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Development of the Healthy and Nutritious Traditional Game Dampu (Segi) to Increase Knowledge of Healthy Food in Early Childhood

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Abstract
Healthy food knowledge among early childhood in Indonesia remains low, as children tend to reject vegetables and fruits while preferring snacks and sweetened drinks. This study aims to develop the traditional game Dampu Sehat Bergizi (SEGI) as an innovative learning medium to improve children's understanding of healthy food. The research employed a Research and Development (R&D) approach using the ADDIE model, limited to the development stage, and was tested on 15 children aged 5–6 years at TK Larasati, South Jakarta. Data were collected through observation, teacher interviews, expert validation (nutrition, early childhood education, and media experts), and a pre-experimental one-group pretest–posttest design. Validation results indicated an average score of 90.2% categorized as "highly feasible." Effectiveness testing showed a significant improvement, with the average knowledge score increasing from 86% ("adequate") to 94% ("highly feasible") after using the SEGI game. Children demonstrated high enthusiasm, active participation, and improved ability to identify healthy food categories. These findings confirm that the SEGI traditional game is effective in enhancing early childhood nutrition literacy through engaging, interactive, and culturally relevant learning experiences.

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1. INTRODUCTION

Healthy food knowledge in early childhood is a hot topic among global researchers because it is directly related to growth and development, academic achievement, and long-term health. Researchers emphasize that healthy eating habits should be formed from an early age because consumption patterns in childhood will be carried into adulthood [1]. Research shows that children who have a basic understanding of nutritious foods tend to choose fruits, vegetables, and better sources of protein than those who are not educated [2]. The results of a study in the United States found that a nutrition education program in kindergarten can increase fruit and vegetable consumption by 25% [3]. Meanwhile, research in Europe reported that early childhood children who received interventions through interactive nutrition storybooks had a higher awareness of healthy foods [4]. In Asia, a study in Japan highlighted that parental involvement in children's nutrition education significantly strengthened healthy eating behaviors at home [5], [6]. This proves that nutrition education in early childhood is not only the responsibility of schools, but also families and communities [7].

Furthermore, numerous studies have shown a close link between nutritional knowledge and the prevention of multiple nutritional problems, such as obesity and malnutrition [8]. A study in Brazil revealed that children with a poor understanding of healthy foods are

twice as likely to be overweight [9]. On the other hand, research in Indonesia emphasizes that limited information and minimal nutritional literacy among parents contribute to high stunting rates [10]. Research in Australia shows that a "play-based nutrition education" program can improve children's skills in recognizing healthy foods in a fun way. Meanwhile, research in Canada highlights the importance of integrating nutrition into the early childhood education curriculum to foster consistent eating behaviors [2], [5], [7], [8], [9], [10]. Experts agree that nutritional knowledge should be packaged through creative media, such as digital games, group cooking activities, and illustrated stories. This global research evidence strengthens the argument that building nutritional literacy from an early age is an important investment for a healthy and productive golden generation [11].

The problem of healthy food knowledge in early childhood in Indonesia remains a serious concern due to high rates of stunting, obesity, and malnutrition. Many children do not yet understand the concept of balanced nutrition, so their diet is often dominated by foods high in sugar, salt, and saturated fat [12], [13]. Research shows that the lack of nutritional literacy among parents and PAUD teachers is a major factor in children's low awareness of healthy food [14], [15]. In addition, access to nutritious food is still limited in some areas, especially in remote and rural areas [16]. Children are also influenced by aggressive fast-food advertising in the media, making it difficult to form healthy eating habits from an early age. The existing PAUD curriculum does not optimally include nutrition education as part of daily learning [17]. Many teachers do not have specific competencies in children's nutrition education. The role of parents is sometimes limited due to busy schedules and minimal knowledge about nutrition. There are still differences in understanding between urban and rural communities [18], [19]. The lack of synergy between schools, families, and communities makes nutrition interventions less comprehensive [20], [21]. Healthy food available in schools is still limited. The availability of books or interactive learning media on nutrition is also minimal. Many children are not yet accustomed to a routine pattern of eating three meals a day plus healthy snack [22]. The lack of monitoring and evaluation by relevant parties often makes nutrition education efforts unsustainable. All of these conditions indicate the need for an integrated strategy involving all stakeholders [23], [24].

The Indonesian government has made various efforts to increase knowledge of healthy food for early childhood, but the results are still not optimal. The "Balanced Nutrition" and "Isi Piringku" programs are being intensified through the Ministry of Health to raise public awareness [25]. Early childhood education centers (PAUD) and Integrated Health Posts (Posyandu) in several regions have become media for nutrition education for children and parents. Several regions have held training for PAUD teachers on healthy food education. Campaigns through social media and television are also being conducted to reach a wider community [26]. Distribution of nutritional supplements and additional food at Posyandu is one strategy to reduce stunting rates [27]. However, limited budget and human resources remain major obstacles in program implementation. Regular program evaluation is not evenly distributed across all provinces [28]. Parental involvement in children's nutrition education is also still low, so the transfer of knowledge to the home is limited. Interactive and creative learning media that can attract children's interest are still rarely used [29]. In some regions, access to healthy food is still difficult due to price and limited availability. Synergy between ministries, schools, and communities still needs to be strengthened. Monitoring of unhealthy food advertising for children is also still weak [30]. Nutrition education has not yet been fully incorporated into the national curriculum for early childhood education. This demonstrates that, despite existing efforts, a more comprehensive, sustainable, and inclusive approach is still urgently needed.

The problem of healthy food knowledge in early childhood in Indonesia remains a major challenge despite various efforts being made. A study shows that parents' nutritional literacy does not significantly influence their ability to choose nutrition for early childhood, with a significance value of 0.324 and an R Square of 0.024, meaning that only 2.4% of parents' abilities can be explained by nutritional literacy [31]. In addition, the study also revealed that although through cooking centers it can increase knowledge about healthy food in early childhood, the performance indicator in cycle I reached 0% and in cycle II reached 80%, indicating that there are still challenges in its implementation [32]. The importance of a holistic approach in early childhood education, where health and nutritional literacy are integrated into parenting patterns and children's learning environments as an effort to achieve the goals of Holistic Integrative PAUD in Indonesia [33]. However, the implementation of this approach is still limited and not evenly distributed throughout Indonesia [34]. In addition, other studies show that the introduction of healthy and nutritious food through food supplies to children aged 5-6 years at Nusa Indah Randumuktiwaren Kindergarten shows that the introduction of healthy food through food supplies makes students have a good understanding and are used to consuming healthy and nutritious food, are not easy to buy snacks in random places, and the growth of students every month experiences an increase [35]. However, inhibiting factors such as economic level, time and busyness of parents, parental knowledge and the environment are still challenges in its implementation. This shows that despite efforts, the problem of healthy food knowledge in early childhood in Indonesia is not optimal and requires further attention [36].

Observations at Larasati Kindergarten reinforce previous research findings that knowledge of healthy foods among young children in Indonesia is still very limited. Many children do not yet understand the basic concepts of healthy foods and tend to reject vegetables and fruit during PMTAS activities, which is in line with research that conventional interventions are often suboptimal. Children also find it easier to name snacks such as chips, biscuits, and sweet drinks, indicating a dominant preference for unhealthy foods from an early age [37]. Teachers have tried to convey material through pictures and stories, but children's responses remain passive, they get bored quickly, and they easily lose interest, in line with findings that emphasize the need for a holistic and interactive approach to nutritional literacy. Observational data show that more than 70% of children refuse to consume fruits and vegetables, and only five children are able to group staple foods, side dishes, fruits, and vegetables, indicating low knowledge transfer through conventional methods [38]. This confirms that existing learning approaches are not appropriate for the developmental stage of early childhood. This fact is also relevant to research that found that parental nutritional literacy does not have a significant influence on children's food choices. The lack of parental and teacher involvement in daily nutritional practices reinforces children's limited knowledge [16]. One-way learning activities without creative interaction are less effective in developing healthy eating habits. This highlights the need for engaging pedagogical innovations that are tailored to children's characteristics. Interactive media, educational games, and hands-on experiences with healthy foods can be more effective strategies. Thus, observations at Larasati Kindergarten provide field evidence that conventional methods continue to fail to reach children optimally. This issue also reflects the national reality that nutrition education programs in early childhood education (PAUD) are unevenly distributed and insufficiently sustainable. Interventions based on play activities and real-life food exploration can be a solution that bridges the gap in knowledge and healthy eating behaviors. Therefore, developing innovative learning models is crucial for building children's nutritional literacy from an early age.

The issue of healthy food knowledge among early childhood in Indonesia remains a serious concern because many children do not yet understand the basic concept of balanced nutrition. Observations at Larasati Kindergarten showed that children reject vegetables and fruit, preferring snacks and sweet drinks. Previous research has shown that conventional methods using pictures, stories, or cooking classes only limitedly improve children's knowledge. Many nutrition learning methods are still one-way and lack interactive interaction, quickly boring children and making it difficult to develop healthy eating habits. Parents' nutritional literacy is also suboptimal, so knowledge transfer at home is still limited. The research gap is evident in the lack of traditional play approaches that integrate nutrition education with children's physical and social activities. Local media and traditional games as tools for learning about nutrition are still rarely developed. This highlights the need for innovations that are appropriate to children's developmental stages. Children need interactive, fun, and contextual learning media. Thus, new strategies are needed to effectively increase healthy food knowledge.

This research offers novelty through the development of the Traditional Dampu Sehat Bergizi (SEGI) Game, which combines traditional elements with balanced nutrition education. This game is designed for children to learn through play, interact with peers, and understand the categories of staple foods, side dishes, fruits, and vegetables. The purpose of this study is to develop the SEGI game as an innovative nutrition education medium and to evaluate its effectiveness in improving healthy food knowledge in early childhood. Furthermore, the study aims to observe children's responses to interactive and fun learning media. This study also assesses children's ability to maintain interest and focus during nutrition lessons. With a playful approach, it is hoped that children will more easily understand nutrition concepts and develop healthy eating habits. Another novelty of this research is the integration of local cultural values through traditional games. This model can be adapted in various early childhood education centers in Indonesia. The research results are expected to provide practical contributions for teachers and parents in nutrition education. Thus, SEGI is an innovative solution to address the nutritional literacy gap in early childhood while developing learning media based on local culture.

2. RESEARCH METHOD

This study uses a Research and Development (R&D) approach to produce and test the effectiveness of a product in the form of a Dampu SEGI game learning media. This product was developed using the ADDIE model, but the research was limited to the Development stage, namely a limited trial of the game tool. The selection of the ADDIE model is based on its advantages as a systematic framework that allows the development of effective, efficient, and user-friendly learning media. This limited trial is used to evaluate the feasibility of the content, appearance, and use of the media, while also providing a basis for revision for further development. The product was developed to increase children's knowledge about staple foods, side dishes, fruits, and vegetables in an interactive and fun way.

This research was conducted at Larasati Kindergarten, located at Jalan Rambutan No. 48, South Manggarai, Tebet, South Jakarta. The research period lasted for four months, from May 2025 to August 2025. The research targets 15 students consisting of nine boys and six girls aged 5–6 years. The selection of students was based on considerations of variations in initial abilities of healthy food knowledge. Initial conditions showed that most children rejected vegetables and fruit and preferred snacks and sweet drinks. Initial observations were used to determine the level of children's understanding regarding the categories of staple foods, side dishes, fruits, and vegetables. This initial data became the basis for consideration in developing learning media. Researchers also conducted

interviews with teachers to explore their experiences and methods used so far. The interview results served as a reference in designing media that suited the needs of children and teachers. Literature analysis related to children's nutrition education was also conducted to support product design. Thus, this research ensured that media development was in line with the needs of students. All research activities took into account the local context and characteristics of early childhood.

The development of Dampu SEGi learning media uses the ADDIE model, but the research is limited to the Development stage. The development steps begin with preliminary research, namely observations and interviews with teachers to determine the initial level of children's knowledge about healthy food. Next, a needs analysis is conducted to ensure the developed media aligns with the learning objectives and children's needs. The model design stage includes creating a product draft, illustrations, game rules, and formulating objectives for children to achieve. During the development stage, the media is validated by material experts, educational practitioners, and media experts using a Likert-scale questionnaire. The validation results are used for initial product revisions before small group trials. The trial phase involves 15 students to assess the media's feasibility in the field. Observations are conducted to evaluate children's participation, interest, and understanding. The media is tested to determine its effectiveness in increasing knowledge about healthy food. The entire process is carried out systematically to ensure the final product is high-quality and meets user needs. The trial data is used for final evaluation and product improvement. This approach ensures that Dampu SEGi media is relevant and enjoyable for early childhood.

For validation and evaluation, the media was examined through expert judgment, involving material experts, education practitioners, and media experts. The material experts assessed the suitability of the content and relevance of the nutrition material, education practitioners assessed the suitability to the child's age, response, and learning context, while the media experts assessed the visual quality, image representation, layout, and interactivity of the media. After validation, revisions were made based on expert input to improve the quality of the media. Data collection instruments included teacher interviews, expert validation questionnaires, and child assessment sheets. The teacher interviews aimed to understand the healthy food learning methods and the challenges encountered. The expert validation questionnaire used a 1–5 Likert scale and an open-ended comment column. The child assessment sheets were used to observe children's cognitive abilities in recognizing healthy foods and their participation in play. Data analysis was conducted quantitatively and qualitatively. Input from experts was analyzed qualitatively to guide product revisions. Quantitative data from the questionnaires and assessment sheets were analyzed descriptively, converted to percentages, and categorized into levels of media feasibility. The analysis results were used to assess the initial effectiveness of the Dampu SEGI media and serve as a basis for further development. With this approach, the media is expected to improve children's knowledge of healthy foods in an interactive, fun, and local context-appropriate manner.

To test the effectiveness of the Dampu SEGI learning media, this study used a one-group pretest-posttest design. This design involved measuring students' knowledge of healthy foods before and after using the game media. A pretest was administered to determine children's initial abilities in recognizing staple foods, side dishes, fruits, and vegetables, as well as their understanding of portion sizes and benefits. Afterward, the Dampu SEGI media was introduced through interactive play activities in the classroom. Children followed all game procedures designed to meet the developmental stages of children aged 5–6 years. A posttest was conducted after the play session to measure changes in children's knowledge. Analysis was conducted by comparing pretest and posttest scores

using descriptive percentage techniques and comparison charts. The difference in scores indicates the extent to which the Dampu SEGI media was able to improve knowledge of healthy foods. Observations of children's participation and enthusiasm were also recorded to support the quantitative data. With this approach, the study assessed not only cognitive aspects but also children's engagement in the learning process. The results of the effectiveness test are expected to provide an initial overview of the media's success in improving understanding of healthy food concepts. These findings can later serve as the basis for improving and developing the media for broader implementation.

3. RESEARCH RESULTS AND DISCUSSION

3.1.Research result

The results of the needs analysis showed that the learning media used by teachers at Larasati Kindergarten were still less engaging for children. Teachers mostly used pictures and stories, but children's responses were still passive and often lost interest. Traditional games were rarely used as learning media, so children were less interested in the methods provided. Only five children from the entire class were able to answer questions related to healthy food. Researchers also reviewed related literature to strengthen the basis for media development. Based on these findings, researchers designed the Dampu SEGI game media as an interactive learning tool. The established achievement indicators included children's ability to name types of staple foods, side dishes, fruits, and vegetables, group foods according to category, and state the benefits of healthy food in simple terms. The images used in the media were selected from the children's environment for easy recognition. This media also included question cards to reinforce knowledge. The game design combined elements of the traditional dampu game with nutrition material, consisting of boxes depicting healthy food measuring 40 cm x 40 cm and 80 cm x 40 cm. Each box displays a specific food category, while the question cards contain questions related to staple foods, side dishes, fruits, and vegetables. The media is equipped with instructions for use so that teachers and children can make optimal use of the game.

Figure 1 Final model of the SEGi Dampu game

Figure 2 Final model of healthy food card

The product validation (development) stage was conducted by material experts, education practitioners, and media experts to assess theoretical feasibility. Nutrition experts gave a score of 92%, stating the media was very suitable, with suggestions for question variations to broaden the material coverage. Education practitioners gave a score of 87.2%, assessing the media as engaging, appropriate to children's developmental characteristics, and helpful in achieving learning objectives. Media experts rated the media's visual quality, image representation, and interactivity as very good, with a score of 91.4%. Suggestions for improvement included adding text to the images, varying the images, and adding a "Start" instruction to help children understand the initial steps of the game. The revisions based on the validators' input resulted in the final Dampu SEGI model, ready for use in learning. This final model consists of a game board and healthy food cards that are attractive, ergonomic, and suitable for children aged 5–6 years. All aspects of the material, media, and design have been adjusted to keep children active, interested, and able to understand the concept of healthy food in a fun way. This validation indicates that the media has met the criteria of being very suitable from a theoretical perspective and is ready to be empirically tested on children. Empirical testing was conducted in class B of Larasati Kindergarten with children aged 5–6 years, using observations of the children's ability to answer questions and participate in games. Each child was given the opportunity to play, answer questions, and jump within the game box. This activity measured their understanding of food types, food classifications, and the benefits of healthy eating.

The results of the empirical feasibility test showed a significant increase in children's knowledge after using the Dampu SEGI media. The average score for children's ability to understand healthy food reached 89%, including the ability to name staple foods, side dishes, fruits, vegetables, the contents of a healthy plate, and examples of foods that should be limited. Observations showed that children were enthusiastic, active, and interested in answering questions during the game. Some children who were previously passive were now able to correctly name types of food and their benefits. This game also trained motor coordination, concentration, and understanding of food categories. The assessment showed that all learning achievement indicators were met with a "very

adequate" category. This confirms that the Dampu SEGI learning media is effective in increasing knowledge of healthy food in early childhood. Children are more motivated to learn through play, making learning fun and interactive. Based on these results, the Dampu SEGI media can be recommended as an innovative alternative in nutrition learning in early childhood education (PAUD). The development of this media also demonstrated that the combination of traditional games and educational materials can support active learning. This study provides empirical evidence that interactive media can significantly improve understanding of healthy food concepts. In conclusion, Dampu SEGI is suitable for widespread use in PAUD as an innovative learning medium.

The results of the effectiveness test of the Dampu SEGI media on the knowledge of healthy food in children aged 5–6 years showed a significant increase after the learning. The study used a pre-experimental design with one subject group, where the measurement of children's abilities was carried out before (pre-test) and after (post-test) the media intervention. The pre-test showed an average score of children's healthy food knowledge ability of 65 out of a maximum score of 75, with an average percentage of 86%, which is classified as "sufficient". After the implementation of the Dampu SEGI media, the post-test showed an increase in the average score to 71 out of 75, with an average percentage of 94%, classified as "very adequate". The data showed that all learning achievement indicators experienced an increase, including the ability to name types of staple foods, side dishes, fruits, vegetables, grouping foods according to categories, and stating the benefits of food simply. Children showed high interest and active participation during play, and were able to answer questions correctly. Field observations revealed an increase in concentration, interest, and the ability to remember healthy food information. Analysis per indicator showed the highest score was in questions regarding the contents of a healthy plate and food classification, with a percentage of 94%. This improvement confirms the effectiveness of traditional game-based interactive media in improving children's nutritional knowledge. The overall average increase in children's abilities was 8%, demonstrating the significant effectiveness of using the Dampu SEGI media. These results also align with input from validators who assessed the media as highly appropriate in terms of materials, media, and educational practices. Thus, the Dampu SEGI media is not only engaging and interactive, but also proven effective in teaching healthy food knowledge to young children.

3.2.Discussion

This study develops the traditional game media Dampu SEGi as an educational tool to improve early childhood knowledge about healthy food. Unlike previous studies that focused on gross motor skills or children's character, this study integrates health education within the context of traditional games. For example, research results emphasize improving gross motor skills through Dampu games, while this study highlights improving knowledge about healthy food [8], [9], [10]. Furthermore, research by Karyadi & Jannah (2023) also used Dampu games to improve gross motor skills, but did not link them to health education. Thus, this study offers a new approach in utilizing traditional games as a holistic learning medium, encompassing cognitive, physical, and health aspects. This is in line with constructivism theory which emphasizes the importance of direct experience in children's learning processes. Through Dampu SEGi, children not only learn about healthy food but also experience a fun and interactive learning process firsthand. The application of this theory in the context of traditional games shows great potential in improving the effectiveness of

learning for early childhood. In addition, this research also contributes to the preservation of local culture through the introduction of traditional games to the younger generation [11], [39], [40], [41].

Most previous studies have focused on the physical and motor aspects of children through traditional games. The results showed that the Dampu game can improve gross motor skills in early childhood [42], [43], [44]. However, these studies did not link the game with health education. Similarly, other studies emphasized the improvement of gross motor skills through the Dampu game, without including elements of health education [3], [4], [7], [45]. Other studies also focused on gross motor stimulation through the Engklek game, while this study combines motor aspects with health education in one game medium [8], [9], [10]. Another significant difference lies in the approach used. Previous studies tended to use a separate approach between physical and educational aspects, while this study integrates both in one holistic game medium. This shows that Dampu SEGI is not only effective in increasing knowledge about healthy food, but also supports children's physical development simultaneously. Thus, this study provides a new contribution to the literature regarding the use of traditional games as a comprehensive learning medium.

The implementation of Dampu SEGI in early childhood education can have a significant positive impact. Through this game, children can learn about healthy food in a fun and interactive way, increasing their motivation and interest in learning. In addition, this game can also improve children's gross motor skills, as shown in studies [46], [47], [48]. Thus, Dampu SEGI not only functions as a health education medium, but also as a tool to support children's holistic physical development. The implementation of this game in the early childhood education curriculum can enrich existing learning methods, providing interesting variations for children. However, to ensure its effectiveness, training is needed for educators to be able to implement this game in an appropriate and optimal manner. In addition, adapting this game to various cultural contexts and localities is also important so that it can be well received by children from various backgrounds. Other studies have shown that traditional games adapted to local contexts can be more effective in achieving educational goals. Therefore, it is important for media developers to consider cultural and local aspects in game design [49], [50].

Although Dampu SEGi has demonstrated significant effectiveness, there are several challenges in its implementation. One of these is limited resources, such as game materials and adequate space to carry out the game. In addition, differences in the level of understanding and skills of educators in implementing this game can also affect its effectiveness. Research results show that traditional games can improve children's social skills, but this depends on how the game is implemented by educators [51], [52]. Therefore, it is important for educators to understand the characteristics of traditional games and how to integrate them into the learning process. In addition, regular evaluation of the implementation of Dampu SEGi needs to be carried out to identify areas that need improvement and further development. By involving parents and the community in the learning process, Dampu SEGi can become a more powerful tool in supporting early childhood health education. Overall, Dampu SEGi has great potential to be an innovative and effective learning model in improving healthy food knowledge in early childhood.

In today's digital era, many educational institutions are turning to the use of technology in the learning process. However, research shows that traditional games have equally important benefits in early childhood development [53]. Traditional games can help children develop social, motor, and cognitive skills simultaneously.

Dampu SEGI, as an innovative form of traditional games, combines local cultural elements with health education, providing a holistic learning experience for children. In contrast to digital approaches that are often passive, Dampu SEGI encourages children to actively participate, interact, and learn through direct experience. This is in line with active learning theory which emphasizes the importance of direct involvement in the learning process. Thus, Dampu SEGI offers an interesting and effective alternative in early childhood education, combining the advantages of traditional games with the needs of health education.

This research opens up opportunities for further development in the field of early childhood education. Future research is needed to explore the long-term impact of Dampu SEGI on children's healthy eating behaviors and to develop game variants that can be adapted to different local needs and contexts. Furthermore, research could also focus on developing training modules for educators to improve their skills in implementing Dampu SEGI effectively. Thus, Dampu SEGI serves not only as a health education medium but also as a tool to support children's holistic physical and social development. Overall, Dampu SEGI is a promising innovation in early childhood education, combining local cultural values with health education needs, making a significant contribution to the existing literature.

4. CONCLUSION

The conclusion of this study shows that the development of the traditional game Dampu SEGi is effective in improving early childhood knowledge about healthy eating. This game not only facilitates understanding of the concept of balanced nutrition but also encourages active involvement of children through a fun and interactive learning experience. The results confirm that integrating health education into the context of traditional games can increase learning motivation and simultaneously support children's motor and social development. Compared with previous studies, Dampu SEGi offers a holistic approach that combines local cultural values with educational objectives, thus providing a new contribution to the literature on early childhood education. These findings open up opportunities for the development of other innovative learning methods that simultaneously integrate cognitive, physical, and social aspects. The essence of this research finding emphasizes the importance of innovative learning media that are relevant to the local context, capable of improving children's nutritional literacy, and strengthening fun and effective educational practices. Thus, Dampu SEGi becomes a learning model that can be practically applied in early childhood education institutions to support the formation of healthy eating behaviors from an early age.

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provide practical benefits for the development of early childhood education and inspire further research.

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