integral).
19. Você costuma consumir arroz com feijão em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de comer arroz com feijão.
20. Você costuma consumir legumes e verduras crus ou como ingredientes de pratos cozidos como sopas em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de comer hortaliças.
21. Você costuma consumir frutas ou saladas de frutas em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de comer frutas.
22. Você costuma consumir leite desnatado ou semidesnatado em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de beber leite com quantidade reduzida de gorduras.
23. Você costuma retirar a gordura ou pele na maior parte das vezes que você come carnes de boi, porco ou frango/galinha?   (a) Sim (b) Não   Objetivo: Verificar o costume de retirar gordura/pele das carnes.
24. Como que você costuma comer carnes de boi, porco ou frango/galinha na maior parte das vezes?   (a) Não como carnes de boi, porco ou frango/galinha (b) Fritas (c) Grelhadas, assadas ou ensopadas   Objetivo: Verificar o costume de comer carnes não fritas.
25. Como que você costuma comer peixes na maior parte das vezes?   (a) Não como peixes (b) Fritos (c) Grelhadas, assadas ou ensopados   Objetivo: Verificar o costume de comer peixes não fritos.
26. Você costuma consumir ovos cozidos, ovos mexidos, omelete ou ovos fritos em quantos dias na semana?   (a) Entre dois a quatro dias na semana (b) Mais que cinco dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de comer ovos.

27. Você costuma consumir bolos, roscas, pães ou biscoitos caseiros em quantos dias na semana?   (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana   Objetivo: Verificar o costume de comer bolos, roscas, pães ou biscoitos feitos em casa sem usar massas prontas.
28. Você costuma consumir castanha do pará, castanha de caju, nozes ou amendoim sem adição de sal ou açúcar em quantos dias na semana?   (a) Mais que um dia na semana (b) Pelo menos um dia na semana (c) Nunca ou eventualmente (como em festas de final de ano)   Objetivo: Verificar o costume de comer castanhas.
29. Quando você tem costume de consumir água na maioria das vezes?   (a) Antes dos sinais de sede (b) Após os sinais de sede (c) Não costumo beber água   Objetivo: Verificar o costume de beber água.
30. Quando você tem costume de consumir café ou chá na maior parte das vezes?   (a) Eu não costumo tomar café ou chá (b) Durante as refeições (c) Durante e entre as refeições (d) Apenas entre as refeições   Objetivo: Verificar o costume de beber café ou chá entre refeições.

Itens relacionados ao consumo de ingredientes culinários processados	
31. Quando você costuma adicionar açúcar, mel, melado ou rapadura em bebidas tipo café, chás, leite ou sucos? (a) Nunca (b) Quando a bebida não está adoçada ou sinto necessidade de adicionar mais (c) Sempre Objetivo: Verificar o costume de adoçar os alimentos antes de experimentá-los.	
32. Quando você costuma adicionar sal no alimento pronto tipo saladas e cozidos? (a) Nunca (b) Quando a salada ou cozido não está temperado ou sinto necessidade de adicionar mais (c) Sempre Objetivo: Verificar o costume de adicionar sal nos alimentos prontos antes de experimentá-los.	
33. Você costuma usar óleo vegetal ou azeite para o preparo do alimento em quantos dias na semana? (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana Objetivo: Verificar o costume de usar gorduras não saturadas no preparo do alimento.	
34. Você costuma usar manteiga (como Tirolez®, Itambé® e Aviação®) ou banha para o preparo do alimento em quantos dias na semana? (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana Objetivo: Verificar o costume de usar gorduras saturadas no preparo do alimento.	
35. Quando você costuma adicionar óleo vegetal ou azeite no alimento pronto? (a) Nunca (b) Quando sinto necessidade de adicionar mais (c) Sempre Objetivo: Verificar o costume de adicionar óleo vegetal ou azeite nos alimentos prontos.	
36. Quando você costuma adicionar manteiga (como Tirolez®, Itambé® e Aviação®) no alimento pronto? (a) Nunca (b) Quando sinto necessidade de adicionar mais (c) Sempre Objetivo: Verificar o costume de adicionar manteiga nos alimentos prontos.	

Itens relacionados ao consumo de alimentos processados	
37. Você costuma consumir alimentos que contêm ervilha, milho, palmito, picles, azeitonas ou seletas em quantos dias? (a) Um a três dias no mês (b) Nunca (c) Mais que um dia na semana Objetivo: Verificar o costume de comer alimentos enlatados processados.	
38. Você costuma consumir bebidas alcoólicas como cerveja, cidra ou vinho em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Entre dois a quatro dias na semana (c) Mais que cinco dias na semana Objetivo: Verificar o costume de beber bebidas alcoólicas processadas.	
39. Você costuma adicionar queijos (como muçarela, minas frescal e minas padrão) aos alimentos em quantos dias na semana? (a) Mais que cinco dias na semana (b) Entre dois a quatro dias na semana (c) Nenhum ou um dia na semana Objetivo: Verificar o costume de comer queijos.	

Itens relacionados ao consumo de alimentos ultraprocessados	
40. Você costuma consumir bolos e biscoitos industrializados em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de comer bolos e biscoitos ultraprocessados.	
41. Você costuma consumir doces como chocolate, sorvete, chicletes ou balas em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de comer guloseimas ultraprocessadas.	
42. Você costuma consumir bebidas alcoólicas como destilados tipo cachaça, uísque, vodca ou rum em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de beber bebidas alcoólicas ultraprocessadas.	
43. Você costuma usar molhos comprados já prontos (tipo molhos de tomate, branco, madeira, <i>barbecue</i>, italiano e queijos) em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de usar molhos prontos.	
44. Você costuma adicionar <i>catchup</i> ou mostarda em alimentos como sanduíches, salgados ou batata frita em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de adicionar <i>catchup</i> ou mostarda aos alimentos.	
45. Você costuma consumir lanches como salgados fritos ou assados, sanduíche/hambúrguer, cachorro quente ou pizza em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de comer lanches.	
46. Você costuma consumir cereais matinais (como Sucrilhos®, All Bran®, Corn Flakes® e Crunch®) e barras de cereais industrializadas em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de comer guloseimas ultraprocessadas.	
47. Você costuma consumir salgadinhos de pacote ou batata frita de pacote em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de comer salgadinhos de pacote ou batata frita.	
48. Você costuma consumir refrigerantes ou sucos como Del Valle®, Maguary®, Sufresh®, Mid® e Taeq® em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de beber refrigerante ou sucos artificiais.	
49. Você costuma usar temperos como Knorr®, Sazon®, Maggi® em quantos dias na semana? (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana Objetivo: Verificar o costume de usar temperos prontos.	

50. Você costuma consumir pães tipo bisnaguinha, sanduíche e <i>hot dog</i> em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de comer pães ultraprocessados.
51. Você costuma usar margarina, maionese, creme de leite não fresco ou creme vegetal para o preparo de alimentos como saladas, molhos para macarrão, massas de tortas ou estrogonofe em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de usar gorduras ultraprocessadas no preparo dos alimentos.
52. Você costuma adicionar margarina em pães e biscoitos ou creme de leite não fresco ou chantilly nas frutas em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de adicionar gorduras e doces ultraprocessados aos alimentos prontos.
53. Você costuma consumir doces de frutas em calda ou geleias industrializadas em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de comer doces ultraprocessados.
54. Você costuma consumir iogurte (não natural) e bebidas lácteas (como Toddyinho®) em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de comer lácteos ultraprocessados.
55. Você costuma adicionar requeijão, Polenguinho® ou patês industrializados no alimento pronto em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de adicionar lácteos ou patês ultraprocessados aos alimentos prontos.
56. Você costuma comer mortadela, salame, peito de peru, presunto ou <i>nuggets</i> em quantos dias na semana?   (a) Nenhum ou um dia na semana (b) Até dois dias na semana (c) Mais que dois dias na semana   Objetivo: Verificar o costume de comer carnes ultraprocessadas.

APÊNDICE C - Termo de Consentimento Livre e Esclarecido

Universidade de São Paulo
Faculdade de Saúde Pública
Av Dr. Arnaldo, 715 – CEP 01246-904 – São Paulo - Brasil

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Título do Projeto: Desenvolvimento de uma escala para avaliar a qualidade da dieta habitual de adolescentes e jovens adultos por meio da Teoria da Resposta ao Item

Pesquisador Responsável: Thanise Sabrina Souza Santos

Este projeto tem o objetivo de desenvolver um instrumento para avaliar a qualidade da dieta de adolescentes e jovens adultos. Para tanto será necessário realizar um grupo de conversas, em local acordado, para avaliar a clareza e pertinência das perguntas do questionário da pesquisa. Este encontro será realizado em pequeno grupo de pessoas e em local de fácil acesso a todos.

A execução do projeto envolve risco mínimo, pois durante a sua execução, os participantes não serão submetidos (as) a nenhum procedimento que possa causar danos à saúde, bem como nenhum agravo, visto que as condutas a serem adotadas objetivam a promoção da saúde e são respaldadas na literatura científica.

Após ler e receber explicações sobre a pesquisa, e ter meus direitos de:

1. Receber resposta a qualquer pergunta e esclarecimento sobre os procedimentos, riscos, benefícios e outros relacionados à pesquisa;
2. Retirar o consentimento a qualquer momento e deixar de participar do estudo;
3. Não ser identificado e ser mantido o caráter confidencial das informações relacionadas à privacidade;
4. Receber uma via deste termo de consentimento livre e esclarecido;
5. Procurar esclarecimentos com o Comitê de Ética em Pesquisa da Faculdade de Saúde Pública da Universidade de São Paulo, sito à Av. Dr. Arnaldo, 715, Cerqueira César – CE 01246-904, São Paulo, SP – Telefone: (11) 3061-7779 – e-mail: coep@fsp.usp.br, em caso de dúvidas ou notificação de acontecimentos não previstos.

Declaro que concordo em participar desse estudo e que me foi dada a oportunidade de ler e esclarecer as minhas dúvidas.

São Paulo, ____ de ____ de ____.

Nome: _____

Assinatura: _____

Eu, Thanise Sabrina Souza Santos, declaro que forneci todas as informações referentes ao projeto ao participante e/ou responsável.

_____
Telefone: (11) 3061-7853

Data: ____ / ____ / ____.

APÊNDICE D - Guia de perguntas para grupo focal

- Agradecer a presença de todos.
- Apresentar os objetivos do estudo: construção de um instrumento para avaliar a qualidade da dieta, com perguntas fechadas. Este instrumento será disponibilizado na internet.
- Apresentar os objetivos da realização dos grupos focais: avaliar se as perguntas do instrumento estão claras, se estão adequadas para avaliar a qualidade da dieta.
- Falar como se desenvolverá o grupo focal e informar sobre o uso do gravador. Pedir para não falarem ao mesmo tempo.
- Solicitar assinatura do TCLE e preencher informações no verso do TCLE.
- Não existem respostas certas, quero conhecer a opinião de vocês sobre as perguntas que vou apresentar. A participação de vocês irá contribuir muito para o trabalho. Apesar das diferenças, agora somos um grupo para discutir as perguntas deste instrumento com profundidade.
- Entregar um papel de rascunho e caneta para caso queiram fazer alguma anotação sobre os itens.

Grupo focal 1: itens comportamentais

1. Pensando que vocês tenham que desenvolver um instrumento para avaliar a qualidade da dieta, quais características da alimentação deveriam ser consideradas na elaboração das perguntas?
2. As perguntas deste instrumento deveriam considerar quais comportamentos (costumes/hábitos/práticas) relacionados com alimentação?
  - 2.1. Em seguida, eu irei entregar para vocês algumas perguntas elaboradas para avaliar comportamentos relacionados com alimentação. Como escrever estas perguntas para que avaliem estes objetivos de forma mais clara? **As perguntas e seus objetivos serão entregues impressas para cada participante.**
  - 2.2. Quais perguntas poderiam ser acrescentadas ou excluídas do instrumento para que ele melhor avalie os comportamentos alimentares?
3. Alguém tem algo mais para dizer para finalizarmos a nossa discussão?

4. Obrigada pela participação de todos. A nossa conversa foi muito produtiva e contribuiu para a construção das perguntas do instrumento de avaliação da qualidade da dieta.

Grupo focal 2: itens sobre consumo de alimentos in natura e minimamente processados e ingredientes culinários

1. Pensando que vocês tenham que desenvolver um instrumento para avaliar a qualidade da dieta, quais características da alimentação deveriam ser consideradas na elaboração das perguntas?]

2. Aqui nesta cesta tem alguns exemplos de alimentos *in natura* e minimamente processados. **Serão apresentados alguns alimentos *in natura* e minimamente processados para exemplificar.**
  - 2.1. Em seguida, eu irei apresentar para vocês algumas perguntas elaboradas para avaliar o consumo de alimentos *in natura* e minimamente processados. Como escrever estas perguntas para que avaliem estes objetivos de forma mais clara? **As perguntas e seus objetivos serão entregues impressas para cada participante.**
  - 2.2. Quais perguntas poderiam ser acrescentadas ou excluídas do instrumento para que ele melhor avalie o consumo de alimentos *in natura* e minimamente processados?

  3. Aqui nesta cesta tem alguns exemplos de ingredientes culinários (usados para temperar e cozinhar os alimentos). **Serão apresentados alguns ingredientes culinários para exemplificar.**
    - 2.3. Em seguida, eu irei apresentar para vocês algumas perguntas elaboradas para avaliar o uso de ingredientes culinários. Como escrever estas perguntas para que avaliem estes objetivos de forma mais clara? **As perguntas e seus objetivos serão entregues impressas para cada participante.**
    - 2.4. Quais perguntas poderiam ser acrescentadas ou excluídas do instrumento para que ele melhor avalie o uso de ingredientes culinários?

3. Alguém tem algo mais para dizer para finalizarmos a nossa discussão?

4. Obrigada pela participação de todos. A nossa conversa foi muito produtiva e contribuiu para a construção das perguntas do instrumento de avaliação da qualidade da dieta.

Grupo focal 3: itens sobre consumo de alimentos processados e ultraprocessados

1. Pensando que vocês tenham que desenvolver um instrumento para avaliar a qualidade da dieta, quais características da alimentação deveriam ser consideradas na elaboração das perguntas?
2. Aqui nesta cesta tem alguns exemplos de alimentos processados. **Serão apresentados alguns alimentos processados para exemplificar.**
  - 2.1. Em seguida, eu irei apresentar para vocês algumas perguntas elaboradas para avaliar o consumo de alimentos processados. Como escrever estas perguntas para que avaliem estes objetivos de forma mais clara? **As perguntas e seus objetivos serão entregues impressas para cada participante.**
  - 2.2. Quais perguntas poderiam ser acrescentadas ou excluídas do instrumento para que ele melhor avalie o consumo de alimentos processados?
3. Aqui nesta cesta tem alguns exemplos de alimentos ultraprocessados. **Serão apresentados alguns alimentos ultraprocessados para exemplificar.**
  - 3.1. Em seguida, eu irei apresentar para vocês algumas perguntas elaboradas para avaliar o consumo de alimentos ultraprocessados. Como escrever estas perguntas para que avaliem estes objetivos de forma mais clara? **As perguntas e seus objetivos serão entregues impressas para cada participante.**
  - 3.2. Quais perguntas poderiam ser acrescentadas ou excluídas do instrumento para que ele melhor avalie o consumo de alimentos ultraprocessados?
4. Alguém tem algo mais para dizer para finalizarmos a nossa discussão?
5. Obrigada pela participação de todos. A nossa conversa foi muito produtiva e contribuiu para a construção das perguntas do instrumento de avaliação da qualidade da dieta.

APÊNDICE E – Escala de conhecimento nutricional (NKTS)

Nutritional Knowledge Test

1. Marcel has been playing with a ball all afternoon. During this time Kevin has been sitting at home watching television. Which of the following statements is most applicable?
  - ☐ Marcel burns more energy than Kevin
  - ☐ Kevin burns more energy than Marcel
  - ☐ Both boys burn about the same amount of calories
  - ☐ I do not know
2. Which row lists three dishes that have all been prepared using very little fat?
  - ☐ Fried potatoes, escalope, fish fingers
  - ☐ Boiled egg, boiled potatoes, steamed fish
  - ☐ Omelette, meat balls, spaghetti
  - ☐ I do not know
3. Which substance is good for your teeth?
  - ☐ Nitrate
  - ☐ Fluoride
  - ☐ Iodine
  - ☐ I do not know
4. Bread, cake, pasta, potatoes and rice contain mainly...?
  - ☐ Protein
  - ☐ Carbohydrates
  - ☐ Minerals
  - ☐ I do not know
5. Dietitians use the American term 'junk food' to describe certain foods. What do they mean by this?
  - ☐ Foods that have the health needs of adolescents in mind
  - ☐ Special cottage-cheese and sour-milk products
  - ☐ Foods that contain a lot of energy but are of very little nutritional value
  - ☐ I do not know
6. What effect does the fibre contained in our food have on the human body?
  - ☐ It strains the circulatory system
  - ☐ It stimulates the process of digestion
  - ☐ It makes people fat
  - ☐ I do not know
7. The ingredients list found on food items may contain a number of different terms for sugar. Which row lists three terms for special types of sugar?
  - ☐ Dextrose, fructose, maltose
  - ☐ Calcium, sodium, magnesium
  - ☐ Riboflavin, taurine, quinine
  - ☐ I do not know

8. A breakfast merely consisting of bread, jam and butter does not contain enough...?

- ☐ Carbohydrates
- ☐ Protein
- ☐ Fat
- ☐ I do not know

9. Which row lists three foods that contain a lot of vitamin C?

- ☐ Peppers, cabbage, citrus fruit
- ☐ Celery, carrots, cucumbers
- ☐ Parsley, tomatoes, rhubarb
- ☐ I do not know

10. What is the other commonly used term for energy?

- ☐ Kilowatt
- ☐ Kilopond
- ☐ Joule
- ☐ I do not know

11. Which row lists three terms for energy-free sweeteners?

- ☐ Aspartame, saccharin, cyclamate
- ☐ Cyclamate, ascorbic, sodium
- ☐ Sulphate, dextrin, sodium
- ☐ I do not know

APÊNDICE F – Escala de motivações de saúde para escolhas alimentares (SOFIE)

Health motivation influencing food choices questionnaire

1. Is your diet healthy?
☐ Disagree ☐ Indifferent ☐ Agree
2. Do you enjoy fruit and vegetables?
☐ Disagree ☐ Indifferent ☐ Slightly agree ☐ Moderately agree
3. Is the food you eat at home healthy?
☐ Disagree ☐ Indifferent ☐ Agree
4. Do you feel well informed about what are health foods?
☐ Disagree ☐ Indifferent ☐ Agree
5. Do you like the food your parents prepare at home?
☐ Disagree ☐ Indifferent ☐ Slightly agree ☐ Moderately agree
6. How healthy do you think yoghurt and yoghurt products are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy
7. How healthy do you think cheese products (e. g. cheddar, brie, cheese strings) are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
8. How healthy do you think chocolate is?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
9. How healthy do you think bread and toast are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
10. How healthy do you think bowl of cereal is?
☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy
11. How healthy do you think cereal bars are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
12. How healthy do you think sandwiches, toasties and pannini are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy
13. How healthy do you think pasta dishes are?
☐ Unhealthy ☐ Indifferent ☐ Healthy
14. How healthy do you think tea is?
☐ Unhealthy ☐ Indifferent ☐ Healthy
15. How healthy do you think milk is?
☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy
16. How healthy do you think juices are?
☐ Very unhealthy ☐ Unhealthy ☐ Indifferent ☐ Healthy ☐ Very healthy

APÊNDICE G – Escala de qualidade da dieta (ESQUADA)

Questionário para avaliar a qualidade da dieta

1. Você costuma tomar o café da manhã?

☐ Não costumo.

☐ Sim, eu costumo tomar pelo menos em um dia na semana.

2. Quais alimentos você costuma comer no café da manhã?

☐ Eu não costumo comer no café da manhã

☐ Eu costumo apenas beber líquidos, como: água, suco, leite, chá, café e/ou outras bebidas, ou comer alimentos, como: tapioca, cuscuz, bolos, biscoitos, bolachas, pães e/ou outros que seja necessário mastigar.

☐ Eu costumo comer alimentos como: tapioca, cuscuz, bolos, biscoitos, bolachas, pães e/ou outros que seja necessário mastigar e, também, beber líquidos como: água, suco, leite, chá, café e/ou outras bebidas.

3. Você costuma almoçar?

☐ Não costumo.

☐ Sim, eu costumo almoçar pelo menos um dia na semana.

4. Quais alimentos você costuma comer no almoço?

☐ Eu não costumo almoçar ou costumo comer alimentos como: macarrão instantâneo (miojo), salgados e/ou hambúrguer tipo *fast food*, por exemplo, coxinha, pizza, Hot Hit®, Hot Pocket®, X-salada, X-ovo, Mc Donald's®, Bob's® ou Subway®.

☐ Eu costumo comer alimentos, como: pães, queijos e/ou sanduíches feitos em casa, ou eu costumo comer alimentos, como: arroz, feijão, carne (boi, porco, frango, peixe ou opção vegetariana) e/ou salada.

5. Você costuma substituir a refeição do almoço ou jantar por lanches? (Considere exemplos de lanches: pizza, salgados, Hot Hit®, Hot Pocket®, X-salada, X-ovo, Mc Donald's®, Bob's®, Subway®, escondidinho industrializado, estrogonofe industrializado ou lasanha industrializada.).

☐ Não costumo.

☐ Sim, às vezes eu substituo.

☐ Sim, eu costumo substituir em um ou dois dias na semana.

☐ Sim, eu costumo substituir em três ou mais dias na semana.

6. Você costuma cozinhar ou ajudar no preparo dos alimentos em refeições como almoço e jantar? (Considere ajudar no preparo: lavar, picar e/ou cozinhar os alimentos.).

☐ Não costumo.

☐ Sim, eu costumo em pelo menos um dia na semana.

7. Onde você ou alguém da sua casa costuma adquirir frutas, legumes e/ou verduras?

☐ Em supermercados e/ou hipermercados ou não costumamos adquirir frutas, legumes e/ou verduras.

☐ Em feiras livres, hortas, feiras de alimentos orgânicos, compra direta do produtor ou produção própria e/ou de alguém da família ou vizinho.

☐ Em quitandas, sacolões, hortifrutis, minimercados, barraquinhas e/ou CEASA.

8. “Por mais R\$1,00 leve a porção grande de batata frita.” Em situações como no exemplo apresentado, você costuma escolher a maior porção dos alimentos pagando um pouco a mais?

- ☐ Sim
- ☐ Não

9. Você costuma comer arroz integral e/ou macarrão integral?

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um a quatro dias na semana.
- ☐ Sim, eu costumo comer em cinco ou mais dias na semana.

10. Você costuma comer aveia, quinoa e/ou centeio?

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um a quatro dias na semana.
- ☐ Sim, eu costumo comer em cinco ou mais dias na semana.

11. Você costuma comer legumes ou verduras crus e/ou cozidos? (Não considerar o consumo de mandioca, batata, cará e inhame.).

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um a quatro dias na semana.
- ☐ Sim, eu costumo comer em cinco ou mais dias na semana.

12. Você costuma comer frutas? (Não considerar o consumo de sucos.).

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um a quatro dias na semana.
- ☐ Sim, eu costumo comer em cinco ou mais dias na semana.

13. Você costuma comer castanha do Pará/Brasil, castanha de caju e/ou nozes?

- ☐ Não costumo.
- ☐ Sim, eventualmente (como em festas de final de ano).
- ☐ Sim, eu costumo comer em um a quatro dias na semana.
- ☐ Sim, eu costumo comer em cinco ou mais dias na semana.

14. O que você costuma beber quando está com sede?

- ☐ Água.
- ☐ Refrigerante, suco de fruta natural ou em pó, de caixinha, lata e/ou garrafa. (Também considerar bebidas como Feel Good®, H2O®, Fresh® e/ou Aquarius®.)

15. Você costuma comer bolos, bolachas ou biscoitos industrializados (comprados prontos)? (Considerar também aqueles feitos com massas prontas.).

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo comer em pelo menos um dia na semana.

16. Você costuma comer *catchup*, mostarda e/ou maionese industrializados (comprados prontos)?

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo comer em pelo menos um dia na semana.

17. Você costuma comer lanches como salgados fritos ou assados, hambúrguer tipo *fast food*, cachorro quente e/ou pizza industrializada (comprada pronta)? (Considerar como exemplos de hambúrguer tipo *fast food*: X-salada, X-ovo, Hot Hit®, Hot Pocket®, Mc Donald's®, Bob's®, ou Subway®.).

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um ou dois dias na semana.
- ☐ Sim, eu costumo comer em mais do que dois dias na semana.

18. Você costuma comer cereais matinais e/ou barrinhas de cereais industrializados? (Considerar como exemplos de cereais matinais: Sucrilhos®, Nescau Cereal®, Corn Flakes®, Crunch® ou All Bran®).

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo comer em pelo menos um dia na semana.

19. Você costuma comer salgadinhos de pacote (tipo chips) como: Ruffles®, Cheetos®, Elma Chips®, Doritos®, Pringles® ou pipoca de microondas?

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um ou dois dias na semana.
- ☐ Sim, eu costumo comer em mais do que dois dias na semana.

20. Você costuma beber refrigerantes e/ou sucos em pó, de caixinha, em lata e/ou garrafa? (Considerar como exemplos: Del Valle®, Maguary®, Tang®, Sufresh®, Mid®, Taeq®, Feel Good®, H2O®, Fresh® ou Aquarius®.).

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo beber em pelo menos um dia na semana.

21. Você costuma comer caldas/coberturas industrializadas para sorvete, geleias industrializadas, doce de leite, creme de avelã como Nutella® e/ou leite condensado?

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo comer em pelo menos um dia na semana.

22. Você costuma beber bebidas achocolatadas como Toddynho®?

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo beber em pelo menos um dia na semana.

23. Você costuma comer mortadela, salame, patês/pastas industrializados com sabor de carne, peito de peru/frango, presunto e/ou apresuntado?

- ☐ Não costumo.
- ☐ Às vezes.
- ☐ Sim, eu costumo comer em pelo menos um dia na semana.

24. Você costuma comer *nuggets/steak* (frango empanado industrializado), salsicha e/ou hambúrguer industrializado (comprado pronto)?

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um ou dois dias na semana.
- ☐ Sim, eu costumo comer em mais do que dois dias na semana.

25. Quando você está em casa, você costuma comer macarrão instantâneo (miojo), sopas em pó, alimentos/pratos congelados industrializados e/ou hambúrguer tipo fast food? (Considerar como exemplos: Nissin®, Cup Noodles®, Vono®, lasanha industrializada, estrogonofe industrializado, escondidinho industrializado, Hot Hit®, Hot Pocket®, X-salada, X-ovo, Mc Donald's®, Bob's® ou Subway®.).

- ☐ Não costumo.
- ☐ Sim, às vezes.
- ☐ Sim, eu costumo comer em um ou dois dias na semana.
- ☐ Sim, eu costumo comer em mais do que dois dias na semana.

ANEXOS

ANEXO A - Autorização do Secretário de Educação do Estado de São Paulo

GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DE ESTADO DA EDUCAÇÃO

Gabinete do Secretário
 Praça da República, nº 53 - CEP: 01045-903

INTERESSADO: Universidade de São Paulo – Faculdade de Saúde Pública
ASSUNTO: Aplicação de Questionário em Escolas da Rede

INFORMAÇÃO

*Autorizo, diante
 de Carlos Fagundes
 S. Carlos, 24/III/18.
 J. A. S.*

Trata o presente instrumento de solicitação da Universidade de São Paulo para aplicação de pesquisa intitulada: "Desenvolvimento de uma escala para avaliar a qualidade da dieta habitual de adolescentes e jovens adultos por meio da Teoria da Resposta" em escolas da rede pública estadual.

A pesquisa da doutoranda Thanise Sabrian de Souza Santos tem como objetivo desenvolver uma escala de avaliação da qualidade da dieta de adolescentes e jovens adultos brasileiros. Essa ferramenta pode apoiar futuramente, a Secretaria de Estado da Educação (SEE), no diagnóstico e avaliação da efetividade das ações de Educação Alimentar e Nutricional desenvolvidas pela rede.

Além disso, a parceria entre Poder Executivo e Universidade, promove o intercâmbio de conhecimentos, experiências e informações técnicas e científicas; tão importantes para busca constante de eficiência na administração pública.

A nutricionista responsável técnica pelo Programa Nacional da Alimentação Escolar na SEE, Viviane Fagundes Piatecka, avaliou o conteúdo da pesquisa e está de acordo com a divulgação conforme email anexado.

GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DE ESTADO DA EDUCAÇÃO

Gabinete do Secretário
Praça da República, nº 53 - CEP: 01045-903

O Comitê de Ética em Pesquisa da Faculdade de Saúde Pública da Universidade de São Paulo aprovou a realização desse estudo, conforme ofício enviado pela Universidade, e a pesquisadora se compromete a entregar um relatório com os resultados finais para a SEE.

Aguardo sua orientação e possível autorização para prosseguir com a divulgação da presente pesquisa.

Respeitosamente,

Assinatura manuscrita em azul de Geórgia Castilho Russo Tavares.

Geórgia Castilho Russo Tavares
Assessora
Chefia de Gabinete

São Paulo, 19 de Março de 2018.

ANEXO B - Aprovação do Comitê de Ética em Pesquisa

USP - FACULDADE DE SAÚDE
PÚBLICA DA UNIVERSIDADE
DE SÃO PAULO - FSP/USP

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Desenvolvimento de uma escala para avaliar a qualidade da dieta habitual de adolescentes e jovens adultos por meio da Teoria da Resposta ao Item

Pesquisador: Thanise Sabrina Souza Santos

Área Temática:

Versão: 1

CAAE: 59451416.3.0000.5421

Instituição Proponente: Faculdade de Saúde Pública da Universidade de São Paulo - FSP/USP

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.864.366

Apresentação do Projeto:

Estudo de abordagem metodológica em avaliação de consumo alimentar que busca desenvolver e validar uma escala de avaliação da qualidade da dieta. Para tanto, três etapas metodológicas serão feitas. Na etapa teórica, serão elaboradas questões e possibilidades de respostas para cada item seguindo recomendações nacionais e internacionais reconhecidas. A pertinência aos itens para medir a qualidade da dieta será avaliada, em grupos focais, com especialistas da área de Alimentação e Nutrição. Na etapa empírica, serão aplicadas as questões com divulgação e disponibilização do formulário na World Wide Web. Na etapa analítica, será utilizada a Teoria da Resposta ao Item com avaliação da correlação entre os itens e a variável latente em estudo: qualidade da dieta.

Objetivo da Pesquisa:

Desenvolver uma escala de avaliação da qualidade da dieta a partir da Teoria da Resposta ao Item.

Avaliação dos Riscos e Benefícios:

Riscos e benefícios adequadamente descritos para os participantes do Grupo Focal

Riscos mínimos.

Endereço: Av. Doutor Arnaldo, 715

Bairro: Cerqueira Cesar

CEP: 01.246-904

UF: SP

Município: SAO PAULO

Telefone: (11)3061-7779

Fax: (11)3061-7779

E-mail: coep@fsp.usp.br

USP - FACULDADE DE SAÚDE
PÚBLICA DA UNIVERSIDADE
DE SÃO PAULO - FSP/USP

Continuação do Parecer: 1.854.366

Comentários e Considerações sobre a Pesquisa:

A pesquisa envolverá dois grupos de sujeitos:

1. Especialistas que tomarão parte nos grupos focais.
2. Respondentes do questionário na web, chamados de usuários, com idade entre 14 a 50 anos.

O estudo é relevante e está bem delineado.

Considerações sobre os Termos de apresentação obrigatória:

Como o estudo envolve dois grupos diferentes de participantes, especialistas e usuários do instrumento, é preciso que os pesquisadores apresentem dois TCLE diferentes, já que a participação, os riscos e benefícios poderão se dar de modo diferente.

TCLE proposto para os participantes do Grupo Focal está adequado. Contudo não foi apresentado TCLE dos participantes que responderão na plataforma web.

Recomendações:

Incluir TCLE para participantes com idade entre 14 a 50 anos que responderão via plataforma web.

Conclusões ou Pendências e Lista de Inadequações:

Pendência: TCLE para participantes via web

Considerações Finais a critério do CEP:

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_P ROJETO_756822.pdf	30/08/2016 22:49:38		Aceito
Projeto Detalhado / Brochura Investigador	Projeto.pdf	30/08/2016 22:48:52	Thanise Sabrina Souza Santos	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TERMODECONSENTIMENTOLIVREEE SCLARECIDO.pdf	30/08/2016 22:44:39	Thanise Sabrina Souza Santos	Aceito
Folha de Rosto	Folhaderosto.pdf	16/08/2016 16:31:33	Thanise Sabrina Souza Santos	Aceito

Situação do Parecer:

Pendente

Necessita Apreciação da CONEP:

Endereço: Av. Doutor Arnaldo, 715
Bairro: Cerqueira Cesar CEP: 01.246-904
UF: SP Município: SAO PAULO
Telefone: (11)3061-7779 Fax: (11)3061-7779 E-mail: coep@fsp.usp.br

USP - FACULDADE DE SAÚDE
PÚBLICA DA UNIVERSIDADE
DE SÃO PAULO - FSP/USP

Continuação do Parecer: 1.864.366

Não

SAO PAULO, 13 de Dezembro de 2016

Assinado por:
Maria Regina Alves Cardoso
(Coordenador)

Endereço: Av. Doutor Arnaldo, 715
Bairro: Cerqueira Cesar CEP: 01.246-904
UF: SP Município: SAO PAULO
Telefone: (11)3061-7779 Fax: (11)3061-7779 E-mail: coep@fsp.usp.br

CURRÍCULO LATTES

Thanise Sabrina Souza Santos Endereço para acessar este CV: <http://lattes.cnpq.br/4786920921049777>ID Lattes: **4786920921049777**

Última atualização do currículo em 19/05/2019

Possui graduação em Nutrição e mestrado em Ciência da Nutrição, ambos pela Universidade Federal de Viçosa. Doutoranda no Programa de Pós Graduação Nutrição em Saúde Pública da Faculdade de Saúde Pública/USP, com período sanduíche com Growth, Exercise, Nutrition and Development (GENUD) Research Group, na Universidad de Zaragoza, Espanha. **(Texto informado pelo autor)**

Identificação

Nome	Thanise Sabrina Souza Santos
Nome em citações bibliográficas	SANTOS, T. S. S.; SANTOS, THANISE SABRINA SOUZA; SOUZA SANTOS, THANISE SABRINA

Endereço

Endereço Profissional	Faculdade de Saúde Pública/USP. Faculdade de Saúde Pública Pacaembu 01246904 - São Paulo, SP - Brasil Telefone: (11) 30617705

Formação acadêmica/titulação

2015	Doutorado em andamento em Nutrição em Saúde Pública. Faculdade de Saúde Pública/USP, FSP/USP, Brasil. com período sanduíche em Universidad de Zaragoza (Orientador: Luis Moreno). Título: Desenvolvimento de uma escala para avaliar a qualidade da dieta habitual de adolescentes e jovens adultos por meio da Teoria da Resposta ao Item, Orientador: Betzabeth Slater Villar. Coorientador: Maria Alice Altenburg de Assis. Bolsista do(a): Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES, Brasil.
2012 - 2014	Mestrado em Ciência da Nutrição (Conceito CAPES 6). Universidade Federal de Viçosa, UFV, Brasil. Título: Desenvolvimento e validação relativa de Questionário de Frequência Alimentar Semiquantitativo baseado na Pirâmide Alimentar para crianças de 8 e 9 anos do município de Viçosa, Minas Gerais, Ano de Obtenção: 2014. Orientador: Luciana Ferreira da Rocha Sant'Ana. Coorientador: Sylvia do Carmo Castro Francheschini. Bolsista do(a): Conselho Nacional de Desenvolvimento Científico e Tecnológico, CNPq, Brasil.
2007 - 2011	Graduação em Nutrição. Universidade Federal de Viçosa, UFV, Brasil.

Formação Complementar

2018 - 2018	IELTS: Produção oral, nível B1. (Carga horária: 16h). Universidade de São Paulo, USP, Brasil.
2018 - 2018	Desenvolvimento de Habilidades Orais e Pronúncia da Língua Inglesa. (Carga horária: 32h). Universidade de São Paulo, USP, Brasil.
2017 - 2017	Curso Intensivo de Lengua y Cultura Española para Extranjeros. (Carga horária: 60h). Universidad de Zaragoza, UNIZAR, Espanha.
2017 - 2017	Compreensão oral: palestras e aulas. (Carga horária: 32h). Universidade de São Paulo, USP, Brasil.

Betzabeth Slater Villar

Endereço para acessar este CV: <http://lattes.cnpq.br/9309234246831567>

ID Lattes: **9309234246831567**

Última atualização do currículo em 07/05/2019

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