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Media Gizi Indonesia (MGI) that has been published since 2004 is a scientific journal that provides articles regarding the results of research and the development of nutrition including community nutrition, clinical nutrition, institutional nutrition, food service management, food technology, current issues on food and nutrition. This journal is published once every 4 months: January, May, and September.

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INTRODUCTION TO THE EDITOR

Media Gizi Indonesia (MGI) is a scientific journal published regularly every 4 months that provides articles regarding the research and the development of nutrition knowledge including community nutrition, clinical nutrition, institutional nutrition, food service management, food technology, and current issues on food and nutrition. Media Gizi Indonesia provides a variety of scientific articles in the scope of Nutrition and Health.

The recent volume is special issue in collaboration with the 3rd Bengkulu International Conference on Health 2023 (B-Icon), which consisted of original research and meta-analysis in the field of nutrition throughout the lifecycle, which focuses on child nutrition, pregnancy, food product development, and degenerative disease prevention. To date, child and adolescent nutrition has raised concerns since it manifests to a better quality of life during adulthood. The concern focused on the health impacts of preventable intergenerational nutrition issues in the earlier periods. For that, MGI presents relevant research related to anemia, stunting, children's growth, and dietary intervention to the selected population. Besides presenting studies related to child and adolescent nutrition, the current edition of MGI also shows research in food product development to provide better food products to alleviate nutritional problems. Furthermore, original research on the prevention of degenerative diseases in community setting.

We do hope MGI scientific journals can leverage the development of a writing culture and communicative scientific studies as well as attract readers and writers to participate in MGI for future issues. Media Gizi Indonesia will maintain its role in providing current, relevant, and topical issues in food and nutrition. Hopefully, the works displayed by MGI can provide benefits and enrich the readers' knowledge.

Editorial Team

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THE RELATIONSHIP OF FATTY ACID CONSUMPTION WITH TOTAL CHOLESTEROL LEVEL IN CORONARY ARTERY DISEASE PATIENTS

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ABSTRACT

Coronary artery disease is one of the significant causes of death and is still a health problem for developed and developing countries. Increased cholesterol in the blood is caused by heredity and high-fat consumption. The effect of dietary fat on artery disease is related to the impact of fatty acid components and cholesterol on blood cholesterol. This study aims to determine the relationship between consumption of Saturated Fatty Acids (SFA), Monounsaturated Fatty Acids (MUFA), and Polyunsaturated Fatty Acids (PUFA) with total cholesterol levels in patients with coronary artery disease. The research design used was descriptive-analytic in clinical nutrition with a cross-sectional approach. The population in this study were 405 patients with coronary artery disease at the artery clinic of RSUD Dr. M. Yunus Bengkulu. The sample was 32 patients collected using a purposive sampling technique. Using the Chi-Square test, data analysis was used to determine the relationship between the consumption of SFA, MUFA, and PUFA with total cholesterol levels in patients with coronary artery disease. The study's results found a significant relationship between SFA consumption and coronary artery disease. Still, conversely, there was no significant relationship between MUFA and PUFA consumption with total cholesterol level in coronary artery disease patients, namely that SFA consumption was inadequate (p-value = 0.043, OR = 0.407), inadequate MUFA consumption (p-value = 0.710), and inadequate of PUFA consumption (p-value= 0.465). The conclusion is that saturated fatty acids are related to total cholesterol in coronary artery disease while conversely to monounsaturated fatty acids and polyunsaturated fatty acids.

Keywords: coronary artery disease, total cholesterol, SFA, MUFA, PUFA

INTRODUCTION

Coronary Artery Disease (CAD) is a disease that causes many deaths and is still a health problem for developed and developing countries (Susilo, 2015). This death often occurs with a sudden artery attack and without any previous symptoms (Santosa & Baharuddin, 2020). Coronary artery disease is a type of artery disease caused by plaque in the artery arteries (Purnama, 2020). This condition is caused by narrowing or plaque blockage in the coronary arteries, otherwise known as coronary artery atherosclerosis. One of the components that make up this plaque is cholesterol crystals. Therefore, one of the risks of atherosclerosis is high blood cholesterol levels (Sianturi and Evi, 2019).Several risk factors cause coronary artery disease. Some of them are smoking, unhealthy eating lifestyle, lack of physical activity, high blood pressure, diabetes and dyslipidemia. However, other factors have an influence, such as genetic and environmental factors (Santosa & Baharuddin, 2020).

The World Health Organization (WHO) estimates that CAD is the leading cause of death worldwide, with 17 million deaths per year in 2008 and will increase to 23.4 million deaths in 2030, with more than 80% occurring in countries developing (Setyaji et al., 2016). According to Riskesdas 2013, the prevalence of coronary artery disease based on a doctor's diagnosis in Indonesia is 0.5%, and based on doctor diagnosis or symptoms is 1.5% (Litbangkes, 2013). Based on data on the prevalence of artery disease diagnosed by Indonesian doctors is 1.5% and 1.3% based on doctor diagnosis in residents of all ages, according to Bengkulu Province (Litbangkes, 2018). The data explanation shows that the prevalence of artery sufferers is the same as it was from 2013 to 2018. According to data from RSUD Dr. M. Yunus Bengkulu, 1080 patients were undergoing outpatient care at the cardiac polyclinic in 2021.

The prevalence of CAD based on interviews with those whom a doctor has diagnosed and those diagnosed by a doctor or symptoms increases

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with age, the highest in the 65-74 year age group, namely 0.2% and 3.6% and decreases in the age group ≥ 75 years. The prevalence of CAD that a doctor or symptoms have ever diagnosed is higher in women (0.5% -1.5%). The prevalence of CAD is higher in people who do not attend school and do not work. Based on CAD that a doctor has diagnosed, the prevalence is higher in urban areas, but based on the doctor's diagnosis and symptoms, it is higher in rural areas and at the lowest ownership index (Litbangkes, 2013).

Hereditary factors and high-fat consumption cause increased cholesterol in the blood. The effect of dietary fat on artery disease is related to the impact of fatty acid components and cholesterol on blood cholesterol, especially LDL cholesterol. Increased saturated fat and cholesterol consumption can increase low-density lipoprotein (LDL) cholesterol concentration. Bad fats such as saturated fat can be converted into cholesterol, thereby increasing blood cholesterol levels, especially LDL, by reducing its breakdown or catabolism (Yuliantini et al., 2015).

The research by Rukmasari & Sumarni, (2018) concluded that the consumption of nutrients in coronary artery disease patients varies greatly. Cholesterol consumption and fat consumption in this study were above the recommended requirement. Excessive consumption of fat has a huge effect on blood cholesterol. Fat in the diet works together with cholesterol to reduce the activity of LDL receptors in the liver. This will cause a reduction in the disposal of LDL in the blood so that total cholesterol and LDL in the blood rise. Increased cholesterol in the diet causes an increase in plasma cholesterol concentration and is associated with the risk of cardiovascular disease.

Consumption of fat, incredibly saturated fat, will increase plasma cholesterol levels. It is estimated that for every 1% addition of saturated fatty acids from total energy, blood cholesterol will increase by 1.9 mg/dL. Consuming large amounts of saturated fat in the human body will increase total blood cholesterol (Hairuddin et al., 2019). Monounsaturated fats generally benefit blood cholesterol levels, mainly when used as a substitute for saturated fatty acids. Monounsaturated fatty acids (MUFA) are more effective in lowering blood cholesterol levels than polyunsaturated fatty acids (PUFA) (Sartika, 2008).

Consumption of polyunsaturated fats in patients with CAD can increase bad cholesterol (LDL), as seen from the chemical structure of polyunsaturated fats, which are easily oxidized and trigger a change in fatty acid isomers from cis to the transform. Polyunsaturated fatty acids in trans form also increase LDL cholesterol levels and reduce HDL cholesterol levels (Bertalina, 2015).

The results of research conducted by Zahroh & Bertalina, (2014) show that continuous consumption of polyunsaturated fats will be a problem related to the benefits of polyunsaturated fatty acids, which can reduce blood cholesterol levels. However, the study found that 37.5% of patients who consumed good polyunsaturated fatty acids experienced high blood cholesterol levels. This is because patient daily cholesterol consumption is ≥ 200 mg, causing blood cholesterol levels to increase. Based on the above background, the researchers are eager to know the relationship between the consumption of saturated fatty acids, monounsaturated fatty acids, and polyunsaturated fatty acids and total cholesterol levels in patients with CAD at the artery clinic of RSUD Dr. M. Yunus Bengkulu.

METHODS

This research used a cross-sectional approach by examining the dynamics and risk factors and their impacts through direct observation and data collection. The population in this study were 405 patients with coronary artery disease at the artery clinic of RSUD Dr. M. Yunus Bengkulu. The sample was 32 patients using a purposive sampling technique. Several criteria, namely the inclusion criteria consisted of residing in Bengkulu, men and women aged 25-65 years, having been diagnosed by a doctor as suffering from coronary artery disease, willing to be interviewed about food consumption, weight and height measurements, taking statin medication, able to communicate well, having lipid profile examination results for total cholesterol levels, and exclusion criteria during the research process for patients having complications such as Acute renal failure dan chronic kidney disease, patients who were not

willing to be interviewed and were not willing to be sampled. SFA, MUFA and PUFA consumption data were collected using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) consumption survey. Consumption data was obtained using interview techniques by enumerator to patients accompanied by their families regarding their consumption habits of SFA, MUFA and PUFA fats for the last one-month. Non-random sampling was used using the purposive sampling technique—the Chi-Square test analysis data. The Research ethics were issued by the Bengkulu Ministry of Health Polytechnic Ethics Commission with No. KEPK. BKL/204/05/2023.

RESULTS AND DISCUSSION

Based on Table 1, it is known that the description of consumption of saturated fatty acids (SFA) in patients with coronary artery disease shows that almost all of them (84.4%) are inadequate, consumption of monounsaturated fatty acids (MUFA) in patients with coronary artery disease shows that the majority (65.6%) are inadequate, the consumption of saturated fatty acids (PUFA) in coronary artery disease patients shows that most (62.5%) are inadequate.

Table 1. Overview of Consumption of SFA, MUFA, and PUFA with Total Cholesterol Levels in CAD Patients at the Artery Polyclinic of RSUD Dr. M. Yunus Bengkulu

Consumption of Fatty acids		n (%)
Saturated Fatty Acids (SFA)	Inadequate	27 (84.4)
	adequate	5 (15.6)
Monounsaturated Fatty Acids (MUFA)	Inadequate	21 (65.6)
	adequate	11 (34.4)
Polyunsaturated Fatty Acids (PUFA)	Inadequate	20 (62.5)
	adequate	12 (37.5)

At Table 2, statistical test results obtained p-value = 0.043 (<0.05; OR = 0.407), meaning there is a significant relationship between consumption of SFA and total cholesterol level in patients with coronary artery disease at the artery clinic of RSUD. Dr. M. Yunus Bengkulu, the analysis results showed that most of the consumption of SFA was inadequate, with abnormal total cholesterol levels of 59.2%, and none of the consumption of SFA was adequate for abnormal total cholesterol levels.

Based on Table 3. The statistical test results obtained P-value = 0.710 (<0.05; OR = 0.758), meaning there is no significant relationship between consumption of MUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic. RSUD.Dr. M. Yunus Bengkulu, the analysis results showed that almost half of the inadequate MUFA consumption experienced abnormal total cholesterol levels of 47.6% and the majority of consumption of MUFA, which both experienced abnormal total cholesterol levels of 54.5%.

Table 2. The relationship between SFA, MUFA, and PUFA consumption with total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Fatty acid	Total cholesterol						P-value	OR 95%
	Abnormal		Normal		Total			
	n	%	n	%	n	%		
SFA consumption								
inadequate	16	59.2	11	40.7	27	100	0.043*	0.407 (0.259-0.642)
adequate	0	0.0	5	100.0	5	100		
Total	16	50.0	16	50.0	32	100		
MUFA consumption								
inadequate	10	47.6	11	52.3	21	100	0.710*	0.758 (0.175-3.274)
adequate	6	54.5	5	45.4	11	100		
Total	16	50.0	16	50.0	32	100		
PUFA consumption								
inadequate	9	45.0	11	55.0	20	100	0.465*	584 (0.138-2.483)
adequate	7	58.3	5	41.6	12	100		
Total	16	50.0	16	50.0	32	100		

*Chi-Square test.

Table 3. The relationship between the consumption of SFA and total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Consumption of Saturated fatty acids	Total Cholesterol (mg/dL)				Total		p-value	OR
	Abnormal		Normal					
	n	%	n	%	n	%		
Inadequate	16	59.2	11	40.7	27	100	0.043	0.407
Adequate	0	0.0	5	100.0	5	100		

Table 4. The relationship between consuming MUFA and total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Consumption of MUFA	Total Cholesterol (mg/dL)				Total		p-value	OR
	abnormal		normal					
	n	%	n	%	n	%		
Inadequate	10	47.6	11	52.4	21	100	0.710	0.758
Adequate	6	54.5	5	45.5	11	100		

Table 5. The relationship between the consumption of PUFA and total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Consumption of Polyunsaturated fatty acids (PUFA)	Total Cholesterol (mg/dL)				Total		p-value	OR
	Abnormal		Normal					
	n	%	n	%	n	%		
Inadequate	9	45.0	11	55.0	20	100	0.465	0.584
Adequate	7	58.4	5	41.6	12	100		

At Table 4 the statistical test results obtained p-value = 0.465 (<0.05; OR = 0.584) meaning that there is no significant relationship between consumption of PUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic of RSUD. Dr. M. Yunus Bengkulu's analysis showed that almost a portion of those consuming bad PUFA experienced abnormal total cholesterol levels of 45%, and most of those consuming adequate PUFA experienced Abnormal total cholesterol levels of 58.3%.

The Relationship of Consumption of SFA with Total Cholesterol Levels in CAD Patients

Based on the results of this study, it was found that there was a significant relationship between the consumption of SFA and total cholesterol levels in patients with coronary artery disease at the artery clinic at RSUD Dr M. Yunus Bengkulu Year 2023. Most patients who consume bad SFA have abnormal total cholesterol levels, and none consume good SFA with abnormal total cholesterol levels.

The results of interviews found that the source of food high in SFA, which is often consumed with a frequency of ≥ 1x a day (every meal), is palm oil. This aligns with research by Sayon-Orea et al. (2015) that the consumption of palm oil significantly influences CVD risk. Interview results showed that respondents often consumed foods that contained a lot of fat, such as coconut milk and fried dishes. Consumption of fried foods has a direct link to a higher risk of CVD, as oil has different health effects depending on the form in which it is eaten (used for sauces, cooking, or frying). The frying process can affect the quality and amount of fat consumed. This oil uptake has been shown to differ depending on the frying time (Sayon-Orea et al., 2015).

Food items stuffed with SFA that respondents rarely consume are coconut milk, young coconut meat, shrimp and rapeseed. Shellfish (Lokan) also contain bioactive compounds, including prostaglandins, fatty acid derivatives, alkaloids,

and other compounds. These substances have certain types of activity. Based on Hasyimi, there is another type of shellfish, namely *Anadaragranosa*, which has a reasonably high cholesterol content of around 177.295 mg/100 gr. This amount can still be said to be suitable for consumption if it refers to the provisions of WHO and NCEP (National Cholesterol Education Program), but it is possible that it could increase total cholesterol levels in shellfish after processing, which affects body cholesterol.

High consumption of saturated fatty acids significantly increases LDL cholesterol levels and reduces HDL levels. This automatically increases total blood cholesterol (which is a combination of LDL and HDL cholesterol) and reduces the ratio between LDL and HDL (Bertalina, 2015). Most adults need to reduce saturated fatty acids to reduce CVD risk. The recommended implementation strategy to achieve this reduction is to shift food choices from those high in saturated fatty acids to those high in monounsaturated and polyunsaturated fatty acids. Reducing SFA and replacing it with vegetable oils rich in PUFA, especially soybean oil, reduces CAD by 29% (Sacks et al., 2017). This is the same as research from Mozaffarian (2016) that increasing the consumption of PUFA-rich vegetable oils is an evidence-based strategy to reduce the risk of CAD and, as a substitute for saturated animal fats, reduces the incidence of CAD.

The National Institute of Clinical Excellence (NICE) reports that dietary energy derived from SFA is likely associated with CAD mortality and emphasizes that reducing SFA intake is essential for CAD prevention. NICE claims that 30,000 lives could be saved each year by replacing SFA with PUFA. Reducing SFA intake and replacing it with PUFA is more beneficial for preventing CVD. These findings provide evidence that consuming PUFA as a substitute for SFA minimizes the incidence of CAD and suggests that a shift towards greater consumption of PUFA compared to SFA will significantly reduce CAD rates (Valk, 2022) .

The Relationship between MUFA Consumption and Total Cholesterol Levels in CAD Patients

Based on the results of this study, it was found that there was no significant relationship between the consumption of MUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic at RSUD Dr M. Yunus Bengkulu Year 2023. Almost a portion of those consuming MUFA that are not good experience abnormal total cholesterol levels, and the majority of those consuming MUFA that are good experience abnormal total cholesterol levels. This is seen in MUFA consumption habits and the portions consumed.

The results of interviews with 32 respondents found that canola oil, peanuts, and avocado are food sources of MUFA that are rarely consumed. Meanwhile, olive oil is never consumed. According to Doloksaribu (2016), food ingredients found in monounsaturated fats are oleic acid and its sources, as well as liquid animal and vegetable fats, mainly olive oil and avocado. Research by Sayon-Orea et al. (2015) proves this, as they state that consumption of olive oil, vegetable oil, and mustard oil does not increase the risk of CVD. This aligns with Ryan et al. (2013) research that a diet high in MUFA can reduce LDL oxidation and increase HDL.

The results of direct interviews with respondents during the research revealed that most respondents never consumed oil sources from plants. In this study, only two people consumed canola oil with a consumption frequency of 1-3x a day because the price was unaffordable, so causing the consumption of MUFA in the majority of respondents to fall into the wrong category (Lidiyawati & Kartini, 2014).

The Relationship between PUFA Consumption and Total Cholesterol Levels in CAD Patients

Based on the results of this study, there was no significant relationship between the consumption of PUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic at Dr RSUD. M. Yunus Bengkulu in 2023. Almost half of those consuming bad PUFA experience abnormal total cholesterol levels, and most of those consuming good PUFA experience abnormal total cholesterol levels.

Through the results of direct interviews with 32 respondents during the research, it was discovered that the food sources for PUFA, which are often consumed with a food frequency of ≥ 1x

a day (every meal), are tofu and tuna. This research is in line with Handayani, et al., (2021) which states that reducing total cholesterol levels and increasing HDL levels is based on the influence of omega-3 fatty acids PUFA obtained when consuming fish.

They are consuming unhealthy foods, such as excessive consumption of fat and cholesterol, while low levels of PUFA can cause an increase in cholesterol levels in the blood and the risk of coronary artery disease (Rukmasari & Sumarni, 2018). This is in line with the results of research by Sacks, Lichtenstein, et al (2017), increasing PUFA intake can reduce cholesterol levels in the blood. The lack of PUFA may be due to the patient's need for knowledge regarding the food ingredients that should be consumed. So, patients need to be referred to a nutrition consultation clinic to understand eating arrangements so that consumption of PUFA is as required; with appropriate consumption, it can reduce cholesterol levels (Zahroh & Bertalina, 2014).

CONCLUSION

Based on the research results and discussion regarding the description of respondents' food consumption, almost all of their consumption of SFA is not good; most of their consumption of MUFA and PUFA is not good. Meanwhile, a significant relationship existed between the consumption of SFA. Still, conversely, there was no significant relationship between the consumption of MUFA and PUFA and total cholesterol levels in patients with coronary artery disease.

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THE EFFECT OF PROVIDING NUTRITIONAL COUNSELING ON THE LEVEL OF KNOWLEDGE, ATTITUDES, AND COMPLIANCE WITH FE TABLETS CONSUMPTION FOR PREGNANT WOMEN WITH ANEMIA IN THE GROGOL COMMUNITY HEALTH CENTER AREA

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ABSTRACT

Anemia contributes to maternal mortality during pregnancy, with a 2021 prevalence of 5.02% in Grogol. Non-compliance with Fe tablet consumption is a key factor. Nutritional counseling can effectively improve mothers' knowledge, attitudes, and compliance with Fe tablet intake. This study examines the impact of nutritional counseling on knowledge, attitudes, and compliance with Fe tablet consumption among anemic pregnant women at Grogol Community Health Center. Using a pre-experimental one-group pre-post-test design, 35 anemic pregnant women in their second and third trimesters were randomly sampled from clinic records. They received 15-20 minutes of counseling with leaflets. Knowledge and attitudes were assessed via interviews and questionnaires, while compliance was measured using the pill count formula. The Wilcoxon Signed Rank Test evaluated changes from baseline to post-counseling. Nutritional counseling increased knowledge (28.60%), attitudes (17.10%), and compliance (22.80%). Significant improvements were found in knowledge (p=0.001), attitude (p=0.001), and Fe tablet compliance (p=0.002). Nutritional counseling at the Grogol Community Health Center should be provided periodically to carry out promotive and preventive functions in the incidence of anemia in pregnant women.

Keywords: Anemic pregnant women, compliance, nutrition counseling, knowledge, attitude, fe tablets

INTRODUCTION

Nowadays, anemia during pregnancy is still a health problem which is a contributing factor to the high maternal mortality rate which is often referred to as "Potential Danger to Mother and Child". According to the World Health Organization (2017), the incidence of anemia in pregnant women in 2016 had a prevalence of around 40% globally, while in 2019 the global prevalence rate of anemia in pregnant women was around 36.5% (WHO, 2021). This shows that the incidence of anemia in pregnant women is still quite high worldwide. The results of Basic Health Research (Riskesdas) in 2018 showed that the 2018 prevalence rate of pregnant women with anemia in Indonesia was 48.9%. The rate experienced a quite high increase compared to that of 2013 with a prevalence of 37.1% (Ministry of Health of the Republic of Indonesia, 2018). The prevalence of anemia in pregnant women in 2021 in the Grogol Community Health Center area was 5.02% (Grogol Community Health Center, 2021).

Anemia that occurs during pregnancy can increase the risk of maternal and child death, the emergence of infectious diseases, premature birth of the baby, and disruption of the growth and development process of the fetus, either when the baby is still in the womb or after it is born (Ministry of Health of the Republic of Indonesia, 2021). One preventive measure to reduce the incidence of anemia in pregnant women that can be done is by administering red blood cell supplement tablets (TTD) during pregnancy in a minimum quantity of 90 TTD, where one tablet contains iron (ferrous fumarate which is equivalent to 60 mg of elemental iron) and 0.4 mg of folic acid (Ministry of Health of the Republic of Indonesia, 2021).

The prevalence of administering 90 TTD in the Grogol Community Health Center area in 2021 is 92.23%. This prevalence has met the target when it is compared with the achievement in Sukoharjo Regency, namely > 90%. However, several villages such as Telukan Village with a percentage of 88.76%, Parangjoro 70.71%, Pondok 78.37%,

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Langenharjo 68.41%, and Gedangan with a percentage of 87.70% still have a prevalence below 90% (unfulfilled) (Grogol Health Center, 2021). This shows that the provision of 90 Fe tablets for pregnant women in the Grogol Community Health Center area has not been carried out optimally because those villages have not reached the 90% target.

Nutritional counseling can be an effective way to increase maternal knowledge which is expected to have a positive influence on awareness and compliance with the consumption of Fe tablets in pregnant women so that anemia during pregnancy can be prevented and treated before delivery. Djati, et al (2017) stated that the occurrence of two-way communication in counseling between the counselor and the client means that mothers have more opportunities to ask questions so that the information they need is more precise and meets their needs. In addition, mothers' motivation can be strengthened through counseling causing an increase in compliance with the consumption of Fe tablets during pregnancy. Besides, individuals' inner perceptions can be more convincing in providing an action plan through counseling. According to the health belief model theory proposed by Strecher & Rosenstock (1997), the presence of good or bad perceptions originating from knowledge, experience, or information can provide confidence so that individuals are aware to view something. Knowledge plays an important role in determining the level of consumption of Fe tablets because it can influence the attitude of pregnant women. If pregnant women's knowledge is lacking, it can cause individuals' less optimal health behavior to prevent anemia (Shofiana, et al, 2018). Accordingly, counseling can be a strategy for changing social behavior and communication by influencing actions that can be observed and measured to improve health status (Juma et al, 2015).

Purbowati's (2016) research result in the working area of the Kedaung Wetan Community Health Center, Tangerang City, shows that there is an increase in compliance with the consumption of Fe tablets after providing nutritional counseling in the treatment group after the nutritional counseling process with a percentage of 89.7%. Research conducted by Djati, et al (2017) in the Sumpiuh Community Health Center II area also shows that there is an influence of nutritional counseling on the consumption of Fe tablets with a percentage of 76.2% in the treatment group after the treatment in the form of nutritional counseling.

Based on the preliminary survey, researchers interviewed 10 anemic pregnant women. The results showed that 70% of the respondents stated that they did not regularly consume Fe tablets and in one week only consumed Fe tablets < 3 times/ week. Then, 50% of the respondents stated that the reason for not routinely consuming them was that they felt they had only consumed the vitamins given by the obstetrician and ignored the Fe tablets from the health center. This shows that one of the factors causing anemia is that pregnant women are not compliant with consuming Fe tablets during pregnancy.

This study aimed to determine the effect of nutritional counseling on the level of knowledge, attitudes, and compliance with the consumption of Fe tablets among pregnant women with anemia in the Grogol Community Health Center area.

METHODS

This study utilized pre-experimental with a group pretest and posttest design in which there was no control group. This research was carried out in the working area of the Grogol Community Health Center, Grogol District, Sukoharjo Regency on 16 December 2022 - 28 February 2023. The population in this study were all pregnant women registered in the Grogol Community Health Center area in 2022 with inclusion criteria including pregnant women with trimester anemia II and III, pregnant women who lived in the research area for approximately 6 months, pregnant women who did not work as a health worker, pregnant women who received Fe tablets from the community health center, the distance between the current pregnancy and the previous pregnancy was > 2 years. The exclusion criteria included pregnant women who did not complete all questionnaires and did the post-test. The sample used in this research was 35 respondents. Sampling was carried out using a simple random sampling technique.

The independent variable in this research is the provision of nutritional counseling, while the

dependent variable in this research is the level of knowledge, attitude, and level of compliance with the consumption of Fe tablets. Data collection in this study was carried out through interviews and pre-post test questionnaires consisting of 20 statements regarding anemia and the importance of consuming Fe tablets for the level of knowledge and 28 statements regarding consuming Fe tablets for attitudes. The level of compliance was taken using the calculation method using the pill count formula and the use of a checklist instrument in the KIA book containing a table of Fe tablet consumption schedules. The level of knowledge was scored using the Guttman scale. If the answer is correct, the score is 1. If it is incorrect, the score is 0. The total score obtained was divided by the number of questions, then multiplied by 100 to obtain a result in the form of a percent value. The knowledge category can be said to be good if the respondents can answer 15-20 statements correctly. It is considered sufficient if they answer 8-14 statements correctly, and considered poor if they answer 0-7 statements correctly. Attitude scoring was done using a Likert scale with five answer categories. The score of positive statements (favorable) with the answer "Strongly Agree" is 5, "Agree" is 4, "Undecided" is 3, "Disagree" is 2, and "Strongly Disagree" is 1. The score for negative statements (unfavorable) with the answers "Strongly Agree" is 1, "Agree" is 2, "Undecided" is 3, "Disagree" is 4, and "Strongly Disagree" is 5. Attitude can be said to be positive if the respondents' T > T mean. It can be considered as a negative attitude if the respondents' T < T mean. Compliance level scoring was obtained using the pill count calculation formula, where the number of Fe tablets consumed was divided by the number of Fe tablets received, then multiplied by 100%. Consumption of Fe tablets can be said to be compliant if the percentage is 100% in one month, if <100% then it is said to be non-compliant.

The steps for conducting nutritional counseling are as follows: 1) Greeting and doing a self-introduction to the respondents; 2) explaining the purpose and benefits of nutritional counseling; 3) asking about the respondents' availability; 4) conveying the technical counseling which is carried out for 15-20 minutes; 5) explaining the material counseling using leaflets regarding the meaning of anemia, characteristics of anemia, causes of anemia during pregnancy, the impact of anemia, steps to prevent anemia, the meaning of Fe tablets, the importance of consuming Fe tablets during pregnancy, the ways to consume Fe tablets, kinds of food consumption to limit and avoid during pregnancy; 6) conducting a question and answer session with respondents regarding the respondents' eating habits, respondent complaints (reasons for non-compliance), how the respondent consumes Fe tablets, and repeating questions regarding counseling material; 7) expressing gratitude for the respondents' availability in attending counseling sessions.

In this study, univariate analysis consisted of maternal age, gestational age, educational background, employment, maternal anemia status, knowledge, attitudes, and compliance of pregnant mothers in consuming Fe tablets in the form of a frequency and percentage distribution table for each variable in the SPSS program. Analysis of the influence and differences in levels of knowledge, attitudes, and compliance to consuming Fe tablets at the beginning and the end using the Wilcoxon Signed Rank Test. Analysis of the relationship between variables used the Spearman Correlation Test. This research has received approval from the Health Research Ethics Commission (KEPK) Faculty of Medicine, Muhammadiyah University of Surakarta with ethical clearance No. 4744/B.1/KEPK-FKUMS/I/2023.

RESULTS AND DISCUSSION

Table 1 shows a description of the characteristics of the respondents. Regarding maternal age, the majority of respondents experienced pregnancy in the early adulthood category, namely 26-35 years (48.60%), 22 respondents (62.90%) were in the second trimester of their pregnancy, and 13 respondents (37.10%) were in the third trimester of their pregnancy. The majority of respondents had their highest education at high school or vocational school level (74.30%), did not work or were housewives (68.60%), and had mild levels of anemia, namely Hb levels in the range of 10-10.9 g/dl (74.30%).

Table 2 shows that there were differences in the level of knowledge, attitudes, and compliance

Table 1. Distribution of Characteristics of Pregnant Women with Anemia

Characteristic	n	%
Maternal age		
Late adolescents	12	34.30
Early adulthood	17	48.60
Late adulthood	6	17.10
Total	**35**	**100.00**
Gestational age		
Second trimester	22	62.90
Third trimester	13	37.10
Total	**35**	**100.00**
Educational background		
Elementary education (Elementary school [SD], Junior high school [SMP] graduate)	8	22.90
High school (Senior high school [SMA], Vocational high school [SMK])	26	74.30
Tertiary education (S1)	1	2.90
Total	**35**	**100.00**
Employment		
Housewives	24	68.60
Labor	3	8.60
Private employees	5	14.30
Self-employed	3	8.60
Total	**35**	**100.00**
Anemia status		
Mild anemia	26	74.30
Moderate anemia	7	20.00
Severe anemia	2	5.70
Total	**35**	**100.00**

Table 2. Description of Level of Knowledge, Attitudes, and Compliance with Fe Tablet Consumption

Variables	Nutritional counseling				Improvement levels (%)
	Before		After		
	n	%	n	%	
Level of Knowledge					
Good	19	54.30	29	82.90	28.60
Sufficient	15	42.90	6	17.10	
Poor	1	2.90	0	0.00	
Total	35	100	35	100	
Attitudes					
Positive	21	60.00	27	77.10	17.10
Negative	14	40.00	8	22.90	
Total	35	100	35	100	
Compliance					
Compliant	22	62.90	30	85.70	22.80
Non-compliant	13	37.10	5	14.30	
Total	35	100	35	100	

with the consumption of Fe tablets before and after the administration of nutritional counseling, with a significant percentage increase in the level of good knowledge of 28.60%; positive attitude of 17.10%; and compliance with Fe tablet consumption was 22.80%.

Table 3 indicates that the average results of correct answers chosen by respondents before the administration of nutritional counseling on indicators regarding anemia were <80%, while on indicators regarding consumption of Fe tablets >80%. After nutritional counseling administration, respondents experienced an increase in each indicator, where each indicator had an average of > 80%.

Table 4 shows that before the nutritional counseling process, the average respondents' answers, if rounded, had a score of 4 on the indicator of the importance of consuming Fe tablets and the side effects of consuming Fe tablets. The average respondents' answers on the indicator of how to consume Fe tablets and compliance with consuming Fe tablets if rounded had a score of 3. After the nutritional counseling process, the average respondents' answers to each indicator, if rounded, had a score of 4.

Table 5 shows the results of the bivariate analysis describing that $p < 0.05$ at the level of knowledge ($p = 0.001$); attitude ($p = 0.001$); and compliance with Fe tablet consumption (0.002), where these results indicated that there was an influence of providing counseling on the level of knowledge, attitudes, and compliance with Fe tablet consumption.

Table 6 shows that 23 respondents (65.72%) who had a good level of knowledge tended to have a positive attitude, while 6 other respondents (17.14%) had a negative attitude. A total of 4 respondents (11.43%) who had a sufficient level of knowledge also had a positive attitude, while the other 2 respondents (5.71%) had a negative attitude. Based on the results of the correlation analysis, the result was $p = 0.516$, meaning that the level of knowledge had no relationship or connection with the mothers' attitudes because $p > 0.05$.

Table 7 portrays that 25 respondents (71.43%) who had a good level of knowledge tended to be compliant in consuming Fe tablets during pregnancy, while 4 other respondents (11.43%)

were not compliant in consuming Fe tablets. A total of 5 respondents (14.28%) who had a sufficient level of knowledge were also compliant in consuming Fe tablets, while 1 other respondent (2.86%) was not compliant in consuming Fe tablets. Based on the results of the correlation analysis, the result was p = 0.860, meaning that the level of knowledge had no relationship or connection with the level of compliance because p > 0.05.

Table 8 illustrates that 27 respondents (80.00%) who had a positive attitude tended to be compliant in consuming Fe tablets, 3 respondents (8.57%) who had a negative attitude were also compliant in consuming Fe tablets, and 5 other respondents (14.29%) were not compliant in consuming Fe tablets. Based on the results of the correlation analysis, the result was p = 0.001, meaning that the mothers' attitudes had a significant relationship or relationship with the mothers' level of compliance because p < 0.05.

Characteristics of Pregnant Women

Regarding maternal age, the majority of respondents experienced pregnancy in the early adulthood category, namely 26-35 years (48.60%), where at this age a woman's reproductive organs can be said to be mature and physically and mentally ready to conceive (Ministry of Health of the Republic of Indonesia, 2014). However, several respondents experienced pregnancies < 20 years, where if a woman is pregnant at < 20 years, the reproductive organs in her body are still in the period of development and maturation of the reproductive system, so at this age, they tend to still need more nutritional supplies compared to pregnant women aged > 20 years. Apart from that, several respondents also experienced pregnancies > 35 years, where at this age the body's immune system tends to decrease and start to enter a degenerative period so that there is a greater risk of experiencing health problems during pregnancy, one of which is anemia (Rahmaniah & Linda, 2019).

Based on the characteristics of gestational age, 22 respondents (62.90%) were in the second trimester of their pregnancy, and 13 respondents (37.10%) were in the third trimester of their pregnancy. During pregnancy, blood thinning reaches its maximum limit in the second and

Table 3. Percentage of Respondents' Correct Answers to the Questionnaire of Knowledge

Indicators	Question number	Levels of knowledge				Increase levels (%)
		Before		After		
		Mean Item (%)	Mean Total (%)	Mean Item (%)	Mean Total (%)	
Side effects of consuming Fe tablets	13	37.14	38.57	77.14	78.57	40.00
	20	40.00		80.00		
Causes of anemia	6	45.71	62.85	80.00	87.40	24.55
	16	80.00		94.28		
Ways of preventing anemia	7	80.00	64.28	85.71	85.71	21.43
	12	48.57		85.71		
Definition of anemia	17	68.57	68.57	85.71	85.71	17.14
Symptoms of anemia in pregnant women	9	57.14	54.28	65.71	71.42	17.14
	14	51.42		77.14		
Impact of anemia during pregnancy	10	91.42	71.42	91.42	85.71	14.29
	18	51.42		80.00		
The importance of consuming Fe tablets	2	85.71	87.14	100.00	100.00	12.86
	3	88.57		100.00		
Ways of consuming Fe tablets	4	77.14	81.90	94.28	91.42	9.52
	5	80.00		85.71		
Definition of Fe tablets	8	88.57	95.71	94.28	98.57	2.86
Administration of Fe tablets	11	88.57	84.28	80.00	85.71	1.43
	15	80.00		91.42		

Table 4. Results of Respondents' Answers to the Questionnaire of Attitudes

Indicators	Question number	Attitudes			
		Before		After	
		Mean Item	Mean Total	Mean Item	Mean Total
Ways of consuming Fe tablets	8	3.60	3.42	4.29	4.03
	11	3.57		3.94	
	13	3.91		4.20	
	18	2.43		3.74	
	15	3.71		4.00	
	22	3.31		4.03	
The importance of consuming Fe tablets	4	3.94	3.74	4.43	4.22
	14	4.20		4.34	
	19	4.17		4.46	
	6	3.34		4.11	
	23	3.54		4.06	
	25	3.30		3.94	
Side effects of consuming Fe tablets	5	3.94	3.60	4.46	3.85
	24	3.80		3.97	
	7	3.69		3.86	
	12	3.14		3.57	
	21	3.43		3.74	
Compliance with Fe tablet consumption	1	3.77	3.40	4.29	3.90
	16	3.63		3.94	
	20	2.17		3.80	
	26	3.60		4.14	
	2	3.71		4.00	
	3	3.51		3.91	
	9	3.40		4.11	
	10	3.54		3.86	
	17	3.31		3.80	

Table 5. Differences in Levels of Knowledge, Attitudes, and Compliance with Fe Tablet Consumption before and after Nutrition Counseling

Variables	Minimum	Maximum	Mean ± SD	p-value
Level of knowledge				
Before (%)	5.00	19.00	14.31 ± 3.47	0.001*
After (%)	14.00	20.00	17.46 ± 1.82	
Level of Attitudes				
Before	15.76	64.10	50.00 ± 10.00	0.001*
After	31.87	65.69	50.00 ± 10.00	
Level of compliance				
Before (%)	10.00	100.00	75.92 ± 35.07	0.002*
After (%)	16.67	100.00	91.68 ± 21.86	

Notes: *Wilcoxon signed rank test

Table 6. Attitudes of Pregnant Women with Anemia Based on Level of Knowledge After Nutrition Counseling

Level of knowledge	Attitudes				Total		p-value
	Positive		Negative				
	n	%	n	%	n	%	
Good	23	65.72	6	17.14	**29**	**82.86**	
Sufficient	4	11.43	2	5.71	**6**	**17.14**	0.516*
Total	**27**	**77.15**	**8**	**22.85**	**35**	**100.00**	

Description: *Spearman Correlation

Table 7. Compliance Level of Pregnant Women with Anemia Based on Level of Knowledge After Nutrition Counseling

Level of knowledge	Level of Attitudes				Total		*p-value*
	Compliant		Non-Compliant				
	n	%	n	%	n	%	
Good	25	71.43	4	11.43	**29**	**82.86**	
Sufficient	5	14.28	1	2.86	**6**	**17.14**	0.860*
Total	**30**	**85.71**	**5**	**14.29**	**35**	100.00	

Description: *Spearman Correlation

Table 8. Compliance Level of Pregnant Women with Anemia Based on Mothers' Attitude After Nutrition Counseling

Attitudes	Level of compliance				Total		*p-value*
	Compliant		Non-Compliant				
	n	%	n	%	n	%	
Positive	27	80.00	0	0.00	**27**	**80.00**	
Negative	3	8.57	5	14.29	**8**	**20.00**	0.001*
Total	**30**	**85.71**	**5**	**14.29**	**35**	**100.00**	

Description: *Spearman Correlation

third trimesters or 5-8 months. As the mothers' gestational age increases, the risk of suffering from anemia becomes higher if it is not balanced with a balanced diet and regular consumption of Fe tablets (Herawati & Rusmiati, 2018).

Based on the characteristics of maternal education, the majority of respondents in this study had their final education at the high school or vocational school level (74.30%). Education, most of which is high school, influences the mothers' understanding and analytical power in receiving information (Fitrianingsih, et al, 2019). The higher individuals' education level, the more open their mindset can be in accepting new information so that it can have an impact on positive behavior toward fulfilling nutrition during pregnancy (Herawati & Rusmiati, 2018).

Based on the characteristics of mothers' employment, the majority of respondents were unemployed or housewives (68.60%). Employment is a factor related to economic status and income. Pregnant women who do not work are at risk of experiencing anemia because they tend to have low incomes so they are less able to buy food that contains enough iron, while pregnant women who work tend to have better incomes so they can improve their health status, such as by consuming nutritious food more often and visiting health facilities during pregnancy (Aminin & Dewi, 2020). Families with low incomes also tend to influence mothers to disobey the consumption of Fe tablets compared to families with higher incomes (Agegnehu et al., 2019).

Based on the characteristics of the anemia status of pregnant women, the majority of respondents experienced mild anemia, namely Hb levels in the range of 10-10.9 g/dl (74.30%). Anemia during pregnancy has several impacts,

such as increasing the risk of maternal and child death, the emergence of infectious diseases, premature birth, abortion (miscarriage), and can affect the growth and development of the fetus, both while it is still in the womb and after it is born (Ministry of Health of the Republic of Indonesia, 2021).

Description of Knowledge, Attitudes, and Compliance of Pregnant Women

Differences exist in the level of knowledge, attitudes, and compliance with the consumption of Fe tablets between before and after nutritional counseling, with a significant percentage increase in the level of good knowledge of 28.60%; positive attitude of 17.10%; and compliance with Fe tablet consumption was 22.80%.

Based on the results of interviews before the nutritional counseling, 17.14% of respondents reasoned that they did not consume Fe tablets because they felt they had routinely consumed vitamins or supplements given by obstetricians and therefore they ignored the Fe tablets given by the community health center. This happened because respondents had the perception that the vitamins or supplements given by obstetricians were considered better than the Fe tablets given by the community health center. One capsule of the *folamil genio* type supplement consumed by several respondents contained 1 mg of folic acid; beta-carotene 10,000 IU; vitamin B1 3 mg; vitamin B2 3.4 mg; nicotinamide 20 mg; vitamin B6 2 mg; Ca pantothenate 7.5 mg; Ca carbonate 100 mg; vitamin B12 4 mcg; vitamin D3 400 IU; vitamin K1 50 mcg; biotin 30 mcg; copper gluconate 0.1 mg; Fe polymaltose complex (IPC) 30 mg; DHA from algae 40 mg; and 8 mg arachidonic acid, while the Fe tablets given by the community health center only contain iron (ferrous fumarate which is equivalent to 60 mg elemental iron) and 0.4 mg folic acid (Ministry of Health of the Republic of Indonesia, 2021). Apart from that, 14.28% of respondents who worked said they did not regularly consume Fe tablets because they felt tired and sleepy at night so they forgot to take Fe tablets. Another 5.71% of respondents complained of side effects in the form of nausea when consuming Fe tablets, so they rarely consumed Fe tablets. Based on the results of interviews after the nutritional counseling, 14.28% of respondents who were still disobedient said they experienced nausea that led to vomiting so respondents did not want to force themselves to consume the Fe tablets based on the dose recommended by health workers.

The availability of a checklist filled in on the Fe tablet consumption schedule in the KIA book for pregnant women can also help them to take Fe tablets so that it can help increase compliance. This is also supported by research conducted by Hadiyani and Yunidha (2019), showing that after observations were made in the form of providing a checklist sheet for the Fe tablet consumption schedule which had to be filled out every day, 71% of respondents became compliant in consuming Fe tablets.

The average results of correct answers chosen by respondents on the questionnaire of knowledge before the nutritional counseling on indicators regarding anemia were <80%, while on indicators regarding consumption of Fe tablets >80%. This indicated that the majority of respondents had received fairly good information about the importance of consuming Fe tablets during pregnancy, but still lacked information about anemia during pregnancy. After the nutritional counseling process, respondents experienced an increase in each indicator, where each indicator had an average of > 80%. This showed that through nutritional counseling, respondents could find out more information about anemia and the importance of consuming Fe tablets during pregnancy.

An increase in knowledge can also be influenced by educational factors. Most of the respondents had their final education at the high school or vocational school level. Education, most of which is high school, can influence the mothers' understanding and analytical power in receiving information (Fitrianingsih, et al, 2019). Education is a factor that influences maternal knowledge to know and understand appropriate nutritional intake to meet the needs of the mother and fetus (Savadogo et al, 2014). The higher individuals' education level, the more open their mindset can be in accepting new information so that it can have an impact on positive behavior toward fulfilling nutrition during pregnancy (Herawati & Rusmiati, 2018).

In the questionnaire of attitude, before the nutritional counseling process, the average respondents' answers, if rounded, had a score of 4 on the indicators of the importance of consuming Fe tablets and the side effects of consuming Fe tablets, showing that the majority of respondents already had a fairly positive attitude regarding the importance of consuming Fe tablets. However, some respondents are still not compliant enough in consuming Fe tablets, where the average respondents' answers to the indicator of how to consume Fe tablets and compliance with Fe tablet consumption, if rounded, had a score of 3. After the nutritional counseling, the average respondents' answers to each indicator, if rounded, had a score of 4. This showed that there was a positive increase in the respondents' attitudes, where the respondents could accept any information provided well during nutritional counseling so that it had an impact on their attitudes of being obedient in consuming Fe tablets.

By attending nutritional counseling sessions, pregnant women become more familiar with the causes of problems and understand the nutritional needs required during pregnancy, the impact of anemia during pregnancy, and the potential to overcome their health problems. If they feel that the behavior is not appropriate, then the mothers are moved to be selective in choosing better behavior, which can have an impact on increasing their attitudes toward consuming Fe tablets (Khairia, 2017).

Differences in Levels of Knowledge, Attitudes, and Compliance Before Fe Tablet Consumption and After Nutrition Counseling

Based on the results of bivariate analysis, the results obtained were $p < 0.05$ at the level of knowledge ($p = 0.001$); attitude ($p = 0.001$); and compliance with Fe tablet consumption (0.002), where these results indicated that there was an influence of providing counseling on the level of knowledge, attitudes and compliance with Fe tablet consumption. These results were in line with research results conducted by Khairia (2017) showing the influence of nutritional counseling on pregnant women's knowledge ($p = 0.000$) and mothers' attitudes ($p = 0.000$). This is also in line with research conducted by Yanti et al. (2018), showing the influence of nutritional counseling on pregnant women's knowledge ($p = 0.028$) and mothers' attitudes ($p = 0.001$). Research from Kamau et al (2019), stated that during the research the attitude of pregnant women in the intervention group toward consuming iron-folic acid (IFAS) resulted in an overall positive change in attitudes. Research by Djati et al. (2017) also showed the influence of counseling on compliance with blood supplement tablet consumption ($p = 0.002$). This is also supported by research by Purbowati (2016), where there was an effect of providing nutritional counseling on compliance with iron tablet consumption in the treatment group ($p = 0.001$). Research by Berhane & Belachew (2022) also stated that providing education through counseling is effective in increasing compliance in consuming iron-folic acid supplements (IFAS) with a percentage increase of 42.6% in the intervention group. Providing education through counseling is effective in increasing the knowledge of pregnant women, encouraging a diet rich in iron, and increasing consumption of IFA (iron folic-acid) tablets or Fe tablets (Nahrisah et al, 2020).

Based on the results of the analysis of respondents' attitudes, it shows that there was an improvement in respondents' attitudes after the nutritional counseling. In both before and after the nutritional counseling, the majority of respondents had positive attitudes (T score > 50). Respondents were able to accept any information provided well, both by health workers before nutritional counseling, and by researchers during nutritional counseling. This was because health workers were good enough at providing information about how to consume Fe tablets and the reasons for the importance of consuming Fe tablets during pregnancy. In addition, most respondents were currently pregnant with their second child, so they already had experience with previous pregnancies. According to Azwar (2013), something that an individual has experienced and is currently experiencing plays a role in forming attitudes and influencing appreciation of social stimuli.

Counseling can be a strategy for changing social behavior and communication by influencing actions that can be observed and measured to improve health status (Juma et al, 2015). An increase in understanding and knowledge

can certainly have an impact on changes in consumption patterns of foods that are nutritious and contain high Fe, as well as being more compliant in consuming Fe tablets. Through counseling, pregnant women can change their attitudes and behavior to improve their nutritional status (Bara et al, 2015). Counseling can strengthen the women's motivation which is expected to increase compliance in consuming Fe tablets (Djati et al, 2017). If the mothers understand the importance of consuming Fe tablets well, then they tend to try to improve themselves to comply with consuming Fe tablets regularly (Khairia, 2017).

Correlation between Knowledge, Attitudes, and Compliance After Nutrition Counseling

Based on the results of the correlation analysis of the mothers' attitudes based on the level of knowledge after nutritional counseling, the result was $p = 0.516$, meaning that the level of knowledge had no relationship or connection with the mothers' attitudes because $p > 0.05$. This could happen because the majority of respondents already had fairly good knowledge regarding information about the importance of consuming Fe tablets during pregnancy, but still lacked information about anemia during pregnancy before attending nutritional counseling. Apart from that, most of the respondents were also experiencing their second pregnancy, so respondents had more experience with previous pregnancies. According to Azwar (2013), something that an individual has experienced and is currently experiencing plays a role in forming attitudes and influencing appreciation of social stimuli.

Based on the results of the correlation analysis of the mothers' level of compliance based on the level of knowledge after nutritional counseling, the result was $p = 0.860$, meaning that the level of knowledge had no relationship or connection with the level of compliance because $p > 0.05$. This is in line with research conducted by Purwati and Dayani (2022). The research showed that there was no significant relationship between knowledge and compliance with consuming blood supplement tablets ($p = 0.2008$). These results are also supported by research conducted by Adnyana et al. (2020) revealing that respondents who had good knowledge still had a low level of compliance in consuming blood supplement tablets.

Based on the results of the correlation analysis of the level of compliance based on the mothers' attitude after nutritional counseling, the result was $p = 0.001$, meaning that the mothers' attitude had a significant relationship or relationship with the mothers' level of compliance because $p < 0.05$. This showed that a good understanding and self-awareness regarding the importance of consuming Fe tablets during pregnancy can have an impact on the mothers' attitudes in taking action to comply with consuming Fe tablets. The implementation of health behavior was influenced by a positive attitude to prevent anemia during pregnancy, one of which was obediently consuming Fe tablets. According to Notoatmodjo (2014), attitude is one of the factors that can influence health behavior. This is in line with research conducted by Utari and Rahmad (2022) revealing that there was a relationship between attitude and compliance with the consumption of Fe tablets in pregnant women with a result of $p = 0.018$. This is also supported by the health belief model theory put forward by Strecher & Rosenstock (1997), where the presence of good or bad perceptions originating from knowledge, experience, or information can provide confidence which stimulates individuals to do something, in this case, being obedient to consuming Fe tablets.

CONCLUSION

There was a percentage increase in the level of knowledge after the administration of nutritional counseling (28.60%); attitude (17.10%); and compliance with Fe tablet consumption (22.80%). There is an effect of providing nutritional counseling on the level of knowledge ($p = 0.001$); attitude ($p = 0.001$); and compliance with Fe tablet consumption ($p = 0.002$). Health workers at the Grogol Community Health Center are suggested to conduct nutritional counseling for every pregnant woman who experiences anemia even though the pregnant woman's Hb level is in the mild anemia category so that anemia during pregnancy can be treated early when the Hb is checked in the first trimester of pregnancy.

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ENHANCING ADOLESCENT GIRLS ANEMIA PREVENTION KNOWLEDGE AND ATTITUDES THROUGH NUTRITIONAL CONSULTATIONS

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ABSTRACT

Anemia is a public health problem in Indonesia that can affect all age groups, from toddlers to the elderly, and primarily affects adolescents. One way to prevent anemia among them is by increasing knowledge and attitudes through nutritional consultation to achieve promotive and preventive efforts. In 2018, anemia in women was higher (27.2%) than in men (20.3%). This study aimed to determine the effect of nutritional consultations on the knowledge and attitudes of young women in preventing anemia in Bengkulu City. A quasi-experimental study with a non-randomized control group design, pre-test, and post-test design was conducted from October to November 2021 at SMP N 8 Bengkulu City. The intervention group subjects are 30 respondents, and at control group are 30 respondents; all were purposively selected. A paired T-test was used to analyse the effect of the intervention. The results showed a significant difference in the pre-test and post-test knowledge in the treatment group (p=0.002). At the same time, there was no significant difference between the pre-test and post-test knowledge of the control group (p=0.095). In comparison, the mean attitude before treatment did not differ between groups (p=0.048); each group showed differences after treatment. Intervention and control groups influence knowledge and attitudes before and after treatment (p=0.013).

Keywords: anemia, knowledge, attitude, young women

INTRODUCTION

Anemia is one of the health problems in Indonesia that can occur in groups of toddlers to elderly. Adolescence is at risk of anemia due to menstruation, so there is a lot of blood loss, and puberty is at risk of iron deficiency anemia. Besides menstrual factors, iron intake is essential in accelerating growth and development (Ministry of Health Republic Indonesia, 2018). Anemia generally occurs worldwide, especially in developing countries. It affects 13% of women and 45% in developed countries among women aged 15-49 year (Department of Nutrition and Public Health, 2014). Whereas in Asia, the prevalence of anemia among adolescent girls reached 191 million people aged 10-19 years, the prevalence of anemia was 7.5 million. Indonesia is positioned in the 8th out of 11 countries. Iron deficiency anemia among pregnant women in Indonesia is 50.5%; among postpartum women is 45.1%; among adolescent girls aged 10-18 years is 57.1%; and among women aged 19-45 years, 39.5% (Indonesian Ministry of Health, 2012). The results of Riskesdas showed that anemia in women was 27.2% and in men was 20.3%; based on these data, anemia in women was higher than in men aged 15-24 years by 32% (Indonesian Ministry of Health, 2018).

Adolescence is a transition from childhood to adulthood; during this period of growth and development, physiological, psychological, and social changes occur. Nutritional fulfilment in adolescents must be higher because adolescents need adequate nutrition to fulfil their needs (Almatsier, et al. 2011). Increased physiological needs because adolescents are experiencing a period of growth can also be one of the causes of iron deficiency anemia. Iron deficiency or anemia is mainly caused by insufficient nutritional intake; irregular food consumption patterns influence the lack of iron nutrient intake. In addition, iron deficiency in adolescent girls can also be caused by menstruation and infectious diseases. (Ely, Laksono, Dyah, 2017). Studies found that as many as 63.4% of adolescents experienced anemia caused by low knowledge, which is a dominant factor in adolescent girls. Knowledge of foods high in iron is also still low (Sintha, 2019). Knowledge of anemia is still low in adolescents,

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which will cause them not to care about their daily food intake.

One way to increase nutrition knowledge is through nutrition education and nutrition consultations. Information is provided in the form of nutritional consultation to prevent anemia. Avoiding anemia in adolescent girls can be done by increasing knowledge and attitudes through nutrition consultation so that promotive and preventive efforts can be achieved. Education in the form of consultation is an approach used to help individuals gain better knowledge (PERSAGI PAGI, 2013). Nutrition education is critical for adolescent girls to create awareness and disseminate knowledge about anemia control and prevention (Priyanka & Asfia, 2015). Individuals who have better nutritional knowledge have attitudes toward eating healthier foods (Heaney, et al. 2011)

Effective and efficient media can be used to support nutrition counselling so the target will receive that information. The media can be mobile devices or mobile phones because one of the most widely accessed media in adolescents is the primary way to get digital information quickly and can reach many targets that are not limited to space and time. Social media can be used as an Android-based mobile phone application. The use of smartphones is increasingly growing among teenagers, causing various changes in their attitudes and behaviour so that they can quickly get information (Firmansyah et al., 2019).

Teenagers are the age group that uses the internet the most to fulfil their information needs. 91% of the population aged 15-19 use the internet, and the main reason someone uses the internet is to communicate (Gabrielli, et al. 2017). Based on Faza research at SMAN 2 Padang, nutrition education provided to adolescent girls using Instagram and WhatsApp can increase respondents knowledge about balanced nutrition. This is because the information on Instagram is more effective. After all, it is accompanied by images and videos that can support information delivery (Rusdi, et al. 2021). The purpose of this study was to find out whether nutrition consultation can improve the knowledge and attitudes of adolescent girls in anemia prevention in Bengkulu City.

METHODS

This research uses a quasi-experimental study with a non-randomized control group pre-test, post-test, and pre-test design. Study conducted in October - November 2021 at SMPN 8 Bengkulu City. At the beginning of the study, the two groups were given pre-test questions of knowledge and attitudes. After that, the treatment group was given nutritional consultation about anemia using self-designed Android application media, and the control group was not given nutrition consultation. However, respondents read their Android application media in the PlayStore. After three weeks, both groups were given post-test questions about nutritional anemia. The study subjects were 30 intervention group respondents and 30 control group respondents, using a purposive sampling technique with inclusion criteria included adolescent girls, coming at the time of nutrition consultation. Meanwhile the exclusion criteria were respondents sick during the study. Primary data was collected through interviews using knowledge and attitude questionnaires.

The univariate analysis describes the characteristics of each research variable; this analysis only produces the distribution and percentage of each variable. The variables to be analysed are knowledge and attitude. Bivariate analysis is carried out on two variables suspected to be related; the data obtained is then processed, analysed, and presented as a table. First, the normality test is carried out on the results of the pretest-posttest behaviour in the treatment group using the Kolmogorov-Smirnov test. Differences in knowledge and attitudes before and after nutrition consultation in each group using the Paired T-test statistical test of normally distributed data, but for data that is not normally distributed using the Wilcoxon Signed Ranks Test. Differences in knowledge and attitudes between the treatment and control groups using the independent sample t-test statistical test of customarily distributed data, including expertise and perspectives. Non-normally distributed data used the Mann Whitney Test statistical test (12).

RESULTS AND DISCUSSION

Respondent Characteristics

The frequency distribution of respondents based on age 12-13 years mainly was 49.1% in the treatment group and 50.9% in the control group. For the education level of the father and mother, most of the high school/tertiary level is more than 50% of the treatment and control groups. While father occupation in the treatment group was 47.2% and the control group was 54.1% more private, the mother occupation mainly was housewives in the treatment group 49.0% and the control group 51.0%.

Based on the results of statistical tests obtained p>0.05, it can be concluded that there is no difference between the treatment group and the control group; there is homogeneity in the variables of respondents' age, education, and occupation.

Description Level of knowledge and attitudes

Table 2 shows that the average knowledge of treated respondents was 56.9, with a standard

Table 1. Characteristics of Respondents in the Treatment Group and Control Group

Characteristics Respondents	Treatment		Control		p
	f	%	f	%	
Age of respondent					
12- 13 Years	27	49.1	28	50.9	0.640
14-15 Years	3	60.0	2	40.0	
Father education					
High (high school, university)	19	51.4	18	48.6	0.791
Low (SD, SMP)	11	47.8	12	52.2	
Mother education					
High (high school, university)	13	56.5	10	43.5	0.426
Low (SD, SMP)	17	45.9	20	54.1	
Father occupation					
Civil servant	5	71.4	2	28.6	0.228
Private worker	25	47.2	28	52.8	
Mother occupation					
Not working	24	49.0	25	51.0	0.739
Working	6	54.5	5	45.5	

Table 2. Description of knowledge and attitude levels before treatment in each group

Variables	Group						
	Treatment			Control			
	Before Treatment			Before Treatment			
	Min	Max	Mean ± SD	Min	Max	Mean ± SD	p
Knowledge	20	80	56,9 ± 18,5	10	80	51,0 ± 18,6	0,219[e]
Attitude	4	46	35,6 ± 8,21	28	44	37,4 ± 4,0	0,048[e]

e = Independent T – test

Table 3. Description of knowledge level and attitude after treatment of each group

Variables	Group						
	Treatment			Control			
	After Treatment			After Treatment			
	Min	Max	Mean ± SD	Min	Max	Mean ± SD	p
Knowledge	30	90	71.5[a] ± 18.3	10	80	53.5[a] ± 17.4	0.001[e]
Attitude	4	48	39.2[b] ± 7.5	28	43	37.0[b] ± 4.1	0.080[f]

a = Mean ± Standard Deviation b = Median ± Standard Deviation
e = Independent T-test f= Mann-Whitney

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deviation of 18.5, while the control group had an intermediate knowledge level of 51.0, with a standard deviation of 18.6. The moderate attitude of the treated had a 35.6 standard deviation of 8.21, and the perspective of the control group was 37.4, with a standard deviation of 4.0.

The statistical test results obtained the values of knowledge (p=0.219) and mood (p=0.048), meaning that both the group treated with the modified media Android application and the control group had the same understanding before the study (p>0.05). Based on the results of statistical tests on the level of knowledge and attitudes towards anemia after treatment, the mean score of understanding between the treatment group and the control group was different, as shown in Table 3.

The average knowledge of the treatment and control groups had different scores, higher in the treatment group, 71.5 with a standard deviation of 18.3, while the control group's knowledge score was 53.5 with a standard deviation of 17.4. The post-test attitude between the treatment group and the control group can be seen from the average value; the post-test philosophy in the treatment group is 39.2 with a standard deviation of 7.5, and the control group attitude value is 37.0 with a standard deviation of 4.1. The difference test results obtained the values of knowledge (p=0.219) and attitude (p=0.048) after the post-test between the treatment group and the control group. A knowledge p-value of 0.001 and an attitude of p-value 0.080 mean a significant difference in the level of knowledge after being consulted.

Differences in Knowledge and Attitudes Before and After in the Treatment Group and Control Group

Table 4 shows the difference in knowledge and attitude scores in the treatment and control groups before and after treatment. The results of the difference test showed that the average knowledge before treatment was 50.0, with a standard deviation of 18.5; in the measurement after treatment, the average ability was 64.6, with a standard deviation of 18.3, while the moderate attitude in the treatment group was 32.5, with a standard deviation of 8.2. The attitude obtained in the first post-test measurement was 36.4, with a standard deviation 7.5.

The results of the statistical test of knowledge (p=0.002) and attitude (p=0.001) obtained a value of p<0.05; it can be concluded that there is a significant difference in ability and philosophy before and after treatment in the treatment group.

The difference in knowledge and attitude scores of the control group was only assessed once. The average pre-test knowledge result in the control group was 44.0 with a standard deviation of 18.8; in the post-test measurement, the intermediate ability was 47.0 with a standard deviation 17.4. The attitude of the control group showed the average pre-test was 35.9 with a standard deviation of 4.0; in the post-test measurement, the moderate attitude was 35.3 with a standard deviation of 4.1. The results of the difference test Knowledge (p=0.0095) and Attitude (p=0.581) show no significant difference between the pre-test and post-test knowledge and attitude.

Change in Score (Knowledge, Attitude, and Practice) in Both Groups

The assessment of changes in knowledge and attitude scores in both groups can be seen in Table 5. The statistical test results showed that the increase in knowledge score for the treatment group was 16.0 with standard deviation of 20.7, while for the control group, the change in

Table 4. Differences in Knowledge and Attitude Scores Before and After Training for Treatment Group and Control Group

Variables	Group					
	Treatment			Control		
	Before treatment	After treatment	p	Before treatment	After treatment	p
	Average	Average		Average	Average	
Knowledge	50.0[a] + 18.5	64.6[a] + 18.3	0,002[c]	44.0[a] + 18.8	47.0[a] + 17.4	0,095[c]
Attitude	32.5[b] + 8.2	36.4[b] + 7.5	0,001[c]	35.9[a] + 4.03	35.3[a] + 4.1	0,581[c]

a = mean + Standar Deviasi
e = Independent T – test
f= Mann-Whitney
b = Median + Standar Deviasi

Table 5. Changes in Knowledge Score, Attitude of Treatment Group and Control Group

Variables and Groups	n	Average	SD	p
Knowledge				
Treatment	30	16.0	20.7	0.138f
Control	30	8.6	16.7	
Attitude				
Treatment	30	14.6	23.0	0.013f
Control	30	3.03	9.5	

f= Mann-Whitney

knowledge score was 8.6 with standard deviation of 16.7. Likewise, the attitude results in the treatment group were 14 with standard deviation of 23.0; the control group increased the attitude score by 3.03 with standard deviation of 9.5. As for the practice of the treatment group, it showed 3.80 with standard deviation of 1.835; for the control group, the median of change in practice score was 2.00 with a standard deviation of 2.334.

The results of the difference test on knowledge ($p = 0.138$) and attitude ($p = 0.013$) show a non-significant change in the knowledge and attitude scores. There is a significant change between the treatment group and the control group. Although there was no significant difference in knowledge between the two groups before and after treatment, the changes in the treatment group were more important than in the control group.

Knowledge Level

The study results showed a significant difference in pre-test and post-test knowledge in the treatment group. At the same time, there was no significant difference between the pre-test and post-test knowledge of the control group. The knowledge of adolescent girls before being given the intervention averaged 56.9 in the treatment group and 51.0 in the control group; after the intervention, the treatment group was 71.5, and the control group was 53.5. However, there are still schoolgirls whose knowledge still needs to be improved; the less understood material is the signs and symptoms of anemia 78%, the impact of anemia on adolescent girls 85%, and prevention of anemia 80%. After the intervention, there was an increase in knowledge of 16-8 points, significantly different between the treatment and control groups. The results of Putu (2018) showed that the level of knowledge before and after counselling was given to each group was the level of knowledge less than nine samples (81.8%), the good category was two samples (18.2%) and increased after the intervention was carried out, namely the good category as many as six samples (54.5%), while the control group knowledge level did not experience significant changes, namely the category less before nutritional counselling as many as four samples (40%), after the intervention, there were less than five samples (50%). This is because the intervention provided is in nutritional counselling, where pregnant women raise the problems faced intensively (Need, 2018).

The group that was given nutrition consultation using Android media increased significantly. The control group was assigned nutrition consultation without using Android media, and the increase in knowledge was still low. The treatment group showed a better knowledge of anemia incidence than the control. We know consultation is a structured process as a form of intervention on behaviour that aims to influence a person's knowledge to achieve efforts to increase nutritional knowledge, especially about the incidence of anemia. Knowledge is a process of finding out, from previously not knowing to knowing, through education consultation or experience (Notoatmodjo, 2007).

The results of this study align with Fertimah (2018), where the results show that the provision of audiovisual media and meditation applications has an effect in increasing knowledge about anemia and compliance with taking iron tablets for pregnant women. This is influenced by the increase in smartphone users, which is said to be a new type of media because it can access information quickly through internet facilities, one of which is smartphone-based media, namely Android applications. Likewise, Wilarsih (2022) states that there is an increase in the knowledge of premarital women before and after being given nutritional counselling. One of the efforts that can increase the knowledge and abilities of individuals or families about nutrition can be made through counselling. Counselling is a way to fulfil food to help individuals and families better understand. Research by Hestuningtyas (2014) also states that there are differences in knowledge before and after

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being given nutritional counselling, increasing the behaviour and knowledge of mothers regarding child feeding, making nutritional intake increase; this shows that nutritional counselling conducted once a week has proven to be quite effective in changing feeding. Sofiyana (2013) also stated that there was an increase in the knowledge of mothers of toddlers; before the nutritional counselling was done, mothers of toddlers had sufficient knowledge, and after being given counselling, mothers of toddlers had good knowledge, especially in terms of food forms and frequency of feeding.

Knowledge is the result of sensing a particular object. Sensing occurs through the five human senses, namely the senses of sight, hearing, smell, taste, and touch. Most human knowledge is acquired through the eyes and ears (Notoatmodjo S, 2007). In the knowledge difference test in the two groups, although there was a very significant difference, the change in the treatment group was much more critical than in the control group; the average answer increased in the post-test knowledge of respondents. According to expert research, the senses that channel the most knowledge into the brain are the eyes (approximately 75% to 87%), while the other 13% to 25% are conducted through other senses. Good knowledge will support behaviour in implementing nutrition, especially Fe intake; nutrition knowledge is essential and can influence individuals (Notoadmojo, 2014). According to Aini (2019), the adolescent phase is an essential period for shaping behaviour and changing mindsets, so they are crucial to influencing (education and health), both from direct education and information technology media, such as smartphones. Nowadays, information technology is developing rapidly. Many people are helped by various facilities produced by the seduction of technology. One of the developing technologies is Android-based smartphones. Because it provides convenience and benefits to its users, many practitioners and academics are developing its application (Kamel et al. 2014).

Innovations in Information Technology (IT) have brought about various changes and improvements in other fields, such as healthcare. Health Information Technology (HIT) apps or projects provide more data or comprehensive information on health-related topics. It provides on-the-go access to health-related information (Ceniza, Angie, 2020). According to Muhson (2010) and Sinta et al. (2019), Advances in science and technology significantly influence various fields of human life, such as education. Education is an inseparable part of the human maturation process, which undoubtedly contributes to the development of science and technology. However, education also needs to utilise advances in science and technology to achieve its goals effectively and efficiently. In the era of globalisation, technology is progressing, and there are many smartphone users, especially teenagers. People or teenagers find it easier to access information from these devices because they are easy to carry around and access at any time. So, researchers created a health education innovation based on the Android application studio (Muhson, 2010). Research conducted by Hendryani (2020). on the creation of Android mobile health applications to monitor and evaluate stunting, from the results of system testing, mobile health applications to monitor and assess stunting can work well.

The nutrition consultation process in the treatment group is information conveyed to participants through knowledge, skills, and experience. The process of nutrition consultation conducted in the treatment group is information conveyed to participants in the form of knowledge, skills, and experience (Alo, 2011), as well as explaining and explaining an idea, understanding, or message verbally to the target group who obtain information and knowledge obtained is a significant factor because respondents can apply the information received to prevent the incidence of anemia (Sudjana, 2000).

Nutrition consultation is one of the essential activities that respondents are willing and able to apply when consuming food ingredients containing iron. The results of measurements in the post-test treatment group after the nutrition consultation was carried out increased; this could be due to the treatment group using android media that has been developed not only given media but the question and answer method in this way (seeing, hearing) makes it easier for respondents to receive information. In contrast to the knowledge of the control group, respondents did not show too

much improvement. This was because, during the consultation, they only understood what they had experienced; the material obtained by the respondents was only sourced from experience and existing media, so they were less able to explore the respondents' knowledge and did not know what the respondents wanted.

Attitude

Attitude is a stage towards the process of behaviour change; with a positive change in attitude, it is expected that there will be a change in behaviour from the subject as expected. The mean attitude before treatment was no different, while each group showed a difference after treatment. These results align with research conducted by Fachruddin (2017), before being given an intervention, 72.9% of children knowledge level was good, 78.5% of attitudes were positive, and children with well-balanced nutrition practices were 54.9%. After being given the intervention, good knowledge, positive attitudes, and well-balanced nutrition practices increased by 11.8%, 5.5%, and 15.9%, respectively. Android-based nutrition education media is better than other media. Nutrition education interventions improve balanced nutrition behaviour. Likewise, Sofiyana and Noer (2013) states that there are differences before and after nutritional counselling, where there is an increase in knowledge and attitude changes after conducting nutritional counselling four times in 1 month during the intervention.

Rahmawati research (2017) states that providing health education through nutritional counselling can affect the improvement of respondents' attitudes regarding balanced nutrition in toddlers in preventing malnutrition. Based on Azzahra (2015), there was an increase in attitudes that were categorised as good before and after being given counselling in the treatment group about growth and feeding. Still, in the control group, there was no increase in attitudes before and after being given nutritional counselling using leaflet media. Likewise, Rizqi (2019) increased the attitude score of female students by being given nutrition education about anemia. There was an increase in scores of students who were not given nutrition education; this could be because students who received nutrition education get an additional picture of anemia nutrition that they previously did not know to know better. In addition, the language used in providing nutrition education is easy to understand, with messages conveyed briefly and clearly so that students who receive nutrition education understand more about anemia nutrition. According to WHO, attitude describes a person likes and dislikes towards action; a person perspective is often obtained from his own experience or other people; someone with a positive attitude does not always manifest in real action (Notoadmojo, 2014). Counselling is a two-way relationship between the counsellor and the client that helps the client achieve better changes. Nutrition counselling is essential to identify or change a person habits that may interfere with nutritional status. Nutrition counselling aims to assist clients in changing nutrition-related behaviours to improve the quality of nutrition (PERSAGI PAGI, 2013).

CONCLUSION

The results showed that nutrition consultation increased knowledge by 16% of the intervention group, while the control group increased knowledge by 8.6%. For the intervention group, attitudes increased by 14.6%, and the control group increased attitudes by 3.03%. The provision of nutrition consultation can improve the knowledge and attitude of adolescent girls in preventing anemia in Bengkulu City. It is necessary to improve the provision of nutritional counselling to adolescents by health workers in the working area of the West Lingkar Health Center, not only about the prevention of anemia but also about the importance of consuming Fe tablets and nutrients needed by adolescents to prevent one of them is anemia.

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MACRONUTRIENT INTAKE AND OBESITY IN ADOLESCENTS: A META-ANALYSIS STUDY

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ABSTRACT

Obesity is a condition with excess body fat due to an imbalance in energy intake consumed more than the physical activity expended. Adolescents who are obese can increase the risk of degenerative diseases. This study aimed to determine the relationship between macronutrients, including carbohydrate, protein, and fat intake, and obesity in adolescents. This study uses a meta-analysis method. Articles were taken from Google Scholar, PubMed, and Science Direct databases. The articles analyzed were articles published from 2000 – 2022, full text; the keywords used for the search were "carbohydrate", "protein", "fat", "obesity, and "adolescents". The articles were collected using PRISMA diagram and analyzed by Review Manager Application 5.4. With the fixed effect model and random effect model. From the results of this study, seven articles were identified. The results of the forest plot show the relationship between carbohydrate intake and obesity in adolescents, p-value < 0.001; OR = 2.58, protein intake with obesity in adolescents obtained p-value = 0.02; OR = 2.92, and fat intake with obesity in adolescents obtained p-value < 0.001; OR = 6.20. The conclusion of this study shows that the variables of carbohydrate, protein, and fat intake have a significant relationship with obesity in adolescents.

Keywords: macronutrients, humans, adolescent, pediatric obesity, carbohydrates, adipose tissue

INTRODUCTION

Obese adolescents experience an extended imbalance between energy intake and output. The consumption of digested energy exceeds that used for metabolism and daily activities. Excess energy intake is stored as fat and fat tissue, resulting in weight gain. (Riswanti, 2016). Being overweight in adolescents is caused by a lack of physical activity and unhealthy eating behaviors such as the consumption of fast food. Teenagers who consume fast food in excess can become obese because fast food has a high nutritional content of fat and high calories (Sani & Handayani, 2021). Adolescent eating patterns are met by macronutrient intake and the amount of intake consumed every day; the expenditure of a small intake is due to a lack of physical activity in adolescents, resulting in obesity (Vionie & Novera, 2020). Adolescents who are obese can increase the risk of degenerative diseases such as heart disease and stroke. Today, the risk of obesity has increased dramatically (Suraya, 2018).

The World Health Organization (WHO) has declared obesity a global epidemic. The prevalence of overweight is increasing very rapidly throughout the world, and developed countries such as Europe, the USA, and Australia have reached dangerous levels (Pajriyah & Sulaeman, 2021). The prevalence of obesity According to the World Health Organization (WHO) 2014, the condition of children aged 5-19 years who were obese reached 39.0%; women were more obese (40.0%) than men (38.0%). Based on the 2018 Basic Health Research Results, the prevalence of obesity in adolescents aged 13-15 years according to (BMI/A) in Indonesia was recorded at 60,020 (4.8%) and adolescents aged 16-18 years at 51,826 (4.0%) (Riskesdas, 2018).

Some research results prove a relationship between macronutrient intake and the incidence of obesity in adolescents. The results of Kurdanti research (2015) found that risk factors for obesity in adolescents are energy intake (OR=4.69), fat (OR=2.34), and carbohydrates (OR=2.64). Anggrainy (2018) research results also prove a relationship between energy intake and adolescent nutritional status. Other studies have shown no correlation between the intake of simple carbohydrates, saturated fat, physical activity levels and nutritional status in adolescents with obesity and obesity. This study is critical because there is still little proves that summarizes the

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relationship between macronutrient intake and obesity in adolescents. Therefore, it is necessary to carry out a meta-analysis to combine two or more research results to obtain new quantitative data.

METHODS

This research design uses a meta-analysis method, a form of quantitative research. The research design used was to analyze the results of previous studies to determine the relationship between macronutrient intake and obesity in adolescents. Articles were obtained from Google Scholar, PubMed, and Science Direct databases. The keywords used in finding articles are (Carbohydrates, protein, fat, obesity, and adolescents). The articles included in this study are articles published from 2000 – 2022. The selected articles discuss the relationship between macronutrient intake and obesity in adolescents, published in Indonesian and English. The research sample is obese adolescents. The data collection process is presented as PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analysis*) diagrams. The study final results were reported using the adjusted Odds Ratio (aOR). Data was processed using Review Manager (RevMan 5.4). The process of searching for articles using a journal search database is shown in Figure 1. The meta-analysis begins with identifying journals, namely searching for journals from the database with specified keywords. The next step is to remove the same articles (removing duplicate articles), followed by a filtration process so that six articles are eligible for meta-analysis to determine the effect of carbohydrate intake on obesity, six articles qualify for meta-analysis to assess the impact of protein intake on obesity, and seven articles are eligible for meta-analysis to determine the effect of fat intake on obesity.

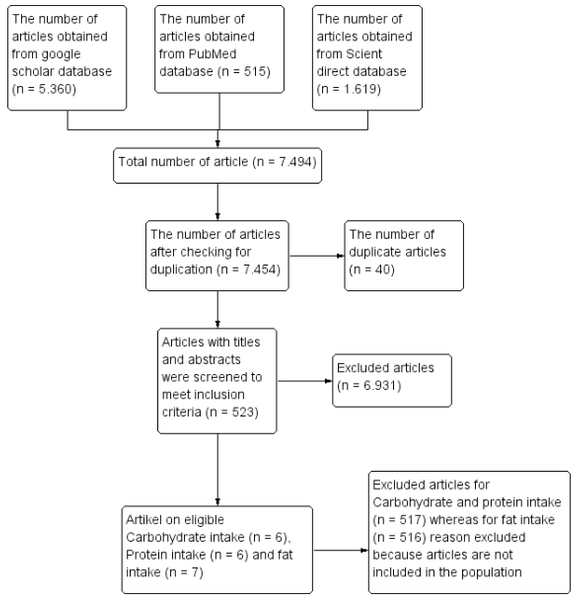


Figure 1. Flow Chart of carbohydrate, protein and fat intake article search process with PRISMA

RESULTS

Figure 2 shows that the variation between studies is heterogeneous. Imelda (2020) showed that excess carbohydrate intake will be at risk of 2 times experiencing obesity. The results of Kartika

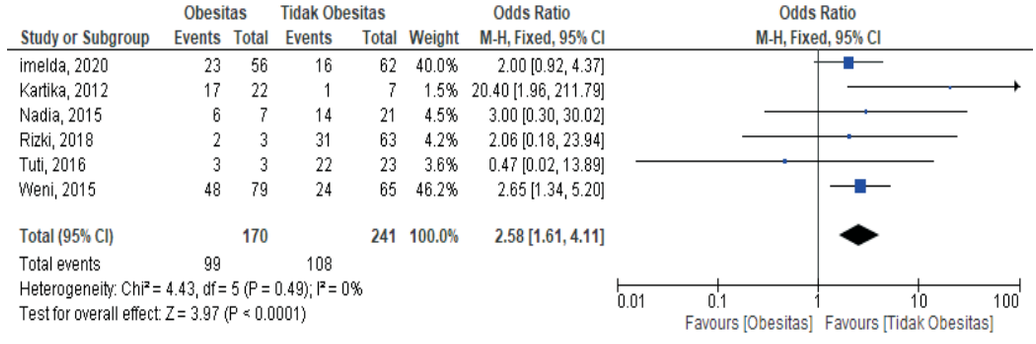
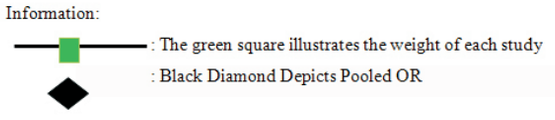


Figure 2. Fores Plot the relationship between carbohydrate intake and obesity in adolescents



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study (2012) the risk of adolescents experiencing obesity is higher (OR=20.4), Nadia (2015) showed that excess carbohydrate intake increases the risk of 3 times obesity, Risk (2018) and Weni (2015) showed the risk of obesity by 2.06 times and 2.65 times when excessive carbohydrate intake, but Tuti (2016) showed no relationship between carbohydrate intake and the incidence of obesity in adolescents. This is evidenced by the p-value in the heterogeneity test, with p = 0.49 and I^2 value 0%, so the fixed effect model is used in this analysis. The forest plot above showed that the pooled odds ratio obtained is 2.58 (95% Cl 1.61 – 4.11), so it can be concluded that adolescents with excessive carbohydrate intake have a 2.58 times greater risk of being obese. There is a significant relationship between carbohydrate intake and obesity in adolescents, evidenced by the p < 0.001.

Figure 3 above shows that the variation between studies is heterogeneous. Imelda (2020) results showed that excess protein intake will be at risk of 3.49 times experiencing obesity. Kartika (2012) (OR=9) and Tuti (2016) (OR=10.59) showed a higher risk of adolescents becoming obese. Nadia (2015) showed that excess carbohydrate intake increased the risk of obesity 2.7 times, Riski (2018) showed the risk of obesity by 4.8 times when excessive carbohydrate intake, but Weni (2015) showed no relationship between protein intake and the incidence of obesity in adolescents. This is evidenced by the p-value in the heterogeneity test, which p = 0.002, and I^2 value 73%, so in this analysis, using the random effect model. The forest plot above shows that the pooled odds ratio obtained is 2.92 (95% Cl 1.15 – 7.46), so it can be concluded that excessive protein intake has a 2.92 times greater risk of obesity in adolescents. There is a significant relationship between protein intake and obesity; this is evidenced by the p = 0.02.

Figure 4 above shows that the variation between studies is heterogeneous. Imelda (2020) results showed that excess fat intake will be at risk of 6.57 times experiencing obesity. Tuti (2016) (OR=23,9), Kartika (2012) (OR=33,75), and Putu (2017) (OR=50.09) showed a higher risk of adolescents becoming obese. Nadia (2015) showed that excess fat intake increased the risk of obesity by 2.46 times, Weni (2015) showed the risk of obesity by 2.34 times with excessive fat intake,

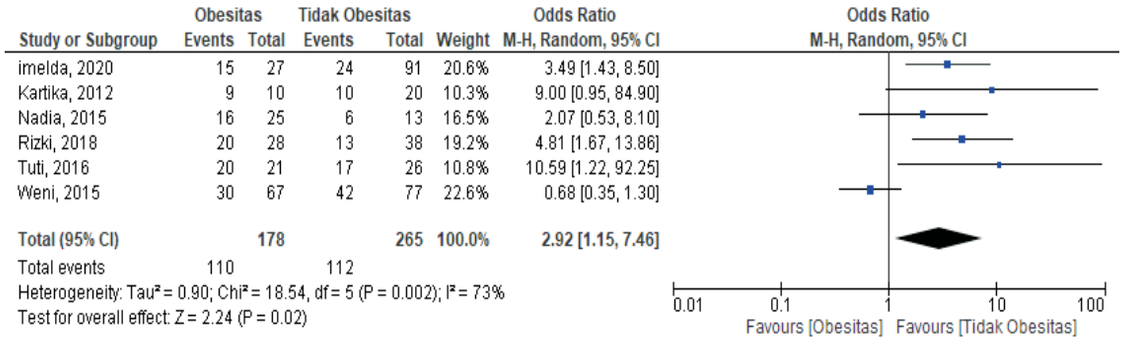

Figure 3. Forest Plot, the relationship of protein intake with obesity in adolescents

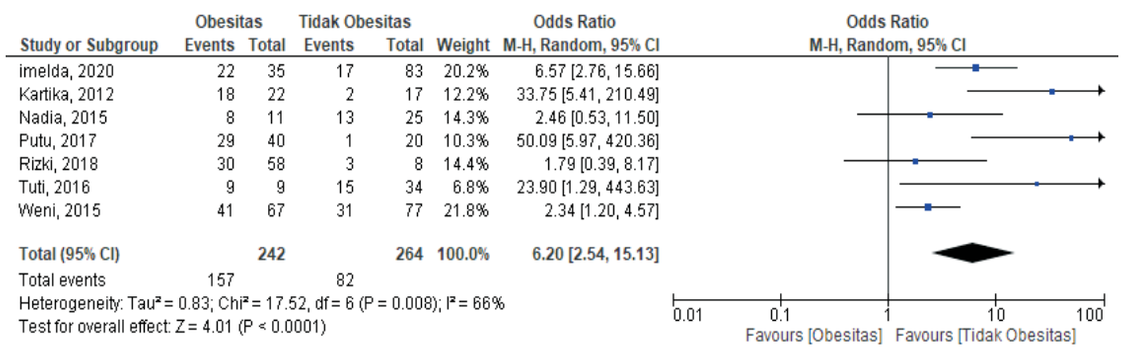

Figure 4. Forest Plot Relationship between fat intake and obesity in adolescents

but Rizki (2018) study showed no relationship between fat intake and the incidence of obesity in adolescents. This is evidenced by the p-value in the Heterogeneity test, which is p = 0.008, and the I^2 value 66%, so the random effect model is used in this analysis. The forest plot above shows that the pooled odds ratio obtained is 6.20 (95% Cl 2.54 – 15.13), so it can be concluded that excessive fat intake has a 6.20 times greater risk of obesity in adolescents. There is a significant relationship between fat intake and obesity; this is evidenced by the value of p = 0.0001.

Figure 5a below shows a funnel plot of the relationship between carbohydrate intake and obesity in adolescents. The left plot has a standard error between 0.4 - 1.75, while the right plot has a standard error of 0.3 - 1.25. Figure 3 shows an asymmetric distribution of research, where the distribution of research is not balanced between the left and right of the center line boundary. Figure 5b shows a funnel plot of the relationship between protein intake and obesity in adolescents. The left plot has a standard error between 0.4 - 0.8, while the right plot has a standard error of 0.5 - 1.25. Figure 3 shows an asymmetric distribution of research, where the distribution of research is not balanced between the left and right of the center line boundary. Figure 5c above shows a funnel plot of the relationship between fat intake and obesity in adolescents. The left plot has a standard error of 0.2 - 0.7, while the right plot has a standard error of 0.5 - 1.5. Figure 5 shows an asymmetric distribution of research, where the distribution of research is not balanced between the left and right of the center line boundary. Based on the Funnel Plot image, it can be concluded that there is a publication bias.

DISCUSSION

Based on a review of 7 articles, the prevalence of obesity problems was 47.58%. The causes of obesity in adolescents are multifactorial, including adolescents who have excessive energy intake, fat intake, protein, and carbohydrate intake. Another factor that can cause obesity is the frequent Consumption of Fast food. The fast-food menu is high in calories, salt, and fat. Fast food consumption can cause various diseases, including obesity (Mulyani et al., 2020). The primary cause of obesity is an energy imbalance between energy intake and energy expenditure over a long period. Excess energy intake is obtained from lack of physical activity, consumption of high-energy foods and snacks such as fast food, and psychosocial influences (Kartolo & Santoso, 2022).

In the seven articles reviewed, it was found that obese adolescents had a percentage of carbohydrate intake of more than 64.26%, protein intake of 62.25%, and fat intake greater than 66.97%. Carbohydrates are the primary source

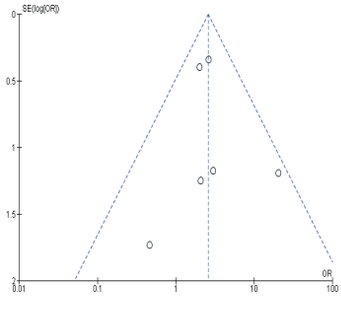

Figure 5a. Funnel plot relationship between carbohydrate intake and obesity in adolescents

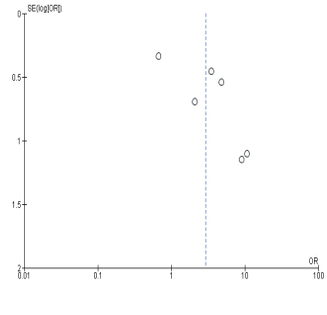

Figure 5b. Funnel Plot the Relationship of Protein Intake with Obesity in Adolescents

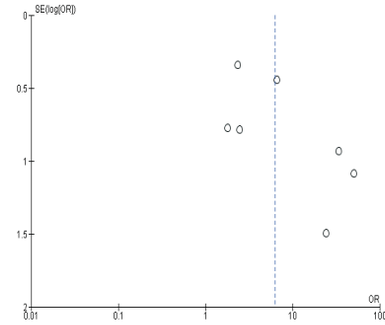

Figure 5c. Funnel Plot Relationship between Fat Intake and Obesity in Adolescents

Information:
SE : Standard Error
❍ : Representing Articles
------- : *Center Line* to see the symmetry of the plot

of macronutrients for the body; if the intake of carbohydrates is excessive, the cells can convert carbohydrates into fat. Carbohydrates that enter through food intake must be balanced with the body needs. An imbalance in carbohydrate intake that enters body can last for a long time, causing nutritional problems, including obesity (Sineke et al., 2019). If adolescents consume protein in amounts that are more than needed, most of the excess protein will be stored in the form of fat. Foods that are high in protein are usually high in fat, which can lead to obesity (Sopiah et al., 2021). Fat intake is the most dominant factor associated with obesity in adolescents. Fat intake has a relationship with obesity; excessive fat intake in the long term can trigger obesity (Telisa et al., 2020).

In this study, carbohydrate intake has a significant relationship with the incidence of obesity in adolescents. Adolescents with excessive carbohydrate intake have a 2.58 times greater risk of being obese. Carbohydrates are nutrients needed by the body in large amounts to produce energy. Adolescents with more carbohydrate intake will be at risk of obesity compared to adolescents who have sufficient carbohydrate intake. Obesity can occur because the carbohydrate intake exceeds the nutritional adequacy rate. Adolescents with more carbohydrate intake will increase insulin secretion, fat storage, and serum triglyceride levels. Excess intake will be stored in muscle or fat. However, if it accumulates for a long time, it will cause obesity. This study is in line with research on adolescents in Kayuuwi village, which states that adolescents with excess carbohydrate intake have a significant relationship with obesity. Carbohydrates are needed for growth, metabolism, utilization of food, and activity. Carbohydrates that enter through food intake must be balanced with body needs. The imbalance in carbohydrate intake that enters the body can last for a long time, causing nutritional problems, including obesity metabolism, food utilization, and activity. Carbohydrates that enter through food intake must be balanced with body needs. The imbalance in carbohydrate intake that enters the body can last for a long time, causing nutritional problems, including obesity metabolism, food utilization, and activity. Carbohydrates that enter through food intake must be balanced with body needs. The imbalance in carbohydrate intake that enters the body can last for a long time, causing nutritional problems, including obesity (Rorimpadei et al., 2020).

Protein intake is a protective factor that can act as an energy source. This is because the intake of fat and carbohydrates is insufficient, so it breaks down protein. Research at Pekunden Elementary School in Semarang said a relationship existed between protein intake and the incidence of obesity ($p = 0.01$). Excess protein intake will break down cell protein into amino acids to be used as energy or stored as fat. In this study, protein intake had 2.92 times greater risk for obesity in adolescents (Rizki et al., 2018). Protein is used as an energy source after undergoing a deaminase process in the liver, namely the hydrolysis of amino acids into keto acids and ammonia (NH_4^+). Then, the amino acids enter the Krebs cycle to be converted into acetyl Co-A, which has been formed and is used to produce fatty acids. Fatty acids play a role in forming adipose cells, forming fat tissue that can increase body weight and become obese (Sopiah et al., 2021). Protein intake in research subjects came from food sources such as vegetable protein and animal protein. Food sources of vegetable protein in adolescents come from nuts, soy products (tofu, tempeh), vegetables, and fruit. One exchange unit of bean (20 gram), tofu (110 gram), and tempeh (50 gram) contain 5 gram of protein. Vegetable and fruit also contain protein but in small amount. One unit of vegetable B (spinach, broccoli, kale, etc.) contain 1 gram of protein, while vegetable C (cassava leave, young jackfruit, etc.) contain 3 gram of protein. The vegetable protein intake consumed by adolescents is mostly coming from fruit. However, because the protein content of fruit is present in small amount, soybean products are the food source of vegetable protein that contribute the most significant to protein content. Subjects' median intake of soy products was 65 gram/day. This amount is still less than the recommended vegetable protein intake, 2-3 units of exchange in one day (Beti, 2015).

Fat intake is the most dominant factor associated with obesity in adolescents. In this study, excessive fat intake had a 6.20 times greater risk for adolescent obesity. Fat intake that exceeds needs in the long term can trigger obesity. Fat is

an essential nutrient as an energy source for every gram of fat that comes from food; the oxidation process in the body will produce nine calories (Sjahmien, 2017). Fat has an unlimited storage capacity, so excess fat intake is followed by increased fat oxidation; about 96% of fat will be stored in the body. In line with Fitriani (2020) said that there was a significant relationship between fat intake and obesity at SMA 86 Jakarta students obtained an OR value of 2.27, which means that respondents have a level of fat intake that is 2.27 times more likely to be obese. Excess fat intake will increase the risk of obesity and will most likely increase the risk of cardiovascular disease (Soetjiningsih, 2004). The advantage of a meta-analysis study is that this method offers a mechanism for estimating the size of the effect in statistical terms (Odds Ratio), and it is significant; combining data from various studies will increase generalization capabilities and statistical power, while the weakness is that there is publication bias.

CONCLUSION

Of the seven articles reviewed, most of the adolescents had an excessive intake of macronutrients, with a prevalence of obesity problems of 47.58%. There is a significant relationship between carbohydrate, protein, and fat intake with obesity in adolescents. It is hoped that it can be used as input and for adolescents to monitor the intake of macronutrients so that no excess intake can lead to obesity in adolescents. Future researchers can conduct similar research by searching for articles in other sources such as DOAJ, Elsevier, Scopus, and Oxford Academic.

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THE EFFECT OF SOY MILK WITH BOILED MORINGA LEAVES ON BLOOD SUGAR LEVELS IN TYPE 2 DIABETES MELLITUS PATIENTS: STUDY IN BENGKULU, INDONESIA

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ABSTRACT

Diabetes mellitus is a significant threat to society and even results in death. The content of soybeans that can lower blood glucose levels are protein, isoflavones, fiber, and a low glycemic index. Moringa leaves contain antioxidants such as flavonoids, vitamin A, E, C, and selenium, which help lower blood glucose levels. However, it is unknown whether combining soy milk with boiled moringa leaves is also beneficial in reducing blood sugar levels. This study aimed to determine how combining soy milk and boiled moringa leaves affects blood sugar levels in type 2 diabetes mellitus patients at Posbindu Puskesmas Nusa Indah. Bengkulu city in 2023. The design used in this study is a pre-experimental design with a pre-test and post-test design. Fifteen pre-elderly samples aged 45 to 59 years with blood sugar levels of 140 to 199 mg/dL were randomly selected as intervention targets in this study. The treatment combined 200 ml of soy milk with 150 mL of Moringa leaf decoction, and then 350 mL of soymilk was produced. The intervention was given twice daily, as much as 175 mL for seven days. Data analysis using the Paired T-test showed that there was a significant relationship between intervention and the sugar level of type 2 diabetes mellitus ($p < 0.001$). There was a substantial decrease in blood glucose levels after administering the soymilk intervention with Moringa leaf decoction after seven days of intervention with $p < 0.001$. This combination product can be used as a functional food ingredient as an alternative for lowering blood glucose levels.

Keywords: Soymilk, Moringa Leaves, Blood Sugar Levels, Pre-elderly

INTRODUCTION

Diabetes mellitus (DM) is a significant threat to society because it can cause complications from heart disease, obesity and even death. Many epidemiological studies show an increase in the prevalence of type 2 diabetes mellitus in the world (Hermawan et al., 2021). Bad eating habits cause sugar and fat levels in the body to increase excessively. This forces the pancreatic gland to work hard to produce the hormone insulin to process the incoming sugar. Lifestyle changes appear to be an essential cause of this problem. It is estimated that there are still many (around 50%) undiagnosed diabetes in Indonesia. DM complications that often occur, especially in the nervous system or neuropathy, will cause an increase in morbidity and mortality so that the financial impact on DM becomes high and the productivity of DM patients decreases (Perkeni, 2021).

The International Diabetes Federation IDF (2021) estimates that at least 537 million people aged between 20 and 79 years suffer from diabetes worldwide in 2021, representing a prevalence of 1 in 10 of the total population of the same age. The IDF estimates that the global diabetes population is expected to increase to 643 million by 2030 and 783 million by 2045. Undiagnosed diabetes affects nearly 1 in 2 adults. As many as 541 million people are at higher risk of developing type 2 diabetes as they get older; the prevalence of diabetes increases to 19.9% or 111.2 million at the age of 65-79 years.

Globally, countries in the Arab region, North Africa and the West Pacific are ranked first and second with a prevalence of diabetes in the population aged 20-79 years of 12.2% and 11.4%; Southeast Asia is ranked third with 11.3% of sufferers. Indonesia is ranked 7th among ten countries with a high number of Diabetes Mellitus sufferers, so it can be estimated that Indonesia's contribution to the prevalence of Diabetes cases in Southeast Asia (Ministry of Health of the Republic of Indonesia, 2020). The 2018 Basic Health Research (*Riset Kesehatan Dasar – Riskesdas*) results show that the prevalence of diabetes

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mellitus in Indonesia based on a doctor's diagnosis at age >15 years is 2%. This figure shows an increase compared to the prevalence of diabetes mellitus in the population aged >15 years in the 2013 *Riskesdas* results of 1.5%. However, the prevalence of diabetes mellitus, according to blood sugar examination results, increased from 6.9% in 2013 to 8.5% in 2018.

Based on the profile of the Bengkulu City Health Service, in 2021, 17,419 people were suffering from Diabetes Mellitus and the prevalence was obtained based on doctor's diagnosis in the population aged 15 years in Bengkulu Province, 1.26%, the highest prevalence is in Bengkulu City with 1.77%, with female gender being more suffer from diabetes with the number of 1.13% compared to the number of men of 0.69%. Based on the service profile of the Bengkulu City Community Health Center, the highest community health center is the Nusa Indah Community Health Center, which had an incidence of DM of 140 people in 2021. One method of treating Diabetes Mellitus is non-pharmacological in the form of diet therapy, exercise, education, and counselling (Partika et al., 2018).

Soymilk is a highly nutritious drink. It contains lecithin compounds for metabolic balance and the amino acid arginine, which can maintain the balance of the insulin hormone (Rahadiyantie et al., 2017). Apart from soy milk, several plants can also be used as alternative treatments for Diabetes Mellitus, such as Moringa leaves. Moringa leaves (*Moringa oleifera*) are one of the readily available plants in Indonesia. Moringa leaves contain antioxidants such as flavonoids, vitamin A, E, C, and selenium, which help lower blood glucose levels. Inhibition of the glucosidase enzyme causes a decrease in the rate of carbohydrate digestion into monosaccharides, which can be absorbed by the small intestine, thereby reducing postprandial hyperglycemia (Safitri, 2018). Based on the problems regarding Diabetes Mellitus, non-pharmacological treatments seem more efficient to use; besides being easy to find, they are also effortless to obtain with their benefits, such as soy milk and Moringa leaf decoction. Therefore, researchers researched the effect of boiled Moringa leaves and soy milk on reducing blood sugar levels in people with type 2 diabetes mellitus at *Posbindu*, Nusa Indah Health Center, Bengkulu City, in 2023.

METHODS

The design used in this study was a pre-experimental design with a pre-test and post-test design. The treatment was a combination of 200 mL of soy milk with a decoction of 150 mL of moringa leaves, producing as much soy milk as 350 mL. The intervention was given twice daily, as much as 175 mL for seven days. Purposive technique sampling was used to conduct this study. The sample size was calculated by using the Lemeshow formula (Lameshow, 1997) :

$$n = \frac{z^2 1 - \alpha/2 P(1-P)}{d^2}$$

Where:
n = sample size
z= z score at 95% confidence = 1.96
P=maximum estimate = 0.5
D = alpha 0.10 or sampling error 10%

Based on the formula above, 15 people were obtained as subjects. Then, the subjects were selected according to the inclusion criteria in this study, including pre-elderly people aged 45 - 59 who have a current blood sugar level range between 140 - 199 mg/dL, do not take diabetes mellitus medication, and are willing to become a respondent by signing an informed consent paper.

A validated questionnaire and a reliability test measured knowledge. Knowledge was good if 8 out of 15 questions were correctly answered. According to Louis et al. (2007), Sedentary activity can be categorized as high if ≥ 5 hours per day and as low if ≤ 5 hours per day (ASAQ, 2007). Current blood sugar levels were measured by Easy Touch Test Strip 25S, with is followed these steps: preparing an easy touch device, cleaning your finger with an alcohol swab and frick it, and pushing and taking a sample of blood with a stick trip inaccessible touch equipment. See the blood glucose level result on the screen of an easy-touch display.

Bivariate analysis of the results used the Paired T-Test and Independent T-Test to compare the control group and treatment group regarding

the average value of blood sugar levels before and after the intervention. Before data analysis is carried out, it is necessary to test the normality of the data first. The Ethics Committee of the Bengkulu Ministry of Health Poltekkes No. KEPK. BKL/471/07/2023 approved this research.

RESULTS AND DISCUSSIONS

Characteristics of Respondents

Respondent characteristics assessed in this study include gender, physical activity, education, knowledge, and occupation. Table 1 presents the results of these characteristics.

Table 1 shows the results of the characteristic test for all pre-elderly ages, totalling 15 people 100%, women 9 people 60%, and men 6 people 40%. The physical activity of the respondents who worked amounted to 9 people 60% and those who did not work 6 people 40%.

Bivariate analysis result

The significant value of the intervention group <0.05, it can be concluded that the data is not normally distributed and the bivariate analysis used is the Wilcoxon Signed Rank Test to compare the differences between the two paired groups > 0.05, it can be concluded that the data are normally distributed, so bivariate analysis uses the Paired Sample T Test to test the average difference between the two samples (before and after) as in Table 2.

Table 1. Respondents Characteristics

Characteristics Respondents	n	%
Gender		
Woman	9	60.0
Man	6	40.0
Physical Activity		
Not Sedentary	9	60.0
Sedentary	6	40.0
Education		
Elementary-junior high school	9	60.0
Senior high school-university level	6	40.0
Knowledge		
Good	7	46.7
Not good	8	53.3
Occupation		
Working	8	53.3
Not Working	7	46.7

Table 2. The effect of soymilk with boiled moringa leaves on blood sugar level.

Random blood sugar level	**Before** Mean ± SD	**After** Mean ± SD	p-Value
	159.67±11.721	126.33 ±9.904	<0.001

In Table 2, it is found that the average value before being given treatment is 159.67 with a standard deviation of 11.72; after being given soy milk with moringa leaves, a decrease in blood sugar level changed with the average value of 126.33 with a standard deviation of 9.904. The P-value is <0.001, which is a significant value, so the results obtained show the effect of giving soy milk with boiled leaves moringa.

Based on research that has been conducted on 15 respondents with the administration of a combination of soymilk with boiled moringa leaves for seven days a week, given two times in the morning and evening, where there is a decrease in blood sugar level, the change in blood sugar level after and before with a p-value of <0.005 where this indicates that there is an influence from the intervention given done. The intervention decreased blood sugar level by 126.33 mg/dL.

Previous research that aligns with this research was conducted by Sartika (2019), who found that giving as much as 10 gram of soy milk daily can reduce sugar level. In the blood, it was found that there were differences in blood sugar levels before and after administration intervention. Blood sugar level decreased by 126.33 mg/dL. In line with Septian study, Wijaya (2019) shows the results of the effect of giving moringa leaf decoction lowering blood sugar level in diabetes mellitus; this is because soymilk contains isoflavone, saponin, lecithin and phytosterol which can lower blood sugar level.

The other major soybean bioactive compound are isoflavones, associated with protein. Soy isoflavones are phytochemical, often referred to as phytoestrogen because they are structurally sound, resemble ÿ-estradiol, and can bind to the estrogen receptor, but have a higher affinity, have estrogenic and anti-estrogenic properties as shown in cell culture and clinical studies. Most of the isoflavones naturally occur in soybeans as

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glycoside, genistein, diazine, and glycerin; after being digested or fermented by ÿ- glucosidase, they are converted into bioactive forms, aglycones: genistein, daidzein, and glycerin (Rizzo et al., 2018). the considerable variation in the abundance of the respective isoflavones in soy and soy foods and their bioavailability resulted in inconsistent physiological functions found among different studies (Chatterjee et al., 2018). Some evidence suggests that Estrogen receptor (ER) binding is only part of the effects of isoflavones. Genistein and daidzein (and their metabolite equals) improve glycemic control and significantly alter homeostasis glucose through insulin secretion by inhibiting tyrosine kinase (TK) (Liu et al., 2013). Isoflavones activate adenosine 5-monophosphate (AMP)--activated protein kinase (AMPK). This results in a decrease in hepatic blood glucose while stimulating glucose uptake independent of insulin in skeletal muscle and modulating glucose transport in peripheral tissues.

In addition, isoflavones can also regulate lipid metabolism without the mediation of estrogen receptors, increase expression of peroxisome proliferator-activated receptor gamma (PPARÿ) and activate activated protein kinase (AMPK), which results in increased activity of the yang gene involved in lipoprotein metabolism reduces the production of triglyceride-rich particles and increasing its lipolysis promoting the metabolism of High-Density Lipoprotein promote absorption, utilization and catabolism of fatty acids (Kim et al, 2021). Isoflavones can also inhibit the expression and activity of sterol-regulatory elements and protein-binding proteins (HDL), which bind to carbohydrate-regulatory elements. These proteins increase the expression of lipogenic genes and enzymes. Another key involved mechanism may be that soy isoflavones may modulate lipoprotein metabolism, including its effect on several enzymes necessary in lipid transformation, including lipoprotein lipase (LPL), hepatic lipase (HL) also called hepatic triglyceride lipase (HTGL), and alpha-hydroxylase (Mendonça et al., 2020). It contains soy milk *Lactobacillus plantarum*, which can improve lipid profiles and slow the development of nephropathy in diabetic patients (Abbasi et al., 2018). In addition, the structural similarities between soy isoflavones and endogenous 17-ÿ-estradiol suggest that isoflavones, by binding to the estrogen receptor, cause gene activation and beneficial effects on glucose and lipid (Vargas-Sánchez et al., 2019)

Phytochemical analysis of Moringa leaves has revealed that Moringa leaves are rich in minerals such as potassium, calcium, iron and phosphorus and various antioxidants such as flavonoids and vitamin C. Moringa plants have been studied comprehensively in the treatment of multiple diseases such as typhoid fever, arthritis, malaria, swelling, skin diseases, parasitic diseases, hypertension, diabetes (Anwar et al., 2021). The protein obtained from Moringa leaves, Mo-LPI, reduces blood glucose levels and is a promising alternative or complementary agent for treating diabetes (Paula et al., 2017).

Moringa leaves have been shown to inhibit the activity of ÿ-glucosidase, ÿ-amylase pancreas, and intestinal sucrose, contributing to its antihyperglycemic properties. This inhibitory effect is possible thanks to phenols, flavonoids, and tannins in Moringa leaves. A delay in the digestion of carbohydrates, caused by inhibiting this enzyme, causes a decrease in post-prandial hyperglycemia and hemoglobin A1C (HbA1C) (Vargas-Sánchez et al., 2019). The antidiabetic activity of flavonoids supports the regulation of carbohydrate digestion, insulin signaling, insulin secretion, glucose uptake, and deposition of adipose (Sangeetha, 2019). Flavonoids target many of the molecules involved in regulating several pathways, such as increasing ÿ cell proliferation, increasing insulin secretion, reducing apoptosis, and repairing hyperglycemia by regulating glucose metabolism in the liver (Pandey et al., 2009).

Flavonoids hydrolyze and conjugate significant enzymes in the intestine, colon and liver. In the gut, Hydrolyzed and conjugated enzymes convert flavonoid monomer units into glucuronides, esters sulphate, and methyl esters (Al-Ishaq et al., 2019). Flavonoid conjugation occurs in two phases of the small intestine (phase one) and then in the liver, at the end of phase one and the beginning of phase two. In the liver, metabolites the conjugated conjugates undergo further processing to produce sulphate and glucuronide derivatives facilitated and excreted via bile and urine. Flavonoids that are not absorbed move to the colon, where they

undergo hydrolysis or fermentation by the colonic microbiota. The microbiota hydrolyses flavonoid glucuronides in the liver into aglycones, then breaks down into lower molecular compounds that are easily absorbed (Thilakarathna et al., 2013).

The major limitation of this research is that it does not consider other factors that might confound the effects of the intervention on blood sugar levels, as it might bias the analysis crucial to conclude the results. Nonetheless, this study could be used as a pilot study and developed further with a better study design.

CONCLUSION

There is an effect of giving a combination of soy milk with boiled moringa leaves on blood sugar levels in patients with type 2 diabetes mellitus at *Posbindu,* Nusa Indah Health Center, Bengkulu City, in 2023. For further research, apart from being given drinks, the raw materials of Moringa leaves and soy milk can be processed into other food forms, for example, Moringa leaf pudding with soymilk, thus reducing the boredom of diabetes mellitus sufferers.

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ENERGY AND SUGAR CONTENT OF READY-TO-DRINK TEA AND COFFEE MARKETED IN SOUTH TANGERANG, INDONESIA

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ABSTRACT

Excessive sugar consumption, primarily through sugar-sweetened beverages, has been linked to the occurrence of type 2 diabetes mellitus (T2DM). The Ministry of Health of Indonesia recommends that the maximum sugar consumption for the general population not exceed 50 g per day. One type of sugar-sweetened beverage that has been massively distributed in Indonesia is ready-to-drink (RTD) tea and coffee. This study examined the energy and sugar content of the RTD coffee and tea marketed in the modern retail market and their contribution to the Indonesian recommended dietary allowance. This study was conducted in June 2022. Ready-to-drink (RTD) coffee and tea were purchased from five supermarkets and three minimarkets in South Tangerang City, Banten, Indonesia. Data obtained from the product label was recorded and then analysed descriptively. 47 coffee (17 brands) and 58 tea (20 brands) products were obtained during the survey. Most coffee (55.3%) and tea (86.2%) products are distributed in plastic bottles. The median serving size of coffee (240 mL) is slightly smaller than that of tea (250 mL). On average, one serving size of coffee and tea products contributes to 35.7% and 34.8% of the recommended dietary allowance of sugar, respectively. Consumers are advised to take caution while consuming RTD coffee and tea products as they might contribute to excessive sugar consumption. The government must impose regulations to limit sugar content in food and beverage products and increase consumer education to reduce sugar consumption, especially sugar-sweetened products.

Keywords: sugar-sweetened beverages, coffee, sugar, tea

INTRODUCTION

Diabetes mellitus (DM) is a chronic, non-communicable disease that has emerged as a new threat to public health in the past few years. The American Diabetes Association (ADA) defines DM as a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association, 2010). The World Health Organization stated that worldwide, 8.5% of adults aged 18 years and older had DM in 2014 (WHO, 2023). In Indonesia, the prevalence of DM diagnosed by healthcare professionals increased from 1.1% in 2007 to 1.5% in 2018 (KEMENKES, 2007, 2018). The International Diabetes Federation reported that in 2021, Indonesia will have approximately 19.5 million people with diabetes (International Diabetes Federation, 2021).

DM impacts the quality of human life and overall life expectancy. DM is associated with macrovascular complications such as coronary heart disease, cardiomyopathy, arrhythmias, sudden death, cerebrovascular disease, and peripheral artery disease (Viigimaa et al., 2020). DM also leads to microvascular complications such as diabetic nephropathy, retinopathy, neuropathy, and sexual dysfunction (Faselis et al., 2020). DM was reported as a direct cause of 1.5 million deaths, and 48% of all deaths due to diabetes occurred before the age of 70 years worldwide (WHO, 2023). DM also puts a financial burden on the national health system. BPJS Kesehatan claimed that the cost of DM treatment has increased from IDR 6.5 trillion in 2018 to IDR 7.5 trillion in 2022 (CNN Indonesia, 2023).

Excessive sugar intake, primarily through sugar-sweetened beverages (SSB), has been linked to the occurrence of type 2 diabetes mellitus (T2DM). Sugar-sweetened beverages contain high amounts of added sugar and induce low satiety, which leads to increased energy intake, hence their contribution to weight gain (Yoshida & Simoes, 2018). The uncontrolled weight gain will lead to overweight and obesity, which are risk factors for T2DM and other chronic diseases (Lean & Te Morenga, 2016; Malik & Hu, 2022). A recent meta-analysis of prospective cohort studies concluded that increased consumption of SSB and artificially

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sweetened beverages are associated with the risk of T2DM (Meng et al., 2021). The Ministry of Health of Indonesia recommends that the maximum sugar intake for the general population not exceed 50 g daily to prevent diabetes and cardiovascular disease (Kemenkes, 2014).

One type of sugar-sweetened beverage that has been massively distributed in Indonesia is ready-to-drink (RTD) tea and coffee. According to Statista Market Insight, the RTD coffee and tea market value in Indonesia in 2022 will be approximately IDR 30 trillion (USD 2 billion) (Statista Market Insight, 2023). Statistics Indonesia reported that Indonesian purchased RTD coffee, milk coffee, and tea more than any other beverages (Badan Pusat Statistik, 2022). Ready-to-drink (RTD) coffee and tea are convenient and can be easily purchased in many modern retail markets in urban areas. Coffee and tea have been widely known to contain many phytochemicals that show various health functions such as antioxidant, anti-inflammatory, immuno-regulator, anticancer, cardiovascular-protective, anti-diabetic, anti-obesity, and hepatoprotective effects (Barrea et al., 2023; Tang et al., 2019). However, RTD coffee and tea products in Indonesia usually contain added sugar, which may undermine the health benefits. Currently, there is limited data regarding the sugar content of RTD coffee and tea distributed in modern markets in Indonesia. This data could be used as a basis for consumer education on RTD coffee and tea consumption. Therefore, this paper aims to examine the energy, sugar, and other nutrient content of RTD coffee and tea and their contribution to the recommended dietary allowance in Indonesia.

METHODS

This observational study was conducted through a market survey in June 2022. The survey locations were modern retail markets consisting of five supermarkets and three minimarkets around the UIN Syarif Hidayatullah Jakarta campus in Ciputat, South Tangerang City, Banten Province, Indonesia. South Tangerang City is an urban area situated very close to Jakarta, the current capital of Indonesia; hence, it is considered one of the supporting areas of the capital city.

The definition of RTD coffee and tea products was adopted from the Indonesian Food Category (BPOM, 2019). A coffee drink was defined as a drink made from coffee powder, instant coffee, and/or coffee extract and drinking water, with or without added sugar or other food ingredients. A tea drink was defined as a drink made from the brewing process of tea leaf and/or tea extract in water, with or without added sugar and/or other food ingredients and packaged hermetically.

The data was collected by purchasing samples of RTD coffee and tea products in the markets. Products with identical brands and variants in different markets were only obtained once to prevent data duplication. The product label information, namely brands, variants, type of packaging, serving size, energy, and nutrition contents, was then recorded using the Google Forms application. Data cleaning and editing were performed to ensure its completion and validity. Data analysis was conducted using descriptive statistics.

RESULTS AND DISCUSSION

Products Characteristics

This survey collected 105 RTD product variants from 8 modern markets in South Tangerang City, consisted of 47 coffee and 58 tea products. Almost all tea products were marketed in plastic bottle packaging (86.2%), while most coffee products were either packed in plastic bottle (55.3%) or can (34.0%) (Table 1). Plastic PET bottle packaging was reported to be as effective as glass packaging in retaining the antioxidant capacity during cold storage in RTD green tea products compared to retort pouches (Kim et al., 2011). However, sunlight exposure to plastic packaging should avoided to prevent contamination of heavy metals from bottle material (Umoafia et al., 2023).

The tea products mostly have a larger serving size of 250–299 mL (46.6%) than coffee, which is served in a 200–249 mL size (55.3%) (Figure 2). The serving size is proposed to influence the consumption of foods or beverages, and the impact depends on whether the total energy per serving or the number of servings is emphasised on the label

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Table 1. Characteristics of the RTD coffee and tea products packaging

Characteristics	Coffee		Tea	
	n	%	n	%
Type of packaging				
Glass bottle	3	6.4	0	0.0
Plastic (PET) bottle	26	55.3	50	86.2
Can	16	34.0	2	3.4
Carton box	2	4.3	6	10.3
Serving size				
< 200 mL	7	14.9	5	8.6
200 – 249 mL	26	55.3	22	37.9
250 – 299 mL	9	19.1	27	46.6
≥ 300 mL	5	10.6	4	6.9
Product Origin				
Locally manufactured	32	68.1	56	96.6
Imported	15	31.9	2	3.4

(Bucher et al., 2018). The Indonesian government has mandated food producers to include nutrition facts on most processed foods and beverages, such as RTD coffee and tea. Both total energy per serving and number of servings are required to be printed in bold (BPOM, 2021). As much as 68,1% of RTD coffee products were manufactured locally, while 31,9% were imported. Meanwhile, almost all tea products (96,6%) were manufactured locally (Table 1).

Energy, Sugar, and Other Nutrient Content of Coffee Products

Table 2 lists the energy, sugar, and other nutrients found in the nutrition facts label of coffee products. The information on energy, sugar, total fat, protein, carbohydrate, and sodium content was found in all of the coffee products, which is in line with the government regulation that the inclusion of that information is mandatory in a nutrition fact label (BPOM, 2021)Additional information on saturated fat, cholesterol, and fiber is not mandatory and is only found in several products.

The average energy content of the coffee products is 135 kcal per serving, contributing to 6.3% of the recommended dietary allowance. The average sugar content of coffee products is 17.9 g, contributing to nearly one-third of the maximum sugar intake recommendation. Some products contain 42 g of sugar, almost the maximum recommendation. The energy and sugar content of coffee products marketed in Indonesia are higher than those found in other countries such as Slovenia (Zupanič et al., 2019), Australia (Pinho-Gomes et al., 2023), and Taiwan (Yen et al., 2022).

Coffee naturally contains a trace amount of fat and protein. However, several products list fat, saturated fat, cholesterol, and protein content on their nutritional facts label. The amount of saturated fat was also quite high, which comes from the additional dairy or non-dairy creamer in the ingredients for products such as latte, cappuccino, milk coffee, etc.

Energy, Sugar, and Other Nutrient Content of Tea Products

The energy, sugar, and other nutrients found in the nutrition facts label of tea products are listed

Table 2. Energy, sugar, and other nutrient content of coffee products and its contribution to nutrient reference value

Nutrients	n	Reference value	Mean	SD	Min	Max	Contribution per serving size
Energy (kcal)	47	2150[1]	135	47	15	280	6.3%
Sugar (g)	47	Max 50[2]	17.9	6.6	0	42	35.7%
Total fat (g)	47	67[1]	3.5	3.4	0	22.5	5.2%
Saturated fat (g)	40	Max 30[2]	2.9	2.0	0	10	9.5%
Cholesterol (mg)	14	Max 300[2]	3.8	3.5	0	10	1.3%
Protein (g)	47	60[1]	2.7	2.0	0	12	4.4%
Carbohydrate (g)	47	325[1]	24.7	8.2	2	46	7.6%
Fiber (g)	14	30[1]	3.9	3.3	0	12	13.1%
Sodium (mg)	47	Max 2000[2]	107.2	54.6	5	290	5.3%

[1] Regulation of Head of National Agency of Drug and Food Control of Republic of Indonesia Number 9 Year 2016 on Nutrient Reference Value (BPOM, 2016)
[2] Health Ministerial Decree Number 41 Year 2014 on Nutritional Guidelines (KEMENKES, 2014)

Table 3. Energy, sugar, and other nutrient content of tea products and its contribution to nutrient reference value

Nutrients	n	Reference value	Mean	SD	Min	Max	Contribution per serving size
Energy (kcal)	58	2150[1]	83	45	0	210	3.8%
Sugar (g)	58	Max 50[2]	17.4	7.6	0	34	34.8%
Total fat (g)	58	67[1]	0.5	1.5	0	6	0.8%
Saturated fat (g)	43	Max 30[2]	0.4	1.2	0	5	1.4%
Cholesterol (mg)	5	Max 300[2]	0.8	1.8	0	4	0.3%
Protein (g)	58	60[1]	0.3	0.8	0	4	0.4%
Carbohydrate (g)	58	325[1]	19.2	8.8	0	36	5.9%
Fiber (g)	2	30[1]	1.0	0.0	0	1	3.3%
Sodium (mg)	58	Max 2000[2]	44.9	46.2	0	190	2.2%
Vitamin C (mg)	3	90	0.9	0.1	0	1	1.0%

[1] Regulation of Head of National Agency of Drug and Food Control of Republic of Indonesia Number 9 Year 2016 on Nutrient Reference Value (BPOM, 2016)

[2] Health Ministerial Decree Number 41 Year 2014 on Nutritional Guidelines (KEMENKES, 2014)

in Table 3. The information on energy, sugar, total fat, protein, carbohydrate, and sodium content was found in all of the tea products, in line with the government regulation on nutrition facts labels (BPOM, 2021)Several products' nutrition facts labels include additional information on saturated fat, cholesterol, fiber, and vitamin C, which is not mandatory.

The average energy content of the tea products is 83 kcal per serving, contributing to 3.8% of the recommended dietary allowance. The average sugar content of the tea products is 17.4 g, contributing to nearly one-third of the maximum sugar intake recommendation. Although the total energy content of tea products is slightly lower than coffee, the sugar content is quite similar. The energy and sugar content of tea products marketed in Indonesia are also higher than those found in other countries such as Slovenia (Zupanič et al., 2019) and Taiwan (Yen et al., 2022).

Similar to coffee, tea contains a negligible amount of fat and protein. Additionally, milk is the primary source of fat and protein in products such as milk tea, Thai tea, and teh tarik. However, the variation of dairy ingredients in tea products is not as significant as in coffee products; hence, the energy content of coffee products tends to be higher.

In contrast to coffee products, vitamin C is found in tea products. Three products list vitamin C in their nutritional facts label, which comes from additional lemon or other fruit extracts in their ingredient list. Fruit-flavored tea variants are pretty common in Indonesia. However, most fruit was only available as artificial flavoring, not the original extract.

Current Regulation and Possible Impact of RTD Consumption

Indonesian, especially Javanese, are known to have a preference for sweetness in their food and drinks. Sartika et al. (2022) explained that this could be traced back to the cultural, or cultivation system, era during Dutch colonization when the mass production of sugarcane was enforced. The people incorporated sugarcane juice into their food and drink recipes, possibly giving people more preferences for sweetness after a long term of repetitive exposure (Sartika et al., 2022).

The Indonesian government has declared that Indonesian maximum free sugar intake should not exceed 50 g daily, according to the Nutritional Guidelines or *Pedoman Gizi Seimbang* (KEMENKES, 2014). However, based on the Total Diet Study conducted by the Ministry of Health in 2014, 77 million people, or 29.7% of the Indonesian population, consumed more than 50 g of sugar daily (Atmarita et al., 2017). The obligation to include information on sugar content in the nutrition facts label of processed foods has been declared mandatory by Kemenkes (2015) and BPOM (2021). However, based on several studies, consumer behavior in reading the food label, including the nutrition fact label, is considered

low (Badriyah & Syafei, 2019; Yayasan Lembaga Konsumen Indonesia, 2019). Some determining factors associated with consumer behavior on food label reading are sex, knowledge, and attitude towards food label reading (Huda & Andrias, 2018; Melinda & Farida, 2021; Sinaga & Simanungkalit, 2019). Family support is especially needed for children to ensure that they provide good nutrition for their children (Rizona et al., 2022). Therefore, consumer education is essential to increase their awareness regarding the sugar content on the food label.

Several recommendations on how to lower the sugar consumption from RTD products have been proposed. From the supply side, it is recommended that the government enforce the regulation to limit the sugar content of the products and provide nutritional information, especially for total sugar content. It is also suggested that the availability of less sugary products at the market counter be promoted, the distribution of products with high sugar content should be restricted, and further studies should be conducted on the sugar consumption policy at the population level. (Sartika et al., 2022). It is also recommended that the government impose a sugar tax on sugar-containing foods and a sugar import tax (Kusnali et al., 2019). On the demand side, an educational approach to altering Indonesian preferences for sweet taste should be taken, with an emphasis on the benefits of reducing sugar intake and the promotion of healthier eating habits from an early age (Sartika et al., 2022).

CONCLUSION

The sugar content of RTD coffee and tea products distributed in Indonesia's modern market is relatively high. Consumers must exercise caution when purchasing and consuming the products, as they may contribute to excess sugar consumption. The government must take several actions to reduce sugar consumption in RTD products by enforcing solid regulations to limit sugar content in food and beverage products and increasing consumer education to reduce sugar consumption, especially in sugar sweetened RTD products. Further studies are needed to examine the energy and sugar content of products marketed in traditional markets since they might have different distribution channels.

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THE INFLUENCE OF NUTRITION MANAGEMENT EDUCATION ON MOTHERS KNOWLEDGE AND ATTITUDES IN FULFILLING NUTRITION FOR OBESE PREGNANT WOMEN

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ABSTRACT

Obesity is a high obstetric risk increasing the risk of maternal and fetal morbidity and death. Complications that can occurred in pregnant women with obesity are an increased risk of hypertension, gestational diabetes, spontaneous abortion, and postpartum hemorrhage. This research aims to determine the effect of nutritional management education on mothers knowledge and attitudes in fulfilling nutritional needs of obese pregnant women. The study used a quasi-experiment with a pre-test and post-test with a control group design. The sample in this study was 60 obese pregnant women who were divided into an intervention group and a control group, each with 30 respondents. The instruments used were observation sheets and nutritional management menu lists. Data analysis used the Mann-Whitney test with a significance level of $p \leq 0.05$. The study showed a significant difference between knowledge (p-value=0.015) and mothers' attitudes towards fulfilling nutrition (p-value=0.011) before and after nutrition management education. Nutrition management education is critical to improving nutritional fulfilment for pregnant women.

Keywords: Obesity, Nutrition Management Education, Pregnant Women

INTRODUCTION

Obesity is the most common obstetric problem affecting mothers and children (Flegal et al., 2012). In 2015, it was 32 deaths per 100,000 live birth happened, and the National Medium Term Development Plan (RPJMN) target to be achieved by 2024 was 16 deaths per 1000 births (Ministry of Health of the Republic of Indonesia, 2022). The Maternal Mortality Rate (MMR) in Bengkulu Province in 2020 was 32 deaths, with a distribution of 8 pregnant women (25%), 9 maternal deaths (28.12%) and 15 maternal deaths (46.9%) during the postpartum period. The direct causes of maternal death are bleeding (25% of postpartum hemorrhage), infection of germs or bacteria that enter the blood vessels (15%), preeclampsia (12%), obstructed labor (8%), complications of unsafe abortion (13%) and other causes (8%). Meanwhile, the indirect cause of maternal death is due to disease and not due to pregnancy and childbirth, one of which is obesity in pregnant women. Obesity is an indirect cause of maternal death because pregnant women who are obese will be susceptible to various complications (Sudirtayasa, 2018).

Symptoms of obesity can occur in all age groups, and body weight increases rapidly. These following body shape, appearance and facial characteristics in obese patients included thighs that appear enlarged, especially in the proximal part, relatively small hands with pointed fingers, facial emotional abnormalities, relatively small nose and mouth with a double chin, round face with chubby cheeks, enlarged upper arms, enlarged upper arms found in the biceps and triceps, relatively short neck, swollen chest with enlarged breasts, bulging stomach (pendulous stomach) and abdominal striae, ginigenu valgum puberty (x-shaped limbs) with the two inner groins sticking together and friction which can cause wounds on the skin (Guyton & Hall, 2018).

Pregnant women with obesity are required to follow a diet and should follow a healthy diet specifically for pregnant women or with nutritional management. During pregnancy, the body needs more protein, calories, vitamins and minerals such as folic acid and iron for fetal growth and development. The principle of good eating during pregnancy is breakfast. Pregnant women are advised to consume nutrient-rich foods at

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breakfast. Avoiding breakfast will give rise to the desire to eat more when the next meal arrives and can cause complaints such as dizziness and nausea (Evan, 2017).

Interventions that can be applied to overcome the problem of obesity are regulating eating and increasing physical activity through a nutritional education approach. Nutrition education is an effort to promote health related to healthy eating habits throughout life, starting at the early stages of life (Kostanjevec et al., 2011).

The diet of pregnant women who are obese will eat if they want to eat, not because they need to or because they are hungry; this can cause an increase in excess energy intake with high fat and carbohydrate content if this is done continuously without being balanced with physical activity it can increase risk of obesity in pregnant women. Physical activity also influences the occurrence of obesity in pregnant women; regular physical activity affects the body regular calorie expenditure; in this case, it can be concluded that lack of physical activity in pregnant women can cause fat accumulation, which can cause obesity in pregnant women.

During the pregnancy class, an initial research survey was conducted at the BPM Working Area of the West Ring Health Center, Bengkulu City, by interviewing ten third-trimester pregnant women with obesity. The results showed that 7 (70%) pregnant women had insufficient knowledge about nutritional management, and 4 (40%) pregnant women had not adopted a special diet for pregnant women with obesity. This is because most pregnant women have a secondary education level, so it is challenging to receive new information; apart from that, they also support it as housewives who have experience receiving information only from family members at home and neighbors. This provides limited access to the latest information.

Management of nutrition and diet in pregnant women with obesity is not just about losing weight but also about maintaining weight stability and preventing weight gain again. Reduce fatty foods, especially saturated fat, because it makes it easier for fat globules to stick to the walls of blood vessels. Consume little fat (30% of total calories consumed) and reduce excessive carbohydrate consumption to maintain body weight within normal limits (Sulistyoningsih, 2018).

METHOD

This research used the quasi-experimental method with a pre-test and post-test control group design. The study was conducted at the BPM working area of the West Ring Health Center, Bengkulu City. The independent variable in this research was nutrition management education, and the dependent variable was the attitudes and knowledge of pregnant women. The population in this study was all second-trimester pregnant women with a BMI $\geq$ 30 kg/m^2 from April to July 2023. The experimental group consisted of 30 pregnant women, and the control group consisted of 30 pregnant women. All subjects were purposively selected using the purposive sampling technique.

The research consisted of stages of data collection before intervention, intervention and data collection after intervention. Initial measurements (pre-test) were carried out on the first day before the intervention, and then nutrition management education was continued in the intervention group. At the same time, the control group was not given nutrition management education. The nutrition management intervention group used the lecture method, assisted by health center nutritionists and researchers, as well as the question and answer method and demonstration. Educational material includes prenatal nutrition, exclusive breastfeeding, and diet menu settings. We demonstrate how to prepare a daily food menu according to the daily needs of pregnant women with obesity/diet menu settings. The intervention was carried out for two consecutive days. Each meeting consisted of two sessions: the first session of lectures and discussions and the second session of demonstrations. The lecture and discussion session was held for 40 minutes, and the demonstration was held for 60 minutes, equipped with respondents practice. Seven days after the intervention ended, a post-test was given. In the control group, the post-test was shown on the seventh day after the pre-test. Nutrition management education in the control group was carried out after the post-test. Data analysis used

the Mann-Whitney test with a significance level of p≤0.05. The Ethical Clearance number used in this research is 178/KEPSTIKESSAPTABAKTI/2023.

RESULTS AND DISCUSSION

The research results can be seen in Table 1, which showed that the majority of respondents in both groups were young adults, in the control group 63.3% and in the intervention group 76.7%. Most mothers in the control group had a primary education level of 60%, while in the intervention group, most mothers had a secondary education level of 56.7%. Regarding family income, most have incomes below the minimum wage, 80% in the control group and 63.3% in the intervention group. The majority of respondents' employment status was not working, 86.7% in the control group and 90% in the intervention group.

In Table 1, the age characteristics of most respondents are young adults; as many as 77% are in the intervention group. Regarding maternal educational characteristics, 26.7% of the intervention group. Regarding income below the minimum wage, 63.3% of the intervention group. Regarding job characteristics, 90% of the intervention group did not work.

Based on table 2, it can be seen that after being given nutrition education, there was an increase in knowledge scores in the treatment and control groups. In the treatment group, before being given nutrition education, the average knowledge was 60.57 ± 12.16. After being given nutrition education, the knowledge score increased to 79.04 ± 4.10. In the control group, before being given nutrition education, the average knowledge was 60.89 ± 7.06, after being given nutrition education it increased to 68.76 ± 6.73. Even though there was an increase in knowledge scores in both groups, the increase in the treatment group was higher than in the control group. The increase in knowledge in the treatment group was 18.47 ± 16.01 and the control group was only 7.87 ± 6.15. There was a significant increase in knowledge in both the treatment and control groups with p<0.001. There is a difference in increasing knowledge between the treatment group and the control group, p=0.015.

In table 3, it can be seen that after being given nutrition education, there was an increase in attitude scores in the treatment and control groups.

Table 1. Distribution of Respondents Based on Maternal Age, Maternal Education, Family Income, Maternal Occupation, Maternal Nutritional Status

Variable	n	(%)
Age (years)		
Young Adult (18-35)	23	77
Middle Adult (>35-55)	07	23
Mother's Education		
Elementary School	8	26.7
Intermediate (High School)	17	56.7
Higher Education	5	16.6
Income		
Below minimum wage	19	63.3
Above minimum wage	11	36.7
Work		
Does not work	27	90
Work	3	10

Table 2. Knowledge scores before and after intervention between the treatment group and the control group

Knowledge Score	Interventions group		Control group		p-value
	Mean ± SD	p-value	Mean ± SD	p-value	
Before	60.57 ± 12.16		60.89 ± 7.06		
After	79.04 ± 4.10	<0.001 [a]	68.76 ± 6.73	<0.001 [a]	0.015 [b]
Gain Score	18.47 ± 16.01		7.87 ± 6.15		

In the treatment group, before being given nutrition education, the average attitude score was 76.46 ± 6.85. After being given nutrition education, it increased to 86.61 ± 6.43. In the control group, before being given nutrition education, the average attitude score was 79.58 ± 6.54. After being given nutrition education, the attitude score increased to 83.54 ± 6.04.

Even though there was an increase in attitude scores in both groups, the increase in attitude scores in the treatment group was higher than in the control group. The increase in attitude score in the treatment group was 10.49 ± 9.29 and the control group was only 1.46 ± 5.49. There was a significant increase in knowledge in both the treatment and control groups with p=0.015. There was a difference in the increase in attitude scores between the treatment group and the control group with p=0.011 using nutrition management education. Which means that there is a significant influence of nutrition management education on mothers' knowledge and attitudes in fulfilling the nutrition of pregnant women with obesity. This is in line with research conducted (Sulistiawati et al., 2021), which states that providing educational information during pregnancy positively impacts maternal knowledge because pregnant women know what to eat and avoid.

Providing appropriate education to pregnant women can increase the mother's knowledge, which is expected to change the mother's attitude. Attitude formation can be influenced by several things, such as experience, culture, other people, emotions and mass media. Attitudes will be formed by providing information that is perceived positively or negatively. Providing nutritional management education shows that fulfilling balanced nutrition appropriate to pregnant women condition is essential, influencing mothers' daily attitudes (Mulyani, 2017). The results of this research align with research by Yunitasari et al. (2020), which revealed a significant influence between education, brainstorming and demonstration on increasing the knowledge, attitudes and behavior of pregnant women in managing the diet menu in the intervention group. , while in the control group, there were no significant values.

The results of this study are also supported by research by Muluye et al. (2020), which shows no change in knowledge in the control group. The effectiveness of nutrition management education has also been studied in Kenya, where the average knowledge of nutrition management was significantly higher in the intervention group than in the control group (Waswa et al., 2015). This is in line with the research results of Mutiso et al. (2015), who state that nutrition management education and psychosocial factors strongly influence the extent to which IYCF is used.

Research in Ethiopia states that pregnant women have inadequate knowledge and practices regarding nutrition during pregnancy, resulting in poor behavior and health status of pregnant women, which can increase the risk of maternal morbidity and death (Tenaw et al., 2018). During pregnancy, mothers with an obese body mass index (BMI) have a greater risk of experiencing antenatal, intrapartum, postpartum and neonatal complications such as gestational hypertension, increased gestational diabetes mellitus, thromboembolism, increased cesarean delivery, premature labor, macrosomia, meconium aspiration and neonate. Stillbirth. In addition, children born to mothers who are obese have a high risk of obesity and metabolic diseases, including neuropsychiatric and cognitive disorders. Babies born to mothers who are obese tend to be at risk of being admitted to the NICU because they have an umbilical cord arterial pH <7.10 (Melchor et al., 2019; Mulyani et al., 2021). Providing educational interventions regarding nutritional management, especially

Table 3. Attitude scores before and after intervention between the treatment group and the control group

Attitude Score	Interventions group		Control group		p-value
	Mean ± SD	p-value	Mean ± SD	p-value	
Before	70.67 ± 6.58		78.85 ± 6.45		
After	81.16 ± 6.31	<0.001 [a]	80.34 ± 6.14	0.003 [a]	0.011 [b]
Gain Score	10.49 ± 9.29		1.46 ± 5.49		

for pregnant women who are obese, must be a priority in antenatal care. Obesity is also a form of prolonged malnutrition, which has long-term risks. This is necessary so the mother can reach the recommended weight during pregnancy.

CONCLUSION

The attitude and knowledge of pregnant women in nutritional management during pregnancy can prevent complications such as preeclampsia and diabetes mellitus, especially among obese pregnant women. They can reduce weight in pregnant women, but the nutrition of pregnant women remains adequate so that it does not interfere with the growth and development of the fetus. A healthy diet can be carried out with always having breakfast. Mothers are advised to eat foods rich in nutrients, choose foods with fiber and low sugar content, use fruit as a snack, drink lots of water at least 2 liters per day, not consume large amounts of food at once, and limit certain foods, such as sweet, savory and fat-containing foods.

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ANALYSIS OF FOOD SECURITY, SOCIAL HEALTH, ENVIRONMENTAL AND HOUSEHOLD FOOD SECURITY ON STUNTING INCIDENCE OF CHILDREN AGED 12-59 MONTHS IN COASTAL HOUSEHOLDS IN BENGKULU PROVINCE

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ABSTRACT

The natural wealth of coastal areas is not accompanied by the welfare of the people who occupy a lower economic stratum than other land communities, including in fulfilling nutrition. The study aims to analyze the influence of food security and social, health, environmental and household food security factors on the incidence of stunting in children aged 12-59 months in coastal households in Bengkulu Province. The research methodology used a mixed approach, between quantitative and qualitative. Data analysis used Structural Equation Modeling (SEM). The study results showed that the policy aspect significantly affected food security (β=0.085; t=1.979; and p-value < 0.05) but is non-significant on stunting. There was a significant positive effect of health on food security with a value of β=0.237, value t = 7.157, and p-value <0.05. Health had no significant effect on stunting with a value of β=-0.040, value t = 0.963, and p-value > 0.05. Environmental aspects had a substantial adverse impact on food security (β=-0.492; t=12.846; and p-value <0.05) and a significant positive effect on stunting (β=0.155; t=2.781; and p-value < 0.05). The social aspect had a non-significant relationship with both food security and stunting. Food security was significantly related to stunting (β=0.441; t=7.971; and p-value <0.05). The research conclusion is that food security had a significant favorable association with stunting.

Keywords: food security, social, health, environment, stunting.

INTRODUCTION

Economic potential and wealth in coastal areas are accompanied by abundant marine products and other biodiversity. However, the natural wealth of coastal regions is not accompanied by the real welfare of the people's lives and occupies a low economic strata compared to other land communities, including in fulfilling nutrition (Leo *et al.*, 2018; Sutrisno, 2014) . Nutrition is essential for optimal growth and development (Auliya & Budiono, 2015). One of the determining factors of nutritional quality is food consumption patterns, which are influenced by the level of food availability, namely the type and amount of food consumed (Retnaningsih et al., 2011).

The impact of stunting on toddlers can also be caused directly by the mother's knowledge regarding nutrition, toddler eating patterns, cleanliness and sanitation at home (Nyoman Supariasa et al., 2022). People in coastal areas depend on using marine resources for their livelihoods. According to research by Baculu and Jufri (2017), a protein intake level of 96.43% is sufficient for toddlers on the coast of Donggala Regency. However, research by Lusiana & Maryanto (2014) shows that the poor nutritional status of toddlers from fishing families is 80% greater than that of toddlers from farming families. The risk factor most strongly associated with stunting in coastal areas is low levels of protein adequacy (Leo et al., 2018)

A strategy that can be implemented is to develop a local food movement based on various values and motivations, such as environmental preservation, healthy lifestyles, utilisation of local biological resources, respect for local farmers, and public awareness (Dwiartama et al., 2020; Khumaera, 2020). Society's social economy and culture can influence the nutritional intake of society and individuals. The environment has a major influence on energy and nutritional intake (Singh Sekhon, 2014).

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Socio-economic and cultural society can influence the nutritional intake of society and individuals. The environment significantly influences energy and nutritional intake (Singh Sekhon, 2014). The problem is whether the policies/strategies implemented are effective enough; therefore, research examining the relationship between policies and the prevalence of stunting is crucial.

Efforts to reduce nutritional problems must be handled cross-sector at all levels. Mothers and pregnant women must be provided with knowledge about nutrition and pregnancy and exclusive breastfeeding for healthy mothers. The prevalence of very short and stunted toddlers in Indonesia is 29.9%, and in Bengkulu Province is 27.9% (Ministry of Health, 2018).

There are various strategies to overcome the problem of stunting; one of the strategies for achieving food security is food diversification, which can be done with the Local Food Development program to increase food availability, quality and diversification by exploring the potential of local food in increasing availability to meet the consumption needs of quality, diverse and affordable food at the household level. Strategies that can be implemented in developing the local food movement are based on various values and motivations, such as environmental preservation, healthy lifestyle, utilization of local biological resources, respect for local farmers, and community awareness (Dwiartama et al., 2020; Khumaera, 2020).

METHODS

This study used a mixed method, quantitative and qualitative approach, combining them into one piece of information to interpret the overall results. This research was conducted using mixed methods, quantitative and qualitative approaches, combining the two into one piece of information to interpret the overall results. The research technique surveyed coastal families in 6 districts and one city in Bengkulu province with a sample of 478 households. A quantitative approach was taken to analyze food security, a determining factor in the incidence of stunting in toddlers. Data were collected using a list of questions arranged according to the topics collected through interviews, observations, and focus group discussions. Data analysis uses Partial Least Square Structural Equation Modeling (SEM PLS) analysis.

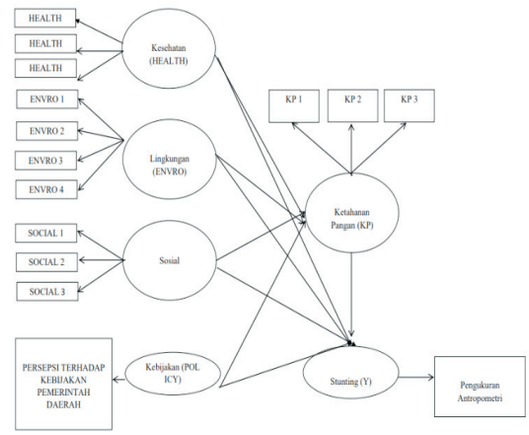

Figure 1. Development of a Research Hypothetical Model

Information:

KP : RT Food Security
KP1 : Diversity
KP2 : Food Quantity Analysis
KP3 : Food Quality Analysis
HEALTH : Health
HEALTH : Distance access to health facilities
HEALTH 2 : Access to healthcare facilities
HEALTH 3 : Ownership of Health Insurance
ENVRO : Environment
ENVRO 1 : Access to clean water
ENVRO 2 : Physical quality of water
ENVRO 3 : Access Sanitation
ENVRO 4 : Waste disposal
SOCIAL : Social Determinants
SOCIAL1 : Parental Education
SOCIAL2 : Mother Knowledge
SOCIAL3 : Level of Family Income
POLICY : Policy
POLICY1 : Perception of Local Government Policy
Y : Stunted
Y1 : Anthropometric Measurements

This study uses the Structural Equation Modeling (SEM) method with the Partial Least Square (PLS) approach, often called SEM-PLS. In the first condition of internal consistency, this

study uses a parameter, composite reliability (CR), which has a threshold value of 0.700, with each outer loading value. The indicator for each variable is at least 0.500. Then, it is necessary to test the multicollinearity of the indicators with the criterion value of the variance inflation factor (VIF) of less than five (<5). Indicators with an outer loading value of less than 0.500 and/or a VIF value greater than five (> 5) are excluded from the model.

RESULTS AND DISCUSSIONS

We are analyzing the influence of food security and social, health, environmental and household food security factors on stunting in children aged 12-59 months in coastal households in Bengkulu Province.

From the initial measurement model, some indicators do not meet the outer requirements loading and composite reliability requirements, such as the indicators h3_transportation and e1_air clean, which have outer values loading respectively of -0.229 and 0.072 which is far from the minimum limit of 0.500. These indicators need to be issued to produce a good model. Evaluation of measurement models that have issued indicators that do not meet internal consistency requirements is presented in Table 2, with all indicators of outer loadings, internal consistency, and non-multicollinearity fulfilling the requirements.

From Figure 2, the final model of the relationship between variables shows that nutritional status can be reflected from the anthropometric indicators of weight/height, weight/age and height/age. As expected, all the manifest variables from the nutritional status indicators had a positive effect. H/A contributed 0.779 to the incidence of stunting. Sanitation is an indicator that positively influences the environment, giving a contribution of 1,000. The distance from the house to the health facility can have a positive influence because the distance from the house that is too far can affect the condition of the community in obtaining health services, which will also affect the incidence of stunting. In contrast, food diversity (0.910) and food quality (0.644) affect food security (0.441), which is reflected in the incidence of stunting. Respondents' perceptions of society and government in policy negatively influence

Table 1. Evaluation of the Initial Measurement Model

Variable	Indicator	Outer Loading	CR	VIF
Stunting	W/H	0.923	0.851	1.897
	W/A	0.722		1.331
	H/A	0.775		1.640
Environment	e1_airclean	0.072	0.218	1.157
	e2_qualityair	-0.049		1.006
	e3_sanitation	0.994		1,010
	e4_trash	-0.105		1.153
Health	h1_insurance	-0.063	0.169	1.137
	h2_distance	0.940		1.035
	h3_ transportation	-0.229		1.106
Food security	kp1_ diversity_ food	0.903	0.667	1.124
	kp2_ quantity_ pangan	0.624		1,082
	kp3_kualitas_ pangan	0.315		1,043
Policy	p1_ community	0.711	0.733	1.136
	p2_ government	0.855		1.152
	p3_legislatif	0.483		1.072
Social	s1_ knowledge_ mother	0.891	0.746	1.051
	s2_revenue	0.639		1.051

From Table 1 above, the following equation can be derived:

Stunts = 0.923 (W/H) + 0.722 (W/A) – 0.775(H/A).....(1)

Environment = 0.072 e1_airClean – 0.049 e2_k.air + 0.994 e3_ sanitation – 0.105 e4_sampah.....….....(2)

Health = 0.063 h1_insurance + 0.940 h2_distance–0.229 h3_ transportation.....……..(3)

Food Security = 0.903 kp1_kerag_p + 0.624 kp2_quantity_p + .315 kp3_quality_p …...…..(4)

Policy = 0.711p 1_ Society + 0.855 P 2_ Government + 0.483_ legislature .....….…..….....(5)

Social = 0.891s 1_ mother_knowledge + 0.639s 2_ income .....…….....(6)

stunting and social variables related to mothers' knowledge and family income.

The second and third criteria are convergent validity and discriminant validity. Convergent validity evaluation uses average variance extracted (AVE) criteria with a threshold of

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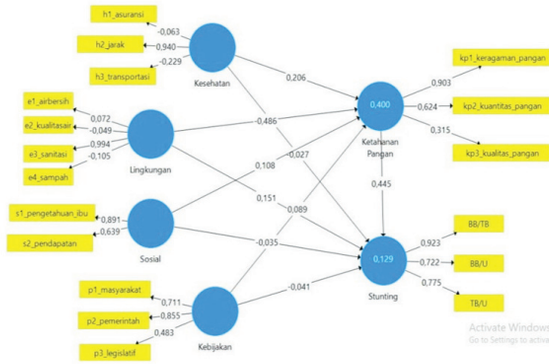

Figure 2. Initial Model of Relations Between Variables (Outer Loadings, Path Coefficients and P-Values).

Table 3. Evaluation of Convergent Validity

Variable	AVE
Policy	0.658
Health	1,000
Food security	0.621
Environment	1,000
Social	0.601
Stunt	0.658

Table 2. Evaluation of the Final Measurement Model

Variable	Indicator	Outer Loading	CR	VIF
Stunt	W/H	0.924	0.851	1,897
	W/A	0.715		1,331
	H/A	0.779		1,640
Environment	e3_sanitation	1,000	1,000	1,000
Health	h2_distance	1,000	1,000	1,000
Food security	kp1_diversity_food	0.910	0.761	1,078
	kp2_quantity_pangan	0.644		1,078
Policy	p1_community	0.748	0.793	1.116
	p2_government	0.869		1.116
Social	s1_knowledge_mother	0.889	0.746	1,051
	s2_revenue	0.641		1,051

Table 4. HTMT Discriminant Validity Evaluation

	Policy	Health	Food Security	Environment	Social	Stunt
Policy						
Health	0.195					
Food security	0.684	0.463				
Environment	0.524	0.074	0.819			
Social	0.764	0.194	0.779	0.456		
Stunt	0.064	0.072	0.461	0.079	0.196	

0.500. Discriminant validity evaluation can use Heterotrait-Monotrait (HTMT). HTMT is considered more reliable in identifying validity. The HTMT has a maximum threshold of 0.900.

Based on Table 3, it is obtained that all AVE values exceed 0.500. The following table presents the HTMT discriminant validity evaluation matrix. All values of the matrix have a range of less than 0.900, which means there is no problem with discriminant validity in this study.

The study used 2.000 bootstrapping analysis methods (random re-sampling) from the questionnaire data to evaluate the path coefficient and R^2. Aims to minimize the problem of abnormal research data. The path coefficient describes the formation of linkages between constructs, while R2 describes how much influence the construct has in explaining its endogenous variables. As the hypothesis is developed, the evaluation of the structural model uses a two-tailed p-value.

Table 5. Model Hypothesis Testing Results

Variable relationship	Betas (β)	Statistics t	p-values	Information
Food Security → Health	0.237	7.157	<0.001	Significant
Stunting → Health	-0.040	0.963	0.336	Non-significant
Food Security → Environment	-0.492	12.846	<0.001	Significant
Stunting →Environment	0.155	2.781	0.005	Significant
Social →Food Security	0.076	1.778	0.076	Non-significant
Social →Stunting	-0.021	0.346	0.729	Non-significant
Food Security →Policy	0.085	1.979	0.048	Significant
Stunting →Policy	-0.035	0.634	0.526	Non-significant
Food security→ stunt	0.441	7.971	<0.001	Significant

The processing results show a significant favorable influence on food security with a value of β = 0.237, t value = 7.157, and p-value <0.05. Health has no significant effect on stunting with a value of β= -0.040; t value = 0.963, and p-value > 0.05. Environmental aspects have a significant adverse effect on food security (β= -0.492; t value = 12.846; and p-value < 0.05) and a significant positive effect on stunting (β= 0.155; t value = 2.781; and p-value <0.05). The social aspect has a non-significant effect on both food security and stunting. The policy aspect positively affects food security (β= 0.085; t value = 1.979; and p-value <0.05) but is non-significant on stunting. Food security significantly affects stunting (β= 0.441; t value = 7.971; and p-value <0.05).

The R^2 value of the processing results was obtained at 0.398 for food security and 0.127 for stunting. Each of these values can be classified as moderate and weak. Specifically, this also means that health, environmental, social and policy aspects explain 39.8 % of the factors influencing food security in the research model. The health, environmental, social, policy, and food security aspects only explain 12.7% of the factors influencing stunting in the research model.

Structural Model Equations

Food security = 0.237 (health) + (-0.492) (environment) + 0.085 (policy) + 0.424 (error) = 0.27.....(1)

Based on the structural model equation above, it can be explained that food security against stunting is influenced by health by 0.237, environment by -0.492 and policy by 0.085 with an error rate of 0.424. Thus, overall food security is influenced by health, the environment and policies of 0.27.

Stunting = 0.005 (environment) + 0.000 (food security) + 0.393 (error)

= 0.398.....(2)

Evaluation of model fit Apart from the path coefficient and R2 value, several other criteria are used, especially to evaluate the suitability of the resulting model. Several parameters are used, such as the value of f two, which measures the effect of each exogenous variable on endogenous variables, standardized root mean square residual (SRMR), and Stone-Geisser (Q^2). These criteria are presented in Table 6.

All model fit criteria give good results. SRMR value of 0.094 is still below the threshold of 0.100. Q2 values for food security and stunting are all greater than zero as a threshold. Meanwhile, all f^2 values for the independent variables are in the range of 0.000-0.332, which means that the effect of exogenous on endogenous variables varies in the very low to large categories.

Table 6. Results of Evaluation of the Fit Model

Variable	R 2	SRMR	Q 2	f 2 Food security	f 2 stunt
Policy	-		-	0.010	0.001
Health	-		-	0.090	0.002
Food security	0.398		0.240	-	0.135
Environment	-		-	0.332	0.017
Social	-		-	0.008	0.000
Stunt	0.127	0.094	0.068	0.010	0.001

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Outer loading result 1 shows an outer loading value still below 0.5, so indicators with an outer loading value below 0.5 must be removed. Research by Urke et al. (2013) shows that the highest incidence of stunting occurs in rural areas compared to urban and coastal areas. Research by Leo et al. (2018) and Ikhtiarti et al. (2019) shows that the risk factors for stunting in mountainous and coastal areas are based on energy adequacy levels, protein adequacy levels, Fe adequacy levels, low history of exclusive breastfeeding, environmental sanitation, health services, caregiver knowledge. The importance of a policy approach to achieving food security and stunting, Jiren et al. (2020) examined farmers in Ethiopia as an essential focus in ensuring food security. Food insecurity in the household and menu composition that is not nutritious, unbalanced and does not vary in quality and quantity can cause stunted growth and nutritional deficiencies in toddlers (Tessema et al., 2013).

Correctly mapping nutritional status problems for toddlers so that nutritional improvement programs do not increase nutritional problems at the next age. This strategy focuses on increasing household food security and food diversity using quantitative and qualitative analysis (Torlesse et al., 2016). Also, by taking a policy approach to achieve food security (Jiren et al., 2020), Transportation is crucial in supporting community access to health services. Ideally, community outreach to health service facilities should be carried out regularly.

Poor environmental sanitation with access to clean water, use of inadequate latrines and low compliance with hand washing behavior have contributed to the increase in infectious diseases. This infectious disease can cause impaired food absorption, which results in nutritional disorders and long-term impacts. Prolonged nutritional disorders affect the linear growth of toddlers, such as stunting (Tentama et al., 2020).

The research results showed that the research locations mostly had goose-neck latrines in areas with and without extensive water access. Access to clean water and water quality are primarily moderate and reasonable. Actions to improve the environment are necessary; the goal is to make the environment healthy for all living things. Thus, a healthy environment can influence the quality of life and health of those who live there (Celesta & Fitriyah, 2016). A poor environment in terms of sanitation, drinking air, and population density also stunts children's health due to unhealthy behavior and low health knowledge (Aisyah & Suyatno, 2019). Schmidt's (2014) research shows that in ASIAN countries, children who live without sanitation, hygiene, and clean drinking water do not grow well compared to children who receive these facilities. Environmental risk at different levels considers how the environment interacts with nutrition related to stunting (Vilcins et al., 2018).

Low family income is also possible because residents around the coast have a relatively low economic level; where during the western season, some fishermen do not go to sea, and most of them only depend on fish in the sea for their livelihood (Kristiyanti, 2016). Research by Arlius, Sudargo, and Subejo (2017) shows that food security and the nutritional status of children under five are closely related; if the family lacks food, it will affect their nutritional status. Toddlers need a balanced nutritional intake to prevent stunting by increasing maternal nutritional knowledge (Yuliantini et al., 2022). It is crucial for parents to pay more attention to parenting patterns, especially in the variety of food served (Aisyah, Suyatno, 2019). Low family income is also possible because residents around the coast have a relatively low economic level; where during the western season, some fishermen do not go to sea, and most of them only depend on fish in the sea for their livelihood (Kristiyanti, 2016). Research by Arlius, Sudargo, and Subejo (2017) shows that food security and the nutritional status of children under five are closely related; if the family lacks food, it will affect their nutritional status. Toddlers need a balanced nutritional intake to prevent stunting by increasing maternal nutritional knowledge (Yuliantini et al., 2022). It is crucial for parents to pay more attention to parenting patterns, especially in the variety of food served (Aisyah, Suyatno, 2019).

Research shows that coastal families in Bengkulu Province, both in locus and non-locus areas, are mainly secure due to food diversity and analysis of food quantity in the medium vulnerable and medium food quality categories, but almost half of the food quality analysis is not utilized.

Family food security is the family's ability to meet the food needs of household members in terms of quantity, quality, and variety by local culture. In contrast, family food security is reflected in the family's availability, purchasing power and affordability in fulfilling food (Natalia et al., 2013). Likewise, research by Roaedi et al. (2014) states that there is a relationship between the level of household food security and the nutritional status of children under five.

Research conducted by Damayanti and Khoirudin in 2016 stated that there are things that can influence food security in an area, namely income, the education level of the head of the household, and the number of individuals in the family. A good influence on food security if it is in a more positive direction. Income is an influential component when deciding the amount of financial use, the family can use to provide household food. If income increases, the food consumed can vary, which will determine better nutritional education (Aritonang et al., 2020). Household food insecurity, low maternal education and *Trichuris trichura* infection are some of Ethiopia's main factors causing malnutrition (Wolde et al., 2015). Based on the Spatial Error Model (SEM), seven parameters were significant at the 10% level. The SEM model produces an AIC of 165.11, considered better than the OLS method regression model, which produces an AIC of 175.53 (Revildy et al., 2020). Nur Susanti's research (Nur Susanti, 2022) shows that handling stunting needs to be carried out optimally by implementing two specific and sensitive interventions. Active involvement of all parties, including the minor elements of the village, starts from communizing perceptions and interests, which are communicated routinely and measurably (there is ongoing evaluation and monitoring to determine the progress of program development). The quality and quantity of human resources from technical implementers so that stunting can be handled quickly and precisely. So, the design of stunting prevention strategies in coastal households is strengthened by collaborative public action partnerships involving multiple factors, sectors and actors (PPN/Bappenas, 2019).

CONCLUSION

Analysis of food security and social, health, environmental and household food security factors on the incidence of stunting in children aged 12 - 59 months in coastal households in Bengkulu Province shows that food security significantly influences stunting.

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DIFFERENCES IN MACRONUTRIENT AND MICRONUTRIENT INTAKE OF STUNTED TODDLERS IN RURAL AND URBAN AREAS OF BENGKULU PROVINCE

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ABSTRACT

Stunting prevalence in Kepahiang District is the highest compared to other districts. In Bengkulu, the incidence rate is lower than in other districts. Dietary intake is a direct factor causing stunting. This study examines the differences in macronutrient and micronutrient intake in stunted toddlers in rural and urban areas of Bengkulu Province. The study, with a cross-sectional design, was conducted from August to September 2020. A sample of 134 toddlers aged 12-24 months was selected using accidental sampling. Dietary intake data were collected using the Semi-Quantitative Food Frequency Questionnaire (SFFQ), and other data were collected through questionnaires. The collected data were analyzed using univariate and bivariate analyses with T-tests and Mann-Whitney tests. Macronutrient intake in stunted toddlers in rural areas was lower than in urban areas. Micronutrient intake in rural areas was also lower than in urban areas, except for vitamin A. Statistically, there were no differences in macronutrient (carbohydrates, proteins, fats) and micronutrient (vitamin A, calcium, phosphorus, iron, zinc) intake between rural and urban toddler in relation to stunting ($p > 0.05$). Based on the data obtained, the overall nutrient intake provided to the toddlers has not met the toddlers' nutritional needs. Regular counselling sessions from house to house for mothers with stunted toddlers are necessary. This would enable mothers to understand better their toddlers' dietary needs and how to monitor their growth.

Keywords: Intake, Macronutrients, Micronutrients, Toddlers, Stunting

INTRODUCTION

Malnutrition is characterised by over- or under-nutrition, which imposes a significant financial burden on the healthcare system(Kizilyildiz et al., 2016). In 2020, it is estimated that 149 million children under the age of 5 will be stunted, a condition characterized by being below the expected height for their age on a global scale. It is estimated that malnutrition is the cause of death in about 45% of all cases involving children less than 5 years old. This is especially true in countries with low or middle incomes. At the same time, rates of overweight and obesity in children are also increasing in the same countries (WHO, 2021). In general, 99 million micronutrient-deficient children (aged 6-59 months) live in South Asia, 98 million in Sub-Saharan Africa, and 85 million in East Asia and the Pacific (Stevens et al., 2022).

The government has established five pillars to address stunting, including visionary and committed leadership, national education that leads to behavior change, integrated program at all levels of government and food and nutrition sensitivities (Badan Ketahanan Pangan Kementrian Pertanian, 2019). These efforts must be carried out integrated to achieve maximum results. Based on the results of SSGI 2021, stunting nationally has decreased by 1.6%/year, from 27.7% in 2019 to 24.4% in 2021. Most of the 34 provinces showed signs of decline compared to the previous year (Kemenkes RI, 2021).

Toddlers who face stunting often lack proper nutrition. Infectious diseases can also be a significant cause of this problem. In addition, parental health characteristics and background also play an essential role in the development of stunting in children (Ismawati et al., 2020). Food intake and infectious diseases are direct factors in the onset of nutritional problems. The nutrient intake of children under five must fulfil their needs to avoid stunting. Based on observations, children with stunting problems tend to consume foods such as poultry, eggs, and fruits less frequently.

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This is different from children who are not stunted, who generally have a pattern of consuming these foods with a more frequent frequency. The lack of consumption of these nutritious foods can be one of the factors that cause growth problems in children (Mahfouz et al., 2022).

Based on the geographical and socio-economic characteristics of the region, stunting was found to be more common in rural areas than in urban areas. Certain factors in rural areas, such as limited access to health services, income inequality, and possibly less food availability and diversity, may influence the higher prevalence of stunting there compared to urban areas (Kalinda et al., 2023; Sserwanja et al., 2021; Tadesse et al., 2023).

Bengkulu Province is one of the regions in Indonesia that also faces nutrition issues in children under five. Data in 2018 from e-PPGBM shows that the stunting rate among children under five reached 17.2%, while the rate of severe stunting children was 6.3%. Kapahyang district recorded the highest rate of stunted children under five with 28.2% and severe stunting children with 7.77%. Meanwhile, in Bengkulu City, the stunting rate of the under-fives was 10.7%. Based on this background, this study wants to see the differences in macronutrient and micronutrient intake in stunted toddlers in rural and urban areas.

METHODS

This research is an analytical survey with a cross-sectional design. The study is planned to take place from August to September 2020. The research location was selected based on predetermined criteria. An accidental sampling method was used to collect samples. The target population of this study were mothers with children aged 12-24 months in the August-September 2020 period. This age group was chosen purposively because it is in the first 1000 days of life period, a golden age for stunting prevention. The minimum sample size was calculated using Sample Size Determination in Health Sciences using 80% CI. The minimum sample based on that calculation was 63(Ogston et al., 1991). Furthermore, to minimize sample loss by adding 5% of the minimum sample, (Dettori, 2011) 67 samples were obtained in each group. In total, this study involved 134 respondents, divided into 67 toddlers from Sidodadi Health Centre (rural area) and 67 from Pasar Ikan Health Centre (urban area). The inclusion criteria were willingness to participate in the study and aged 12-24 months during the study period. Exclusion criteria included children with mental disorders or physical disabilities and children who were sick or receiving medical treatment. The variables studied include nutrient intake, which refers to the amount of food children consume, such as macronutrients including carbohydrates, protein, and fat, and micronutrients, including vitamin A, calcium, phosphorus, iron and zinc. In addition, stunting is defined as the level of a child's length/height as measured by age. To collect data on intake and nutritional status, the Semi-Food Frequency Questionnaire (SFFQ) tool and other data related to children's characteristics were used to measure their nutritional status. Data collection using semi-FFQ showed the diversity of foods generally consumed by the people of Bengkulu. There is no difference in the type of food between urban and rural communities. The collected data were then analyzed for univariate and bivariate. In the bivariate analysis, the T-test and Mann-Whitney test were used to determine the extent of the relationship between the independent variable and the dependent variable. In 2020, the Poltekes Ethics Committee of the Ministry of Health Bengkulu approved study protocol KEPK/093/19/2020. Health Research Ethics Committee confirms informed consent and instruments.

RESULTS AND DISCUSSIONS

All mothers under five are over 20 years old; in urban residents, mothers' height is mostly more than 150 cm (100%), higher education (82.09%), and mothers work more in rural than urban areas. For the characteristics of babies, most have birth weight and normal birth length both in rural and urban areas. In addition, the mother provides exclusive breastfeeding and early initiation of breastfeeding.

Based on the table above, the average carbohydrate intake of rural toddlers is 91.19 grams, while urban children's is 92.36 The average protein intake of rural toddlers is 31.1985, and

Table 1. Characteristics of Mothers and Toddlers in Rural and Urban

Variable	Rural		Urban	
	n	%	n	%
Mother Age (years)				
<20 years	0	0.0	0	0.0
≥20 years	67	100.0	67	100.0
Mother Height (cm)				
<150 cm	6	8,9	0	0.0
≥150 cm	61	91.0	67	100.0
Mother Education				
Low	40	59.7	12	17.91
Hight	27	40.3	55	82.09
Mother Occupation				
No	60	89.6	59	88.06
Yes	7	10.4	8	11.94
Birth Weight				
Low	7	5.2	3	2.2
Normal	60	44.8	64	47.8
Birth Length				
Short	11	8.2	5	3.7
Normal	56	41.8	62	46.3
Exclusive breastfeeding				
Yes	52	38.8	57	42.5
No	15	11.2	10	7.5
Early Breastfeeding Initiation				
Yes	50	37.3	62	46.3
No	17	12.7	5	3.7

Table 2. Distribution of Macronutrient and Micronutrient Intake of Rural and Urban Children in Bengkulu in 2020.

Variable	Mean	SD	Min	Max
Carbohydrate (g)				
- Rural	91.19	32.90	34.0	201.6
- Urban	92.36	33.11	33.6	203.4
Protein (g)				
- Rural	32.19	11.8	9.7	66.7
- Urban	38.13	16.2	11.2	93.7
Fat (g)				
- Rural	26.22	8.67	6.0	52.0
- Urban	26.73	9.89	8.2	50.0
Vitamin A (RE)				
- Rural	1192.38	912.66	105	4832
- Urban	1230.59	1063.71	70.8	8001
Calcium (mg)				
- Rural	277.0	225.2	56.0	11.55
- Urban	449.8	431.5	73.8	25.63
Phosphor (mg)				
- Rural	443.38	198.33	3.8	232.2
- Urban	557.45	378.29	2	975.0
Iron (mg)				
-Rural	5.71	3.06	1.9	16.5
-Urban	6.75	3.62	1.2	17.0
Zinc (mg)				
-Rural	3.39	1.46	1.3	9.75
-Urban	4.03	2.02	1.2	10.7
HAZ (SD)				
-Rural	-1.45	1.31	-4.05	3.67
-Urban	-1.01	1.61	-3.89	4.54

urban 38.134. The average fat intake of rural toddlers is 26.22, and urban 26.737. Rural children under two's average vitamin A intake were 1192.3896 RE, and urban 1230.59 RE. The average calcium intake of rural children under five is 277.01; for urban children, it is 449.77. The average phosphorus intake of rural children under five was 443.77, and for urban children was 577.456. The average iron intake of rural children under five was 5.71, and urban 6.75. The average zinc intake of rural children under five is 3.39 mg and urban 4.03. The mean nutritional status of rural children under five was -1.453 and urban -1.0151 (Table 2).

To answer the research objectives, the stunting variable was analyzed to see the nutritional and stunting status frequency distribution. The results of the analysis found that 41 people were stunted. Furthermore, of the 41 people with stunting nutritional status, 7 had severe stunting status, and 34 had short status, as shown in Table 3. The next analysis looked at differences in macronutrient intake and specific micronutrients in stunted children in rural and urban areas, which can be seen in Table 4.

Data from the table above show that the average carbohydrate intake of severe stunting

Table 3. Distribution of Nutritional Status of Rural and Urban Toddlers in 2020

Variable	Rural		Urban	
	n	%	n	%
Nutritional Status				
Not Stunting	46	68.6	47	70.1
Stunting	21	31.3	20	29.8
Stunting Status				
< -3SD (Severe stunting)	3	14.3	4	20.0
-3SD to <-2SD (Short)	18	85.7	16	80.0

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Table 4. Differences in Macronutrient and Micronutrient Intakes among Rural and Urban Stunting Children in Bengkulu Province in 2020

Variable	> -3SD (Severe Stunting)					-3 SD s.d < -2SD (Stunting)					p value
	n	mean	SD	Min	Max	n	mean	SD	Min	Max	
Carbohydrates (g)											
- Rural	3	79.3	59.6	41	148	18	205.04	453.12	47	201.6	0.40
- Urban	4	101.7	67.8	58	203	16	97.44	44.29	33	203.4	
Protein (g)											
- Rural	3	47.3	14.9	35	64	18	33	12.4	15	66	0.99
- Urban	4	43.2	34	18	93	16	34.18	12.2	12	55	
Fat (g)											
- Rural	3	21.0	11	9	32	18	28.4	10.2	14	52	
- Urban	4	18.3	6.29	11	24	16	26	7.8	8	39	0.99
Vitamin A (RE)											
- Rural	3	908.0	927.6	355	1979	18	1417	1320	105	4832	0.99
- Urban	4	710.3	602.6	70	1336	16	1216	800.6	103	1054	
Calcium (mg)											
- Rural	3	215.0	173.5	89	413	18	272	209	56	737	0.16
- Urban	4	787.0	1184.7	138	2563	16	331.2	240.39	103	1054	
Phosphor (mg)											
- Rural	3	498.0	225	266	772	18	498.2	240.5	185	975	0.68
- Urban	4	838.7	993.9	236	232.2	16	493.2	215.6	248	1054	
Iron (mg)											
-Rural	3	5.0	3.6	2	9	18	4.7	2.5	1	12	0.68
-Urban	4	4.2	2.21	1	6	16	5.6	3.6	1	15	
Zinc (mg)											
-Rural	3	3.0	2	1	5	18	2.83	1.33	1	12	0.85
-Urban	4	4.0	4.08	1	10	16	3.125	1.45	1	7	

toddlers in rural areas was 79.3 gram and in urban areas 101.7 gram, while the average carbohydrate intake of short toddlers in rural areas was 204.6 and in urban areas 204.61. Statistical tests showed no difference in the carbohydrate intake of stunted children in rural and urban areas (p-value = 0.80). The average protein intake of severe stunting toddlers in rural areas was 47.3 gram and in urban areas 43.25 gram, while the protein intake of short toddlers in rural areas was 33 gram and in urban areas 12.4 gram. Statistical test results showed no difference in the protein intake of stunted toddlers in rural and urban areas (p-value = 0.99). The average fat intake of severe stunting toddlers in rural areas was 21 gram and in urban areas 18.25 gram, while the fat intake of short toddlers in rural areas was 28.4 gram and in urban areas 26 gram. Statistical test results showed no difference in fat intake of stunted toddlers in rural and urban areas (p-value = 0.99).

The average vitamin A intake of severely stunted toddlers in rural areas is 908. In urban areas, it is 710.3 gram, while the vitamin A intake of short toddlers in rural areas is 1417 and in urban areas is 1216. Statistical tests showed no difference in vitamin A intake between rural and urban stunted children (p-value = 0.99). The average calcium intake of severe stunting toddlers in rural areas is 215 mg and in urban areas 787 mg, while the calcium intake of short toddlers in rural areas is 272 and in urban areas 331.2. Statistical tests showed no difference in calcium intake between rural and urban stunted children (p-value = 0.16). The average phosphorus intake of severe stunting toddlers in rural areas was 498 mg, and in urban areas, 838.7 mg. In comparison, the phosphorus intake of short toddlers in rural areas was 498.2 mg and in urban areas 493.3 mg. Statistical tests showed no difference in phosphorus intake between rural and urban stunted children (p-value

= 0.68). The average iron intake of severe stunting toddlers in rural areas was 5 mg and in urban areas 4.2 mg, while the iron intake of short toddlers in rural areas was 4.7 mg and in urban areas 5.6 mg. Statistical tests showed no difference in iron intake between rural and urban stunted children (p-value = 0.68). The average zinc intake of severe stunting toddlers in rural areas was 3 mg and in urban areas 4 mg, while the zinc intake of short toddlers in rural areas was 2.83 mg and in urban areas 3.125 mg. Statistical test results showed no difference in the protein intake of stunted toddlers in rural and urban areas (p-value = 0.85).

The amount of macro and micronutrients consumed by severe stunting toddlers is less compared to short toddlers in the village and the city. The nutritional intake of toddlers needs to be considered so that the dietary needs of toddlers are met. Stunted toddlers tend to consume fewer macronutrients (carbohydrates, protein and fat) than toddlers who are not stunted. (Elisanti et al., 2023; Limardi et al., 2022). In addition to micronutrients, toddlers need micronutrients to prevent stunting. Toddlers who consume less vitamin A, iron, calcium, phosphorus and zinc are more at risk of stunting. (Chairunnisa et al., 2018).

Children who are stunted due to inadequate nutritional intake. The cause of lack of intake is related to the level of maternal education; in research, it was found that maternal education in rural areas is lower, so the possibility of mothers not understanding the nutritional needs of children. In addition, food consumption is also related to production; working mothers will help the family economy. Most mothers have non-working status. This is in line with previous studies, which show that deficiencies in macronutrients and micronutrients are the main factors affecting the nutritional status of children in many countries (Verma & Prasad, 2021). The study found no differences between the intake of zinc and vitamin A nutrients between rural and urban children and the incidence of stunting, in line with previous research, which states that the consumption of nutritional supplements between rural and urban areas is not different (Sharif et al., 2020). In contrast to research conducted by Zou, which resulted in the findings of vitamin A intake between children living in cities and villages, there are differences. Urban children consume more vitamin A than rural children (Zou et al., 2023). Ssentongo study showed a significant association between vitamin A deficiency and linear growth failure in preschool children in Uganda (Ssentongo et al., 2020).

In this study, the calcium intake of children living in rural and urban areas showed no difference. This is in line with previous research, which states no calcium consumption difference between rural and urban areas (Zou et al., 2023). Calcium intake in rural areas was lowest compared to urban and metropolitan areas. In the metropolitan and urban groups, diets tended to be high in calories, containing more milk, dairy products, and vegetables than subjects in rural areas. Dietary calcium intake was significantly lower ($p<0.001$) in subjects in rural areas than in urban and metropolitan areas. (Harinarayan & Ramalakshmi, 2015; Valaei et al., 2017)

Phosphorus is crucial in bone mineralization, making it particularly important in the growth phase. Low levels of phosphorus consumption in respondents were associated with low consumption of animal products in both the case and control groups. However, the analysis showed no significant difference. This result is in line with other studies that found no correlation between phosphorus intake and the incidence of stunting in children aged 24-59 months. This indicates that several other nutrients need to interact with phosphorus. In the context of this study, it was found that only intake of phosphorus, vitamin A, and the proportion between calcium and phosphorus intake was adequate, while intake of other nutrients was considered insufficient (Wessells & Brown, 2012).

This study found no difference in iron consumption between children living in rural and urban areas. This contrasts previous studies that found iron intake was lower in rural children than urban children. The estimated FeBio intake in Mexican children aged 12 to 59 months was deficient (less than 1 mg per day) and negatively associated with low socioeconomic status and living in rural areas. We also found that iron absorption from food was less than 10%. This is because: 1) the majority of iron consumed by

our population was non-heme, which has lower absorption compared to heme iron; 2) there was high consumption of ingredients that inhibit iron absorption, such as phytate and calcium, and low consumption of meat, which can increase iron absorption (Venegas-Aviles et al., 2020).

This study found no difference in zinc consumption between rural and urban toddlers, which aligns with Zou's findings. Zou's study found that serum zinc levels in village children and adolescents tended to be higher than in cities. The specific cause of this difference requires further research. The primary source of zinc in our body comes from food. To avoid zinc deficiency, it is recommended to have a balanced diet and consume red meat, which is a good source of zinc, and some seafood, such as oysters, but in moderation. (Zou et al., 2023). Another study conducted in Bengkulu City found that fish biscuits are foods rich in zinc and can improve the nutritional status of toddlers. (Yunita et al., 2022).

This study found no association between macro and micronutrient intake and the incidence of stunting. In contrast to Siringoringo study, where carbohydrate and protein intake were associated with the incidence of stunting in under-fives, this did not apply to fat consumption. Likewise, Vitamin A, Calcium, Iron and Zinc were related to stunting in under-five children (Siringoringo et al., 2020). The study conducted by Suryani found the same thing: the intake of macronutrients and micronutrients is not associated with stunting in toddlers (Suryani et al., 2022). This could be because all children under five who were analyzed were stunted. In addition, most of the nutritional needs of stunted toddlers have not been met. This study is in line with previous research that found no difference in the diversity of food consumption of short and severe stunting children. Differences in the variety of food consumed affect the adequacy of nutrients.(Rahmawati et al., 2020) In addition, the ability of families to meet food needs also affects the consumption patterns of stunted and severely stunted toddlers (Nkurunziza et al., 2017)

The limitation of this study are the sample size and recall bias, where mothers may forget the food given to toddlers. However, to anticipate memory bias by giving mothers free time to remember the food given to toddlers. If gaps in consumption patterns are found, confirmation will be repeated with the mother.

CONCLUSION

Each toddler has different nutritional needs. Stunted toddlers in urban areas consume more macro and micronutrients than in rural areas. Education regarding the need for macro and micronutrients and sources of nutrients in food needs to be carried out, especially in rural areas.

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THE EFFECT OF STORYTELLING METHOD THROUGH FAIRY TALE BOOK MEDIA ON CHILDREN'S KNOWLEDGE AND ATTITUDES ABOUT FRUIT AND VEGETABLE CONSUMPTION

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ABSTRACT

In Indonesia, fruit and vegetable consumption is still low, especially among school-age children. culture, environment, socioeconomic, and ethnic background are factors that influence vegetable consumption. Education can help improve children's knowledge and perceptions about fruit and vegetable consumption. This research aims to determine the effect of the storytelling method through fairy tale books on children's knowledge and attitudes regarding fruit and vegetable consumption in MIN 2 Bengkulu City. This research shows that fairy tale book media intervention students' knowledge and attitude showed significant effect with p-value < 0.001. So that it can be concluded that storytelling method through fairy tale book media can be an alternative learning method in the classroom to increase children awareness, knowledge, and attitudes about the importance of consuming and vegetables.

Keywords: consumption, fruits, vegetables, fairy tale, book media, storytelling

INTRODUCTION

Vegetables and fruits contain a lot of antioxidants acted as bioactive compounds that help prevent cell damage and improve metabolism. The antioxidant content in fruits and vegetables can fight oxidant compounds and free radicals that can weaken the body health (Ministry of Health, 2018). Balance nutrition guidelines in Indonesia includes 150 grams of fruit (equivalent to three Ambon bananas, one and a half papayas, or three medium oranges) and 250 grams of vegetables (equivalent to two cups or two servings of vegetables after cooking and draining). It is recommended to eat at least 300-400 grams in total of vegetables and fruits per person per day for Indonesians, especially infants and school-age children, and no less than 400 to 600 grams per day for adults and adolescents, with about two-thirds of the recommended amount coming from vegetables (World Health Organization, 2018).

In Indonesia, fruit and vegetable consumption is still low, especially among school-age children. According to the results of the Riskesdas 2018, average fruit and vegetable consumption is only 4.5% from overall calorie intake, with consumption levels of fruit and vegetable of children even lower, at only 4% from total calorie intake. Bengkulu Provincial Basic Health Survey (2018) showed that 12.20% of 5 to 9 year olds children and 9.35% of more than 10 years old children consuming less than recommended servings of fruits and vegetables. People are said to have adequate fruit and vegetable intake if they have consumed at least 5 servings of fruit and vegetables (a combination of vegetables and fruit) per day (Riskesdas Bengkulu, 2018).

Data from the Bengkulu City Health Office (2021) on child health screening from 12 primary school showed 19.54% children consumed low fruit and vegetable. Stated that culture, environment, socioeconomic, and ethnic background are factors that influence vegetable consumption (Bengkulu City Health Office, 2021). Without parental coercion, children are willing to eat vegetables and fruits if they understand the purpose of their intake.

To encourage improvement of fruit and vegetable consumption, the training process for children needs to used media as an effective and efficient material dissemination tool (Prastikaningrum et al., 2020). Media access in health education can help children become more active because it uses their five senses and involved their full psychomotor potential (Fitryadi, 2020).

Education can help improve children's knowledge and perceptions about fruit and vegetable consumption. Storytelling is one way

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to provide information to children about the importance of consuming fruits and vegetables. to hone imagination and provide when a child listens to someone's speech, the person's brain reacts to do the same thing the person said, which called mirroring. A child's brain activity is similar to that of a fairy tale reader, as he or she imagining the story being told to them (Fitriyani et al., 2022).

Storytelling is suitable for children aged 3-12 years. Children at this age love fairy tales, fantasy, folklore, superhero stories, and stories about science. The time needed for storytelling is 5-25 minutes. Storytelling can be told or retold many times when eating vegetables and fruits. (Widyastuti, 2020). To determine the influence of the storytelling method through fairy tale books on children's knowledge and attitudes regarding fruit and vegetable consumption in MIN 2 Bengkulu City.

MATERIALS AND METHOD

This quantitative research uses pre-experimental method and the questionnaire by research Mitsla (2019). Independent variable in this research is the of telling stories using fairy tale book media and dependent variable is the knowledge and attitude of children. The data analysis process uses the Wilcoxon signed rank test.

RESULTS AND DISCUSSIONS

Characteristics of Respondents

Table 1. Characteristics of students based on age, gender, and mother's education.

Variable	(n)	(%)
Age		
8	3	9.4
9	8	25.0
10	10	31.3
11	9	28.1
12	2	6.3
Gender		
Girls	16	50.0
Boys	16	50.0
Mother Education		
Elementary School	3	9.4
Senior High School	21	65.5
College	8	24.9

Table 2. Mean Knowledge Before and After the Fairy Tale Book Intervention

Variable	(n)	Mean ± SD	Min–Max
Before	32	77.19 ± 12.504	50–100
After	32	94.06 ± 7.121	80–100

Mean Attitude Before and After Being Given Fairy Tale Book Media

Table 3. Mean Attitudes Before and After the Fairy Tale Book Media Intervention

Variable	(n)	Mean ± SD	Min–Max
Before	32	34.94 ± 4.303	23–40
After	32	38.19 ± 1.925	34–40

The Effect of Fairy Tale Book Media on Children's Knowledge and Attitudes of MIN 2 Bengkulu City

Table 4. Effect of Fairy Tale Book Media on Children's Knowledge and Attitudes of MIN 2 Bengkulu City

Variable	Before	After	ΔMean	p value
	Mean ± SD	Mean ± SD		
Knowledge	77.19 ± 12.504	94.06 ± 7.121	16.87	<0.001
Attitude	34.94 ± 4.303	38.19 ± 1.925	3.25	<0.001

This study shows that storybooks can improve the fruits and vegetables. Interventions with fairy tale book media can increase the average knowledge from 77.19 to 94.06 and attitudes from 34.94 to 38.19.

The results of this study are consistent with previous research by Tiara, Nur, et al. (Tiara et al., 2019) that showed 90.6% increment in good knowledge after intervention using storybooks. The results of this study are also in line with research conducted by Fitryadi (2020) at SD IT Thariq Bin Ziyad, namely, the attitude score before being given media intervention from 82.00 increased to 89.00 after being given storybook media intervention.

CONCLUSION

The mean value of knowledge about fruit and vegetable consumption through fairy tale book media increased, and attitudes about fruit and vegetable consumption through fairy tale book

media increased. There was an effect of fairy tale book media at MIN 2 Bengkulu City.

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Papers submitted to the editorial are self-generated papers, scientific, contain contemporary issues and unpublished. To avoid duplication, the editor does not accept papers that are also sent to other journals at the same time for publication.

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II. FORMAT MANUSCRIPT WRITING

Manuscript should be typed using MS Word program, 1.5 space on A4 paper size with the left should be 4 cm length, while right, top, and bottom margin should be 3 cm length. The font used should be Times New Roman, sizing 16 pt for the title, 10 pt for author's name, 9 pt for author's identity, 11 pt for abstract and main content, and 9 pt for tables and figures. Specifically, for tables, single spaced should be used. The contents of the paper are made in two columns. The length of article should not below 10 pages and should not exceed 15 pages, send both in print-out and softcopy. Authors should also follow the manuscript preparation guidelines.

III. WRITING SYSTEM

Title in English

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Abstract in English (include keywords)
Introduction
Methods
Results and Discussion
Conclusion and Suggestion
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Annotation

a. Title and Author's Identity

Title is written as clear, concise, informative, and understandable as possible. The maximum length of the title consists of 20 words. The author's name and identity (affiliation, city), are included

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b. Abstract and Keywords

Abstracts are written in English in Bahasa Indonesia and in Times New Roman 11 pt, single-spaced. Abstracts consist of no more than 250 words length, written in 1 (one) paragraph. Keywords are written below the abstract, consist of 3-5 specific words that are consistently used in the manuscript. Avoid using quotations and the use of abbreviations in writing abstracts.

Abstracts contain brief information regarding the background of the study, objectives of the study, brief summary of the methods (research design, subject selection, methods of data analysis), results, and discussion (use the most specific data in answering the objectives of the study, along with the signification results of statistical test, if any), conclusion as well as the significance/urgency of obtained conclusion..

c. Manuscript

The core section of a manuscript consists of subtitles: introduction, methods, results and discussions, and conclusion and suggestions.

Introduction

The introduction part comprises the background of the study, research intention, research questions, previous studies and the objectives of the study.

Methods

The methods section consists of the steps completed by the author in doing the research, elaborated completely, yet concisely, begins from research design (including the sampling methods, if any), samples, materials, & tools used, working methods, techniques of data collection, and data analysis.

Methods also include agreement from ethical commission (research involving human subject and/or animal experience).

Results and Discussions

Results of the study provide clear and concise results that are in line with the objectives of the study. The results can be complemented with tables and figures to help explaining the results.

- Number and title of a table are placed above the table and are written in bold. Table numbering is done in sequence. The lines used in table are only in table head and bottom (without column lines) with single space. Further explanations regarding the data on the table, the explanation can be written below the table.
- Number and label of figures are placed below figures and are written in bold. Figures numbering is done in sequence.
- Sources of reference are placed below tables/figures for tables and figures cited from other references (other than research results).

Discussions explains research results, concisely, and clearly. Using relevant arguments to the research topic and answering the research questions. Employ references (other research results or theories) to support the explanation of research. If there is abbreviation, use the standardized

abbreviations. The use of abbreviations must be preceded by the extensions first. Foreign terms are written in *Italics*. Numbers written in the beginning of a sentence are written in a word.

Conclusion

Conclusion elucidates important matters discussed in the result and analysis briefly, concisely, clearly, and answers research questions. Conclusion can be completed with suggestions (if necessary).

Acknowledgement (if necessary)

Acknowledgement given to person/institution who have important roles in conducting a research (for example, funders) and/or writing scientific manuscripts and includes explanations whether the research is part of a series of research in thesis/dissertation.

References

Writing references refers to the APA Referencing Guide 6th edition. [*Publication Manual of the American Psychological Association*. (6th ed.). (2010). Washington, D.C.: American Psychological Association]. References are arranged systematically and sorted alphabetically according to author's name. Generally, writing references is as follows:

Author, A.A., Author, B.B, & Author, C.C. (year of publication). *Title of publication: sub title*. (Edition [if not the first edition]). City of publication: Publisher.

A minimum of 80% of the literature used comes from 'up to date' sources (published no more than 10 years before scientific papers submitted to MGI). Unpublished sources, such as manuscripts or personal communication cannot be used as references for the writing.

EXAMPLES OF CITATION IN MANUSCRIPT

a. 1 author

Smith (2017) or (Smith, 2017)

b. 2 author

Smith dan Jones (2017) or (Smith and Jones, 2017)

c. 3 or more authors

Smith, et al (2017) or (Smith et al*.,* 2017)

EXAMPLES OF REFERENCES WRITING

a. **References from books**

- Contento, I. R. (2011). Nutrition education (2nd ed.). Sadburry, Massachusetts: Jones and Bartlett Publishers.
- Mahan, L. K., & Raymond, J. L. (2017). *Krause's food & the nutrition care process*. Canada: Elsevier Health Sciences.

b. **Books or reports composed by organizations, associations, or government agencies**

Kementerian Kesehatan. (2013). *Hasil Riset Kesehatan Dasar 2013.* Jakarta: Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan RI.

c. **Book chapters on a book that has editors**

Brown, J.E. (2011). Nutrition through the life cycle (4th Ed.). Janet Sugarman Isaacs, *Infant Nutrition* (pp. 223–225). Belmont, CA, USA: Wadsworth.

d. **Conference manuscript – online**
Bochner, S. (1996). Mentoring in higher education: Issues to be addressed in developing a mentoring program. Paper presented at the Australian Association for Research in Education Conference, Singapore. Retrieved from http://www.aare.edu.au/96pap/bochs96018.txt

e. **Manuscripts from a journal**
El-Gilany, A. H., & Elkhawaga, G. (2012). Socioeconomic determinants of eating pattern of adolescent students in Mansoura, Egypt. *The Pan African Medical Journal*, 13, 22. https://doi.org/10.4314/pamj.v13i1.

McDonald, C. M., McLean, J., Kroeun, H., Talukder, A., Lynd, L. D., & Green, T. J. (2015). Correlates of household food insecurity and low dietary diversity in rural Cambodia. *Asia Pacific Journal of Clinical Nutrition*, 24(4), 720–730. https://doi.org/10.6133/apjcn.2015.24.4.14

Diana, R., Sumarmi, S., Nindya, T. S., Rifqi, M. A., Widya, S., & Rhitmayanti, E. (2017). *Household Income and Unbalanced Diet Among Urban Adolescent Girls. Proceedings ofthe 4th Annual Meeting ofthe Indonesian Health Economics Association (INAHEA 2017)*.

f. **Thesis/Dissertation – printed version**
Hilgendorf, M. (2018). *Assessing malnutrition in liver disease patients being evaluated for transplant using the nutrition focused physical exam* (Unpublished master's thesis). University of Kentucky, Lexington, Kentucky.

Diana, R. (2014). *Pengaruh pemanfaatan pekarangan dan penyuluhan terhadap konsumsi sayur dan asupan gizi rumah tangga dan balita.* Institut Pertanian Bogor.

g. **Thesis/Dissertation – web version**
Hilgendorf, M. (2018). *Assessing malnutrition in liver disease patients being evaluated for transplant using the nutrition focused physical exam* (Master's thesis, University of Kentucky, Lexington, Kentucky). Retrieved from https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1065&context=foodsci_etds

h. **Web page (if referenced are a few pages on the same web page, use the homepage page)**
SStatistic Bureau of East Java. (2018). Number and Percentage of Poor, P1, P2 and Poverty Line By Regency / Municipality, in 2017. Retrieved November 22, 2018, from https://jatim.bps.go.id/statictable/2018/01/15/733/jumlah-dan-persentase-penduduk-miskin-p1-p2-dan-garis-kemiskinan-menurut-kabupaten-kota-tahun-2017.html

Example of tables:

Table 1. Characteristics of Patients in Malnutrition and Non-Malnutrition Groups

Karakteristik	Malnutrition (n=70)		Non-Malnutrition (n=233)		Total (n=303)	X^2	p value
	n	%	n	%			
Sex							
Male	38	54,3	117	52,5	155	0,070	0,790
Female	32	45,7	106	47,5	138		
Age							
<55 years old	48	68,6	151	67,7	199	0,890	0,180
≥55 years old	22	31,4	72	32,3	94		
Education							
Low	24	34,3	51	22,9	75	10,153	0,063
Middle	33	47,1	151	67,7	184		
High	13	18,6	21	9,4	33		

Table 2. Average of Nutrition Intake in Malnutrition and Non-Malnutrition Groups

Nutrition Intake	Malnutrition (Mean ± SD)	Non-Malnutrition (Mean ± SD)	t	*p value*
Calories	1328,1± 215,3	1482,9± 327,4	2,04	0,032
Protein	43,2±13,1	48,7±17,3	2,47	0,010

Example of a figure:

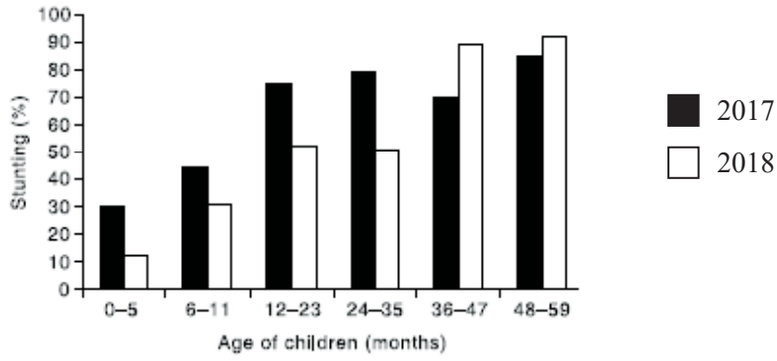

Figure 1. Changes in Stunting Prevalence (%) in Toddlers in Kalimantan

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