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EFFECTS OF E-BOOKLET EDUCATION FOR ADOLESCENTS ON KNOWLEDGE ABOUT OBESITY AND FOOD CONSUMPTION

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Abstract

Background: *Obesity is a public health issue with an increasing prevalence across all age groups globally. Furthermore, obesity can be treated and prevented using several methods, including education intervention.* ***Objective:*** *This study aims to determine the impact of education intervention using an e-booklet on knowledge enhancement and food intake improvements.* ***Method:*** *This study used a single-group pre-posttest intervention approach on senior high school adolescents in Kulon Progo Regency, Yogyakarta, Indonesia. The sample was selected based on inclusion criteria, including students from State Senior High School 1 Sentolo, grades X and XI, willing to participate as respondents, available during data collection, and with BMIZ > 1 SD, totaling 46 individuals. In addition, education intervention was provided through an e-booklet through a WhatsApp group, while knowledge and food intake data were observed during the pretest, posttests 1 and 2. Knowledge data were collected through a questionnaire, while food intake data were collected using 2 x 24-hour food recall and analyzed with t-test and Wilcoxon test.* ***Results:*** *The knowledge scores of the students during the pretest, posttest 1, and posttest 2 were 56.3, 94.5, and 98.5, respectively. The results showed that there was a significant increase in knowledge in both posttests 1 and 2. Furthermore, energy, protein, carbohydrate, and fat intake levels decreased during the pretest, posttests 1 and 2 measurements. Energy intake decreased by 126%, 110%, and 91%, while protein intake reduced by 163%, 156%, and 106%. The fat intake also decreased by 153%, 137%, and 106%, while carbohydrate intake reduced by 100%, 91%, and 76%. The analysis showed a significant improvement in food intake in both posttests 1 and 2 except for carbohydrate intake in posttest-1.* ***Conclusion:*** *Based on these findings, nutrition*

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education using an e-booklet had a positive impact on increasing knowledge about obesity and improving food intake among overweight and obese adolescents.

Keywords: *Education, Adolescent, Obesity, Food consumption*

1. INTRODUCTION

Obesity is a condition characterized by the excessive and abnormal accumulation of fat in the body, posing significant health risks. In addition, it is one of the dual nutrition problems in Indonesia and has been reported to have an increasing prevalence across various parts of the world. According to a previous study, more than 4 million annual death cases were reported in 2017 due to complications arising from the condition[1]. In Indonesia, its prevalence among individuals aged ≥15 years increased by 4.4%, from 26.6% in 2013 to 31% in 2018[2]. Yogyakarta is a province in Indonesia with a high incident rate of 14.43% for obesity and overweight among adolescents aged 16-18 years[3], ranking among the top 10 regions with the highest prevalence rates within the country.

Several factors play a significant role in the development of obesity, including technological advancements, economic factors, transportation, and communication[4], impacting changes in movement, consumption, and sleep patterns as well as increased stress[5],[6]. Furthermore, the choice of high-energy-density food intake, high fat, sugar, and salt content, sedentary lifestyle, and lack of physical activity have been identified as major contributors[7]. A study in Yogyakarta reported that a high intake of fried foods among productive-age adults[8] and the passive use of transportation is associated with an increased risk of obesity among adults[8] and adolescents[9]. Other studies showed that adolescents' obesity issues are linked to inadequate knowledge[10], limited access to healthy food in schools or canteens, and the lack of nutrition education programs in schools[11].

Education is an effective intervention to enhance knowledge among adolescents, thereby enabling the development of positive attitudes and behaviors[12]–[14]. Moreover, adolescents represent a potential age for active learning and becoming agents of healthy behavioral change for themselves, their environment, and families in adulthood[14], [15]. Previous studies successfully showed the effectiveness of nutrition education on various topics, including anemia in Makassar, South Sulawesi[16], balanced nutrition for elementary school children in Yogyakarta[17], stunting and anemia in Yogyakarta[18], as well as sexual and reproductive health in urban areas of Indonesia[19].

An e-booklet combines Android technology and a pocket-sized book, thereby enhancing its portability, cost-effectiveness, and environmentally friendliness. This approach prioritizes the specific needs of clients or users while offering engaging textual content and visually appealing elements[20]. Therefore, this study aims to enhance adolescents' knowledge and improve their consumption using an e-booklet.

2. METHOD

2.1 Design

This study used a single-group pre-posttest intervention approach. The intervention provided comprised education about obesity, covering its definition, causes, impacts, food intake in terms of food portions and selection, as well as recommendations for physical activities. In addition, it was presented in the form of an e-booklet and shared as a file through a WhatsApp group. The educational content and interactive discussions within the WhatsApp group were conducted for 60 minutes daily over 4 consecutive days with different materials. Day 1 discussed the definition, causes, and impacts of obesity, day 2 covered food intake, day 3 focused on physical activities, and day 4 consisted of a review session.

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2.2 Location and Time

The study was conducted in Kulon Progo Regency due to a high obesity prevalence of 12.73%,[3] and data were collected from February-March 2023.

2.3 Population and Sample

The population comprised all senior high school students in Kulon Progo Regency. School selection was carried out randomly, leading to the selection of State Senior High School 1 Sentolo. The sample was selected using the total sampling method with inclusion criteria being students with BMIZ-score >1 standard deviation, from grades X and XI, aged 14-18 years, and willing to participate as study subjects. The sample selection procedure is presented in Figure 1.

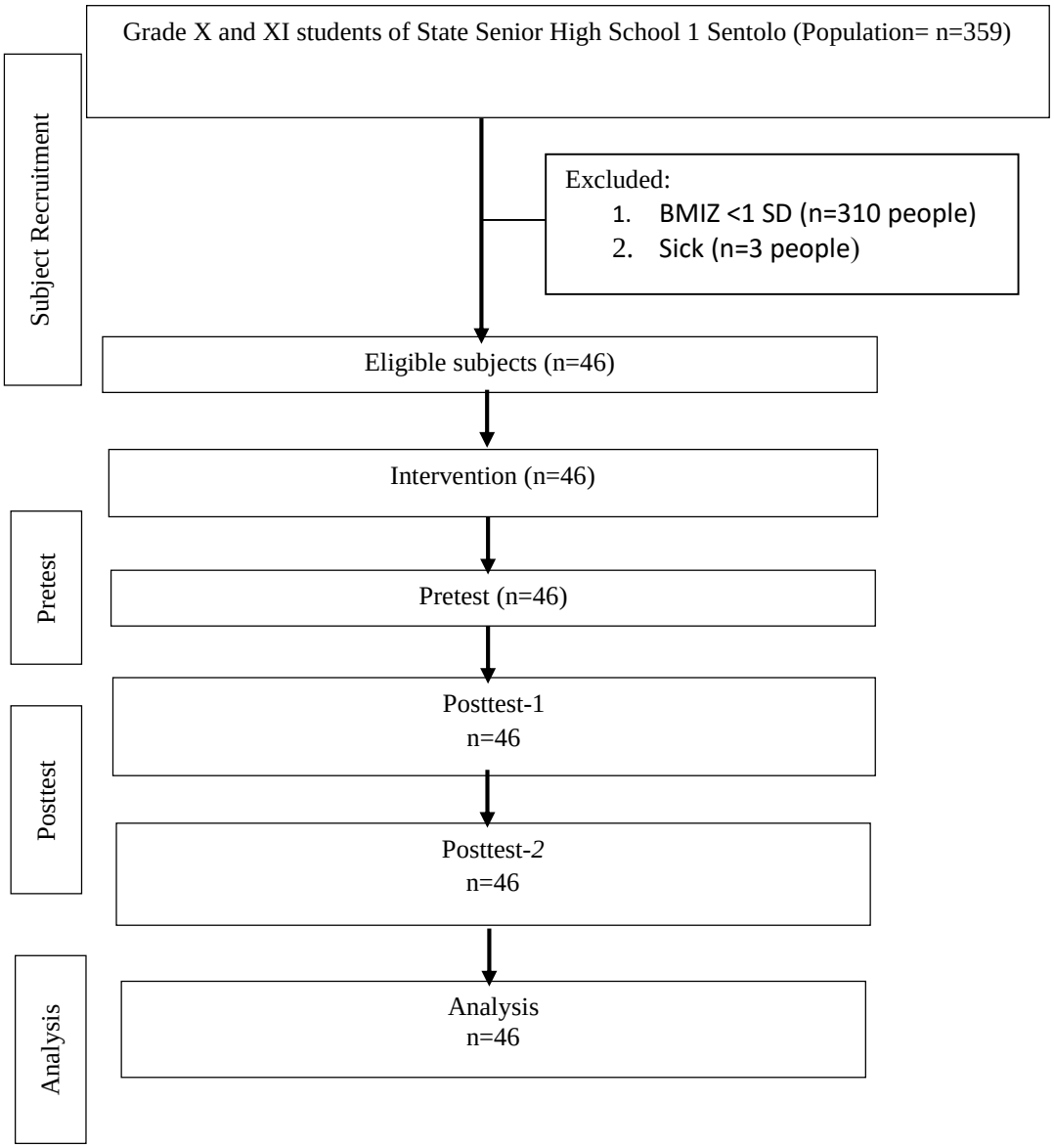

Figure 1: Study Consort Diagram

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2.4 Instrument

Students' knowledge was observed using a self-administered questionnaire consisting of 20 multiple-choice questions. The questionnaire was subjected to validity and reliability tests. Each correct answer carried a score of 5, leading to a maximum score of 100 when all answers were correct. Furthermore, students' food intake was observed through a 2x24-hours food recall between school days and weekends. Body weight was then measured using GEA brand digital scales, height was measured using a microtoa, and age was determined by calculating the measurement date and the birth date in even-year units. Consumption recall data were collected by the researcher and 4 trained nutrition expert candidate enumerators, while anthropometric data were measured by the researcher and 3 health center staff members who underwent prior perception alignment.

2.5 Data Analysis

Knowledge was categorized as follows: poor (<56% correct answers), adequate (56-75% correct answers), and good (>75% correct answers). Food intake was categorized as severe deficit (<70% RDA), moderate deficit (70%-79% RDA), mild deficit (80%-89% RDA), normal (90%-119% RDA), and excess (>120% RDA). Nutrition status was determined using BMIZ and analyzed with WHO AnthroPlus software. The variable was categorized into severely underweight (<-3SD), underweight (-3SD to <-2SD), normal (-2SD to 1SD), overweight (>1SD to 2SD), and obese (>2SD). Furthermore, data were analyzed univariately by calculating the minimum, maximum, mean, and standard deviation values, which were presented in narrative, tables, and figures. Differences in knowledge before and after the intervention were analyzed using the Wilcoxon test for non-normally distributed data and the t-test for normally distributed data.

2.6 Ethical Considerations

This study obtained ethical approval from the Health Research Ethics Committee of the Health Polytechnic, Ministry of Health Yogyakarta with reference number DP.04.03/e-KEPK.1/084/2023, dated February 10, 2023.

3. RESULTS

3.1 Sample characteristics

The majority of the samples were from grade X, aged 16 years, and classified as overweight, as shown in Table 1.

Table 1: Sample characteristics

Characteristics	n	%
Grade Level		
X	26	56.5
XI	20	43.5
Gender		
Male	23	50.0
Female	23	50.0
Age (Years)		
15	2	4.3
16	30	65.2
17	13	28.2
18	1	2.2
Nutrition Status		
Overweight	37	80.4
Obese	9	19.6

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3.2 Adolescents' knowledge before and after intervention

Based on the results, there was an increment in adolescents' knowledge after the intervention, as shown in Figure 2.

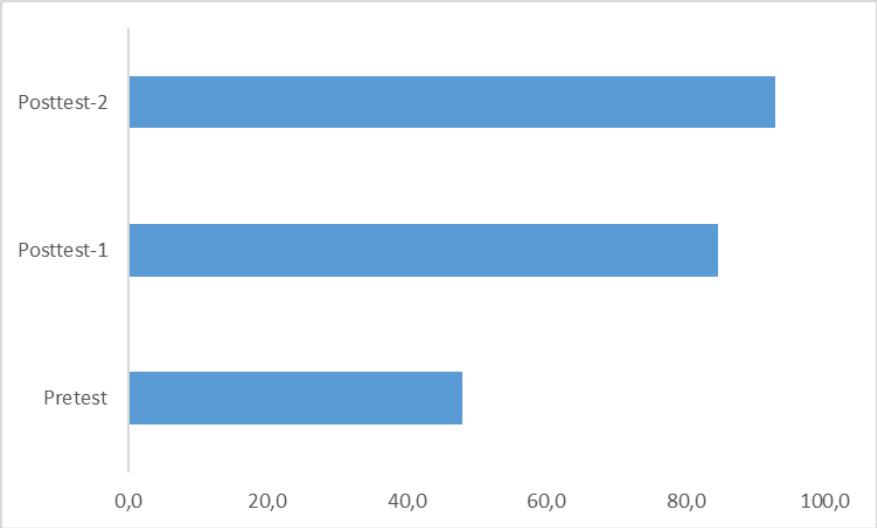

Figure 2: Increased knowledge

When observed in more detail, all aspects of knowledge increased, including the definition, causes, and impacts of obesity, food intake, as well as physical activities, as shown in Figure 3.

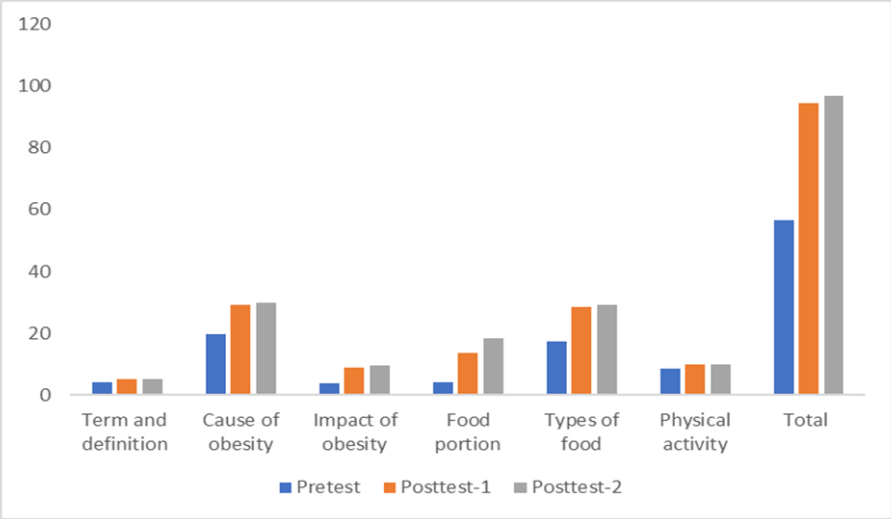

Figure 3: Increased knowledge based on question aspects

3.3 Food intake

The adequacy levels of food intake in terms of energy, protein, fat, and carbohydrate showed a decrease after the intervention in both posttests 1 and 2, as illustrated in Figure 4.

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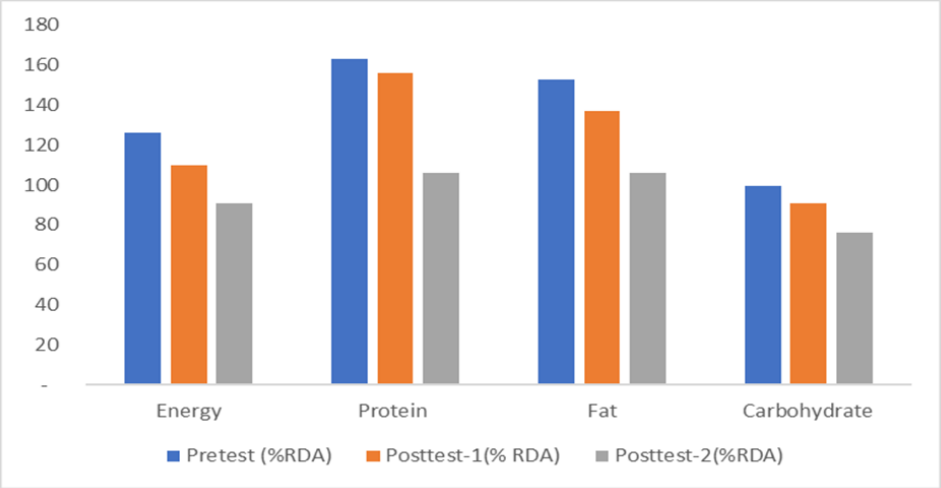

Figure 4: Intake before and after Intervention

3.4 Implications of education on adolescents' knowledge and food intake

Education significantly increased knowledge and decreased all types of food intake in both posttests 1 and 2, except for posttest-2 in terms of carbohydrate intake, as shown in Table 2.

Table 2: Implications of education on adolescents' knowledge and food intake between measurement times.

Variables	Measurement times	Value		Mean ± SD	p-*value*
		Min	Max		
Knowledge	Pretest -Posttest-1[b]	25 70	70 95	48.7±10.8 84.5±6.3	0.000*
	Pretest-Posttest-2[b]	25 80	70 100	48.7±10.8 91.6±6.8	0.000*
Enery	Pretest -Posttest-1[a]	59.62 70.45	171.11 165.70	126.1±28.2 109.6±26.2	0.000*
	Pretest-Posttest-2[b]	59.62 70.10	171.11 104.55	126.1±28.2 90.7±8.3	0.000*
Protein	Pretest -Posttest-1[b]	80.29 52.02	329.51 397.86	162.5±52.6 140.2±42.1	0.001*
	Pretest-Posttest-2[a]	80.29 58.38	329.51 146.25	162.5±52.6 106.1±24.5	0.000*
Fat	Pretest -Posttest-1[b]	52.02 70.34	397.86 382.00	152.9±61.2 136.6±53.2	0.032*
	Pretest-Posttest-2[b]	52.02 55.35	397.86 187.39	152.9±61.2 106.6±17.7	0.000*
Carbohydrate	Pretest -Posttest-1[b]	55.50 56.44	149.18 135.29	99.6±22.6 91.1±20.8	0.609
	Pretest-Posttest-2[b]	55.46 54.80	149.18 94.89	99.6±22.6 76.2±9.9	0.001*

Description: a. t-test

b. *Wilcoxon*

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*p<0.05

4. DISCUSSION

Education intervention has been proven to be an effective method for enhancing the literacy of adolescents, encompassing the domain of healthcare[13]. Several studies stated that adolescents represented a potential age to acquire new knowledge and experiences. Furthermore, this was consistent with the characteristics of having a high curiosity level, acting as agents of change, and having extensive opportunities for themselves, their environment, and families in the future[21].

In this study, the sample population consisted of individuals experiencing overweight and obesity with an equal proportion of males and females. Global data showed that the overweight phenomenon was a global threat with various accompanying risks[1]. The results indicated that adolescents' obesity tended to develop into adults' obesity, hindering productivity, competitiveness in the job market, and academic abilities[1], [22]–[24]. Moreover, it was associated with self-esteem crises[25], [26] and being targets of bullying[25], [27].

The results of this study showed that education intervention for adolescents significantly and consistently increased knowledge in the posttests 1 and 2 measurements. These results were consistent with previous studies on a short-course intervention to enhance cadres' capacity regarding toddlers' growth and development[28] as well as home visit education intervention to enhance mothers' knowledge about growth, development, and infant young children feeding (IYCF)[29].

The analysis also showed a consistent and statistically significant decrease in total energy, carbohydrate, protein, and fat consumption between posttests 1 and 2. The decrease in consumption was an expected impact of this education intervention, leading to weight loss as well as a decrease in the prevalence of overweight and obesity. Other findings indicated a significant decrease in protein intake after education. Although this served as one measure of intervention success, it could disrupt adolescents' growth and development[30], hinder learning performance[31], and impede the maturation process of reproductive organs when the reduction in protein intake persisted for a prolonged period. This condition could also increase the risk of abnormalities during puberty[30], anemia[32], as well as lead to reduced fitness and other malnutrition risks[33]. Therefore, the reduction in calorie intake must be accompanied to ensure adolescents still fulfilled their nutrition needs. Improvement in food consumption after education had also been reported in previous studies, such as nutrition education for the eating behavior of adolescent athletes in California[34], elementary school children in Mexico[35], and elementary school students in Indonesia[17].

The school-based nutrition education program was highly promising in achieving optimal outcomes as students were well-literate members of society. Moreover, education content on obesity was an engaging issue for adolescents [24], [36]. The reduction in food intake caused by education intervention was not only associated with decreasing portion sizes but also comprised substituting fried and heavily processed foods (fried and then baked with spices), reducing sugary drinks, and increasing fruit consumption. At present, fried foods served as a swift and convenient cooking approach, yielding a crispy, savory, delicious taste that was satisfying to the palate[37]. Several studies had also shown that sweetened beverages offered a pleasant taste. Both fried foods and sweetened beverages significantly contributed to significant overweight issues [8], [38], [39].

To maintain its sustainability and ensure consistent results, this education program could be integrated into the curriculum for adolescent students to support their learning performance and future productivity. This program could also be combined with existing initiatives, such as school canteens, healthy schools, Information and Counseling Centers for Adolescents, and others.

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5. STUDY LIMITATION

The limitation of this study included the relatively short intervention period of 1 week, making it challenging to measure the impact on weight loss outcomes. Furthermore, the education intervention was conducted only on 1 treatment group within the overweight population in urban areas, potentially yielding different results in other settings.

6. CONCLUSION

In conclusion, education successfully enhanced knowledge as well as significantly and consistently reduced food intake. A nutrition education program aimed at controlling obesity in adolescents should be continued by schools as part of the curriculum. Moreover, adolescent health program facilitators at Public Health Centers must consider using an e-booklet, which had been designed and proven effective in improving knowledge and enhancing food intake for overweight adolescents.

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Conflict of Interest

None

Author Contribution

Conceptualization, T.S. and M.P.R.; methodology, T.S. and A.B.; software, W, N.T.L, I.S.; validation, M.P.R.; formal analysis, A.B.; investigation, T.S., A.B., M.P.R.; data curation, T.S. and A.B.; writing—original draft preparation, writing—review and editing. All authors read and approve the manuscrip

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