

SCHOOL-BASED INTERVENTION TO IMPROVE DIETARY QUALITY OF MID-MORNING SNACKS: A STUDY PROTOCOL

INTERVENÇÃO ESCOLAR PARA MELHORAR A QUALIDADE ALIMENTAR DOS LANCHES DA MANHÃ: UM PROTOCOLO DE ESTUDO

A.O.
ARTIGO ORIGINAL

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ABSTRACT

Schools appear to be a key place to develop healthy eating habits. Currently in Portugal there is no mandatory legislation regarding school mid-morning snacks, allowing the children to bring all types of foods from home. This study aims to assess the effects of a school-based intervention in the dietary and nutritional quality of mid-morning snacks among children of São Miguel Island, Azores.

The protocol describes the design of a quasi-experimental study that will include children attending second grade. The intervention involves children, school and family and will consist of two main components: i) a dietary education component through a storybook; and ii) dietary evaluations of mid-morning snacks brought from home during the intervention. The effects will be evaluated through assessment of the dietary quality of mid-morning snacks converted into a nutritional traffic-light label. To measure children's nutrient intake an electronic database, including the Portuguese Food Composition Table will be used. Data on mid-morning snacks foods will be collected pre- and post-intervention.

Through the implementation of this school-based intervention that involves children, their parents and teachers we expect to improve children's food choices in mid-morning snacks. Ultimately, it is expected that these findings will contribute to the short- and long-term development of future dietary interventions in schools.

KEYWORDS

Childhood, Dietary education, Eating habits, Mid-Morning snack

RESUMO

A escola tem sido considerada um local privilegiado para a aquisição de hábitos alimentares saudáveis. Atualmente, em Portugal, não existe legislação obrigatória referente ao lanche da manhã realizado na escola, possibilitando que as crianças consumam qualquer tipo de alimento trazido de casa. Este estudo tem como objetivo avaliar os efeitos de um programa de educação alimentar na qualidade alimentar e nutricional dos lanches da manhã em crianças da ilha de São Miguel, Açores.

O protocolo descreve o desenho de um estudo quase-experimental que irá incluir crianças do segundo ano de escolaridade. A intervenção envolverá as crianças, a escola e as suas famílias, e consiste em dois eixos principais: i) inclusão da educação alimentar no currículo escolar, através da leitura de um livro de histórias; e ii) avaliações qualitativas dos lanches da manhã durante a intervenção. A avaliação da qualidade alimentar dos lanches será realizada utilizando um semáforo nutricional. A avaliação da qualidade nutricional será realizada através de uma base de dados eletrónica, que incluiu a Tabela Portuguesa de Composição dos Alimentos. A recolha de dados será realizada nos momentos pré- e pós-intervenção.

Espera-se que a implementação deste programa de educação alimentar possibilite a melhoria das escolhas alimentares das crianças no lanche da manhã, em resposta a uma intervenção que envolverá as crianças, os seus pais e professores. Em última instância, espera-se que os resultados possam contribuir para a definição de futuras políticas alimentares e nutricionais, em contexto escolar, a curto e longo prazo.

PALAVRAS-CHAVE

Infância, Educação alimentar, Hábitos alimentares, Lanche da manhã

INTRODUCTION

Childhood overweight (pre-obesity and obesity) is a serious public health problem that has tripled in prevalence in many countries worldwide since the 1980s (1). According to the results from the Portuguese National Food, Nutrition and Physical Activity Survey 2015–2016 (IAN-AF 2015–2016 Survey), one-quarter of children were overweight. Particularly, the Azores showed the highest prevalence of overweight among the population under 18 years old (31.5%) (2). More recent findings from the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative 2022 indicate that 31.9% of Portuguese children aged between 6 and 8 years old were overweight (3). The same trend was observed in the Azores (43.0% of overweight, of which 22.8% of children were obese). Despite its reduction between 2008 and 2019, Portugal presented an increase in childhood overweight in 2022, with a higher average than that observed in the WHO European Region (3).

An active and healthy lifestyle, including a balanced diet, are essential in maintaining good health and prevent childhood overweight. The consumption of nutritionally and energetically balanced snacks between meals (i.e., mid-morning and mid-afternoon) is described as a typical meal pattern of a healthy population. Snacking is frequently defined as food consumed between meals and may contribute to achieve the recommended intake of healthy foods such as milk and fruit, as well as the ingestion of vitamins, minerals, and fibre (4). However, is typically seen as consumption of high-energy, low-nutrient-density foods such as sweet snacks, chips, cookies, and sugar-sweetened beverages (4, 5). According to the IAN-AF 2015–2016 Survey, approximately 78% of children between 3 and 9 years old consume a mid-morning snacks (MMS) (2). The evidence shows that MMS provides more than a quarter of the total energy intake in Portuguese children (6, 7). It is usually characterised by low consumption of fruit and vegetables and high consumption of milk and dairy products, sweet snacks, bread, and breakfast cereals (6-9).

School-based interventions that promote the modification of children's food environments are effective in improving their eating habits in the short- and long-term (10). The inclusion of multicomponent interventions such as parental, teacher and school staff involvement, as well as the promotion of school gardens, cooking lessons, the use of mascots/ cartoon characters in food, and the use of appealing packaging to promote healthy foods seem to have a greater impact on the effectiveness of dietary interventions (11).

In Portuguese preschools and elementary schools' children do not have access to school buffets/cafeterias. Thus, most foods consumed at MMS or mid-afternoon snacks are brought from home or provided by school meal programs such as milk, fruit, and vegetables. Currently there is no legislation regulating school snacks brought from home despite the availability of some framework documents (12-14). This lack of regulation

allows children to bring all types of foods and beverages to school.

To our knowledge, scientific evidence on school-based interventions to improve the dietary and nutritional quality of MMS among Portuguese children remains limited and have not been investigated in the Azores.

OBJECTIVES

The main aim of this study is to assess the effects of a school-based intervention on the dietary and nutritional quality of MMS among children in second grade at São Miguel Island, Azores.

METHODOLOGY

Study Design

This is a quasi-experimental study with a pre- and post-intervention design to evaluate the effects of a school-based intervention on the dietary and nutritional quality of MMS over children in the second grade (aged 7 and 8 years old). This study will be conducted in all elementary public schools in São Miguel Island, Azores, Portugal.

Participants

Located in the Azores archipelago, the São Miguel Island is the biggest of nine islands and has the largest young population (15). São Miguel's School Network comprises 76 public elementary schools (6 to 9 years old) and a total of 5500 students (16).

In the Portuguese education system children attending second-grade are typically aged 7 years old. In this grade, children have the ability to read and understand information concerning behaviours and daily activities. The acquisition of knowledge about the digestive system and the influence of food on daily life is included in the school curriculum (17). These points were considered when choosing the inclusion of second-grade students.

Selection Criteria

Participants who meet the inclusion criteria (attendance of second grade in public schools, absence of school interventions promoting healthy lifestyles, and informed consent provided by parents or caregivers) will be eligible.

Overview of the school-based intervention

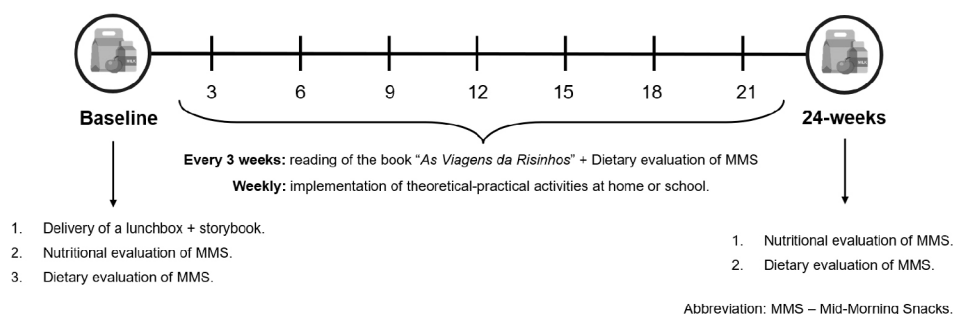
Intervention

This study will explore the effectiveness of conducting a dietary intervention in elementary schools and its potential to improve the dietary and nutritional quality of children's MMS. To achieve this, nutrition education will be implemented by trained teachers and the intervention will focus on two main axes: (1) a dietary education component through a storybook and (2) qualitative evaluations of MMS brought from home during the intervention.

The total duration of the intervention will be 24 weeks, and results will be measured pre- and post-intervention (Figure 1).

Figure 1

Study design



Teachers Training

Training will be delivered to ensure the acquisition of knowledge to carry out the dietary education component. All teachers from eligible classrooms will receive a 4-hour online training in order to implement all the activities and perform the evaluation of snacks during the intervention period. This approach will be complemented with the delivery of a guide to perform MMS evaluations and weekly contacts of teachers from the research team to address any questions. The training topics are based on the content included in the intervention, indicated in Table 1.

Axis 1 - Dietary Education Component

This axis focuses on the inclusion of dietary education in the school curriculum through a storybook. The main purpose is to improve participants' knowledge and behaviours about the composition of a healthy MMS.

The storybook was chosen as the main strategy to deliver the intervention given its ease-to-convey messages and exposure of healthy foods to children through images (18). Also, it's a material that can be used in school as a teaching manual. In fact, the storytelling has been shown helpful in promoting students' global development such healthy eating habits, when included in curricular activities (19). Furthermore, storybook can be utilized as a tool to promote healthful behaviours among parents and families once it's a creative modality to influence behaviours and attitudes through theoretical-practical activities related to food (18).

The storybook was developed by dietitians and nurses from the departments of nutrition and school health of the São Miguel Island Health Unit. The illustrations were created by an illustrator, and the graphic design was developed by a marketing firm. Finally, the prototype was revised by the Faculty of Social Sciences and Humanities of University of the Azores to ensure the age-appropriateness of the content.

The book named "As Viagens da Risinhos" (20) is an instrument composed of theoretical content (eight book chapters) and theoretical-practical activities (food education activities adjusted to each chapter) developed to amplify the messages from the storyline.

Each chapter works as a dietary module based on three main food groups according to the Portuguese food guide (21, 22): (i) milk and dairy products; (ii) fruit; and (iii) cereal and cereal products (bread, cookies, and breakfast cereals). The chapters will be read by the responsible teacher in the classroom every three weeks and food education activities will take place weekly at home and at school. This ensures that every week there will be an activity (food education sessions or theoretical-practical activities at home and at school) as recommended in the literature, fostering the acquisition of knowledge and change in children's behaviours (23). More information about the contents is included in the storybook is shown in Table 1.

Axis 2 – Qualitative evaluation of mid-morning snacks

This axis works in parallel with the dietary education component. Children's MMS will be evaluated every three weeks during the intervention by the responsible teacher.

During the intervention period, the responsible teacher will receive a notification from the research team about the day when the dietary assessment should be carried out. Without prior announcement, the MMS foods that each participant brought to school will be recorded in a specific grid developed for this purpose. The analysis of the dietary quality of snacks will be carried out by the researchers. The result of these evaluations will be delivered to students and then to parents through a sticker based on a nutritional traffic-light label (more details in section Qualitative Evaluation). The received sticker will be attached to the last page of the storybook, where children and parents will be able to check their progress throughout the intervention.

Table 1

Overview of the contents included on storybook "As Viagens da Risinhos"

NUTRITION CHAPTER	CONTENTS	ACTIVITIES
Chapter 1 – "O Planeta BaLanSa"	<ul style="list-style-type: none">• Definition of MMS.• Definition of the common food groups in MMS: milk and dairy, fruit, and cereal.• Characters presentation.	School: Link the characters (guardians) to their food groups. Home: Review the book chapter and explain to the family who the characters are and their roles.
Chapter 2 – "Risinhos Escolhe Branco"	<ul style="list-style-type: none">• Recommended milk and dairy food portions and equivalents.• Nutritional value and health benefits of milk and dairy food portions and equivalents.• Practical pointers for increasing the intake of the milk and dairy food portions and equivalents.	School: Identify which dairy products should be promoted and limited in the daily diet. Home: Select and colour the healthy dairy products with parents. Create a list of favourite healthy dairy products.
Chapter 3 – "Deserto de Sabores"	<ul style="list-style-type: none">• Recommended fruit daily food portions.• Definition of fruit juice and other drinks.• Definition of added sugars.	School: Colour the number of squares according to the sugar content of different drinks. Home: Identify the three most consumed drinks at home. Colour the number of squares with the sugar content corresponding to each of these drinks.
Chapter 4 – "O Poder da Fruta"	<ul style="list-style-type: none">• Recommended fruit daily food portions.• Nutritional value and health benefits of fruit.• Practical pointers for increasing the intake of fruit.	School: Create the "fruit day" once in a week in the classroom. Home: Using an alphabet soup, identify 14 fruits that can be incorporated into your daily snack.
Chapter 5 – "O Castelo Grãos"	<ul style="list-style-type: none">• Recommended cereal' daily food portions and equivalents.• Types of cereal.• Definition and types of bread.• Nutritional value and health benefits of bread.• Practical pointers to choose a healthier bread.	School: Identify and link the healthiest breads to the "eat more often" option and less healthy breads to the "less often" option. Home: Identify and link the healthiest fillings to the "eat more often" option and less healthy toppings to the "less often" option.
Chapter 6 – "O Túnel Secreto"	<ul style="list-style-type: none">• Definition and types of cookies.• Practical pointers to choose healthier cookies.	School: Evaluate with the teacher the nutritional quality of the cookies they brought on the day of reading the chapter. Home: Cook with parents one of the three cookie recipes provided by the project team. Bring them to school to share with classmates.
Chapter 7 – "Entre Grãos"	<ul style="list-style-type: none">• Definition and types of breakfast cereals.• Practical pointers to choose healthier cereals.	School: Identify in the classroom the cereals with <15 g of sugar. Home: Identify the breakfast cereals most consumed at home and evaluate them using a nutritional traffic-light label.
Chapter 8 – "A Chegada"	<ul style="list-style-type: none">• Importance of nutritionally balanced MMS.• Sustainable MMS.	School: Make a drawing about the end of the story. Home: Create a weekly MMS menu with parents.

MMS: Mid-Morning Snacks

Data Collection

Prior to the implementation of the intervention, the evaluation of the dietary and nutritional quality of MMS will be performed. During the intervention only the dietary quality of MMS will be carried out. At the end of the intervention 24-weeks' time point, a new evaluation of the dietary and nutritional quality of MMS will be performed. The dietary quality of the MMS will be performed as a qualitative evaluation and nutritional quality as a quantitative evaluation.

a) Qualitative Evaluation

Dietary data will be collected by the teacher through recording the foods that the children brought for their MMS. Each food will be categorized into three food groups as established by the Directorate-Regional and Directorate-General for Education guidance for school buffets: 'foods to promote', 'foods to limit' and 'foods to avoid' (12, 14). The global result of the MMS evaluation will be based on a nutritional traffic-light label, in agreement with the three food groups aforementioned: Healthy (green sticker): all foods brought to the MMS are classified as 'foods to promote'; Can be healthier (yellow sticker): at least one food brought to the MMS is classified as a 'food to limit'; and Not healthy (red sticker): at least one food brought to the MMS is classified as a 'food to avoid' (more information about the foods in Table 2).

b) Quantitative Evaluation

Nutritional data will be collected by the research team through an instrument designed for the purpose which allows obtain detailed information about the food to convert into nutrients. Food portions will be estimated by using a detailed description and quantification of all foods and beverages in the meal, a predefined household measure list, standard units and a photographic method for foods that are not on the list or with various standard weights.

The estimation of children's nutrient intake will be made through an electronic platform to convert foods into energy (kcal) and nutrients

[protein (g), total fat (g), saturated fat (g), total carbohydrates (g), free sugars (g), added sugars (g), fibre (g) and sodium (mg)]. This platform includes the Portuguese Food Composition Table (24) and the European Food Information Resource (EuroFIR) network databases (25), which were previously updated for the IAN-AF 2015/2016 Survey (26). For missing foods direct analyses of available information from nutritional declarations on food labels will be used.

Study Design Assessment

The evaluation of this school intervention will be defined as an instrument to reflect on the methodology used and ensure its continuous improvement. To achieve this, process and success indicators were defined to evaluate the results (Table 3).

DISCUSSION OF THE RESULTS

Despite the national decrease in the prevalence of childhood overweight between 2008 and 2019, the findings from COSI Portugal 2022 in the Azores emphasize that overweight remains a worldwide public health problem that requires the development and implementation of preventive actions (3). School-based interventions have been identified as a vital strategy in the prevention of obesity by targeting a change in obesity-related behaviours in children (27). To date, different types of interventions supported by multicomponent approaches have shown an improvement of the quality of the diet in children (10, 28). However, data on the effectiveness of interventions to improve the nutritional and dietary quality of MMS is lacking.

This study protocol describes the planning process and design of a 24-week school-based intervention. The intervention uses a combination of strategies such as teachers and parents' involvement, incorporation of dietary education curricula, in-class material (storybook, posters, theoretical-practical activities, videos, mascots) and development of motivational strategies (e.g., stickers) to facilitate the acquisition of nutrition-related knowledge and to promote changes in dietary

Table 2

Food items classification

TO PROMOTE	TO LIMIT	TO AVOID
Water	Fruit Nectar	Sweets and cakes
Milk or plant-based drinks sugar-free	Loaf bread	Salty and sugar cookies
Yogurt	Butter	Soft drinks
Fresh fruit	Jam/marmalade	Flavoured milk or sweetened plant-based drinks
Bread	Cookies (such Marie biscuit, water and salt or cream-cracker)	Croissant and brioche bread
Cheese		Charcuterie products
Peanut butter		Chocolate cereal bars
Breakfast cereals, corn/rice tortilla and toasts		Chocolate filling
Nuts and seeds		Candy

Table 3

Process and Success Indicators

	PROCESS INDICATOR(S)	SUCCESS INDICATOR(S)
Evaluate the dietary and nutritional quality of participants' MMS at pre- and post-intervention.	% of snacks evaluated (dietary and nutritional quality) at pre-and post-intervention.	% of participants with a nutritionally balanced MMS at pre- and post-intervention. % of participants with foods to promote in MMS at pre- and post-intervention.
Monitor the dietary quality of participants' MMS during the implementation.	% of MMS evaluated through evaluation grid during implementation.	% of participants with a nutritionally balanced MMS during implementation. % of participants with foods to promote in MMS during implementation.
Raise awareness among participants about the adoption of a nutritionally balanced MMS.	N of food education activities carried out in the classroom. N of food education activities carried out at home.	N of food education activities completed in the classroom. N of food education activities completed at home.

MMS: Mid-Morning Snacks

N: Number

behaviours (27). All the material was developed by a multidisciplinary team of dietitians, nurses, and teachers based on scientific information, and reviewed to ensure a grade-appropriate intervention.

There are several strengths to the current study. Firstly, this school-based intervention is a comprehensive, multicomponent, and multilevel approach based on a solid theoretical framework, as evidence suggests, that ensure a more effective intervention. In particular, the inclusion of a dietary education component in the school curriculum through a storybook reduces the barriers to making healthy nutrition choices (29). In addition, this intervention is a high-impact strategy as it targets both school and home settings which are the environments where children can develop healthy eating habits (30,31). Regarding school, teachers are usually the role model to their classroom students. They are able to create environments that draw the children's attention and introduce and maintain their interests in different content aiming to expand and solidify their knowledge. Thus, teachers can promote students' motivation and achievements. In this study protocol, the teachers will receive training that will allow them to organise their class time and develop the planned activities around the nutrition contents (32). Nevertheless, parent's role also assumes a key part in children's dietary pattern. They are a role model in eating behaviours and have direct control over the foods that make up their children's diet such as the MMS (food groups, portion sizes, etc.). The inclusion of activities to be made with the family at home is an approach to improve their knowledge, attitudes and behaviours (33, 34).

Nonetheless, some limitations should be noted. First, this is a quasi-experimental study. This type of study design tends to overestimate the size effect. However, quasi-experimental studies can be the next level below non-randomized trials if well-designed (35). Additionally, there is not a consistent definition of "snacks" present in the literature which could affect the data collection and interpretation of results from other studies (36).

To our knowledge, this school-based intervention will be the first to investigate changes in the dietary and nutritional quality of MMS among second grade children in São Miguel Island, Azores, Portugal.

CONCLUSIONS

We expect that this school-based intervention will result in an improvement of food choices in MMS as a response to an intervention that combines dietary education and continuous monitoring of the dietary quality of children's snacks. Ultimately, it is expected that this study will contribute to the definition of future school-based interventions within the school context, as well as to the development of food and nutrition programs and policies that can be implemented at a regional or even national level.

ETHICS APPROVAL

The study protocol was approved by the board of the Hospital do Divino Espírito Santo de Ponta Delgada (HDES) after a favourable report by the Health Ethics Committee (Ref. 1199/CES/2021). The authors declare that the procedures followed the ethical principles expressed in the Declaration of Helsinki and the Portuguese law.

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CONFLICTS OF INTEREST

None of the authors reported a conflict of interest.

AUTHORS' CONTRIBUTIONS

DV, TP, FS, AG, FM, NM, SG, MG, PF, MC, CM, RV, SV, ARM: Conception and design of the study; DV: Writing—original draft preparation; ARM, FS and SV: Writing—review and editing; ARM: Project administration. All authors have read and agreed to the published version of the manuscript.

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