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Original Research

The Effectiveness of Using Bilingual Infographics (English-Indonesian) in Improving Balanced Nutrition Knowledge in Adolescents

Efektivitas Penggunaan Infografis Bilingual (English-Indonesian) dalam Meningkatkan Pengetahuan Gizi Seimbang pada Remaja

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Abstract: *Adolescence is a critical growth phase vulnerable to nutritional problems due to changing dietary patterns. The primary challenge in nutrition education is the availability of media that can attract adolescents' interest while delivering messages effectively. This study aims to determine the effectiveness of using bilingual infographics (English-Indonesian) in increasing knowledge of a balanced diet among adolescents at State Islamic Senior High School 2 Pekanbaru. Methods: This study used a quasi-experimental design with a one-group pre-test and post-test design. The population in this study were students of State Islamic Senior High School 2 Pekanbaru, with the sampling technique using total sampling, which resulted in 115 respondents who met the inclusion criteria. Research variables included the level of balanced diet knowledge, individual characteristics (age and gender), and nutritional status based on anthropometry (Weight/Height). The data collection tool used a structured questionnaire regarding balanced nutrition guidelines. Data were analyzed statistically using the Paired T-test at a 95% confidence level. Results: The results showed that the majority of respondents were 16 years old (53.0%) and male (56.5%). Most respondents had a normal nutritional status (67.8%), but overweight (19.1%) and obese (8.7%) groups were found. Knowledge analysis showed a statistically significant but modest increase in the mean score from 12.59 to 12.91 (p= 0.007). While the overall score increase was relatively small, the largest improvement was observed in the understanding of diverse food consumption (from 55.7% to 76.5%). Conclusion:The use of bilingual infographic media positively influenced the balanced diet knowledge of adolescents. As an adaptive and communicative instrument, this media supports health education in schools; however, the results should be interpreted cautiously due to the absence of a control group in the study design*

Key word: Adolescents, Balanced Diet, Bilingual Infographics, Knowledge

1. INTRODUCTION

Adolescence is a critical phase of growth marked by significant changes in lifestyle and dietary patterns. According to the 2023 Indonesian Health Survey (SKI), the prevalence of normal nutritional status among adolescents aged 16–18 in Indonesia reached 79.6%. Meanwhile, severe thinness accounted for 1.7%, thinness 6.6%, overweight 8.8%, and obesity 3.3% (1). A lack of understanding of the principles of balanced nutrition in this group often leads to a double burden of malnutrition. In the digital age, the primary challenge in nutrition education is no longer a lack of information but rather how to present that information in an engaging and easily understandable manner.

Balanced nutrition refers to a daily diet that provides nutrients in appropriate types and amounts to meet the body's needs (2). Among adolescents, balanced nutrition messages emphasize a healthy diet combined with regular physical activity to support growth, development, and overall health (3). The results of a balanced nutrition knowledge test among adolescents showed a significant relationship with their eating patterns. A better understanding of balanced nutrition is associated with improved dietary patterns (4).

Reading has become a challenge over the years especially on Indonesian Students context. This is due to the lack of diverse strategies used by teachers, less students-centered activity and law motivation. Reading comprehension is an essential skill that allows students to understand and interpret information effectively. It is a complex cognitive activity that involves both bottom-up and top-down processes. Bottom-up processes focus on decoding vocabulary and grammatical structures, whereas top-down processes involve using prior knowledge and drawing inferences (5). Reading has become a significant challenge for Indonesian students, particularly in understanding health-related information. This is often due to conventional teaching strategies and low motivation. While reading comprehension is a complex cognitive activity involving bottom-up and top-down processes, its application in nutrition education remains challenging as students often struggle to decode complex health messages (5)

To overcome these challenges, this study proposes the use of bilingual infographics as a strategic intervention. Unlike conventional nutrition education media, which often rely on text-heavy posters or traditional lectures, infographics concisely combine text and visuals. This approach aligns with the Cognitive Load Theory, suggesting that learners process information more effectively through simultaneous visual and verbal channels (6). By reducing extraneous cognitive processing, infographics help adolescents internalize complex nutritional concepts. The novelty of this bilingual format (English-Indonesian) lies in its dual benefit: it not only conveys vital health messages but also enhances language literacy, providing an added value that is more engaging for contemporary adolescents compared to conventional single-language media (7). This study aims to evaluate whether this intervention can significantly improve adolescents' knowledge of balanced nutrition.

2. METHODS

This study employed a quasi-experimental design with a one-group pretest–posttest approach. The study was conducted at State Islamic Senior High School 2 Pekanbaru, involving students in grades X and XI as research subjects. Sampling was carried out using a total sampling technique, resulting in a sample size of 115 adolescents. Ethical considerations were maintained by requiring all respondents to provide their informed consent, signifying their voluntary willingness to participate in the entire study. The research procedure was conducted in three systematic phases via digital platforms. In the first phase, respondents were asked to fill out a Google Form which included the informed consent section, followed by a pre-intervention questionnaire to measure initial knowledge and collect primary data (age, gender, and anthropometric measurements).The second phase was the intervention, consisting of 30 minutes of controlled exposure to bilingual infographic media. The bilingual format developed based on the Balanced Nutrition Guidelines (2014), provided detailed education on: (1) The Four Pillars of Balanced Nutrition (dietary diversity, hygiene, physical activity, and weight monitoring); (2) The "Balanced Nutrition Tumpeng"; (3) The "My Plate" (Isi

Piringku) guidelines detailing food proportions; and (4) The importance of daily water intake. In the final phase, respondents completed a post-intervention questionnaire, also administered via Google Form, to evaluate the increase in their knowledge. The collected data were then analyzed using the paired t-test at a 95% confidence level (α = 0.05) to evaluate the effectiveness of the intervention. The Balanced Nutrition Knowledge Instrument consists of 14 true or false statements with a maximum score of 14. Based on previous testing, all 14 questions were declared valid and the instrument demonstrated good reliability, Validity testing showed that all 14 items were valid, with r-calculated values ranging > r-table = 0.3610, with a Cronbach's Alpha value of > 0.6 (8).

3. RESULTS

Respondent Characteristics

This study involved 115 adolescent respondents. The majority of respondents (61 individuals; 53.0%) were 16 years old. Based on gender, there was a predominance of male respondents (65 individuals; 56.5%), compared to female respondents (50 individuals; 43.5%). Most respondents (73 individuals; 63.5%) were in the 11th grade.

Respondent Nutritional Status

Anthropometric measurements showed that the majority of respondents (78 individuals; 67.8%) had normal nutritional status. However, 22 respondents (19.1%) were overweight, and 10 respondents (8.7%) were classified as obese. The characteristics and nutritional status of the respondents are presented in Table 1.

Table 1. Respondents' Characteristics and Nutritional Status

Respondent Characteristics	Frequency	
	N	%
Age (years)		
14 years	1	0,9
15 years	11	9,6
16 years	61	53,0
17 years	42	36,5
Gender		
Male	65	56,5
Female	50	43,5
Nutritional Status		
Severely thinness	1	0,9
Thinness	4	3,5
Normal	78	67,8
Overweight	22	19,1
Obese	10	8,7
Total	115	100

(Source: Primary Data, 2026)

Balanced Nutrition Knowledge Analysis

Based on the statistical test results, the average knowledge score of respondents increased from 12.59 on the pretest to 12.91 on the posttest, as shown in Table 2.

Table 2. Results of the Paired Samples T-Test of Respondents' Knowledge

Variabel	Mean	N	Std. Deviation	p
Pre Test	12,59	115	1,115	,007
Post Test	12,91	115	1,039	

(Source: Primary Data, 2026)

Distribution of Knowledge Based on Questionnaire Items

An analysis of respondents' correct answers shows changes in knowledge levels for each questionnaire item regarding balanced nutrition before and after the intervention, as presented in Table 3.

Table 3. Distribution of Respondents' Correct Answers by Questionnaire Item

No	Question Items	Correct Answers in the Pre-test		Correct Answers in the Post-test	
		n	%	n	%
1	Consuming vegetables and fruits can help prevent constipation.	105	91,3%	105	91,3%
2	Mangoes are a good source of vitamin A, whereas oranges are a primary source of vitamin C.	80	69,6%	70	60,9%
3	Fish, meat, tempeh, tofu, and nuts are sources of protein that function as building materials in the body.	113	98,3%	115	100,0%
4	Here's a balanced meal: steamed rice + rice vermicelli + balado egg + crackers.	107	93,0%	107	93,0%
5	Drink water only when thirsty.	111	96,5%	113	98,3%
6	Washing hands with soap and running water before eating can help prevent infectious diseases.	112	97,4%	115	100,0%
7	It is necessary to cover the nose and mouth when sneezing to help prevent the spread of infectious diseases.	113	98,3%	110	95,7%
8	Regulating dietary intake and engaging in regular physical exercise can help prevent overnutrition.	94	81,7%	108	93,9%
9	Adolescents are advised to engage in at least 60 minutes of physical activity each day.	99	86,1%	105	91,3%
10	To achieve an ideal body weight, this can be accomplished by consuming a balanced, high-quality diet in moderate amounts.	115	100,0%	115	100,0%
11	Engaging in physical activity is one of the pillars of balanced nutrition.	113	98,3%	109	94,8%
12	Practicing clean and healthy living habits is one of the pillars of balanced nutrition.	109	94,8%	111	96,5%
13	Consuming a variety of foods is one of the pillars of balanced nutrition.	64	55,7%	88	76,5%
14	Maintaining and monitoring a normal body weight is one of the pillars of balanced nutrition.	112	97,4%	114	99,1%

Based on Table 3, the results showed an increase in the percentage of correct answers for most items following the intervention. A significant knowledge gain was observed for the item concerning the concept of "a diverse diet as a pillar of balanced nutrition," where the proportion of correct responses rose from 55.7% in the pretest to 76.5% in the posttest. Similarly, the understanding of strategies to prevent overnutrition

through dietary management and physical activity increased from 81.7% to 93.9%. A steady improvement was also noted in hygiene behaviors; for instance, handwashing with soap achieved a perfect score (100%) in the posttest. Conversely, slight declines occurred in a few items, such as the understanding of Vitamin A sources (mangoes and oranges), which dropped from 69.6% to 60.9%, and perceptions of sneezing etiquette, which dipped from 98.3% to 95.7%. However, regarding the achievement of ideal body weight through quality food consumption, all respondents (100%) demonstrated consistent understanding across both tests.

4. DISCUSSION

The results of the study showed that the use of bilingual infographics contributed positively to increasing knowledge about a balanced diet in adolescents ($p = 0.007$). This improvement was clearly seen in the understanding of the pillars of balanced nutrition. Although the mean knowledge score increased from 12.59 to 12.91, indicating a statistically significant difference, the substantive gain of 0.32 points is relatively small. This modest increase may be attributed to high baseline scores in several questionnaire items, but it nonetheless confirms that the media had a positive impact. From a practical standpoint, this small increase suggests that while the infographic effectively reinforced existing knowledge, it may not have been sufficient to introduce entirely new complex concepts within a single exposure. However, the significant *p*-value indicates that even this minor shift was consistent across the sample, suggesting that the bilingual infographic serves effectively as a "refresher" or supplementary tool rather than a primary comprehensive curriculum. Furthermore, the use of bilingual media may have diverted some cognitive focus toward language decoding, which, while beneficial for literacy, could explain the limited gain in pure nutritional score compared to studies using simpler single-language formats.

This study is in line with the research of Risalah and Iryanti (2023) on the influence of infographic media on adolescent girls' knowledge about balanced nutrition. The test results showed a significant effect of infographic media on knowledge about balanced nutrition in adolescent girls with a p-value of $0.000 < 0.05$ (9). This study is also in line with Oktariani et al. (2026) regarding the effectiveness of a bilingual approach in balanced nutrition education for the prevention of heart disease in adolescents. The results showed a significant change ($p<0.001$) in adolescents' knowledge of balanced nutrition. Students' knowledge of balanced nutrition and heart disease prevention increased from an average of 64.6 to 83.2 (+28.8%), with the good category increasing from 23% to 73% (10).

The effectiveness of utilizing infographics in this study is a strategic response to the high frequency of social media use identified in the preliminary survey. The shift toward digital consumption is evident in the survey data, where TikTok (79.1%) and Instagram (71.2%) serve as the primary conduits for nutritional information among adolescents. This trend suggests that health interventions must adapt to the visual-centric habits of the 'digital native' generation. Research indicates that social media-based health education can significantly improve health-seeking behavior, provided the content is aesthetically pleasing and concise (11). Furthermore, the integration of bilingual infographics addresses the specific needs of Indonesian youth who are increasingly exposed to global health content. Studies have shown that bilingual educational materials not only facilitate better comprehension of technical terms but also increase engagement by making the information feel more modern and globally relevant (12). The findings indicate that infographics are effective for a wide range of

learners, particularly those who benefit from visual input. The study demonstrates that combining text with images is especially helpful for visual learners, as it enhances their understanding of concepts. In practice, infographics function as a form of scaffolding that simplifies reading tasks and increases students' willingness to participate, supporting the idea that they are useful for learners who struggle with reading (13). This was particularly evident in the most significant increase in knowledge observed in item 13, regarding the 'consumption of a diverse diet,' which rose sharply from 55.7% to 76.5%. The visualization in the bilingual infographic successfully explained the concept of dietary diversity, which was previously poorly understood by students.

The results of this study demonstrate a notable improvement in adolescents' understanding of balanced nutrition following the intervention. The most significant increase in knowledge was observed in item 13, concerning the "consumption of a diverse diet" as a fundamental pillar of balanced nutrition, which rose sharply from 55.7% to 76.5%. This substantial gain indicates that the visualization in the bilingual infographic effectively clarified the concept of dietary diversity a principle that was previously poorly understood by the students. Furthermore, comprehension regarding the prevention of overnutrition through diet and physical activity (item 8) also showed significant improvement, increasing from 81,7% to 93.9%.

The sharp increase in knowledge regarding "dietary diversity" and "overnutrition prevention" underscores the effectiveness of infographics in translating abstract nutritional guidelines into actionable visual cues. This success is consistent with research by Zhu et al. (2022), which demonstrates that visual-based interventions are particularly effective in improving the comprehension of dietary patterns compared to traditional, text-heavy methods. Specifically, the use of familiar icons in the "Isi Piringku" visualization likely reduced the cognitive effort or cognitive load required for students to grasp the complex relationships between various food groups (14).

However, a few items exhibited a slight decrease in scores, specifically regarding the sources of Vitamin A (item 2) and sneezing etiquette (item 7). This suggests that while there was a significant overall increase in knowledge (with the mean score rising from 12.59 to 12.91), respondents may have practiced selective attention. According to the Selective Attention Theory (Houts et al., 2006), individuals tend to prioritize high-salience visual elements, such as the colorful "Isi Piringku" plate and physical activity icons, while potentially overlooking peripheral details or specific micronutrient information. Consequently, while infographics are highly effective for broad conceptual shifts, detailed nutritional facts may require more targeted visual emphasis or supplementary reinforcement (15).

Conversely, the slight decrease in specific knowledge such as Vitamin A sources (item 2) and sneezing etiquette (item 7) may be explained by the Selective Attention Theory. According to Houts et al. (2006), when presented with multimedia materials, individuals tend to prioritize "high-salience" information. In this study, respondents likely focused on large, colorful graphics depicting main meals and physical activities, while overlooking peripheral or detailed textual information regarding micronutrients and hygiene protocols. This suggests that while infographics are powerful tools for conveying overarching concepts, detailed micronutrient education may still require supplementary verbal reinforcement or more specific visual cues to ensure all details are equally retained (15).

Despite these minor discrepancies, the intervention demonstrated a positive contribution to the respondents' knowledge levels. A significant milestone was achieved in item 10, where 100% of respondents correctly understood the practical steps to achieve their ideal body weight by the end of the session. This perfect score on a complex application-based question indicates that the infographic succeeded in transforming theoretical knowledge into actionable health literacy.

The success of this intervention at State Islamic Senior High School 2 Pekanbaru confirms that bilingual visual media serves as more than just a communication tool; it acts as a driving force for adolescents to learn and adopt the pillars of balanced nutrition. The integration of English and Indonesian not only caters to the modern educational environment of the school but also increases the perceived value of the information, encouraging students to integrate these healthy habits into their daily lives. This study utilized a one-group pretest–posttest design without a control group, which limits the ability to isolate the intervention's effect from external factors. Additionally, the short duration of the intervention and the focus on a single school in Pekanbaru may limit the generalizability of the findings to a broader adolescent population. Future research should consider longer exposure periods and a multi-center approach with a control group to further validate the effectiveness of bilingual health media.

5. CONCLUSION

The implementation of bilingual infographic media (English-Indonesian) contributed to a statistically significant improvement in balanced diet knowledge among adolescents at State Islamic Senior High School 2 Pekanbaru. This is indicated by an increase in the mean knowledge score from 12.59 in the pre-test to 12.91 in the post-test ($p = 0.007$). While the overall score gain is modest, the bilingual visual media demonstrated a notable positive impact on specific areas, such as the understanding of 'diverse food consumption,' which increased from 55.7% to 76.5%. Additionally, the intervention reinforced awareness regarding the prevention of overnutrition through diet and exercise, reaching 93.9%. Despite these positive shifts, the prevalence of overweight (19.1%) and obesity (8.7%) at the study site suggests that while infographics serve as an adaptive supplementary tool, nutrition education should be delivered sustainably to effectively foster long-term health behavior changes."

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