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Research Article

Development of an Obesity Prevention Education Model Using Comic MediaDigital-Based Learning for Teenagers in Jambi City

Solihin Sayuti[1]*, Alpari Nopindra[2], Andriana Marwanto[3], Nur Ahmad Habibi[4]

[1] Health Promotion Department, Health Polytechnic, Ministry of Health, Jambi; e-mail:solihin.sayuti91@poltekkesjambi.ac.id
[2] Health Promotion Department, Health Polytechnic, Ministry of Health, Jambi; e-mail:alparinopindra@poltekkesjambi.ac.id
[3] Department of Sanitation, Health Polytechnic, Ministry of Health, Bengkulu; e-mail:andrian.marwanto@gmail.com
[4] Nutrition Department, Ministry of Health Polytechnic, Padang; e-mail:nahindo2022@gmail.com
* Correspondenting Author : Solihin Sayuti

Abstract: Obesity is a condition in which the body is overweight, as measured by several measurements. The accumulation of fat in the body's subcutaneous tissue, or under the skin, around organs, and sometimes even in the tissue itself, is a sign of obesity. In the past five years, the prevalence of adolescent obesity in Indonesia has nearly doubled. Objective:The production of digital comics on obesity prevention for teenagers.Method:This study used an RnD approach based on the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The media was validated by media expert validators, linguists, public health practitioners, agency validators, and students of SMKN 4 Jambi City. Data collection used a literature review, and data were analyzed manually.Results:The development of a digital comic for obesity prevention at SMKN 4 Jambi City began with identifying potential and problems, collecting data, and information. The product design was created using the Canva application. The product received validation results, namely 95% from media experts (very suitable), 93% from language experts (very suitable), 98% from public health practitioners (very suitable), and 100% from institutions consisting of teachers (very suitable). After receiving suggestions and comments from the validators, the product was then revised. Then the results of the product trial on the participant group were 88% (very suitable).Conclusion:Digital comics on obesity prevention can be used as a health education medium with a very good feasibility test. Recommendation: Digital comics on obesity prevention can be digitized on an Android basis.

Keywords:Educational Media; Comics; Teenagers; Obesity

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1. Introduction

Obesity is a global public health problem characterized by excessive fat accumulation resulting from a long-term imbalance between energy intake and energy expenditure (World Health Organization [WHO], 2000). In response to the escalating prevalence of obesity worldwide, the World Health Organization set a target to reduce obesity rates to 2010 levels by 2025. However, despite global and national efforts, obesity prevalence remains high and continues to increase in many countries, including Indonesia.

Obesity is commonly defined as a condition of excessive body weight caused by abnormal or excessive fat accumulation in subcutaneous tissue and around vital organs, which may impair health. One widely used indicator to assess obesity is the Body Mass Index (BMI), calculated as body weight divided by height squared. Excessive consumption of high-energy foods, particularly those rich in fats and carbohydrates, combined with low

physical activity levels, contributes significantly to positive energy balance and fat accumulation (Qatrunnada & S., 2022). When energy intake consistently exceeds energy expenditure, surplus energy is stored in adipose tissue, eventually leading to obesity.

Indonesia currently faces a double burden of malnutrition, namely undernutrition and overnutrition. Unbalanced dietary patterns and lifestyle changes have resulted in excessive energy intake relative to daily energy expenditure, increasing the prevalence of overweight and obesity across age groups. Excess fat accumulation poses serious health risks, including type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, and certain types of cancer (Safitri & Rahayu, 2020). If left unmanaged, obesity not only affects physical health but also contributes to psychological, emotional, and social problems that reduce quality of life.

National health data further illustrate the seriousness of this issue. The Indonesian Ministry of Health reports that based on the 2015–2019 National Medium-Term Development Plan (RPJMN), 13.5% of adults aged 18 years and older were classified as obese, while 28.7% had a BMI ≥ 25 and 15.4% had a BMI ≥ 27. Among children aged 5–12 years, the combined prevalence of overweight and obesity reached 20.7%, while adults with a BMI ≥ 25 increased to 33.5% (Ministry of Health of the Republic of Indonesia, 2018). These findings indicate that obesity remains a persistent and growing public health concern in Indonesia.

The increasing prevalence of obesity is alarming because it significantly elevates the risk of chronic non-communicable diseases, including cardiovascular disease, hypertension, diabetes mellitus, and cancer, which contribute to premature morbidity and mortality (Safitri & Rahayu, 2020). Adult obesity, in particular, has long-term implications for health systems due to its association with high treatment costs and reduced productivity.

Understanding the risk factors associated with obesity is essential for effective prevention, especially among adolescents and adults. Dietary habits, such as excessive consumption of foods high in sugar, fat, and refined carbohydrates, are major contributors to obesity. Additionally, unhealthy lifestyles characterized by sedentary behavior, lack of physical activity, and socioeconomic transitions further exacerbate the problem. Nutritional knowledge also plays a crucial role, as inadequate understanding of balanced nutrition may lead to poor food choices and inappropriate dietary patterns (Jufri et al., 2022).

Food intake, particularly excessive energy and carbohydrate consumption, is one of the primary determinants of obesity. When carbohydrate intake exceeds the body's energy needs, unused energy is converted into fat and stored in adipose tissue. Continuous accumulation of stored fat increases body weight and raises the risk of obesity. Although carbohydrates are essential as a primary energy source, excessive intake without sufficient physical activity significantly contributes to weight gain (Peralta-Argomeda et al., 2016).

Given the rising prevalence of obesity and its serious health consequences, preventive efforts focusing on nutritional education, balanced diets, and healthy lifestyles are urgently needed. Improving public awareness and knowledge about proper nutrition is a key strategy in reducing obesity rates and promoting long-term health outcomes.

2. Literature Review

Obesity

Obesity is a condition characterized by excessive accumulation of fat in the body, which occurs in adipose tissue, negatively impacting health. Obesity is the accumulation of excess body fat caused by an imbalance between energy intake and energy output. Obesity is defined as excess body fat, typically accumulating in the subcutaneous tissue surrounding organs (under the skin).(8)

Obesity is defined as a height measurement that is 3 or more standard deviations higher than the median standard deviation of growth according to the World Health Organization (WHO). Obesity in adults poses a serious risk for non-communicable conditions such as cardiovascular disease (especially heart disease and stroke), which can be fatal and even lead to death at a young age. A BMI for age that is at least one standard deviation above the median WHO growth standards is considered overweight or obese; a BMI that is at least two standard deviations above the median WHO growth standards is considered obese.(9)

*World Health Organization*The World Health Organization (WHO) classifies obesity based on a person's nutritional status. Weight divided by height (kg/m2) yields the Body

Mass Index (BMI). This obesity calculation can be used for individuals aged 18 to 70, with normal spinal structure, who are not athletes or pregnant women, and for children under 18, depending on gender and age.

Anthropometric measurements in adults with the formula below:

$$\text{BMI} = \frac{\text{Body Weight (Kg)}}{\text{Height (m)2}}$$

Information :
BMI = Body Mass Index, or BMI
TB = Height (Kg)
BB = Body Weight $(m)^2$
For the category of Asian adults, WHO sets a cut-off figure of >25, as shown in the table below.

Obesity Classification Table

Classification	BMI
Underweight	<18.5
Average or normal weight	18.5-22.9
Overweight with risk	23-24.9
Obesity I	25-29.9
Obesity II	>30

BMI measurements can be used as an initial screening tool to diagnose overweight or obesity. The higher a person's BMI, the greater their risk of obesity-related complications. People with obesity levels I and II are at higher risk of developing conditions such as heart disease or stroke than those with a healthy weight.(4)

3. Proposed Method

This research uses an RnD approach based on the ADDIE Model (Analyze, Design, Development, Implementation, and Evaluation) by following the Borg and Gall development procedures according to(10)consisting of 1) Potential and Problems, 2) Data Collection, 3) Product Design, 4) Product Validation, 5) Product Revision, 6) Trial, 7) Product Revision. The procedure begins with a needs analysis and literature study. The research instrument is a pocket book assessment sheet by validators, namely media experts, linguists, public health practitioners, agency validators, and participant groups.

Data analysis used descriptive analysis of validator comments and suggestions obtained from the assessment sheet. The questionnaire data was qualitative and quantified using a Likert scale. The assessment continued by calculating the percentage of product suitability using the following formula:

$$P=\Sigma R/N$$

Information:
P = Percentage of final score
$\sum R$ = Total number of assessment results
N = Maximum score

Source:(10)in the Development of Pop-Up Book Media in Science Subjects, Animal Life Cycle Material, Grade IV Elementary School(11)

The product eligibility percentage results will be changed according to the criteria in the following table:

Table 1. Eligibility Level Interval

No.	Percentage	Validity Level
1.	80% < V ≤ 100%	Very Feasible
2.	60% < V ≤ 80%	Feasible
3.	40% < V ≤ 60%	Fairly Decent
4.	20% < V ≤ 40%	Less Feasible
5.	0% < V ≤ 20%	Very Less Feasible

Source:(12)

4. Results and Discussion

The diabetes prevention comic book was created and developed based on the ADDIE model (Analysis, Design, Development, Implementation and Evaluation) using the Research and Development (RnD) method steps by Borg and Gall as follows:

1. Analysis

a. Potential and Problems

Obesity is a global problem that affects 2 billion people worldwide and threatens public health, including in Indonesia. By 2030, it is estimated that 1 in 5 women and 1 in 7 men will be living with obesity (equivalent to more than 1 billion people worldwide). The global prevalence of obesity is higher in women than in men, and the largest number of people with obesity are in developing countries, where the double burden of malnutrition persists and systems are severely underprepared and ill-equipped to effectively address obesity and its consequences. Globally, more than 160 million healthy life years were lost due to high BMI in 2019, and the figure is likely to increase every year. This represents more than 20% of all healthy life years lost due to preventable chronic health conditions. If we are to address preventable NCDs, success in addressing obesity is crucial. In Indonesia, over the past 10 years, there has been a significant increase in obesity, from 10.5% in 2007 to 21.8% in 2018. Obesity is a risk factor for non-communicable diseases such as diabetes mellitus, heart disease, cancer, hypertension, and Other metabolic and non-metabolic diseases contribute to deaths from cardiovascular disease (5.87% of total deaths), diabetes, and kidney disease (1.84% of total deaths). Obesity is now classified as a disease requiring comprehensive intervention.

b. Data and information collection

Next, the researchers conducted a literature review from various sources, such as health articles, digital books, and journals, to develop educational comic media for obesity prevention. Some of the references used as material in the comic include the Ministry of Health Regulation (Minister of Health Regulation)Regarding obesity in Indonesia, particularly regarding prevention and management, several regulations can be found. Among them is Minister of Health Regulation No. 41 of 2014 concerningBalanced Nutrition Guidelines,Minister of Health Regulation No. 28 of 2019, and Minister of Health Regulation No. 2 of 2020. In addition, there are also regulations related to the Healthy Living Community Movement (Germas)as regulated in Presidential Regulation Number 1/2017, as well as the regulation of salt, sugar and fat content in food products as regulated in the relevant Ministerial Regulation of Health. Meanwhile, the reference used regarding the image is an ideal body weight comic, not a fantasy from the Ministry of Health.

2. Design

The design of an obesity prevention comic begins with determining the theme and target age group, i.e., the target audience. Therefore, in this study, the obesity prevention comic has the theme of ideal body weight, not a fantasy from the Ministry of Health, and is targeted at teenagers in high school and vocational schools. After that, a storyboard or sketch is created to ensure it adheres to the predetermined theme. This includes creating the front and back covers, a foreword, a table of contents, the main body, and a closing.

3. Development

*Storyboard*The pocket book created in the previous stage was then developed by designing characters from an obesity prevention comic. The pocket book was developed using digital drawings using a smartphone in the Canva app, combining illustrations and text.

4. Implementation

a. Product Validation

Product validation was conducted by expert validators in various fields, who assessed and provided comments and suggestions to reduce errors in the obesity prevention comic and thus support product development. There were four validators:

1. Validation of Public Health Practitioners/Health Promotion

The results of the assessment by one validator, namely a public health practitioner, can be seen in the following table:

Table 1. Summary of Assessment of Comics on Obesity Prevention in Adolescents (High School/Vocational High School) by Public Health/Health Promotion Practitioners

No	Assessment Aspects	Number of Aspects	Max Value	Eligibility Percentage*
1.	Educational Media	35	35	100
2.	Linguistics	20	20	100
3.	Comic Design	40	40	100
	Amount	95	95	100

**Eligibility: Very Feasible (80% < V ≤ 100%), Feasible (60% < V ≤ 80%), Quite Feasible (40% < V ≤ 60%),*
Less Feasible (20% < V ≤ 40%), Very Less Feasible (0% < V ≤ 20%)

Based on the validation results carried out by public health practitioners, the feasibility percentage was 100% with very feasible criteria.

2. Media Expert Validation

The results of the assessment by one media expert can be seen in the following table:

Table 2. Summary of Assessment of Comics on Obesity Prevention in Adolescents (High School/Vocational High School) by Media Experts

No	Assessment Aspects	Number of Aspects	Max Value	Eligibility Percentage*
1.	Comic Design	52	55	94
2.	Educational Media	15	15	100
	Amount	67	70	97

**Feasibility: Very Feasible (80% < V ≤ 100%), Feasible (60% < V ≤ 80%), Fairly Feasible (40% < V ≤ 60%),*
Less Feasible (20% < V ≤ 40%), Very Less Feasible (0% < V ≤ 20%)

Based on the validation results carried out by media experts, the feasibility percentage was 97% with very feasibility criteria.

3. Linguist Validation

The results of the assessment by one linguist can be seen in the following table:

Table 3. Summary of Assessment of Comics on Obesity Prevention in Adolescents (High School/Vocational School) by Language Experts

No	Assessment Aspects	Number of Aspects	Max Value	Eligibility Percentage*
1.	Linguistics	25	30	83
2.	Educational Media	15	15	100
	Amount	40	45	92

**Eligibility: Very Feasible (80% < V ≤ 100%), Feasible (60% < V ≤ 80%), Quite Feasible (40% < V ≤ 60%),*

Less Feasible (20% < V ≤ 40%), Very Less Feasible (0% < V ≤ 20%)

Based on the validation results carried out by language experts, the feasibility percentage was 92% with very feasibility criteria.

4. Agency Validation

The agency validation was conducted by a single validator, a teacher from SMK N 4 Kota Jambi. The assessment results can be seen in the following table:

Table 5. Summary of Assessment of Comics on Obesity Prevention in Adolescents (High School/Vocational High School) by Institutional Validators

No	Assessment Aspects	Number of Aspects	Max Value	Eligibility Percentage*
1.	Educational Media	35	35	100
2.	Linguistics	20	20	100
3.	Book Design	40	40	100
	Amount	95	95	100

**Eligibility: Very Feasible (80% < V ≤ 100%), Feasible (60% < V ≤ 80%), Quite Feasible (40% < V ≤ 60%),*

Less Feasible (20% < V ≤ 40%), Very Less Feasible (0% < V ≤ 20%)

Based on the validation results, the feasibility percentage was 100% with very feasible criteria.

b. Product Design Revision

At this stage, design revisions were made after receiving comments and suggestions during the expert validation phase. This was used to correct deficiencies in the Obesity Prevention Comic for Teenagers (High School/Vocational High School) to support the development of the media.

1. Public Health Practitioner/Health Promotion

Public health/health promotion practitioners received comments and suggestions to add a foreword, bibliography, and enlarge the font size in the obesity prevention comic. Therefore, the researchers made several improvements, including a foreword and a bibliography to list references. They also increased the font size for all letters in the pocketbook.

2. Media Expert

Based on comments and suggestions from media experts, the obesity prevention comic cover had attractive colors but needed to include the agency's logo, and the title of the pocketbook needed to be changed to suit the target group. Therefore, the researchers made several improvements, including adding the agency's logo.

3. Linguist

According to linguists, the PHBS pocketbook is capable of engaging readers and using appropriate language. However, the obesity prevention comic book requires further adjustments to the enhanced spelling (EYD). Based on these suggestions, the researchers revised the sentence structure using enhanced spelling (EYD).

c. Product Trial

The product trial was conducted on a limited group of participants, namely adolescents aged 16-19 years at SMK N 4 Jambi City. A participant group of 40 participants was then obtained. Researchers conducted a face-to-face product trial in class by giving each group one obesity prevention comic to read and each adolescent received an assessment sheet to fill out. The assessment results for the participant group are as follows:

Table 6. Trial of obesity prevention comics for adolescents in vocational schools/high schools

No	Assessment Aspects	Mark N=40	Number of Aspects	Max Value	Eligibility Percentage *
1.	Comic View		1027	1200	86
2.	Comic Content		552	600	92
3.	Educational Media		546	600	91
	Amount		2113	2400	89

**Eligibility: Very Feasible (80% < V ≤ 100%), Feasible (60% < V ≤ 80%), Quite Feasible (40% < V 60%),*

Less Feasible (20% < V ≤ 40%), Very Less Feasible (0% < V ≤ 20%)

Source: Processed Primary Data

Based on the results of product trials conducted on the participant group, the feasibility percentage was 89% with very feasibility criteria.

5. Evaluation

A formative evaluation was conducted on the development of a comic media platform for obesity prevention in adolescents. Formative evaluation occurs throughout the development process. It aims to identify deficiencies in the media to be developed, allowing for subsequent improvements based on the suggestions received. The evaluators involved in this formative evaluation were experts and a group of participants. Therefore, the evaluation in this study was derived from the expert and participant assessments conducted during the implementation phase, as follows:

1. Public Health Practitioner/Health Promotion

   There was an evaluation of the comic's content, including the addition of a foreword and bibliography. Furthermore, there was an evaluation of the comic's design, including the font size used in the comic.

2. Media Expert

   Media experts conducted an evaluation of the book design aspects, namely improvements to the illustration components and comic cover layout.

3. Linguist
   There is an evaluation of the linguistic aspects, namely improving sentence structure and the use of Enhanced Spelling (EYD).

4. Participant Group
   The participant group's evaluation focused solely on the comic's appearance, specifically the need to increase the font size. Meanwhile, the obesity prevention comic was able to attract readers and increase insight into obesity prevention in adolescents.

Discussion

Media development was carried out based on the ADDIE Model (Analyze, Design, Development, Implementation, and Evaluation) with the RnD method following the Borg and Gall procedure. According to Sugiyono (2015) the media development procedure carried out with the development research stages of Borg and Gall consists of 10 stages including 1) Potential and Problems, 2) Data Collection, 3) Product Design, 4) Product Validation, 5) Product Revision, 6) Field Testing, 7) Product Revision, 8) Field Operational Testing, 9) Final Product Revision, 10) Mass Production.(10)However, this study only carried out 7 stages of procedures becausedue to the limited funds spent by researchers to create media on a large scale, so that the media products produced by researchers are only for demonstration purposes.

The research began with the analysis stage, namely identifying the potential and problems related to obesity prevention comics for adolescents by collecting data and information through literature studies.

The next stage in developing a comic is design and development. The design of the comic on preventing obesity in adolescents was created using the Canva application. The comic, entitled "Ideal Body Weight Comic is Not a Fantasy" from the Ministry of Health, consists of a front cover, back cover, foreword, table of contents, and bibliography with 22 pages. Based on the attention function according to Sulistyani et al. (2013) in(13), that pocket books printed in small, full-color packaging can attract and engage students' attention, allowing them to concentrate on the written material. Therefore, during the development process, researchers created the pocket book's character and design by incorporating bright colors on each page.

At the implementation stage, researchers validate the product to determine the feasibility of a product. According to(10)Product validation requires the presence of several experts or experienced personnel to assess the product. Each expert should assess the design. Therefore, in this study, validation was conducted by four validators: one public health practitioner, one media expert, one language expert, and an institutional validator, a teacher from SMK N 4 Kota Jambi.

The results of the comic's suitability percentage include: validators from public health/health promotion practitioners assessed the educational media, language, and design aspects of the comic, obtaining a percentage of 100%. Linguists assessed the linguistic and educational media aspects, obtaining a percentage of 92%. Likewise,(14)which obtained a linguist's feasibility score of 87.5%. Furthermore, this study

obtained a media expert assessment for the book design and educational media aspects, with a percentage of 97%. In contrast to(15)The Mind Mapping-Based Pocketbook Development to Improve Elementary School Students' Social Studies Learning Outcomes only achieved a "feasible" rating with a percentage of 78.5%. Furthermore, the agency validator's assessment of the obesity prevention comic, which assessed the educational media, language, and comic design aspects, achieved a percentage of 100%. Based on the feasibility criteria, this percentage falls into the very feasible category.

At this stage, the validator also provided comments and suggestions to identify the comic's strengths and weaknesses. These deficiencies were then used as input for improvement during the product revision stage. Revisions were made to several aspects of the assessment, including the comic's content, including the addition of a foreword and bibliography. Furthermore, revisions were made to the language aspect, including the use of sentences in accordance with EYD (Indonesian Standard of Indonesian Language) and the use of capital letters. Improvements were also made to the comic's design, including the font size and the addition of the agency logo and title to the cover layout.

After product revisions, a trial was conducted with a product usage simulation. The trial phase was limited to 40 participants, namely adolescents at SMK N 4 Jambi City. The trial was conducted by providing an assessment sheet for the feasibility of the illustrated obesity prevention comic, consisting of three assessment aspects: comic appearance, comic content, and educational media. Based on the trial results, a feasibility percentage of 89% was obtained, with the feasibility criteria being included in the very feasibility category. Similarly, the research(16)which obtained a very suitable category with a score of 3.33 and 3.39 in the Development of Ethnoscience-Based Digital Pocket Books in Elementary Schools in Singkawang City.

The development continued with the evaluation stage. The evaluation was obtained from the assessment results of experts and participant groups that had been carried out in the implementation stage. From public health/health promotion practitioners, there was an evaluation of the comic aspect as a health education medium. Next, there was an evaluation from media experts on the comic design aspect. Then, according to linguists, there was an evaluation of the linguistic aspect. Likewise, the agency validator and participant groups conducted an evaluation of the comic's use for adolescents.

5. Conclusion

The development of obesity prevention comics for adolescents begins with the analysis stage, namely identifying potential and problems as well as collecting data and information from literature studies. This is followed by the design and development stage, by determining the theme and targets. The design was created using the Canva application. Then the implementation stage was carried out with validation by public health practitioners/Health Promotion obtaining a result of 100% (very feasible), media experts obtaining a result of 97% (very feasible), linguists obtaining a result of 92% (very feasible), and agency validators obtaining a result of 100% (very feasible) and the participant group trial obtaining 89% (very feasible) so that the ideal weight obesity prevention comic book from the Ministry of Health can be used as a health education medium with a very feasible

feasibility test. Meanwhile, the evaluation stage was carried out formatively during the development process. So that the evaluation was obtained from the results of expert and participant group assessments that had been carried out at the implementation stage. It is recommended for further researchers to digitize Android-based and develop media with other health issues.

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Reference

Firman, R. A., & Julianto. (2021). Development of pop-up book media in science subjects on animal life cycle material for elementary school teacher educators. *Journal of Educational Research*, *9*(10), 3451–3463.

Hamzah Sr, B. H. (2020). Stunting prevention movement through community education in Muntoi Village, Bolaang Mongondow Regency. *JPKMI (Jurnal Pengabdian kepada Masyarakat Indonesia)*, *1*(4), 229–235.

Jufri, S., Robert, D., Harikedua, V., Makaminang, M. A., & Ligawa, F. (2022). Nutrition knowledge and physical activity with obesity in adults in Kotabunan Village, Kotabunan District, Bolaang. *E-Proceedings of National Seminar*, *1*(2), 168–176.

Ministry of Health of the Republic of Indonesia. (2012). *Indonesian health profile*. Ministry of Health Indonesia.

Ministry of Health of the Republic of Indonesia. (2017). *Pedoman umum pencegahan dan penanggulangan obesitas*. Ministry of Health Indonesia.

Ministry of Health of the Republic of Indonesia. (2018). *Obesity epidemic*. Health Journal.

Pas, E. G., & Wardani, K. W. (2022). Development of a mind mapping-based pocket book to improve elementary school students' social studies learning outcomes. *Jurnal Basicedu*, *6*(6), 9715–9725.

Peralta-Argomeda, J., Huamantinco-Araujo, A., Suarez, L. Y. T., Pimentel, H. F., Quispe Phocco, R. F., & Roldán-Pérez, G. (2016). The relationship between energy, carbohydrate, protein, and fat intakes and central obesity in adults in Kepuharjo Village, Cangkringan District, Yogyakarta. *UCV*, *1*(2), 1–16.

Pratama, R. A., & Saregar, A. (2019). Development of scaffolding-based student worksheets (LKPD) to train concept understanding. *Indonesian Journal of Science and Mathematics Education*, *2*(1), 84–97.

Qatrunnada, R. D., & S. (2022). Factors that cause overweight and obesity in school-age children and adults. *Media Gizi Kesmas*, 2–6.

Safitri, D. E., & Rahayu, N. S. (2020). Determinants of nutritional status of obesity in urban adults: A systematic review. *Arkesmas (Public Health Archives)*, *5*(1), 1–15.

Sanusi, R., Ho, Y., & Wulandari, R. (2020). Development of a personal hygiene pocket book (nails, hands, and feet) for elementary school students. *Jurnal Minda*, *2*(1), 1–12.

Sugiatmi, Rayhana, Suryaalmsah, I. I., Rahmini, Akbar, Z. A., & Harisatunnasyitoh, Z. (2019). Increasing knowledge about overweight and obesity in caregivers of IGBS Darul Marhamah Islamic Boarding School, Jatisari Village, Cileungsi District, Bogor Regency, West Java. *Community Service Journal*, *1*(September), 1–5.

Sugiyono. (2015). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Alfabeta.

Sulistri, E., Sunarsih, E., & Utama, E. G. (2020). Development of ethnoscience-based digital pocket books in elementary schools in Singkawang City. *Journal of Education: Research and Literature Review in Education, Teaching, and Learning*, *6*(3), 522.

Vadilla, V. N., Habisukan, U. H., Tastin, T., 'Aini, K., & Hapida, Y. (2019). Development of pocket books as learning media on eubacteria material in senior high schools. In *Proceedings of the National Seminar on Biology Education 2019* (pp. 106–110).