DOI: 10.1590/1413-81232023282.11222022

Food consumption scale validation in VAMOS Program: a proposal to assess eating behavior changes in Brazil

Validação da escala de consumo alimentar no Programa VAMOS: uma proposta para avaliar as mudanças no comportamento alimentar no Brasil

Tânia Rosane Bertoldo Benedetti (https://orcid.org/0000-0002-2035-5082) [1]
Marina Christofoletti (https://orcid.org/0000-0002-5672-6869) [1]
Ricardo Teixeira Quinaud (https://orcid.org/0000-0001-6043-3658) [1]
Cezar Grontowski Ribeiro (https://orcid.org/0000-0003-0640-3110) [2]
Lisandra Maria Konrad (https://orcid.org/0000-0002-8863-4862) [1]
Humberto Moreira Carvalho (https://orcid.org/0000-0002-2855-0296) [1]
Manuela Mika Jomori (https://orcid.org/0000-0003-2294-6692) [1]

Abstract *This study aimed to validate the frequency consumption scale (FCS) and establish cut-off points to assess changes in the eating behavior of participants in the VAMOS Program. The study was based on a community intervention conducted in 2019 in 70 Brazilian cities, with 458 adults from Primary Care. The questionnaire consisted of 12 questions about food frequency consumption. The questions were inserted into the analytical workflow, divided into the descriptive analysis, exploratory and confirmatory factor analysis (EFA), item response theory (IRT) modeling, and construction and validity of an applied questionnaire score. EFA indicated a two-factor structure, with three "healthy" (raw vegetables, fruits, and cooked vegetables) and three "unhealthy" (sugary drinks, sweets, and the replacement of meals with snacks) eating items. Items responses' probabilities indicate a daily consumption of two healthy and once or non-weekly consumption of unhealthy items. Finally, the four categories proposed for FCS can respond over time. Therefore, the FCS proposal can be used effectively for program nutrition evaluation. Furthermore, it is possible to attribute behavior change in Brazilian primary care users with six items.*

Key words *Healthy Diet, Primary Health Care, Public Health, Psychometrics*

Resumo *Este estudo teve como objetivo validar a escala de consumo de frequência (ECF) e estabelecer pontos de corte para avaliar mudanças no comportamento alimentar dos participantes do Programa VAMOS. O estudo baseou-se em uma intervenção comunitária realizada em 2019 em 70 cidades brasileiras, com 458 adultos da Atenção Básica. O questionário era composto por 12 questões sobre o consumo de frequência alimentar. As questões foram inseridas no fluxo de trabalho analítico, divididas em análise descritiva, análise fatorial exploratória e confirmatória (EFA), modelagem da teoria de resposta ao item (TRI) e construção e validade de um escore de questionário aplicado. EFA indicou uma estrutura de dois fatores, com três itens alimentares "saudáveis" (vegetais crus, frutas e vegetais cozidos) e três "não saudáveis" (bebidas açucaradas, doces e a substituição de refeições por lanches). As probabilidades das respostas dos itens indicam um consumo diário de dois itens saudáveis e um consumo único ou não semanal de itens não saudáveis. Por fim, as quatro categorias propostas para o ECF podem fornecer respostas ao longo do tempo. A proposta do ECF pode ser usada efetivamente para avaliação nutricional do programa. Além disso, é possível atribuir a mudança de comportamento em usuários da atenção básica brasileira com seis itens.*

Palavras-chave *Dieta Saudável, Atenção Primária à Saúde, Saúde Pública, Psicometria*

[1] Universidade Federal de Santa Catarina. R. Eng. Agronômico Andrei Cristian Ferreira s/n, Trindade. 88040-900 Florianópolis SC Brasil. tania.benedetti@ufsc.br
[2] Instituto Federal de Educação Ciência e Tecnologia do Paraná. Curitiba PR Brasil.

Introduction

Nutrition-related evidence has been focused on developing guidelines by the World Health Organization (WHO) Department of Nutrition for Health and Development (NHD). These guidelines aim to carry out effective actions to address different forms of malnutrition (unhealthy food) and establish standard methodologies to improve public awareness of the WHO policy recommendations[1]. For example, in Brazil, there are the Brazilian Food Guidelines, which recommend people to 1) increase the consumption of unprocessed and minimally processed food, 2) develop the cooking skills to prepare their meals at home, and 3) reduce the processed and ultra-processed food intake. These recommendations have been considered important strategies for reaching healthy eating habits[2].

In this context, a community-based intervention has been tested in Primary Health Care. The "*Vida Ativa Melhorando a Saúde - VAMOS*" (Active Life Improving Health) is a behavior change program that aims to motivate people to adopt an active and healthy lifestyle regarding physical activity and eating[3,4]. The VAMOS is a pioneer in Brazilian public health, and it has shown improvements in the level of physical activity[5,6], the increase in healthy food consumption[6,7], and bodyweight reduction[6].

The VAMOS Program team established a method to evaluate eating behavior based on the final version of the Risk and Protective Factors Surveillance System for Chronic Diseases by Telephone Survey (VIGITEL). The Ministry of Health widely used the measurement in Brazil[8]. This measurement was called as frequency consumption scale (FCS). The FCS used by the VAMOS Program was chosen because it showed higher applicability (8,50±1,17) and viability (8,92±0,99) to be used in Primary Health Care[9].

Few researchers have been concerned with verifying the psychometric proprieties measurements and establishing cut-off points to classify people assessed by VAMOS Program. Until now, in Brazil, no study describes the cut-off points definitions of eating behavior questionnaires. The VIGITEL questionnaire, even being validated, does not present a classification of all their answers[10,11]. Then, some questions remain unclear, such as: "Is eating unprocessed and minimally processed food three times per week healthier than two times?" and "If the individual answers that he/she eats these foods twice/week but does not use sugared drinks anytime, he/she is less healthy than the individual who eats three times/week but also uses sugared drinks three times/week?". Such classification could provide data to improve health interventions and evaluate changes related to eating behaviors.

Therefore, establishing cut-off points for these eating marks selected by the VAMOS Program[9] could improve the program's effectiveness once this classification allows attaining a sensibility to verify behavior changes. In this sense, some mathematical approaches, such as the Factor Analysis, seem appropriate for this evaluation since it defines factors that represent the instrument[12]. In addition, the Item Response Theory is another method that evaluates respondents without depending on the same items included in the questionnaire[13]. Therefore, this study aimed to validate the FCS and establish cut-off points to assess changes in the eating behavior of participants in the VAMOS Program.

Methods

Intervention and Place

A methodological study was carried out based on a community intervention entitled "VAMOS Program: from training to Implementation" in Santa Catarina, Brazil. This study was a non-randomized controlled trial approved by the Human Research Ethics Committee of the Federal University of Santa Catarina (number 1,360,210) and registered with the RBR-2vw77q indicator in the Brazilian Registry of Clinical Trials (http://www.ensaiosclinicos.gov.br/).

The intervention intends for participants to increase physical activity levels, improve healthy eating, reduce body mass, and improve the perception of the quality of life[4]. The program targets the Brazilian population of both genders, aged 18 or older, of different social contexts.

Recently updated, the program is in its third version (VAMOS 3.0) with a duration plan of nine months, including 18 booklets that can be used in face-to-face group meetings or individually on an online platform[14].

Participants

The data was collected between April and December 2019 with the assistance of 458 users of Primary Health Care from 70 Brazilian municipalities attending the VAMOS Program, version 3.0. In this version, the program was offered

in presential and online versions, chosen by the professional responsible for the implementation. In addition, all participants signed the Free and Informed Consent Form.

Instrument

The data were collected through a questionnaire composed of sociodemographic variables (gender, age, education), one quality of life and 12 questions regarding consumption and frequency of food, and inquiries related to physical activity and sedentary behavior. The approach has been validated previously[9]. The present study will be considered sociodemographic variables, quality of life and consumption, and frequency of food

Quality of life was measured by a question from the World Health Organization quality of life assessment[10]. Next, food and beverage indicators of VIGITEL were validated[11] using 20 items considered more appropriate to the VAMOS program. This instrument is easy-applicable by any professional – it is viable, reproducible, low cost, and consists of clear items, even showing adequate specificity to evaluate people with chronic diseases[9]. Then, 12 questions were selected from this part of the VIGITEL measurement to compose VAMOS consumption and food frequency[9]. These questions were related to the daily consumption of water, beans, raw and cooked vegetables, meat, fruits, soft drinks and artificial juices, milk, sweets, and snacks. The answers options were "never", "one day a week", "two days a week", "three days a week", "four days a week", and "five or more days a week"[9].

Variables

Outcome

The study variables inserted in the analytical process were consumption and food frequency questions. For factor analysis, the selected variables ranged in value from one to six (consumption of water, beans, raw vegetables, cooked vegetables, proteins, fruits, sugary drinks, milk, sweets, and replacement of meals with snacks).

Exposure

The variables used were gender (male and female), age (18 to 59 years and ≥60 years), education (0 to 8 years, 9 to 11 years, ≥12 years), and quality of life (very poor, bad, neutral, good, very good).

Statistical methods

The analytical workflow of the present study was as follows: (i) descriptive analysis of sample characteristics and items responses; (ii) exploratory and confirmatory factor analysis to explore questionnaire constructs and item selection; (iii) item response theory (IRT) modeled to characterize a respondent's standing on the measured construct accurately and explore sources of variation; and (iv) construction and validity of an applied questionnaire score. In addition, extensive details about estimation methods for each model, priors, computation, and codes are provided as supplementary material.

Descriptive Analysis

Initially, we examined sample characteristics by gender, age, education, and quality of life. We then examined absolute and relative frequencies in the questionnaire items.

Factorial Analysis

We started by checking the theoretical dimensionality of the approach using Exploratory Factor Analysis (EFA). The analysis was conducted using the Principal Axis Factor with a Direct Oblique Rotation (Oblimin). In addition, eigenvalues analysis was performed using Kaiser Criterion (<1), Cattel criterion (scree plot graphical display), and Parallel analysis suggesting the number of factors to retain. Finally, we adopted the criteria of values ≥0.40 for an item loading on a factor with no less than three items in a factor[12]. These criteria were repeatedly used, starting from the proposed 4-factor model until testing different models (e.g., three-factor or two-factor) to obtain an acceptable factor solution.

Subsequently, we applied a Confirmatory Factor Analysis (CFA) to examine the model's factorial structure. Since this is the first empirical evaluation of the questionnaire, we opted to set loadings above 0.50 as acceptable, as suggested in the literature[15]. Thus, the final model was tested through the most recommended fit indices in the literature[16]: Chi-square (X2), Chi-square ratio (X2/df), Tucker Lewis Index (TLI), Normed Fit Index (NFI), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Standardized Root Mean Square (SRMS), Goodness of Fit Index (GFI), and Expected Cross-validation Index (ECVI).

Item Response Theory

Assuming the dimensions and items reduction produced in the previous step, we examined the respondents' standing on the measured construct. Then, we explored variation sources using IRT modeling within a multilevel framework. First, we explored the variations among responses aggregated by participants. Hence, we used a varying intercept model assuming participants' responses (Level 1) nested by the different participants (Level 2). We also explored the responses probabilities aggregated at level-2 by gender, age (18 to 59 years old and more than 60 years old), and quality of life (very poor, bad, neutral, good, and very good).

Overall questionnaire score definition and validation

The factor analysis indicates two groups of outcomes, named according to the questionnaire's dimensions as healthy eating behavior (raw vegetables, cooked vegetables, and fruits) and unhealthy eating behavior (sugary drinks, sweets, and replacement of meals with snacks). The healthy eating behavior range answers for each variable were 1 to 6 points, and unhealthy eating behavior variables had the opposite range (6 to 1 points).

Considering the structure defined in the previous steps, we summed each item's score, resulting in an overall score range between 6 and 36 points. We then fitted a multilevel regression model, considering between-participant variation by gender, age group, and quality of life, to examine whether the overall score could describe the participants' responses in a similar pattern as observed in IRT models.

Based on the coefficients estimates of quality of life from the multilevel regression model, we established the cut-off points of the scale (very unhealthy, unhealthy, almost healthy, and healthy) to facilitate an easy and fast diagnostic during the professional intervention. Quality of life was considered because it is a variable recommended by the theoretical framework of the program[17] and a secondary outcome of the VAMOS Program[4]. Estimates were regularized following the previous description in the item analysis.

Lastly, we examined the validity of the overall score sensitiveness to detect individuals' response changes after an intervention. Hence, we estimated each participant's responses over time (i.e. 0=pre and 1=post-intervention). We used a varying-intercept and varying-slope model, in which each participant's response could vary at baseline (intercept) and in response to the intervention (slope).

Results

Descriptive Analysis

This study was based on data from the baseline of the VAMOS Program in 2019, which was carried out using two strategies: (i) face-to-face groups at Health Centers (HC) with printed material and (ii) individually in a virtual environment, through the Moodle platform. HCs from all over the state of Santa Catarina attended the study, resulting in 326 participants. The online version comprised 132 participants and was released by volunteer health professionals from HC. Of all the participants, 88% were female, adults (73.5%), and had more than 12 years of schooling (37.4%).

Factorial Analysis

The EFA indicated that the questionnaire presented a two-factor structure with six items. The analysis of the six items showed substantial adequacy of the KMO and Bartlett indicator, explaining 53.7% of the variance. Kaiser criterion suggested two factors to retain: Scree Plot (https://doi.org/10.48331/scielodata.BV8GBN)[18] and Parallel analysis. All six items loaded higher than 0.40 on a single factor with no cross-loadings. Items 3 (raw vegetables), 4 (cooked vegetables), and 7 (fruits) loaded in the first factor with factor loadings of 0.71, 0.47, and 0.63, respectively. Sugary drinks (item 9), sweets (item 11), and replacement of meals with snacks (item 12) loaded in the second factor with factor loadings 0.73, 0.5, and 0.49, respectively. This 2-factor solution with six items was found satisfactory to be tested with CFA. For interpretation purposes, the factors were named "Healthy eating behavior" and "Unhealthy eating behavior". The consumption of water, beans, proteins, and milk items was not included in any factor.

We found in the initial model (M1) that all items loaded into their factors with magnitude equal or over 0.5 and CFA indices were acceptable: X2=13.45; Chi-square ratio=1.68; TLI=0.95; NFI=0.94; RMSEA=0.05; CFI=0.97; SRMS=0.03; GFI=0.99; and ECVI=0.12. Modification Indexes did not suggest covariance between measure errors items, and M1 was considered acceptable.

Item Response Theory

Items' response probabilities of the Healthy and Unhealthy eating behavior are presented in Figure 1 and reported as supplementary material[18]. The proportion of Healthy eating behavior variables in the sample indicates a daily consumption of raw vegetables and fruits. In this factor, the cooked vegetables had the highest probability of three times per week. The Unhealthy eating behavior variables proportion describes a frequency of consumption of sugary drinks and sweets of once and none per week, respectively. On the other hand, the only probability that differed in this factor was that the participants reported no consumption of ready meals with snacks.

The probabilities of healthy and unhealthy eating behavior responses considered the variations item responses aggregated by gender, age, and quality of life; they are presented in Figure 2 and supplementary material[18]. The healthy eating behavior variables maintained the probability of raw vegetables and fruit consumption daily among participants, and the cooked vegetable consumption responses indicate no different proportion. The proportion of unhealthy eating behavior variables describes an equal consumption of sugary drinks and sweets as once or none per week. Lastly, replacing meals with snacks was a behavior with a low probability of occurrence in most consumption frequencies.

Multilevel regression analysis and an item response theory were fitted to adopt a scale cut-off points interpretation. The scale ranged between six and 36[18]. Based on both analyses, we observed that the 36-point scale had a discrete variance with each variable and showed similar values, demonstrating the scale's sensitivity to measuring eating behavior variations. Additionally,

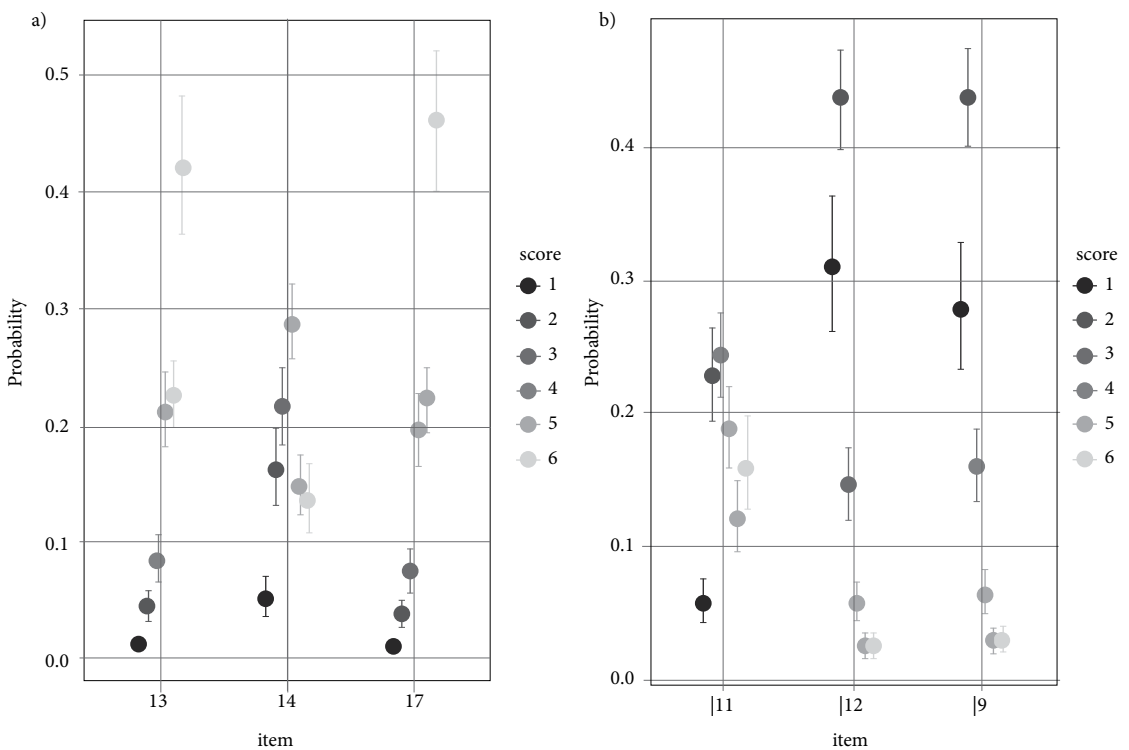

Figure 1. Responses' probabilities of the healthy eating behavior (a) and unhealthy eating behavior (b) dimensions.

Notes: Weekly consume of raw vegetables (l3), cooked vegetables (l4) and fruits (l7), sweets (l11), replacement of meals with snacks (l12) and sugary drinks (l9). The response score were as follows: 1="never"; 2="one per week"; 3="twice per week"; 4="three times per week"; 5="four times per week"; 6="more than five times per week".

Source: Authors.

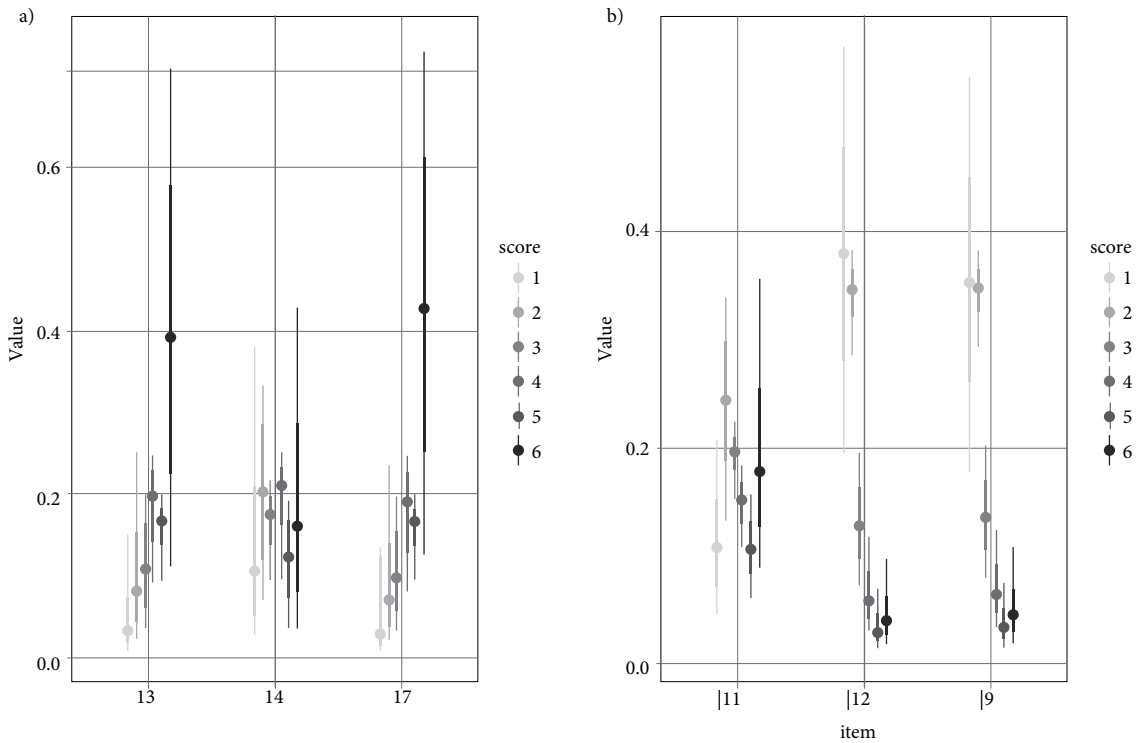

Figure 2. Responses' probabilities of healthy eating behavior (a) and unhealthy eating behavior (b) dimension considering gender, age, and quality of life variabilities.

Notes: Weekly consume of raw vegetables (l3), cooked vegetables (l4) and fruits (l7), sweets (l11), replacement of meals with snacks (l12) and sugary drinks (l9). The response score were as follows: 1="never"; 2="one per week"; 3="twice per week"; 4="three times per week"; 5="four times per week"; 6="more than five times per week".

Source: Authors.

Table 1. Estimates (95% confidence intervals) of the Food Consumption Scale by age, gender, and quality of life.

	Food Consumption Scale
	Estimate (95%CI)
Age	
18 to 59	24.30 (21.89 to 26.42)
More than 60	26.68 (24.16 to 28.83)
Gender	
Male	24.94 (21.99 to 27.60)
Female	25.70 (22.89 to 28.14)
Quality of life	
Very bad	23.75 (20.16 to 26.89)
Bad	23.78 (20.80 to 26.48)
Neutral	25.45 (22.46 to 27.97)
Good	26.85 (23.95 to 29.29)
Very good	26.83 (23.50 to 29.75)

Source: Authors.

based on the estimates of quality of life from the multilevel regression analysis (Table 1), we classified the scale's cut-off points into four categories (Figure 3).

There was a low variation partition coefficient (95%CI) in age, gender, and quality of life variables. Between the age and gender categories, no substantial variation was identified. However, quality of life describes the lower categories ("Very Bad" and "Bad") with lower values on the scale than the higher categories ("Neutral", "Good", and "Very Good"). Such variation used this whole number (23 scores) for the "Unhealthy" cut-off point. In addition, the scale classification is the first category created based on a theoretical approach, with at least one answer about daily healthy foods and the non-consump-

tion of unhealthy food. These values range from scores of 31 to 36, representing the "Healthy" category. The second category, "Almost Healthy", ranges from 24 to 30. Lastly, the other two categories were from 16 to 23 ("Unhealthy") and six to 15 ("Very Unhealthy"), maintaining the same numeric proportion (Figure 3).

Multilevel logistic model

The coefficients of variation of the model partition are shown in Table 2. Given this analysis, it is possible to verify that the scale has a long-term sensitivity to measure temporary behavior changes. Furthermore, the score can also be used in community practices implementing the VAMOS Program, as its effectiveness was proven in the subsample.

This section may be divided into subheadings. It should provide a concise and precise description of the experimental results, their interpretation, and the practical conclusions that can be drawn.

Discussion

This study shortened the VAMOS Program FCS questionnaire and offered two different factors. The healthy and unhealthy eating behavior allows a scale of 36 points, with four classifications. Finally, the measurement proposed seems to be able to verify the behavior change after an intervention.

The three factors related to consuming raw and cooked vegetables and fruits showed higher factor loadings, which were enough to reflect the healthy eating behaviors construct[19-24]. Therefore, international dietary and food guidelines have recommended increasing the consumption of these food groups to reach three portions or 400g per day[23,25-28]. However, the Brazilian Dietary Guideline is the only to recommend raw vegetable consumption, named unprocessed food[2].

In several countries, the population used to buy ready-washed and cut fruits and vegetables; in Brazil, these products are considered minimally processed foods and are not usually practiced by the Brazilian population[2]. As a common practice, the Brazilian population prepares fresh products from scratch. However, they see this as a barrier to buying, preparing, and eating fresh products[29-31].

One reason can be related to the needing for cooking skills to use fresh fruits and vegetables in the meals because these foods require pre-preparation tasks, such as washing, peeling, and cutting[30]. Another reason concerns the accessibility to fresh foods, which depends on the sociodemographic conditions, such as place of living, food cost, and production[32,33]. Then, items in the mea-

Table 2. Estimates of the Food Consumption Scale, pre and post intervention.

	Estimate (95%CI)	Est. Error
Group-level effects		
Intercept	3.06 (2.23 to 3.88)	0.42
Time	0.62 (0.03 to 1.72)	0.45
Intercept, time	0.51 (-0.97 to 0.84)	-0.32
Population-level effects		
Intercept	27.06 (26.11 to 28.02)	0.49
Time	1.45 (0.47 to 2.42)	0.49
Family specific parameters		
Sigma	3.10 (2.57 to 3.74)	0.30

Note: CI=Confidence interval.

Source: Authors.

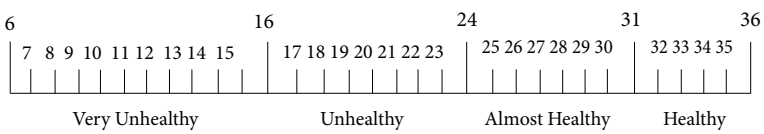

Figure 3. Graphic representation of food pattern with scores according to the four categories in the Food Consumption Scale.

Source: Authors.

surement evaluating the consumption of these foods are useful parameters for the classification of healthy eating behaviors evaluation, according to the dietary recommendations[2].

The participants attending this study presented a higher probability of consuming raw vegetables and fruits daily (Figure 2), evaluated as healthy eating behavior by the VAMOS FCS. The fact that participants eat three portions of raw fruits and vegetables every day[23,28] is suitable for the Brazilian dietary recommendation[2,29]. This specificity established a higher cut-off point of 31 to classify healthy eating behaviors from a 36-point scale. Bellow this parameter could be considered low consumption for this population but not unhealthy. Therefore, it means it would not reach the Brazilian dietary recommendation, but almost there[2,29]. Consequently, it seems adequate and theoretically justified by these parameters (Figure 3).

In this study, the classification of individuals with 'almost healthy' consumption seemed reasonable from 24 points (Figure 3) since most of participants were around this parameter, independent of age, gender, and quality of life (supplementary material). However, Ronteltap *et al.*[21] emphasize that "healthy eating is not as clear-cut for consumers and is not understood and interpreted identically by everybody". Moreover, the authors claim that, in their study, healthy and unhealthy eating practices go through concrete representation and abstract representation levels of individuals. The first one was related to specific ingredients, nutrients, and preparation methods, and the second one was related to various eating patterns based on lifestyles, for example.

The concrete representative levels, such as specific foods and abstract ones (variation regarding age, gender, and quality of life), are covered by the aspects involved in the evaluation by VAMOS FCS. Based on a sample submitted to the VAMOS intervention program[4,14], it was expected that the participants would improve their diet, eating healthy foods more frequently. The analysis model found the coefficients estimate to quality of life in the FCS. The range from neutral to a high quality of life answers was reported from the value correspondent to 24 points (Table 1). Beyond this parameter, it could be considered a good frequency of healthy foods consumption, specifically for those who did not use to eat them anyway before the intervention. So, suppose some of the samples could improve their diet even eating healthy foods less than five but not less than one time per week. In that case, it is important to consider this was improving and classifies this range as "almost healthy" rather than 'unhealthy' food consumption. It was then prudent to adopt 'almost healthy' and 'healthy' eating behaviors to classify respondents' consumption.

In the present study, three items were considered adequate to evaluate unhealthy eating behaviors: sweets, sugary drinks, and ready snack-based meals. These items are deemed ultra-processed foods, which have a high energy density. In addition, they are composed of free sugar, saturated and trans fats, salt, additives, preservatives, and other substances damaging to the health[30,34].

Louzada *et al.*[34] identified nutrient-based dietary patterns among 32,898 Brazilian people aged ≥10 years old and associated them with a dietary share of ultra-processed foods. They called 'unhealthy pattern' the ultra-processed foods that show a high level of total, saturated and trans fats and less dietary fiber. This dietary pattern was inversely associated with "healthy pattern 1" (more protein and micronutrients and less free sugars) and "healthy pattern 3" (more dietary fiber and minerals and less free sugars).

These findings support the present study results, which considered the consumption of ultra-processed foods (sugary drinks, sweets, and snacks-based meals) as unhealthy eating behaviors. The sample reported low probabilities of occurrence in most frequencies of consumption of sugary drinks, sweets, and snacks-based meals. Ultra-processed foods are also known as high risk factor, supported by the Brazilian Food Guidelines[2]. So, the frequency of their consumption above once per week is sufficient to influence the classification as unhealthy frequency. This continuous attribution involves the Brazilian Food Guidelines, which recommend reducing processed and ultra-processed food intake regardless of quantity[2], implying that every behavior change increases the quality of food consumption.

Like the present study, Guertin *et al.*[35] validated the Healthy and Unhealthy Eating Behavior Scale (HUEBS) to evaluate self-determined and non-self-determined motivation for healthy and unhealthy eating behaviors at different stages of change. The researchers also presented 2-factors solutions – healthy and unhealthy eating behaviors – as in this study, supporting high factor loadings and internal consistency. The healthy subscale had items with fruits and vegetables similar to our study and other foods such as whole grains, lean meats, legumes, and foods with low fat and sugar cooked with specific

techniques. The unhealthy subscale consisted of white sugar and artificial sweeteners, snack foods (ultra-processed), and sugary drinks as in the present study, in addition to processed meat, prepacked meals, foods made by deep-frying methods, alcoholic drinks, and others.

However, there was no focus on the Brazilian Dietary Guidelines in the HUEBS[35], which considered unprocessed foods, such as raw vegetables, and the replacement of a meal with snacks. Furthermore, the HUEBS scale evaluates the frequency of consumption from "never" to "always" by a 7-point scale per item, which is unclear if "always" is every day/week/month or all day[35]. Moreover, the HUEBS aims to evaluate the self-determined motivation on eating behavior change stages, as opposed to the present study that considers only the changes in food consumption[35]. Additionally, they did not present a cut-off point to classify the participants according to their answers, as shown here[35].

We found a high probability of sugary drinks and sweets intake once and none per week among participants (Figure 1), which can be considered adequate to any dietary guideline[2,23,28]. For this population, unhealthy eating behaviors seem less frequent, and therefore it justifies establishing a high cut-off point (24 on a scale) in the 36-point scale (Figure 3) to classify these behaviors. So, twice a week could be an unhealthy frequency, and four times or more per week could be very unhealthy for this group. Indeed, such a change can stimulate the participants to improve their parameters and achieve healthier eating behaviors.

Quality of life has been included to assess health and participant satisfaction. It also provides a critical check of the impact of the intervention delivery on public health[17]. Although the evidence does not fully understand the effects of dietary interventions on quality of life, most studies report improvement after the intervention[36]. A statistical methodology can be used to begin exploring the impact of dietary changes on the quality of life. Furthermore, developing specific tools to accurately assess the effect of diet changes on the quality of life has been encouraged[36].

Determining appropriate methods of assessing eating behavior has been reported to be essential for planning health programs[37]. The validation of this scale of eating behavior is critical to help measure the VAMOS Program's effectiveness/efficiency. The establishment of scores has been previously proposed as a viable alternative to keep assessing eating behavior[38]. Furthermore, it allows an analysis of the quantitative (weekly consumption) and qualitative aspects (the type of food consumption), inferring the feasibility of associating these results with other explanatory variables[39].

As mentioned before, Guertin *et al.*[35] validated the HUEBS to evaluate self-determined and non-self-determined motivation for healthy and unhealthy eating behaviors at different stages of change. The stages of eating behavior change proposed were represented by the following statements: (i) detection ("I am trying to decide if I should change my eating behaviors"; stage 1); (ii) decision ("I am debating whether I am going to start changing my eating behaviors"; stage 2); (iii) implementation ("I want to know more about how I can change my eating behaviors"; stage 3); (iv) maintenance ("I want to learn more about things I can do to make healthy eating part of my lifestyle"; stage 4), and (v) habit ("Healthy eating is already part of my lifestyle"; stage 5).

The authors found that people with higher healthy eating behaviors showed significant differences between the later stage (habit) and the other stages (detection, decision, maintenance, and implementation) of the eating behavior change. In contrast, people with higher unhealthy eating consumption showed significant differences between earlier stages (detection and decision) and the other ones[35]. This approach can explain how people manage their actions toward healthy eating behaviors over time, and according to their motivation, for each eating behavior change.

However, even the authors claim that detecting these differences in people's eating behaviors and change processes becomes easier with HUEBS evaluation is not a direct measurement of food consumption. Therefore, a background of professionals is necessary to manage and assist them in improving their diets effectively, unlike the VAMOS FCS. On the other hand, VAMOS FCS can be complemented with the evaluation of HUEBS if there is an interest in evaluating the stages of eating behavior changes and the Brazilian population's motivation to eat.

According to data from the present study, VAMOS FCS showed four categories that can classify people in different moments. The program's aim fits well once some categories, such as "almost healthy", can stimulate people to improve their diet to achieve the goals of Brazilian dietary recommendations. On the other hand, unhealthy classification is a warning for those needing more attention and specific strategies to increase un-

processed foods and reduce the consumption of ultra-processed foods[9].

The VAMOS-FCS aims to evaluate the eating behavior changes with VAMOS interventions. Therefore, the constructs and the classification of cut-off points of measurement seemed appropriate. The factor analysis becomes the valid measurement to evaluate eating behavior changes caused by the VAMOS Program.

To the best of our knowledge, this is the first study to establish cut-off points to classify eating behaviors on a Brazilian scale, with a national and wide use. The methods adopted in this study showed efficacy in reaching this classification. The high probabilities for healthy eating behaviors found in this study show that high cut-off points parameters are necessary to achieve healthy eating behaviors in this population, which can stimulate to increase in healthy food consumption.

It is important to note that the VAMOS FCS questionnaire does not evaluate the number of food portions chosen daily by the participants. However, it was assumed that this measurement evaluates the frequency of consumption in a week. In that case, it may encourage the participants to increase their healthy eating behaviors, as achieving the recommendation in a single day is more difficult.

The limitations of the present study can be related to the sample. The participants were from a non-randomized controlled trial, with most of the sample from a single state of Brazil. Therefore, the use of this scale in other states is useful. Furthermore, for comparison reasons, it is usual to adopt gold standard measurements to validate food consumption scales. However, the methodology adopted in this study presented relevant theoretical considerations combined with data from the target population. Moreover, the short instrument can be easily used by health professionals in the Health Primare Care and other contexts.

Conclusions

Eating behavior is one of the primary outcome variables in the VAMOS Program. Therefore, developing this scale will optimize the evaluation of the program results, inferring more concrete and effective data from the participants on the consumption of healthy and unhealthy foods and, consequently, on behavior change. Furthermore, this scale has implications in the clinical practice of HCs, as it may assist in the monitoring of eating behaviors in various actions and, on the other hand, serves as a basis for research in different contexts.

Collaborations

TRB Benedetti: conceptualization, methodology, resources, writing - review and editing, visualization, supervision. M Christofoletti: conceptualization, methodology, investigation, writing - original draft preparation. HM Carvalho: conceptualization, formal analysis, data curation, writing - review and editing, supervision. MM Jomori: conceptualization, methodology, investigation, writing - original draft preparation, writing - review and editing, supervision. CG Ribeiro: methodology, writing - original draft preparation. LM Konrad: methodology, writing - original draft preparation. RT Quinaud: formal analysis, investigation, data curation, writing - original draft preparation. All authors have read and agreed to the published version of the manuscript.

Acknowledgments

The study received logistical support from the Primary Health Care units involved in the project.

Funding

This research was funded by the Brazilian research funding agency Programa de Pesquisa para o Sistema Único de Saúde/Fundação de Amparo a Pesquisa do Estado de Santa Catarina (PPSUS, Research Program Single Health System/FAPESC, Santa Catarina State Research Support Foundation) (Process 484/2016).

Referências

1. World Health Organization (WHO). *Evidence-informed guideline development for World Health Organization nutrition-related normative work continuous quality improvement for efficiency and impact*. Geneva: WHO; 2018.
2. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Departamento de Atenção Primária à Saúde. *Dietary Guidelines for the Brazilian*. Brasília: MS; 2015.
3. Benedetti TRB, Schwingel A, Gomes LS, Chodzko-Zajko W. Programa "VAMOS" (Vida Ativa Melhorando a Saúde): da concepção aos primeiros resultados. *Rev Bras Cineantropom Desempenho Hum* 2012; 14(6):723-737.
4. Benedetti TRB, Manta SW, Gomez LSR, Rech CR. Logical model of a behavior change program for community intervention - Active Life Improving Health - VAMOS. *Rev Bras Ativ Fís Saude* 2017; 22(3):309-313.
5. Borges RA, Tomicki C, Almeida FA, Schwingel A, Wojtek CZ, Benedetti TRB. Reach of "VAMOS" program in basic healthcare - organizational barriers and facilitators. *Rev Bras Geriatr Gerontol* 2019; 22(3):e180225.
6. Meurer ST, Lopes ACS, Almeida FA, Mendonça RD, Benedetti TRB. Effectiveness of the VAMOS strategy for increasing physical activity and healthy dietary habits: a randomized controlled community trial. *Health Educ Behav* 2019; 46(3):406-416.
7. Gerage AM, Benedetti TRB, Ritti-Dias RM, Santo ACO, Souza BCC, Almeida FA. Effectiveness of a behavior change program on physical activity and eating habits in patients with hypertension: a randomized controlled trial. *J Phys Act Health* 2017; 14(12):943-952.
8. Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Departamento de Análise de Saúde e Vigilância de Doenças Não Transmissíveis. Secretaria de Atenção à Saúde. *VIGITEL Brasil 2018: surveillance of risk and protective factors for chronic diseases by telephone survey: estimates on the frequency and sociodemographic distribution of risk and protective factors for chronic diseases in the capitals of the 26 Brazilian states and the Federal District in 2018*. Brasília: MS; 2019.
9. Silva MC, Ribeiro CG, Benedetti TRB. VAMOS program: instruments for measuring physical activity, feeding and anthropometry. *Rev Bras Cineantropom Desempenho Hum* 2020; 22:e58256,
10. The World Health Organization quality of life assessment (WHOQOL): position paper from the World Health Organization. *Soc Sci Med* 1995; 41(10):1403-1409.
11. Mendes LL, Camposi SF, Malta DC, Bernal RTI, Sá NNB, Velásquez-Meléndez G. Validade e reprodutibilidade de mar-cadores do consumo de alimentos e bebidas de um inquérito telefônico realizado na cidade de Belo Horizonte (MG), Brasil. *Rev Bras Epidemiol* 2011; 14(S1):80-89.
12. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham R L. *Análise multivariada de dados*. Porto Alegre: Bookman Editora; 2009.
13. Hambleton RK. Item response theory: a broad psychometric framework for measurement advances. *Psicothema* 1994; 6(3):535-556.

14. Benedetti TRB, Ribeiro CG, Konrad LM. *Vamos: vida ativa melhorando a saúde: seção 1 – Vamos começar?* Florianópolis: Universidade Federal de Santa Catarina; 2019.
15. Kline RB. *Principles and Practice of Structural Equation Modeling*. New York: The Guilford Press; 2016.
16. Jackson DL, Gillaspy JA, Purc-Stephenson R. Reporting practices in confirmatory factor analysis: an overview and some recommendations. *Psychol Methods* 2009; 14(1):6-23.
17. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: The RE-AIM framework. *Am J Public Health* 1999; 89(9):1322-1327.
18. Benedetti TRB, Christofoletti M, Quinaud RT, Ribeiro CG, Konrad LM, Carvalho HM, Jomori MM. *Data for: Food consumption scale validation in VAMOS Program: a proposal to assess eating behavior changes in Brazil* [Internet]. Disponível em: https://doi.org/10.48331/scielodata.BV8GBN. SciELO Data, V1; 2022.
19. Barrat J. Diet-related knowledge, beliefs and actions of health professionals compared with the general population: an investigation in a community. *J Hum Nutr Diet* 2001; 14:25-32.
20. Bisogni CA, Jastran M, Seligson M, Thompson A. How People Interpret Healthy Eating: Contributions of Qualitative Research. *J Nutr Educ Behav* 2012; 44(4):282-301.
21. Ronteltap A, Sijtsema SJ, Dagevos H, De Winter MA. Construal levels of healthy eating. Exploring consumers' interpretation of health in the food context. *Appetite* 2012; 59(2):333-340.
22. Schermel A, Mendoza J, Henson S, Dukeshire S, Pasut L, Emrich TE, Lou W, Qi Y, L'abbe MR. Canadians' Perceptions of Food, Diet, and Health – A National Survey. *PloS One* 2014; 9(1):e86000.
23. Food and Agriculture Organization of the United States (FAO). *Plates, pyramids, planet: Developments in national healthy and sustainable dietary guidelines: a state of play assessment*. Washington, D.C.: FAO; 2016.
24. Provencher V, Jacob R. Impact of Perceived Healthiness of Food on Food Choices and Intake. *Curr Obes Rep* 2016; 5(1):65-71.
25. King JC. An evidence-based approach for establishing dietary guidelines. *J Nutr* 2007; 137(2):480-483.
26. Aranceta J, Pérez-Rodrigo C. Recommended dietary reference intakes, nutritional goals and dietary guidelines for fat and fatty acids: a systematic review. *Br J Nutr* 2012; 107(Supl. 2):S8-S22.
27. Montagnese C, Santarpia L, Buonifacio M, Nardelli A, Caldara AR, Silvestri E, Contaldo 2007F, Pasanisi F. European food-based dietary guidelines: A comparison and update. *Nutrition* 2015; 31(7-8):908-915.
28. Food and Agriculture Organization of the United States (FAO). *Food-based dietary guidelines* [Internet]. 2017 [cited 2021 mar 22]. Available from: http://www.fao.org/nutrition/education/food-based-dietary-guidelines/en/.
29. Monteiro C, Moubarac J, Levy R, Canella D, Louzada M, Cannon G. Household availability of ultra-processed foods and obesity in nineteen European countries. *Public Health Nutr* 2018; 21(1):18-26.
30. Jomori MM, Vasconcelos FAG, Bernardo GL, Uggioni PL, Proença RPC. The concept of cooking skills: A review with contributions to the scientific debate. *Rev Nutr* 2018; 31(1):119-135.
31. Popkin BM. Relationship between shifts in food system dynamics and acceleration of the global nutrition transition. *Nutr Rev* 2017; 75(2):73-82.
32. Galego CR, D'avila GL, Vasconcelos FAG. Factors associated with the consumption of fruits and vegetables in school-children aged 7 to 14 years of Florianópolis, South of Brazil. *Rev Nutr* 2014; 27(4):413-422.
33. Castro IRR. Challenges and perspectives for the promotion of adequate and healthy food in Brazil. *Cad Saude Publica* 2015; 31:7-9.
34. Louzada M, Ricardo C, Steele E, Levy R, Cannon G, Monteiro C. The share of ultra-processed foods determines the overall nutritional quality of diets in Brazil. *Public Health Nutr* 2018; 21(1):94-102.
35. Guertin C, Pelletier L, Pope P. The validation of the Healthy and Unhealthy Eating Behavior Scale (HUEBS): Examining the interplay between stages of change and motivation and their association with healthy and unhealthy eating behaviors and physical health. *Appetite* 2010; 144:104487.
36. Carson TL, Hidalgo B, Ard JD, Affuso O. Dietary intervenções and quality of life: a systematic review of the literature. *J Nutri Educ Behav* 2014; 46(2):90-101.
37. Cavalcante AAM, Priore SE, Franceschini SCC. Estudos de consumo alimentar: aspectos metodológicos gerais e o seu emprego na avaliação de crianças e adolescentes. *Rev Bras Saude Mater Infant* 2004; 4(3):229-240.
38. Fornés NS, Martins IS, Velásquez-Meléndez G, Latorre MRDO. Food consumption scores and serum lipids levels in the population of São Paulo, Brazil. *Rev Saude Publica* 2002; 36(1):12-18.
39. Ferreira FC, Barbosa LB, Vasconcelos SML. Studies assessing food consumption by the scores method: a systematic review. *Cien Saude Colet* 2019; 24(5):1777-1792.

Article submitted 20/12/2021
Approved 25/08/2022
Final version submitted 27/08/2022

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva