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ORIGINAL ARTICLE

VALIDATION OF AN EDUCATIONAL TECHNOLOGY ON HEALTHY EATING AMONG UNIVERSITY STUDENTS

Bruna da Silva Castro[1], Ricardo Amorim de Sousa Garcia[2], Danyelle Cristina Pereira Santos[3], Sara da Silva Penha Ferreira[4], Janaina Maiana Abreu Barbosa[5],Flor de Maria Araújo Mendonça Silva[6], Luís Cláudio Nascimento da Silva[7], Adriana Sousa Rêgo[8], Adrielle Zagmignan[9]

Highlights:
(1) E-book validated with high agreement by students and expert judges.
(2) Educational tool promotes critical thinking on healthy eating habits.
(3) Technology supports self-care and health promotion in university settings.

ABSTRACT

Objective: To validate an educational technology on healthy eating among university students. *Method:* This is a quantitative study, developed at private universities in São Luís-MA from May to October 2022, with three study groups: target audience (n=24), health expert judges (n=22) and communication expert judges (n=13). Data collection from each group was carried out through digital questionnaires produced in Google Forms and was evaluated using a Likert scale. Aspects of content, writing, appearance, motivation, language, graphic illustration, cultural and content adequacy, objective and relevance were evaluated. To validate the e-book, the Content Validity Index (CVI) was used. *Results:* The e-book presented a total CVI of 0.97, a validation index considered adequate. The overall CVI for the target audience was 0.97; for the health expert judges, the content was validated with a CVI of 0.95; and for the communication judges, the CVI was 0.99, indicating a high level of agreement. *Conclusion:* The technology was considered valid by the target audience, health expert judges, and communication judges and can be used as an educational tool, leading the target audience to think more critically and ensuring effectiveness in self-care and health promotion.

Keywords: healthy diet; validation study; nutrition and food programs and policies; student health; educational technology.

[1] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0009-0004-7688-150X
[2] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0001-5194-4835
[3] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0002-8402-9913
[4] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0009-0006-2476-0305
[5] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0001-5263-6586
[6] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0002-2796-0939
[7] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0002-4206-0904
[8] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0002-2494-030X
[9] Universidade Ceuma. São Luís/MA, Brazil. https://orcid.org/0000-0001-9865-2223

INTRODUCTION

The nutritional status of the population has a significant effect on the development of the country, so that eating practices are greatly influenced by nutritional knowledge.[1,2] Overweight and obesity are major public health concerns, mainly because weight gain is an important risk factor for the development of chronic non-communicable diseases (NCDs) and is associated with reduced life expectancy.[3,4] It is alarming how weight gain has increased in prevalence in many countries, reflecting the changes in the global eating model that have occurred in recent decades.[5,6]

Some studies have shown that young adults are more vulnerable to weight gain than any other age group, especially the university population.[7-9] Most university students lead a life that favors the appearance of NCDs due to their dietary choices, especially because the transition from high school to university is a critical period for changes in habits, lifestyle and weight gain.[10,11] Among risk factors in Brazilian university students, a prevalence of 31.1% of excess weight, 27.5% of hypercholesterolemia, 34.8% of sedentary lifestyle and 8.4% of high blood pressure were observed, which are directly linked to the foods consumed.[12]

To reduce risk factors, it is necessary to implement and practice educational programs that are aimed at promoting health and preventing diseases in universities, which are favorable environments for implementing strategies directing students who want and seek better health.[10]

Guiding the population to rethink their habits and giving them a new vision about healthy choices are health education practices that transform their users and encourage changes in behavior.[13] Educational materials, technical manuals, training courses, and professional qualifications have already been implemented by the National Food and Nutrition Policy (PFNP), whose main objective is to inform and encourage healthy habits.[14]

The development and validation of a technology for these purposes will provide the target audience with guidance on these food choices within the university, understanding their benefits and promoting a healthier lifestyle, in addition to enabling the dissemination of information. To this end, the objective of this study was to validate an educational technology on healthy eating among university students.

METHOD

This was a methodological strategy study with a quantitative approach, carried out in higher education institutions located in the city of São Luís, Maranhão, from May to October 2022.

The validated e-book has 26 pages and covers the following topics: obstacles to healthy eating in the university environment, and then addresses the prioritization of natural foods, the importance of reading labels, protein consumption, hydration, and physical activity. It highlights how to prevent obesity and provides some diverse recipes that contribute to a healthy diet. In addition, it provides contact information for scheduling appointments at the outpatient clinics at Ceuma University, which offers services with a multidisciplinary team. This e-book is available in the Ceuma library with the ISBN: 978-65-89907-06-0.

For the groups that participated in the validation of the e-book entitled “E-book More Health”, three distinct groups were selected, called “target audience” (referring to university students), “expert judges in the health área,” and “expert judges in the communication area” (Figure 1).

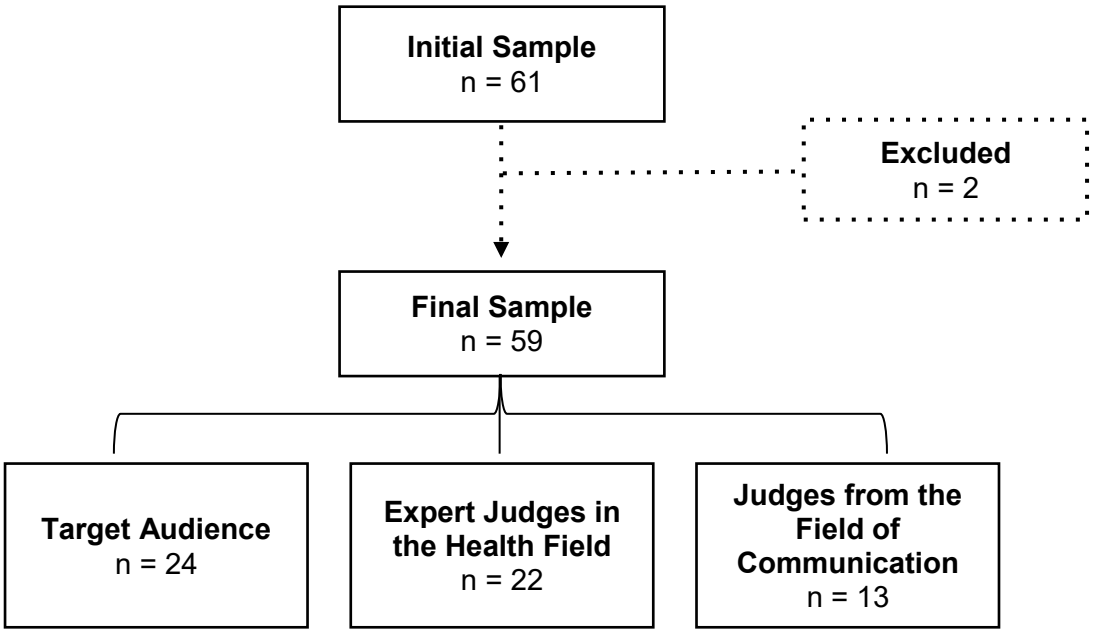

Figure 1 – Sample Selection Flowchart

As an inclusion criterion, the target audience group was formed by convenience, by university students duly enrolled in the following undergraduate courses: nutrition, medicine, nursing, physiotherapy, and law. For the group of judges specialized in the health area, the following aspects were adopted: having at least a master's degree in the health area, having scientific Productions, and having at least three years of experience in higher education institutions. The group of judges from the communication area was composed of individuals who should work in some of the following areas: social communication, graphic design, visual arts, marketing, and/or education, considered important for the evaluation of appearance, graphics, layout, visual communication, information layouts, and expressive language of the material. As exclusion criteria, incomplete completion of the data collection instrument, failure to meet the aspects mentioned for each group, and a return period of more than 30 days were used.

The sampling for the target audience groups and expert judges in the health area was calculated using the formula $n = Za^2.P(1-P)/e^2$, obtaining, from this, the value of 22 minimum participants from each group, using the following parameters: Za (confidence level) = 95%; P (proportion of agreement) = 85%; e (admitted difference) = 15%.[15] The group of judges from the communications area was selected using a "snowball" sample, which is a convenience sample commonly used when the population is made up of individuals with characteristics that are difficult to find according to the selection criteria.[16]

Data collection from each group was carried out using the Suitability Assessment of Materials (SAM) questionnaire, which assessed content, writing style, graphic illustration, presentation, motivation, and cultural suitability, applied in Google Forms, which were sent electronically on social networks and were evaluated using a Likert scale, a tool used to measure the agreement of individuals on a given study, with values from 1 to 4, with 1 being totally adequate, 2 being adequate, 3 being partially adequate, and 4 being inadequate.[17]

The e-book evaluation instrument was divided into two stages. The first stage consisted of questions to collect information about the groups, in order to characterize them in terms of identification data: gender, course, and period enrolled for the target audience; age, gender, profession, time since graduation, time working in the area, degree, and scientific production for judges specialized in the health area; and gender, profession, and time working in the area for judges in the area of communication. The second stage included questions regarding the e-book of guidance

for university students on healthy eating, according to the specificities of each group. Aspects regarding content, writing, appearance, motivation, language, graphic illustration, cultural and content adequacy, objective, and relevance were evaluated. At the end of each evaluation block, a blank space was made available for the judges to justify their answers or propose suggestions.

For the items evaluated in the e-book to be validated, the Content Validity Index (CVI) was used, considering an item validated when it presented a value equal to or greater than 0.79, a value recommended by the literature as a cut-off point when more than six people respond to the questionnaire. [16,17] The calculation of the individual CVI for each question was performed by adding the answers 1 and 2 for each item evaluated in the e-book, and this sum was divided by the total number of individuals who responded to the questionnaire in their respective group. To calculate the CVI for each aspect evaluated in the e-book, the individual CVIs were added and divided by the number of questions for each aspect. To arrive at the overall CVI, the CVIs for all aspects evaluated were added and divided by the number of aspects evaluated. Items 3 and 4 were eliminated or revised and validated when suggestions for changes were presented.[16] The agreement analysis considered the calculation of the percentage of scores obtained equal to or greater than 60%. The scores were calculated using the Statistical Package for the Social Sciences (SPSS) statistical program, version 20.0.

The results were organized and tabulated in Microsoft Excel version 2016, and the demonstration of the results obtained was presented in tables. The research was approved by the Research Ethics Committee (CEP) of Ceuma University, under opinion number 5,328,956. The individuals were informed of the objectives and protocols of the research through the Free and Informed Consent Form (FICF), as proposed in Resolution No. 466/12, previously sent through the Google Forms tool. Those who agreed to participate in the research went on to the stage of viewing and reading the e-book and finished by answering the questionnaire.

RESULTS

Twenty-four university students participated in the educational technology validation process, of whon 96% were female, and the average age was 22 years old (SD = 1.5). Regarding the undergraduate course, 71% were studying nutrition, 13% medicine, 8% nursing, 4% physiotherapy, and 4% law. Of these university students, 83% were in the 8th period, 13% in the 1st period, and 4% in the 6th period of their respective courses.

According to the aspects evaluated by the target audience regarding content, writing, appearance, and motivation, the e-book was successfully validated, presenting an overall CVI of 0.97. None of the items were considered inadequate by the university students and presented CVI per response ranging from 0.87 to 1. When evaluated by the aspect of each block of questions, the CVI varied between 0.94 and 0.99, placing it within the validation parameters. Regarding the aspect related to the motivation of the e-book, three items were scored as partially adequate, but no comments were mentioned or any type of change was requested (Table 1).

Table 1 – Level of agreement of the target audience regarding the validation criteria. São Luís, Maranhão, Brazil, 2022. (n=24)

	Totally suitable	Adequate	Partially adequate	CVI %
1 – Regarding the Content of the More Health e-book				**0,98**
1.1 The content sequence is adequate	0,79	0,20	-	1
1.2 The material is easy to understand	0,83	0,16	-	1
1.3 Information is presented clearly and objectively	0,79	0,16	0,04	0,95
2 – Regarding the Writing of the More Health e-book, answer:				**0,97**
2.1 The letters are in an appropriate size	0,70	0,25	0,04	0,95
2.2 The letters have an appropriate shape	0,70	0,25	0,04	0,95
2.3 The text is easy to understand	0,87	0,12	-	1
2.4 The text is interesting	0,75	0,25	-	1
3 – Regarding the appearance of the More Health e-book, answer:				**0,99**
3.1 The cover catches your eye	0,70	0,25	0,04	0,95
3.2 The images are easy to understand	0,87	0,12	-	1
3.3 The images are self-explanatory	0,62	0,37	-	1
3.4 The e-book looks organized	0,79	0,20	-	1
3.5 Images serve to complement the text	0,75	0,25	-	1
4 – Regarding the Motivation of the e-book More Health, answer:				**0,94**
4.1 In your opinion, any university student who reads the e-book will understand what it is about	0,79	0,16	0,04	0,95
4.2 You felt motivated to read the e-book until the end	0,70	0,16	0,12	0,87
4.3 The educational material covers the topics needed by university students who want to change their eating habits.	0,83	0,12	0,04	0,95
4.4 The educational e-book motivated you to think about healthy eating among university students	0,87	0,12	-	1
		CVI GLOBAL	**0,97**	

Legend: CVI- Content Validation Index

Regarding the health specialist judges, 23 volunteers participated in the survey, of which 74% were female. Regarding the area of expertise, 26% were nutritionists, 22% biomedical scientists, 13% biologists and 17% represented other areas (medicine, physiotherapy and psychology). Regarding the length of service, 30% had between 9 and 14 years of experience, 17% between 15 and 20 years and 9% between 21 and 25 years of experience in the health area.

Based on the responses to the questionnaires, none of the items evaluated by the health care expert judges were considered inadequate. In the evaluation of this group, an overall CVI of 0.95 was obtained, achieving and validating the proposed objective. Regarding the aspects evaluated in each block of questions, it was observed that the CVIs varied between 0.95 and 0.96. However, it was observed that, in item 3.5, the value obtained for the individual CVI was below the others (0.86), although within the estimated value for validation, being pertinent to observe and correct according to the suggestions of the evaluators, of which 3 judges considered it partially adequate (Table 2).

Table 2 – Level of agreement of health expert judges regarding the validation criteria. São Luís, Maranhão, Brazil, 2022. (n=22)

	Totally suitable	Adequate	Partially adequate	CVI %
1 – Refer to the purposes, goals or ends that you want to achieve by using the e-book				**0,96**
1.1 They are consistent with the needs of university students	0,65	0,30	0,04	0,95
1.2 Promotes change in behavior and attitude	0,39	0,56	0,04	0,95
1.3 Can it circulate in scientific circles in the area of obesity, healthy eating among university students or related topics?	0,78	0,17	0,04	0,95
1.4 Meets the goals of those looking for a healthy diet	0,69	0,26	0,04	0,95
1.5 They are consistent from the point of view of a healthy diet	0,69	0,30	-	1
2 – Refers to the way in which the guidelines are presented. This includes their general organization, structure, presentation strategy, coherence and formatting.				**0,95**
2.1 The e-book is suitable for university students who aim to eat healthily	0,69	0,26	0,04	0,95
2.2 Messages are presented in a clear and objective manner	0,78	0,13	0,08	0,91
2.3 The information presented is scientifically correct	0,60	0,39	-	1
2.4 The material is appropriate to the sociocultural level of the proposed target audience	0,78	0,21	-	1
2.5 Logical sequences of the proposed content	0,78	0,13	0,08	0,91
2.6 The information is well structured in terms of agreement and spelling	0,69	0,21	0,08	0,91
2.7 The writing style corresponds to the level of knowledge of the target audience	0,73	0,26	-	1
2.8 Information on the cover, back cover, summary, acknowledgements and/or introduction is consistent	0,73	0,21	0,04	0,95
2.9 The title and topic sizes are appropriate	0,78	0,13	0,08	0,91
2.10 The illustrations are expressive and sufficient	0,73	0,17	0,08	0,91
2.11 The page number is correct	0,69	0,30	-	1
3 – Refers to the characteristic that evaluates the degree of significance of the educational material presented.				**0,95**
3.1 The themes portray key aspects that should be reinforced	0,78	0,21	-	1
3.2 The e-book allows the transfer and generalization of learning	0,73	0,26	-	1
3.3 The e-book proposes ways for university students to achieve a healthy diet	0,78	0,17	0,04	0,95
3.4 The e-book covers topics that university students need to know about healthy eating.	0,65	0,30	0,04	0,95
3.5 It is suitable for use by any college student who wants to change their habits.	0,73	0,13	0,13	0,86
		CVI GLOBAL		**0,95**

Legend: CVI - Content Validation Index

Regarding the communications judges, 13 professionals from the area participated, among whom 54% were male. In this group, 38% were from the marketing and advertising area; 31% were journalists; 23% were graphic designers; 8% were marketing technicians. Regarding the time working in the area, 38% had between 1 and 5 years of work, 23% had between 6 and 10 years of work; 8% had

between 11 and 15 years of work, as well as those in the 16 to 20 years group, and 23% had more than 20 years of work in the area.

Based on the responses of the communication judges, it was observed that, regarding the aspects of content, language, motivation and cultural adequacy, the CVI was unanimous, reaching a maximum value of 1. Only item 3.2, when evaluated individually, obtained an IVC of 0.92, in which there was disagreement by one judge, but without taking it out of the validation parameters. None of the items were judged as inadequate by the communication judges, reaching an overall IVC of 0.99 and, consequently, considering the e-book valid (Table 3).

Table 3 – Level of agreement of experts in the area of communication and marketing regarding the validation criteria. São Luís, Maranhão, Brazil, 2022. (n=13)

	Totally suitable	Adequate	Partially adequate	CVI %
1 – Regarding the content of the e-book, answer:				**1**
1.1 The objective is clear, facilitating the prompt understanding of the material	1	-	-	1
1.2 The content covers information related to behaviors that help prevent complications from an unhealthy diet.	1	-	-	1
1.3 The proposed material is limited to the objectives, so that the viewer can reasonably understand it in the time allowed.	0,92	0,07	-	1
2 – Regarding the Language of the More Health e-book, answer:				**1**
2.1 The reading level is suitable for university students to understand	0,76	0,23	-	1
2.2 The conversational style makes it easier to understand the text	0,69	0,30	-	1
2.3 Vocabulary uses common words	0,69	0,30	-	1
3 – Regarding the graphic illustrations of the More Health e-book, answer:				**0,96**
3.1 Does the cover attract attention and portray the purpose of the material?	0,92	0,07	-	1
3.2 Illustrations present key visual messages so that the reader can understand the main points on their own, without distractions.	0,76	10,15	0,07	0,92
4 – Motivation				**1**
4.1. There is interaction between the text and/or figures and the reader, leading them to solve problems, make choices and/or demonstrate skills.	0,84	0,15	-	1
4.2 Desired behavior patterns are modeled or well demonstrated	0,84	0,15	-	1
4.3 There is motivation for self-efficacy, that is, people are motivated to learn because they believe that tasks and behaviors are feasible.	0,76	0,23	-	1
5 – Regarding the Cultural Adequacy of the Mais Saúde E-book, answer:				**1**
5.1 The material is culturally appropriate to the logic, language and experience of the target audience	0,92	0,07	-	1
5.2 Presents culturally appropriate images and examples	0,84	0,15	-	1
		CVI GLOBAL	**0,99**	

Legend: CVI- Content Validation Index

Regarding the comments mentioned by the three research groups at the end of each block of questions, analyses and corrections were made to improve the e-book. The main suggestions made were: inclusion of references in the text and formatting. When asked about the unity of meaning, there was unanimous praise for both the content and the illustrations of the e-book (Frame 1).

Frame 1 – Some modifications made to the Mais Saúde E-book based on suggestions from the target audience and expert judges and the groups' opinions

Group suggestions	**Modifications made**
Inclusion of the Food Guide for the Brazilian population	Inclusion of QR Code directing users to the Food Guide for the Brazilian population
Ministry of Health 2014	Inclusion of the link to access information regarding
References used throughout the text and images	Inclusion of references to both texts and references
Formatting	e-book Standardization
Unity of meaning	**Groups' Opinion**
Characteristic that assesses the degree of significance of the material	*"Very important for the academic environment and also for society" (health specialist judge 1)*
Regarding the graphic illustrations of the e-book	*"Good illustrations, good colors and they follow a pattern" (communication judge 1)*
Regarding the content of the e-book	*"For the purpose proposed by the work, it is adequate" (communication judge 2)*
Referring to the purposes, goals or ends you wish to achieve	*"Good illustrations, good colors and they follow a pattern" (health expert judge 2)*
Regarding the appearance of the e-book	*"Educational and easy-to-understand content! The use of images and graphics facilitates understanding of the topic covered" (university student 1)*
Regarding the content presented	*"Important in food education" (university student 2)*

DISCUSSION

The e-book is a teaching tool that can be used to stimulate nutritional education actions and promote behavioral change.[17] In the present study, an educational technology on healthy eating among university students was validated in the e-book format called "More Health e-book", achieving satisfactory IVCs (0.97) and being capable of distribution to the target audience.

In the active search for data, it was not possible to find any validated educational material aimed at eating habits for university students. However, it has been shown that the period of entry into university has been related to negative changes in the eating habits of young people.[18–20] It is also worth noting that the first years at university are associated with weight gain and an increased prevalence of overweight and obesity, increasing the potential risk of the onset of chronic diseases.[21]

Therefore, this moment represents an important period for the development of interventions to promote health, through educational tools.[17-18] The incentive to adjust modifiable risk factors, those that can be corrected with a change in behavior, is an ally in the fight against NCDs.[18]

The Ministry of Health recommends the dissemination and creation of educational plans that guide and raise awareness among the population regarding healthy eating, since NCDs are in the spotlight, representing future challenges for health managers in combating morbidity and mortality in the affected population. In this context, educational technologies, such as the "Mais Saúde E-book", have proven to be effective in promoting health, improving patients' knowledge and helping them understand how their choices affect their health.[17]

To develop quality materials, the validation stage needs to be thorough and requires the application of effective evaluation methods, such as the IVC. Other studies that validated educational materials are described in the literature and, in particular, used the IVC as a tool to validate content, appearance, writing, motivation and other items.[15-17,22]

The submission of educational technology to this stage was based on the principle of evaluating and legitimizing its credibility before disseminating it to the target audience, reinforcing the importance of the gradual construction of adequate material.[17,22]

In this study, the university audience evaluated the e-book positively and considered it motivating, explanatory and interactive. The inclusion of this audience in the validation process allowed an active contribution regarding their interests in identifying with the content, observing their own desires and ensuring a reliable suitability of the material for the population seeking a healthy diet.[16,22]

Furthermore, the validation process, by involving multidisciplinary groups, shows credibility and favorable aspects, as it brings together various specialized knowledge in the subjects addressed, being a factor observed in other validation studies.[16,23,24].

Although the overall CVI of the e-book was satisfactory in the study, the judges pointed out suggestions and possible changes in order to contribute to improving the final version of the material, such as the inclusion of a food guide for the Brazilian population. This guide presents in an uncomplicated way the degree of food processing, the food groups and the 10 steps for a healthy diet.[16,25]

It is important to mention the limitations of the study, among which we can highlight the difficulty in recruiting judges from the communications area according to the pre-determined sample size. Some, despite being part of various sectors of communications, did not show availability or interest in participating. Furthermore, the delay in returning to view the e-book and accessing the questionnaire made it difficult to improve the material in its validation and final version.

Despite this, the e-book is considered an instrument that guides and offers information that can lead to a change in behavior regarding university students' food choices. In addition, it offers the support of qualified professionals for individualized care at the university where the research was conducted.

CONCLUSION

The E-book entitled "More Health e-book", in its final version, proved to be appropriate and successfully validated for use within universities, giving users the possibility of self-evaluating and questioning their food choices, encouraging new eating habits.

In addition, the development of this e-book highlights the importance of submitting educational technology to a validation process. In view of this, it is important to point out that, taking into account suggestions and observations presented by the research groups, corrections were made to make the teaching material even though it achieved IVCs and a degree of agreement with sufficient values to declare it valid and suitable for its applicability within the university environment.

It is believed that this educational material is a tool or resource to encourage changes in behavior and the dissemination of information about the best food choices inside and outside the university, allowing a reflection on the current lifestyle and diet and the adoption of new habits.

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Authors' contributions	
Bruna da Silva Castro:	Data curation; Formal analysis; Investigation; Validation; Visualization; Writing – original draft.
Ricardo Amorim de Sousa Garcia:	Data curation; Formal analysis; Investigation; Validation; Visualization; Writing – original draft.
Danyelle Cristina Pereira Santos:	Data curation; Formal analysis.
Sara da Silva Penha Ferreira:	Data curation; Formal analysis.
Janaina Maiana Abreu Barbosa:	Conceptualization; Data curation; Formal analysis; Project administration; Writing – review & editing.
Flor de Maria Araújo Mendonça Silva:	Conceptualization; Data curation; Formal analysis; Project administration; Writing – review & editing.
Luís Cláudio Nascimento da Silva:	Conceptualization; Data curation; Formal analysis; Project administration; Writing – review & editing.
Adriana Sousa Rêgo:	Conceptualization; Data curation; Formal analysis; Project administration; Writing – review & editing.
Adrielle Zagmignan:	Conceptualization; Data curation; Project administration; Resources; Supervision; Writing – review & editing.
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Corresponding author:	Adrielle Zagmignan Universidade Ceuma R. Anapurus, 1 – Renascença II, São Luís/MA, Brazil. ZIP CODE 65075-120 adrielle004602@ceuma.com.br
Editor-in-chief:	Adriane Cristina Bernat Kolankiewicz. Ph.D

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