Implementing the S.M.A.R.T. Framework in Preschool Nutrition Programs using AI-Generated Educational Materials

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Abstract

The Mediterranean diet is among the most extensively researched and renowned dietary patterns globally. It is characterized, among other food intakes, by high consumption of fruits. Low fruit and vegetables consumption in young children is a considerable health burden in developed countries worldwide. Preschool children are an ideal group for acquiring healthy eating habits, as this is when dietary and physical activity habits are shaped, potentially impacting lifelong health. In the present study a combination of the Specific, Measurable, Achievable, Relevant, Time-Bound (S.M.A.R.T.) framework, as a new and innovative method, along with a non-restrictive dietary model in preschool populations was implemented. The S.M.A.R.T. intervention aimed to increase daily fruit consumption during snack time at school, supported by AI-generated visual materials designed to promote engagement and multisensory exploration. Thirty-two preschool children participated in the intervention for a total of 10 weeks. The results of the present study revealed that fruit consumption rates during snack time at the preschool context were higher four and eight weeks after a specially designed program using the S.M.A.R.T. framework, thus showing that the implementation of this method for nutrition programs in preschool settings, along with a non-restrictive dietary model could bring beneficial effects for targeted educational interventions in the preschool.

Key words: preschool, Pre-K, fruit consumption, S.M.A.R.T. framework, guilt-free approach

Introduction

According to Zapata et al. (2025) childhood obesity is a global health problem, with its prevalence having tripled since 1975. Proper nutrition plays a significant role in a child's development. Healthy eating contributes to appropriate physical and mental growth as well as emotional and psychological balance. Eating habits and shared meals serve as a form of communication and connection within the family, school, and other social settings (Lagstrom et al., 1999). In preschool education, nutrition is incorporated into the school's "routine" and is mentioned in the curriculum at various points as a learning framework. Thus, dietary habits can become a subject of experiential learning and be connected to all thematic axes of the preschool education curriculum. During the preschool years, children's nutritional education is influenced by both family and school, establishing a critical foundation for their future body weight (Cummingham et al., 2014). Moreover, preschool children are an ideal group for acquiring healthy eating habits, as this is when dietary and physical activity habits are shaped, potentially impacting lifelong health (Institute of Medicine, 2002).

Nutrition in Preschool-Aged Children

As preschool-aged children grow and gradually gain more autonomy, they start making more choices about their diet, which affects their health and well-being, even though much of their behavior remains under adult control. Due to the developmental characteristics and limitations of this age, young children often either do not know or are not aware of the choices they make. When children do not know how to make choices or do not understand the consequences of their choices, the decisions they make regarding their personal diet can

include unhealthy options (Feinstein et al., 2008; Institute of Medicine, 2002). The early years of life are crucial for encouraging the consumption of appropriate foods through specific behavioral techniques such as repeated exposure to certain flavors, sensory learning, and the overall promotion of fruit and vegetable intake in preschool-aged children (Nekitsing et al., 2018). Findings from the study of Dazeley and Houston-Price (2015) suggest that interactive, hands-on exposure to fruits and vegetables can improve children's willingness to try them, highlighting the value of such activities in promoting healthy eating behaviors. It is well recognized that the family environment significantly influences children's health, as it can encourage healthy behaviors and lifestyle habits. Family members can serve as influencing role models for their children (Kanellopoulou et al., 2021; Natale et al., 2014). A more recent review showed that strategies like taste tests, combined with non-taste exposures, such as learning about a food's origin, its role in a balanced diet, are more effective in encouraging children to try, eat, and enjoy unfamiliar foods (Johnson & Johnson, 2025). By encouraging diverse multisensory explorations, children may develop greater openness and self-awareness, thereby expanding their range of food experiences (Coe et al., 2024).

The Mediterranean Diet – Conceptual Definition and Key Components

The Mediterranean diet was first defined by Ancel Keys as being low in saturated fat and high in vegetable oils, observed in Greece and Southern Italy during the 1960s (Davis et al., 2015). The Mediterranean diet is among the most extensively researched and renowned dietary patterns globally. Its traditional roots lie in the civilizations around the Mediterranean Sea, making this diet closely linked to the social customs and lifestyles of that area. UNESCO has acknowledged the Mediterranean diet as an intangible cultural heritage, emphasizing its deep connection to its geographical origin and its environmentally responsible agricultural and dietary practices.

It is characterized, among other food intakes, by high consumption of fruits (Guasch-Ferré & Willett, 2021). The Mediterranean diet has been shown to prevent the development of various diseases such as cardiovascular disease, depression, diabetes and obesity (Jay Widmer et al., 2015).

The Effect of Fruit Consumption on Developing Organisms

Fruit consumption is a significant component of recommended healthy dietary patterns and is associated with the prevention of chronic diseases that may affect social and cognitive function. According to Halkjelsvik and Bere (2023), fruits contain not only essential nutrients but also valuable dietary elements that are unique. Specifically, the nutrients and secondary metabolites contained in fruits affect molecular systems and cellular processes that are essential for maintaining cognitive function, and this is also true for young organisms. Flavonoids (a polyphenol abundant in fruits) improve cognitive performance. Also, fruit consumption helps maintain a healthy gut microbiome, which is also responsible for efficient cognitive function (Halkjelsvik & Bere, 2023). Additionally, the antioxidants (polyphenols, flavonoids), as well as the numerous vitamins and trace elements obtained from various foods, particularly fruits, contribute to the increase in school performance (Esteban-Comejo, 2016).

Snack Time at School - Research on Preschool Children

Across various studies, preschoolers' diets are consistently characterized by low fruit and vegetable intake and high consumption of sweets and energy-dense, nutrient-poor foods (Androutsos et al., 2023; Hutchinson et al., 2021; Min et al., 2021). These patterns have been linked to increased risk of overweight and obesity (Lee et al., 2021; Roe et al., 2022). Offering a greater variety of healthy foods in childcare settings and integrating nutrition education may

support healthier eating habits from an early age (CDC, 2017; Control CfD, Prevention, 2014; Fox et al., 2010).

Nekitsing et al. (2018), in a review of the literature on childhood obesity in the USA, observed that the most effective strategy for adopting healthy eating at school is repeated exposure to the target food and the active involvement of parents and students throughout the process. The strategy of repeated exposure works through the process of familiarization. According to the mere exposure theory, even a single exposure is enough to create a positive attitude towards a stimulus. Thus, interventions involving repeated exposure to taste-testing a food contribute to positive acceptance over time (Rioux et al., 2018), and when repeated exposure is combined with increased fruit intake during snack time and the implementation of multiple strategies (active involvement of parents and children, experiential multisensory activities, clearly defined goals), the results are more immediately visible and have a stronger impact (Roe, 2022). Hausner et al. (2012) have shown that children increase their fruit and vegetable consumption after approximately five exposures to the food; however, on average, children usually need between eight and ten exposures at regular intervals, e.g., once a week.

A systematic review of the relevant literature has shown that not eating enough fruit and vegetables is a considerable health burden in developed countries. Eating adequate amounts of fruit and vegetables is associated with a reduced risk of future non-communicable diseases (such as heart and circulatory disease). Early childhood represents a critical period for the establishment of dietary habits that track into adulthood. Interventions to increase consumption of fruit and vegetables in early childhood may therefore be an effective strategy to reduce this disease burden (Hodder et al., 2020).

Additionally, a recent research on the fruit and vegetable consumption of toddlers showed that future research should investigate the time factor regarding continued fruit consumption after the end of the research intervention and the need to include the involvement of microsystems (peers, parents, teachers) in the process of changing dietary attitudes (Hasan et al., 2023).

Finally, research by Lee et al. (2021) highlights significant differences in fruit and vegetable consumption by primary school students at home compared to extra-family systems such as school. This research emphasizes the need not only for active parental involvement but also for the establishment of fruit consumption, especially during the school snack.

School-Family Collaboration - The Ecological Theory Model

A comprehensive theory supporting school and family collaboration is that of Urie Bronfenbrenner's ecological perspective (1989). According to ecological theory, human development is perceived as a result of individuals interacting with the alternating, dynamic environment in which they live (see Figure 1).

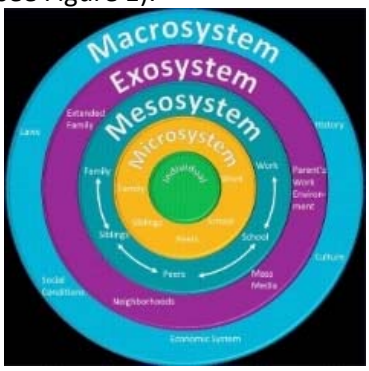

Figure 1: The structure of the environment according to the Ecological Systems Model

The environments of individuals are considered as multiple systems of the:

- Immediate environment (such as parents, educators, and peers)
- Indirect environment (such as culture and society).

This specific model was developed by Bronfenbrenner (1989) and is based on a systemic approach. Its fundamental principle is the view that throughout life, individuals participate in many different systems that are in continuous interaction and interdependence, influencing their development. Specifically, individuals participate in five different systems. In this study, we focused on the following 2 subsystems: microsystem and mesosystem, with the dominant mediator of interaction between the family and school microsystems being the participants of preschool age. According to ecological theory, they are defined as:

- Microsystems, systems that belong to the immediate environment of the child, such as family, school, and neighborhood. At this level, interactions are direct, and their impact on the individual is strong and decisive. Additionally, the interaction of microsystems increases as the child grows and participates in more microsystems.
- Mesosystem, the system where relationships and interactions between microsystems occur (e.g., the relationship between educators and parents). It is considered the target of intervention to improve and change children's behavior, as the quantity and quality of interactions operating within it determine the system's effectiveness for the positive development of the child.

Significance of Present Research

According to the World Health Organization (WHO), the Mediterranean diet is no longer prevalent among children in Greece, Spain, and Italy where over 40% of children aged nine are overweight or obese. These Mediterranean countries, once the epitome of healthy eating, now face the highest rates of childhood obesity in Europe (Lopez-Gil et al., 2023). Recent research has shown that adherence to the Mediterranean diet, which emphasizes the daily consumption of fruits, contributes to the prevention and management of obesity in both children and adults (Manzano-Carrasco, 2020). Given that preschool age is a period of rapid development and a particularly important phase for the development and establishment of dietary habits mainly through interaction during snack time, the implementation of an intervention program becomes necessary.

Starting from Bronfenbrenner's ecological theory (1979), the present research was designed with the aim of contributing within the framework of child-centered values not only in terms of acquiring knowledge and skills but also in terms of transforming attitudes of preschool children so that they willingly and independently include the consumption of fruits during snack time. The purpose of the study was to test an educational intervention within the school context as a self-contained microsystem (Bronfenbrenner, 1979). In order to attain this goal, the S.M.A.R.T. framework was implemented, as a completely new and innovative method for preschool populations.

Definition of the S.M.A.R.T. Framework

The S.M.A.R.T. framework incorporates all the criteria that assist in the attainment of specific goals within a given timeframe. The acronym S.M.A.R.T. stands for Specific, Measurable, Achievable, Relevant, and Time-bound. S.M.A.R.T. goals help define specific, achievable, and measurable objectives, as well as set a timeframe for their accomplishment.

Specific

A S.M.A.R.T. goal must be clear and well-defined. Vague or generalized goals are not useful as they do not provide sufficient direction.

Measurable

It is vital to have specific criteria for measuring progress toward the goal. If a goal is not measurable, it is difficult to determine progress or to know when it has been achieved.

Achievable

Goals must be realistic and attainable. While an ambitious goal can be motivating, if it is perceived as unattainable, it can lead to frustration and decreased morale.

Relevant

The goal should align with personal preferences and needs so that it harmonizes with what feels familiar and meets our desires.

Time-bound

A goal should have a clear, defined timeline that includes a start date and a target date. The timeline creates a sense of commitment to the goal.

Methodology

Research Aim

The present research aims to investigate the impact of a S.M.A.R.T. intervention on preschool children's consumption of fruits during school snack time. The study follows a quasi-experimental, one-group pretest–posttest design, which allows for the observation of changes over time in the absence of a control group.

Research Question

Are there significant differences in the scores of fruit consumption during snack time at school before and after participation in a S.M.A.R.T. intervention program in preschool participants?

Sample

The program involved 32 preschool children (aged 4-6 years) and their parents. Participants came from an urban area in Northern Greece. The sample was randomly chosen.

Ethical Considerations

Due to ethical considerations, a control group was not used, as it would involve withholding a health-promoting intervention from children. Instead of using a control group, we employed a pre-post test design to observe changes over time within the same group, allowing us to assess shifts in behavior while respecting ethical considerations.

Participation was entirely voluntary. Researchers obtained informed and written consent from parents, participant teachers, and the school director. Oral consent was obtained from each child individually, with each child making the decision to take part based on their own interest and willingness. Information on the research's content and procedures was provided in appropriate language. All participants were free to quit the program any time they wished.

Moreover, and in order to ensure the privacy and confidentiality of the participants, the research was conducted anonymously, since no personal data of the children was utilized or disclosed during the study. The study collected neither information that could identify the informants nor data that was sensitive.

All participants were informed that they are entitled to receive information about research findings.

Research Tools

Snack Checklist: the food consumed during snack time at school was written down.

Application of S.M.A.R.T. Goals

Specificity: Encourage preference for fruit consumption during snack time.

Measurability: Measure the first goal using a checklist writing down the food consumed during school snack time.

Attainability: Snack time occurs daily at a specific time within the school curriculum.

Relevance: The quality of diet concerns all members of the school community (teachers, parents, children).

Time-bound: The program runs throughout the second half of the school year, with a total duration of 10 weeks.

Procedure

Phase 1 - Time 1: Pre-test - *Duration of measures:* 1 week

At the end of the first trimester, parents were informed that their children would independently choose their snacks for school without parental involvement. Snacks are not provided by the school and are consumed at approximately 10:00 a.m. During pre-test, for five consecutive days, the type of snack each participant consumed was recorded. If the snack included fruits and these were consumed, one point was given. In all other cases, no point was given. A point is equal to .20. The maximum points each participant could collect was five and were equal to 1.

Phase 2 – Intervention - Duration: 10 weeks

The intervention aimed to activate students, encourage voluntary participation in experiential-multisensory activities, and involve them exclusively in decision-making. The role of the researcher and parental participation was supportive, while participants acted as mediators in the interaction between family and school (the mesosystem according to Bronfenbrenner's ecological theory).

Day 1:

The intervention, titled *"Can You Eat a Rainbow?"*, was developed with reference to Suen's (2011) work.

Days 2 to 6:

All images used in the present study were created using the generative Artificial Intelligence tool "Image Creator from Microsoft Designer". These images were used as educational aids to enhance the multisensory, child-led activities, serving as visual stimuli in support of the intervention. Participants observed images of rainbows, where each color corresponded to fruits of the same color (Images 1 and 2). Using their existing experience, children brainstormed other known fruits for each of the five rainbow colors or shared past relevant past experiences so that a vivid interaction took place.

Image 1: fruit rainbow

Image 2: fruit rainbow

With the participants' consent and willingness, an agreement was made to consume a fruit of their choice each day for five consecutive days. Each day focused on a different color of the rainbow (see Images 3–7), and participation was entirely voluntary. The selection of the fruit was a personal decision, emphasizing autonomy and responsibility. Since the success of the process relied on the participants' active engagement, they were responsible for independently choosing a fruit that matched the color of the day to include in their snack.

At the end of each school day, a colored card corresponding to the next day's rainbow color was given to each participant. This served as a visual reminder at home when preparing their snack. Participants were also free to include other foods alongside the designated fruit.

During the activity, participants presented the fruit they had brought and explored its properties using all five senses. This sensory investigation was followed by a discussion about the nutritional benefits of the fruit. Time was also dedicated to personal expression and reflection, allowing participants to share their thoughts and experiences.

Image 3
Day 1: Red Fruits

Image 4
Day 2: Orange Fruits

Image 5
Day 3: Yellow Fruits

Image 6
Day 4: Green Fruits

Image 7
Day 5: Blue Fruits

Thinking Routines – the Concept of Balanced / Non-restructive Nutrition

An exculpatory approach to dietary habits, one that avoids a dichotomous classification of foods as strictly "good" or "bad", can positively influence individual food choices (Contois, 2015; Yu, 2020). In line with this perspective, children were encouraged to reflect on and redefine their dietary perceptions without criticism, particularly regarding the concept of non-restrictive eating. This process took place alongside the fruit-tasting activities and was facilitated through structured thinking routines. To support this reflective engagement, a series of five images, one for each day of the 5-day intervention, was used. These are presented below (Images 8 to 12):

Image 8
Day 1 of Intervention

Image 9
Day 2 of Intervention

Image 10
Day 3 of Intervention

Image 11
Day 4 of Intervention

Image 12
Day 5 of Intervention

Thinking routines are one of the cores of a method called "Visible Thinking", developed by Project Zero at Harvard Graduate School of Education. It is defined as: *"a flexible and systematic research-based conceptual framework, which aims to integrate the development of students' thinking with content learning across subject matters"* (Project Zero, 2011a). They are called routines because they are structured steps of thinking designed to foster deep understanding, critical thinking, and metacognitive skills and make thinking visible.

In the present research, the thinking routine "See-Think-Wonder" was chosen, along with relevant images (Images 8-12), because it is useful to elaborate prior beliefs through observation and interpretation. The routine was used as a group discussion technique which is broken down into smaller steps of thinking. While participants observe a visual source, in our case the set of Images 8-12, specific questions were addressed in the following order:

1. **See:** What do you see?
2. **Think:** What do you think about that?
3. **Wonder:** What does it make you wonder?

(Project Zero, 2011b)

As part of a multimodal learning approach, each activity concluded with a music and movement session related to healthy nutrition. Additionally, at the end of each of the five days, participants colored the corresponding section of a rainbow worksheet to match the color of the fruit they had consumed that day. Upon completion of the entire process, participants received tangible, positive reinforcement in the form of a rainbow-themed sticker and enjoyed tasting fruit in an alternative form, freshly squeezed orange juice.

Skill Stabilization

Duration: 2nd-10th week of the program

Second week: Over the course of five days, participants were encouraged, voluntarily and independently, to include fruits of their own choice in their snack, alongside any other foods they wished to consume. After snack time, during circle time, participants were invited to voluntarily draw the fruits they preferred and to associate them with the benefits they offer. These personal preferences were then shared with the group, leading to a guided discussion that promoted critical thinking around healthy eating habits.

On the fifth and final day, a reflective group discussion was held. As a result, participants collectively designated two days of the week as "Rainbow Days," during which a fruit of their choice would be consumed at snack time for a period of eight weeks.

Weeks 3 to10: Parents were informed and encouraged to support the initiative by providing verbal reminders, encouragement, and praise at home. On each "Rainbow Day," participants who consumed a fruit of their choice were invited to stamp a dot-to-dot rainbow, using a stamp color that corresponded to the fruit they had eaten. This served as a fun and visual reminder of their progress. Upon completing the entire process, participants received tangible positive reinforcement in the form of a certificate celebrating their achievement in the challenge: *"Can You Eat a Rainbow?"*

Phase 3

Time 2: Post-test 1: 4 weeks after intervention completion

Duration of measurement: 1 week

Time 3: Post-test 2: 8 weeks after intervention completion

Duration of measurement: 1 week

Upon completion of the 10-week intervention program, participants' snack intake was recorded over a five-day period on two separate occasions:

- **Time 2 (Post-test 1):** Four weeks after the conclusion of the intervention
- **Time 3 (Post-test 2):** Eight weeks after the conclusion of the intervention

As in the pre-test phase, the type of snack consumed by each participant was recorded daily. If a snack included fruit, the participant was awarded one point; if not, zero points were given. Each point corresponded to a value of 0.20. Therefore, the maximum number of points

a participant could earn during each post-test period was five, equating to a total score of 1.00.

Results

Participants attended a specially designed program for fruit consumption during snack time at school for 10 weeks, using the S.M.A.R.T. framework. Their consumption of fruits was measured before the special program, after 4 weeks and after 8 weeks.

A repeated-measures ANOVA was conducted to evaluate the effect of time on fruit consumption during snack time at school. The means and standard deviations for fruit consumption at each time point are presented in Table 1.

Table 1: Descriptive statistics for Fruit Consumption School Snack

Time	M	SD
Pre-test	.2984	.35344
Post-test time-point 1	.5359	.35098
Post-test time-point 2	.5309	.40357

Mauchly's test indicated that the assumption of sphericity was not met, $\chi^2(2) = 6.84$, $p = .03$ (Table 2). Therefore, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .87$). The effect of time on fruit consumption was statistically significant, $F(1.74, 54.04) = 9.22$, $p = .001$, partial $\eta^2 = .229$ (Table 3).

Table 2: Mauchly's Test of Sphericity[b]

					Epsilon[a]		
Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.796	6.848	2	0.033*	.830	.872	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept
Within-Subjects Design: Time

Table 3: Tests of Within-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	1.179	2	.589	9.222	.000	.229
	Greenhouse-Geisser	1.179	1.661	.710	9.222	.001	.229
	Huynh-Feldt	1.179	1.743	.676	9.222	.001**	.229
	Lower-bound	1.179	1.000	1.179	9.222	.005	.229
Error (time)	Sphericity Assumed	3.962	62	.064			
	Greenhouse-Geisser	3.962	51.491	.077			
	Huynh-Feldt	3.962	54.048	.073			
	Lower-bound	**3.962**	**31.000**	**.128**			

a. Computed using alpha = .05

Post-Hoc Tests

Post-hoc pairwise comparisons with a Bonferroni adjustment indicated that fruit consumption was significantly higher at both time 2 ($p < .001$) and time 3 ($p = .01$) compared

to baseline. There was no significant difference between fruit consumption at time 2 and time 3 (p = 1.00) (Table 4).

Table 4: Post-hoc tests

Eat fruits Time (I)	Eat fruits Time (J)	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Time 1	Time 2	-.238**	.051	.000	-.367	-.108
Time 1	Time 3	-.232*	.075	.013	-.424	-.041
Time 2	Time 1	.238**	.051	.000	.108	.367
Time 2	Time 3	.005	.061	1.000	-.148	.158
Time 3	Time 1	.232*	.075	.013	.041	.424
Time 3	Time 2	-.005	.061	1.000	-.158	.148

* The mean difference is significant at the 0.05 level.

[a] Adjustment for multiple comparisons Bonferroni

Discussion

The findings of the present study revealed that fruit consumption during snack time in the preschool context increased significantly four weeks after the implementation of a specially designed program based on the S.M.A.R.T. framework. Notably, fruit intake remained significantly higher even eight weeks after the conclusion of the intervention, indicating a degree of behavioral persistence. These results suggest that the application of the S.M.A.R.T. framework in preschool nutrition programs can be effective in promoting and maintaining healthy dietary behaviors over time.

This aligns with previous research demonstrating the efficacy of the S.M.A.R.T. framework in enhancing outcomes in educational settings (Lawlor, 2012; Li & Wong, 2019; Poe et al., 2021). In the present study, the intervention lasted for 10 weeks and involved repeated exposure to a variety of fruits. Consistent with this approach, Nekitsing et al. (2018) found that repeated exposure is a safe and effective method for influencing food preferences and increasing fruit and vegetable intake in preschool children.

Children in this study were also independently and actively engaged in the program, particularly in decision-making regarding snack preparation. Similar findings have been reported in earlier research. Repeated taste-testing has been shown to increase acceptance of unfamiliar foods over time (Rioux et al., 2018). Moreover, when repeated exposure is combined with strategies such as active involvement of children and parents, multisensory experiential activities, and clearly defined goals, interventions yield stronger and more immediate effects (Hodges, 2020; Roe, 2022). Supporting this, Hausner et al. (2012) reported that fruit and vegetable consumption in children increases significantly after approximately five exposures.

Limitations

This study has several limitations. First, due to the small sample size, the findings reflect correlations rather than causal relationships. As such, the results should be interpreted with caution, and generalizability to broader populations is limited. The constrained sample and the focus on a single urban preschool reflect real-world limitations commonly encountered in school-based intervention research.

Conclusions

This study addressed the issue of fruit consumption during snack time in a preschool setting. The findings revealed that fruit intake increased significantly at both four and eight weeks following the implementation of a structured program based on the S.M.A.R.T. framework. These results suggest that applying the S.M.A.R.T. framework, in combination with a non-restrictive dietary approach, can yield beneficial outcomes for targeted nutrition education interventions in early childhood settings.

Future Research

A documented shift away from the traditional Mediterranean diet, particularly among younger populations, has been reported (Martimianaki et al., 2022), raising concerns about potential long-term health implications. This underscores the critical importance of implementing effective nutrition programs starting in the preschool years. As an exploratory pilot study, the present research prioritized depth over breadth, offering preliminary insights into the feasibility and potential impact of an innovative intervention within a specific educational microsystem. Future studies should involve larger, more diverse samples across multiple sites or regions to enhance external validity and enable comparative evaluations of different intervention models.

Parental involvement was another element of this study. While parents participated in a supportive but non-intervening role during snack preparation, their influence as role models remains significant in shaping children's dietary habits (Kosti et al., 2021). Future research should explore the effects of more active parental engagement, including informational components and joint activities, to better understand their role in reinforcing healthy eating behaviors. This could involve initiating the intervention at the start of the academic year and systematically tracking fruit consumption both at school and at home. Additionally, future study designs should incorporate comparison groups to assess the relative effectiveness of the S.M.A.R.T. framework against alternative intervention strategies.

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