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Ingrid Sofia Vieira de Melo[1]
João Victor Laurindo dos Santos[1,2]
Clara Andrezza Crisóstomo Bezerra Costa[1]
Dafiny Rodrigues Silva Praxedes[2,3]
André Eduardo da Silva Júnior[2,3]
Mateus de Lima Macena[2,3]
Nassib Bezerra Bueno[2,3]

[1] Instituto Federal de Alagoas, Departamento de Agroindustria, *Campus* Satuba. Satuba, AL, Brasil.

[2] Universidade Federal de Alagoas, Faculdade de Nutrição, Laboratório de Nutrição e Metabolismo. Maceió, AL, Brasil.

[3] Universidade Federal de São Paulo, Escola Paulista de Medicina, Programa de Pós-Graduação em Nutrição. São Paulo, SP, Brasil.

Correspondence
Ingrid Sofia Vieira de Melo
ingrid.melo@ifal.edu.br

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Larissa Loures Mendes

Internet-based nutrition education program and the dietary food processing degree of adolescents

Programa de educação nutricional via internet e o grau de processamento de alimentos de adolescentes

Abstract

Objective: To test the effectiveness of an internet-based nutrition education program in adolescents living in an undeveloped city. ***Method***: A clinical trial with 66 adolescents aged 14-19 years, students from a federal public school (removed for blinding) subjected to an internet-based nutrition education program was conducted. The activities took place every 15 days for 12 weeks, focused on encouraging the decrease in the processed/ultra-processed foods intake and the increase of natural/minimally processed foods intake. Activities included sending instant messages and applying quiz games. ***Results***: There was a reduction in total energy consumption, but without reductions in the consumption of processed and ultra-processed foods. Adolescents from lowest economic classes increased their consumption of natural and minimally processed foods. Girls decreased, while boys increased their consumption of ultra-processed foods. ***Conclusions***: The internet-based nutrition education program was effective in reducing total energy consumption, but not the consumption of processed and ultra-processed foods specifically.Brazilian Registry of Clinical Trials (ReBEC) under number RBR-9crqgt.

Keywords: Adolescent; Dietary intake; Internet-based intervention; Ultra-processed food.

Resumo

Objetivo: Testar a eficácia de um programa de educação nutricional baseado na internet em adolescentes residentes em uma cidade subdesenvolvida. ***Método***: Foi realizado um ensaio clínico com 66 adolescentes de 14 a 19 anos, estudantes de uma escola pública federal (removido para cegamento), submetidos a um programa de educação nutricional baseado na internet. As atividades ocorreram a cada 15 dias durante 12 semanas, com foco em incentivar a redução do consumo de alimentos processados/ultraprocessados e o aumento do consumo de alimentos *in natura*/minimamente processados. As atividades incluíram o envio de mensagens instantâneas e a aplicação de jogos de perguntas e respostas. ***Resultados***: Houve uma redução no consumo

total de energia, mas sem redução no consumo de alimentos processados e ultraprocessados. Adolescentes das classes econômicas mais baixas aumentaram o consumo de alimentos *in natura* e minimamente processados. As meninas reduziram, enquanto os meninos aumentaram o consumo de alimentos ultraprocessados.***Conclusões***: O programa de educação nutricional baseado na internet foi eficaz em reduzir o consumo total de energia, mas não especificamente o consumo de alimentos processados e ultraprocessados. Registrado no registro Brasileiro de Ensaios Clínicos (REBEC: RBR-9crqgt).

Palavras-chave: Adolescente. Consumo alimentar. Intervenção baseada na internet. Alimentos ultraprocessados.

INTRODUCTION

Adolescents generally view the Internet as an accessible, fast and reliable source of health care information and have shown a preference for receiving health information digitally rather than in print.[1] This type of tool seems to promote greater engagement of adolescents and actively involve them in the learning process.[2] Therefore, it seems important to incorporate this tool into nutrition education strategies, especially considering that, for example, the consumption of ultra-processed foods (UPF) has been identified as a risk factor for obesity among adolescents.[3] and excess weight in young adults.[4]Brazil is a country marked by social inequality. Adolescents living in small and poor cities, in particular, form a group that lacks health education services, when compared to adolescents in a better economic situation.[5,6]Therefore, the objective of this research was to test the effectiveness of an internet-based nutritional education program with adolescent students from a public school in a small town in the Northeast of Brazil.

METHOD

This study was registered in the Brazilian Registry of Clinical Trials (ReBEC) under number RBR-9crqgtand approved by the Research Ethics Committee of the Universidade Federal de Alagoas.

We included adolescents aged 14-19 years, students of a federal public high school/technical school in the municipality of Murici, in the countryside of Alagoas, who had access to the internet inside and/or outside the school. The city's Human Development Indexes (HDI) is 0.527, considered low. Adolescents were recruited by invitation during the break from classes by a trained researcher.

This study is a single-arm clinical trial whose intervention was the implementation of an internet-based nutrition education program. The intervention was performed every 15 days for 12 weeks. The education program consisted of implementing informative nutritional education activities whose focus was to encourage a reduction of consumption of processed foods (PF) and UPF and an increase in the consumption of natural and minimally processed foods (NMPF), by making information available through the internet. The activities included sending messages via a multi-platform instant messaging application, voice calls to smartphones with short, objective, and eye-catching informative material, and a quiz-type game application (gamification). The interaction between students and members of the research group took place at least once a week, during the 12-week duration of the intervention, to ensure that the adolescents were attentive and participating in the planned activities. Participants were informed that they could get in touch at any time by email or telephone if they had any questions or problems with accessing the internet.

Six Food and Nutrition Education (FNE) activities were developed over 12 weeks. The activities were conducted with the assistance of digital platforms, such as WhatsApp® and quizUP® apps, with the goal of engaging participants and facilitating the understanding of topics related to nutrition. In the 2nd week after the start of the study, participants received instructions on the classification of foods according to the Brazilian Dietary Guidelines and were encouraged to classify everyday eatenfoods. In the 4th week, participants were encouraged to conduct preliminary studies on the Food Pyramid and then answer a quiz on the topic. In the 6th week, another quiz was used for participants to identify health problems related to overweight and obesity; they were also encouraged to conduct prior studies on the content. In the following weeks, other activities focused on specific topics, such as the difference between “diet” and “light” foods (8th week), through educational slides with examples of these foods. In the 10th week, participants conducted preliminary research on the impacts of healthy eating in the prevention of non-communicable chronic diseases. They answered quiz questions to test their knowledge of the subject. Finally, in the 12th week, participants were guided via WhatsApp® to interpret food labels, including energy and nutrients. These

activities aimed to provide practical knowledge and encourage more conscious food choices through an interactive and accessible approach.

Upon being included in the survey, the adolescents answered socioeconomic survey forms[7] (CCEB – Economic Classification Criteria Brazil) and physical activity survey forms[8] (IPAQ – International Physical Activity Questionnaire). At inclusion and after the intervention, the following were measured: weight, height, and waist circumference; later the body mass index-age score z (BAZ) was calculated. Additionally, all participants were assessed for food consumption (primary outcome) with the aid of a photo album of food portions at the beginning and end of the intervention, through a 24-hour recall (over 3 days, including one day on the weekend). Adolescents did not receive free meals at school, any food they consumed was taken from home or purchased at the school canteen. Energy consumption, NMPF, PF, and UPF were calculated in Kcal based on food composition tables and nutritional labels of industrialized products; all these values were de-attenuated to adjust the inter-individual variability of the group.[9]

Food consumption means before and after the intervention was compared using a paired-samples "t" test. To verify which variables interacted with changes in food consumption, mixed linear models were used, where the between-subject factors were age, sex, IPAQ, BAZ, and CCEB and the intra-subject factor was the time of intervention (pre and post). As a measure of the effect of this analysis, the Partial eta² was calculated. All analyzes adopted an alpha value equal to 5% and were conducted with the R software (R Core Team, Vienna, Austria).

RESULTS

Table 1 shows the descriptive characteristics and food consumption analysis of the 66 included students. After the intervention, there was a significant reduction in total energy consumption, but without specific reductions in food consumption according to the degree of processing. There was an interaction between economic class and changes in NMPF consumption and interaction between sex and UPF consumption (Figure 1). Adolescents from lowest economic classes C-E increased the consumption of NMPF, while those from class A-B2 decreased (PartialEta² = 7%; p = 0.03, Figure 1A). As for gender, girls decreased, while boys increased the consumption of UPF (PartialEta² = 7.9%; p = 0.02, Figure 1B).

Table 1.Descriptive and food consumption characteristics of the sample of adolescents who received nutritional education via the internet (n = 66).Murici-AL, 2017.

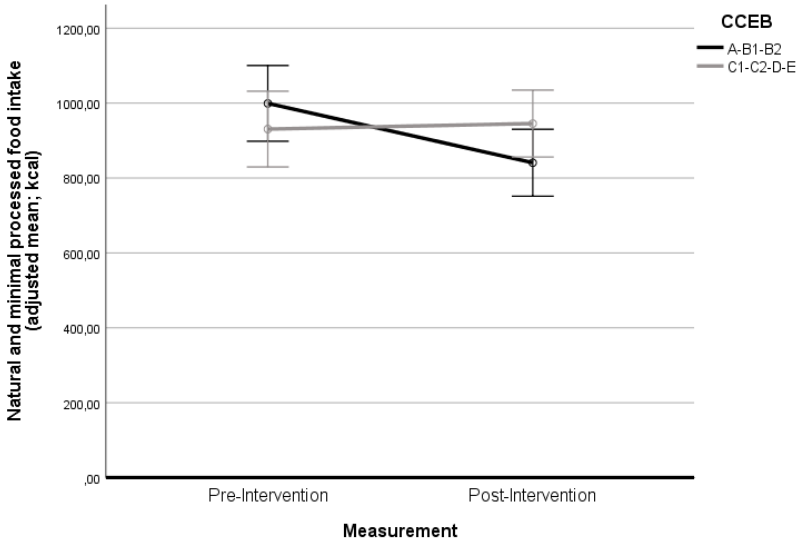
Variable	n	%
CCEB		
A-B1-B2	33	50.0
C1-C2-D-E	33	50.0
Sex		
Female	29	43.9
Male	37	56.1
IPAQ		
Inactive	14	21.2
Minimally active	18	27.3
Active	21	31.8
Very active	13	19.7
	Mean	SD
Age (years)	17.15	0.49
HAZ	-0.30	0.80
BAZ	-0.04	1.04
Food consumption before the intervention		
Energy (kcal)	2016.2	578.9
NMPF (kcal)	964.9	286.5
PF (kcal)	527.2	153.2
UPF (kcal)	475.9	247.7
Food consumption after the intervention		
Energy (kcal)	1839.1[a]	368.1
NMPF (kcal)	893.0	262.8
PF (kcal)	484.3	208.5
UPF (kcal)	464.3	146.4

CCEB Economic Classification Criteria Brazil; IPAQ International Physical Activity Questionnaire; HAZ Height for Age Z-score; BAZ Body mass index for Age Z scores; NMPF Natural and Minimally Processed Foods; PF Processed Food; UPF Ultra-Processed Food.

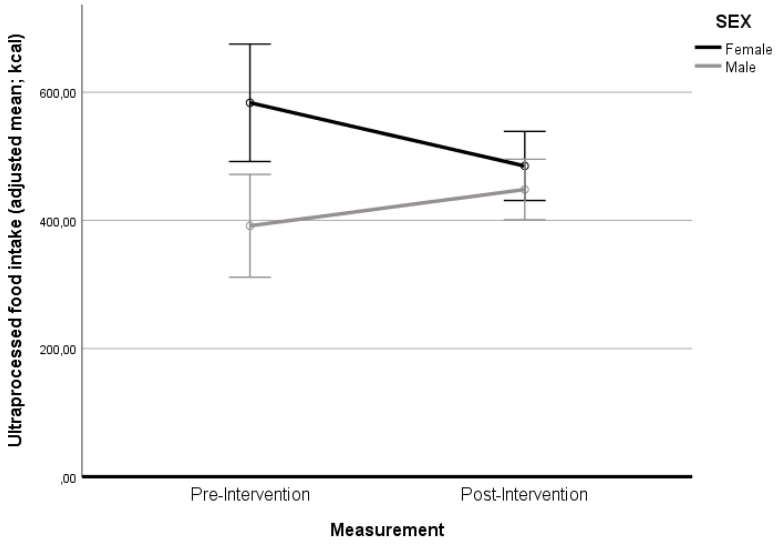
[a] Significantly different from food consumption prior to intervention by the paired (p = 0.02).

Figure 1. Analysis of the interaction of between-subject factors and average food consumption through mixed linear models (n = 66).

A



B



DISCUSSION

The internet-based nutrition education program was able to reduce the total energy consumption among adolescents, without specific changes in the consumption of food classes according to the degree of processing.The reduction in energy intake found in our study is consistent with the study by Kartini et al.[10] which, despite not observing significant changes in food consumption after an Instagram-based intervention, recorded a considerable reduction in energy intake. Additionally, in an earlier study with young gymnasts, Áquilo et al.[11] reported a decrease in energy intake following a nutrition education program, suggesting that these findings may reflect typical behavioral adaptation in this age group. It is also important to consider the possibility of underreporting, especially of unhealthy foods, as suggested by Praxedes et al.[12] which may explain the discrepancy between the reduced energy intake and the maintenance of UPF consumption. Thus, the combination of these factors suggests that the intervention may have indirectly influenced the participants' eating behavior, resulting in lower energy intake.Interactionanalyses revealed that there was a slight increase in NMPF consumption in those in the lowest economic classes and a reduction in UPF

consumption by girls. Access to food and food insecurity can influence dietary patterns, especially in lower economic classes. Studies indicate that people from lower economic classes or in situations of food insecurity are more likely to consume fewer fresh and minimally processed foods due to financial challenges, opting for UPF that are lower in cost and more accessible.[13-18] However, the increase in the consumption of INMP among adolescents from lower economic classes in the study sample may be attributed to the intervention conducted in the clinical trial, which may have played an important role in improving the food choices of this group. This change is particularly significant, considering that the adoption of healthier eating habits can have a positive long-term impact on health.The lower intake of UPF observed among the female participants may be associated with factors related to aesthetic pressures and the development of restrictive eating behaviors, which are often more intense among female adolescents. Studies indicate that these pressures, stemming from body dissatisfaction and the desire to lose weight, are associated with restrictive eating practices.[19,20] Additionally, social influences that reinforce rigid beauty ideals may intensify these tendencies. Such ideals often promote an aversion to foods considered unhealthy, such as UPF,[21,22] which may explain the reduction in the consumption of these foods among the participants.This fact is corroborated by Tallon et al.[23] who suggested the use of technology-based programs to promote dietary changes and provide nutrition information is feasible. The absence of a decrease in the consumption of PF and UPF may be because the intervention was not long enough to promote changes in eating habits.

Behavior repetition is what leads to the formation of new eating habits given that when the behavior is habitual, people need little information to make decisions.[24] In addition, although it was not the objective of the study, the parents were not involved in the intervention and these are key elements for decision-making on food purchase and consumption by adolescents,[23,25] including PF and UPF, which are more practical and increasingly accessible, including for low-income families.[26]Family involvement in nutritional education is essential to promote sustainable changes in adolescents' eating habits. Extending educational materials to parents and guardians could provide a stronger foundation for changes in adolescent eating behavior. Inadequate dietary patterns can be acquired during childhood and adolescence and persist into adulthood, and parents have a significant influence on the food choices of their children and adolescents.[27-30]Including guardians could foster a family environment conducive to better food choices, benefiting the entire family. Furthermore, this type of approach could also help address the growing accessibility and convenience of UPF, which are particularly appealing to low-income families.

CONCLUSIONS

Therefore, the internet-based nutrition education program was effective in reducing total energy consumption in adolescents living in an undeveloped city, but additional studies that improve strategies focused on reducing the consumption of PF and UPF in a lasting way are needed.

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Contributors

De Melo ISV and Bueno NB were responsible for the study concept and design, data analysis and interpretation, and critical review of the manuscript. Santos JVL and Costa CAC were responsible for data acquisition and manuscript preparation. Praxedes DRS, Silva Júnior AE, and Macena ML were responsible for manuscript preparation.

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