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The Influence of Nutrition Education Media in the Form of Storybooks and Digital Animation on Preschool Children's Nutrition Knowledge

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ABSTRACT

This study aims to analyze the influence of media education in the form of storybooks and digital animations on the nutritional knowledge of preschool children. Using a quasi-experimental design with pretest and posttest samples, 78 preschool children were randomly assigned into a control group, a storybook group, and a digital animation group. Nutritional knowledge was measured using a validated 10-item questionnaire. The storybook group demonstrated a statistically significant improvement in nutritional knowledge ($p = 0.006$) with the highest mean score increase of +10.2 points. In contrast, the digital animation group showed a minimal, non-significant improvement of +2.7 points ($p = 0.343$), while the control group experienced a decline of -3.2 points. The difference in knowledge score changes among the three groups was statistically significant ($p = 0.002$). Storybooks proved more effective because their structured, narrative-visual format allows for active interaction and step-by-step comprehension, whereas the digital animation likely caused cognitive overload and passive learning due to excessive visual stimulation. Implementing this approach in preschool curricula can systematically improve children's healthy eating habits, serving as a viable strategy to combat long-term nutritional issues like stunting and obesity.

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1. INTRODUCTION

Preschool children are those who are between 3 and 6 years old, at this age, children go through several stages of development, including physical, motor, cognitive, social, emotional, and language development (Mustikaati et al., 2026). One way to develop cognitive abilities is by providing learning experiences that promote the habit of eating nutritious foods in children (A'yun et al., 2024). The habit of healthy eating should be instilled in children so that nutritious eating behaviors can be carried into adulthood (Mariska et al., 2025), examples of unhealthy eating habits in children include consuming fast food, foods high in sugar, and foods high in salt (Rembet et al., 2021) as a result of unhealthy eating, children may experience stunting, anemia, obesity, and vitamin A deficiency (De Paiva et al., 2025). According to the 2024 Indonesian Nutritional Status Survey, the prevalence of stunting among children under five in Indonesia declined to 19.8%. Nevertheless, this figure remained above the national target of 14% set in the 2020 – 2024 National Medium-Term Development Plan (RPJMN) (Sari et al., 2025).

Children's nutritious eating habits can be influenced by the nutritional knowledge they possess (Nasution et al., 2024), therefore, it is important to provide nutrition education to children from an early age to enhance their knowledge and improve their healthy eating behaviors (Khadijah et al., 2025). In line with that, in this study (Hapsari et al., 2022) it is explained that nutrition education influences preschool children's positive attitudes toward eating vegetables. Thus, providing nutrition education to children not only increases their knowledge but also helps them develop the habit of eating nutritious foods.

The challenge in providing nutrition education to preschool children lies in creating engaging and easily understandable learning harexperiences so that children do not become bored (Syahfitri et al., 2022). The use of engaging media is one of the key factors for success in delivering education (Titin et al., 2023). Several studies have attempted to examine the use of various media for nutrition education among preschool children, such as the study by (Marwan et al., 2025) which found that video media can help children understand the importance of having a balanced and nutritious breakfast, while another study (Nurahmadi & Dalimunthe, 2024) also explained that pop-up book media can improve children's nutritional knowledge and breakfast habits. The researchers in this study had previously developed educational media in the form of digital animation, which was tested in an earlier study and found to have a significant effect on the nutritional knowledge of the target group (Nurlaili et al., 2026). Therefore, nutrition education media provided to children can enhance their knowledge about the nutritional value of food. Based on the explanation above, the researchers are interested in examining the influence of nutrition education media in the form of storybooks and digital animations on the nutritional knowledge of preschool children.

The general objective of this study is to analyze the influence of educational media in the form of storybooks and digital animations on the nutritional knowledge of preschool children. The specific objectives of this study are, 1) to identify the characteristics of the participants, 2) to analyze their nutritional knowledge before and after the intervention, and 3) to analyze the effectiveness of nutrition education media on changes in nutritional knowledge within the treatment groups.

2. METHODS

This study was a quasi experimental research with an untreated control group design using dependent pretest and posttest samples. The research was conducted over 8 months, from March to November 2023, at RA Al Kamal, located at Depok City. The population in this study

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comprised all students at RA Al Kamal, with a total population of 88 children. The selected sample included both male and female students aged 5–7 years. Sample selection was conducted using a purposive sampling method. All students who met the inclusion criteria were randomly assigned into three groups: the control group (K), the nutrition education group using storybooks (BC), and the nutrition education group using digital animation (AD). The minimum sample size required for each treatment group was determined using the Lemeshow formula (Nattino, 2020). Based on prior statistical parameters and a 10% dropout adjustment, the minimum sample size was increased from 14 to 16 students per group. Ultimately, a total of 26 participants were successfully enrolled in each of the three treatment groups, resulting in a final total sample size of 78 participants. The study collected primary data (participants' characteristics, weight, height, and nutritional knowledge scores) via questionnaires and direct measurements. The nutritional knowledge questionnaire (10 multiple-choice questions) was valid at a 5% significance level ($r > 0.510$) and highly reliable (Cronbach alpha = 0.876). This research obtained ethical approval from the Health Research Ethics Committee (Non-Medical), Universitas Muhammadiyah Prof. Dr. Hamka, with approval number 03/23.08/02861. The study was conducted in the following sequential phases:

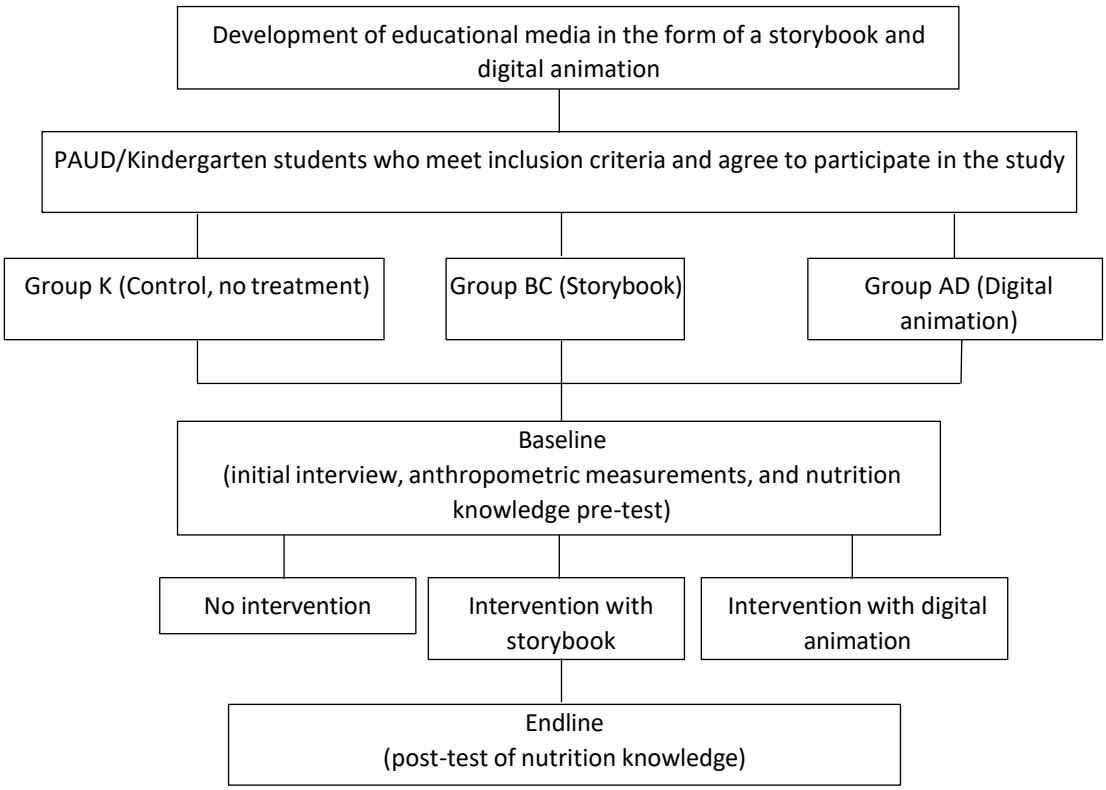

Figure 1. Research stages

3. RESULTS AND DISCUSSION

3.1. Educational Media Concept: Digital Animation and Storybook

The digital animation videos and illustrated storybooks developed for this study were designed to deliver key nutritional messages through engaging visual narratives. Six core messages and their corresponding educational concepts were integrated into both media formats, as summarized in **Table 1**.

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Table 1. The concept of educational media

No	Key Messages	Concept of Educational Media
1	Washing hands before eating	The teacher encourages the children to wash their hands while singing the "7 Steps of Handwashing" song
2	Dining etiquette in Islam	The teacher invites the children to pray before eating and reminds them to eat with their right hand
3	My plate (balanced meal guidelines)	The teacher explains to the children that every meal should include four types of food: staple foods, side dishes, vegetables, and fruits, along with examples of each
4	Encouragement to eat vegetables	The teacher advises a child who does not like eating vegetables and explains the benefits of vegetables for the body
5	Encouragement to eat fruits	The teacher explains the benefits of fruits and encourages the children to eat fruits together
6	Getting into the habit of drinking water	The teacher reminds the children to prepare water when taking their meals and also reminds them to drink water after eating

The duration of the digital animation video was carefully tailored to match the developmental attention span of the target age group. Literature suggests that 4-year-old children have an attention span of 8–12 minutes, whereas 6-year-old children average 12–18 minutes, showing a progressive increase with age (Avan et al., 2022) Factoring had in these parameters, the nutrition animation video was designed with a runtime of 8 minutes and 20 seconds. This precise duration was selected to optimize knowledge absorption within the children's peak attention span while preventing excessive screentime. The following are several illustrated from the digital animation titled *"Bekal Sehat Mas Uta"*. **Figure 2** illustrates the opening scene of the animation, while **Figure 3** presents the visualization of the My Plate concept used to introduce the recommended balanced meal composition for children.

Figure 2. Opening

Figure 3. Illustration of My Plate

The storybook developed as nutrition education media in this study also conveys the same messages as the digital animation *"Bekal Sehat Mas Uta"*. However, the material is presented in a simpler format with shorter sentences to ensure preschool children can easily understand it. The following are several illustrated pages from the storybook titled *"Bekal Sehat Mas Uta"*. **Figure 4** shows the storybook cover page, whereas **Figure 5** presents the illustration of the My Plate concept used to reinforce the message of balanced nutrition.

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Figure 4. Storybook Cover Page

Figure 5. Illustration of My Plate

3.2 Participant Characteristics

The participant characteristics evaluated in this study included gender distribution and nutritional status. Nutritional status was categorized using the Body Mass Index-for-Age (BMI-for-age) Z-score criteria for children aged 5–18 years, dividing participants into severely thinness (<-3 SD), thinness (-3 SD to <-2 SD), normal (-2 SD to +1 SD), overweight (>+1 SD to +2 SD), and obese (>+2 SD) (Kementerian Kesehatan RI, 2023). The baseline distribution across the study groups is presented in **Table 2**.

Table 2. Distribution of participants by gender and nutritional status

Characteristic	Control Group n (%)	Storybook Group n (%)	Digital Animation Group n (%)	Total n (%)
Gender				
Male	18 (69.2)	12 (46.2)	9 (34.6)	39 (50.0)
Female	8 (30.8)	14 (53.8)	17 (65.4)	39 (50.0)
Nutritional Status				
Severely thinness	0 (0.0)	2 (7.7)	2 (7.7)	4 (5.1)
Thinness	3 (11.5)	2 (7.7)	0 (0.0)	5 (6.4)
Normal	18 (69.2)	19 (73.1)	19 (73.1)	56 (71.8)
Overweight	1 (3.8)	1 (3.8)	4 (15.4)	6 (7.7)
Obese	4 (15.4)	2 (7.7)	1 (3.8)	7 (9.0)
Total	**26 (100.0)**	**26 (100.0)**	**26 (100.0)**	**78 (100.0)**

Nutritional status refers to the physiological condition of an individual resulting from the balance between nutrient intake and the body's ability to digest, absorb, and utilize those nutrients. Both undernutrition and overnutrition remain critical public health concerns, as each is associated with significant health risks. Undernutrition increases susceptibility to infectious diseases and impaired growth, whereas overnutrition is linked to a higher risk of non-communicable diseases such as obesity, diabetes, and cardiovascular disorders (Leocádio et al., 2021).

In this study, a total of 16.7% of participants were classified as having overnutrition, consisting of 7.7% overweight and 9.0% obese. National data from Indonesia indicate that the prevalence of overweight among children aged 5–12 years is approximately 10.8%, while obesity reaches 9.2% (Oktaviani et al., 2023). Although the proportion of overnutrition

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observed in this study is slightly lower than national estimates, it remains a concern that requires attention. Continuous monitoring and early preventive interventions are essential to avoid further increases and to reduce the long-term risk of diet-related non-communicable diseases among children.

3.3 The Effect of Nutrition Education on Participants' Nutritional Knowledge

Nutritional knowledge is a person's understanding of the nutrients contained in food (Umasugi et al., 2020). Nutritional knowledge influences a person's behavior in selecting foods, which in turn can affect their nutritional status (Umasugi et al., 2020). The distribution of participants based on their nutritional knowledge is presented in the following **Table 3**.

Table 3. Distribution of nutritional knowledge categories and mean score changes

Nutritional Knowledge	Control Group (n=26)	Storybook Group (n=26)	Digital Animation Group (n=26)	p-value[x]
Pre-test				
Low (<60%)	20 (76.9)	15 (57.7)	26 (100.0)	
Moderate (60%–80%)	6 (23.1)	8 (30.8)	0 (0.0)	0.000*
High (>80%)	0 (0.0)	3 (11.5)	0 (0.0)	
Mean Score	57.5±10.7[a]	62.7±12.7[a]	43.4±11.0[b]	
Post-test				
Low (<60%)	23 (88.5)	6 (23.1)	23 (88.5)	
Moderate (60%–80%)	3 (11.5)	11 (42.3)	3 (11.5)	0.000*
High (>80%)	0 (0.0)	9 (34.6)	0 (0.0)	
Mean Score	54.3±10.9[a]	72.9±15.7[b]	46.2±16.5[c]	
Δ Score (Post - Pre)	−3.2[a]	10.2[b]	2.7[b]	0.002*
p-value[y]	0.057	0.006*	0.343	

Notes:
[x] derived from Kruskal-Wallis test
[y] derived from Wilcoxon signed-rank test
[a, b, c] within the same row denote statistically significant differences between groups (p<0.05)
* Statistically significant (p<0.05)

Table 3 summarizes the distribution of nutritional knowledge categories and mean score changes across the three study groups: control, storybook, and digital animation. At baseline, the majority of participants in all groups were classified as having low nutritional knowledge (<60%). The digital animation group showed the lowest baseline condition, with 100% of participants in the low category, compared to 76.9% in the control group and 57.7% in the storybook group. The proportion of children with moderate knowledge (60–80%) was highest in the storybook group (30.8%), followed by the control group (23.1%), while no participants in the digital animation group reached this category. Only a small proportion of children in the storybook (11.5%) and control groups (0.0%) achieved high knowledge (>80%). The mean knowledge scores were 62.7 ± 12.7 (storybook), 57.5 ± 10.7 (control), and 43.4 ± 11.0 (digital animation). Statistical analysis indicated a significant difference between groups at baseline (p = 0.000).

After the intervention, the storybook group demonstrated a marked improvement. The proportion of children with high nutritional knowledge increased to 34.6%, while those in the

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low category decreased to 23.1%. In contrast, the digital animation group showed minimal improvement, with 88.5% of participants remaining in the low category and none reaching the high category. Similarly, the control group exhibited a worsening trend, with 88.5% classified as low knowledge post-test. The post-test mean scores were 72.9 ± 15.7 (storybook), 54.3 ± 10.9 (control), and 46.2 ± 16.5 (digital animation). The difference between groups remained statistically significant (p = 0.000).

The mean change (Δ score) demonstrated distinct patterns across the three groups. The storybook group showed the highest improvement with an increase of +10.2 points, indicating a substantial gain in nutritional knowledge following the intervention. In comparison, the digital animation group exhibited only a modest improvement of +2.7 points. Conversely, the control group experienced a decline in knowledge, as reflected by a negative change of −3.2 points. Furthermore, the between-group comparison of Δ scores revealed a statistically significant difference (p = 0.002), indicating that the magnitude of change in nutritional knowledge varied significantly among the three groups.

Within-group analysis indicated that only the storybook group experienced a statistically significant improvement (p = 0.006). The control group (p = 0.057) and digital animation group (p = 0.343) did not show significant changes.

3.4 Discussions

This study demonstrates that storybook-based nutrition education is significantly more effective than digital animation in improving preschool children's nutritional knowledge. The storybook intervention produced the largest improvement in both knowledge distribution and mean scores, indicating its strong educational impact. This finding is consistent with early childhood learning theory, which emphasizes that young children learn more effectively through narrative, visual, and context-rich formats. Storybooks integrate text and images within meaningful storylines, allowing children to connect abstract nutritional concepts to familiar situations.

Recent studies support this mechanism. Yilmaz-Onal et al. (2026) that dialogic reading-based nutrition education significantly improved preschool children's knowledge and dietary diversity, highlighting the importance of interaction during storytelling. Similarly, Widiana & Harwanto (2025) reported that storytelling enhances comprehension, engagement, and retention of nutrition information among young children. The significant improvement observed in this study may also be attributed to the interactive nature of storybook use, where educators or caregivers can ask questions, clarify concepts, and reinforce messages, thereby promoting active learning.

Although digital animation is often considered engaging, this study found only modest, non-significant improvements in the animation group. Several factors may explain this outcome. First, according to multimedia learning theory, excessive visual stimulation can lead to cognitive overload, particularly in preschool children with limited working memory capacity (Son & Butcher, 2024) demonstrated that overly complex animations may distract children from core learning content, reducing comprehension. Second, digital animation tends to promote passive learning, where children consume information without active engagement. In contrast to storybooks, animation may not inherently encourage interaction unless specifically designed with participatory elements. Nevertheless, digital media should not be entirely discounted. Rahmawati et al. (2022) found that digital animation significantly improved preschool children's nutritional knowledge. Recent evidence suggests that well-designed digital nutrition education interventions can improve nutrition knowledge and behavior, particularly eating habits among children and adolescents, especially when

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interactive elements are incorporated (Talens et al., 2025). Therefore, the limited effectiveness observed in this study may reflect suboptimal design or implementation rather than the medium itself.

The decrease in knowledge scores in the control group suggests that nutritional knowledge may decline over time without reinforcement. This finding highlights the importance of continuous and structured nutrition education during early childhood, a critical period for cognitive and behavioral development. These findings suggest that storybook-based interventions are highly suitable for preschool nutrition education, as they align with children's developmental characteristics and learning preferences.

4. CONCLUSION

In this study, the participants were divided into three groups: the control group, the storybook group, and the digital animation group. Of the 26 participants in the control group, 69.2% were male and 30.8% were female. In the storybook group, out of a total of 26 participants, 46.2% were male and 53.8% were female. In the digital animation group, out of 26 participants, 65.4% were female and the remaining 34.6% were male. The participants' nutritional status in this study was classified based on BMI-for-age. The majority of participants in each group had normal nutritional status, namely 69.2% in the control group, 73.1% in the storybook group, and 73.1% in the digital animation group.

The results demonstrate that storybook-based nutrition education was significantly more effective than digital animation in improving preschool children's nutritional knowledge. Children exposed to storybooks achieved the largest increase in mean knowledge scores and showed substantial movement from low-knowledge to high-knowledge categories. In contrast, digital animation produced only minimal improvements, while the control group experienced a decline in nutritional knowledge. These findings support the growing body of evidence indicating that narrative-based educational approaches are particularly effective for young children. Storybooks provide meaningful, engaging, and developmentally appropriate learning experiences that facilitate the acquisition and retention of nutritional knowledge. Consequently, storybook-based nutrition education should be considered a promising strategy for promoting nutrition literacy during early childhood.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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