RESEARCH ARTICLE

The Effect Of A Combination Of Video Media Education And Discussion On Knowledge, Attitudes, And Behavior Of Balanced Nutrition In Elementary School Students Baubau City

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ABSTRACT

Nutritional issues among school-aged children in Indonesia, such as underweight, wasting, and stunting (Indonesia Health Survey 2023), require effective interventions on balanced nutrition education. Educational media, such as animated videos, are considered effective in improving children's understanding, attitudes, and behaviors. This study aims to evaluate the impact of balanced nutrition education interventions on the knowledge, attitudes, and practices of elementary school students in Baubau City, Southeast Sulawesi. A quasi-experimental study with a non-randomized pre-test and post-test design. The intervention group received education through videos and small group discussions for eight weeks in the classroom. The control group received education via e-leaflets and WhatsApp discussions once. The sample involved 4th and 5th-grade students from SD Negeri 2 Baubau (intervention) and SD Negeri 3 Baubau (control). Knowledge, attitudes, and practices were assessed using questionnaires before and after the intervention. Data analysis was conducted with wilcoxon test. The intervention group showed significant improvements in knowledge (from 7.0±2.9 to 12.3±1.2), attitudes (from 28.1±3.3 to 34.4±2.2), and practices (from 31.5±5.1 to 35.6±4.4). In contrast, the control group showed only a slight increase in knowledge (from 8.1±1.6 to 8.8±1.7) and remained stable in attitudes and practices. The changes in the treatment group demonstrated significant improvements in all measured variables—knowledge, attitudes, and practices—with p < 0.001. Conversely, in the control group, significant changes were observed only in knowledge levels (p<0.001). Education through videos and group discussions is more effective than e-leaflets, although neither approach significantly altered eating patterns.

INTRODUCTION

The nutrition problem of school-age children in Indonesia is still high based on the Indonesian Health Survey in 2023, with a prevalence of underweight of 30.9%, wasting 53.5%, and stunting 44.1%. In Southeast Sulawesi, the underweight rate reached 36%, wasting 52.7%, and stunting 40.8%, while in Baubau City the prevalence of underweight was 23.7%, wasting 11.1%, and stunting 29.7%.

Malnutrition negatively affects children's physical, mental, and intellectual development, and inhibits the nation's economic potential (Papotot et al., 2021; Rahmi et al., 2020).

A good diet plays an important role in fulfilling the nutrition of school-age children, who are experiencing rapid growth and need balanced nutrition education. UNICEF emphasises the importance of Food-Based Dietary Guidelines (FBDG) and diet sustainability as an effort to protect children's nutritional rights (Wiens et al., 2020). School-aged children are targeted for nutrition education to promote understanding and practice of healthy eating patterns, which has been shown to improve children's knowledge and behaviour (Jusriani, 2023).

Consumption patterns in Southeast Sulawesi are dominated by carbohydrates (82%) and fish (61.2%), but consumption of other animal proteins is still low (4.3%). This diet is influenced by food distribution, economic level, and low nutritional knowledge (Haeruddin et al., 2019). The use of educational video media is effective in improving students' knowledge and behaviour related to balanced nutrition. Interesting and interactive videos can facilitate understanding of concepts and overcome the limited time for delivering material (Novanto et al., 2024). Initial observations showed that most primary school students in Baubau City had not received information about balanced nutrition. Therefore, SDN 2 Baubau and SDN 3 Baubau were selected as research locations to improve students' knowledge through balanced nutrition education using video media(Kartini et al., 2019; Wiradnyani & Dkk., 2019).

MATERIALS AND METHODS

This study used a quasi-experimental design with a non-randomised pre-test and post-test control design. The research was conducted at SDN 2 Baubau and SDN 3 Baubau, Baubau City, Southeast Sulawesi, from September to October 2024

Population and Sample

The study population was grades 4 and 5 students in both primary schools, with a total population of 200 students. The research sample was determined using a purposive sampling technique, with 25 students per group and a drop-out correction of 10%, so that the total sample used was 100 students.

This study consisted of three main stages. The first stage was the pre-test, which aimed to measure students' knowledge, attitudes, and balanced nutrition behaviour before the intervention. The second stage was the intervention, where the treatment group received balanced nutrition education through a 10-minute educational video and small group discussions conducted for 8 weeks (1 time per week for 60 minutes). Meanwhile, the control group received nutrition education through e-leaflets sent through WhatsApp groups once. The third stage was the post-test, which was conducted to evaluate changes in students' nutritional knowledge, attitudes and behaviors using a questionnaire and 24-hour recall. This intervention aims to compare the effectiveness of different educational methods, namely educational videos with small group discussions in the treatment group and e-leaflets in the control group, in improving students' balanced nutrition knowledge, attitudes, and behaviors. The research instruments used consisted of questionnaires to measure knowledge, attitudes, and behaviours related to balanced nutrition, as well as 24-hour recall forms to assess students' food intake patterns. The educational media used in this study included educational videos and e-leaflets. The validity test results showed that all items had a validity value of more than 0.254, while the reliability test resulted in a Cronbach's alpha value of 0.769, indicating that the instrument had a good level of reliability.

Inclusion Criteria

Ability to communicate well, good health, and willingness and attendance during nutrition education interventions.

Exclusion Criteria

Limited communication and impaired health

Students who had moved schools or did not attend the entire 8-week intervention. For example, if a student attended meetings 1-2 but did not attend the next meeting, the student was included in this criterion.

Data Analysis

Data from the results of the study were analyzed for each variable using spss. The independent variable was balanced nutrition education, while the dependent variables were nutritional knowledge and consumption patterns. This study uses univariate and bivariate analysis. Univariate data in the form of respondent characteristics and distribution of knowledge levels, attitudes. Bivariate data in the form of the influence of nutrition education through video media and leaflets on balanced nutritional knowledge and attitudes and actions in students. The normality test used was the Kolmogorov Smirnov test with a total sample of >50 people and all the variables studied were not normally distributed. After that, the difference between the control group and the treatment group was tested using the Mann-Whitney test. Furthermore, because the data on the results of scoring the level of knowledge, attitudes, and actions are not normally distributed, the statistical test used is the Wilcoxon test, the difference is considered significant if the p value <0.05.

RESULTS

Univariate Analysis

Table 1. Characteristics of Treatment Group Respondents Based on Class, Age, Parental Education, Parental Occupation, and Parental Income

Karakteristik	Kelompok Perlakuan		Kelompok Kontrol		P-Value
	n (50)	%	n (50)	%	
Parent's Education					
Father Educations					
Not in School	1	2,00	2	4,00	
Elementary School	2	4,00	1	2,00	0,514
Junior High School	3	6,00	1	2,00	
Senior High School	22	44,00	29	58,00	
University	22	44,00	17	34,00	
Mother Educations					
Not in School	2	4,00	0	0,00	
Elementary School	2	4,00	0	0,00	
Junior High School	3	6,00	0	0,00	0,005
Senior High School	20	40,00	37	74,00	
University	23	46,00	13	26,00	
Parent's Occupation					
Father Occupations					
Civil Servant	9	18,00	16	32,00	
Private Employee	12	24,00	7	14,00	
Entrepreneur	22	44,00	22	44,00	0,378
Farmers	1	2,00	0	0,00	
Laborer	3	6,00	4	8,00	
Not Working	1	2,00	1	2,00	

Karakteristik	Kelompok Perlakuan		Kelompok Kontrol		P-Value
	n (50)	%	n (50)	%	
Pekerjaan Ibu					
Civil Servant	11	22,00	6	12,00	
Private Employee	4	8,00	3	6,00	0,056
Entrepreneur	10	20,00	7	14,00	
Not Working	25	50,00	34	68,00	
Family Income in Rupiah					
500.000-1.000.000	5	10,00	0	0,00	
1.100.000-2.000.000	13	26,00	12	24,00	0,125
2.100.000-3.000.000	11	22,00	15	30,00	
>3.000.000	21	42,00	23	46,00	

Table 1 presents a description of the characteristics of respondents from the treatment and control groups based on various variables, including age, parents' education level, parents' occupation type, and family income per month. In the treatment group, the majority of respondents were aged 10 years (62%), while the proportion of the youngest respondents, aged 9 years, was the lowest (4%). The father's education level was dominated by high school/equivalent and college graduates (44% each), while the lowest education level was the no school category (2%). Mothers' education level is predominantly in the tertiary category (46%), with the lowest level in the no school and primary school graduates categories (4% each). In terms of occupation, the majority of fathers were self-employed (44%), while the lowest occupation categories were farmer and not working (2% each). In contrast, mothers' occupation is most dominant as housewives or not working (50%), with the lowest occupation category being private employees (8%). In terms of family income, the largest proportion was in the more than Rp3,000,000 category (42%), while the lowest category was Rp500,000-Rp1,000,000 (10%). This distribution shows a significant variation in characteristics among treatment group respondents.

Meanwhile, in the control group, the characteristics of the respondents also showed a varied distribution. Most respondents were 12 years old (74%), while the proportion of 10-year-old respondents only reached 22%. The father's education level was mostly in the category of high school graduates (58%), with the lowest education level in the categories of no school, elementary school graduates, and junior high school graduates (2% each). Mothers' education level was dominated by senior high school graduates (74%), with only 26% of mothers having a university education. In terms of occupation, the majority of fathers were self-employed (44%), while the lowest occupation category was not working (2%). The majority of mothers' occupations were in the category of not working or as housewives (68%), with the lowest proportion in the category of private employees (6%). In terms of family income, the income category of more than Rp3,000,000 dominated (46%), while the Rp1,100,000-Rp2,000,000 category only reached 24%.

Statistical analysis using the chi-square test showed that most of the characteristic variables between the treatment and control groups were not significantly different, with a p-value > 0.05 for age (p = 0.341), father's education level (p = 0.514), father's occupation (p = 0.378), mother's occupation (p = 0.056), and family income (p = 0.125). However, there was a significant difference in the mother's education level (p = 0.005), indicating an inhomogeneous distribution of this variable between the two groups. Overall, these results suggest that the two groups have relatively similar characteristics, except for the mother's education level.

Table 2. Distribution of Knowledge, Attitudes, and Behaviors in the Intervention Group

Variables	Categories	Baseline	Endline	P-Value*

		n	%	n	%	
Knowledge	Good 76-100%	4	8	37	74	
	Satisfactory 65-75%	8	16	13	26	<0,001
	Poor <60%	38	76	0	0	
	Total	50	100	50	100	
Attitude	Positive attitude >60%	45	90	50	100	
	Negative attitude <60%	5	10	0	0	0,003
	Total	50	100	50	100	
Behaviors	Positive Behaviors >40	1	2	25	50	
	Negative Behaviors <40	49	98	25	50	<0,001
	Total	50	100	50	100	

*Fisher-Exact Test

Table 2 illustrates the distribution of knowledge levels, attitudes, and behaviors of the treatment group at two time points: baseline and endline. In the knowledge variable, there was a significant improvement during the study period. At baseline, out of 50 respondents, only 8% had a good level of knowledge (76-100%), 16% were in the fair category (65-75%), and the majority, 76%, were in the poor category (<60%). On the attitude variable, results showed that the majority of respondents had a positive attitude (>60%) from baseline. At baseline, 90% of respondents had a positive attitude, and this figure increased to 100% endline.

The behaviors variable showed a more gradual pattern of change than knowledge and attitude. At baseline, only 2% of respondents had positive behaviors (>40%), while 98% were in the negative behaviors category (<40%). At endline, the proportion of respondents with positive behaviors increased to 50%, although the other half were still in the negative category. Statistical analysis showed that changes in knowledge level were highly significant (p < 0.001), changes in attitude were significant (p = 0.003), and changes in behaviors were also highly significant (p < 0.001). These findings indicate that the intervention effectively improved knowledge, attitudes, and behaviors.

Table 3. Distribution of Knowledge, Attitudes, and Behaviors in the Control Group

Variables	**Categories**	**Baseline**		**Endline**		**P-Value***
		n	%	n	%	
Knowledge	Good 76-100%	0	0	6	12	
	Satisfactory 65-75%	23	46	29	58	0,024
	Poor <60%	27	54	15	30	
	Total	50	100	50	100	
Attitude	Positive attitude >60%	13	26	13	26	
	Negative attitude <60%	37	74	37	74	0,592
	Total	50	100	50	100	
Behaviors	Positive Behaviors >40	0	0	0	0	
	Negative Behaviors <40	50	100	50	100	**
	Total	50	100	50	100	

*Fisher-Exact Test

Table 3 shows the changes in knowledge, attitudes and behaviors of the control group at two time points, namely baseline and endline. In the knowledge variable, the proportion of respondents with good knowledge increased from 0% at baseline to 12% at endline. Respondents with sufficient knowledge also increased from 46% to 58%, while respondents with poor knowledge decreased from 54% to 30%. In the attitude variable, there was no change. The proportion of respondents with positive attitudes remained at 26%, while respondents with negative attitudes remained at 74% at

both times. On the behavior variable, all respondents showed negative behaviors at both baseline and endline without any change, with 100% of respondents in the negative behaviors category.

The knowledge variable had a p value of 0.024, indicating a statistically significant difference between baseline and endline. In contrast, the attitude variable had a p value of 0.592, indicating no significant difference. For the behavior variable, the p value could not be calculated (N/A) as the data was constant as indicated by the '**' sign. These results indicate that the intervention did not affect attitudes or behaviors, but did improve the knowledge level of respondents.

Table 4. Macronutrient Intake of Study Respondents Before and After the Intervention in the Treatment Group

Energy and Macro Nutrients	Before		After	
	Mean±SD	%RDA	Mean±SD	%RDA
Energy (kkal)	639,8±220,9	38,7	707,4±241,7	42,8
Carbohydrat (g)	84,0±30,1	33,6	92,9±33,5	37,1
Protein (g)	22,6±10,7	56,5	22,2±7,5	55,5
Fat (g)	23,3±13,9	42,3	26,6±12,8	48,3

Table 4 shows the comparative results of macronutrient consumption in the study respondents before and after the intervention in the treatment group. The data includes information on energy and macronutrients such as carbohydrates, protein, and fat, with details of mean, standard deviation, percentage of nutritional adequacy at each stage (baseline and endline). Before the intervention, the mean energy intake was 639.8 ± 220.9 kcal, which was 38.7% of the RDA. After the intervention, this increased to 707.4 ± 241.7 kcal, or 42.8% of the RDA. Carbohydrate intake rose from 84.0 ± 30.1 g (33.6% of the RDA) to 92.9 ± 33.5 g (37.1% of the RDA). Protein intake slightly decreased from 22.6 ± 10.7 g (56.5% of the RDA) to 22.2 ± 7.5 g (55.5% of the RDA). Fat intake increased from 23.3 ± 13.9 g (42.3% of the RDA) to 26.6 ± 12.8 g (48.3% of the RDA). Overall, the intervention led to increases in energy, carbohydrate, and fat intake, while protein intake showed a slight decrease.

Table 5. Macronutrient Intake of Study Respondents Before and After the Intervention in the Control Group

Energy and Macro Nutrients	Before		After	
	Mean±SD	%RDA	Mean±SD	%RDA
Energy (kkal)	638.0±231.3	38.6	660.8±177.9	40.0
Carbohydrat (g)	83.2±31.4	33.2	81.0±29.9	32.4
Protein (g)	22.5±11.3	56.2	22.4±7.3	56.0
Fat (g)	23.6±13.6	42.9	26.9±6.4	48.9

Table 5 illustrates the changes in macronutrient consumption among control group respondents before (baseline) and after the intervention (endline). The table provides a comparison of macronutrient intake (energy, carbohydrates, protein, and fat) of study respondents in the control group before and after the intervention. The data shows slight changes in energy and fat intake, with energy increasing from 638.0 ± 231.3 kcal (38.6% RDA) to 660.8 ± 177.9 kcal (40.0% RDA) and fat increasing from 23.6 ± 13.6 g (42.9% RDA) to 26.9 ± 6.4 g (48.9% RDA). Carbohydrate intake decreased marginally from 83.2 ± 31.4 g (33.2% RDA) to 81.0 ± 29.9 g (32.4% RDA), while protein intake remained almost unchanged at 22.5 ± 11.3 g (56.2% RDA) before and 22.4 ± 7.3 g (56.0% RDA) after the intervention. These results suggest minimal impact of the intervention on macronutrient intake in the control group.

The Effect Analysis Results

Table 6. The Effect Of Video-Based Balanced Nutrition Education Intervention on The Level of Knowledge, Attitudes and Behavior In The Treatment Group

Variables	Mean±SD			
	Basline	**Endline**	**Delta**	**P-Value***
Knowledge	7,0±6,0	12,3±1,2	5,30	<0,001
Attitude	28,1±3,3	34,4±3,4	6,30	<0,001
Behavior	31,5±5,1	35,6±3,5	4,10	<0,001

*Wilcoxon test

Table 6 The results of this study showed that the intervention applied to the treatment group significantly improved participants' knowledge, attitudes, and actions. The average knowledge score increased from 7.0±6.0 in the pre-test to 12.3±1.2 in the post-test, with a change (delta) of 5.3, which was statistically significant (p-value <0.001). A similar improvement was also observed in the attitude score, which increased from 28.1±3.3 in the baseline to 34.4±3.4 in the post test, with a delta of 6.3 and a p-value of <0.001, indicating statistical significance. In addition, the mean action score increased from 31.5±5.1 at baseline to 35.6±3.5 at endline, with a change of 4.1 which was also statistically significant (p-value <0.001). Overall, these findings indicate that the intervention had a significant positive impact on improving the knowledge, attitudes and actions of the participants in this study.

Table 7. The Effect of Video-Based Balanced Nutrition Education Intervention on The Level of Knowledge, Attitudes and Behavior In The Control Group

Variables	Mean±SD			
	Baseline	**Endline**	**Delta**	**P-Value***
Knowledge	8,1±1,6	9,2±1,7	1,1	<0,001
Attitude	20,1±4,7	20,3±4,8	0,2	0,115
Behavior	27,5±2,7	31,6±4,4	4,0	0,277

*Wilcoxon Test

Table 7 presents the results of the bivariate analysis of knowledge, attitudes and behaviors in the control group, measured at two different times (Baseline and Endline). In the control group, the results showed that the knowledge variable experienced a statistically significant increase. The baseline mean score for knowledge was 8.1±1.6, which increased to 9.2±1.7 at endline, with a difference of 1.1 and a p value of <0.001. In contrast, the attitude variable showed an increase in mean from 20.1±4.7 at baseline to 20.934.8 at endline, with a difference of 0.2; however, this change was not statistically significant (p=0.115). For the behaviors variable, the baseline mean was 27.5±2.7, which increased to 31.6±4.4 at endline, with a difference of 4.0; although there was an increase, the p=0.277 value indicated that this change was also not statistically significant. Thus, only the knowledge variable showed significant changes (p<0.05), while the attitude and behaviors variables experienced statistically insignificant improvements.

Table 8. Differences in The Effect, Mean Scores of the Knowledge, Attitudes, and Behaviors Between the Intervention and Control Groups

Variables	Mean±SD Baseline		Delta	Mean±SD Endline		Delta	P-Value Baseline	P-Value Endline
	Treatment	**Control**		**Treatment**	**Control**			
Knowledge	7.0±2.9	8.1±1.6	1,1	12.3±1.2	8.8±1.7	4,5	0,034	<0,001
Attitude	28.1±3.3	20.1±4.7	8,0	34.4±2.2	20.3±4.6	14,1	<0,001	<0,001
Behaviors	31.5±5.1	27.5±2.7	4,0	35.6±4.4	31.6±3.0	4,0	0,317	<0,001

*Mann-Whitney Test

Table 8 shows that the treatment group experienced significant improvements in all three variables measured compared to the control group. On the Knowledge variable, there was a substantial

increase in the treatment group from 7.0±2.9 at baseline to 12.3±1.2 at endline, while the control group only increased slightly from 8.1±1.6 to 8.8±1.7, with a baseline p-value of 0.034 and endline <0.001, but on the knowledge variable, the baseline p-value being smaller than 0.05 indicates that there was a statistically significant difference between the treatment and control groups at baseline. A similar improvement was seen in the attitude variable, where the treatment group improved from 28.1±3.3 to 34.4±2.2, while the control group remained stable (20.1±4.7 to 20.3±4.6), with a p-value <0.001 at both baseline and endline but this highly significant inequality indicates that the two groups were not equal in terms of attitude before the intervention. For the Behaviors variable, the treatment group also improved from 31.5±5.1 to 35.6±4.4, while the control group barely changed (27.5±2.7 to 27.7±3.0), with a significant difference at endline (p-value <0.001) indicating that there was no statistically significant difference between the treatment and control groups at baseline (p-value 0.317). These overall findings indicate that the intervention applied to the treatment group was effective in significantly improving knowledge, attitude, and behaviors compared to the control group but the knowledge and attitude variables showed inequality at baseline, while the behaviors variables were equivalent. This needs to be considered in the interpretation of research results to ensure valid conclusions about the effectiveness of the intervention.

DISCUSSION

The Influence of Parental Characteristics on Respondents' Knowledge, Attitudes, and Behaviors

Parental characteristics and household income influence the impact of interventions on children's knowledge, attitudes, and behaviors. The analysis revealed a significant difference only in maternal education level (p = 0.005), with the intervention group having a higher proportion of mothers with higher education (46%) compared to the control group (26%). Higher maternal education positively correlates with the ability to convey health information to children (Mondal et al., 2014). Moreover, the majority of fathers in both groups were self-employed, while mothers were unemployed, providing more time to accompany their children. Both groups predominantly had higher household incomes, facilitating access to educational and health resources (Sausenthaler et al., 2007). The income parity indicates that differences in children's behaviors were more influenced by the effectiveness of the intervention than by economic factors. These findings align with previous studies showing that maternal education and household income enhance the impact of interventions. Differences in children's attitudes and behaviors reflect the effectiveness of the intervention, with maternal education serving as a supporting factor. This study underscores the importance of respondent characteristic homogeneity for result validity and the development of more effective interventions (Abderbwih et al., 2022; Smith & Murphy, 2019).

The Effect of Balanced Nutrition Education on Respondents' Knowledge

Education plays a crucial role in improving knowledge, with the selection of appropriate methods and media being key to success (Moore et al., 2018; Nurfadhillah et al., 2021). This study demonstrates that educational interventions significantly enhance respondents' understanding, particularly regarding the importance of handwashing with soap, which reached 100% comprehension at the endline phase. However, understanding of vegetable consumption remained low, with only 18% providing correct answers, indicating the need for strengthened outreach on healthy eating patterns. In the control group, no significant changes were observed; for instance, understanding of foods with the highest water content increased only from 20% to 28%, underscoring the importance of educational interventions(Worsley, 2002). Siagian's study supports these findings, showing that balanced nutrition education improves knowledge and attitudes with a significant p-value (<0.005) (Siagian & Manurung, 2024). Conversely, Dwilestari Puji Utami & Shovie Rizqiea (2021) study found that nutrition education did not significantly impact mothers' knowledge about febrile seizures, due to the short duration and lack of supporting media. Educational media,

such as videos and presentations, have proven effective in enhancing knowledge, with a p-value <0.001. The effectiveness of education depends on delivery methods that engage the senses (A'Ayun et al., 2021). Factors such as the time interval between intervention and post-test, as well as high pre-test scores, can influence educational outcomes. Therefore, interactive approaches and visual media-based strategies are highly recommended to maximize the impact of nutrition education(Rohmatulloh et al., 2024).

The Effect of Balanced Nutrition Education on Respondents' Attitudes

Attitude change through education is a process where individuals alter their views, feelings, or behaviors toward an issue through acquired information or experiences (Ajzen, 1991). Education is often delivered through media such as videos, which are effective in conveying messages in an engaging and easily understandable manner. In this study, the intervention group demonstrated a significant improvement, with 94% of respondents agreeing on the importance of drinking eight glasses of water daily, while the control group showed minimal changes in understanding the negative impacts of dehydration, increasing only from 0% to 2%. This supports Ajzen's theory that attitude change takes longer than knowledge acquisition as it involves deeply held personal beliefs. The use of videos as an educational method has proven effective in influencing attitudes, as visual and audio elements enhance audience focus and memory retention. Videos are often supplemented with interactive features such as quizzes, encouraging critical thinking and reinforcing understanding. Rahmi et al., (2020) reported a significant relationship between pre- and post-intervention attitudes (p<0.05), showing that good knowledge influences attitudes and behaviors. Nuryani (2018) found significant changes in balanced nutrition attitude scores among peer educators after the intervention (p=0.000). Training nutrition ambassadors also proved effective in fostering positive attitudes toward balanced nutrition among adolescents. However, differing results were reported by Siagian, who found no significant change in respondents' attitudes after balanced nutrition education (p>0.05) (Siagian and Manurung, 2024). This indicates that while nutrition education is often effective, not all interventions succeed, necessitating further evaluation of educational methods and contexts to achieve optimal outcomes(Lestari et al., 2023).

The Effect of Balanced Nutrition Education on Respondents' Behaviors

Nutrition education plays a crucial role in shaping knowledge-based behaviors, which tend to be long-lasting (Winda and Dafit, 2021). This study showed a significant increase in handwashing practices in the intervention group (100%), whereas breakfast habits declined to 50%. The control group experienced limited changes, such as consistently low vegetable consumption (0%). These findings align with Michie et al., (2011), who emphasized that long-standing habits are difficult to change without practical support. Challenges in breakfast habits are consistent with Barr et al. (2015), who highlighted the importance of education and food access. A 24-hour dietary recall analysis revealed suboptimal macronutrient intake in both the intervention and control groups, as changes in eating behavior involve external factors such as food access and socioeconomic conditions (Contento, 2008). Other studies show mixed results: Widhi & Alamsyah (2022) found no significant effect of nutrition interventions (p = 0.614), while Waldani et al., (2018) reported significant differences (p = 0.001). Behavioral change requires time and is influenced by individual knowledge and attitudes (Artika Sari, 2018; Nurmasyita et al., 2015). According to Keller et al., 2021), behavior change takes 18–254 days. While nutrition education is effective in improving knowledge and attitudes, comprehensive interventions, including food access, are necessary to maximize changes in consumption behavior.

CONCLUSION

The study results demonstrate that providing balanced nutrition education through video media and regular Focus Group Discussions (FGDs) is more effective in improving respondents' knowledge, attitudes, and behaviors compared to e-leaflets. In the intervention group, significant improvements were observed in knowledge, with the proportion of respondents with good knowledge increasing drastically from baseline (less than 60%) to 86% at midline 2 and remaining high at endline (74%). Respondents' attitudes also showed consistent positivity, with 100% of respondents maintaining a positive attitude at every time point after the intervention. Respondents' behaviors improved gradually, with the proportion of positive behaviors increasing from 2% at baseline to 50% at endline.

In contrast, the control group showed more limited changes. Although there were improvements in knowledge and attitudes, these changes were not significant. For the knowledge variable, the proportion of respondents with good knowledge increased from 0% at baseline to 12% at endline, while attitudes and behaviors showed no significant changes. The mean score differences between the intervention and control groups for knowledge, attitudes, and behaviors indicated a greater positive impact in the intervention group, with significant p-values for each variable ($p < 0.001$). Although the intervention successfully improved respondents' knowledge, attitudes, and behaviors, it is worth noting that neither educational medium resulted in significant changes in respondents' dietary patterns. Furthermore, sample equality at the beginning of the study needs to be considered, as significant differences at baseline could influence the interpretation of results. Overall, the education method using videos and FGDs was more effective than e-leaflets in improving knowledge and attitudes but requires further development to influence dietary behavior changes.

AUTHORS CONTRIBUTIONS

La Ode Abdul Malik Maulana: Collected primary and secondary data on the student at Elementary School 2 and Elementary School 3 Baubau City. On the other hand, conducted SPSS analysis and Nutrisurvey analysis.

Abdul Salam and Rahayu Indriasari: Offered guidance and contributions throughout all phases of the research process, including problem identification, methodological design, and data analysis.

Andi Zulkifi, Healthy Hidayanty, and Burhanuddin: Evaluated the research results in terms of methodology, analysis, and conclusions, and offered constructive criticism and suggestions to enhance the quality of the research.

ETHICAL CLEARENCE

This research received approval from the Research Ethics Committee of the Faculty of Public Health, Hasanuddin University, Makassar, as indicated by the ethical clearance number 1898/UN4.14.1/TP.01.02/2024, issued on August 13, 2024.

CONFLICT OF INTEREST

The authors affirm that there are no conflicts of interest associated with the preparation of this article. This research was carried out independently, with full funding provided by the authors themselves, without any external grants, sponsorships, or scholarships.

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