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Differences in Nutrition Knowledge Between Junior High School Students who Receive Nutrition Education Using Offline and Online Booklet Media

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Booklets, E-Booklets, Nutritional Knowledge, Offline, Online

ABSTRACT
The increasing prevalence of adolescent nutritional problems, particularly those related to breakfast habits and obesity, necessitates effective nutrition education strategies that can be implemented both in traditional face-to-face settings and through digital platforms. Contemporary educational approaches must adapt to technological advances while maintaining pedagogical effectiveness, making it crucial to evaluate the comparative efficacy of different delivery methods for nutrition education among adolescents. This study aims to determine the difference in nutrition knowledge levels among junior high school students who received nutrition education using booklet media through offline (*luring*) and online (*daring*) methods. The research design employed was a quasi-experimental approach with a nonequivalent control group design, involving 60 eighth-grade students from SMP Al-Islam 1 Surakarta and SMP Muhammadiyah 5 Surakarta. Participants were divided into a control group (offline) and an experimental group (online). Data were collected using a questionnaire consisting of 20 validated questions regarding the importance of breakfast, administered before (pretest) and after (posttest) the intervention. Data analysis was conducted using the Wilcoxon test for within-group comparisons and the independent sample t-test for between-group comparisons. The results showed an average difference in students' knowledge scores of 19.67 for the offline method and 19.83 for the online method, with a p-value of 0.904, indicating no significant difference between the two methods. These findings suggest that both methods are equally effective in improving students' nutrition knowledge, making them viable alternatives for nutrition education in schools.

INTRODUCTION

Adolescence is a period of transition from childhood to adulthood. During this time, individuals experience significant physical, mental, emotional, and social development (WHO, 2018). Adolescence is characterized by changes in physical characteristics and psychological functions, particularly those related to the reproductive organs. Furthermore, adolescence is a period during which individuals experience cognitive, emotional, social, and moral changes (Ministry of Health of the Republic of Indonesia, 2020). The impact of the adolescent transition

is a shift in adolescent consumption patterns toward fast food consumption and a decrease in physical activity, resulting in an increased risk of obesity in adolescents (Telisa et al., 2020).

According to the World Health Organization (WHO), by 2022, more than 390 million children and adolescents aged 5-19 years will be overweight, and 160 million will be obese. This global trend reflects significant nutritional challenges that extend beyond developed countries to include developing nations in Southeast Asia and Africa, where rapid urbanization and changing dietary patterns contribute to rising obesity rates. The associated health consequences include increased risk of metabolic disorders, cardiovascular diseases, and psychosocial problems that can persist into adulthood (WHO, 2024).

According to the 2018 Basic Health Research (*Riset Kesehatan Dasar* or *Riskesdas*), the prevalence of overnutrition or obesity among adolescents (13-15 years old) continued to increase, from 10.8% in 2013 to 16.4% in 2018. The increase in obesity prevalence also occurred in Central Java Province, where, according to the 2013 and 2018 *Riskesdas*, Central Java Province experienced an increase from 9.5% to 14.6% (*Riskesdas* 2013 and *Riskesdas* 2018).

Overweight or obesity is the excessive accumulation of fat caused by an imbalance between energy intake and energy expenditure. Overweight and obesity are significant issues because they can persist into adulthood and are contributing factors to various metabolic and degenerative diseases, such as heart disease, diabetes, cancer, osteoarthritis, and others (Kansra et al., 2021). In adolescents, being overweight or obese causes a number of health problems that significantly impact quality of life, such as psychosocial issues, sleep disturbances, sleep apnea (temporary cessation of breathing), and bone disorders (Puspitasar et al., 2019).

A study examining the relationship between breakfast habits and obesity in adolescents found that adolescents who skip breakfast have a 43% higher risk of obesity compared to those who regularly eat breakfast (Ardeshirlarijani et al., 2019). Breakfast is beneficial because it provides the body with sufficient energy to carry out various activities throughout the day. Skipping breakfast leads to increased consumption of calorie-dense snacks, which can lead to increased body fat and weight gain (Arraniri et al., 2017).

A 2011 study by Sartika showed that the risk factor most associated with obesity in children aged 5-15 in Indonesia is education level. Health education starting at an early age is a strategic step for both short-term and long-term benefits (Rostania et al., 2013). Thus, providing nutritional information to improve nutritional understanding is crucial for adolescents. Providing nutritional information as part of nutrition education in schools can be implemented, and the knowledge gained can form the basis for developing good eating habits.

Several methods can be implemented to improve adolescents' nutritional knowledge, such as delivering information through online platforms and in-person learning. Online learning is effective not only for health education but also for general education. Online learning, utilizing Moodle for teachers and lecturers during the pandemic, also showed positive results, with 85% of 607 participants achieving a score above 50 after participating (Abidin et al., 2021). Research by Azra (2022) showed an increase in nutritional knowledge in the offline group compared to the online group. The significant increase in adolescents' nutritional knowledge scores when given direct nutrition education using booklets is due to students' improved attention and concentration during face-to-face interactions.

However, despite these individual studies examining either online or offline nutrition education methods, there remains a significant research gap regarding the direct comparative effectiveness of these approaches when applied to the same population under controlled conditions. While previous research has demonstrated the general effectiveness of both digital and traditional educational methods, few studies have systematically compared their relative efficacy in nutrition education specifically among Indonesian adolescents, particularly in the post-pandemic educational landscape where hybrid learning approaches have become increasingly relevant.

Nutrition education can be conducted both offline and online. The use of booklets in nutrition education is expected to improve understanding of the material presented. This research aims to address several specific objectives: (1) to determine the differences in nutritional knowledge levels between junior high school students who received nutrition education using booklets through offline and online methods; (2) to analyze the effectiveness of each delivery method in improving students' understanding of breakfast importance; (3) to evaluate the practical implications of implementing both approaches in school settings; and (4) to provide evidence-based recommendations for nutrition education program design. The expected benefits of this research include providing empirical evidence for educators and policymakers regarding optimal nutrition education delivery methods, contributing to the theoretical understanding of educational media effectiveness in health promotion, offering practical guidance for schools seeking to implement nutrition education programs, and supporting the development of evidence-based nutritional interventions that can be adapted to various educational contexts and resource availability.

METHOD

This quantitative study employed a quasi-experimental design with a nonequivalent control group design. It compared a control group (offline nutrition education using a booklet) and an intervention group (online nutrition education using an e-booklet). Pretests and posttests were used to determine differences in junior high school students' knowledge levels before and after the intervention. The study was conducted at SMP Al-Islam 1 Surakarta and SMP Muhammadiyah 5 Surakarta from August to December 2024, with a population of 153 eighth-grade students. The sample was determined using the Lemeshow formula with simple random sampling, resulting in 60 respondents (30 in the control group and 30 in the experimental group) who met the inclusion and exclusion criteria. The independent variable was the nutrition education method (offline and online), while the dependent variable was students' knowledge level. Data collection was conducted using a closed-ended questionnaire containing 20 valid questions regarding the importance of breakfast for students.

The research process included initial stages (permitting and proposal development), instrument testing (validity and reliability), intervention implementation, and final stages (data analysis and report development). The booklet and e-booklet media used underwent feasibility testing. Primary data were collected from respondent identities and knowledge test results, while secondary data were obtained from the schools. Data processing was carried out through editing, scoring, coding, entry, cleaning, and tabulating stages using SPSS. Univariate analysis was used to describe knowledge data, while bivariate analysis used the Wilcoxon test to

measure differences in knowledge levels between offline and online methods. The decision-making criteria were a p-value <0.05 indicating a significant difference in knowledge between the two methods, while a p-value ≥0.05 indicated no significant difference.

RESULTS AND DISCUSSIONS

Knowledge Before and After Counseling

The study involved 60 eighth-grade students, 30 from SMP Al-Islam 1 Surakarta and 30 from SMP Muhammadiyah 5 Surakarta, meeting the established inclusion criteria. According to Arikunto (in Nurriski (2021), the knowledge level measurement scale is divided into three categories: good if the score is ≥ 75%, sufficient if the score is 56% - 74%, and poor if the score is ≤ 55%. Students' knowledge levels before and after the intervention are shown in Tables 1 and 2:

Table 1. Distribution of Students Based on Offline Knowledge Level (Control Group)

Category Knowledge	Before		After	
	n	%	n	%
Not Enough	10	33,3	0	0
Enough	18	60	6	20
Good	2	6,7	24	80
Total	**30**	**100**	**30**	**100**

Table 1 shows that the categorization results in the control group (offline) before the intervention (pretest) showed that 10 students (33.3%) had poor knowledge, 18 students (60%) had adequate knowledge, and 2 students (6.7%) had good knowledge. After the intervention, which involved counseling using a booklet, students' knowledge levels were reassessed using the same questionnaire as before to measure knowledge and determine whether there were any changes before and after the intervention. The posttest results showed that 0 students had poor knowledge, 6 students (20%), and 24 students (80%) had good knowledge.

Table 2. Distribution of Students Based on Online Knowledge Level (Experimental Group)

Category Knowledge	Before		After	
	n	%	n	%
Not Enough	28	93,3	9	30
Enough	2	6,7	16	53,3
Good	0	0	5	16,7
Total	**30**	**100**	**30**	**100**

Table 13 above shows that the categorization results in the control group (offline) before the intervention (pretest) showed that 28 students (93.3%) had poor knowledge, 12 students (6.7%) had adequate knowledge, and 0 students had good knowledge. After the intervention, which included counseling using a booklet, students' knowledge levels were reassessed using the same questionnaire as before to gauge knowledge and determine whether there were any changes before and after the intervention. The posttest results showed that 9 students (30%) had poor knowledge, 16 students (53.3%), and 5 students (16.7%) had good knowledge.

Nutritional knowledge refers to a person's ability to select foods as sources of nutrients and to process available food ingredients (Utama, 2021). The influence of education on individual nutritional knowledge about healthy breakfasts can be influenced through the provision of nutrition education to adolescents. This education is delivered through engaging media to ensure the material is easily understood and avoids boredom among adolescents (Anisa, 2022).

This study used booklets and e-booklets as tools in the outreach process. Booklets and e-booklets offer advantages in supporting nutrition education activities, including: they can be used for learning at any time, readers can adapt to their own learning, readers can view the material at their own pace, the material can be shared with others, they cover a broader range of topics, are easy to create, and are relatively inexpensive (Andreansyah, 2015).

This study used both offline and online methods. According to Tam (2019), face-to-face or offline nutrition education with short sessions has been shown to be more effective in improving nutrition knowledge than education solely using booklets or leaflets. Several studies have shown that students' nutrition knowledge improves after receiving online nutrition education through WhatsApp groups and Instagram (Arza et al., 2021; Wardhani et al., 2021). However, Wardhani's 2021 study found that online nutrition education through WhatsApp groups was not able to significantly change student behavior.

Table 3. Total Correct Answers Before Intervention (Pretest) in the Offline Method

No.	Questions	Pretest	
		n	%
1.	Definition of breakfast	26	87
2.	Good breakfast time	16	53
3.	Benefits of breakfast	25	83
4.	Relationship between breakfast and nutritional status	10	33
5.	Relationship between breakfast and nutritional status	18	60
6.	Amount of food consumed at breakfast	22	73
7.	Recommended energy intake from breakfast	9	30
8.	Recommended protein intake from breakfast	4	13
9.	Benefits of breakfast	21	70
10.	Number of protein servings on my plate	23	77
11.	Number of vegetable servings on my plate	17	57
12.	Number of fruit servings on my plate	22	73
13.	Number of carbohydrate servings on my plate	11	37
14.	Nutrients contained in a good breakfast	27	90
15.	Examples of carbohydrate-rich foods	25	83
16.	Examples of foods Protein sources	21	70
17.	Types of foods containing vitamins and minerals	28	93
18.	Examples of foods that are sources of vitamins and minerals	23	77
19.	Examples of morning snacks	12	40
20.	Factors influencing breakfast habits	9	30

Table 3 shows that in processing the data on correct answers before the intervention in the offline group of 30 students, the highest percentage was 28 students (93%) regarding the

types of foods containing vitamins and minerals. This high percentage of answers to this question is likely due to the material's ease of understanding and the students' presumed familiarity with information about the types of foods containing vitamins and minerals. The lowest percentage was 4 students (13%) regarding the recommended amount of protein in breakfast. These responses indicate that many students were unaware of the recommended amount of protein in breakfast before the intervention.

Table 4. Total Correct Answers Before the Intervention (Pretest) in the Online Method

No.	Questions	Pretest	
		n	%
1.	Definition of Breakfast	17	57
2.	Good Breakfast Time	11	37
3.	Benefits of Breakfast	18	60
4.	Relationship between Breakfast and Nutritional Status	15	50
5.	Relationship between Breakfast and Nutritional Status	12	40
6.	Amount of Food Consumed at Breakfast	12	40
7.	Recommended Energy Amount from Breakfast	10	33
8.	Recommended Protein Amount from Breakfast	9	30
9.	Benefits of Breakfast	11	37
10.	Number of Protein Servings on My	9	30
11.	Number of Vegetable Servings on My Plate	9	30
12.	Number of Fruit Servings on My Plate	10	33
13.	Number of Carbohydrate Servings on My Plate	9	30
14.	Nutrients Contained in a Good Breakfast	17	57
15.	Examples of Carbohydrate Foods	15	50
16.	Examples of Protein Foods	13	43
17	17. Types of foods containing vitamins and minerals	21	70
18.	Examples of foods that are sources of vitamins and minerals	16	53
19.	Examples of morning snacks	11	37
20	Factors influencing breakfast habits	12	40

Table 4 shows that in the data processing of correct answers before the intervention in the online group of 30 students, the highest percentage was regarding types of foods containing vitamins and minerals, with 21 students (70%). This high percentage of answers to this question is likely due to the material's ease of understanding and the students' presumed familiarity with information about types of foods containing vitamins and minerals. Meanwhile, the lowest percentages were regarding the recommended amount of protein from breakfast, with 9 students (30%), the number of protein portions on my plate, with 9 students (30%), the number of carbohydrate portions on my plate, with 9 students (30%), and the number of carbohydrate portions on my plate, with 9 students (30%). The responses to these questions indicate that many students were unfamiliar with the material before the intervention.

Table 5. Difference in Pretest and Posttest Scores for the Offline Group

No.	Name	Age	Gender	Pretest Score	Posttest Scores	Difference in Value
1.	KAM	12 Years	Women	70	80	10
2.	CRP	13 Years	Women	65	90	25
3.	KAM	13 Years	Women	65	80	15
4.	RNF	13 Years	Women	50	75	25
5.	SYM	13 Years	Women	50	85	35
6.	RNAA	13 Years	Men	70	95	25
7.	GAS	13 Years	Men	70	85	15
8.	SUA	13 Years	Women	50	70	20
9.	ALH	14 Years	Men	65	90	25
10.	DAGP	13 Years	Men	50	75	25
11.	SI	13 Years	Women	65	80	15
12.	KAAP	13 Years	Women	65	85	20
13.	MAB	13 Years	Women	65	80	15
14.	SAR	13 Years	Women	90	90	0
15.	MKFS	13 Years	Men	70	85	15
16.	NAFH	12 Years	Men	60	70	10
17.	KFP	13 Years	Women	50	80	30
18.	IBK	13 Years	Women	55	65	10
19.	KKV	13 Years	Women	65	95	30
20.	KZZ	13 Years	Women	50	75	25
21.	ENR	14 Years	Men	60	80	20
22.	ECP	13 Years	Women	75	90	15
23.	OAAP	13 Years	Women	65	70	5
24.	GR	13 Years	Men	60	65	5
25.	ARFH	13 Years	Men	60	85	25
26.	AMM	13 Years	Men	35	65	30
27.	ARH	14 Years	Women	65	85	20
28.	WNA	13 Years	Women	80	80	0
29.	FZ	14 Years	Women	50	90	40
30.	MPK	13 Years	Women	55	95	40
		Average		**61,50**	**81,17**	**19,67**

Table 5 shows that the data processing of the difference in pretest and posttest scores for the offline group, with a total of 30 students, yielded an average pretest score of 61.50, a posttest score of 81.17, and a difference of 19.67. The highest difference of 40 was found in two students: FZ, whose pretest score increased to 90 during the posttest, and MPK, whose pretest score increased to 95 during the posttest. The lowest difference of 0 was found in two students: SAR, whose pretest score remained unchanged during the posttest, and WNA, whose pretest score remained unchanged during the posttest.

Table 6. Difference in Pretest and Posttest Scores for the Online Group

No.	Name	Age	Gender	Pretest Score	Posttest Scores	Difference in Value
1.	RA	14 Years	Men	40	70	30
2.	NLA	13 Years	Women	45	65	20

No.	Name	Age	Gender	Pretest Score	Posttest Scores	Difference in Value
3.	SAD	14 Years	Women	55	65	10
4.	WNA	14 Years	Women	55	90	35
5.	FAZM	13 Years	Men	55	70	15
6.	AS	13 Years	Women	45	55	10
7.	FSA	14 Years	Men	50	65	15
8.	MM	13 Years	Men	25	55	30
9.	ASC	12 Years	Men	50	75	25
10.	ZPR	13 Years	Men	40	40	0
11.	SS	14 Years	Women	35	60	25
12.	FCAS	13 Years	Women	50	65	15
13.	AAA	12 Years	Women	55	70	15
14.	RIY	14 Years	Women	60	80	20
15.	MRSNS	14 Years	Men	35	60	25
16.	FEC	13 Years	Women	35	65	30
17.	MMI	13 Years	Women	45	65	20
18.	NRB	12 Years	Women	40	80	40
19.	RBS	13 Years	Men	50	50	0
20.	DAL	13 Years	Women	30	45	15
21.	AR	13 Years	Women	65	70	5
22.	DSN	13 Years	Men	40	60	20
23.	FMAB	14 Years	Men	35	50	15
24.	EFA	12 Years	Women	45	85	40
25.	MRNS	13 Years	Men	25	40	15
26.	AAAZ	13 Years	Women	35	60	25
27.	BPP	12 Years	Men	40	40	0
28.	TRW	14 Years	Women	35	65	30
29.	NKA	14 Years	Women	50	75	25
30.	DPPR	13 Years	Men	20	45	25
Average				**42,83**	**62,67**	**19,83**

Table 6 shows that the data processing of the difference in pretest and posttest scores for the online group, with a total of 30 students, yielded an average pretest score of 42.83, a posttest score of 62.67, and a difference of 19.83. The highest difference in scores was 40 for two students: NRB, whose pretest score increased to 80 during the posttest, and EFA, whose pretest score increased to 85 during the posttest. The lowest difference in scores was 0 for three students: ZPR, whose pretest score was 40, but showed no change in posttest scores; RBS, whose pretest score was 50, but showed no change in posttest scores; and BPP, whose pretest score was 40, but showed no change in posttest scores.

The calculation of pretest and posttest scores for the offline and online groups showed that five students had consistent scores. This could be due to several factors: students already had a good understanding of the material before the intervention, but there was no improvement after the intervention. The questions used were easy, so students could answer easily and achieve high scores. The questions used were difficult, so students struggled to answer well, and the posttest results were similar to the pretest results. Students did not take the pretest and posttest questions seriously.

Differences in Nutrition Knowledge Between Students Receiving Nutrition Education Using Online and Offline Booklets

Data obtained from both schools will be processed using SPSS to obtain descriptive statistics. The processed descriptive statistics will yield maximum, minimum, mean, standard deviation, and variance scores. Two groups will be divided into two groups: a control group and an experimental group. The control group consists of students who received nutrition education using offline booklets, while the experimental group consists of students who received education using online e-booklets. To determine the level of student knowledge in both groups, a posttest will be administered after each group has been given different treatments. This is intended to compare and determine differences in the results of the treatments given to the two groups.

This study used an independent sample t-test. The independent sample t-test is used to determine significant differences in the averages between two independent samples (Rozak and Hidayati, 2019). Two tests must be met before conducting an independent sample t-test: the normality test and the homogeneity test. The independent sample t-test was used in this study to answer the research question, "Is there a difference in nutritional knowledge between junior high school students who receive nutrition education using booklets, both offline and online?" To answer this question, an independent sample t-test was conducted on the difference in pretest and posttest scores for the control group (offline) and the difference in pretest and posttest scores for the experimental group (online).

Table 7. Results of Difference in Student Knowledge Scores in the Offline and Online Methods

Method	Category	Result	Sig (p)
The Difference in Online Learning	Median ± SD	20 ± 10,74	0,904
	Mean	20,00	
	Minimum	0,00	
	Maximum	40,00	
The Difference in Online Learning	Median ± SD	20 ± 10,49	
	Mean	19,67	
	Minimum	0,00	
	Maximum	40,00	

Table 7 data shows that the results of the difference in students' knowledge scores using the pretest and posttest score difference data in the online learning group have a minimum value of 0 and a maximum value of 40. Respondents with a total of 30 students have an average knowledge score using the score difference data of 20.00, a mean value of 20 and a standard deviation of 10.74. The results of the difference in students' knowledge scores using the pretest and posttest score difference data in the offline learning group have a minimum value of 0 and a maximum value of 40. Respondents with a total of 30 students have an average knowledge score using the score difference data of 19.57, a mean value of 20 and a standard deviation of 10.49. It can be concluded that the difference in scores between online and offline learning outcomes, with an average of 0.43, and a minimum, maximum, mean, and standard deviation, did not show a significant difference. The results of the independent sample t-test analysis using

the difference in pretest and posttest scores to determine the difference in nutritional knowledge between junior high school students who received nutrition education using booklets, both online and offline, yielded a p-value of 0.904. Based on these results, it can be concluded that there is no difference in nutritional knowledge between junior high school students who received nutrition education using booklets, both online and offline (Savoie-Roskos, Wengreen, & Durward, 2017).

These results align with research conducted by Akmal, R (2025), which aimed to analyze the comparison of learning outcomes between online and offline learning for students in the Economics Study Program at the Pangeran Dharma Kusuma Institute. The results showed that although there was a difference in average learning outcomes between students participating in online and offline learning, the difference was not statistically significant. This is evidenced by the results of the Mann-Whitney test, with an Asymp Sig. (2-tailed) value of 0.234, greater than the 0.05 significance level. It can be concluded that there is no significant difference between the learning outcomes of students participating in online and offline learning.

These results align with research conducted by Rasam & Ani (2024), which aimed to determine the influence of student teaching competencies during offline and online learning. The results of this study showed no difference in student teaching competencies during online and offline learning (Cevikbas & Kaiser, 2022). This study aligns with research conducted by Pratika & Wahyuni (2022), which showed no difference in mathematics learning outcomes between offline and online learning at SMP Krida Utama Gunung Sugih.

Developments in information and communication technology have impacted several sectors, one of which is education. A significant change is the emergence of online learning methods, which are increasingly being implemented by educational institutions. Teaching and learning activities, which were previously conducted through face-to-face interaction, must now be conducted through electronic media, particularly the internet, as a learning system (Imania and Bariah, 2019). Online learning offers greater flexibility and broader access to learning resources, allowing students to participate from anywhere and at any time (Akmal, 2025).

Direct learning, also known as offline learning, is learning without an internet connection. This method provides direct education using media such as television, radio, and student handbooks (Malyana, 2020). According to (Slameto, 2021), offline learning involves direct face-to-face interaction between teachers and students, providing greater space for discussion, interaction, and direct guidance, often considered more effective in enhancing understanding of the subject matter.

Effective learning is learning that provides students with opportunities for independent learning or broadened learning activities (Delen & Senler, 2022). Providing opportunities for independent learning and broadened learning activities is expected to help students understand the concepts being studied (Rohmawati, 2015).

CONCLUSION

The results of the study showed that nutrition education using booklet media, both offline and online, was equally able to improve the knowledge of junior high school students, with an average difference in scores of 19.67 for the offline method and 19.83 for the online method,

respectively, and no significant difference was found between the two (p-value = 0.904). Based on these findings, it is recommended that students apply the information obtained in everyday life and share it with their surrounding environment, schools facilitate nutrition education through various media to support learning, and future researchers explore strategies so that the educational process, both offline and online, runs more effectively and is engaging for students.

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