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## Bra Usage Duration and Breast Cancer Risk: A Case-Control Study

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### ABSTRACT

**Introduction:** Breast cancer is a disease feared by most women, with 2.3 million women worldwide being diagnosed with this disease. In 2024, Indonesia will relocate its capital to East Kalimantan Province, which currently has the second-highest (1%) prevalence of breast cancer cases in Indonesia. **Purpose:** Given the increasing prevalence of breast cancer, it is worthwhile to scientifically examine the relationship between the duration of bra usage, age at first bra usage, bra size suitability, and types of bras used in relation to the occurrence of breast cancer. **Method:** The study design used was a case-control study with a 1:1 ratio of 48 respondents (24 cases and 24 controls) selected through purposive sampling. The analysis employed chi-square and odds ratio tests. **Results:** The study revealed that the average age of the respondents was 45.25 years. Furthermore, the variables of bra usage duration (OR=2.333), age at first bra usage, bra size suitability, and bra type (OR=0.639) showed no association with the occurrence of breast cancer ( $\alpha > 0.05$ ). **Conclusion:** This research concludes that there is no association between bra usage and the occurrence of breast cancer in women in East Kalimantan Province. It is suggested to reduce the duration of bra usage to less than 24 hours to minimize the risk factors for breast cancer.



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## INTRODUCTION

Breast cancer is the most feared disease among women, second only to cervical cancer (Momenimovahed & Salehiniya, 2019). Even with access to the most advanced treatments available today, there is no guarantee of success in the fight against breast cancer. The fact that we have access to the most effective treatments does not change the reality of the situation. This is because women still pay insufficient attention to the topic of breast cancer, both in terms of prevention and early detection. This is one of the factors contributing to the high mortality rate among women (Grunfeld et al., 2002).

Globally, there are 685,000 deaths from breast cancer, with 2.3 million women being diagnosed with the disease (World Health Organization, 2021). Breast cancer is predominantly experienced in developed countries, with Belgium, the Netherlands, and Luxembourg having the highest number of cases (World Cancer Research Fund International, 2022). However, breast cancer in Indonesia ranks as the most prevalent cancer, accounting for 16.6% of new cases and the second-highest (9.6%) in terms of mortality (Globocan, 2020). The three provinces with the highest incidence of breast cancer are Yogyakarta (2.4%), East Kalimantan (1.0%), and West Sumatra (0.9%) (Nindrea et al., 2020). An interesting issue arises as East Kalimantan Province is set

to become the new capital of Indonesia in 2024, yet it ranks second highest in breast cancer cases.

Various factors contribute to the risk of breast cancer in Indonesia, such as menopausal age, age at first pregnancy, breastfeeding, family history of breast cancer, use of oral contraceptives, smoking history, overweight, obesity, high-fat diet, high-calorie diet, and physical inactivity (Fatmawati, 2019; Nindrea et al., 2020; Purwanti et al., 2021). However, there are online rumors on social media suggesting that bras are a cause of breast cancer (So et al., 2015). The book "Dressed to Kill" claims that women who wear bras for 24 hours a day have a 3 out of 4 chance of developing breast cancer, with a risk 125 times higher than women who never or rarely wear bras (Singer, 2018).

A bra itself is an undergarment that is worn by women on a daily basis. When adolescent girls enter puberty and experience menarche, they start wearing this garment. Considering the increasing prevalence of breast cancer, it is worth scientifically investigating these rumors. Based on this, the objective of this research is to determine the relationship between the duration of bra usage, age at first bra usage, bra size suitability, and types of bras used in relation to the occurrence of breast cancer.

## METHODS

This study utilized a case-control design. The total population of breast cancer patients affiliated with the Cancer Information and Support Center (CISC) in the entire East Kalimantan Province in 2019 was 45 cases. The Lemeshow formula was used to determine the sample size, resulting in a total of 24 respondents for the case group. With a 1:1 ratio, the total sample size became 48 respondents. Purposive sampling was employed to select the samples. The case samples were breast cancer patients affiliated with CISC in East Kalimantan, while the control samples were selected based on age matching from female patients in the internal medicine department of RSUD Abdoel Wahab Sjahranie Samarinda, who exhibited early symptoms such as breast pain. The inclusion criteria for the study were as follows: being diagnosed with breast cancer based on the respondent's acknowledgment of the doctor's diagnosis, being a member of the CISC community, and residing in the cities of Samarinda, Balikpapan, and Tenggarong. The exclusion criteria for the case samples were unwillingness or inability to communicate due to their health condition. The secondary data collection instrument utilized CISC membership cards, while the primary data collection involved respondent acknowledgment and a questionnaire consisting of respondent characteristics and questions regarding bra usage duration, age at first bra usage, bra size suitability, and types of bras used.

The operational definitions and objective criteria of this study can be seen in Table 1 below.

Table 1. Operational Definition and Objective Criteria

Variables	Operational Definition	Measurement Tool	Objective Criteria
Breast Cancer	A cancerous disease originating from the glands, ducts, and supportive tissues of the breast, excluding breast skin, characterized by the presence of lumps, concave skin, nipple	CISC membership and questionnaire	1. Breast cancer 2. Not breast cancer (Arafah & Notobroto, 2018)

Variables	Operational Definition	Measurement Tool	Objective Criteria
	retraction or deviation, and pain, tenderness, or special bleeding from the nipple.		
Duration of Bra Usage	The length of time spent wearing a bra per day	Questionnaire	1. $\geq 24$ hours 2. $< 24$ hours (Singer, 2018)
Age at first bra usage	Information about the time of initial bra usage	Questionnaire	1. $< 12$ years old 2. $\geq 12$ years old (Chen et al., 2015)
Bra Suitability	The appropriateness of the bra size based on the breast shape	Questionnaire	1. Suitable 2. Oversized (Hsieh & Trichopoulos, 1991)
Type of bra	Categorization of bras based on the material used for manufacturing	Questionnaire	1. Wired 2. Non-wired (So et al., 2015)

The analysis used in this study employed univariate analysis by calculating frequencies, followed by bivariate analysis using the chi-square test and odds ratio.

## RESULT

The average age of the respondents was 45.25 years, with the highest age group falling within the range of 46-50 years (12.5%). More than half of the breast cancer patients had a college education level (33.3%), while the majority of non-breast cancer respondents had a high school education level (35.4%). The majority of the respondents were homemakers, with 23% being breast cancer patients and 35.4% being non-breast cancer respondents. The highest number of respondents came from Samarinda City, with 29.2% in the case group and 50% in the control group.

Table 2. Characteristics of Respondents (n=48)

Variable	Case		Control		Mean
	n	%	n	%	
<b>Age (years)</b>					45.25
31-35	2	4.2	2	4.2	
36-40	4	8.3	4	8.3	
41-45	5	10.4	5	10.4	
46-50	6	12.5	6	12.5	
51-55	4	8.3	4	8.3	
56-60	1	2.1	1	2.1	
61-65	2	4.2	2	4.2	
<b>Education</b>					
Junior High School	0	0	1	2.1	
Senior High School	8	16.7	17	35.4	
College	16	33.3	6	12.5	
<b>Occupation</b>					
Civil servant	4	8.3	1	2.1	
Private sector	5	10.4	5	10.4	
Entrepreneur	4	8.3	1	2.1	
Housewife	11	23.0	17	35.4	



Variable	Case		Control		Mean
	n	%	n	%	
<b>Address</b>					
Tenggarong	6	12.5	0	0	
Balikpapan	4	8.3	0	0	
Samarinda	14	29.2	24	50.0	

Table 3. Bivariate Analysis of Variables (n=48)

Variable	Breast cancer		Not breast cancer		P value	OR
	n	%	n	%		
<b>Duration of Bra Usage</b>					0.248	2.333
≥24 hours	14	58.3	9	37.5		
<24 hours	10	41.7	15	62.5		
<b>Age at first bra usage</b>					0.050	N/A
<12 years old	5	20.8	0	0.0		
≥12 years old	19	79.2	24	100.0		
<b>Bra Size Suitability</b>					1.000	N/A
Suitable	23	95.8	24	100.0		
Oversized	1	4.2	0	0.0		
<b>Type of bra</b>					0.739	0.639
Wired	5	20.8	7	29.2		
Non-wired	19	79.2	17	70.8		

In this study, an analysis was conducted to determine whether there is a relationship between several factors related to bra usage and the occurrence of breast cancer in women. The results of the study showed that there is no significant relationship between the duration of bra usage within 24 hours and the occurrence of breast cancer. Although the prevalence of breast cancer was higher in women who used bras for 24 hours (58.3%) compared to those who used bras for less than 24 hours (41.7%), the analysis results indicated that this difference is not statistically significant.

Furthermore, the study also evaluated the relationship between the age of first bra usage and the occurrence of breast cancer. The results showed that there is no significant relationship between the age of first bra usage and the occurrence of breast cancer. Although the prevalence of breast cancer was higher in women who first used bras at the age of ≥12 years (79.2%) compared to those who used bras at an age <12 years (20.8%), the analysis results indicated that this difference is not statistically significant.

Additionally, the variable of bra size suitability was also evaluated in this study. The results showed that there is no significant relationship between bra size suitability and the occurrence of breast cancer. Although the prevalence of breast cancer was higher in women who used bras that matched their breast size (95.8%) compared to those who used bras larger than their breast size (4.2%), the analysis results indicated that this difference is not statistically significant.

Lastly, the study also examined the relationship between the type of bra used and the occurrence of breast cancer. The results showed that there is no significant relationship between the type of bra and the occurrence of breast cancer. Although the prevalence of breast cancer was higher in women who used wire-free bras (79.2%)

compared to those who used underwire bras (20.8%), the analysis results indicated that this difference is not statistically significant. However, it is known that women who use wire-free bras have a 0.639 times greater risk compared to those who use underwire bras.

## DISCUSSION

The findings of this study reaffirm that bras are not a risk factor for breast cancer. This is in line with research that states that there is no relationship between bra usage and breast cancer, especially in terms of bra usage aspects, including cup size, average number of hours worn per day, and age of regular bra usage initiation (Chen et al., 2015). This is further supported by research that states that there is no difference in the occurrence of acute skin toxicity in women with breast cancer who use bras or do not use bras (Thongkhao et al., 2019).

Bras serve as support for women's breasts. This is to maintain the firmness of the breast shape, preventing sagging due to gravity, aging, and increased body fat (Naviri, 2016). The introduction of bras in Indonesia began in the early 19th century during the Dutch colonial era, referred to as "kutang," and it was taught to girls from a young age. Later, due to the influence of Islam and Javanese and Malay cultures, women were required to wear bras as part of their cultural norms (Woodrich, 2013). This is the reason why Indonesian women wear bras for a duration of  $\geq 24$  hours, including while sleeping, and only take them off briefly after bathing before putting them on again. Sleeping in a bra is currently a personal choice for women. However, in this case, the duration of bra usage is not a cause of breast cancer.

Another study claims that bras are associated with breast cancer through a meta-analysis that shows that wearing a bra while sleeping can increase the risk of breast cancer by 1.3 times. In addition, wearing a bra for more than 12 hours per day increases the risk of breast cancer by 1.08 (So et al., 2015). However, it is not known exactly how wearing a bra can cause breast cancer. The explanation obtained is based on speculation or possibilities that the disease can develop through direct or indirect pathways. The hypothesis of a direct cause is that bras, as the only item of clothing that compresses the entire covered organ, can cause disease through the production of radial scar tissue. Radial scar tissue in the breast is a proliferative hyperplastic lesion associated with an increased risk of breast cancer. Radial scar lesions in the breast are common breast disorders. These lesions have been associated with persistent breast ischemia, followed by progressive infarction of breast tissue (Rios et al., 2016).

Meanwhile, the indirect hypothesis involves the inhibition of chemical activity as a cause of breast cancer. This is because the mammary glands are the only structures in a woman's body that can migrate in all directions. When women wear bras, which restrict the movement of the mammary glands, it can impair the glands' ability to function and regulate body temperature. More than 88 percent of breast drainage occurs through the lymph nodes located in the axilla. In other words, the axillary lymph nodes are responsible for drainage. When antigens, or foreign substances, enter the body, antigenic materials and cells mediating the inflammatory response produced by local immune activity at the aggression site are collected by all lymphatic channels. These components are then transferred into the lymph flow. Antigenic substances and cells help moderate the inflammatory response caused by local immune system activity at the attack site. This is because the antigenic materials and cells mediate the inflammatory response, which explains why everything is as it is. Lymphatic vessels are known as "super information highways" because of the information they carry and the fact that lymph contains a lot of information about the local inflammatory situation

in the upstream drainage area. This is because there is information included in the lymph. Lymph contains this information. Bras with long and tight intensity can externally restrict and potentially obstruct the flow, which can hinder lymphatic drainage and cause the accumulation of potentially harmful chemicals in the breast. If the flow is obstructed, lymphatic drainage is impeded, and potentially harmful chemicals accumulate (Rios et al., 2016).

Meanwhile, 63% of teenage girls in Indonesia still believe that wearing a bra for more than 12 hours can cause breast cancer (Simangunsong, 2018). The exact causes of breast cancer in each individual are still unknown. However, many studies state that most breast cancers develop from acquired (non-inherited) genetic changes that have not yet been identified (American Cancer Society, 2022).

It is important for the public to have a better understanding of the risk factors for breast cancer, such as genetic factors like BRCA1, BRCA2, PTEN (Cowden syndrome), and TP53 (Li-Fraumeni syndrome), family history of breast cancer, exposure to ionizing radiation, hormonal and reproductive factors, prolonged estrogen hormone therapy, age, obesity, and alcohol consumption. It is also important to be aware of protective factors in breast cancer prevention, such as breastfeeding for 12 months, which can reduce the risk of breast cancer. Additionally, physical activity is a protective factor in reducing the risk of breast cancer (Gross, 2000).

The author acknowledges that there are still limitations, such as a limited sample size. Therefore, further research with a larger sample size of cases and controls, accompanied by a better study design, is highly necessary. Furthermore, it is important to re-examine other risk factors that contribute to East Kalimantan Province ranking second nationally with the highest number of breast cancer patients.

## CONCLUSION AND RECOMMENDATION

Conclusion in this study confirms that bras are not a cause of breast cancer in women in East Kalimantan. However, wearing bras for  $\geq 24$  hours has a 2.333 times greater risk of developing breast cancer compared to wearing bras for  $<24$  hours. Therefore, it is recommended for women to reduce the duration of bra usage, such as removing bras during sleep, as a preventive measure to reduce the risk of breast cancer. The findings of this study also debunk the myth that wearing bras can cause breast cancer. Hence, it is important to provide communication, information, and health education to the public in order to enhance knowledge and understanding of breast cancer.

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## Antimicrobial Effects of *Annona squamosa* Leaf Extract on *Staphylococcus aureus* Growth: An In Vitro Study

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### ABSTRACT

**Introduction:** Mastitis is inflammation of the breast tissue due to infection with the *Staphylococcus aureus* bacteria causing local infections. It takes the natural ingredient *Annona squamosa* extract as an antimicrobial. **Purpose:** to determine the effectiveness of *Annona squamosa* leaf extract on the inhibition and killing power of *Staphylococcus*. **Method:** Experimental laboratory research with antibacterial activity test. Tube dilution method by incorporating bacteria and extracts with concentrations of 20%, 22.5%, 25%, 27.5%, 30%, and 32.5% and then measuring the MIC. The diffusion method is carried out by planting bacteria in a Nutrient Agar Plate and then giving the extract with 6 concentrations to calculate the MBC. **Results:** The results of the One-Way ANOVA test obtained a significance value of ( $p < 0.001$ ), indicating that changes in the concentration of *Annona squamosa* made a significant difference to *Staphylococcus*. The correlation test showed a significant p-value of ( $p < 0.001$ ), which means that there was a significant relationship between the administration of extract and the number of *Staphylococcus*. **Conclusion:** *Annona squamosa* leaf extract is able to significantly inhibit the growth of *Staphylococcus* bacteria and the higher the concentration of *Annona squamosa* leaf extract, the fewer the number of bacterial colonies that grow.



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## INTRODUCTION

The Indonesian government has enacted Government Regulation Number 33 of 2012 on Exclusive Breastfeeding, which defines exclusive breastfeeding as the provision of breast milk to infants from birth up to 6 months of age, without adding any other food or drink (Kementerian Kesehatan, 2012). Exclusive breastfeeding has been found to reduce under-five mortality by approximately 13%, and 16% of neonatal deaths can be prevented if infants are breastfed from birth and receive colostrum (Ade Harshindy & Budi Raharjo, 2022). However, the coverage rate of exclusive breastfeeding in Indonesia tends to decline, with the Ministry of Health setting a target coverage rate of 80%.

Common issues that occur in breastfeeding mothers include sore nipples, breast engorgement, breast milk stasis, and mastitis. These problems can disrupt the continuity of breastfeeding and pose health risks to mothers if left untreated (Bambang Ari Purwoko, 2019). Mastitis is an inflammation or infection of the breast characterized by hardening, redness, and pain, often accompanied by a fever  $>38^{\circ}\text{C}$ ,

caused by a *Staphylococcus aureus* bacterial infection (Ika Trisanti dan Nasriyah, 2019). According to the Indonesian Demographic and Health Survey in 2015, 37.12% of postpartum mothers experienced breastfeeding issues such as breast milk stasis and mastitis (Jamaruddin S, Ferawati Taherong, & Syatirah, 2022). *Staphylococcus aureus* is one of the gram-positive bacteria that is part of the normal flora of the mucous membranes and skin in humans. This opportunistic bacterium can cause local infections in various parts of the body. Examples of problems that can arise from *Staphylococcus aureus* infection include bacteremia, pneumonia, meningitis, osteomyelitis, sepsis, nosocomial infections, and others. *Staphylococcus aureus* can cause both local infections on the skin and nasal mucosa and endocarditis (Rahmadani, Budiyo, 2017).

According to the Centers for Disease Control and Prevention, *Staphylococcus aureus* is currently a serious threat due to its resistance to various antibiotics. Hence, many studies are now focusing on the development and utilization of the antibacterial potential of natural substances (Centers For Disease Control and Prevention, 2013). *Annona squamosa*, commonly known as Sugar Apple, is one of the medicinal plants that show potential as an antibacterial agent. The leaves of *Annona squamosa* are known to possess significant health benefits due to the presence of various phytochemical compounds such as alkaloids and flavonoids (Kumar et al., 2021). Research has shown that *Annona squamosa* leaf extract exhibits biological activities such as anticancer, antidiabetic, antioxidant, antifungal, and antimicrobial effects (Anaya-Esparza et al., 2020). The leaf extract of *Annona squamosa* has demonstrated potential for pharmaceutical development (Sundaramahalingam et al., 2021).

A study by Jangnga (2018) revealed that ethanol extract of *Annona squamosa* leaves has inhibitory effects on the growth of *Enterococcus faecalis* bacteria in vitro (Jangnga & Kambaya 2018). Another study demonstrated that flavonoid compounds in sugar apple leaf extract can inhibit the growth of *Staphylococcus aureus* bacteria using the well diffusion method (Karunia & Supartono, 2017). These findings indicate the need for further research on the effectiveness of ethanol extract of *Annona squamosa* leaves in inhibiting the growth of *Staphylococcus aureus* bacteria using the tube dilution and diffusion methods. The aim of this study is to determine the inhibitory and bactericidal effects of *Annona squamosa* leaf extract on *Staphylococcus aureus*, thereby providing an alternative natural treatment solution for mastitis caused by *Staphylococcus aureus* bacteria.

## METHODS

This study utilized laboratory experimental research using an in vitro approach with the tube dilution and diffusion methods for antibacterial activity testing. The research was conducted from January to February 2023 at the Biology Laboratory of Muhammadiyah University of Lamongan. The research sample consisted of *Staphylococcus aureus* bacteria on Nutrient Agar (NA).

The *Annona squamosa* leaf sample, obtained from Palang District, Tuban Regency, was extracted using the maceration method. The leaves were thoroughly washed with running water, then cut into small pieces and dried in an oven before being blended into a powdered form. The maceration process involved soaking the powdered plant material in 96% ethanol solution for three cycles of 24 hours each, with intermittent stirring. Afterward, the extract was filtered and subjected to rotary vacuum evaporation at a temperature of 60-70°C to reduce the extraction volume. The resulting concentrated extract was then diluted with 96% ethanol.

*Staphylococcus aureus* bacteria were prepared in the laboratory and adjusted to a McFarland standard of 0.5. The bacteria were diluted twice to achieve a bacterial concentration of  $1 \times 10^6$ . The tube dilution method was performed by adding the ethanol extract of sugar apple leaves to each reaction tube labeled A-F, with concentrations of 20%, 22.5%, 25%, 27.5%, 30%, and 32.5%, respectively. Tube KB served as the Bacterial Control. Each tube contained different series of test substance concentrations, with sterile aquadest used as the diluent. The bacterial suspension was added to each test tube. All tubes were incubated at 37°C for 18-24 hours, and the turbidity was observed to determine the Minimum Inhibitory Concentration (MIC). Subsequently, a volume of 0.01 ml was taken from each tube and streaked onto NA medium. The plates were incubated again at 37°C for 18-24 hours. After incubation, the colonies grown on the NA plates were counted to determine the Minimum Bactericidal Concentration (MBC).

The obtained data were subjected to One-Way ANOVA statistical analysis to determine differences, and Pearson correlation analysis was conducted to assess the relationship between the administration of *Annona squamosa* leaf extract and *Staphylococcus aureus* bacteria.

## RESULT

The turbidity level of the sugar apple leaf extract solution was observed to determine the Minimum Inhibitory Concentration (MIC). The Minimum Inhibitory Concentration (MIC) is the lowest concentration of an antimicrobial agent that can inhibit the growth of bacteria. The comparison of turbidity levels at each concentration is shown in Figure 1.

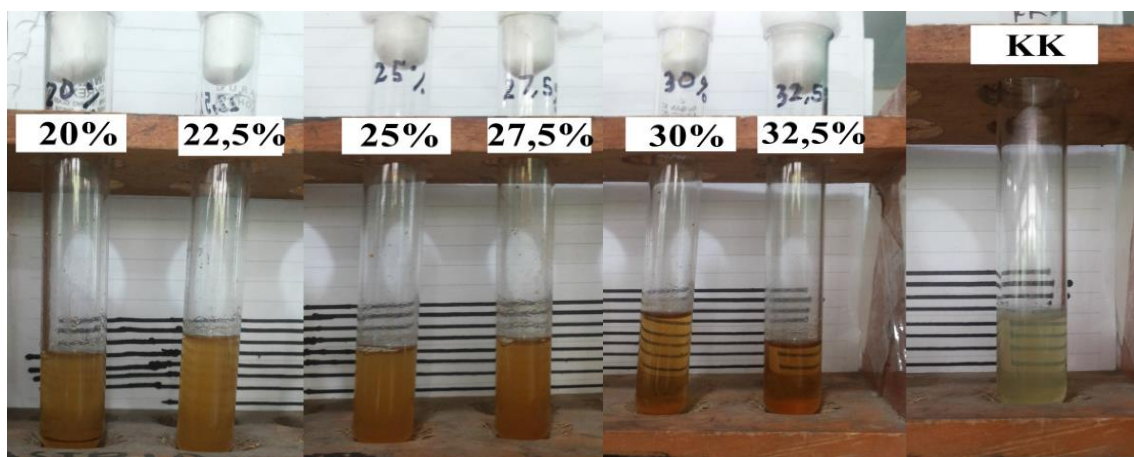


Figure 1. Results of Minimum Inhibitory Concentration (MIC) of *Annona Squamosa* Leaf Extract Showing the 30% Concentration

From the observations, it can be observed that the higher the treatment concentration, the lower the turbidity level in the tubes. It can be seen that the 30% concentration is the lowest concentration that does not show turbidity in the tube, indicating that the MIC in this study is at a concentration of 30% as shown in Figure 1.

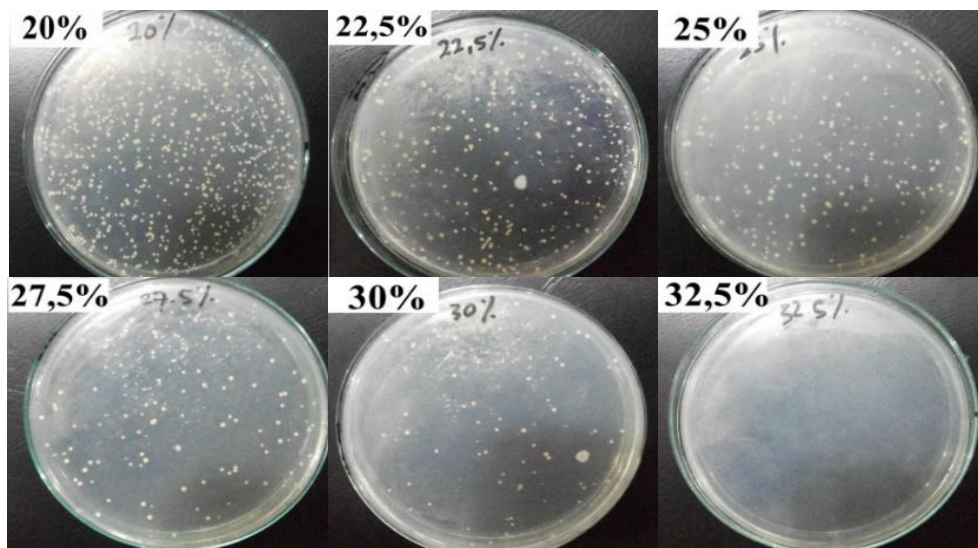


Figure 2. Results of Minimum Bactericidal Concentration (MBC) of Annona Squamosa Leaf Extract Showing the 32.5% Concentration

The Minimum Bactericidal Concentration (MBC) is the lowest concentration of an antimicrobial agent that can kill bacteria, indicated by the absence of bacterial growth on the Nutrient Agar Plate (NAP) medium. From the observations in Figure 2, it can be seen that as the concentration of sugar apple leaf extract increases, the colony count of *Staphylococcus aureus* decreases. The highest colony growth is observed at the KB concentration, while a decrease in bacterial growth is observed at concentrations of 32.5%, 30%, 27.5%, 25%, 22.5%, and 20%. The results show no growth of *Staphylococcus aureus* bacteria at a concentration of 32.5%. Thus, it can be concluded that the MBC in this study is obtained at a concentration of 32.5%. For a clearer presentation of the colony counts on each plate, Table 1 is provided.

Table 1. Number of Bacterial Colonies in Each Replication

Number	Concentration	Number of bacterial colonies per replication				Mean	Standard Deviation
		P 1	P 2	P 3	P 4		
1	32.5%	0	0	0	0	0	0
2	30.0%	89	68	45	77	69.75	±18.608
3	27.5%	122	156	168	175	155.25	±23.514
4	25.0%	315	231	256	270	268	±35.242
5	22.5%	432	407	414	400	413.25	±13.745
6	20.0%	633	580	473	510	549	±71.447
7	KB (0%)	291000	283000	301000	311000	296500	±12151.817

The One-Way ANOVA test yielded a significance value of ( $p < 0.001$ ) as shown in Table 2. This indicates that the change in sugar apple leaf extract concentration has a significant effect on *Staphylococcus aureus*. The correlation test, as shown in Table 3, yielded a significance value of ( $p < 0.001$ ), indicating a significant relationship between the administration of sugar apple leaves and the number of *S. aureus* colonies. The Pearson correlation coefficient is  $r = -0.919$ . The negative sign indicates an inverse relationship, where a higher concentration of sugar apple leaf extract results in a lower number of bacterial colonies, and vice versa.



Table 2. Results of One-Way ANOVA Statistical Test

Data Name	Sum of Square	DF	Mean square	F	Sig
Number of colonies	3.01+11	6	5.015+10	2377.363	.000
	4.43+08	21	21096300		
	3.01+11	27			

Table 3. Results of Pearson Correlation Statistical Test

Data Name		Concentration	Number of Colonies
Concentration	Pearson Cor	1	-.919
	Sig. (2-tailed)	.	.000
	N	28	28
Number of Colonies	Pearson Cor	-.919	1
	Sig. (2-tailed)	.000	.
	N	28	28

## DISCUSSION

This study aims to determine the effectiveness of *Annona squamosa* leaf extract against the inhibitory and bactericidal activity on *Staphylococcus aureus*. The results of the study showed that *Annona squamosa* leaf extract was able to inhibit the growth of *Staphylococcus aureus* bacteria, as indicated by the obtained Minimum Inhibitory Concentration (MIC) value at a concentration of 30%. The results also showed that *Annona squamosa* leaf extract was able to kill *Staphylococcus aureus* bacteria, as indicated by the obtained Minimum Bactericidal Concentration (MBC) value at a concentration of 32.5%.

Plants contain various metabolite compounds with different chemical properties such as polarity and solubility. Several solvents have been developed for the extraction of plant metabolites, including methanol, ethanol, ethyl acetate, and other solvents (Kamoda, Lelyana, & Sugjaman, 2020). In this study, *Annona squamosa* extract was prepared using 96% ethanol as the solvent, as ethanol is relatively non-destructive to active chemical compounds. Additionally, 96% ethanol contains a small amount of water, allowing it to absorb more active substances. Ethanol is also a universal solvent that can dissolve both polar and nonpolar compounds, ensuring that the required active compounds are fully extracted (Al-Judaibi, Al-Zahrani, Altammar, Ismail, & Darweesh, 2014).

The different concentrations of *Annona squamosa* leaf extract showed a significant difference in the inhibitory activity against *Staphylococcus aureus* bacteria. This result is consistent with the study conducted by Santhoshkumar & Kumar (2016) on the phytochemical activity and antibacterial effect of *Annona squamosa* leaf extract, which found that higher concentrations of *Annona squamosa* leaf extract corresponded to higher antibacterial activity. The inhibitory activity of this extract may be attributed to the higher concentration of antibacterial compounds capable of inhibiting the growth of *Staphylococcus aureus* colonies (Santhoshkumar & Kumar, 2016).

As the concentration of *Annona squamosa* leaf extract increased, the number of bacterial colonies decreased, and vice versa. Gram-positive bacteria, such as *Staphylococcus aureus*, have a membrane structure that contains more peptides, fewer lipids, and a cell wall composed of polysaccharides (teichoic acids). Teichoic acids are polymers that can dissolve in water, making the cell wall of gram-positive bacteria more polar (Vijayalakshmi & Nithiya, 2015). Flavonoids present in *Annona*

squamosa leaf extract are polar compounds, allowing them to penetrate the cell wall more easily. Flavonoids act as antibacterial agents by disrupting cell wall synthesis, interfering with the cytoplasmic membrane, and inhibiting energy metabolism (Xiao, Zhu, & Zhang, 2014). This is in line with the research conducted by Alberta (2016) on the inhibitory effect of ethanol extract of *Annona squamosa* leaves on the growth of *E. coli* and *Staphylococcus aureus* bacteria, which found that *Annona squamosa* leaf extract exhibited higher antibacterial and inhibitory effects on *Staphylococcus aureus* compared to *E. coli* (Tansil et al., 2016).

*Annona squamosa* has long been recognized for its medicinal properties, and different parts of the plant, such as fruits, seeds, bark, twigs, and leaves, possess their own unique benefits. *Annona squamosa* leaves are known to have extensive pharmacological properties and biological activities such as antioxidant, antimicrobial, antidiabetic, antiviral, and anticancer effects (Mohammad Zahid, 2018). This is due to the presence of phytochemical compounds in *Annona squamosa* leaves, including glycosides, phytosterols, saponins, tannins, phenols, and the two most important compounds, alkaloids and flavonoids (Hosseinabadi, 2021). Alkaloids and flavonoids are the most significant compounds contributing to the antimicrobial activity of *Annona squamosa* leaves (Santhoshkumar & Kumar, 2016). Flavonoids can induce disturbances in microbial membranes, coagulate cytoplasmic components and cause leakage, as well as interfere with bacterial cell metabolism (Kumar et al., 2021). This is consistent with the research conducted by Swantara (2022), who performed phytochemical screening of *Annona squamosa* leaves and found the presence of flavonoid compounds, particularly flavonol, in the extract. These compounds exhibited inhibitory effects on the growth of *Staphylococcus aureus* bacteria (Swantara, Damayanti, & Suirta, 2022).

## CONCLUSION AND RECOMMENDATION

The conclusion of this study is that *Annona squamosa* leaf extract at a concentration of 30% is capable of significantly inhibiting the growth of *Staphylococcus aureus* bacteria, and the higher the concentration of *Annona squamosa* leaf extract, the fewer bacterial colonies are observed. Furthermore, *Annona squamosa* leaf extract also exhibits significant bactericidal activity against *Staphylococcus aureus* at a concentration of 32.5%. A suggestion for further research is to conduct in vivo studies to investigate the pharmacological effects of *Annona squamosa* leaves on the human body.

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## Factors for Decision to C-section Delivery in Indonesia: Insights from IDHS 2017

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### ABSTRACT

**Introduction:** Cesarean delivery (C-sections) showed 17.6% of all deliveries in Indonesia, which exceeded the WHO standard of 15%. C-sections in government hospitals reached 20-25%; in private hospitals, the number was higher, above 30%. **Purpose:** The study aimed to determine the factors influencing the decision of cesarean section delivery in Indonesia. **Method:** The study used a cross-sectional design. Data came from the Indonesian Health Demographic Survey (IDHS) 2017. The population and samples were 2,464 women aged 15-49 years—data analysis using chi-square test and multiple logistic regression. **Result:** The study found that the proportion of cesarean delivery in private hospitals reached 53.8%. Factors related to the decision to c-section delivery ( $p < 0.05$ ) were maternal education, place of residence, domicile island, spouse's occupation and education, wealth index, health insurance, and antenatal care history. **Conclusion:** The wealth index was the dominant factor for the decision to c-section delivery. The government is expected to be able to improve the quality of services and facilities in cesarean section delivery by government hospitals so that it can be the alternative decision for the community with a variety of wealth index and education backgrounds.



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## INTRODUCTION

C-section delivery is a surgical procedure to give birth to the fetus by making an incision to open the abdominal and uterine walls or a hysterotomy to remove the fetus from the mother's womb. In recent years, vaginal delivery has been considered a difficult way of giving birth. It tends to be dangerous for maternity mothers and their babies, so the cesarean section method in some communities has become a decision in the maternity method (Putra et al., 2021). World Health Organization (WHO) reported that the average cesarean section ranged from 10-15% as the maximum targeted range for lifesaving interventions for mothers and children in the event of childbirth (Hailegebreal et al., 2021). The demand for cesarean sections in several developing countries is overgrowing every year. In addition, WHO noted that the prevalence of cesarean delivery increased by 46% in China and 25% in Asia, Europe, and Latin America. The data shows that globally, the number of deliveries through cesarean section is relatively high (Ferinawati & Hartati, 2019).

The Indonesian Ministry of Health stated that the cesarean section delivery rate in Indonesia exceeded the WHO standards' maximum limit of 5-15%. Cesarean delivery in Indonesia reached around 30-80% of the total delivery (Putri Susanto et al.,

2019). The prevalence of cesarean section delivery in women aged 10-54 years was 16.7%, where DKI Jakarta Province occupied the highest position, 31.1%, and Papua Province occupied the lowest place, 6.7%. C-section deliveries were higher in urban areas by 22.1% (National Institute of Health Research and Development, 2018). The increasing trend of cesarean delivery occurred in several private and government hospitals (Ayuningtyas et al., 2018). The number of deliveries C-section in Indonesia, Especially in government hospitals, was about 20-25% of the total number of deliveries, while in private hospitals, the number is higher, which was about 30-80% of the total number of deliveries (Ayuningtyas et al., 2018; Viandika & Septiasari, 2020).

Cesarean delivery must be done if medical indications can endanger the mother and baby. However, many factors outside medical symptoms, both from the mother's and baby's side, cause the decision of cesarean section. According to the theory of deontology (obligation), cesarean delivery without medical indication can be ethical if the doctor has done his duty, carried out the procedure with informed consent, and performed cesarean section following applicable medical procedures without the slightest error. Many factors influence the mother's decision to choose a cesarean delivery site. The factors affecting to the place of decision of cesarean section were maternal age, education, and location of residence (Krisnawati & Sulistiyarningsih, 2018; Kumar & Dhillon, 2020; Ortiz-Prado et al., 2017; Roy et al., 2021), wealth index, birth order, size and type of newborn pregnancy (Krisnawati & Sulistiyarningsih, 2018; Kumar & Dhillon, 2020; Roy et al., 2021), gender, the height of mother (Krisnawati & Sulistiyarningsih, 2018), history of previous cesarean delivery, desire for cesarean section in early pregnancy, gestational overweight/pre-obesity, and family income (de Oliveira et al., 2016). Therefore, this study aims to determine the factors influencing mothers choosing a cesarean delivery site in Indonesia.

## METHODS

The type of research used was quantitative, with a *cross-sectional* approach using secondary data from the Indonesian Demographic and Health Survey (IDHS) 2017. The population of this study was women aged 15-49 years who were successfully interviewed by IDHS, as many as 49,627. The number of samples used in this study was 2,464 women aged 15-49 years who met the inclusion criteria, namely women who had undergone a cesarean section. In contrast, the exclusion criteria were women with incomplete data. The independent variables were age (low-risk if the mother was 20-35 years old and high-risk if the mother was <20 and >35 years old), education (primary, if the mother takes elementary to junior high school education, secondary if the mother studied until high school, and highest if the mother studied until college), occupation (no and yes), residence (urban and rural), domicile island (Sumatra, Java, Bali and NTT, Kalimantan, Sulawesi, Papua, and Maluku), spouse occupation (agricultural sector, informal outside the agricultural industry, employee, professional/technical), spouse education (primary if a spouse takes elementary-junior high school education. secondary if a spouse takes education until high school, and highest if the spouse studied until college), wealth index (quantile 1, quantile 2, quantile 3, quantile 4 and quantile 5), health insurance (no and yes), antenatal care history ( $\geq 4$  and <4). The dependent variable was the decision to c-section delivery (private and government). The bivariate analysis test was chi-square and multivariate using multiple logistic regression with the backward *method*. Ethical clearance from this study was obtained from DHS with ICF IRB number FWA00000845.

## RESULTS

Based on the conducted research, the following results were obtained:

Table 1. The Relationship of Factors Influencing the Decision of Place of Delivery in Indonesia (n=2464)

Variable	Place of Delivery				p
	Private		Government		
	n=1,325	%	n=1,139	%	
<b>Age</b>					
Low Risk	835	54.3	702	45.7	0.505
High Risk	490	52.9	437	47.1	
<b>Education</b>					
Primary	138	42.3	188	57.7	<0.001
Secondary	720	53.2	633	46.8	
Highest	467	59.5	318	40.5	
<b>Occupation</b>					
No	621	52.5	561	47.5	0.254
Yes	704	54.9	578	45.1	
<b>Residence</b>					
Urban	967	59.4	662	40.6	<0.001
Rural	358	42.9	477	57.1	
<b>Domicile Island</b>					
Sumatra	487	59.4	333	40.6	<0.001
Javanese	586	69.1	262	30.9	
Bali & NTT	64	35.4	117	64.6	
Kalimantan	62	31.5	135	68.5	
Sulawesi	102	34.3	195	65.7	
Papua & Maluku	24	19.8	97	80.2	
<b>Spouse Occupation</b>					
Agricultural sector	249	60.0	166	40.0	<0.001
Informal outside the agricultural sector	400	47.6	440	52.4	
Employees	457	55.0	374	45.0	
Professional/technical	219	57.9	159	42.1	
<b>Spouse Education</b>					
Primary	133	38.0	217	62.0	<0.001
Secondary	795	53.4	694	46.6	
Highest	397	63.5	228	36.5	
<b>Wealth Index</b>					
Quantile 1	64	27.2	171	72.8	<0.001
Quantile 2	139	38.3	224	61.7	
Quantile 3	216	47.0	244	53.0	
Quantile 4	353	59.1	244	40.9	
Quantile 5	553	68.4	256	31.6	
<b>Health Insurance</b>					
No	1287	54.3	1083	45.7	0.011
Yes	38	40.4	56	59.6	
<b>Antenatal Care History</b>					
≥4	1231	54.5	1028	45.5	0.021
<4	94	45.9	111	54.1	

Table 1 shows that women who give c-section delivery in private hospitals are 53.8%. There are 835 (54.3%) women with low age risk in private hospitals, while 702 (45.7%) women give birth in government hospitals. The statistical test results obtained

a p-value of 0.505, so it was concluded that there was no significant relationship between age and the decision of place of delivery. Women who gave birth in private hospitals, there were 138 (42.3%) women who had low education, while among mothers who gave birth in government hospitals, there were 188 (57.7%) women had low education. The statistical test results obtained a p-value of  $<0.001$ , concluding that there was a significant relationship between maternal education and the decision of place of delivery. Women who gave birth in private hospitals, there were 621 (52.5%) women who did not work, while among mothers who gave birth in government hospitals, there were 561 (47.5%) women who did not work. The statistical test results obtained a p-value of 0.254, so it was concluded that there was no significant relationship between the mother's work and the decision of place of delivery. Women who gave birth in private hospitals, there were 967 (59.4%) women who lived in urban areas, while among mothers who gave birth in government hospitals, there were 662 (40.6%) women who lived in urban areas. The results of statistical tests obtained p values  $<0.001$ , so it was concluded that there was a significant relationship between the mother's residence and the decision of place of delivery. Women who gave birth in private hospitals, there were 487 (59.4%) women were domiciled on the island of Sumatra, while among mothers who gave birth in government hospitals, there were 333 (40.6%) women were domiciled on the island of Sumatra. The statistical test results obtained a p-value of  $<0.001$ , so it was concluded that there was a significant relationship between the domicile island and the decision of place of delivery. Women who gave birth in private hospitals, there were 249 (60%) of their spouses in the agricultural sector, while among mothers who gave birth in government hospitals, there were as many as 166 (40%) of their spouses in the agricultural sector. The statistical test results obtained a p-value of  $<0.001$ , so it was concluded that there was a significant relationship between the work of the couple and the decision of the place of delivery.

Respondents who gave birth in private hospitals, there were 795 (53.4%) respondents who had spouse education in the secondary category. In contrast, among mothers who gave birth in government hospitals, 694 (46.6%) respondents had spouse education in the secondary category. The statistical test results obtained a p-value of  $<0.001$ , so it was concluded that there was a significant relationship between the teaching of the couple and the choice of place of delivery. Respondents who gave birth in private hospitals, there were 553 (68.4%) respondents with the most wealth index in quantile 5, while among mothers who gave birth in government hospitals, there were 256 (31.6%) respondents with a wealth index in quantile 5. The results of statistical tests obtained p value  $<0.001$ , so it was concluded that there was a significant relationship between the wealth index and the choice of place of delivery. Respondents who gave birth in private hospitals, there were 1287 (54.3%) respondents who did not have health insurance, while among mothers who gave birth in government hospitals, there were as many as 1083 (45.7%) respondents who did not have health insurance. The results of statistical tests obtained a p-value of 0.011; it was concluded that there was a significant relationship between health insurance and the choice of place of delivery. Respondents who gave birth in private hospitals, there were 1231 (54.5%) respondents who had an antenatal care history  $\geq 4$  times, while among mothers who gave birth in government hospitals, there were 1028 (45.5%) respondents whose antenatal care history  $\geq 4$  times. The statistical test results obtained a p-value of 0.021, concluding a significant relationship between the antenatal care history and the decision of the place of delivery.



Table 2. Multivariate Analysis

Variable	p-value	OR	95%CI OR
<b>Domicile Island</b>			
Sumatra		1	
Javanese	0.001	0.181	0.112 - 0.292
Bali & NTT	0.001	0.139	0.085 – 0.226
Kalimantan	0.007	0.464	0.266 – 0.809
Sulawesi	0.066	0.594	0.341 – 1.034
Papua & Maluku	0.012	0.513	0.305 – 0.862
<b>Spouse Education</b>			
Primary Education		1	
Secondary Education	0.001	1.844	1.340 – 2.536
Higher Education	0.030	1.282	1.024 – 1.603
<b>Wealth Index</b>			
Quintile 1		1	
Quintile 2	0.001	3.204	2.225 – 4.615
Quintile 3	0.001	2.542	1.904 – 3.393
Quintile 4	0.001	1.996	1.539 – 2.589
Quintile 5	0.002	1.448	1.142 – 1.835

Based on Table 2, it is known that the most dominant factor related to the decision of place of delivery, namely the wealth index variable. Women tend to choose private delivery places. On variable domicile islands, islands with access and good infrastructure availability tend to choose cesarean delivery sites at Government Hospitals. In the variable of couple education, the higher the level of education, the mother tends to choose a cesarean delivery place in a private hospital. Similarly, in the wealth index variable, the lower the quintile, the more likely it is to choose a cesarean delivery in a private hospital.

## DISCUSSION

The study results concluded that As many as 53.8% of women chose cesarean delivery in private hospitals. The enthusiasm of mothers is still more significant to perform cesarean section delivery in private hospitals than in government hospitals. In line with research conducted in Chile on childbirth data from 2001-2014, which states that the decision of mothers to have cesarean delivery in private hospitals increases yearly (Borrescio-Higa & Valdés, 2019; Mazzoni et al., 2016). Private hospitals are considered capable of providing better cesarean section facilities and providing more competitive cesarean delivery service packages with the support of professionals, cesarean delivery options, and postpartum services that can give service satisfaction for mothers (Azari et al., 2013; Escuriet-Peiró et al., 2015). Factor What influences the decision of cesarean delivery site is the island of domicile, the education of the spouse, and the wealth index.

The number of public hospitals in Indonesia is 2,561, with most private ownership. Women who live in Java have access to larger private hospitals, coupled with the growth of 352 maternity hospitals, of which 224 are in Java (BPS-Statistics Indonesia, 2023). The affordability of access to this hospital certainly makes it easier for women, especially on the island of Java, to get cesarean section delivery facilities.

High-husband education supports the absorption of good health information, especially about safety and health for maternity mothers, so it can be said that husband education influences decisions about the decision of place of delivery to be carried out by mothers (Arief & Sudikno, 2015). The higher the education of the respondent's

spouse, the more likely to choose a place of maternity in a private hospital (Islam et al., 2022). The instruction can influence knowledge in forming attitudes about cesarean sections. Education can create certain beliefs so that a person can have interests, abilities, experiences, skills, and levels of attention. Highly educated people will be more aware of utilizing better health services. Mothers with husbands/partners whose education is higher will support the absorption of good health information, especially about safety and health for maternity mothers, so it can be said that the husband's education influences the decision about choosing a place of delivery.

The higher the wealth quintile, the more women choose to give birth in private hospitals (Hasan et al., 2019; Islam et al., 2022). Vice versa, the lower the wealth quintile, the more likely women are to choose to give birth in a government hospital. Family income is essential in meeting basic needs (primary) and secondary needs. Families with good economic status will be more easily fulfilled than families with low financial levels. Family income or economic status also affects the utilization of health services, in this case, the decision to birthplaces in private hospitals (Nahsriana & Syahban, 2018; Putri Susanto et al., 2019). Economic status is also positively correlated with cesarean delivery in India. Women from wealthy families may not have the financial constraints to have a C-section. However, an inverse relationship was observed between the household wealth quintile and cesarean delivery in Tamil Nadu (Roy et al., 2021). Personal insurance services in private hospitals support C-delivery services, where the insurance is usually attached to the work of the husband/wife or is also the couple's decision (Borrescio-Higa & Valdés, 2019). Economic conditions also support this insurance service. From the data above, it can be concluded that the higher the wealth quintile, the higher it is to choose a private hospital. Financial preparation is essential for pregnancy, childbirth, and the puerperium and complications that may occur. Delivery carried out in private hospitals costs more than in government hospitals.

## CONCLUSIONS AND ADVICE

Women mainly chose private hospitals for cesarean sections. Lower secondary education tends to have cesarean section delivery in government hospitals, while secondary, upper, and upper secondary education has a common tendency to give birth in government hospitals. The government is expected to be able to improve the quality of services and facilities in cesarean section delivery so that it can be a decision for the community, especially those with secondary to higher education backgrounds.

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## Enhancing Adolescent Girls' Knowledge about Anemia through Instagram: A Pre-Experimental Study

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### ABSTRACT

**Introduction:** The prevalence of anemia among adolescent girls in Indonesia reaches 32%, necessitating effective measures to improve their knowledge about anemia. The use of Instagram, a social media platform, can be one strategy to provide relevant and important information about anemia. **Purpose:** To determine the influence of using Instagram as a social media platform on the knowledge of adolescent girls about anemia. **Methods:** The research design was a pre-experimental design with a one-group pre-test and post-test. A sample of 63 respondents was selected using simple random sampling. The data were analyzed using Paired T-Test and ANOVA. The educational media used on Instagram consisted of short videos and posters. **Results:** The results of the study revealed that the mean knowledge score of the students before the intervention was 42.4 with a standard deviation of 12.5, while the mean knowledge score after the intervention was 60.1 with a standard deviation of 16.8. There was a significant increase in knowledge by 17.7 points, with a p-value of <0.001, indicating the influence of education through Instagram on the improvement of students' knowledge about anemia. **Conclusion:** The active use of Instagram as a social media platform plays a crucial role in enhancing the knowledge of adolescent girls about anemia. In the context of health education, Instagram proves to be an effective medium for delivering information to a broader target audience.



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## INTRODUCTION

Anemia is a health issue that can affect infants, adolescents, pregnant women, and the elderly (Budiarti, Anik, & Wirani, 2021). Adolescent girls are particularly vulnerable to anemia, as evidenced by the higher prevalence of iron-deficiency anemia among them compared to adolescent boys (Sulistyawati & Nurjanah, 2018). Adolescent girls are at risk of anemia due to menstruation, and many of them are concerned about their body shape, leading to improper diets and food restrictions (Munir, Sari, & Hidayat, 2022).

The global prevalence of anemia ranges from 40-88%. According to the World Health Organization (WHO), the incidence of anemia among adolescent girls in developing countries is approximately 53.7% of all adolescent girls. Anemia often affects adolescent girls due to factors such as stress, menstruation, and inadequate nutrition (Kaimudin, Lestari, & Afa, 2017). In Indonesia, the prevalence of anemia among adolescents reaches 32%, meaning that 3-4 out of 10 adolescents suffer from anemia, indicating a high incidence of this condition (Kementerian Kesehatan R.I.,

2021). According to data from the Health Department of Central Sulawesi Province, the prevalence of anemia among adolescents aged 10-14 years is 0.13%, and among those aged 16-18 years, it is 0.14%. In 2015, there was an increase in anemia among adolescents aged 10-14 years, with 431 cases out of 264,915 individuals (0.16%), and among those aged 16-18 years, there were 454 cases out of 263,416 individuals (0.17%) (Nasruddin, Faisal Syamsu, & Permatasari, 2021).

Anemia in adolescent girls can be caused by various factors, such as menstrual bleeding (Turner, Parsi, & Badireddy, 2023; Chai, Huang, Rakočević, & Chung, 2021), inadequate intake of iron-rich and protein-rich foods (Sari, Judistiani, Herawati, Dhamayanti, & Hilmanto, 2022), improper diets (Setyaningsih, Mansur, & Naimah, 2022), and non-compliance with iron supplement intake (Humayrah & Putri, 2023; Sirupa, Wantania, & Suparman, 2016). These factors can negatively impact cognitive function, leading to fatigue, decreased concentration, and academic underperformance. Adolescent girls with anemia are also at risk of giving birth to low birth weight babies and experiencing stunting in the future (Sari et al., 2022; Tura, Egata, Fage, & Roba, 2020; Utami, Margawati, Pramono, & Wulandari, 2021), as well as experiencing decreased energy levels, weakened immunity, reduced physical fitness, and productivity (Khobibah, Nurhidayati, Ruspita, & Astyandini, 2021; Widaningsih, 2023).

The problem of anemia in adolescent girls is often attributed to their lack of knowledge about anemia, including recognizing its signs, symptoms, causes, impacts, and preventive measures. This lack of knowledge ultimately affects their dietary patterns and leads to insufficient consumption of iron-rich foods (Soekardy, 2023; Subratha & Ariyanti, 2020). Many adolescents tend to overlook the issue of anemia and its prevention due to a lack of awareness and inadequate information dissemination, as well as insufficient attention from parents, communities, and the government regarding adolescent health and suboptimal healthcare services for adolescents (Hearttadini, 2020). Previous studies have shown that the increasing prevalence of anemia among adolescents, which is associated with poor food choices, is related to low knowledge about anemia (Hasyim, Mutalazimah, & Muwakhidah, 2018; Laksmi & Yenie, 2018; Romandani & Rahmawati, 2020).

One approach to address the issue of anemia is through education. Various educational methods have been employed, including leaflets (Hannanti, Ibnu Malkan Bakhrul Ilmi, & Muh. Nur Hasan Syah, 2021), brochures, magazines, books, booklets, posters, videos (Fadhilah et al., 2022; Subratha & Ariyanti, 2020), and social media platforms (Baroroh, 2023; Rusdi, Helmizar, & Rahmy, 2021). In the current digital era, social media has become an integral part of adolescents' lives. Instagram, in particular, is a widely used and popular social media platform among adolescents, offering the potential as an effective tool for delivering health information to adolescent audiences. Instagram provides easy, visual, and interactive access to engaging content for adolescent girls. Therefore, the use of Instagram as an educational medium can be an effective strategy to improve the knowledge of adolescent girls about anemia (Laor, 2022; Nomiaji, Marsofely, Sumiati, Andeka, & ..., 2020). However, despite its potential, research on the influence of using Instagram as a social media platform on the improvement of knowledge among adolescent girls about anemia is still limited in Indonesia. Therefore, this study aims to determine the influence of using Instagram as an educational medium on the knowledge of adolescent girls about anemia.

## METHODS

The research design was a pre-experimental design with a one-group pretest and posttest design. The research was conducted from April to May 2023 at SMAN 3 Poso. The population of this study consisted of 171 female students in grade X at SMAN 3 Poso. The sample for this research comprised 63 respondents, selected using a simple random sampling technique. The sample was drawn from 8 classes by randomly selecting students using a Random Number Generator application.

The variables of this research are the usage of Instagram media and the knowledge of adolescent girls regarding anemia. The utilization of Instagram social media is measured by examining the level of interaction carried out by Instagram users towards the content posted by the researcher, such as the number of likes, shares, or comments (Laor, 2022). The criteria are as follows: Inactive if the number of likes on the content is less than 3. Active if the number of likes on the content is 3 or more. The knowledge of adolescent girls refers to their comprehension of anemia, including understanding its definition, causes, symptoms, impacts, prevention, and treatment. The criteria are as follows: Good if the answer score is 76-100%, Sufficient if the answer score is 56-75%, Lacking if the answer score is 55 or less.

The data collection process begins with conducting a pretest to measure the level of knowledge of the female students about anemia. Next, we provide educational counseling through Instagram media using 6 content items consisting of 2 short videos (reels) and 4 posters. Instagram link: <https://www.instagram.com/reel/CsX8VoVRABzImq3w6T4njg9NIwYL7zX4JIbNO00/?igshid=MzRIODBiNWFIZA==> The videos are less than 2 minutes in duration and contain information about what anemia is, how anemia can affect adolescent girls, and ways to prevent anemia, such as increasing the consumption of iron-rich foods, using iron supplements like iron tablets, and actively participating in adolescent health center activities. After one week, the female students are given a posttest to measure their knowledge after attending the counseling. Data analysis will utilize the paired sample t-test to determine the difference in mean knowledge scores before and after the Instagram education, while ANOVA test will be used to determine the difference in mean number of likes based on the post knowledge categories.

## RESULT

Based on the conducted research, the following results were obtained:

Table 1: Frequency distribution based on respondent characteristics

Variable	Number (n=63)	Percentage (%)
<b>Age (years)</b>		
14-15	22	34.9
16-17	41	65.1
<b>Instagram usage</b>		
Active	35	55.6
Inactive	28	44.4
<b>Knowledge before</b>		
Good	0	0
Sufficient	10	15.9
Lacking	53	84.1
<b>Knowledge after</b>		
Good	9	14.3
Sufficient	29	46.0
Lacking	25	39.7

Table 1 shows that respondent aged 16-17 years accounted for 65.1%, the number of active Instagram users was 55.6%, the knowledge before receiving education was 84.1%, and the knowledge about anemia after receiving education was 46.0%.

Table 2 Frequency Distribution of Respondents' Answers Based on Questions about Anemia

No	Question	Pre		Post	
		n	%	n	%
1.	What is anemia	20	31.7	39	61.9
2.	Cause				
	a. Intestinal worms, TB	8	12.7	26	41.3
	b. Menstruation	39	61.9	47	74.6
	c. Inadequate consumption of iron-rich foods	48	76.2	57	90.5
	d. Bleeding	26	41.3	37	58.7
	e. Inadequate consumption of protein-rich foods	33	52.4	36	57.1
	f. Too much fatty foods	6	9.5	15	23.8
	g. No idea	2	3.2	0	0.0
3.	How to identify anemia				
	a. Blood test to determine hemoglobin levels	38	60.3	50	79.4
	b. Observing physical characteristics (pale skin and palms)	35	55.6	46	73.0
	c. Frequent dizziness	53	84.1	58	92.1
	d. Frequent eye flashes	36	57.1	51	81.0
	e. Checking for red spots on the skin	4	6.3	19	30.2
	f. Frequent nausea	6	9.5	23	36.5
4.	Sources of dietary iron				
	a. Meat	32	50.8	42	66.7
	b. Fish	33	52.4	45	71.4
	c. Liver	42	66.7	43	68.3
	d. Chicken	40	63.5	41	65.1
	e. Eggs	34	54.0	41	65.1
	f. Potatoes	14	22.2	32	50.8
	g. Peanuts	16	25.4	38	60.3
	h. Cassava leaves	6	9.5	22	34.9
	i. Spinach	21	33.3	39	61.9
	j. Guava	3	4.8	13	20.6
	k. Tomato	9	14.3	19	30.2
	l. Orange	6	9.5	29	46.0
	m. Carrots	9	14.3	22	34.9
5.	Symptoms of anemia				
	a. Dizziness	54	85.7	54	85.7
	b. Eye flashes	37	58.7	38	60.3
	c. Pale eyelids and skin	32	50.8	35	55.6
	d. Weakness	33	52.4	42	66.7
	e. Fatigue	44	69.8	50	79.4
	f. Tiredness	24	38.1	38	60.3
	g. Letarghy	30	47.6	40	63.5
	h. Forgetfulness	7	11.1	16	25.4
	i. Weight loss	6	9.5	21	33.3
	j. Red spots on the skin	0	0.0	14	22.2
	k. Bitter taste in the mouth	4	6.3	23	36.5
6.	Impact of anemia on learning achievement	50	79.4	62	98.4
7.	Anemia can be prevented	62	98.4	63	100.0

No	Question	Pre		Post	
		n	%	n	%
8.	Methods to prevent anemia				
a.	Eating fruits and vegetables rich in vitamin C	42	67.7	41	65.1
b.	Maintaining personal hygiene and cleanliness to avoid intestinal worms	10	16.1	20	31.7
c.	Consuming chicken, liver, eggs	36	58.1	41	65.1
d.	Taking Iron Supplement Tablets	52	83.9	57	90.5
e.	Regular exercise	30	48.4	40	63.5
f.	Reducing consumption of fatty foods	11	17.7	20	31.7
9.	Anemia can be treated	57	90.5	61	96.8
10.	Methods to treat anemia				
a.	Treating intestinal worms, malaria, and tuberculosis	7	12.3	23	37.7
b.	Increasing consumption of iron-rich foods	48	84.2	59	96.7
c.	Supplementing with iron tablets	38	66.7	51	83.6
d.	Regular exercise	35	61.4	41	67.2
e.	Adequate rest	44	77.2	43	70.5
f.	Limiting consumption of fatty foods	14	24.6	28	45.9

Based on Table 2, there is a significant improvement in the knowledge and understanding of the respondents about anemia after the intervention or educational program. Prior to the intervention, only a small percentage of respondents understood the definition of anemia, its causes, symptoms, sources of iron, impact, prevention, and treatment. The percentage of respondents who understood anemia significantly increased after the intervention, for example, from 31.7% to 61.9% in understanding the definition of anemia. Furthermore, question 2e (inadequate consumption of protein-rich foods) had a low percentage value in the pretest (52.4%). This indicates that most students had limited knowledge about the relationship between protein consumption and anemia before receiving education. Additionally, in questions 4j (guava) and 5j (red spots on the skin), no students answered correctly in the pretest, indicating very low knowledge about these aspects before receiving the intervention.

However, after receiving counseling and undergoing the posttest, there was a significant improvement in knowledge and understanding about the causes of anemia, sources of iron, symptoms of anemia, impact on learning achievement, prevention, and treatment of anemia. In question 2c (inadequate consumption of iron-rich foods), question 3e (checking for red spots on the skin), and question 5j (red spots on the skin), there was a significant increase in the percentage of correct answers in the posttest. This indicates that the educational program has successfully provided better information and improved the respondents' understanding of anemia, with understanding percentages increasing up to 90.5% in several aspects related to anemia.

Table 3. Difference in the number of likes based on knowledge about anemia after receiving education through Instagram social media

Knowledge	Mean	SD	p-value
Good	5	1.1	<0.001
Sufficient	2.5	0.9	
Lacking	1.7	2.0	

Table 3 shows that the mean number of likes on Instagram posts for good knowledge is 5, for sufficient knowledge is 2.5, and for poor knowledge is 1.7 likes.



Based on the ANOVA test, the p-value is <0.001, indicating that there is an influence of the number of likes on the knowledge of adolescent girls about anemia.

Table 4. Mean Differences in Knowledge about Anemia before and after Education through Instagram Social Media

Knowledge	Mean	SD	Mean Difference	p-value
Before	42.4	12.5	17.7	<0.001
after	60.1	16.8		

Table 4 shows that the mean knowledge of students before the intervention is 42.4 with a standard deviation of 12.5, while the mean knowledge after the intervention is 60.1 with a standard deviation of 16.8. There is an increase in knowledge of 17.7 points. Based on the paired t-test, the p-value is <0.001, indicating that there is an influence of education through Instagram on the improvement of students' knowledge about anemia.

## DISCUSSION

The results of this study indicate that the use of Instagram, a social media platform, has an influence on the improvement of knowledge among adolescent girls regarding anemia. A total of 56% of the respondents actively use Instagram, and the researchers have uploaded 6 educational posts, including 2 videos and 4 image posters. Based on the number of likes received, it can be concluded that respondents who are active on Instagram have better knowledge about anemia. On the other hand, respondents who are not active on Instagram tend to have lesser knowledge. These findings are consistent with previous studies that have shown the effectiveness of social media, including Instagram, as a platform for health education ([Rahmatini, 2021](#); [Utari, 2017](#)).

The knowledge of the respondents also improved after the intervention. Previously, the percentage of respondents with good knowledge was only 0%, but after the intervention, it increased to 14%. Conversely, the percentage of respondents with inadequate knowledge decreased from 84% to 40%. Knowledge of anemia among adolescent girls can be obtained from various sources of information, with media (electronic, print, internet) being one of the most commonly used sources ([Firdaus & Hidayati, 2019](#); [Nomiaji et al., 2020](#)).

The results of this study also highlight the importance of iron intake in the prevention and treatment of anemia. The respondents have good knowledge about food sources that contain iron, such as meat, fish, liver, and eggs. They also recognize the importance of maintaining nutritional balance and consuming iron supplements as a way to prevent and treat anemia ([Julaecha, 2020](#)). In terms of the impact of anemia, respondents who experienced anemia described symptoms such as easy fatigue, decreased concentration in learning, dizziness, and fatigue ([Sulistyawati & Nurjanah, 2018](#)).

These findings are in line with previous research that emphasizes the importance of iron intake and the impact of anemia on health ([Safitri, 2022](#); [Subratha & Ariyanti, 2020](#)). By using Instagram as an educational tool, information about anemia can be more easily accessed and can bring about changes in the attitudes, feelings, and behaviors of the respondents. According to a study by [Hernianti et al., \(2023\)](#), the use of Instagram as an educational media has been proven effective in improving knowledge, attitudes, and dietary patterns in the prevention of anemia among adolescent girls in Makassar, Indonesia. This study compared the influence of using

WhatsApp and Instagram as instructional media, and the results showed that education through Instagram had a better impact on improving knowledge, attitudes, and dietary patterns in the prevention of anemia among adolescent girls.

Based on these results, it can be concluded that active use of Instagram, a social media platform, plays a crucial role in improving the knowledge of adolescent girls about anemia. In the context of health education, Instagram is one of the effective media for delivering information to a wider target audience. Therefore, the development of visually appealing and easily understandable health education materials suitable for posting on Instagram is highly recommended.

## CONCLUSION AND RECOMMENDATIONS

The use of Instagram, a social media platform, can enhance the knowledge of adolescent girls about anemia. In this study, Instagram media can be considered as an alternative source of information about anemia in schools. There is a need for the development of engaging and easily understandable health education materials in a visual format suitable for posting on Instagram. These materials should be developed while considering the target audience, using easily comprehensible language, and utilizing attractive formats such as images, infographics, or short videos.

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## Knowledge, Attitudes, and Practices of Complementary Feeding among Mothers at the Stunting Locus Area: A Cross-Sectional Study in West Sulawesi

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### ABSTRACT

**Introduction:** Bebanga Village, Kalukku District recorded a stunting prevalence of 38.5%. Stunting is caused by various factors, including mothers' lack of knowledge about IYCF. **Purpose:** To find out the description of knowledge, attitudes, and complementary feeding practices in mothers and the nutritional status of children in the stunting locus area. **Methods:** The study used a cross-sectional design conducted from January to May 2023 at the Stunting Locus in Bebanga Village, West Sulawesi. A total sample of 148 was calculated using proportional random sampling. Measuring the nutritional status of children uses four indicators: weight/age, height/age, weight/height, and BMI/age. **Results:** The prevalence of stunting children in was 48.0%. As many as 51.5% of mothers had sufficient knowledge about complementary feeding, 51.4% of mothers had a negative attitude about complementary feeding, and as many as 76.4% of mothers practiced complementary feeding not according to standards. The chi-square test showed that the aspects of knowledge ( $p$ -value=0.165), attitude ( $p$ -value=0.880), and practice ( $p$ -value=0.280) of complementary feeding among mothers were not related to the incidence of stunting among children at the stunting locus area. **Conclusion:** Many stunted children were found among mothers with good knowledge and attitudes toward ICYF but lacked practice.



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## INTRODUCTION

Children aged 0-23 months are in a period of rapid growth and development, so it is often called the golden and critical periods. The golden period can be realized if, during this period, children get appropriate nutritional intake for optimal growth and development (Prendergast & Humphrey, 2014). Conversely, if children at this time do not receive food according to their nutritional needs, then the golden period will turn into a critical period that will disrupt the growth and development of infants and children, both now and in the future. Children given ASI and MP-ASI appropriately have a 13% lower risk of death (Kemenkes RI, 2020).

Indonesian Nutrition Status Survey (SSGI) data for 2022 shows an increase in the prevalence of stunting under five in West Sulawesi from 33.8% to 35.0%. It makes West Sulawesi the number 2 province with the highest prevalence of stunting nationally (Kemenkes RI, 2023). Stunting is a nutritional problem caused by various factors, including the lack of knowledge of mothers about the practice of infant and child feeding

(IYCF), including the low level of exclusive breastfeeding (Syukri, Nurbaya, Nurcahyani, Nafilata, & Eskadela, 2022), pre lacteal feeding in the first days of the baby's birth (Wolde, Ayele, & Takele, 2019), low mother's knowledge, husband's support and support from health workers and posyandu cadres related to complementary feeding (Mustafyani & Mahmudiono, 2017; Nurbaya, Najdah, Sukardi, & Rahman, 2023), as well as the lack of practice of giving appropriate complementary foods to children (Rd. Halim et al., 2022; Yudianti, Hapzah, & Nurbaya, 2022). The causes of complex stunting problems require cross-sectoral and comprehensive handling (Reinhardt & Fanzo, 2014).

The period of giving complementary foods to toddlers depends on the mother's behavior which is influenced by the mother's knowledge and attitude. Generally, the mother or caregiver contributes most significantly to making decisions about food choices to be given to children (Mahmood, Flores-Barrantes, Moreno, Manios, & Gonzalez-Gil, 2021). The mother's role is enormous in formulating the diet given to her child, from identifying, selecting, handling, and serving to provide the child's daily nutritional menu. The mother's behavior in giving complementary foods, in terms of timeliness, type of food, food consistency, and amount of food, is determined by the mother's knowledge of complementary feeding. Insufficient mothers' knowledge about appropriate complementary feeding is one of the leading causes of nutritional problems in toddlers, especially those under two years of age (Mediani, 2020; Nurbaya, 2021; Oktaviana & Nuzula, 2017).

The data obtained from the results of the *grebek* stunting in the Bebanga Village, Kalukku District, recorded a stunting prevalence of 38.5%. Bebanga Village is one of the locus of stunting areas in West Sulawesi Province (Nurbaya, Kalua, Hasyim, & Damayanti, 2023). This figure is high for the national stunting prevalence standard (Kemenkes RI, 2021). This study aimed to describe the knowledge, attitudes, and practices of complementary feeding among mothers and the nutritional status of toddlers in the stunting locus of the Bebanga Village, Kalukku District, West Sulawesi.

## METHODS

This study used a cross-sectional design which was conducted in the Bebanga Village, one of the stunting areas in Kalukku District, Mamuju. Research activities were carried out from January to May 2023. This study's population was all mothers with children aged 6-23 months in the Bebanga Public Health Center, Mamuju Regency, in 2023.

A total sample of 148 was calculated using proportional random sampling at 15 posyandu in the Bebanga Village. A questionnaire measured the mother's knowledge, attitudes, and practices regarding complementary feeding. Knowledge questionnaire to measure mother's knowledge regarding appropriate complementary feeding. Mother's knowledge was categorized into three groups, namely good (score 80-100), sufficient (score 60-79), and poor (score <60). The attitude questionnaire is to find out how the mother evaluates or responds to giving complementary feeding. The attitude aspect is categorized into two categories, namely positive attitude (mean score <75) and negative attitude (mean score ≥75). While in the practical aspect for the action or practice of the mother in giving complementary feeding under IYCF standards according to the Ministry of Health, namely giving complementary feeding according to the child's age considering five components, namely: age, frequency of administration, amount, texture, variety (4-stars menu), and responsiveness. The practice of giving complementary feeding is categorized into two: appropriate if the five components

comply with IYCF standards and not appropriate if there is 1 component that does not comply with IYCF standards.

The measurement of the nutritional status of toddlers uses four indicators: weight/age, height/age, weight/height, and BMI/age. Nutritional status was measured using the WHO Antro application. After all the data is collected, the data is then analyzed descriptively using the SPSS application and presented in tables and narratives to discuss the research results.

## RESULTS

Table 1 shows the characteristics of the under-five children. Father's age (58.5%) and mother's age (74.3%) are in the age group between 20-35 years. The education of fathers and mothers mostly elementary school, namely 53.4% and 52.0%, respectively. The father's work is mostly farmers 48.8% and housewives 93.2%. Of the 148 children, 64.2% were in the 12–23-month age group. As many as 52.0% are female, and 47.3% are male.

Table 1. Characteristics of children in the stunting locus of Bebanga Village Kalukku District (n=148)

Characteristics	Frequency	
	Number	Percent (%)
<b>Father's age (years)</b>		
<20	1	0.7
20-35	87	58.8
>35	60	40.5
<b>Mother's age (years)</b>		
<20	8	5.4
20-35	110	74.3
>35	30	20.3
<b>Father's education</b>		
Elementary school	79	53.4
Junior high school	24	16.2
Senior high school	34	23.0
Higher education	11	7.4
<b>Mother's education</b>		
Elementary school	77	52.0
Junior high school	24	16.2
Senior high school	37	25.0
Higher education	10	6.8
<b>Father's occupation</b>		
Laborer	29	19.6
Honorary	5	3.4
Fisherman	14	9.5
Trader	3	2.0
Farmer	71	48.0
Civil servant	3	2.0
Driver	7	4.7
Miners	2	1.4
Self-employed	14	9.5
<b>Mother's occupation</b>		
Honorary	2	1.4
Housewife	138	93.2
Farmer	3	2.0

Characteristics	Frequency	
	Number	Percent (%)
Civil servant	3	2.0
Self-employed	2	1.4
<b>Children's age (Months)</b>		
6-8	27	18.2
9-11	26	17.6
12-23	95	64.2
<b>Children's sex</b>		
Male	77	52.0
Female	71	48.0

The nutritional status of the children using four indicators can be seen in Table 2. According to the weight/age indicator, 25.0% of toddlers have underweight status, and the majority have normal status 66.9%. However, the number of stunting toddlers is relatively high, namely 48.0%.

Table 2. Nutritional Status of Children at the Stunting Locus Area of the Bebanga Village, Kalukku District

Nutritional Status	Number	Percent (%)
<b>Weight/age</b>		
Severely underweight	11	7.4
Underweight	37	25.0
Normal	99	66.9
Overweight	1	0.7
<b>Height/Age,</b>		
Stunted	71	48.0
Normal	77	52.0
<b>Weight/Height</b>		
Severely wasted	6	4.1
Wasted	10	6.8
Normal	118	79.7
possible risk of overweight	11	7.4
overweight	3	2.0
<b>BMI/Age</b>		
Severely wasted	6	4.1
Wasted	6	4.1
Normal	121	81.8
Possible risk of overweight	12	8.1
Overweight	2	1.4
Obese	1	0.7

Table 3 shows mothers' knowledge level about complementary feeding with a sufficient knowledge level category of 76 mothers (51.4%), good categorical knowledge of 21.4%, and poor knowledge category of 27.0%.

Table 3. Frequency Distribution based on Knowledge, Attitude, and Complementary Feeding Practices for Mothers

Characteristics	Number	Percent (%)
<b>Knowledge</b>		
Good	32	21.6
Sufficient	76	51.4
Poor	40	27.0
<b>Attitude</b>		

Characteristics	Number	Percent (%)
Negative	76	51.4
Positive	72	48.6
<b>Practices</b>		
Appropriate	35	23.6
Not appropriate	113	76.4

The attitude related to complementary feeding evaluates the mother's response in giving the correct complementary. As many as 51.4% of mothers had a negative attitude, and 48.6% had a positive attitude. Meanwhile, in the practice aspect, which assesses the practice and actions of mothers in providing solids under the golden IYCF standards, it shows that most mothers (76.4%) need to practice complementary foods appropriately.

Table 4. Distribution of Mother's Knowledge, Attitude and Practice on Children Nutritional Status

Variables	Children Nutritional Status (Height/Age)						P-value
	Stunted		Normal		Total		
	n	%	n	%	n	%	
<b>Knowledge</b>							
Good	14	43.8	18	56.3	32	100.0	0.165
Sufficient	42	55.3	34	44.7	76	100.0	
Poor	15	37.5	25	62.5	40	100.0	
<b>Attitude</b>							
Negative	36	47.4	40	52.6	76	100.0	0.880
Positive	35	48.6	37	51.4	72	100.0	
<b>Practice</b>							
Appropriate	14	40.0	21	60.0	35	100.0	0.280
Not appropriate	57	50.4	56	49.6	113	100.0	

Table 4 shows the knowledge of mothers about complementary feeding on nutritional status with Height/Age indicators; as many as 42 (55.3%) mothers with sufficient knowledge and the nutritional status of stunting children out of 76 mothers who have sufficient knowledge about complementary feeding.

The aspect of attitude, as many as 36 (47.4%) mothers have a negative attitude and the nutritional status of stunting children out of 76 mothers who have a negative attitude in giving complementary feeding. While the aspect of mothers' practice in giving complementary feeding and children's nutritional status with Height/Age indicators. As many as 57 (50.4%) mothers who gave complementary feeding did not comply with the standards and nutritional status of stunted children from 113 mothers who gave complementary feeding did not meet the standards.

After conducting the chi-square test, it was found that the aspects of knowledge ( $p\text{-value}=0.165$ ), attitude ( $p\text{-value}=0.880$ ), and practice ( $p\text{-value}=0.280$ ) of complementary feeding among mothers were not related to the incidence of stunted children at the Bebanga Village. It shows that there are other factors apart from knowledge, attitudes, and practices in giving complementary foods that affect the incidence of stunting under five in that area.

## DISCUSSION

These results indicate that the nutritional status of children aged 6-24 months based on the Height/Age indicators in the Bebanga Village shows a high prevalence



of stunting, namely 48.0%. This prevalence is higher than stunting at the provincial level of West Sulawesi, which is 35.5% (Kemenkes RI, 2023). The high prevalence of stunting indicates high nutritional problems in the region (WHO, 2010).

The results of the research conducted in the Bebanga Village illustrated those 148 respondents, there were 32 respondents (21.6%) in the category of good knowledge regarding complementary feeding, 76 respondents (51.4%) mothers had sufficient knowledge regarding complementary feeding, and 40 respondents (27.0%) mothers lack knowledge about giving complementary feeding. The mother's knowledge about complementary feeding is closely related to the mother's education level, most of whom graduated from elementary school (52.0%). It can affect the mother's belief or perception of giving complementary feeding, thereby reducing the mother's desire to act. The higher a person's education, the faster they receive and understand information, so their knowledge is also higher.

In the attitude aspect, 76 respondents (51.4%) had a negative attitude toward giving MP-ASI. In the practical aspect, most of the respondents (76.4%) did not provide complementary feeding under the standards for giving appropriate complementary feeding among children. The results showed that the low practice of mothers in giving complementary feeding was due to negative attitudes and low knowledge about giving MP-ASI. Attitude is a tendency to act (practice). Attitudes are not necessarily manifested in the form of actions because other factors are needed to realize actions, such as facilities and infrastructure (Parandari, Muslimin, Hajrah, Imran, & Adam, 2021). Meanwhile, the practice of giving complementary foods that is not appropriate, such as providing food that is not diverse, has the risk of causing stunting for toddler (Yudianti et al., 2022).

After conducting the chi-square test, it was found that the aspects of knowledge ( $p$ -value=0.165), attitude ( $p$ -value=0.880), and practice ( $p$ -value=0.280) of complementary feeding among mothers were not related to the incidence of stunted children at the Bebanga Village. It shows that there are other factors apart from knowledge, attitudes, and practices in giving complementary foods that affect the incidence of stunting under five in that area. Several studies have shown that the practice of giving complementary foods is not the main cause of stunting among children. Many other factors cause, among others, the incidence of infectious diseases, such as diarrhea and pneumonia, which recur in children (Ariati, 2019). Beliefs and traditions of pre-lacteal feeding can also be a risk factor that hinders exclusive breastfeeding for infants who are at risk of causing stunting (Muthoharoh, 2020; Wolde, Ayele, & Takele, 2019).

## CONCLUSIONS AND SUGGESTIONS

The prevalence of stunted children aged 6-23 months in the Bebanga Village is 48.0%. As many as 51.5% of mothers had sufficient knowledge about complementary feeding, 51.4% had a negative attitude about complementary feeding, and 76.4% of mothers practiced complementary feeding not according to standards. The chi-square test results showed no relationship between knowledge, attitudes, and the practice of giving complementary foods to the incidence of stunting among children aged 6-23 months in the stunting locus area of Bebanga Village. An in-depth study of other aspects of the causes of stunting in the region is needed in order to be able to provide a more valid picture of the causes of stunting so that it can become material for policymakers in efforts to prevent and reduce stunting rates in West Sulawesi.

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## Canira Malolo: An Alternative Treatment for Striae Gravidarum in Postpartum Mothers - A Pre-Experimental Study

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### ABSTRACT

**Introduction:** Postpartum women have several problems both physiologically and psychologically. Physiological changes during pregnancy often cause problems during the puerperium, one of which is skin problems, namely striae gravidarum. **Purpose:** To make Canira Malolo spread from Cacao, Virgin Coconut Oil, and aloe vera, and to know the Effectiveness of Canira Malolo against striae gravidarum in postpartum mothers in Polewali Mandar Regency. **Methods:** This study used a pre-experimental study design with the one group pre-test – post-test design. The sample size is 10 people using purposive sampling technique with inclusion criteria: Postpartum women who have striae gravidarum on the abdomen, have no history of oil allergies, have no open wounds and are willing to become research samples. Data analysis used the Wilcoxon Signed Ranks Test. The study was conducted in May – December 2022. **Results:** The results showed that Canira Malolo's intervention was effective in reducing the appearance of striae gravidarum in postpartum mothers with a p value=0.025. **Conclusion:** Canira Malolo made from cacao, virgin coconut oil, and aloe vera can be used as an alternative for treating Striae Gravidarum in postpartum mothers.



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## INTRODUCTION

Postpartum mothers have several problems both physiologically and psychologically. Physiological changes during pregnancy often cause problems during the puerperium, for example skin problems, namely striae gravidarum or stretch marks. Striae gravidarum is a linear scar tissue on the skin due to stretching of the skin that exceeds its elasticity limit that occurs during pregnancy and weight gain during pregnancy (Ida Miharti & Fitrishia, 2020). Striae gravidarum occurring in pregnancy is considered to be the most common connective tissue change in pregnancy with reported incidence rates usually ranging from 52-90% in women (Brennan, Clarke, Newell, & Devane, 2018).

The cause of Striae gravidarum in general and its epidemiology are not known with certainty. The strongest risks are weight gain during pregnancy, young mother's age, and family history. Striae gravidarum generally appears at 24 weeks of gestation and has the characteristics of stripes at least 5 cm long, with a reddish, purplish color and will gradually change to white or hypopigmented atrophic lines in the postpartum

period. These striae gravidarum lines can be either thin lines or wide lines. Scientists have stated that several hormones, such as estrogen, relaxin, and adrenocorticoid hormones, decrease the density between collagen fibers and increase the ground substance, which causes stretch areas known as striae (Hasnita & Octazuria, 2019).

Striae gravidarum can appear on the abdomen, breasts, thighs or upper arms and is clearly visible from the 6th – 7th month of pregnancy. The effect of striae gravidarum causes itching, burning, dryness and emotional disturbances or psychological problems, especially for mothers who are very concerned about appearance so that it can interfere with social life (Violina Harnanti, Yulianto Listiawan, Astari, & Sandhika, 2019). Various treatments including topical retinoids, laser therapy and chemical peels have been studied (Zulaekha 2022). Topical tretinoin  $\geq 0.05\%$  has shown up to 47% improvement and fractional non-ablative lasers have consistently shown 50 to 75% improvement in treated striae distensae lesions (Farahnik, Park, Kroumpouzou, & Murase, 2017). However, some of these treatment methods certainly require expensive cost.

There are several natural ingredients that can be used to reduce striae gravidarum. VCO (Virgin Coconut Oil) can remove striae gravidarum where coconut oil has a high moisture level and can help keep the skin hydrated. The lauric acid content is also easily absorbed deep into the skin layers which has a positive effect on collagen production. VCO has anti-inflammatory properties and can help reduce healing time for existing striae gravidarum. One study showed that applying VCO to the stomachs of pregnant women for 8 weeks showed a decrease in the number of striae gravidarum in pregnant women (Fenny, 2020).

Another natural ingredient that can be used to reduce striae gravidarum is aloe vera. Aloe vera contains 99% water, glucomannan, sterols, amino acids, lipids and vitamins. Several studies have shown that the aloe vera plant has good antioxidant content. Antioxidants are important substances that protect cells from oxidative damage. Aloe vera contains polysaccharides that work together with essential amino acids and protein-breaking enzymes so that they can replace damaged cells and improve skin conditions (Maan et al., 2018).

Cacao is a plant that is efficacious for maintaining healthy skin. Cacao contains antioxidants contained in cocoa beans to help stimulate skin cells and can fade striae gravidarum. A study on the effect of applying cocoa bean extract on the amount of skin melanin pigment in Wistar rats, showed that cocoa bean extract reduced the amount of melanin pigment in the skin of Wistar rats (Yonathan et al., 2016). Cocoa butter is very good to use because it is rich in vitamin E and stearic acid which are beneficial for skin health such as moisturizing the skin, can ward off free radicals because they contain tocopherols and polyphenols (Prasatya, Suhendra, & Wartini, 2020). Based on this background, this study aims to make a spread made from cacao, virgin coconut oil, and aloe vera (Canira Malolo), and to determine the effectiveness of Canira Malolo against striae gravidarum in postpartum mothers in Polewali Mandar Regency, West Sulawesi.

## METHODS

This study used a pre-experimental design with the one group pre-test – post-test design. The research was conducted from October to December 2022 at 5 Public Health Centers (Batupanga, Binuang, Wonomulyo, Katumbangan, Pambusuang), Polewali Mandar Regency, West Sulawesi. The population is all postpartum mothers in several working areas of the Puskesmas in Polewali Mandar district. Samples were postpartum women who met the sample criteria (childbirth mothers had Striae



gravidarum in the abdomen, had no history of allergies, had no open wounds and were willing to be samples). The number of samples at the beginning of the study was 30 people, calculated using the Sopiyyuddin formula (Sopiyyuddin Dahlan, 2020). Determination of the number of samples at 5 Community Health Centers in Polewali Mandar was carried out proportionally, the sample selection used a purposive sampling technique. After conducting the research, the number of samples was only 10 people because there were several samples that did not meet the criteria and dropped out during the research process.

Data collection techniques based on primary data and secondary data. The primary data is in the form of interviews and observations using instruments, namely questionnaires and checklist sheets. The research variable is Canira malolo with the objective criteria of being smeared (score=1) and not smeared (score=0), the striae gravidarum variable is measured according to OSAS (Observer Scar Assessment Scale) includes color, relief and thickness indicators with objective criteria of real appearance with a score=0 (Color: clear albae/rubra, Relief: uneven surface, thickness: prominent), faint appearance with a score=1 (Color: pale albae/rubra, Relief: flat surface, thickness: not prominent). Giving canira malolo interventions to postpartum mothers is carried out every day for 2 weeks with a duration of giving 2 times a day in the morning and evening with a volume of 3-5 ml each time. The pretest was carried out before the intervention started, and the posttest was carried out after 2 weeks of using Canira Malolo. Secondary data was obtained from the health center regarding data on the number of postpartum mothers. Analysis of research data using the Wilcoxon Signed Ranks Test.

The process of making cacao, virgin coconut oil, and aloe vera spreads to become canira malolo is carried out in several stages. The first stage is preparing the raw materials for making VCO, cocoa butter/oil, aloe vera oil.

### **Manufacturing of Cocoa Powder**

1. Remove the cocoa beans from the shell and then wash them thoroughly.
2. Cocoa beans are dried until the water content reaches 6 – 8%. The drying process is carried out using a drying oven for about 24 hours at 70-80°C, then continued at 100°C for 3-4 hours.
3. The purpose of the cocoa bean roasting process is to sterilize the cocoa beans and make it easier to separate the skin from the contents of the cocoa beans.
4. To change the solid cocoa beans into powder, a grinding process is required using copper.



Figure 1. Drying Cocoa Beans into Cocoa Powder

### Production of Cocoa Butter/ Cocoa Oil

1. 600 grams of cocoa powder mixed with 2000 ml of water then boiled for  $\pm$  1 hour until the solution shrinks and releases oil.
2. Put the cocoa solution in the freezer for 4-6 hours.
3. After going through the process of freezing the solution and separating the cocoa oil, the cocoa solution precipitates and the cocoa oil coagulates.
4. The coagulated cocoa solution is separated in a container and steamed until it melts, after which it is filtered and separated from cocoa oil with water using a separatory funnel to produce 20 ml of cocoa oil.



Figure 2. Process for Making Cocoa Butte/Oil

### Production Of Aloe Vera Oil

1. Peel the aloe vera using a vegetable peeler/knife to slowly peel off the green part of the leaf skin.
2. Match the gel with a spoon. Remove all the flesh and gel from the skin of the leaves until nothing remains into a clean bowl.
3. Blend the peeled aloe vera until smooth.
4. Use 400 grams of refined aloe vera mixed with 200 ml of VCO then cook until it boils until it shrinks for  $\pm$  30 minutes.
5. Separate the aloe vera oil from the dregs using a separatory funnel, and 150 ml of aloe vera oil is produced.



Figure 3. Process For Making Aloe Vera Oil

### Production of VCO

1. Put the thick coconut milk into a plastic bag and then close the plastic bag with a rubber band, let it sit for  $\pm$  24 hours in the freezer.
2. After getting out of the freezer, let it rest for 12 hours at room temperature.

- Next formed 3 layers. The top is residue, the middle is VCO and the bottom is water. Pure oil (VCO) looks clear (clear) like plain water. In contrast to coconut oil after cooking it causes a cloudy color.
- Pierce the center of the plastic (VCO) using a pipette, collect it in the container. Prepare a clean bottle, the top of which is filled with a funnel covered with filter cloth/tissue, oil dripping by drop into the bottle.



Figure 4. The Process of Making VCO

### Production of Canira Malolo

- Prepare all the ingredients: 1000 ml of VCO, 100 ml of aloe vera oil, 20 ml of cocoa oil
- Mix all the ingredients and stir using a stiarel (stirrer) for 20 minutes, until a solution that has been thoroughly mixed is produced.
- Put canira malolo in a sterile bottle and ready to use.



Figure 5. The process of providing the main ingredients for making Canira Malolo Products

## RESULT

The initial analysis in the study was univariate analysis for the observed characteristics of the respondents, namely mother's age and education. The distribution of respondents based on general characteristics is presented in table 1 below.

Table 1. Distribution of Respondents by Age and Mother's Education

Variables	Number (n=10)	Percent (%)
<b>Age</b>		
20 - 35 years	9	90.0
>35 years	1	10.0
<b>Education</b>		
<High School	4	40.0
High School	5	50.0
> High School (College)	1	10.0

Based on Table 1 it shows that most of the respondents were in the age group of 20-35 years with 9 people (90%), and only 1 person (10%) aged >35 years. Meanwhile, for the category of mothers, the highest level of education was at the high school education level, with 5 people (50%).

Bivariate analysis in this study was to see whether or not there were significant differences in the administration of canira malolo on the appearance of striae gravidarum in postpartum mothers.

Table 2. Distribution of Postpartum Mothers Based on Striae Gravidarum Indicators Before and After Intervention

Indicator of striae gravidarum	Before		After	
	n	%	n	%
<b>Color</b>				
Red	4	40.0	2	20.0
Pale	6	60.0	8	80.0
<b>Thickness</b>				
Stand Out	9	90.0	3	30.0
Doesn't Stand Out	1	10.0	7	70.0
<b>Surface/Relief</b>				
Flat	5	50.0	3	30.0
Uneven	5	50.0	7	70.0

Table 2 shows that before the intervention was given to postpartum mothers, the indicator of striae gravidarum in terms of color was more pale as many as 6 people (60%) while there were 4 people who were red in color (40%). While the striae gravidarum indicator in terms of thickness is mostly in the prominent category with 9 people (90%). stretch mark indicators in terms of Surface/Relief with an average category of 5 people (50%) and an uneven category of 5 people (50%).

Table 3. Distribution of Postpartum Mothers Based on Appearances of Striae Gravidarum Before and After Intervention.

Category	<i>Striae Gravidarum</i>			
	Before (n=10)	%	After (n=10)	%
Obvious	9	90.0	4	40.0
Vague	1	10.0	6	60.0

Table 3 shows that before giving the intervention all mothers had stretch marks with a real appearance in 9 people (90%), whereas after being given the intervention most of the mothers had striae gravidarum with a faint appearance in 6 people (60%).

The normality test results for the stretch mark category values before and after the intervention were not normally distributed, so the Wilcoxon Signed Ranks Test was used to test the differences in the appearance of striae gravidarum before and after the intervention.

Table 4. Distribution of Postpartum Mothers Based on Differences in the Appearance of Striae Gravidarum Before and After Intervention

<i>Striae Gravidarum</i>	Mean (Minimum–Maksimum)	SD	p-value
Before Intervention/ Pre-test	0,1 (0-1)	0,3	0,025
After Intervention / Post-test	0,6 (0 -1)	0,5	

Based on Table 4, it shows that after carrying out the Wilcoxon Signed Ranks Test analysis, the results showed that there was a significant difference after giving the

canira malolo intervention to the incidence of striae gravidarum in postpartum mothers with a value of  $p=0.025$ .



Figure 6. Before intervention



Figure 7. After intervention

## DISCUSSION

This research was conducted to overcome striae gravidarum in postpartum mothers in a non-pharmacological way using natural ingredients, namely VCO, Cocoa, and aloe vera which are mixed in several stages into a spread called Canira Malolo. Canira Malolo is the naming of the spread of the product from mixing the three ingredients of Cacao, Virgin Coconut Oil, and aloe vera, where the word canira stands for the three ingredients of Cacao, Virgin Coconut Oil, and aloe vera, while the word malolo means natural beauty in the Mandar area.

Based on the research results, information was obtained that postpartum mothers had never used Cacao, Virgin Coconut Oil, and aloe vera to treat striae gravidarum. Striae gravidarum itself does not threaten the mother's life but can have physiological and psychological effects on the mother (Damanik, Siregar, 2021). There are 2 types of striae gravidarum that occur in postpartum mothers, namely Striae rubra or acute stage and Striae Alba or chronic stage. In this study, before being given the intervention, most of the respondents who experienced striae gravidarum were striae alba, as many as 6 people, while in the striae rubra category, there were 4 people. Treatment for women with striae gravidarum can be treated pharmacologically with radiotherapy, ultraviolet light, laser, cryotherapy, electrosurgery, scalpel surgery, systemic and intralesional. Meanwhile, non-pharmacological treatment can be done topically using natural ingredients (Safitri, 2021).

Several studies have shown that striae gravidarum can be treated topically using herbal ingredients such as olive oil and turmeric, coffee grounds, lemon, aloe vera, potatoes, sugar, banana peels, VCO, cocoa butter/cocoa oil (Candrawati et al., 2021; Meisura, 2022). The results of this study indicate that there is an effect of giving the canira malolo intervention on the appearance of striae gravidarum in mothers, where out of 10 postpartum mothers who experienced striae gravidarum, before the intervention there were 9 mothers with a real appearance, but after the intervention the respondents with a real category were only 4 people the remaining 6 people experienced changes in the vague category. So the use of natural ingredients such as VCO cocoa and aloe vera in this study was quite effective in changing the appearance of striae gravidarum in postpartum mothers.

The research results of Mariasi et al (2021) state that cacao butter or cocoa oil can be used as a raw material for cosmetic products that have benefits for the skin. Cacao butter contains compounds that are useful for the skin such as stearic acid, oleic acid and Vitamin E. Cocoa oil is a product of the cocoa bean plant which contains total phenolics and flavonoids and contains natural antioxidants such as vitamin E so that it can protect the skin from inflammation. Besides that, the benefits found in cocoa beans, especially on the skin, are that they can remove dead skin cells, can soften and



help remove and repair dead skin cells on the skin (Mariasy, Siska Anastasia, Desnita, & Hadari Nawawi, 2021). This is also in line with Ramlan's research which suggests that fats and polyphenols from cocoa beans have quality characteristics that have lotion properties that can improve moisture, oil content and skin smoothness (Ramlah, 2017).

VCO can be used as an active skin moisturizing ingredient, where VCO contains high fatty acids, especially soluble acids and has a high phenolic content, VCO can act as an emollient and as an occlusive agent if used in the right concentration. The use of VCO in this study is in line with the study of Yulia Sari Kubis et al (2015) which showed that there was effectiveness in giving VCO to striae gravidarum in pregnant women, where Topical administration of Olive Oil with VCO ( $p=0.031$ ) would significantly prevent the degree of Striae Gravidarum compared to the control group. placebo. the ingredients contained in VCO include lauric acid, oleic acid,  $\alpha$  tocopherol, vitamin A, vitamin C, omega-3, moisturizer, and has a low water content (Yulia Sari Lubis, Thaufik, & Nurul Widyawati, 2015). While the results of this study were not in line with those of Pratami et al., there were no differences in striae gravidarum based on the number of stripes and the level of erythema between the groups using VCO (Pratami et al., 2014).

Aloe vera has many biological and physiological benefits, such as the ability to accelerate the healing of burns and cuts on the skin and prevent wrinkles on the skin. Aloe vera contains growth hormone which when interacting with growth hormone receptors on fibroblasts can stimulate cell proliferation activity and can increase collagen synthesis. The content of aloe vera can replace damaged cells and improve skin conditions (Intanwati, Wulandari, & Gurnita, 2022). In addition, Aloe vera can help smooth the surface of the skin, help relieve inflammation and itching and can also reduce stretch marks. This is reinforced by the results of research which states that Aloe vera activates Fibroblasts to produce collagen and elastin fibers which can reduce wrinkles and make the skin more elastic and maximize strokes on the mother's stomach (Yuspa & Febrianti, 2021). The use of Aloe vera in this study is in line with research conducted in Bukittinggi which states that administration of aloe vera (Aloe vera) is very effective for removing striae gravidarum (Hasnita & Octazuria, 2019).

## CONCLUSION AND RECOMMENDATION

A smear preparation (canira malolo) has been made from VCO, cocoa and aloe vera to treat striae gravidarum in postpartum mothers. The results of the analysis found that there was a significant difference after giving the canira malolo intervention to the incidence of stretch marks in postpartum mothers with a  $p$ -value=0.025. This study suggests that the results of this study can be used in designing interventions to treat striae gravidarum in postpartum women with a larger sample and it is necessary to match the sample and use a control or comparison group so that it can be used to generalize the degree of stretch marks in postpartum women and control confounding variables that can affect the appearance of stretch marks such as diet, activity and mother's weight.

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