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# Nutrition Education Intervention to Promote Nutrition Knowledge in Pre school Children at District of Leiria, Portugal

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**Abstract**

Several factors can influence children's food choices and preferences. Food and nutrition education at school can therefore be the key to improving children's nutrition knowledge, and consequently their eating behavior. To this end, several strategies seem effective, and the current difficulty lies in choosing the best methodology to implement. To determine which intervention has the greatest impact on preschool children's nutrition knowledge about vegetables: serious game, children's story, children's story associated with stickers, or food wheel. This experimental study had the participation of 162 children, aged between 3 to 6 years, attending four public school institutions in the district of Leiria, Portugal. To increase children's nutrition knowledge about vegetables, four interventions were carried out: digital game, children's story, children's story associated with stickers, and a food wheel. To assess the recognition of foods, identification of vegetables, and the functions of five vegetables (lettuce, tomato, carrot, cucumber, and red cabbage), two instruments were applied at three different times (at the start, conclusion, and 6 months after the intervention). The collected data were analyzed using IBM SPSS software. There was an increase in nutrition knowledge both post-intervention and 6 months follow-up, compared to the initial moment. This increase was statistically significant ($p < 0.001$) when evaluated overall. The intervention with the digital game "Veggies 4 my heart", compared to the children's story associated with stickers, proved to be more effective in increasing nutrition knowledge related to the vegetable's functions, 6 months after the intervention ($p = 0.028$). The four interventions were effective to promote nutrition knowledge about vegetables in preschool children. The interventions with the digital game or with the child's story with stickers seem to be the most appropriate to increase knowledge about vegetable functions.

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## Introduction

It is in childhood that children begin to acquire important knowledge that will influence their future food choices and preferences. Healthy eating habits will prevent the development of several diseases such as malnutrition, overweight, anemia, dental caries, and stunting.[1,2]

Several factors influence children's food choices, including the lack of knowledge about what an adequate and varied diet is, or, on the other hand, the influence of their parents, who may not have a healthy lifestyle. This problem may translate into a low consumption of vegetables and other foods, which leads to a deficit of several vitamins and minerals that are essential for good school performance and cognitive development of children[3,4]

The World Health Organization suggests consuming more than 400 grams of fruit and vegetables per day to promote health and reduce the risk of some non-communicable diseases, including cardiovascular diseases.[5] According to the 2015-2016 Portuguese food and physical activity survey, children are the second group with the highest inadequate intake of fruit and vegetables, the first one being the adolescent group.[6]

Studies show that children's eating habits are acquired through experience, observation, and education. Therefore, the educational contexts - homeand school - are fundamental to food and nutrition education.[1] School interventions that encourage the practice of healthy eating have shown to be effective in teaching new knowledge and changing behaviors and attitudes, however, the success of the intervention depends on the choice of activities to be implemented.[7] A growing number of innovative and differentiated pedagogical strategies are used to increase children's motivation to learn and to engage them in classroom activities. Serious games are increasingly used in educational settings at a wide range of ages, even at early ages. The term "serious games" is used to refer to games that are created with an educational and training purpose, being more than just for entertainment,[8] and that have motivational and enjoyable characteristics.[9] The use of serious games in food education is gaining in popularity and has shown some potential to increase children's knowledge about food. Recent studies have shown that the use of gamification techniques and well-designed apps may increase intake of vegetables and knowledge about this theme.[10] Currently, there are few studies in the literature on interventions aimed at promoting preschool children's knowledge about healthy eating - specifically vegetables. Activities such as recreating healthy meals, using images and toys depicting fruits and vegetables, preparing educational materials to be taught in the classroom, and presenting children's stories, have been shown to have a positive effect on increasing young children's knowledge.[11–13]

Interviews and questionnaires are generally considered effective methods for assessing knowledge, attitudes, and behaviors in the adult population. However, they are not suitable for younger age groups, whose cognitive level requires more interesting and captivating methods. Taking this into account, showing children images seems to be a good approach to assessing their knowledge according to their intellectual development.[2,14,15]

There are currently contrasting opinions about which is the best intervention to implement and the most correct method to assess children's nutrition knowledge.[2,7] Thus, this experimental study aims to determine which interventions have a greater impact on preschool children's nutrition knowledge, specifically about vegetables, the Veggies 4 my Heart serious game, children's story, children's story associated with stickers, or the Portuguese food wheel.

## Methodology

This study used a convenience sample composed of 162 children aged between 3 and 6 years old, attending four public preschool located in the district of Leiria, Portugal. In order to carry out the study, taking into account the constraints associated with the travel of the researchers, the location of the schools and the consent of school directors, it was necessary to use a convenience sample. The study was approved by the Ethics Committee of the Escola Superior de Saúde do Politécnico de Leiria (N.º CE/IPLEIRIA/11/2019).

All parents read and signed the informed consent form which provided all the necessary information

on the study, as well as the guarantee that all data contained in the consent form and collected in the study would be used exclusively by the researchers.

To assess the children's knowledge, two instruments were administered at the start of the intervention (baseline), upon its conclusion (post-intervention), and after 6 months (follow-up). The first instrument contained images of 15 different foods (fruits, meat, candies, fish, bread, cookies, fast-food and vegetables, including the five vegetables of the digital game and the child story), asking children, with the help of an adult, to identify the name of the foods and recognize which ones were vegetables. These 15 foods were selected to cover different food groups and different degrees of familiarity in the age group under study. The second questionnaire aimed at making the connection between the five vegetables of the digital game and the child's story – tomato, lettuce, cucumber, carrot, and purple cabbage – and their health benefits. These five vegetables were selected because these are the most consumed at Portuguese school canteens.

The educational sessions during the intervention were different in each kindergarten. The intervention lasted five weeks, each week exploring one of the vegetables mentioned above. In all of the schools, the activity began with the presentation of the researchers and a brief explanation of the importance of healthy eating. The study duration in all kindergartens was 7 weeks (1 week of pre-test, 5 weeks of intervention and 1 week of post-test).

In Preschool A, the digital game "Veggies4myHeart" was applied to 39 children. Veggies4myHeart, which consists of a village - Veggies Village - with a team of superheroes representing tomatoes, lettuce, cucumber, carrots, and red cabbage. This digital game was designed for this purpose by undergraduate students and researchers of Polytechnic Institute of Leiria and is now available for download at Play Store and App Store (https://play.google.com/store/apps/details?id=com.Veggies4MyHeart.VeggiesPrototype&hl=pt_PT&gl=US; https://apps.apple.com/us/app/veggies4myheart/id1565051577). The game was presented to the children and the tablets were handed out where they had the opportunity to play the mini-games, in pairs, for 20 minutes. In each mini-game,an introduction presents the vegetable, its characteristics, and health benefits and explains the goal of the task. At the end of the game, the tablets were collected and a group discussion was started, followed by a tasting of the vegetable that had been in focus that week, registering the number of pieces consumed by each child at the end of the activity.

In Pre school B, one of the five chapters of the children's story "Who wants to go to the village market?" was presented in each of the intervention weeks to 40 children. The Story Book was made up of five chapters and each one had a vegetable superhero, equal to the digital game, and it was clear in the story the characteristics and functions of the vegetables. To conclude the activity, the children were offered five bowls with different vegetables and the number of pieces of vegetables eaten by each child was registered.

In Preschool C, the intervention was identical to the Preschool Correia Mateus, but at the stage of tasting the children were told that if they wanted to taste any of the vegetables offered they were entitled to receive a sticker corresponding to the vegetable they ate (children could receive up to 5 stickers per session), always registering the number of pieces consumed by each childat the end of the activity. In this Preschool participated 46 children.

In Preschool D the Portuguese food wheel and its fundamentals - complete, balanced, and varied food - were presented to 37 children. Next, the focus was on analyzing the vegetable group, explaining what they are, and presenting some real examples, more specifically those that belong to the intervention (lettuce, tomato, carrot, cucumber, and purple cabbage). Throughout the activity, images of each vegetable were presented, as well as some ways of consuming them and their role in the organism, aiming to improve the children's learning. At the end of the activity, the children had the opportunity to share what they had learned and come into contact with real vegetables. There were offered five bowls with the different vegetables and the number of pieces of vegetables eaten by each child was registered.

The collected data were entered and analyzed using the IBM SPSS software version 27 for Microsoft

Windows. The descriptive statistics of the variables included the calculation of absolute and relative frequencies, means, and standard deviation. Inferential statistics consisted of parametric tests since the assumptions of normal distribution and homogeneity of variances were verified. A Student's t-test for paired samples was used, where the results of the questionnaires at the three moments in time were compared two by two, to verify whether there were statistically significant differences. In addition to this, the ANOVA test was used to compare the means of the questionnaire results. In case of rejection of the ANOVA null hypothesis and to check which methodology had a greater impact on the children's nutrition knowledge, an a posteriori test was performed - Tukey HSD.

**Results**

Of the 162 children participating in this study, 79 (48.8%) were female. Their ages ranged from 3 to 6 years old, the majority being 5 years old, which corresponds to 39.5% of the total sample (Table 1).

**Table 1:Characteristics of preschool-aged children that participated in the Veggies4myHeart project.**

| Sociodemographic characteristics | | n (%) n = 162 (100%) |
|---|---|---|
| Age | 3 years | 26 (16.0%) |
| | 4 years | 40 (24.7%) |
| | 5 years | 64 (39.5%) |
| | 6 years | 32 (19.8%) |
| Gender | Female | 79 (48.8%) |
| | Male | 83 (51.2%) |
| Preschool | A | 39 (24.1%) |
| Preschool | B | 46 (28.4%) |
| Preschool | C | 40 (24.7%) |
| Preschool | D | 37 (22.8%) |

Regarding the various interventions of the project Veggies4myHeart, 39 (24.1%) children participated with the digital game "Veggies4myheart", 40 (24.7%) participated with the children's story "Who wants to go to the village market?", 46 (28.4%) with children's stories associated with stickers and 37 (22.8%), with the presentation of the Portuguese food wheel. Figure 1 represents the number of children that participated in the different phases of the project.

The results of the two questionnaires, performed at three different times (baseline, post-intervention, and follow-up) in all the participants, namely the recognition of foods, the identification of vegetables, and their functions were positive (Table 2). There was an increase in knowledge from baseline to post-intervention and follow-up, at baseline. In both situations, this increase was statistically significant ($p < 0.001$).

In the intervention with the digital game Veggies4myheart, there was a significant increase ($p < 0.001$) in the children's nutrition knowledge regarding the recognition of foods and the functions of vegetables, both on post-intervention and follow-up. This was not the case in the identification of vegetables, with no statistically significant increase ($p > 0.05$) at post-intervention. However, at follow-up, the children's nutrition knowledge had a significant increase compared to the baseline ($p < 0.05$)) (Table 3).

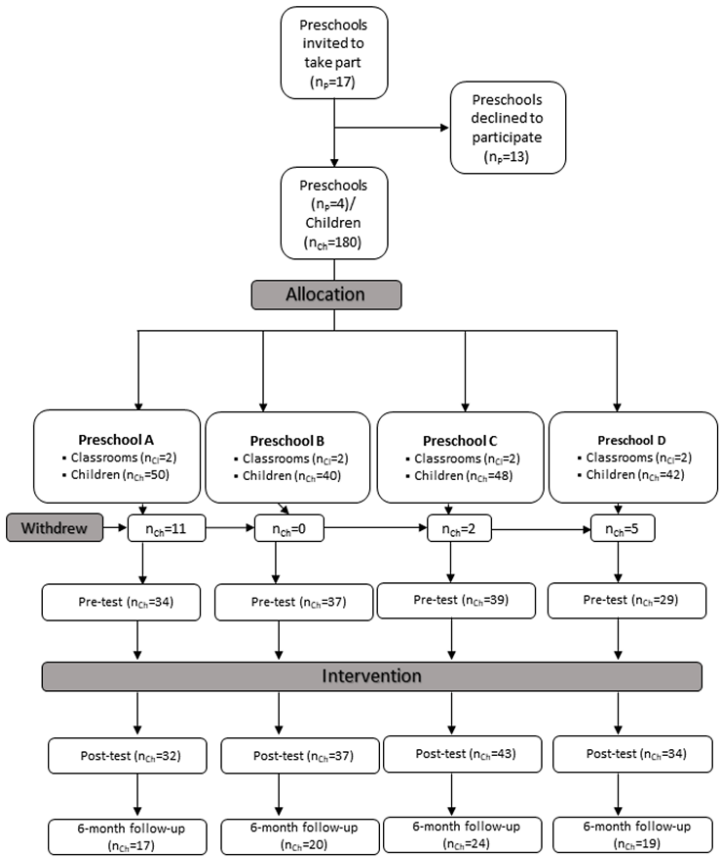


**Fig. 1: represents the number of children that participated in the different phases of the project.**

**Table 2: Nutrition knowledge (food recognition, vegetables identification and vegetables functions) at baseline, post-test and follow-up in preschool children of the Veggies4myHeart project. The number of correct answers is represented as mean and standard deviation.**

| | Nutrition knowledge at baseline (Mean ± SD) | Nutrition knowledge at post-intervention (Mean ± SD) | Nutrition knowledge at follow-up (Mean ± SD) | p-Value Δ average knowledge (after-before) | p-Value Δ average knowledge (follow-up-before) |
|---|---|---|---|---|---|
| Food recognition | 85.3 ± 0.12% | 93.1 ± 0.10% | 91.5 ± 0.10% | <0.001 | <0.001 |
| Vegetables identification | 70.9 ± 0.21% | 77.9 ± 0.22% | 83.0 ± 0.19% | <0.001 | <0.001 |
| Vegetables functions | 22.3 ± 0.22% | 46.3 ± 0.37% | 37.5 ± 0.33% | <0.001 | <0.001 |

In the intervention with the children's story "Who wants to go to the village market?" the children's nutrition knowledge increased in the two moments, compared to the baseline. However, this increase was not always statistically significant. In the assessment of the functions of vegetables, the increase was statistically significant both on post-intervention follow-up, however, in the recognition of vegetables, it was only significant at post-intervention ($p < 0.001$) (Table 3).

**Table 3: Nutrition knowledge(food recognition, vegetables identification and vegetables functions) at baseline, post-intervention and follow-up in the four groups (Digital Game, Children´s story, Children's story and stickers, Portuguese food wheel). The number of correct answers is represented as mean and standard deviation.**

| | | Nutrition knowledge at baseline (Mean ± SD) | Nutrition knowledge at post-intervention | Nutrition knowledge at follow-up (Mean ± SD) (Mean ± SD) | p-Value (Δ average knowledge (post-intervention-baseline)) | p-Value (Δ average knowledge (follow-up-baseline)) |
|---|---|---|---|---|---|---|
| Preschool A – digital game "Veggies4myheart" | Food recognition | 86.0 ± 0.07% | 94.6 ± 0.07% | 93.5 ± 0.07% | <0.001 | <0.001 |
| | Vegetables identification | 73.7 ± 0.18% | 85.7 ± 0.12% | 72.7 ± 0.23% | 0.737 | 0.014 |
| | Vegetables functions | 24.6 ± 0.20% | 56.3 ± 0.27% | 46.9 ± 0.36% | <0.001 | <0.001 |
| Preschool C – children's story | Food recognition | 88.1 ± 0.11% | 92.1 ± 0.12% | 98.4 ± 0.39% | <0.001 | 0.075 |
| | Vegetables identification | 77.0 ± 0.17% | 85.4 ± 0.22% | 81.9 ± 0.23% | 0.244 | 0.114 |
| | Vegetables functions | 22.1 ± 0.17% | 49.5 ± 0.35% | 55.1 ± 0.38% | <0.001 | 0.001 |
| Preschool B – children's story associated with stickers | Food recognition | 82.5 ± 0.15% | 89.5 ± 0.11% | 92.1 ± 0.1% | <0.001 | 0.002 |
| | Vegetables identification | 61.5 ± 0.25% | 82.3 ± 0.18% | 73.8 ± 0.22% | 0.005 | <0.001 |
| | Vegetables functions | 20.4 ± 0.25% | 17.7 ± 0.23% | 40.5 ± 0.39% | 0.002 | 0.381 |
| Preschool D – Portuguese food wheel | Food recognition | 84.8 ± 0.14% | 91.1 ± 0.11% | 88.4 ± 0.15% | 0.011 | 0.014 |
| | Vegetables identification | 73.3 ± 0.16% | 78.5 ± 0.20% | 83.6 ± 0.19% | 0.009 | 0.133 |
| | Vegetables functions | 22.1 ± 0.26% | 35.6 ± 0.33% | 43.5 ± 0.34% | 0.022 | 0.306 |

In the intervention with the children's story "Who wants to go to the village market?" associated with stickers, there was an increase in nutrition knowledge both in the recognition of foods and in the identification of vegetables, at both moments (on post-intervention ($p < 0.05$) and follow-up ($p < 0.001$)). In the vegetable functions assessment, knowledge increased atpost-intervention, but not at follow-up (Table 3).

In the intervention with the Portuguese food wheel, the children's nutrition knowledge increased in the two moments compared to the baseline. This increase was statistically significant ($p < 0.05$), except at follow-up for the identification of vegetables and their functions, ($p > 0.05$) (Table 3).

Table 4 shows the comparison between the average results for each of the questionnaires, to verify which moment of the assessment showed statistically significant differences. This difference is observed in the results of the questionnaire on vegetable functions at follow-up ($p = 0.021$).

Table 4: Differences between post-intervention, follow-up and baseline in nutrition knowledge (food recognition, vegetables identification and vegetables functions).The number of correct answers is represented as mean and standard deviation.

| | | Mean ± SD | p-Value |
|---|---|---|---|
| Food recognition | Δ (average post-intervention – average baseline) | 8.8 ± 0.11% | 0.100 |
| | Δ (average follow-up – average baseline) | 8.9 ± 0.13% | 0.374 |
| Vegetables identification | Δ (average post-intervention – average baseline) | 6.5 ± 0.23% | 0.060 |
| | Δ (average follow-up – average baseline) | 15.2 ± 0.26% | 0.086 |
| Vegetables functions | Δ (average post-intervention – average baseline) | 24.2 ± 0.38% | 0.335 |
| | Δ (average follow-up – average baseline) | 19.2 ± 0.37% | 0.021 |

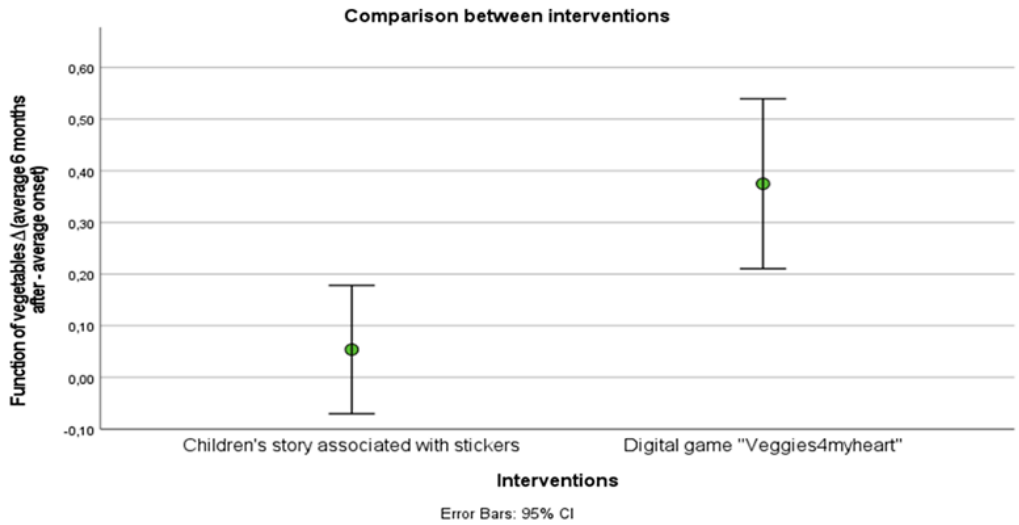


**Fig. 2: Comparison between the two interventions that were statistically significant relating tonutrition knowledge (vegetables functions) when comparedfollow-up to baseline.**

In terms of the most effective methodology for increasing children's nutrition knowledge, regarding the questionnaire on the function of vegetables after 6 months of intervention (follow-up), the digital game Veggies4myheart stood out compared to the children's story associated with stickers, where

knowledge decreased (p = 0.028). The difference between the two interventions is shown in Figure2.

**Discussion**

Currently, nutrition education mediated by interventions in school settings seems to be an added value for improving the eating habits of children and adolescents, as well as increasing the level of food literacy. For this reason, many organizations encourage these types of activities, such as the Food and Agriculture Organization of the United Nations and the World Health Organization.[16] The present study appeared from the need to complement the existing scientific evidence on this theme, proving that school-based interventions contribute to increasing preschool children's knowledge, specifically about vegetables.

This experimental study shows an increase in nutrition knowledge in post-intervention and follow-up, compared to the baseline. However, it is important to mention that, in the intervention with the child story book and stickers there was a decrease between the assessments at post-intervention and follow-up related to the functions of vegetables. This may be due to a lack of stimulation in the interim period, both in the school and family environment. Despite the less positive result, it is still pertinent to evaluate the children's knowledge sometime after the intervention, ideally 6 months, to understand if the knowledge acquired lasts over time.[17]

Although the use of digital games has so far been referred to as negative, the literature currently mentions that if used correctly they can be beneficial in increasing the consumption of healthy food, knowledge about healthy eating, and physical exercise.[18,19] Analyzing the results, the intervention with the digital game "Veggies4myheart" was well accepted by the children, as there was an evolution of their knowledge throughout the intervention, showing to be mainly effective in learning the functions of vegetables, and which lasted into the 6 months of follow-up. A similar study that used a serious game, named Vita Village, showed that the intervention group increased overall nutrition knowledge and specifically, knowledge about the correct number of servings of fruits and vegetables.[20] Review studies that have been conducted to verify the potential of using serious games in nutrition education have found that it seems feasible to translate conventional nutrition education into a game-based approach, since it enhances child motivation and involvement, allowing capturing the attention through the fun aspects of games.[21,22] Some studies have shown that game-based approaches are more effective in increasing children's nutritional knowledge compared with conventional teaching methods.[22–24]

Children's stories are a pedagogical strategy with numerous benefits in the development of cognitive skills, as they stimulate the reading and writing process, which is essential for the acquisition of new knowledge.[25] These stories are usually accompanied by illustrations and images, which, when referring to food, may influence children's perception of food and, consequently, their learning.[26,27] The results of the intervention with the children's story"Who wants to go to the village market?" are in line with the existing literature, and reflected in the increase in the children's learning. Reading stories increases the child's visual familiarity with the food and may also include positive social reinforcement by the adult reading the story.[28] Visual repetition of the food has been shown to be effective not only in increasing familiarity with the food's appearance but also in increasing interest in tasting the food.[29] Recent research indicates that combining the visual familiarity promoted by children's stories with interactive learning methods that engage the child in the activity (such as interactive reading, puppetry, etc.) may have a greater impact on children's acceptance of vegetables than visual exposure alone.[28] One of the theoretical models that has been widely used for planning and conducting nutrition education in children is the Social Cognitive Theory model.[30] This model is an evolution of the social learning theory formulated by Albert Bandura (1986), according to which human beings learn through experience and what they observe around them,[31] which may partly explain the positive results associated with the use of picture books in nutrition education.The picture book content can affect child perception of food, normalizing the images of food that is depicted in books and modeling the emotions or attitudes about each food.[26]

The use of rewards is based on the principle of positive reinforcement and describes the strengthening of behaviour that occurs as a consequence of receiving a positive outcome.[32]

Few studies link the use of stickers to increased knowledge, however, it may be a reward strategy to promote the consumption of vegetables.[33] The present study revealed that not all the nutrition knowledge increased, with knowledge regarding the functions of vegetables decreasing 6 months after the intervention when compared to the baseline.

There are few documented interventions involving the use of the Portuguese food wheel in increasing knowledge in preschool children. However, a study carried out with 5-year-old children, in which the Food Pyramid and its groups were presented, showed advantages in the evolution of the acquisition of learning about the theme.[34]

The Food Wheel and the Food Pyramid are similar approaches and both interesting from the learning point of view, but in the present study, the Food Wheel was used because it is the food guide used for the Portuguese population.[35] By evaluating the results of the intervention with the Food Wheel, we found that they were similar to those of the previous literature, showing an increase in the children's knowledge at both moments after the intervention.[34]

It would be important in future studies to investigate the level of parental nutrition literacy, as this may influence children's nutrition knowledge. One limitation of the study refers to the sample size, which decreased over the three moments (baseline, post-intervention, and follow-up). In addition, the fact that the sample was selected for convenience may also limit the conclusions of the research.

## Conclusion

The interventions used in this study - digital game"Veggies4myheart", children's story, children's story associated with stickers, and Portuguese food wheel - proved to be effective in increasing the nutrition knowledge of this group of preschool children. Although the intervention with the digital game stood out in increasing the knowledge related to the functions of vegetables, we cannot claim that it is the most effective intervention.

Any intervention that succeeds in increasing children's knowledge about healthy eating, particularly vegetables, and contributes to an increase in the consumption of healthy food is relevant. In the future, further studies with a larger sample size should be carried out to explore this theme in children between 3 and 6 years old.

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## Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## References

1. Nunes E, Breda J. *Manual Para Uma Alimentação Saudável Em Jardins de Infância.*, 2001.
2. Zarnowiecki D, Dollman J, Sinn N. A tool for assessing healthy food knowledge in 5-6-year-old Australian children. *Public Health Nutr.* 2011;14(7):1177-1183. doi:10.1017/S1368980010003721
3. Asakura K, Todoriki H, Sasaki S. Relationship between nutrition knowledge and dietary intake among primary school children in Japan: Combined effect of children's and their guardians' knowledge. *J Epidemiol.* 2017;27:483-491. doi:10.1016/j.je.2016.09.014
4. Roberts M, Tolar-Peterson T, Reynolds A,

Wall C, Reeder N, Rico Mendez G. The Effects of Nutritional Interventions on the Cognitive Development of Preschool-Age Children: A Systematic Review. *Nutr* 2022, Vol 14, Page 532. 2022;14(3):532. doi:10.3390/NU14030532

5. Hartley L, Igbinedion E, Holmes J, Flowers N, Thorogood M, Clarke A, Stranges S, Hooper L, Rees K. Increased consumption of fruit and vegetables for the primary prevention of cardiovascular diseases. *Cochrane Database Syst Rev*. 2013;(6). doi:10.1002/14651858.CD009874.pub2
6. Lopes C, Torres D, Oliveira A, Severo M, Alarcão V, Guiomar S, Mota J, Teixeira P, Rodrigues S, Lobato L, Magalhães V, Correia D, Carvalho C, Pizarro A, Marques A, Vilela S, Oliveira L, Nicola P, Soares S, Ramos E.*Inquérito Alimentar Nacional e de Atividade Física, IAN-AF 2015-2016: Relatório de Resultados.*, 2017. https://ian-af.up.pt/projeto/objetivos
7. Chaudhary A, Sudzina F, Mikkelsen BE. Promoting healthy eating among young people—a review of the evidence of the impact of school-based interventions. *Nutrients.* 2020;12:1-34. doi:10.3390/nu12092894
8. Holzmann SL, Dischl F, Schäfer H, Groh G, Hauner H, Holzapfel C. Digital Gaming for Nutritional Education: A Survey on Preferences, Motives, and Needs of Children and Adolescents. *JMIR Form Res.* 2019;3(1):e10284. doi:10.2196/10284
9. Holzmann SL, Schäfer H, Groh G, Plecher DA, Klinker G, Schauberger G, Hauner H, Holzapfel C. Short-Term Effects of the Serious Game "Fit, Food, Fun" on Nutritional Knowledge: A Pilot Study among Children and Adolescents. *Nutrients.* 2019;11(9):2031. doi:10.3390/nu11092031
10. Froome HM, Townson C, Rhodes S, Franco-Arellano B, LeSage A, Savaglio R, Brown JM, Hughes J, Kapralos B, Arcand J. The Effectiveness of the Foodbot Factory Mobile Serious Game on Increasing Nutrition Knowledge in Children. *Nutrients.* 2020;12(11):3413. doi:10.3390/nu12113413
11. Kaufman-Shriqui V, Fraser D, Friger M, Geva D, Bilenko N, Vardi H, Elhadad N, Mor K, Feine Z, Shahar DR. Effect of a school-based intervention on nutritional knowledge and habits of low-socioeconomic school children in Israel: A cluster-randomized controlled trial. *Nutrients.* 2016;8:1-16. doi:10.3390/nu8040234
12. Lawatsch DE. A comparison of two teaching strategies on nutrition knowledge, attitudes and food behavior of preschool children. *J Nutr Educ.* 1990;22(3):117-123. doi:10.1016/S0022-3182(12)80605-4
13. Niemeier BS, Tande DL, Hwang J, Stastny S, Hektner JM. Using education, exposure, and environments to increase preschool children's knowledge about fruit and vegetables. *J Ext.* 2010;48(1):1-5.
14. Matsumoto M, Ikemoto S. The necessary items for inclusion in a questionnaire for assessing the nutrition knowledge of young Japanese children. J Nutr Sci Vitaminol (Tokyo). 2017;63:8-14. doi:10.3177/jnsv.63.8
15. Owen S, Schickler P, Davies J. Food choice: How to assess attitudes of pre-adolescent children. *Nutr Food Sci.* 1997;97(1):5-11. doi:10.1108/00346659710157240
16. FAO. *School-Based Food and Nutrition Education – A White Paper on the Current State, Principles, Challenges and Recommendations for Low- and Middle-Income Countries.* FAO; 2020. doi:10.4060/cb2064en
17. Cauwenberghe EV, Maes L, Spittaels H, Lenthe FV, Brug J, Oppert JM, Bourdeaudhuij ID. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: Systematic review of published and grey literature. *Br J Nutr.* 2010;103:781-797. doi:10.1017/S0007114509993370
18. Aboul-Enein BH, Bernstein J, Kruk J. Fruits and vegetables embedded in classic video games: a health-promoting potential? *Int J Food Sci Nutr.* 2019;70(3):377-385. doi:10.1080/09637486.2018.1513995
19. Ezezika O, Oh J, Edeagu N, Boyo W. Gamification of nutrition: A preliminary study on the impact of gamification on nutrition knowledge, attitude, and behaviour of adolescents in Nigeria. *Nutr Health.* 2018;24(3):137-144. doi:10.1177/0260106018782211
20. Vlieger NM, Sainsbury L, Smith SP, Riley N, Miller A, Collins CE, Bucher T. Feasibility

and Acceptability of 'VitaVillage': A Serious Game for Nutrition Education. *Nutrients.* 2021;14(1):189. doi:10.3390/nu14010189

21. Baranowski T, Ryan C, Hoyos-Cespedes A, Lu AS. Nutrition Education and Dietary Behavior Change Games: A Scoping Review. *Games Health J.* 2019;8(3):153-176. doi:10.1089/g4h.2018.0070
22. Chow CY, Riantiningtyas RR, Kanstrup MB, Papavasileiou M, Liem GD, Olsen A. Can games change children's eating behaviour? A review of gamification and serious games. *Food Qual Prefer.* 2020;80:103823. doi:10.1016/j.foodqual.2019.103823
23. Banos RM, Cebolla A, Oliver E, Alcaniz M, Botella C. Efficacy and acceptability of an Internet platform to improve the learning of nutritional knowledge in children: the ETIOBE mates. *Health Educ Res.* 2013;28(2):234-248. doi:10.1093/her/cys044
24. Lakshman RR, Sharp SJ, Ong KK, Forouhi NG. A novel school-based intervention to improve nutrition knowledge in children: cluster randomised controlled trial. *BMC Public Health.* 2010;10(1):123. doi:10.1186/1471-2458-10-123
25. Rodari G. *Grammar of Fantasy.* Teachers & Writers Collaborative; 2017.
26. Goldman JA, Descartes L. Food depictions in picture books for preschool children: Frequency, centrality, and affect *Appetite.* 2016;96:203-208. doi:10.1016/j.appet.2015.09.018
27. Juzwiak CR. Era uma vez... Um olhar sobre o uso dos contos de fada como ferramenta de educação alimentar e nutricional. 2013;17(45):473-484.
28. Dulay KM, Masento NA, Harvey K, Messer DJ, Houston-Price C. Me and my veggies: The use of interactive, personalised picture books in healthy eating interventions. *Nutr Bull.* 2020;45(1):51-58. doi:10.1111/nbu.12415
29. Droog SM, Nee RV, Govers M, Buijzen M. Promoting toddlers' vegetable consumption through interactive reading and puppetry. *Appetite.* 2017;116:75-81. doi:10.1016/j.appet.2017.04.022
30. Reynolds KD, Hinton AW, Shewchuk RM, Hickey CA. Social Cognitive Model of Fruit and Vegetable Consumption in Elementary School Children. *J Nutr Educ Behav.* 1999;31(1):23-30. doi:10.1016/S0022-3182(99)70381-X
31. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs,* NJ: Prentice Hall.; 1986. 617 p.
32. Corsini N, Slater A, Harrison A, Cooke L, Cox DN. Rewards can be used effectively with repeated exposure to increase liking of vegetables in 4–6-year-old children. *Public Health Nutr.* 2013;16(5):942-951. doi:10.1017/S1368980011002035
33. Nekitsing C, Blundell-Birtill P, Cockroft JE, Hetherington MM. Systematic review and meta-analysis of strategies to increase vegetable consumption in preschool children aged 2–5 years. *Appetite*. 2018;127(April):138-154. doi:10.1016/j.appet.2018.04.019
34. Başkale H, Bahar Z. Outcomes of nutrition knowledge and healthy food choices in 5- to 6-year-old children who received a nutrition intervention based on Piaget's theory. *J Spec Pediatr Nurs.* 2011;16:263-279. doi:10.1111/j.1744-6155.2011.00300.x
35. Barbosa C, Pimenta P, Real H. Roda da Alimentação Mediterrânica e Pirâmide da Dieta Mediterrânica: comparação entre os dois guias alimentares. *Acta Port Nutr.* 2017;11:6-14. doi:10.21011/apn.2017.1102