



## Promotion of Exclusive Breastfeeding Through Drinking “Uyup-Uyup” Herbal

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### Abstract

The tradition of mothers after giving birth is that they usually drink uyup-uyup herbal. Uyup-uyup herbal is believed to facilitate the release of breast milk. Therefore, many mothers drink a traditional drink called uyup-uyup herbal during the postpartum period. This study aimed to treat the role of herbalists as agents of change in promoting exclusive breastfeeding. This study intervention trained uyup-uyup herbalists. Trained Uyup-uyup herbalists then practiced promoting exclusive breastfeeding to breastfeeding mothers. The quantitative study used a quasi-experimental research design to determine the treatment effect of exclusive breastfeeding promotion. The treatment group was located in the Bojongsari District and the control group was in the Padamara district. The number of samples in the treatment group and the control group respectively by 40 breastfeeding mothers. The results showed the differences in knowledge and attitudes about exclusive breastfeeding in the treatment group. From these results, efforts to promote exclusive breastfeeding can be carried out through intermediaries uyup-uyup herbalists to mothers.

### Introduction

Exclusive breastfeeding is influenced by various factors such as demographics, physical, social, and psychological. Demographic factors are age, marital status, level of education, and nutrition supplementation. Biological factors, namely the adequacy of breast milk, infant health problems, maternal obesity, maternal psychological changes, smoking, parity, and aid delivery. Social factors are income, maternal employment, support for families and health professionals, mother's intention, and mother's confidence (Thulier & Mercer, 2009).

Risk factors for potential lactation problems are divided into 4 categories related to (1) maternal history, (2) infant history, (3) maternal physical examination findings, and/or (4) infant physical examination findings (Flagg & Busch, 2019). These risk factors may be modified by the mother and include (1) lack of prenatal breastfeeding education; (2) social support factors (related to breastfeeding

experience or cultural beliefs); (3) history or other stressors; (4) late or lack of prenatal care; (5) pain management during labor (6) use of hormonal contraception postpartum (7) ingested or intravenous substance use and (8) plan to return to work within 6 months postpartum (Abdulwadud & Simpson, 2006). The more risk factors present, the more likely breastfeeding problems will arise. When risk factors are recognized and utilized in conjunction with individual concerns identified in the home visit, education, and interventions can be initiated to promote successful breastfeeding.

Milinga's study stated that 53.8% of breastfeeding mothers use herbs to overcome barriers related to breastfeeding. Most breastfeeding mothers, namely 81%, use herbs made from black pepper but discuss the usage with health care providers. The practice of using herbal among nursing mothers in Tanzania is still popular. (Milinga *et al.*, 2022). Important

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factors affecting women's consumption patterns of health products are related to traditions, namely group identity, cultural background, and social environment. Sociological theory related to factors that contribute to the use of herbs among Nigerian women. The cultural, social, and economic way of choosing goods is a factor related to this. (Omoye, 2017). 37.0% of mothers used herbs during breastfeeding, but very few users of herbs, which is 2.1%, to facilitate breastfeeding. Changes in diet to increase milk supply, namely as much as 93.9%, only 11.4% of breastfeeding women disclosed their use of herbs to health care providers (James *et al.*, 2019).

In Australia, only 60% are breastfeeding and 16% are exclusively breastfeeding. Galactagogues is a term used to describe the substances that are thought to increase breast milk production. Galactagogues are dietary or herbal supplements, such as oats or fenugreek, and pharmaceutical treatments like domperidone. Approximately 1 out of 6 women report starting galactagogues within the first week postpartum. Galactagogue use ranges from 2 to 20 weeks (James *et al.*, 2019). Chao's research stated the use of Chinese herbal medicine in Taiwan during pregnancy and the postpartum period: A population-based cohort study results showed that 33.6% of 369 respondents used herbal medicine. A total of 87.7% had consumed herbal medicine during pregnancy and in the postpartum period.

Health promotion is an effort to help people be able to carry clean and healthy behavior to help themselves, through learning with the community, as local culture and supported by policy community-based health, which is empowerment of communities formed based on the needs of society, managed with the community of health center personnel, cross-sector, and other relevant institutions. Clean and healthy behaviour in the household is an attempt to empower members of the household to know, be willing, and be able to carry out a clean and healthy living behaviour and participation in the public health movement. One of the indicators of clean and healthy living behavior at the household level is exclusive breastfeeding.

One of the community involvements is

the herbalist community because mothers still believe in the habit practice of herbal drinks, which can be attributed to the perception of smooth breastfeeding. Breast milk adequacy in the herbal drink tradition is a means of treatment to see the extent to which the herbalists' role in promoting adequacy of breast milk for the mother. That is expected to change the perception of mothers in assessing the adequacy of breast milk. It will change the perception of mothers to breastfeed infants exclusively to the fullest.

The herbalist community believes in interacting with the mother through the provision of messages/ information regarding perceptions of the adequacy of breast milk. It also believes the mother during the traditions of herbal drink. That habit can support the health of the mother after birth so the milk supply becomes more. Herbalists can also provide psychological support to the mother as well as participate empathetic and able to communicate in accordance with the cultural and family backgrounds of mothers in breastfeeding and promotional signs of adequacy of exclusive breastfeeding. Promotion of exclusive breastfeeding only relied on midwives and volunteers to improve the coverage of exclusive breastfeeding, so there is a need for efforts by the herbal holding community to increase breast milk adequacy.

## Method

This study used a quantitative research design. This research was conducted in Purbalingga in May - October 2015. Quantitative research was conducted to determine the effect of exclusive breastfeeding promotion by herbalists on breastfeeding mothers. The quantitative research study design used a non-randomized control group pretest-posttest design. The method of delivering material used a module tool that contains the meaning of exclusive breastfeeding, its benefits, factors related to exclusive breastfeeding, and signs of breastfeeding adequacy. The effectiveness of the training was measured through the pretest and posttest Knowledge, Attitudes and Practices (KAP) for the promotion of breast milk, a sign of adequacy of breast milk for sellers of herbal medicine uyup-uyup. The population in

this study were all sellers of uyup-uyup herbal medicine located in Bojongsari District. The sample was an herbal medicine seller who sold uyup uyup herbal medicine. Several 40 herbal medicine sellers were taken using a purposive sampling technique with the inclusion criteria of uyup uyup herbal sellers who sold around, were willing to be respondents, and had good communication skills. Exclusion criteria were herbal medicine sellers who did not follow the training until completion and herbal medicine sellers who could not read and write.

This study provided treatment in the form of exclusive breastfeeding promotion training for herbalists in Beji Village of Bojongsari Subdistrict in Purbalingga for the next herbalists. The training for uyup-uyup herbalists was carried out for 3 days. The materials provided were the benefits of uyup-uyup herbal which is useful for stimulating the flow of breast milk, health promotion techniques to provide breastmilk exclusively, and the practice of promoting exclusive breastfeeding to breastfeeding mothers who consume uyup-uyup herbal. Then, herbalists with the best scores for the assessment of knowledge, attitudes, and herbalist skills, will be elected to promote exclusive breastfeeding to mothers who become their customers. Mother samples were divided into the treatment group (Subdistrict of Bojongsari) and the comparison group (Subdistrict of Padamara). In each group, exclusive breastfeeding knowledge and attitudes of mothers are measured. Measurements were made through a pretest and posttest assessment to determine differences in knowledge and attitudes before and after the treatment. Sampling was based on the calculation of a minimum sample. The sample size was calculated using the following formula:

$$n = \frac{Z^2_{1-\alpha/2} \cdot P \cdot (1-P) N}{d^2 (N-1) + Z^2_{1-\alpha/2} P (1-P)}$$

$$n = \frac{1,962 \cdot 0,5 \cdot 0,5 \cdot 634}{0,15^2 (634-1) + 1,96^2 \cdot 0,5 \cdot 0,5}$$

$$n = 40 \text{ mothers}$$

The sampling used purposive sampling, so the sample used 80 breastfeeding mothers

consisting of 40 mothers who have babies 0-6 months promoted by trained herbalists (treatment group) and 40 breastfeeding mothers who have babies 0-6 months received exclusive breastfeeding promotion by midwives when antenatal care (the control group). Inclusion criteria treatment groups were breastfeeding mothers who buy uyup-uyup herbal from their subscription herbalist, and breastfeeding mothers who reside in the District of Bojongsari. Exclusion criteria were mothers who were not willing to become respondents. The inclusion criteria control group were breastfeeding mothers who bought uyup-uyup herbal from untrained herbalists and breastfeeding mothers who received information from health professionals during pregnancy.

The exclusion criteria were mothers who were not willing to become respondents. The validity that was used in this study is construct validity. This questionnaire was done on the validity to be analyzed using product moment correlation. Validity testing was done by comparing the test result with the p-value. These results used indicators p-value since the value of  $p < 0.05$ , so it can be valid. Reliability testing was done by comparing the test results with Cronbach alpha values. Ethical Considerations in this study were conducted by the research ethics approval filed (Ethical Clearance) to the Commission on Ethics and Development Agency Indonesian Health Ministry. The results obtained permit the filing of an ethics research Number. LB.02.01/5.2/ KE266/2015 dated May 5, 2015. The data collection method was done by interviewing with a questionnaire. Mothers prove this willingness in the research activities using signed informed consent after receiving explanations. Explanations of mothers carried out in the study were to include the confidentiality of research results. This study also did not have a negative impact on mothers. Univariate and bivariate analyses were performed by paired t-test, Wilcoxon test, and Mann-Whitney test.

## Results and Discussion

Table 1 shows the majority of mothers who had levels of education graduated junior high school level at 57.5% in the treatment group and 37.5% in the comparison group.

Table 1. Characteristics of Treatment Group and Control Group

No	Characteristic	Category	Treatment		Control	
			f	%	f	%
1.	Maternal Education	Incomplete	0	0	1	2,5
		Primary School	8	20	8	20
		Junior High School	23	57.5	15	37.5
		Senior High School	7	17.5	14	35.0
		Higher Education	2	5	2	5
2.	Maternal Occupation	Housewives	31	77.5	27	67.5
		Employee	1	2.5	2	5
		Entrepreneur	1	2.5	2	5
		Labor	5	12.5	7	17.5
		Etc	5	12.5	2	5
3.	Maternal Occupation	< 20 Year	2	5	3	7.5
		20 – 35 Year	32	80	33	82.5
		> 35 Year	6	15	4	10
4.	Breastfeeding Practice	Breast Milk	25	62.5	20	50
		Breast Milk and Formula Milk	15	37.5	20	50

Most mothers do not work, with the amount of 77.5% in the intervention group and 67.5% in the control group. Maternal age in the intervention groups, most age range 20-35 years by 80%, and 82.5% in the control group. Breastfeeding practices were more common in the intervention group, namely 62.5% compared to the control group, namely 50%.

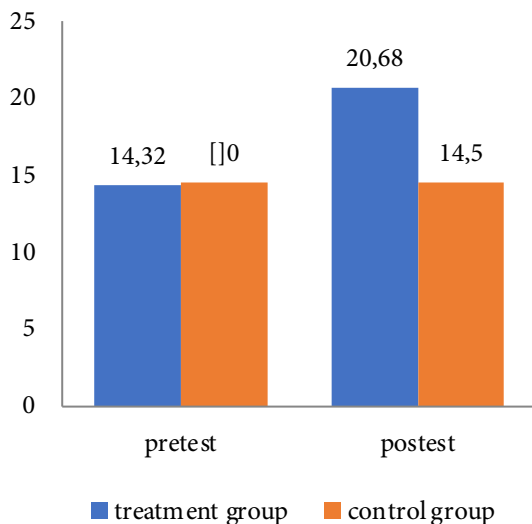


Figure 1. Differences in Knowledge of Exclusive Breastfeeding.

Figure 1 shows an increase in the average value of pretest and posttest knowledge of the treatment group and the results generated

Wilcoxon test p-value = 0.000 indicates the average difference before and after treatment. In the comparison group, there was no increase in the average value between before and after treatment, and also not statistically significant (Wilcoxon test p-value = 0.655). Before treatment the average value of the comparison between the group treated with almost the same and the results obtained by Mann Whitney test p-value = 0.988, so it is not statistically significant. After treatment, the average value of treatment is higher, and statistically no difference in average value between the treatment group and the comparison at the time of the posttest with a Mann Whitney test p-value of 0.000.

There is a difference in exclusive breastfeeding knowledge in breastfeeding mothers in the treatment group and the comparison group after exclusive breastfeeding promotion treatment in the breastfeeding mothers' treated group. The study showed there is an increase in exclusive breastfeeding knowledge scores in breastfeeding mothers' treated group after the promotion of exclusive breastfeeding by herbalists. Health education through health promotion of exclusive breastfeeding promotion conducted by herbalists to breastfeeding mothers who become their customers. The results of this study indicate that there are differences in knowledge

and attitude of breastfeeding mothers who receive exclusive breastfeeding promotion treatment, compared with a control group that did not receive the treatment on the promotion of exclusive breastfeeding by herbalist.

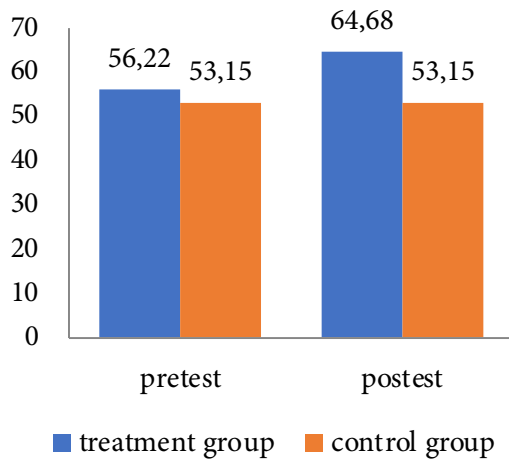


Figure 2. Differences in Attitude of Exclusive Breastfeeding

Figure 2 shows that in the treatment group, there is an increase in the average value of attitudes between before and after, and statistically by the Wilcoxon test obtained by value  $p = 0,000$  so it proved no significant

difference. While the control group average values of the pretest and posttest are similar and statistically by Wilcoxon  $p = 0.100$  value was obtained so it proved no significant difference. Before treatment, the average value of attitude was higher in the treatment group and statistically proved no significant difference ( $p = 0.01$  Mann Whitney test). After the treatment score of attitude in the treatment group improved more and statistically by Mann Whitney test obtained by value  $p = 0,000$  so it proved no significant difference. There is a difference in attitude between the treatment and breastfeeding mothers comparison groups can be caused due to an increase in the attitude of the treatment group due to the positive perception of respondents regarding the promotion of exclusive breastfeeding conducted by herbalists.

In this study, there were differences in the knowledge of exclusive breastfeeding among breastfeeding mothers in the treatment group and the comparison group after being given exclusive breastfeeding promotion treatment by herbalists. Education about breastfeeding and breastfeeding helped to improve breastfeeding knowledge and breastfeeding

Table 2. Test Analysis Knowledge and Attitude in the Treatment Group and Control Group

Difference Test	Variable	Mean	SD	Test Used	p-value	$\alpha$	Conclusion
Treatment Group	Knowledge(Pretest)	14,32	2,49	Wilcoxon test	0,000	0,05	Difference Knowledge
	Knowledge(Post-test)	20,68	2,09				
Control Group	Attitude (Pretest)	56,22	6,20	Wilcoxon test	0,000	0,05	Difference Attitude
	Attitude(Post-test)	64,68	6,49				
Treatment group	Knowledge(Pretest)	14,50	2,57	Wilcoxon test	0,655	0,05	No difference Knowledge
	Knowledge(Post-test)	15,40	6,77				
Control Group	Attitude(Pretest )	53,15	5,59	Wilcoxon test	0,10	0,05	No difference Attitude
	Attitude(Post-test)	53,50	5,54				
Treatment With Control	Knowledge(Treatment)	20,68	2,09	Mann Whitney test	0,000	0,05	Difference Knowledge
	Knowledge(Control)	14,50	6,77				
Treatment With Control	Attitude (Treatment)	64,68	6,49	Mann Whitney test	0,000	0,05	Difference Attitude
	Attitude(Control)	53,50	5,54				

practices (Radhakrishnan & Balamuruga, 2012). Breastfeeding beliefs, knowledge, and self-efficacy could also be increased through interpersonal communication and mass media campaigns (Nguyen *et al.*, 2016).

The comparison group who was not given health education did not experience the treatment process which is the process of providing information on the herbalists to breastfeeding mothers. Health education is a learning process that can lead to a process of growth, development, and change for the better. Breastfeeding mothers can interact with herbalist treatment groups so that from there the interaction changes from not knowing to knowing and being able to do something unusual. Learning is a process that attempts a person to obtain a change in behavior as a whole, as a result of his own experience in interaction with the environment. The learning process does not only come from treatment provided by the promoter but can be done by people who are considered closer and have better knowledge.

Two educational interventions targeted expectant mothers; one involved a 2-session educational program with the provision of a breastfeeding booklet in Iraq reported a significant improvement in knowledge and change in attitude about breastfeeding among participants compared to the control group ( $p < 0.001$ ) (Piro & Ahmed, 2020) and another was delivered via mHealth in Saudi Arabia and reported an increase in intention to exclusively breastfeeding: 80.8% compared to 46.1% pre-intervention (46.1%) (Alnasser *et al.*, 2018). Previous exclusive breastfeeding experience is expected to predispose patients to future exclusive breastfeeding. However, as experts indicate, we should focus on providing objective information about the time and effort required for breastfeeding and help women set challenging and achievable goals, according to their current situation (Spatz, 2017; Santamaría-Martín *et al.*, 2022).

A person's attitude may change by obtaining additional information about a particular object. Attitudes can be formed based on feelings, thoughts, knowledge, beliefs, and past experiences. In this study, the group that was given exclusive breastfeeding

promotion treatment by herbalists had a higher attitude score. In Ichsan's research, it was found that there are significant differences between the knowledge and attitudes about exclusive breastfeeding of mothers who were members of the mothers' support group program and those who were not members of the program. Mothers who are members of the mothers' support group program have better knowledge and attitudes about exclusive breastfeeding (Ichsan *et al.*, 2015). Based on research by Yulidasari, it is known that there is a relationship between health workers' support and culture of exclusive breastfeeding with the status of exclusive breastfeeding in Sungai Ulin Community Health Center (Yulidasari *et al.*, 2017).

In this study, there was a difference in attitude between the treatment and breastfeeding mothers' comparison groups after being given exclusive breastfeeding promotion treatment by herbalists. Improved understanding is possible to be considered to determine the mother's attitude toward exclusive breastfeeding. Most infants today still do not receive the full benefits of breastfeeding, leaving millions at unnecessary risk of illness and death, and most health workers lack the skills needed to help mothers improve (Yasser Abulreesh *et al.*, 2021). Attitudinal issues that pose barriers to exclusive breastfeeding. Most of our participants' responses to those questions addressing negative attitudes to breastfeeding were unfavorable.

Based on research by Yasser Abulreesh *et al.*, an overall score of breastfeeding attitudes averaged  $59.6 \pm 7.3$ , the tendency for scoring a negative attitude to breastfeeding was significantly reported ( $p < 0.5$ ) among 31- to 40-year-old mothers, bachelor's degree holder, employees, and barriers mother's sickness and work. Efforts to minimize such negative attitudes and barriers among susceptible mothers are warranted (Shaheen *et al.*, 2018). Breastfeeding mothers have a positive perception of exclusive breastfeeding promotion treatments that herbalists do to breastfeeding mothers. Mothers misunderstand certain signs in children and consider breast milk to be insufficient. There is a positive attitude toward exclusive breastfeeding among mothers who

do not give exclusive breastfeeding. Mothers' knowledge and attitude were favorable, but it will be optimal if the mothers practice to give exclusive breastfeeding. The motivation given by uyup-uyup herbalists to breastfeeding mothers is one of the factors that encourage mothers to give exclusive breastfeeding by drinking herbal traditions since the drinking of uyup uyup herbs is believed to increase milk production (Perez-Cueto *et al.*, 2009).

Nwosu and Eke noted the study recommends health promotion intervention as a proven method for scaling up knowledge and practice of exclusive breastfeeding in rural communities. Low level of knowledge, worrying about exclusive breastfeeding, resistance to change from cultural imperative, and medical reasons, contribute to low level of practice exclusive breastfeeding. Traditional approach herbal drink made by uyup uyup herbalists was expected to preserve the mother's habit of drinking uyup-uyup herbal. The role of uyup-uyup herbalists in motivating exclusive breastfeeding is a new innovation that can be applied in other places to improve the coverage of exclusive breastfeeding (Nwosu & Eke, 2011).

Implementation of a newborn care package in four health centers in Somalia that included health-training workers and provision of delivery and newborn kids while early initiation of breastfeeding increased from 30.1 to 83.7% with an adjusted odds ratio of 10.6 (95% Confidence Interval: 10.6;  $P < 0.014$ ) (Amsalu *et al.*, 2020). Health education and counseling provided by professionals and non-professional health workers in conducting peer support interventions resulted in some improvements in breastfeeding initiation rates, especially among low-income earners who usually have low education. The most common type of educational or support intervention that can increase the initiation is an informal session delivered in the perinatal period by a trained breastfeeding professional or peer counselor (James *et al.*, 2019).

Breastfeeding efforts sometimes do not reach the target of breastfeeding mothers, so efforts to provide support to them are urgently needed at this time. A multilevel approach was developed from previous research, namely developing education and counseling from

pregnancy to 6 months after delivery. The assessment was implemented and the result was that 44.6% (49/110) of prenatal participants reported that they planned to breastfeed, and 67.0% of delivered participants initiated (Leruth *et al.*, 2017).

### Conclusion

There are differences in knowledge and attitudes of breastfeeding mothers in the treatment group and the control group before and after treatment by the promotion of exclusive breastfeeding herbalists. Sustainable promotion of exclusive breastfeeding by herbalists to breastfeeding mothers is supported by the importance of empowering herbalists to promote exclusive breastfeeding. For herb sellers, to maintain and improve the promotion of exclusive breastfeeding behavior of breastfeeding mothers, the Bojongsari health center needs to routinely provide guidance to the community and involve herbalists in the promotion of exclusive breastfeeding.

### Acknowledgment

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factors affecting women's consumption patterns of health products are related to traditions, namely group identity, cultural background, and social environment. Sociological theory related to factors that contribute to the use of herbs among Nigerian women. The cultural, social, and economic way of choosing goods is a factor related to this. (Omoye, 2017). 37.0% of mothers used herbs during breastfeeding, but very few users of herbs, which is 2.1%, to facilitate breastfeeding. Changes in diet to increase milk supply, namely as much as 93.9%, only 11.4% of breastfeeding women disclosed their use of herbs to health care providers (James *et al.*, 2019).

In Australia, only 60% are breastfeeding and 16% are exclusively breastfeeding. Galactagogues is a term used to describe the substances that are thought to increase breast milk production. Galactagogues are dietary or herbal supplements, such as oats or fenugreek, and pharmaceutical treatments like domperidone. Approximately 1 out of 6 women report starting galactagogues within the first week postpartum. Galactagogue use ranges from 2 to 20 weeks (James *et al.*, 2019). Chao's research stated the use of Chinese herbal medicine in Taiwan during pregnancy and the postpartum period: A population-based cohort study results showed that 33.6% of 369 respondents used herbal medicine. A total of 87.7% had consumed herbal medicine during pregnancy and in the postpartum period.

Health promotion is an effort to help people be able to carry clean and healthy behavior to help themselves, through learning with the community, as local culture and supported by policy community-based health, which is empowerment of communities formed based on the needs of society, managed with the community of health center personnel, cross-sector, and other relevant institutions. Clean and healthy behaviour in the household is an attempt to empower members of the household to know, be willing, and be able to carry out a clean and healthy living behaviour and participation in the public health movement. One of the indicators of clean and healthy living behavior at the household level is exclusive breastfeeding.

One of the community involvements is

the herbalist community because mothers still believe in the habit practice of herbal drinks, which can be attributed to the perception of smooth breastfeeding. Breast milk adequacy in the herbal drink tradition is a means of treatment to see the extent to which the herbalists' role in promoting adequacy of breast milk for the mother. That is expected to change the perception of mothers in assessing the adequacy of breast milk. It will change the perception of mothers to breastfeed infants exclusively to the fullest.

The herbalist community believes in interacting with the mother through the provision of messages/ information regarding perceptions of the adequacy of breast milk. It also believes the mother during the traditions of herbal drink. That habit can support the health of the mother after birth so the milk supply becomes more. Herbalists can also provide psychological support to the mother as well as participate empathetic and able to communicate in accordance with the cultural and family backgrounds of mothers in breastfeeding and promotional signs of adequacy of exclusive breastfeeding. Promotion of exclusive breastfeeding only relied on midwives and volunteers to improve the coverage of exclusive breastfeeding, so there is a need for efforts by the herbal holding community to increase breast milk adequacy.

## Method

This study used a quantitative research design. This research was conducted in Purbalingga in May - October 2015. Quantitative research was conducted to determine the effect of exclusive breastfeeding promotion by herbalists on breastfeeding mothers. The quantitative research study design used a non-randomized control group pretest-posttest design. The method of delivering material used a module tool that contains the meaning of exclusive breastfeeding, its benefits, factors related to exclusive breastfeeding, and signs of breastfeeding adequacy. The effectiveness of the training was measured through the pretest and posttest Knowledge, Attitudes and Practices (KAP) for the promotion of breast milk, a sign of adequacy of breast milk for sellers of herbal medicine uyup-uyup. The population in

this study were all sellers of uyup-uyup herbal medicine located in Bojongsari District. The sample was an herbal medicine seller who sold uyup uyup herbal medicine. Several 40 herbal medicine sellers were taken using a purposive sampling technique with the inclusion criteria of uyup uyup herbal sellers who sold around, were willing to be respondents, and had good communication skills. Exclusion criteria were herbal medicine sellers who did not follow the training until completion and herbal medicine sellers who could not read and write.

This study provided treatment in the form of exclusive breastfeeding promotion training for herbalists in Beji Village of Bojongsari Subdistrict in Purbalingga for the next herbalists. The training for uyup-uyup herbalists was carried out for 3 days. The materials provided were the benefits of uyup-uyup herbal which is useful for stimulating the flow of breast milk, health promotion techniques to provide breastmilk exclusively, and the practice of promoting exclusive breastfeeding to breastfeeding mothers who consume uyup-uyup herbal. Then, herbalists with the best scores for the assessment of knowledge, attitudes, and herbalist skills, will be elected to promote exclusive breastfeeding to mothers who become their customers. Mother samples were divided into the treatment group (Subdistrict of Bojongsari) and the comparison group (Subdistrict of Padamara). In each group, exclusive breastfeeding knowledge and attitudes of mothers are measured. Measurements were made through a pretest and posttest assessment to determine differences in knowledge and attitudes before and after the treatment. Sampling was based on the calculation of a minimum sample. The sample size was calculated using the following formula:

$$n = \frac{Z^2_{1-\alpha/2} \cdot P \cdot (1-P) N}{d^2 (N-1) + Z^2_{1-\alpha/2} P (1-P)}$$

$$n = \frac{1,962 \cdot 0,5 \cdot 0,5 \cdot 634}{0,15^2 (634-1) + 1,96^2 \cdot 0,5 \cdot 0,5}$$

$$n = 40 \text{ mothers}$$

The sampling used purposive sampling, so the sample used 80 breastfeeding mothers

consisting of 40 mothers who have babies 0-6 months promoted by trained herbalists (treatment group) and 40 breastfeeding mothers who have babies 0-6 months received exclusive breastfeeding promotion by midwives when antenatal care (the control group). Inclusion criteria treatment groups were breastfeeding mothers who buy uyup-uyup herbal from their subscription herbalist, and breastfeeding mothers who reside in the District of Bojongsari. Exclusion criteria were mothers who were not willing to become respondents. The inclusion criteria control group were breastfeeding mothers who bought uyup-uyup herbal from untrained herbalists and breastfeeding mothers who received information from health professionals during pregnancy.

The exclusion criteria were mothers who were not willing to become respondents. The validity that was used in this study is construct validity. This questionnaire was done on the validity to be analyzed using product moment correlation. Validity testing was done by comparing the test result with the p-value. These results used indicators p-value since the value of  $p < 0.05$ , so it can be valid. Reliability testing was done by comparing the test results with Cronbach alpha values. Ethical Considerations in this study were conducted by the research ethics approval filed (Ethical Clearance) to the Commission on Ethics and Development Agency Indonesian Health Ministry. The results obtained permit the filing of an ethics research Number. LB.02.01/5.2/ KE266/2015 dated May 5, 2015. The data collection method was done by interviewing with a questionnaire. Mothers prove this willingness in the research activities using signed informed consent after receiving explanations. Explanations of mothers carried out in the study were to include the confidentiality of research results. This study also did not have a negative impact on mothers. Univariate and bivariate analyses were performed by paired t-test, Wilcoxon test, and Mann-Whitney test.

## Results and Discussion

Table 1 shows the majority of mothers who had levels of education graduated junior high school level at 57.5% in the treatment group and 37.5% in the comparison group.

Table 1. Characteristics of Treatment Group and Control Group

No	Characteristic	Category	Treatment		Control	
			f	%	f	%
1.	Maternal Education	Incomplete	0	0	1	2,5
		Primary School	8	20	8	20
		Junior High School	23	57.5	15	37.5
		Senior High School	7	17.5	14	35.0
		Higher Education	2	5	2	5
2.	Maternal Occupation	Housewives	31	77.5	27	67.5
		Employee	1	2.5	2	5
		Entrepreneur	1	2.5	2	5
		Labor	5	12.5	7	17.5
		Etc	5	12.5	2	5
3.	Maternal Occupation	< 20 Year	2	5	3	7.5
		20 – 35 Year	32	80	33	82.5
		> 35 Year	6	15	4	10
4.	Breastfeeding Practice	Breast Milk	25	62.5	20	50
		Breast Milk and Formula Milk	15	37.5	20	50

Most mothers do not work, with the amount of 77.5% in the intervention group and 67.5% in the control group. Maternal age in the intervention groups, most age range 20-35 years by 80%, and 82.5% in the control group. Breastfeeding practices were more common in the intervention group, namely 62.5% compared to the control group, namely 50%.

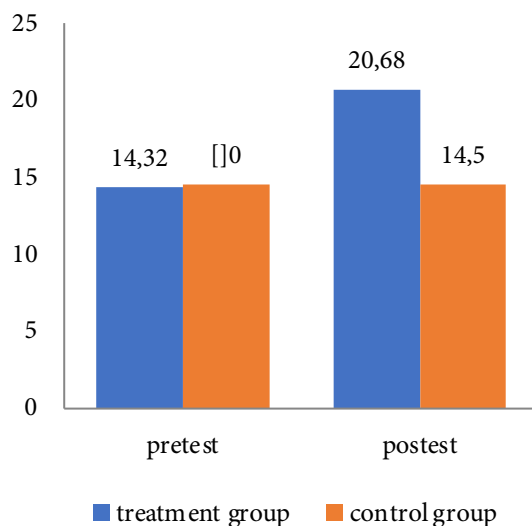


Figure 1. Differences in Knowledge of Exclusive Breastfeeding.

Figure 1 shows an increase in the average value of pretest and posttest knowledge of the treatment group and the results generated

Wilcoxon test p-value = 0.000 indicates the average difference before and after treatment. In the comparison group, there was no increase in the average value between before and after treatment, and also not statistically significant (Wilcoxon test p-value = 0.655). Before treatment the average value of the comparison between the group treated with almost the same and the results obtained by Mann Whitney test p-value = 0.988, so it is not statistically significant. After treatment, the average value of treatment is higher, and statistically no difference in average value between the treatment group and the comparison at the time of the posttest with a Mann Whitney test p-value of 0.000.

There is a difference in exclusive breastfeeding knowledge in breastfeeding mothers in the treatment group and the comparison group after exclusive breastfeeding promotion treatment in the breastfeeding mothers' treated group. The study showed there is an increase in exclusive breastfeeding knowledge scores in breastfeeding mothers' treated group after the promotion of exclusive breastfeeding by herbalists. Health education through health promotion of exclusive breastfeeding promotion conducted by herbalists to breastfeeding mothers who become their customers. The results of this study indicate that there are differences in knowledge

and attitude of breastfeeding mothers who receive exclusive breastfeeding promotion treatment, compared with a control group that did not receive the treatment on the promotion of exclusive breastfeeding by herbalist.

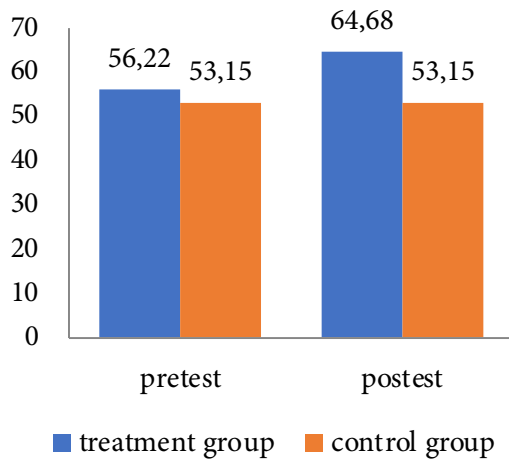


Figure 2. Differences in Attitude of Exclusive Breastfeeding

Figure 2 shows that in the treatment group, there is an increase in the average value of attitudes between before and after, and statistically by the Wilcoxon test obtained by value  $p = 0,000$  so it proved no significant

difference. While the control group average values of the pretest and posttest are similar and statistically by Wilcoxon  $p = 0.100$  value was obtained so it proved no significant difference. Before treatment, the average value of attitude was higher in the treatment group and statistically proved no significant difference ( $p = 0.01$  Mann Whitney test). After the treatment score of attitude in the treatment group improved more and statistically by Mann Whitney test obtained by value  $p = 0,000$  so it proved no significant difference. There is a difference in attitude between the treatment and breastfeeding mothers comparison groups can be caused due to an increase in the attitude of the treatment group due to the positive perception of respondents regarding the promotion of exclusive breastfeeding conducted by herbalists.

In this study, there were differences in the knowledge of exclusive breastfeeding among breastfeeding mothers in the treatment group and the comparison group after being given exclusive breastfeeding promotion treatment by herbalists. Education about breastfeeding and breastfeeding helped to improve breastfeeding knowledge and breastfeeding

Table 2. Test Analysis Knowledge and Attitude in the Treatment Group and Control Group

Difference Test	Variable	Mean	SD	Test Used	p-value	$\alpha$	Conclusion
Treatment Group	Knowledge(Pretest)	14,32	2,49	Wilcoxon test	0,000	0,05	Difference Knowledge
	Knowledge(Post-test)	20,68	2,09				
Control Group	Attitude (Pretest)	56,22	6,20	Wilcoxon test	0,000	0,05	Difference Attitude
	Attitude(Post-test)	64,68	6,49				
Treatment group	Knowledge(Pretest)	14,50	2,57	Wilcoxon test	0,655	0,05	No difference Knowledge
	Knowledge(Post-test)	15,40	6,77				
Control Group	Attitude(Pretest )	53,15	5,59	Wilcoxon test	0,10	0,05	No difference Attitude
	Attitude(Post-test)	53,50	5,54				
Treatment With Control	Knowledge(Treatment)	20,68	2,09	Mann Whitney test	0,000	0,05	Difference Knowledge
	Knowledge(Control)	14,50	6,77				
Treatment With Control	Attitude (Treatment)	64,68	6,49	Mann Whitney test	0,000	0,05	Difference Attitude
	Attitude(Control)	53,50	5,54				

practices (Radhakrishnan & Balamuruga, 2012). Breastfeeding beliefs, knowledge, and self-efficacy could also be increased through interpersonal communication and mass media campaigns (Nguyen *et al.*, 2016).

The comparison group who was not given health education did not experience the treatment process which is the process of providing information on the herbalists to breastfeeding mothers. Health education is a learning process that can lead to a process of growth, development, and change for the better. Breastfeeding mothers can interact with herbalist treatment groups so that from there the interaction changes from not knowing to knowing and being able to do something unusual. Learning is a process that attempts a person to obtain a change in behavior as a whole, as a result of his own experience in interaction with the environment. The learning process does not only come from treatment provided by the promoter but can be done by people who are considered closer and have better knowledge.

Two educational interventions targeted expectant mothers; one involved a 2-session educational program with the provision of a breastfeeding booklet in Iraq reported a significant improvement in knowledge and change in attitude about breastfeeding among participants compared to the control group ( $p < 0.001$ ) (Piro & Ahmed, 2020) and another was delivered via mHealth in Saudi Arabia and reported an increase in intention to exclusively breastfeeding: 80.8% compared to 46.1% pre-intervention (46.1%) (Alnasser *et al.*, 2018). Previous exclusive breastfeeding experience is expected to predispose patients to future exclusive breastfeeding. However, as experts indicate, we should focus on providing objective information about the time and effort required for breastfeeding and help women set challenging and achievable goals, according to their current situation (Spatz, 2017; Santamaría-Martín *et al.*, 2022).

A person's attitude may change by obtaining additional information about a particular object. Attitudes can be formed based on feelings, thoughts, knowledge, beliefs, and past experiences. In this study, the group that was given exclusive breastfeeding

promotion treatment by herbalists had a higher attitude score. In Ichsan's research, it was found that there are significant differences between the knowledge and attitudes about exclusive breastfeeding of mothers who were members of the mothers' support group program and those who were not members of the program. Mothers who are members of the mothers' support group program have better knowledge and attitudes about exclusive breastfeeding (Ichsan *et al.*, 2015). Based on research by Yulidasari, it is known that there is a relationship between health workers' support and culture of exclusive breastfeeding with the status of exclusive breastfeeding in Sungai Ulin Community Health Center (Yulidasari *et al.*, 2017).

In this study, there was a difference in attitude between the treatment and breastfeeding mothers' comparison groups after being given exclusive breastfeeding promotion treatment by herbalists. Improved understanding is possible to be considered to determine the mother's attitude toward exclusive breastfeeding. Most infants today still do not receive the full benefits of breastfeeding, leaving millions at unnecessary risk of illness and death, and most health workers lack the skills needed to help mothers improve (Yasser Abulreesh *et al.*, 2021). Attitudinal issues that pose barriers to exclusive breastfeeding. Most of our participants' responses to those questions addressing negative attitudes to breastfeeding were unfavorable.

Based on research by Yasser Abulreesh *et al.*, an overall score of breastfeeding attitudes averaged  $59.6 \pm 7.3$ , the tendency for scoring a negative attitude to breastfeeding was significantly reported ( $p < 0.5$ ) among 31- to 40-year-old mothers, bachelor's degree holder, employees, and barriers mother's sickness and work. Efforts to minimize such negative attitudes and barriers among susceptible mothers are warranted (Shaheen *et al.*, 2018). Breastfeeding mothers have a positive perception of exclusive breastfeeding promotion treatments that herbalists do to breastfeeding mothers. Mothers misunderstand certain signs in children and consider breast milk to be insufficient. There is a positive attitude toward exclusive breastfeeding among mothers who

do not give exclusive breastfeeding. Mothers' knowledge and attitude were favorable, but it will be optimal if the mothers practice to give exclusive breastfeeding. The motivation given by uyup-uyup herbalists to breastfeeding mothers is one of the factors that encourage mothers to give exclusive breastfeeding by drinking herbal traditions since the drinking of uyup uyup herbs is believed to increase milk production (Perez-Cueto *et al.*, 2009).

Nwosu and Eke noted the study recommends health promotion intervention as a proven method for scaling up knowledge and practice of exclusive breastfeeding in rural communities. Low level of knowledge, worrying about exclusive breastfeeding, resistance to change from cultural imperative, and medical reasons, contribute to low level of practice exclusive breastfeeding. Traditional approach herbal drink made by uyup uyup herbalists was expected to preserve the mother's habit of drinking uyup-uyup herbal. The role of uyup-uyup herbalists in motivating exclusive breastfeeding is a new innovation that can be applied in other places to improve the coverage of exclusive breastfeeding (Nwosu & Eke, 2011).

Implementation of a newborn care package in four health centers in Somalia that included health-training workers and provision of delivery and newborn kids while early initiation of breastfeeding increased from 30.1 to 83.7% with an adjusted odds ratio of 10.6 (95% Confidence Interval: 10.6;  $P < 0.014$ ) (Amsalu *et al.*, 2020). Health education and counseling provided by professionals and non-professional health workers in conducting peer support interventions resulted in some improvements in breastfeeding initiation rates, especially among low-income earners who usually have low education. The most common type of educational or support intervention that can increase the initiation is an informal session delivered in the perinatal period by a trained breastfeeding professional or peer counselor (James *et al.*, 2019).

Breastfeeding efforts sometimes do not reach the target of breastfeeding mothers, so efforts to provide support to them are urgently needed at this time. A multilevel approach was developed from previous research, namely developing education and counseling from

pregnancy to 6 months after delivery. The assessment was implemented and the result was that 44.6% (49/110) of prenatal participants reported that they planned to breastfeed, and 67.0% of delivered participants initiated (Leruth *et al.*, 2017).

### Conclusion

There are differences in knowledge and attitudes of breastfeeding mothers in the treatment group and the control group before and after treatment by the promotion of exclusive breastfeeding herbalists. Sustainable promotion of exclusive breastfeeding by herbalists to breastfeeding mothers is supported by the importance of empowering herbalists to promote exclusive breastfeeding. For herb sellers, to maintain and improve the promotion of exclusive breastfeeding behavior of breastfeeding mothers, the Bojongsari health center needs to routinely provide guidance to the community and involve herbalists in the promotion of exclusive breastfeeding.

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## The Economic Evaluation of Rare Disease Medicines

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### Abstract

Economic evaluation of rare diseases and orphan drugs has gained prominence among scientists, managers, and the general public. This challenging problem requires evaluation and analysis from a variety of perspectives. Economic assessment of technologies can support decision-making and resource allocation. The research objective describes and discusses several important issues when addressing economic evaluation in rare diseases and orphan drugs. The method used in this article review is searching the PubMed, Scopus, and ScienceDirect databases using specific keywords for research articles published in English between 2016 and 2021. We found 537 studies that economically evaluated the cost of treating rare diseases. The selected studies met the eligibility criteria that had been established. To assess the quality of the selected papers, we used a 10-point checklist derived from Drummond's criteria for economic evaluation. Seven papers were reviewed from the initial 20 articles that met the eligibility criteria, and 537 records were initially found across the three databases. The quality of the selected papers ranged from 70% to 100% in meeting Drummond's 10-point checklist. The conclusion of this research is to consistently and continuously identify cost-effective and cost-saving solutions that may help achieve good clinical outcomes and reduce the burden of disease. Future research should focus on the clinical implementation of interventions along with accompanying economic evaluations.

### Introduction

According to the 1983 Orphan Drugs Act, Orphan drugs are defined as products that could address an unmet clinical need but have low investment potential due to the small population affected (Postma *et al.*, 2022). A rare disease (RD) is a pathologic condition affecting fewer than 200,000 individuals (Haendel *et al.*, 2020; Pearson *et al.*, 2018). Approximately 80% of the 5,000–8000 rare diseases that have been identified worldwide are genetic in origin (Haendel *et al.*, 2020; Makarova *et al.*, 2021). Furthermore, the current estimate suggests there are approximately 10,000 rare diseases (Fermaglich & Miller, 2023; Haendel *et al.*, 2020; Taruscio *et al.*, 2011). The medicines proposed

for diagnosing, preventing, and treating RDs are orphan drugs (Mazzucato *et al.*, 2022). The total economic burden of 379 RDs in the United States in 2019 was estimated to be \$997 billion, including \$449 billion in direct medical costs and an additional \$548 billion in indirect, non-medical costs and healthcare costs not covered by insurance (non-covered costs) (Yang *et al.*, 2022).

RDs are often associated with early mortality and long-severe impairment. Although RDs have distinct clinical and pathogenetic characteristics (Haendel *et al.*, 2020), they share many traits in terms of their social and health consequences, rendering RDs a public health concern. Less than one percent of

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rare diseases have effective treatments because their pathogenesis remains largely unknown (Cai *et al.*, 2019; Tumiene & Graessner, 2021). Orphan provides a clear example of the limitations of standard market settings. These pharmaceuticals aim to treat life-threatening or chronically debilitating conditions that affect a small portion of the population, and their limited market potential for recovering development costs necessitates the establishment of a specific legislative framework to support orphan drug development and ensure economic viability (Taruscio *et al.*, 2011). These conditions have a profound impact on affected individuals, as well as on their families, caregivers, healthcare systems, and society (Delaye *et al.*, 2022). In recent decades, there has been an increasing awareness of the significance of rare diseases as a prominent public health concern (Delaye *et al.*, 2022). Accessing therapeutic interventions and appropriate medications may be challenging, as treatment options may be unavailable, restricted, or prohibitively expensive (Angelis *et al.*, 2015). Most research priorities typically focus on the economic impacts, whereas political and public discussions mainly revolve around the frequently outrageous expenses associated with their therapies and administration (Gammie *et al.*, 2017). The high cost of treating rare diseases can be attributed to the time-consuming and expensive process of bringing orphan drugs to market. Moreover, clinical trials should be considered in terms of their challenges and expenses (Adachi *et al.*, 2023; Taruscio *et al.*, 2011). Some orphan drugs, which are used to treat various diseases, may be assumed to be effective for a rare disease that was not claimed on the label or the formulation. If an effective pharmaceutical product remains unaffordable for many patients due to unreasonably high costs, it can become a significant obstacle to achieving positive clinical outcomes.

The commercialization of items with an insufficient cost-effectiveness assessment has occurred in specific circumstances. In such cases, post-marketing surveillance is highly suggested to collect the missing data needed for a comprehensive assessment of cost-effectiveness, clinical relevance, and safety profiles. There were specific reasons for conducting this study to systematically review

the cost-effectiveness analysis of rare disease medicines or orphan drugs.

### Method

Systematic searches were conducted in Pubmed, Science Direct, and Scopus to explore articles related to the economic evaluation of rare disease drugs published between 2016 to 2021. Publications in languages other than English and those categorized as “systematic review,” “meta-analysis,” or “books” were excluded. The review aimed to examine the economic evaluation of the orphan drug to give an overview of the cost of rare disease therapy. The search methods involving MeSH terms were “economic evaluation” “rare disease” AND “orphan drug,” which were used in Pubmed and Science Direct databases. In Scopus, the search terms used were “economic evaluation” OR “cost analysis” OR “cost studies” AND “rare disease” OR “orphan drug.”

Furthermore, to select the article-based inclusion criteria, PICO was used as an inclusion criterion, where P stands for uncommon disease, I stands for orphan drugs, C stands for no intervention, and O stands for the outcome. Therefore, the study conducted full economic evaluations of orphan drugs as its methodology and focused on rare diseases as an indication for orphan drugs. In contrast, the exclusion criteria included qualitative studies, articles in languages other than English, and those with unavailable full text or only abstract available. The PRISMA diagram was used to depict the process of including reviewed papers. After collecting the selected study to review, a quality assessment of included articles was carried out, using Drummond’s 10-point checklist. This critical appraisal done by Eku and PO will count the number of the met or unmet criteria on each paper. The extracted data from the included articles are the authors, the intervention or name of orphan drugs, the study subject, the types of outcomes, the economic evaluation model, and the analysis.

### Result and Discussion

The PRISMA diagram guided the selection of studies (Fig. 1). From Pubmed, Scopus, and ScienceDirect database searches, it was identified 538 publications with an

additional three records. After removing duplicates, a total of 538 studies remained for the screening process. The titles and abstracts of these 538 studies were screened for eligibility, resulting in the exclusion of 518 studies based on the exclusion criteria. This left 20 studies for assessment in the qualitative synthesis. Ultimately, seven papers were selected as the final studies for examining the cost-effectiveness of orphan drugs in treating rare diseases.

The 10 points of the Drummond Methodological Quality Assessment were used to evaluate the quality of economics evaluation journals (Drummond *et al.*, 2015). Seven studies that met the review's inclusion criteria were continued to assess the quality of the method in economic evaluation. Papers were marked with (V) if they fully met the

criteria, while an (X) indicated that the study did not meet the criteria, and an (O) signified that the paper only partially met the criteria or contained some confusing information.) The quality assessment for these studies is presented in Table 1. The Drummond Methodological Quality Assessment revealed a score range of 7-10, equivalent to (70%-100%). The highest score of 10 was achieved by articles authored by (Hagendijk *et al.*, 2021; Jalali *et al.*, 2020), and the lowest score of 7 was given to articles authored by (Giudice *et al.*, 2017). The 10-point Drummond checklist emphasizes key aspects of economic evaluation methodology, including perspective covered, cost considerations, sensitivity analysis, and discount rates used to estimate future treatment costs.

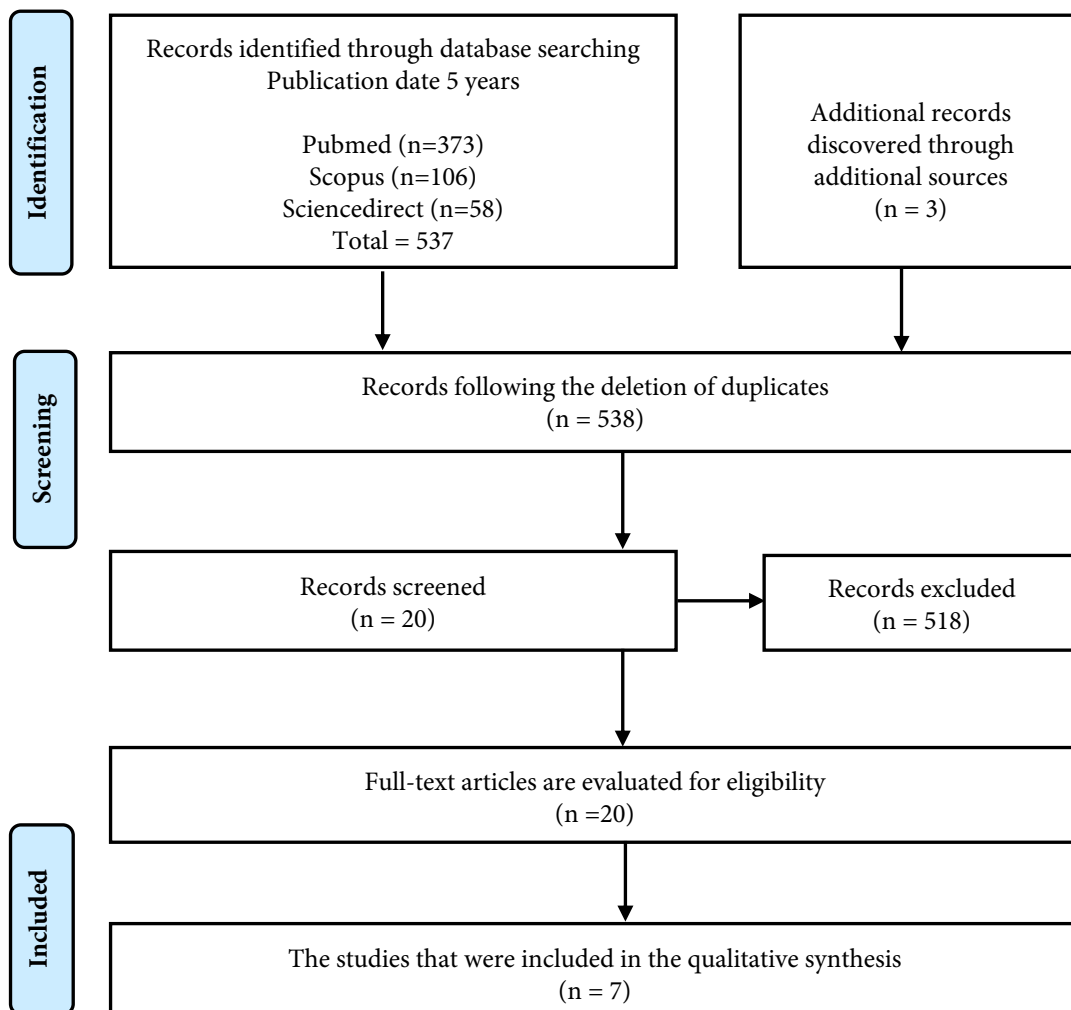


Figure 1. Flow-Chart Summary of Literature Search.

Table 1. Quality Assessment of Reviewed Papers.

No	Questions	Jalali et al. (2020)	Marita et al. (2019)	Wherry et al. (2020)	Kazi et al. (2020)	Giudice et al. (2017)	Galan et al. (2021)	Hagendijk et al. (2021)
1.	Was a well-defined question posed in an answerable form?	V	V	V	V	V	V	V
2.	Was a comprehensive description of the competing alternatives given?	V	V	V	V	V	V	V
3.	Was the effectiveness of the programs or services established?	V	V	V	V	V	V	V
4.	Where are all the important and relevant costs and consequences for each alternative identified?	V	V	V	V	V	V	V
5.	Were costs and effects measured accurately in appropriate physical units (e.g., QALYs)?	V	X	V	V	V	V	V
6.	Were costs and effects valued credibly?	V	X	V	V	V	V	V
7.	Were costs and effects adjusted for differential timing?	V	V	O	V	X	X	V
8.	Was an incremental analysis of costs and effects of alternatives performed?	V	V	V	V	X	V	V
9.	Were allowances made for uncertainty in the estimates of costs and effects?	V	V	V	V	X	X	V
10.	Did the presentation and discussion of study results include all issues of concern to users?	V	V	V	V	V	V	V

Yes: V

No: X

Not clear: O (in cases where the information provided was not satisfactory, thus making it difficult for the reviewer to conclude.

QALY, Quality-Adjusted Life Years; ICER, Incremental Cost-Effectiveness Ratio; IRD, Inherited Retinal Disease; VN, voretigene neparvovec; CF, Cystic Fibrosis; CFTR, Cystic Fibrosis Conductance Regulator; ATTR-CM, Transthyretin Amyloid Cardiomyopathy; TBSA, Total Body Surface Area; ICU/SICU, Intensive Care Unit/ Subintensive Care Unit; NXB, Nexobridâ; TTR, Transthyretin; O-LAR, Octreotide Long-Acting Release; LO, Lutetium-Octreotate

Based on Table 2, we formulated the following Economic evaluation characteristics: 1) Study setting. With four investigations (Jalali *et al.*, 2020; Kazi *et al.*, 2020; Marita *et al.*, 2019; Wherry *et al.*, 2020), Italy (Giudice *et al.*, 2017), Spain (Galan *et al.*, 2021), and the Netherlands (Hagendijk *et al.*, 2021) were among the nations where the studies were

conducted. These studies used a variety of techniques, including two cohort studies, four Markov model studies, and one retrospective research. 2) Time horizon. The duration of the intervention, as well as the monitoring of costs, effects, and benefits, should all be included in the time horizon. It should ideally reflect current clinical procedures. A time horizon

Table 2. Study Summary of Economic Evaluation in Rare Disease Treatments

Study	Country	Study Population	Method	Type of Evaluation	Intervention	Type of Outcome	Type of Cost	Perspective	Result
Jalali (2020)	US	Infants with spinal muscular atrophy	Markov model	Cost-Effectiveness Analysis	Universal screening and treatment with Nusinersen injection.	QALY	Direct cost	Societal	ICER for nusinersen with screening and treatment was more saved.
Marita (2019)	US	The mean age of 15 years old, biallelic RPE65-mediated IRD	Markov model	Cost-Utility Analysis	Voretigene neparvovec (VN) gene therapy vs. standard of care treatment (regular physician visits and supportive care).	QALY	Direct costs Indirect Cost	Health care system and modified Societal perspective	VN offered 1.3 QALY's; from a healthcare system perspective, resulting in ICER \$643 800/QALY and ICER \$480 100/QALY from a modified societal perspective
Wherry (2020)	US	CF patients with the G551D mutation	Cohort	Cost-Effectiveness	Best supportive care plus ivacaftor (CFTR) vs. best supportive care alone	QALY	Lifetime Cost	Societal	The ICER of CFTR was \$950217 per QALY, which is not cost-effective
Kazi (2020)	US	ATTR-CM wild-type or variant and heart failure Patients range in age from 18 to 90 years old.	Markov model	Cost-Effectiveness Analysis	Tafamidis versus ATTR-CM usual treatment.	QALY	Direct Medical Cost	Healthcare	Tafamidis cost-effective at \$100,000/QALY
Giudice (2019)	Italy	Patients with a TBSA concentration of 14–22% and an intermediate-deep thermal burn	Retro spective	Cost-Consequences Analysis	NexoBrida versus standard of care (Burn debridement with eschar removal).	The length of stay in the ICU/SICU and the need for escharotomy and autograft surgeries	Direct Medical Cost	Patient	NXB's average savings was 5350 euros
Galan (2021)	Spain	Transthyretin (TTR) amyloid polynuropathy patients	Cohort	Cost-Consequences Analysis	Inotersen versus patisiran versus tafamidis.	Patient burden and costs compared	Direct Medical Cost Indirect Cost	Patient	The annual cost per patient receiving tafamidis treatment was 137,954€; inotersen treatment was 308,358€, and patisiran treatment was 458,771€.
Hagendijk, (2020)	Nether lands	The advanced neuroendocrine tumor patients	Markov model	Cost-effectiveness Analysis	At a high dose, octreotide long-acting release (O-LAR) was compared to O-LAR 60 mg every 28 days.	QALY	Direct Medical Cost	Healthcare	ICER with LO treatment were €19,000 per QALY to €53,500 per QALY

of 2.5 years was utilized in studies by Jalali *et al.*, (2020) and Kazi *et al.*, (2020), shorter time horizons of 1 year were used by Giudice *et al.* (2017); Marita *et al.* (2019) and Galan *et al.* (2021). Hagendijk *et al.* (2021) used the 28-day longest time horizon in their research. 3) Economic evaluation. The majority of the publications under evaluation performed cost-effectiveness studies to evaluate the efficacy of orphan pharmaceuticals in comparison to the standard of care or the absence of an orphan drug (Hagendijk *et al.*, 2021; Jalali *et al.*, 2020; Kazi *et al.*, 2020; Wherry *et al.*, 2020). A cost-repercussions analysis was used in studies by Giudice and colleagues in 2019 (Giudice *et al.*, 2017) and Galan and colleagues in 2021 (Galan *et al.*, 2021) to evaluate the costs, consequences, and clinical outcomes related to the use of orphan medications. 4) Intervention. In the investigations, almost all orphan medicines were assessed as potential therapeutic choices in comparison to the gold standard of care. In these investigations, the orphan medication was not administered to the comparator or control group. Galan *et al.* contrasted three potential therapies in 2021 (Galan *et al.*, 2021) (based on the disease burden experienced by inpatients and the cost of care. For the treatment of rare diseases, all of the orphan drugs evaluated had received approval from the Food and Drug Administration (FDA) (Giudice *et al.*, 2017; Kazi *et al.*, 2020; Marita *et al.*, 2019; Wherry *et al.*, 2020) or other regulatory bodies, such as the European Medicines Agency (Galan *et al.*, 2021). In this study, the economics of orphan medications such as nusinersen, verotigene neparovvec, ivacaftor, NexoBrid™, inotersen, patisiran, tafamidis, and octreotide were assessed. 5) Type of cost and perspective. The examined publications include a variety of charges and viewpoints, including both direct and indirect medical expenditures. However, in the work by Wherry *et al.* in 2020, patients with cystic fibrosis, a condition that falls within the category of chronic uncommon diseases, had their lifetime expenditures used to determine the Incremental Cost-Effectiveness Ratio (ICER). In this research, the emphasis was on direct medical expenses since they sought to evaluate the cost of care during the use of orphan medications, which is intimately related to the

intervention. Prioritizing healthcare policies and initiatives requires measuring the financial and healthcare costs of diseases in society (Davari *et al.*, 2019). 6) Economic evaluation results. Almost all investigations (Giudice *et al.*, 2017; Hagendijk *et al.*, 2021; Jalali *et al.*, 2020; Kazi *et al.*, 2020; Zimmermann *et al.*, 2019) showed that orphan medications were more cost-effective than their comparators. However, only Wherry in 2020 (Wherry *et al.*, 2020), discovered that ivacaftor was not cost-effective when used in conjunction with supportive treatment to treat cystic fibrosis patients who had the G551D mutation. In a subsequent study by Galan (Galan *et al.*, 2021) that contrasted the prices of inotersen, patisiran, and tafamidis, it was discovered that the latter was the most affordable option for individuals with Transthyretin Amyloid Cardiomyopathy. The cost-effectiveness ratio for tafamidis was also determined to be \$100,000 per Quality-Adjusted Life Year (QALY) (Kazi *et al.*, 2020).

Rare diseases impose a significant clinical and economic burden on patients and healthcare systems, risking the inability to meet patients' needs and hindering equal access to treatment (Cannizzo *et al.*, 2018). Historically, the development of commercial medications has failed to address the requirements of people with rare diseases. To incentivize the development of drugs for rare diseases that would otherwise be uneconomical, numerous jurisdictions have enacted orphan drug legislation. For instance, the only expected expenses associated with expanding the indication of sildenafil to treat pulmonary artery hypertension and chronic thromboembolic pulmonary hypertension are the costs of performing clinical trials and marketing (Gupta *et al.*, 2015; Simoens *et al.*, 2011).

However, due to the small market size, these medications are often quite expensive. Orphan drugs are rarely cost-effective, leading to restrictions in funding and patient access. Conversely, these constraints may not align with societal expectations (Drummond *et al.*, 2007). Some authorities have implemented rigorous negotiations to balance multiple competing societal objectives, such as promoting innovation, facilitating access to medicines, and ensuring affordability (Panteli

*et al.*, 2016; Simoens *et al.*, 2022).

The additional time that caregivers spend providing care implies a loss of annual output. In a recent study that utilized the human resource method for economic evaluation, it was revealed that when a lifetime horizon was considered, high costs resulted in significantly higher indirect costs. Additionally, Dussen *et al.* (2014) examined lost output due to absenteeism and lost production resulting from early retirement while estimating indirect costs using caregivers' actual wages, in comparison to our method of calculating indirect costs using caregivers' actual income. About 10.6 percent of the direct costs were attributed to expenses such as lodging, transportation, food, and other items, indicating a significant burden associated with access to medical services (Pearson *et al.*, 2018; Qi *et al.*, 2021). Pharmaceutical, inpatient, and outpatient treatments were all included in the direct healthcare costs. The majority of the resources needed by individuals with uncommon diseases are covered by pharmaceutical costs. Recent research indicates that drugs have accounted for roughly 90% of rare disease healthcare costs (HsuI *et al.*, 2018). Even though outpatients represent a far larger population than inpatients admitted for the treatment of a rare condition, the average cost per person for inpatients is roughly ten times that of outpatients (Cai *et al.*, 2019). A cost analysis study is required to provide policymakers and hospital administrators with valuable information to enhance hospital services and manage resources effectively (Dianingati *et al.*, 2019). Measuring the economic cost of illness can offer policymakers better insights for developing more targeted interventions for rare diseases at different levels of the healthcare system (Jo, 2014) While some orphan drugs are subject to specific conditions, not all orphan drugs are. There are various instances when the small number of patients treated with an orphan drug and its limited economic viability can be called into question (Simoens, 2011). Financial consequences associated with rare diseases encompass both direct expenditures, which encompass medical and nonmedical expenses, as well as indirect costs. The financial burden associated with specific rare diseases can amount to millions

of dollars each year, primarily due to various cost factors such as hospitalizations, emergency visits, medications, dental health services, palliative care, outpatient visits, insurance expenses and reimbursement, rehabilitation care, home health care, assistive devices, social services, and the provision of caregiver (Angelis *et al.*, 2015; Chiu *et al.*, 2018; Friedlander *et al.*, 2019). The economic burden of a disease comprises three types of costs: direct costs, indirect costs, and intangible costs. (Mursinto & Kusumawardani, 2016). The majority of costs are accounted for by direct costs (Péntek *et al.*, 2016). Among these, the direct medical cost of rare diseases (RD) contributes to nearly half of the total burden (45%), followed by indirect costs due to the loss of productivity (44%), non-medical costs (7%), and uninsured healthcare costs (4%) (Yang *et al.*, 2022). Direct costs include direct medical costs such as drug costs, medical device costs, treatment costs, medical treatment costs, costs associated with supporting examinations like laboratory tests, CT scans, and physiotherapy costs, as well as other direct costs of treatment (direct non-medical costs) such as hospitalization costs, administrative costs, and transportation costs. Indirect costs encompass expenses that cannot be directly attributed to a product or service, such as administration, promotion, security, etc. Four articles calculated direct medical expenses, one article calculated both direct and indirect costs, one article only considered direct costs and one article focused solely on lifetime costs, as per the seven articles reviewed. In addition to the direct medical costs associated with RD, there are significant indirect costs related to productivity losses, non-medical expenses like spending on home or motor vehicle modifications, and certain healthcare costs not covered by insurance. Many people with RDs have high medical needs that lead to missed work, early retirement, and reliance on caregivers for activities of daily living (Yang *et al.*, 2022). The annual cost ranges from £726 to £378,000, with a median value of £31,012. According to the data, 24% of drugs have an annual cost below £10,000, 58% fall within the price range of £10,000 to £100,000, and the remaining 18% have an annual cost equal to or exceeding £100,000 (Onakpoya *et al.*, 2015).

Compared to some studies, one of the factors most directly or indirectly affecting the ultimate price of medicines is the anticipated financial impact of the new treatment on pharmaceutical spending (Jommi *et al.*, 2021; Korchagina *et al.*, 2017; Villa *et al.*, 2019).

To quantify the effectiveness of an intervention, commonly used health outcome measures such as the QALY are employed. Generic health outcome measures, like the QALY, serve as tools to express an intervention's effectiveness (Blonda *et al.*, 2021). The QALY indicator has been considered valuable for assessing both the quantity and quality of life and for comparing diseases, including informal care or mental health care for conditions that are difficult to measure. However, the primary advantage of the QALY approach lies in its ability to guide decisions based on predefined thresholds for "acceptable" and "unacceptable" costs per QALY (Beresniak & Dupont, 2016). The QALY is a statistic derived from an economic model that combines the number of years gained from treatment with the patient's health-related quality of life. In the context of conventional cost-effectiveness analysis (CEA), the metric used is the incremental cost per quality-adjusted life-year (QALY) gained, also known as the incremental cost-effectiveness ratio (ICER). The incremental cost-utility ratio values shift from positive to dominant (lower incremental costs and larger QALYs gained) or decrease when the societal perspective is taken into consideration (Aranda-Reneo *et al.*, 2021). Can the consideration of societal costs change the recommendations of economic evaluations in the field of rare diseases? This is the subject of an empirical analysis. A Norwegian study investigated whether society preferred to prioritize the treatment of rare diseases and accept orphan medications with higher ICERs (Desser *et al.*, 2010).

To make a decision, this metric is compared to a predetermined or revealed willingness-to-pay threshold (Postma *et al.*, 2022). Besides QALY, numerous outcomes resulting from the usage of orphan medications in uncommon diseases have been studied, including ICU/SICU length of stay and the necessity for procedures, as well as patient burden and expenses. The efficacy of a program

is evaluated from multiple perspectives, including those of society, the healthcare system, and the patient.

The economic evaluation component included in the Health Technology Assessment (HTA) serves as the central element in the assessment process, providing valuable insights to inform decisions regarding resource allocation (Jönsson, 2009). HTA can assist health systems in making more efficient use of their limited resources, thereby maximizing population health outcomes within a budget constraint (Teerawattananon *et al.*, 2021). The perspective of economic evaluation should be carefully determined at the beginning of the study. Typically, there are multiple perspectives, including patients, the health system, payers, and society. Measuring costs and consequences is essential for identifying multiple perspectives. Since HTA is always used to determine reimbursement, the payer perspective is very common, but it may not convey the entire cost picture. The societal perspective encompasses healthcare, non-health, productivity, intangible costs, and more, and it presents difficulties in study design, data acquisition, and analysis protocol (Chen, 2022). The application of a societal perspective is highly recommended for conducting economic evaluations in the field of public health (Café *et al.*, 2019). This approach is beneficial as it encompasses and considers multiple perspectives, providing a comprehensive analysis. Health economic evaluations that have been conducted with a limited perspective, focusing only on direct costs in the analysis, may exhibit bias and have the potential to substantially underestimate the actual societal benefits of the interventions. Moreover, the absence of a societal perspective can lead to suboptimal allocation of resources, resulting in a decrease in overall societal welfare and potential losses (Café *et al.*, 2019; Fakhri *et al.*, 2017).

The majority of research in this review concluded that using orphan medicines was cost-effective. Eighty-five percent of orphan drugs showed significant clinical effects. Orphan medications are more likely to be considered cost-effective (and reimbursed if applicable) (Postma *et al.*, 2022). Orphan drugs often offer larger health gains than non-orphan



drugs, but due to their substantially higher costs, they tend to be less cost-effective than non-orphan drugs (Chambers *et al.*, 2020). The absence of high-quality cost and outcome data is a major limitation in rare disease research.

## Conclusion

In summary, the economic evaluation considered all aspects of the intervention, identifying the potential to select a more cost-effective and efficient choice to reduce patient burdens. Adding a new intervention or program typically proves to be more cost-effective.

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## Long-Term Effects of Exercise on Balance and Fear of Falling in Community-Dwelling Elderly

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### Abstract

Falls are the main cause of injuries in the elderly, with an estimated 684,000 fatal falls each year, 60% of which occur in Southeast Asia and the Western Pacific. Studies on the long-term effects of balance training are still limited. This study aimed to assess the long-term impact of physical exercise on the balance and fear of falling in community-dwelling elderly. This was a quasi-experimental study with a pre-post design. The participants were recruited using purposive sampling. The inclusion criteria were older people  $\geq 60$  years old with balance problems. They received a one-month physical exercise. The instruments included the Functional Reach Test (FRT) to assess balance and the Falls Efficacy Scale-International (FES-I) to assess fear of falling. The assessment was conducted pre- and post-intervention and two years later. Data from 23 participants were collected in 2017 and 2019. Data were analyzed using the Wilcoxon Signed-Rank Test and linear mixed model regression. There were significant differences in FRT and FES-I between pre- and post-intervention, pre-intervention, and two years later. There was no significant difference in FRT and FES-I between post-intervention and two years after. There was a significant improvement in the balance and fear of falling one month and two years after the program. The balance program had a long-term effect that lasted at least two years. The inclusion of the balance program in community-based health programs for the elderly can improve balance and prevent falls.

### Introduction

Falls are one of the leading causes of death and disability in the elderly population (WHO, 2021). Falls are the leading cause of fatal and nonfatal injuries among the elderly. The age-adjusted mortality rate of falls in the elderly in the US is 64:100,000, which increased by around 30% in 18 years.<sup>2</sup> Older age, women, previous history of falling, and multimorbidity have a higher risk of falls (Kim *et al.*, 2020; Pirrie *et al.*, 2020). Other important risk factors are sensory impairment, cognitive decline, certain medications, and environmental hazards (Saftari & Kwon, 2018; Wang *et al.*, 2022; Montero-odasso & Speechley, 2018; Gadelha *et al.*, 2018). These risk factors might cause falls through psychological and physiological pathways.

One of the psychological pathways is increased perceived fear of falling, and the physiological pathway can be represented by balance. Fear of falling itself might affect the physiological pathway over time, through muscle atrophy caused by lack of activity (Jeon *et al.*, 2017; Park *et al.*, 2014; physical performance, and physical characteristics in an elderly population. Design: This study is a cross-sectional study with 883 community dwellers 60 yrs or older from a rural area. They completed surveys and evaluations including demographics, the Korean version of the Falls Efficacy Scale-International, the Short Physical Performance Battery, the timed up and go (TUGMerchant *et al.*, 2020) sarcopenia, gait speed and grip strength, cognitive impairment, depression, social isolation, self-perceived

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health, and vision. DESIGN: Observational cross-sectional study. SETTING: Community. PARTICIPANTS: A total of 493 community-dwelling older adults, 60 years and older. MEASURES: FOF and FAR were assessed using validated single closed-ended questions. Questionnaire was administered to evaluate frailty (FRAIL scale - Fatigue, Resistance, Aerobic, Illness, and Loss of Weight).

Falls are preventable. Health promotion and prevention activities, such as screening of fall risk, medication overview, environmental modification, education, and various exercise programs are proven effective in preventing future falls. Fall risk screening and medication overview would help healthcare professionals prioritize fall prevention on higher risk elderly. Exercise programs usually target muscle strength to improve gait and balance, while indirectly improving the perceived fear of falling (Moreland *et al.*, 2020; Matla *et al.*, 2021; Whipple *et al.*, 2019).

There have been studies reporting the effectiveness of physical exercise for fall prevention in the elderly. However, most of the studies were conducted over a short time (Matla *et al.*, 2021; Chen *et al.*, 2019; Im, *et al.*, 2019). A few studies have been conducted in community settings in Indonesia, but there is no long-term evaluation yet (Freiberger *et al.*, 2012; Hars *et al.*, 2014). In some studies with positive long-term outcomes, the exercise programs were more complex and took longer to complete, which might be a challenge to adapt to community settings in Indonesia. However, until now, no study in Indonesia has discussed the long-term outcomes of exercise programs for the elderly, hence this study is still relevant. In addition, for feasibility purposes, simpler programs may be needed to make these exercise programs more accessible to the community. Therefore, there is a need to conduct a community trial to implement a simple exercise program and assess its long-term outcomes. This study aimed to assess the long-term effectiveness of a simple exercise program in improving balance and perceived fear of falling in community-dwelling elderly in Yogyakarta, Indonesia. To further inform the implementation aspects of the program, we also assessed the outcome according to the participants' compliance.

## Method

This was a quasi-experimental study with a pre-post design. and without control groups. We conducted follow-up outcome measurement 2 years after the exercise program, without any intervention during that time. Study participants were recruited using purposive sampling. The inclusion criteria were elderly, above 60 years of age, with moderate and severe risk of falling, regardless of the presence of chronic diseases or multimorbidity. The risk of falling was assessed by balance with the Functional Reach Test (FRT), where an FRT score of more than 25 is considered to have a low risk of falls. The cognitive function of the elderly was clarified using the Mini Mental-State Examination (MMSE) with a score of >23 (Folstein *et al.*, 1975; Hogervorst *et al.*, 2011). Elderly with MMSE scores lower than 23 were excluded from this study. All participants were purposively recruited from the Wirobrajan subdistrict, Yogyakarta City, Indonesia. The baseline characteristics were measured by questionnaires, which are age, sex, education level, current occupation, medication history, and history of falling.

A balance exercise program based on Sherrington's recommendation to include support base reduction was conducted weekly for 60 minutes each (Sherrington *et al.*, 2011). The exercises included: standing heel to toe, raising knees, walking heel to toe with the toes of the back foot touching the heel of the front foot, raising the side leg, walking sideways, raising heels, stepping up a step, sitting to standing. The exercises were designed to challenge the participants' balance and coordination. The intervention was carried out within a week, then intervention for three weeks, and finally post-intervention at the end of November 2017.

Outcomes on balance were collected with the Functional Reach Test (FRT) and the perceived fear of falling was assessed by the Falls Efficacy Scale-International (FES-I). The Functional Reach Test (FRT) is a simple and reliable clinical measure of balance. It was developed by Duncan *et al.* (1990) and has been tested for validity and reliability (Duncan *et al.*, 1990). The FRT measures the distance that a person can reach forward while standing still with their feet shoulder-width apart. The test is performed with a measuring tape attached to a

wall at shoulder height. The person stands facing the wall with their back straight and their feet shoulder-width apart. The person then reaches forward as far as they can without taking a step. The distance that the person reaches is measured from the tip of their finger to the measuring tape. A lower FRT score indicates a greater risk of falls. People with a functional reach of  $\geq 10''/25$  cm were considered to have a low risk of falls (Thomas, 2020). The FRT has been widely used in many studies on elderlies (Bohannon *et al.*, 2017; Balasubramanian *et al.*, 2015; Fujimoto *et al.*, 2015) there are few reports on physical cognitive ability. Objective: To examine the relationship of the results of motor function tests that include physical cognitive ability on the ability to predict falls and to determine which test is the most appropriate. Methods: We studied 174 community-dwelling elderly adults (mean age  $75.7 \pm 5.7$ , 41 males and 133 females. People with a functional reach of  $\geq 10''/25$  cm were considered to have a low risk of falls (Thomas, 2020). The subjects of this study were elderly with functional reach  $< 10''/25$  cm.

The FES-I is a questionnaire containing ten activity questionnaires (Tinetti *et al.*, 1990). The scoring was modified to 0-10 (0=non confident, 5=fairly confident, and 10=completely confident), thus the score ranged from 0-100. The higher the score, the higher the confidence of the respondent. FES-I has been widely used in studies with elderlies as research participants, and proven valid in several languages (Meimandi *et al.*, 2021; Canever *et al.*, 2022; Toronjo-Hornillo *et al.*, 2018). The measurements were taken before and after the intervention. The intervention was carried out in October-November 2017. Another assessment was conducted in August – September 2019. Additionally, the study participants were asked about their compliance in the follow-up measurement, with a simple question of whether they performed the exercise at least once a week in the past 2 years after the exercise program was completed.

Data of the baseline characteristics were presented descriptively. Univariate analyses were performed with non-parametric analysis (Wilcoxon signed rank test), with a significant value (p) below 0.05. Further age and sex adjustment of outcome measurement were

done with linear mixed model regression. We also performed subset analyses according to the compliance of each participant. Ethical clearance for this study was obtained from the Ethical Committee for Health Research, Faculty of Medicine, Duta Wacana Christian University (No.: 474/C.16/FK/2017) and all study participants gave written informed consent.

## Results and Discussion

Initially, there were 24 elderly who participated in the study, but one of them passed away within the study period, so there were data from 23 participants analyzed. They aged between 61-80 years old, with a mean  $\pm$ SD of  $69.96 \pm 6.138$  years at the start of the study in 2017. The MMSE score at the beginning of the study ranged between 24-30 with a mean and standard deviation of  $28.69 \pm 1.55$ . Table 1 shows the baseline characteristics of participants. Most of the study participants were females, which was consistent with a study that reported falls occurred more commonly in women (Gale *et al.*, 2016). They were given a balance exercise program for one month. More than half of the participants (52.2%) consumed antihypertensive medications that might affect the balance, and a few of them have had a history of falling previously (17.4%).

Table 1. Characteristics of Study Participants from Wirobrajan Sub-District, Yogyakarta in 2017 (n=23).

	Total (n)	Percentage (%)
<b>Age</b>		
60-74 years	18	78.3 %
75-89 years	5	21.7 %
<b>Sex</b>		
Female	20	87 %
Male	3	13 %
<b>Education</b>		
Did not complete Elementary School	17	74 %
Elementary School	3	13 %
Junior High School	2	9 %
Senior High School	1	4 %
<b>Current occupation</b>		
Tradesperson	5	21 %
Pensioner	1	4 %

	Total (n)	Percentage (%)
Laborer	1	4 %
Masseur	1	4 %
Unemployed	15	65 %
<b>Medication history</b>		
Antihypertensive	12	52.2%
Antidiabetic	5	21.7%
Hyperuricemia medication	6	26.1%
Other cardiovascular medication	5	21.7%
History of falling: yes	4	17.4%
Follow-up compliance: good	15	65.2%

Source: Primary Data, 2017

The effects of the program were measured using FRT to assess balance and FES-I to assess fear of falling before and after the intervention and two years later, as shown in Table 2. There was a significant improvement in fall risk (according to FRT) from 17.04 cm to 21.87 cm, which slightly decreased to 20.65 over 2 years. There was a significant difference in FRT after 2 years between participants with good and poor compliance. The perceived fear of falling (FES-I) was also increasing by around 10 points after intervention, and slightly increased over 2 years by 1 point, although it was not statistically significant. Figure 1 highlights the different progression between patients with good and poor compliance over time, where the FRT returns to the baseline condition in participants with poor compliance. A study conducted by community-dwelling elderly reported that a one-month exercise increased muscle strength and joint flexibility, which improved balance (Suzuki *et al.*, 2019).

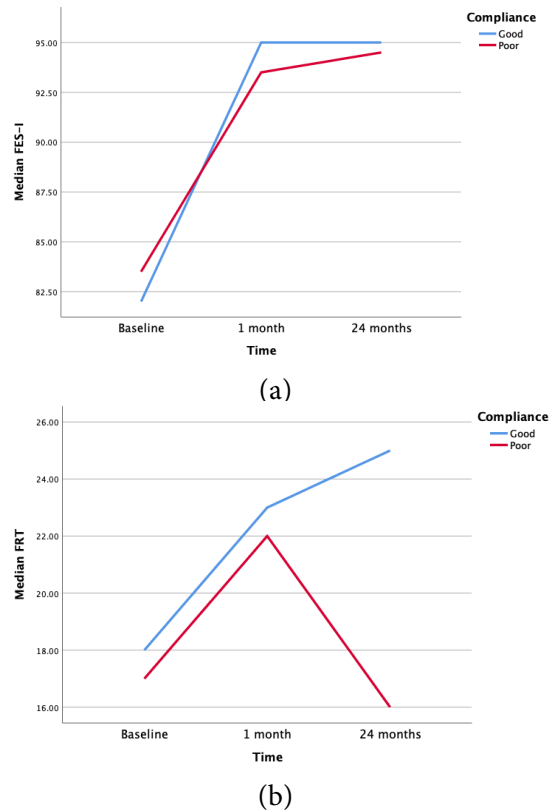


Figure 1. The changes in (a) FES and (b) FRT in three periods of time between participants with good compliance compared to poor compliance after completion of the exercise program.

This study showed that exercise had a long-term positive impact on the elderly's balance. Patil *et al* (2015) conducted case-control intervention research on women aged 70 to 80 years with a history of fall(s) in the previous year and followed them for two years (Patil *et al.*, 2015) falls, and related injuries in older women. Design Two-year randomized controlled trial. Setting Tampere, Finland.

Table 2. Changes in Balance (FRT) and Perceived Fear of Falling (FES-I) from Baseline in 2017 to Post-Intervention and Long-Term in 2019 (n=23).

Variable	Baseline	Post-intervention (1 month)	Long-term (2 years)		
			All (n=23)	Good compliance (n=15)	Poor compliance (n=8)
<b>FRT</b>					
mean (SD), cm	17.04 (2.65)	21.87 (3.39)*	20.65 (4.79)*	23.00 (3.61) †	16.25 (3.49)
median (IQR), cm	18 (1)	22 (3)	21 (9)	25 (5)	16 (2.5)
<b>FES-I</b>					
mean (SD)	82.61 (8.61)	92.65 (5.43)*	93.91 (5.46)*	93.60 (6.21)	94.50 (4.00)
median (IQR)	83 (9)	94 (9)	95 (7)	95 (7)	94.5 (7.5)

\* significant difference compared to baseline (p < 0.05)

† significant difference between good and poor compliance (p < 0.05)

Table 3. Multivariate Models of Change in Balance (FRT) and Perceived Fear of Falling (FES-I) from Baseline in 2017 to Post-Intervention and Long-Term in 2019 Adjusted with Compliance (n=23).

	Coefficient (95 CI%)	p-value
FRT		
Intercept	14.522 (12.806 – 16.237)	< 0.001
Time = 2 years vs pre-intervention	3.609 (1.706 – 5.512)	< 0.001
Time = 2 years vs post-intervention	4.826 (2.923 – 6.729)	< 0.001
Compliance = good vs poor	3.867 (2.235 – 5.498)	< 0.001
FES-I		
Intercept	82.134 (78.571 – 85.697)	< 0.001
Time = 2 years vs pre-intervention	11.304 (7.352 – 15.257)	< 0.001
Time = 2 years vs post-intervention	10.043 (6.091 – 13.996)	< 0.001
Compliance = good vs poor	0.728 (-2.660 – 4.116)	0.669

Participants Women aged 70 to 80 who had fallen in the previous year (n = 409). They found that the exercise group had improved physical functioning indicated by leg strength, chair rise time, backward walking time, and fast walking speed. The physical functioning improved at 6 months, 12 months, and 18 months. The physical functioning at 24 months decreased compared to that at 18 months, but still better than at the beginning of the program. Freiburger *et al.* (2012) gave strength and balance training to women aged 70 – 90 years and measured the effects on their physical performance measured by Timed Get Up and Go test, modified Romberg test, chair rise test, and walking speed. The physical performance of the research participants kept improving until 24 months later. Comparing the functional reach after the intervention and two years later, there was a tendency to decrease with age. This finding was consistent with the results of other studies that reported the effect of age on functional reach (de Waroquier-Leroy *et al.*, 2014; Mohammed *et al.*, 2020).

The statistical analysis of the fear of falling found significantly reduced fear of falling between pre- and post-intervention, and between pre-intervention and two years later. There was no significant difference between the functional reach test post-intervention and two years after. A study delivered balance training to women aged 75 to 85 years and found improved balance, physical activity level, and reduced fear of falling assessed using FES-I (El-Khoury *et al.*, 2015) two arm, parallel group, randomised controlled trial. Setting 20 study sites in 16 medium to large cities throughout

France. Participants 706 women aged 75-85, living in their own home, and with diminished balance and gait capacities, randomly allocated to the experimental intervention group (exercise programme, n=352. Further details of the changes in FRT and FES-I between pre-, post-intervention, and 2 years of follow-up are shown in Table 3. Generally, the table shows that the exercise program significantly improved the balance and perceived fear of falling, whereas good compliance can maintain the improvement over time. This was consistent with the finding of a study that reported compliant older people had a higher positive impact from exercise compared to the non-compliant subjects (Falossi *et al.*, 2022).

This research had some limitations. The number of research participants was relatively small and there was no control group. However, this is the first research in Indonesia that investigated the long-term impact of balance exercise in the elderly.

## Conclusion

Preventing falls in the elderly needs to consider the complex nature of its risk factors. This study showed that a simple exercise program in the community is feasible to improve the physical and psychological risk of falls in the elderly both in the short term and long term. The findings of this study provided evidence that balance exercise could improve the balance and reduce the fear of falling in the elderly with long-term impact. A balance exercise program can be included in the Indonesian community-based program, Posyandu Lansia (integrated



service post for older people program) to improve balance and prevent falls. Future trial with randomization, control groups, and a larger population is needed to design a program that is suitable in Indonesian settings, especially in community settings. Regarding the compliance of participants, further studies are needed to explore the motivation and other characteristics that might influence it.

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## The Exploratory Study on Antecedents of Online Medical Consultation Continuous Usage Intention

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### Abstract

The purpose of this study is to find and analyze factors that can affect the Intention to Recommend in the online medical consultation field. The research model was adapted from a previous study and then modified. Data were collected from women who were >17 years old and who had ever used the online medical consultation application, Halodoc. The research's method was a quantitative survey, with cross-sectional data. Respondents' data were taken by purposive sampling and questionnaires were distributed online. As many as 202 participants had fulfilled the requirements to be analyzed with PLS-SEM. The results showed that five antecedents had a significant influence on Intention to Recommend. Antecedents that were worth noting were Helpfulness Trust, Perceived Benefit, and Reliability Trust, where these factors showed a positive impact on Intention to Recommend. Factors were also found that could make users more considerate or careful in using online medical consultation applications such as Performance Risk and Privacy Risk factors. From the findings of this study, it can be concluded that there are factors that may need to be considered by online medical consultation service providers to maintain or even improve their quality of care.

### Introduction

The development of Internet technology has altered business practices and services across all industries. Similar to what has been done in other industries, telemedicine technology has been proven to be advantageous to people in many ways (Chen *et al.*, 2020; Fernandez, 2020). For instance, the usage of telemedicine services reduces the shortcomings in health services, saves time, and is cost-effective for the impoverished population (Albarrak *et al.*, 2021; Hsu, 2019; Kaium *et al.*, 2020; Pai & Alathur, 2019). According to certain research, if health services do not utilize information technology for further assistance, management will become inefficient, and patients will lose trust in them. Therefore, information technology must be applied to health services (Nurhayati *et al.*,

2019).

Adequate quality of service via telemedicine is known to be associated with increased quality of care. The definition of telemedicine is the extent to which healthcare practitioners employ information and communication technology (ICTs) for diagnosis, health promotion, illness prevention, and transmission of telemedicine applications. Due to their quick services, telemedicine technologies have assisted communities during pandemics (Rahi, 2021). Telemedicine is the professional delivery of health services where a critical factor is distance, using information and communication technology to exchange information for the diagnosis, treatment, and prevention of illness and injury (Gutierrez *et al.*, 2017). Indonesia ranked third globally

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in utilizing health applications Telemedicine which is time and money-saving, makes healthcare more accessible, boosts patient participation, and encourages improved patient care (Pusparisa, 2020).

Online Medical Consultation (OMC) is not a new feature. But just since the pandemic, OMC usage has increased rapidly (Johnson *et al.*, 2021). However, a decrease in OMC satisfaction in 2021 from 2020 has been reported (Deloitte Indonesia *et al.*, 2019). A previous study indicated that patients still complain about limited services and inconsistent care with telemedicine (Gliadkovskaya, 2021). Patients are also less satisfied with telemedicine visits compared to in-person visits (Franco-Lara, 2023). Meanwhile, China faces serious problems in healthcare, such as high medical costs. Although the number of hospitals is sufficient, many patients still find it difficult to see a doctor, especially in tertiary hospitals (Zhang *et al.*, 2018), online medical consultation could be beneficial for the improvement of healthcare quality. However, online medical consultations will have little value if users do not use them appropriately.

The previous study by Yang *et al* (2021) argues that although OMC rapidly growing in popularity, there are still several issues that dampen the Continuum Usage of the OMC. The study exhibits several factors that may affect the people's Continuum Usage of the OMC and one of those factors is Trust. Another study indicates the lack of confidence that may cause hesitation in the Continuous Usage of OMC, which is a complex relationship that incorporates both technological and interpersonal aspects (Zhang *et al.*, 2018). In the field of online services, ratings and reviews play important roles in making a great service. Online ratings of services are thought to help consumers predict their future level of satisfaction with the product or service (Wulff *et al.*, 2014). If two online services have the same quality, customers will always choose the service that has a higher rating (de Langhe *et al.*, 2016a, 2016b).

Users' reviews shape readers' expectations about the quality and performance of the product (Han, 2020). From the studies mentioned it can be inferred that positive review

or Word-of-Mouth (or "Recommendation" as the term that the author will use in this writing) correlates positively with the Continuation of Usage in OMC. In other studies, trust is used as the mediating factor, to search whether certain factors affect the continuous usage of the telemedicine users (van Velsen *et al.*, 2016). In this study, the author wants to investigate which of the chosen factors affects Continuous Usage the most; trust will be used as an independent variable and not as a mediating factor. This study uses a unidimensional construct.

For telemedicine to thrive and improve itself, trust needs to be built as the foundation of telemedicine (Arfi *et al.*, 2021). While privacy concerns, security concerns, and regulatory issues are a big part of internet interactions, which also applies to telemedicine (Alhogail & Alshahrani, 2019; Martínez-Caro *et al.*, 2018). This is the reason why trust is a big field that still needs to be explored in the telemedicine field. In other studies, trust is more often assessed as a unidimensional variable, but in other studies, trust is suggested with a multidimensional approach because the components of trust differ based on the patient's perspective. Trust in health services is more likely benevolence. This research provides a new perspective from the aspect of the trust dimension which combines the perceptions of benefits and risks.

The study model consists of 7 independent variables (Helpfulness trust, Reliability trust, Performance risk, Privacy risk, Perceived benefit, Perceived centeredness, and Benevolence trust) which have a relationship with Online Medical consultation services. This model will be tested empirically on a female population. Generally, women tend to be on their smartphones longer than men (women on average 166.78 minutes/day compared to men 154.26 minutes/day) (Andone *et al.*, 2016). Women were also reported to have significantly higher use of health applications than males (29.0% vs. 19.0%) (Escoffery, 2018). From the previous study, research based on trust and patient perceptions has an impact on intention to recommend which is mediated by the patient's evaluation of OMCS. In this research model, 8 hypotheses will be studied further.

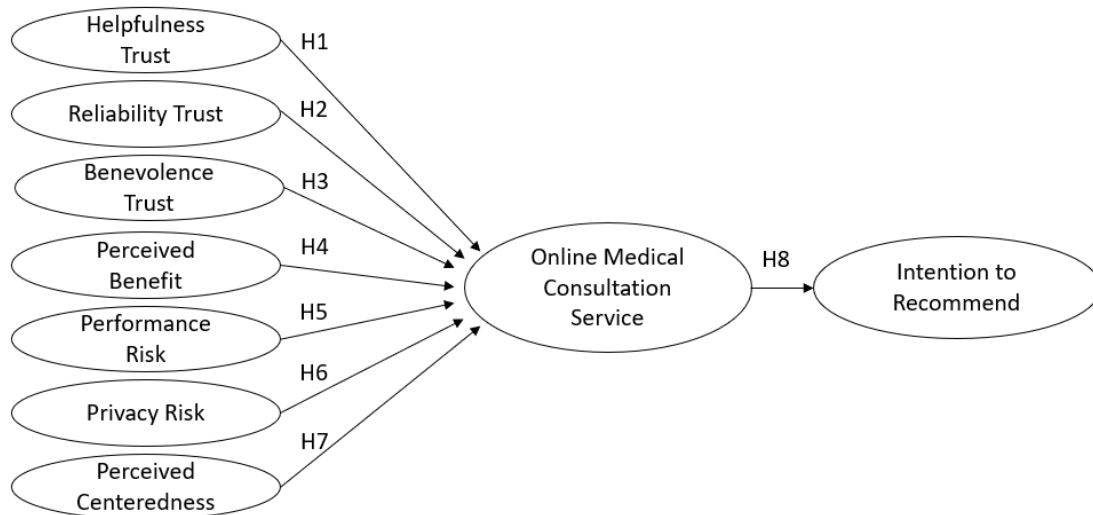


Figure 1. Conceptual Work

## Method

This study was a cross-sectional study using a survey in the form of a Google with purposive sampling as a sample collection technique. The research sample is patients who have used the online consultation service of the Halodoc health application, a total of 202 people. The inclusion criteria of this study were women who had used the online consultation service of the Halodoc health application, aged between 17-65 years old. The sample in this study is women, because women bear significant responsibility for their children, families, houses, and even themselves (Sufyan *et al.*, 2022). The exclusion criteria were men, people who have never used Halodoc before, and those below 17 years old.

Halodoc is the number one mobile health platform that combines patients, doctors, laboratory tests, insurance, pharmacies, and prescription reminders into a single health application. Halodoc collaborates with more than 20,000 doctors and 1,000 reputable pharmacies to provide consumers with one-hour medication delivery and sell over-the-counter medications, vitamins, consumer goods, and prescription medications (Halodoc, n.d.). Halodoc internet searches have also significantly increased (*Google Trends*, n.d.). The survey was conducted by distributing a questionnaire in the form of an online Google form to women who have used Halodoc and met the inclusion criteria.

The number of samples in this study

was calculated according to recommendations (Sarstedt *et al.*, 2022), that in a PLS-SEM study, the minimum sample should be calculated by power analysis. The sample size in this study was based on power analysis with G\*Power 3.1 where  $f^2$  was determined at 0.15, alpha 0.09 and power was 95%, while the number of predictors was 8. From the calculation, the minimum number of samples required was 160 and the denominator degree of freedom was 151. From the distributed questionnaires, it was found that 202 responses met the criteria and became the sample in this study.

After elimination and excluding invalid answers, 202 samples were eligible and sufficient for a minimum requirement from partial least squares structural equation modeling (PLS-SEM) analysis guidance (Kock & Hadaya, 2016). The questionnaire is adapted from Yang *et al* (2021); for variables HT, RT, BEV, PBE, PER, PVR, and PCT, and variable ITR is adapted from Octavius and Antonio (2021) and then modified to novelty concepts. The preparation of the questionnaire has been through a validity process and reviewed by an academic expert panel. Before distribution, the completed questionnaire was then translated into the standard local language (Bahasa) and reviewed by a translator. Data collection was carried out from September 22<sup>nd</sup> to October 3<sup>rd</sup>. All items from the survey were arranged as questions with a 6-point Likert as recommended by (Chomeya, 2010).

Scale answers consisting of strongly

disagree, disagree, slightly disagree, somewhat agree, agree, and strongly agree. This study uses a data analysis method with a multivariate analysis approach due to its complexity. In the conceptual framework, there are seven independent variables (Helpfulness Trust, Reliability Trust, Benevolence Trust, Perceived Benefit, Performance Risk, Privacy Risk, Perceived Centeredness) as the antecedents of OMCS were tested to observe the impact of the dependent variable (Intention to Recommend). The instrument of this study includes the construct: Helpfulness Trust (two items), Reliability Trust (three items), Benevolence Trust (three items), Perceived Benefit (two items), Performance Risk (two items), Privacy Risk (three items), Perceived Centeredness (three items).

This conceptual framework makes up eight hypothetical paths marked with arrows and is regarded as a difficult research model; so, the PLS-SEM approach was used since it could assess complex models in exploratory research. When the emphasis of the investigation is on the model's explanatory and predictive qualities, PLS-SEM techniques are preferred (Hair *et al.*, 2019). This research has passed the ethical test of the Health Research Ethics Commission, Faculty of Medicine, University of Pelita Harapan No: 007M/EC-Apr/IV/2023.

## Results And Discussions

There are 202 respondents, and the demographic data are presented in Table 1. The respondents were all females. Based on age group, most were from the group age of 25 - 34 years old (56.4%). Most were single (58.3%). As many as 57 women (28.2%) have been pregnant before and the number of times they get pregnant is mostly 1 or 2 times (25.7%). Most of the respondents work as employees (33.7%) and there are only 2 people who are not working (0.9%), and most of them have used Halodoc for more than 12 months (33.2%) and 69.8% live around the Jabodetabek area (Jakarta-Bogor-Depok-Tangerang-Bekasi). In terms of health insurance, most do not have private health insurance (54%).

Table 1. Respondent Profile.

	Demographic Variables	Sample	Percentage (%)
Age	17 - 24	46	22.8
	25 - 34	114	56.4
	35 - 44	36	17.8
	45 - 54	4	2.0
	>55	2	1.0
Marital Status	Married	85	41.7
	Single	117	58.3
Pregnant	Never	145	71.8
	Ever	57	28.2
Number of Pregnancy	Never	145	71.8
	1 - 2	52	25.7
	2 - 4	5	2.5
	>4	0	0.0
Job	Housewife	22	10.9
	Self-Employed	32	15.8
	Professional	22	10.9
	Part Timer	20	9.9
	Government Employee	22	10.9
	Employee	68	33.7
	Unemployed	2	0.9
	Student	14	6.9
Duration of using Halodoc	1 - 3 Months	34	16.8
	4 - 6 Months	59	29.2
	7 - 12 Months	42	20.8
	>12 Months	67	33.2
Residency	Jabodetabek	141	69.8
	Non-Jabodetabek	61	30.2
Health Insurance beside BPJS	Have	93	46.0
	Don't Have	109	54.0

To assess the indicator of reliability, the outer loading was measured, and several indicators were eliminated that did not follow the recommended value limit set, which is 0.708. If the value of the indicators is greater than 0.708, then the indicators are considered reliable for measuring each research item (Hair *et al.*, 2019). There were 24 research indicators that met the outer loading criteria. From the internal consistency test, all constructs showed Cronbach's alpha greater than 0.7 and composite reliability ranging between 0.7 and 0.95, indicating that the constructs' reliability of the respective models is reliable (Hair *et al.*, 2019). Convergent validity is determined by measuring the Average Variance

Extracted (AVE). This validity check shows that each construct has an  $AVE \geq 0.50$ , which indicates that all constructs can explain at least 50% of the item variance in the model, thus establishing a convergent validity (Hair *et al.*, 2019). The results of the reliability and validity tests can be seen in Table 2.

Table 2. Reliability and Validity Analysis.

Variables	Indicators	Outer Loading	CA	CR	AVE
HT	HT1	0.915	0.764	0.894	0.809
	HT2	0.883			
RT	RT1	0.909	0.822	0.894	0.738
	RT2	0.876			
	RT3	0.787			
BEV	BEV 1	0.877	0.888	0.931	0.817
	BEV 2	0.913			
	BEV 3	0.921			
PBE	PBE2	0.903	0.843	0.925	0.861
	PBE3	0.953			
PER	PER1	0.872	0.728	0.880	0.786
	PER2	0.901			
PVR	PVR1	0.803	0.855	0.913	0.779
	PVR2	0.935			
	PVR6	0.904			
PCT	PCT1	0.887	0.718	0.837	0.634
	PCT2	0.721			
	PCT3	0.771			
OMCS	OMCS1	0.850	0.824	0.895	0.740
	OMCS2	0.871			
	OMCS3	0.859			
ITR	ITR1	0.841	0.827	0.897	0.743
	ITR2	0.867			
	ITR3	0.878			

Cronbach's Alpha; CR, Composite Reliability; AVEI, Average Variance Extracted; HT–MT, Heterotrait-Monotrait. Var, Variables; HT, Helpfulness Trust; RT, Reliability Trust; BEIV, Benevolence Trust; PBEI, Perceived Benefit; PEIR, Performance Risk; PVR, Privacy Risk; PCT, Perceived Centeredness; OMCS, Online Medical Consultation Service; ITR, Intention to Recommend.

Var, Variables; HT, Helpfulness Trust; RT, Reliability Trust; BEV, Benevolence Trust; PBE, Perceived Benefit; PER, Performance Risk; the second part of the analysis to evaluate the quality of the model in this research by predicting the relation between variables. Parameters in the inner model consist of R-square ( $R^2$ ), Q-square ( $Q^2$ ), and variance inflation factor (VIF).  $R^2$  to measure predictive accuracy,  $Q^2$  to measure predictive relevance and the significance and coefficient of the variables are to be decided

whether the hypothesis can be supported or not.

Previously, common method bias arising from errors or biases in measurement methodology was evaluated using the inner variance inflation factor (VIF). Before proceeding, it is important to conduct an Inner Variance Inflation Factor (VIF) test to check multicollinearity issues. The findings showed all the constructs had inner VIF below 3 as suggested (Hair *et al.*, 2019; Sarstedt *et al.*, 2022); thus, it can be concluded that there is no multicollinearity issue found in this model. The  $R^2$  value of Intention to Recommend = 0.541 which is categorized as moderate predictive accuracy Online Medical Consultation Service has  $R^2 = 0.761$  which is categorized as strong predictive accuracy.

Thus, it can be said that the respective model has a strong explanatory capability to estimate the respective variable. OMCS has a large effect size on ITR with an  $F^2$  value of 1.190. The out-of-sample redundancy value was applied from the blindfolding feature of PLS-SEM (Hair *et al.*, 2019). All the  $Q^2$  are found  $> 0$ , whereas ITR shows  $Q^2 = 0.511$  and was categorized as a large value ( $> 0.5$ ). OMCS has  $Q^2 = 0.753$ . Therefore, it can be said that endogenous constructs in the out-of-sample model approach have sufficient cross-validated redundancy.

Based on the results of hypothesis testing with the bootstrapping feature (Table 4), it was shown that there were six accepted hypotheses ( $p < 0.05$ , CI 5%, and CI 95% following the direction of the hypotheses). However, hypotheses H1 and H4 did not meet the significant requirement, so they are not supported. Meanwhile, it is recommended to use the corrected p-value with the Bonferroni Correction Method approach where the p-value should be lower than the corrected p-value. In this study, there were 8 hypotheses, so the corrected p-value was  $0.05/8 = 0.006$ . From the results of the hypothesis test, it can be found that the variables that have the strongest effects on OMCS are the HT ( $\beta = 0.368$ ) therefore Helpfulness trust could be a great predictor of OMCS, PBE ( $\beta = 0.264$ ), and RT ( $\beta = 0.236$ ). Then, OMCS has a predominant relationship with ITR ( $\beta = 0.737$ )

Table 3. Discriminant Validity with HT/MT Ratio.

Var	BEV	HT	ITR	OMCS	PEB	PCT	PER	PVR	RT
BEV									
HT	0.866 CI[0.794;0.928]								
ITR	0.505 CI[0.388;0.618]	0.655 CI[0.546;0.758]							
OMCS	0.762 CI[0.686;0.834]	0.905 CI[0.839;0.969]	0.883 CI.900[0.837;0.925]						
PEB	0.636 CI.900[0.528;0.739]	0.563 CI.900[0.449;0.667]	0.646 CI.900[0.559;0.726]	0.815 CI.900[0.753;0.874]					
PCT	0.469 CI.900[0.334;0.609]	0.407 CI.900[0.267;0.551]	0.410 CI.900[0.292;0.530]	0.555 CI.900[0.416;0.697]	0.455 CI.900[0.330;0.580]				
PER	0.459 CI.900[0.317;0.584]	0.556 CI.900[0.435;0.664]	0.675 CI.900[0.579;0.766]	0.702 CI.900[0.604;0.791]	0.484 CI.900[0.351;0.598]	0.298 CI.900[0.156;0.460]			
PVR	0.540 CI[0.437;0.638]	0.610 CI[0.510;0.703]	0.710 CI[0.640;0.779]	0.758 CI[0.690;0.825]	0.597 CI[0.503;0.685]	0.450 CI[0.300;0.606]	0.623 CI[0.509;0.729]		
RT	0.640 CI[0.519;0.764]	0.576 CI[0.464;0.687]	0.727 CI[0.652;0.802]	0.808 CI[0.752;0.866]	0.635 CI[0.545;0.718]	0.714 CI[0.581;0.849]	0.457 CI[0.304;0.595]	0.643 CI[0.545;0.739]	

Table 4. Hypothesis Test Results.

Hypothesis	Standardized Coefficient	p-value	Confidence Interval		f <sup>2</sup>	Result
			5%	95%		
			H1 Helpfulness Trust → Online Medical Consultation Service	0.368		
H2 Reliability Trust → Online Medical Consultation Service	0.236	0.000**	0.166	0.308	0.112	Hypothesis Supported
H3 Benevolence Trust → Online Medical Consultation Service	0.001	0.491 <sup>NS</sup>	-0.079	0.076	0.000	Hypothesis not Supported
H4 Perceived Benefit → Online Medical Consultation Service	0.264	0.000**	0.187	0.339	0.164	Hypothesis Supported
H5 Performance Risk → Online Medical Consultation Service	-0.145	0.000**	-0.198	-0.086	0.064	Hypothesis Supported
H6 Privacy Risk → Online Medical Consultation Service	-0.104	0.010*	-0.177	-0.030	0.026	Hypothesis Supported
H7 Perceived Centeredness → Online Medical Consultation Service	0.028	0.231 <sup>NS</sup>	-0.036	0.086	0.002	Hypothesis not Supported
H8 Online Medical Consultation Service → Intention to Recommend	0.737	0.000**	0.690	0.773	1.190	Hypothesis Supported

NS: Not Significant \*Significant p-value <0.05; \*\*Significant corrected p-value <0.006



The output of PLS's prediction can be used to assess predictive ability at the construct indicator level (Shmueli *et al.*, 2019) according to the requirements contained in the flow developed by (Hair *et al.*, 2019). In its development, a method that is considered more appropriate for measuring the predictive ability of a model is the cross-validated predictive ability test (CVPAT) developed by Lienggaard *et al.* (2021), and currently, CVPAT is recommended for measuring prediction-oriented model comparisons in PLS-SEM. From the findings of this study, we obtained CVPAT data compared to the average indicator (IA), both overall and at the indicator level. The results show a lower average loss value, which is indicated by a negative value. In accordance with the flowchart developed by (Sharma *et al.*, 2022), this model has predictive validity. Furthermore, a comparison was made with the linear model (LM), which obtained an average loss value greater than LM with positive results. Therefore, this model can only be said to have predictive validity, according to the naive benchmark stage. Three pathways have significant effects on Intention to Recommend, thus these three pathways are shown to be interconnected and show a link between the antecedents and Intention to Recommend as the dependent variable.

Importance-performance map analysis is a useful tool to identify indicators, providing input to managers to prioritize their improvement activities (Ringle & Sarstedt, 2016). This method is based on the importance that resulted from the total effect and performance based on the mean value. Importance-performance map analyses could be seen in four quadrants, whereas the focus is more on the quadrant with indicators that have more importance, whether the performance is sufficient or vice versa. For the research target construct, namely helpfulness trust in the upper right quadrant, the most important is HT1. These indicators are interpreted as important and have performed well in the eyes of consumers, so they need to be maintained by the management who manages Halodoc telemedicine. There are three indicators in the lower right quadrant which means that in the eyes of consumers, they are considered

important but have below average performance. These indicators are HT2, PBE2 and PBE3.

This research model was conducted on telemedicine users, specifically Halodoc users, to reveal factors that influence telemedicine users to recommend the platform to potential users. The results of this study aligned with research that has been previously conducted by Yang *et al.* (2021) and Octavius and Antonio (2021). What differentiates this study from previous studies is the sample. In this study, the author used women as the sample. According to (Sousa *et al.*, 2014) research, women spend more time on social media. It can be said that women are daily more dependent on their smartphones than men and by using women only as the gender of the sample, we expect that the result of this study will be more reliable.

The distribution of data obtained: based on age group, most were from the group age of 25 - 34 years old (56.4%), most were single (58.3%) and most of the respondents work as employees (33.7%). Based on the results of this distribution, the results show that women are quite busy due to work, thus many of them rely on telemedicine to seek treatments. It was found from 8 hypotheses that six hypotheses were supported and significant with a positive direction. The other 2 hypotheses did not support the hypotheses because they were found to have no significance in the matter. In this research model, 2 hypotheses have a negative direction, namely PER and PVR. This is because it is related to risk. Risk has become a concern for telemedicine users because the use of telemedicine has a close relationship to risk, such as privacy and performance in the application. The risk in this study is characterized by a negative coefficient, where consumers first form an initial expectation of a specific product or service before the transaction.

After their initial consumption, they form perceptions about its performance. Then, consumers compare their performance perceptions with their original expectations and determine the extent to which their expectations are confirmed. Interestingly, the predominant relation from independent variables was shown from helpfulness trust (0.368). The higher the users' trust in an application, the higher the

chances that users will choose that particular OMC. This finding is in line with previous research. Helpfulness trust in telemedicine in this study is not human to human but human to computer (Sousa *et al.*, 2014). Trust contributes to expectation formation and thus influences their satisfaction and intention to continue the service. Research suggests that it is important to note that a good user interface design is crucial to a mobile app's acceptance by its users, where women usually find it more difficult to understand difficult applications (especially in terms of the user interface) (Mohammadzadeh *et al.*, 2022).

Apart from that, an application can be said to be helpful if the application can be used as a "one-stop shopping application", where not only users can get their medical consultation but also can get medicine from cooperating pharmacies or laboratories to carry out supporting examinations. This implication is also reinforced by the IPMA results at the indicator level, which shows that the HT2 indicator is the most important thing, and its performance needs to be improved to support optimal OMCS. The second biggest relation is perceived benefit (0.264). Perceived benefit is a foundational aspect regarding consumers' decision-making and consumers tend to maximize the positive value, which in this case the user's decision to use the Halodoc application to answer questions about their health (Gong *et al.*, 2019).

Based on previous evidence-based studies, it has shown that perceived benefits exerted a positive and significant effect on customers' behavioral intention (Gong *et al.*, 2019). This can be seen by the relationship between OMCS as one of many internet-based services that may bring about potential benefits for consumers, such as cost-effectiveness and time-saving which have been identified as relative benefits as compared with traditional offline services. This also follows the samples used in this study, while productive women have a lot of activities, so they choose to make the best use of their time and be as effective as possible.

The third biggest relation is reliability trust (0.236). Trust can be referred to as perceived trust, which is the user's level of

confidence that an application is trustworthy (Alexandro & Antonio, 2021; Schnall *et al.*, 2015). Trust is also one of the components that are considered the top five most frequent factors that affect the continuance usage intention of OMC applications. In this case, it is related to the trusting attitude by (Schnall *et al.*, 2015) who define trusting attitude as a feeling of expression of a person towards evaluating an object, for example, "I feel that I would trust OMC platforms for reliable medical information services". As an indicator of how well the OMC platforms provide services, trust is critical because if patients trust the platform, both parties will build a mutual understanding, and the relationship will be more likely to continue (Matikiti *et al.*, 2018). Therefore, when OMC patients' trust keeps increasing, they are more likely to continue their relationship with the doctor and pay for the services continuously.

This study also found that there was no adequate evidence from a few antecedents of online medical consultation services, namely the BEV and PCT, although it had a positive effect. Benevolence is the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive (Mayer *et al.*, 1995). Those who are benevolent will use all their abilities and skills to help others to their utmost. Benevolence is described as the certainty that the other will not abuse someone's vulnerability or take unfair advantage of someone, even if the opportunity exists (Di Battista *et al.*, 2020). It is difficult to assess the benevolent attitude of physicians online as the medium because women put a value on something that they can sense (touch, feel, and hear). This benevolent trust will be felt more by the patient in a face-to-face consultation. Perceived centeredness is the extent to which the physicians' services are respectful of patients' preferences and needs (van Velsen *et al.*, 2016). The patient's perception that they feel respected for their preferences and needs is also difficult because in OMCS services there is no special touch that makes patients feel their needs are cared for.

In addition, the time-limited condition also makes the patient feel the same way. This study shows that the OMCS and its antecedents, from the HT to the PCT, might have a significant

association with ITR (0.737;  $p < 0.000$ ). Similarly, the findings of this study support the hypothesis that the customer experience concept adopted in Online Medical Consultation Services may have a favorable impact on Intention to Recommend, which is a higher emotional state than contentment (Klaus & Maklan, 2013; Parasuraman *et al.*, 2020).

This study's novel contribution is to demonstrate a new method for estimating ITR using OMCS. The model has a moderate association strength ( $R^2 = 0.541$ ) and a high effect size ( $f^2 = 1190$ ). The cross-validated redundancy value provided by  $Q^2$  was used to measure model quality in the out-of-sample prediction approach. The  $Q^2$  value found in this study is 0.511, demonstrating the model's validity when parameters are changed. As a result, this model may be deemed acceptable for estimating ITR and should be duplicated and tested in future research with a bigger and more diversified population.

### Conclusions

This research concludes that HT, PBE, PER, PVR, and RT have all been proven to have a significant and positive relation. The strongest relation comes from the components of technological trust, namely Helpfulness Trust, and Reliability Trust. In addition, Perceived Benefit is also a variable that has significant value for OMCS users. Furthermore, OMCS shows adequate evidence and a positive impact on ITR. PCT and BEV showed a negative connection that weakens the OMCS. With these findings, managerial implications can be drawn up. Logical from the findings, 2 elements of technological trust get the most value. Therefore, management needs to create an application that users can trust. Reliable information and a helpful interface can make users continue using the application and recommend it to other people. In addition, because the sample used is a woman and 33.7% are workers who incidentally are busy, therefore making an application that is cost and time-effective. Li et al. (1999) said there are 3 main things that consumers relate to online buying behavior, a price benefit; (2) a convenience benefit; and (3) a recreational benefit in terms of enjoyment which can be realized by being able to provide free vouchers

or attractive prizes. Concerning perceived benefits, OMCS users want to feel these three things when using the application. This research also noted some limitations and one of them was that this study was only conducted on one Online Medical Consultation. By using more than one application, it is hoped that we will get more diverse answers. In addition, the inclusion criteria do not include the frequency of users in a certain period, because it is related to continued usage intention, it is better if the frequency criteria are included in the questionnaire. In addition, this study did not classify patients based on the disease consulted. By knowing what diseases are consulted, it can be seen how far the application answers the user's needs.

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## Mastitis Pain In Postpartum Mothers Using Plumeria Rubra L Ointment

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### Abstract

Treatment of mastitis is usually carried out pharmacologically by giving antibiotics, but the content of antibiotics can pass into breast milk, so an alternative solution is needed for the problem of using herbal plants. *Plumeria rubra* L was processed into an ointment so that it was easy to use. This study aimed to determine the intensity of postpartum maternal mastitis pain with the use of 5% *Plumeria rubra* L ointment. The research design was a true experiment pre-post test control group design. Respondents were divided into 2 groups, namely intervention and control, totaling 32 people. The intervention was given by 5% *Plumeria rubra* L ointment applied to the breasts of postpartum mothers who were given twice a day in the morning and evening for seven days with a size of 5 grams for each use. The result was the intensity of postpartum mastitis pain in the previous control group, most of the percentage was severe pain as much as 66.7%, and after most of the presentations, namely moderate pain as much as 60.0%. The intensity of mastitis pain for postpartum mothers before using red frangipani ointment was mostly the percentage, namely severe pain at 73.3%, and the intensity of mastitis pain for postpartum mothers after using red frangipani ointment, most of the percentages were moderate pain 53.3%. The conclusion obtained was a p-value of 0.004 which indicates a significant difference. To reduce mastitis pain, postpartum mothers can use red frangipani ointment for 7 days.

### Introduction

Breastfeeding provides many benefits for the growth and development of infants (Alonso *et al.*, 2020). However, the breastfeeding process can be hampered due to several problems, one of which is mastitis or breast inflammation caused by sores on the nipples (Alsaleh, 2021). Lack of knowledge about proper breastfeeding techniques is a major factor in the occurrence of mastitis (Aly *et al.*, 2022). The World Health Organization or WHO estimates that 1.4 million people suffer from mastitis and of these 39.5% are postpartum mothers (Andjić *et al.*, 2022). The incidence of mastitis cases in postpartum mothers in Indonesia reaches 10% and most cases occur within the first 12 weeks (Andjić *et al.*, 2022). The Suwawa Community Health Center in Bone Bolango

District, Gorontalo, has recorded an increase in mastitis cases every year, accounting for 30% of the total postpartum mothers. Inappropriate management of mastitis can exacerbate the situation so that it can cause life-threatening septic shock (Bai *et al.*, 2022). One of the efforts to prevent mastitis is by providing knowledge of correct breastfeeding techniques to postpartum mothers, but these efforts have not been effective, this can be seen from the increase in cases of mastitis every year, so proper treatment is needed to prevent complications (Bihani, 2021). Treatment of mastitis is usually carried out pharmacologically by giving antibiotics, but antibiotics can pass into breast milk and cause side effects in the baby, so an alternative solution is needed for this problem (Bintang *et al.*, 2021).

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Indonesian people often use herbal plants to save costs and reduce the side effects of chemicals. One of the plants that is easy to find and often used by the community because of its many uses is *Plumeria rubra* L (*Plumeria rubra* L) (Deng *et al.*, 2021). Its content is in the form of saponins which are useful as vasodilators, anti-inflammatories, and analgesics (Deng *et al.*, 2021). Besides that, it also contains essential oils which are useful as antianxiety (DiLauro *et al.*, 2020). The red color of *Plumeria rubra* L also indicates high levels of antioxidants. *Plumeria rubra* L is processed into an ointment so that it can be easily used as a spread on the skin surface (Djannah *et al.*, 2022). Ointment dosage forms have the advantage of being stable in use and storage (Farahnik & Murase, 2016). The purpose of this study was to determine the use of 5% *Plumeria rubra* L ointment in postpartum women who had mastitis. Specifically, this study aims to analyze the effect of *Plumeria rubra* L 5% ointment intervention on mastitis pain in postpartum women, analyze the effect of lanolin on mastitis pain in postpartum mothers, analyze the differences in the effect of *Plumeria rubra* L 5% ointment intervention and lanolin on mastitis pain in postpartum women at the Public Health Center. Suwawa. Urgency in general, the output of this study can be used as government input in midwifery practice to reduce postpartum maternal mortality caused by inappropriate management of mastitis and reduce the side effects of using antibiotics in postpartum mothers on babies. In particular, this research is important because it can reduce discomfort and prevent postpartum blues. From an economic standpoint, this research can also reduce the burden on mothers who have mastitis.

## Method

The research was conducted at the Suwawa Health Center. The research design that will be used is a true experimental pre-post-test control group design. The design was used to test two related samples. Evaluation of mastitis pain used a numerical rating scale. The intervention would be given *Plumeria rubra* L 5% ointment which would be applied to the breast that has mastitis. *Plumeria rubra* L 5% ointment was given twice a day in the morning

and evening for seven days with the use of 5 grams for each use. For the control group, only lanolin was used as therapy. Data analysis to see the research variables descriptively and determine the relationship between the independent variables and the dependent variable used the independent t-test. The population in this study were all postpartum mothers who experienced mastitis and met the inclusion criteria at the Suwawa Health Center, a total of 64 obtained from the average postpartum mother at the Suwawa Health Center in 2021. The sampling technique for this study used purposive sampling with the criteria of mothers who were willing to be respondents, postpartum mothers with mastitis, age 20-35 years, multipara, LILA >23.5 cm, and exclusion criteria of smoking, diabetes, and using breast implants.

## Result and Discussion

Table 1. Frequency Distribution of Characteristics of Postpartum Mothers

Characteristics of Respondents	N	%
Age		
< 20 years old	-	-
20 - 35 years old	64	100,0
> 35 years old	-	-
Paritas		
1 child	38	60,0
2 child	23	36,7
≥3 child	3	3,3

Source: Primary Data, 2023

Based on Table 1 the characteristics of the respondents according to age, all postpartum mothers were 64 people (100.0%) aged 20-35 years and there were no postpartum mothers who were more than 35 years old or less than 20 years old. Characteristics of respondents based on parity, the majority of respondents had 1 child as many as 38 people (60.0%), had 2 children as many as 23 people (36.7%) while having 3 or more children was 1 person (3.3%).

Based on Table 2, it is known that the intensity of postpartum mastitis pain before using lanolin showed that of the 32 respondents in the control group, most of the 21 respondents (66.7%) had severe pain and 5 respondents (33.3%) had moderate pain. Based on Table 2, it is known that the intensity of postpartum mastitis pain after using lanolin showed that out of 32 respondents, most of

them were 19 respondents (60%) had moderate pain, 9 respondents (26.7%) had severe pain, and 4 respondents (13.3%) mild pain. Based on Table 2 it is known that postpartum mastitis pain before using Plumeria rubra L ointment showed that of the 32 respondents, most of them 24 respondents (73.3%) had severe pain and 8 respondents (26.7%) had moderate pain. Based on Table 2, it is known that postpartum mastitis pain after being given Plumeria rubra L ointment showed that out of 32 respondents, 17 respondents (53.3%) had moderate pain and 15 respondents (46.7%) had severe pain.

Table 2. Distribution Mastitis Pain Intensity Before Using Lanolin in the Control Group

Variables	Frequency	Percent (%)
<b>Before Using Lanolin</b>		
0 (no pain)	-	-
1- 3 (mild pain)	-	-
4- 6 (moderate pain)	11	33,3
7-10 (severe pain)	21	66,7
<b>After Using Lanolin</b>		
0 (no pain)	-	-
1- 3 (mild pain)	4	13,3
4- 6 (moderate pain)	19	60,0
7-10 (severe pain)	9	26,7
<b>Before Using Plumeria rubra L Ointment</b>		
0 (no pain)	-	-
1- 3 (mild pain)	-	-
4- 6 (moderate pain)	8	26,7
7-10 (severe pain)	24	73,3
<b>After Using Plumeria rubra L Ointment</b>		
0 (no pain)	-	-
1- 3 (mild pain)	15	46,7
4- 6 (moderate pain)	17	53,3
7-10 (severe pain)	-	-

Source: Primary Data, 2023

Table 3. Effect of Lanolin on Postpartum Mastitis Pain.

	Mean	Min	Max	SD	P value
Before	7,00	4,00	9,00	1,41	0,00
After	5,40	3,00	8,00	1,63	

Source: Primary Data, 2023

Based on Table 3 it is known that the results of the Kolmogorov-Smirnov Z test

for postpartum mastitis pain before lanolin treatment had a p-value of 0.64 and after lanolin treatment was 0.53. The value of  $p > 0.05$  indicates that both are normally distributed. Before giving lanolin for postpartum mastitis pain the lowest was 4.00, the highest was 9.00, the average was 7.00 with a standard deviation of 1.41 while after the treatment with lanolin using the lowest pain intensity was 3.00, the highest was 8.00, the average was 5, 40 with a standard deviation of 1.63. The average value of the difference between the first measurement and the second measurement is 1.60 with a standard deviation of 0.63. From the results of statistical tests with the sample T-test, the p-value is 0.00. The p-value  $< 0.05$  indicates that there is an effect of lanolin on postpartum mastitis pain.

Table 4. Effect of Plumeria rubra L ointment on Postpartum Mastitis Pain

	Mean	Min	Max	SD	P value
Before	7,00	5,00	9,00	1,00	0,00
After	3,80	2,00	6,00	1,08	

Source: Primary Data, 2023

Based on Table 4 it is known that from the results of the Kolmogorov-Smirnov Z test postpartum mastitis pain before using Plumeria rubra L ointment p-value of 0.90 and after treatment of Plumeria rubra L ointment using of 0.91. The value of  $p > 0.05$  indicates that both are normally distributed. Before the treatment of giving Plumeria rubra L ointment for postpartum mastitis pain the lowest was 5.00, the highest was 9.00, the average was 7.00 with a standard deviation of 1.00 while after the treatment with Plumeria rubra L ointment, the lowest pain intensity was 2.00, the highest was 6.00, the average is 3.80 with a standard deviation of 1.08. The average value of the difference between the first measurement and the second measurement is 3.20 with a standard deviation of 0.94. From the results of statistical tests with the sample T-test, the p-value is 0.00. The p-value  $< 0.05$  indicates that there is an effect of Plumeria rubra L ointment on postpartum mastitis pain. The results of the Kolmogorov-Smirnov Z test for postpartum mastitis pain after treatment had a p-value of 0.37. The value of  $p > 0.05$  indicates that



the variable is normally distributed. Levene test results in a p-value of 0.08. The value of  $p > 0.05$  indicates that the variance in the two groups is the same. It is known that the average postpartum mastitis pain after using lanolin was 5.40 with a standard deviation of 1.63. While the average postpartum mastitis pain after using *Plumeria rubra* L ointment was 3.80 with a standard deviation of 1.08. From the statistical test results, it was obtained that the p-value was 0.004 at alpha 5%. The p-value  $< 0.05$  indicated that there was a significant difference in the average postpartum mastitis pain in the lanolin group and the *Plumeria rubra* L group.

In general, postpartum women experience pain during childbirth, but the intensity of this pain is different (fear and trying to fight the pain) and whether there is support from those around them (Fasihi *et al.*, 2022). Parity also influences the perception of pain. Primiparas will experience pain more easily than multiparas (Fink *et al.*, 2022). Multiparous mothers have experienced pain in multiparas so multiparas already have mechanisms to deal with pain in contrast to primiparas, mothers who have never had the first experience which causes emotional tension, anxiety, and fear which can exacerbate the pain. Pain intensity in primiparas is often more severe than pain in multiparas (Fink *et al.*, 2022).

Factors that affect a person's pain include physiological factors of pain, psychological factors, perception factors, and pain tolerance. Physiological (physical) factors include opening, cervical effacement, lower uterine segment tension, peritoneum pulling, bladder pressure, hypoxia, vaginal pressure, parity (primipara/multipara), then psychological factors include fear, panic, low self-esteem, anger, fear, anxiety, sexual activity disorder (Ghobadi *et al.*, 2021). In addition, the perception factor is a factor that can trigger nociceptors and the pain tolerance factor is closely related to the presence of pain intensity which can influence a person to endure pain and someone who has experienced pain before (Gong *et al.*, 2019).

From the results of the study, it was found that the distribution of pain intensity in the lanolin group before treatment was mostly severe pain percentage 66.7% (21 respondents) and moderate pain 33.3% (11 respondents). After

the lanolin treatment, most of the percentages were moderate pain 60.0% (20 respondents), severe pain 26.7% (8 respondents), and mild pain 13.3% (4 respondents). The distribution of pain intensity in the *Plumeria rubra* L ointment group before treatment was mostly present, namely severe pain at 73.3% (23 respondents) and moderate pain at 26.7% (9 respondents). After the *Plumeria rubra* L ointment treatment, most of the percentages were moderate pain 53.3% (17 respondents), and mild pain 46.7% (15 respondents).

This is supported by the theory of pain control from Melzack and Wall suggesting pain impulses can be regulated or inhibited by defense mechanisms throughout the central nervous system. According to this theory, low-level activity in the small fibers that transmit data-noise-sensitive impulses is inhibited, and the first synapse is spliced by activity in the large ascending fibers and by activity in the descending fibers from higher centers in the brain (Infante *et al.*, 2021). Melzack and Wall proposed that intense activity in small fibers triggered by painful stimuli 'gates open' the first synapse whereas intense activity in heavy fibers 'gates shut' to painful stimuli (Lavon *et al.*, 2019).

A balance of activity from sensory neurons and descending control fibers from the brain regulates defense processes (Liao *et al.*, 2021). Delta-A and C neurons release substance P to transmit impulses through defense mechanisms. In addition, there are mechanoreceptors, thicker beta-A neurons, which are more rapidly releasing inhibitory neurotransmitters (Mohamed-noriega *et al.*, 2022). If the dominant input comes from beta-A fibers, it will close the defense mechanism (Mohamed-Noriega *et al.*, 2022). It is believed that this closing mechanism can be seen when the postpartum companion gently rubs the client's back (Nakagawa *et al.*, 2021). The resulting message will stimulate the mechanoreceptors, if the dominant input comes from delta A fibers and C fibers, it will open these defenses and the client will perceive the sensation of pain (Ohashi *et al.*, 2022).

Even if pain impulses are transmitted to the brain, there are centers of the higher cortex in the brain that modify pain (Oliveira *et al.*,

2021). The descending nerve pathways release endogenous opiates, a natural painkiller that originates from the body (Pagé *et al.*, 2022). This neuromodulator closes the defense mechanism by inhibiting the release of substance P. distraction techniques, lanolin, Plumeria rubra L ointment, hypnosis, and placebo use (Pérez-Báez *et al.*, 2019). Added to Yanti's theory that postpartum pain is caused by adnexal, uterine, and pelvic ligament receptor stimulation (Politis *et al.*, 2012). Stimuli are channeled from afferent tissues through the lower, middle, and upper parts of the hypogastric plexus, lower lumbar, and lower thoracic sympathetic chains to the lower nerve root ganglia at T10-L1. Pain can be transferred from the pelvic region to the navel (umbilicus), upper thighs, and mid-sacrum area (Quinlan-Colwell *et al.*, 2022).

The pain is caused by a combination of stretching the lower uterine segment (and subsequently the cervix) and ischemia (hypoxia) the uterine muscles with an increase in the strength of the cervical contractions will be pulled, this strong contraction also limits the flow of oxygen resulting in ischemic pain (30). Pain is mostly caused by ischemia that occurs in the fibers and stronger contractions are felt more intensely on T12 and L1 cutaneous stimulation (Rouse *et al.*, 2019). Based on the results of statistical tests using a paired t-test, the results ( $p < 0.05$ ) showed that a p-value of 0.000 means that lanolin has a significant effect on postpartum mastitis pain in multiparous women. In postpartum mastitis, the muscles tighten in a tight pulling position with full force, and the muscles throughout the body tighten so that the process of pain in mastitis tends to be more painful than it should be. On the other hand, if the mother gives lanolin while pain occurs, the mother will feel comfortable using the lanolin technique. Appropriately and correctly will increase the mother's ability to control her pain and reduce anxiety, reduce catecholamine levels, stimulate blood flow to the uterus, and reduce muscle tension (Rouse *et al.*, 2019).

Respondents' mastitis pain before and after using lanolin was generally different. This follows the theoretical concept that lanolin can reduce the pain experienced by mothers (Rouse *et al.*, 2019). Here the mother still feels

pain in the breast because lanolin only makes her feel comfortable (Shigematsu-Locatelli *et al.*, 2022). Added to this is the concept that the condition of giving lanolin reduces muscle tension resulting in the postpartum muscles working in an integrated manner, where the circular muscles relax and pull up (Shimpuku *et al.*, 2021).

Based on the results of statistical tests using a paired t-test, the results ( $p < 0.05$ ) showed that a p-value of 0.000 means that frangipani red ointment has a significant effect on postpartum mastitis pain in multiparous women. To deal with pain during postpartum, non-pharmacological pain control methods are very important because they do not harm the mother or fetus, do not slow down postpartum if strong pain control is given, and have no allergic or drug effects (36). The non-pharmacological method is divided into three interacting components that affect the response to pain, namely effective-motivational strategies (central interpretation of messages in the brain that are influenced by one's feelings, memory, experience, and culture), cognitive-evaluative (central interpretation of messages located in the brain influenced by knowledge, one's attention, use of cognitive strategies, and cognitive evaluation of situations) and sensory-discriminatory (giving information to the brain according to physical sensations) (Smith *et al.*, 2022).

Respondents' mastitis pain before and after applying Plumeria rubra L ointment was generally different. This is consistent with the theoretical concept that Plumeria rubra L can inhibit the passage of pain stimuli to the higher centers of the central nervous system (Timmers *et al.*, 2021). Furthermore, tactile stimulation and positive feelings that develop when the form of attention, which is full of touch and empathy, strengthen the effect of Plumeria rubra L ointment to control pain (Tong *et al.*, 2022). Added to this is the concept that Plumeria rubra L ointment is physical contact that gives a feeling of comfort with phytochemicals that will help balance energy and prevent disease (Tsuno *et al.*, 2022). Physiologically stimulates and regulates the body, improving blood flow so that oxygen is carried effectively to the body's tissues (Ueshima, 2022) by relaxing tension.

Plumeria rubra L ointment also soothes the nerves (Underwood *et al.*, 2022).

Based on the results of the above study it is known that the average mastitis pain after using lanolin is 5.40 with a standard deviation of 1.63. While the average postpartum mastitis pain after frangipani red ointment was 3.80 with a standard deviation of 1.08. The results of statistical tests using the independent t-test showed that ( $p < 0.05$ ) showed that the p-value was 0.004, meaning that there was a significant difference in the average postpartum mastitis pain in multiparous women in the lanolin group and the red frangipani group.

Mastitis pain is influenced by psychology including fear and anxiety which can stress the mother. Postpartum stress causes increased production of catecholamines (adrenaline and non-adrenaline) which can reduce vasodilation and increase blood vessel vasoconstriction so that blood flow decreases (Underwood *et al.*, 2022). Lanolin reduces pain because it makes the skin experience relaxation and can also make fetal blood circulation smooth so that oxygen is fulfilled (Warkentin *et al.*, 2021). Smooth blood circulation will also make the muscles weak and loose so that mastitis pain during postpartum can be reduced (Yang & Florio, 2021). This technique reduces pain and emotional distress during the postpartum period without the use of drugs (Yao *et al.*, 2021).

This technique triggers a feeling of comfort through the surface of the skin. Red frangipani ointment for 7 days during postpartum helps mothers feel comfortable and free from pain because it stimulates vasodilators and the content of essential oils can also stimulate the body to release endorphins which are natural pain relievers and create feelings of comfort and good (S. Yu *et al.*, 2020). The effectiveness of this method of bringing stimulation to the brain is smaller and slower than the broad touch fibers. When touch and pain are stimulated together, the sensation of touch travels to the brain closing the gate in the brain. The presence of red frangipani ointment which has a distraction effect can also increase the formation of endorphins in relaxing muscles (Z. N. Yu *et al.*, 2020). Efforts to reduce maternal morbidity when experiencing mastitis

during childbirth for multiparous mothers who have had previous experience of postpartum pain should be health workers introducing Plumeria rubra L ointment to the community so that multiparous mothers have the means to increase knowledge of reducing pain during postpartum in a cheap, easy and effective way (Zhang *et al.*, 2020).

## Conclusion

The distribution of postpartum mastitis pain in multiparous women before lanolin was mostly in the percentage, namely severe pain as much as 66.7%. The distribution of postpartum mastitis pain in multiparous women after lanolin is mostly moderate pain as much as 60.0%. The distribution of the intensity of postpartum mastitis pain in multiparous women before Plumeria rubra L ointment was mostly the percentage, namely severe pain at 73.3%. The distribution of the intensity of postpartum mastitis pain in multiparous women after Plumeria rubra L ointment is mostly the percentage, namely moderate pain at 53.3%. There is an effect of lanolin on postpartum mastitis pain in multiparous women. There is an effect of massage endorphin on postpartum mastitis pain in multiparous women. There was a significant difference in the average postpartum mastitis pain using the lanolin method and postpartum mastitis pain in multiparous women using Plumeria rubra L ointment with an average postpartum mastitis pain result after lanolin of 5.40 with a standard deviation of 1.63. Meanwhile, the average postpartum mastitis pain for multiparous women after frangipani red ointment was 3.80 with a standard deviation of 1.08. From the results of statistical tests, a p-value of 0.004 was obtained.

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## Cortisol Hormone Effects in Pregnant Women on Body Weight and Length at Birth of Babies

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### Abstract

Other mental disorders with a reasonably high prevalence are pregnancy stress of 92.8% and anxiety of 32.6%. Pregnancy pressure can potentially cause low birth weight and small head circumference. In addition, stress during pregnancy will affect neurobehavioral development, ACTH, cortisol, norepinephrine, and epinephrine levels in neonates. This study aimed to assess cortisol exposure in pregnancy with birth weight and birth length in infants. This study used a cohort study approach. The sample in this study was the third-trimester pregnant women as many as 152 respondents. The research instrument used checklist sheets and laboratory tests using the ELISA method. The resulting data were processed using the unpaired t-test and the Pearson correlation test. The results showed a correlation between cortisol levels and birth weight with a value of  $p = 0.004 < 0.05$  and a value of  $r = -0.230$ , indicating that both variables had a low correlation and a negative relationship. This means the higher the cortisol level, the lower the baby's birth weight. There was a correlation between cortisol levels and the baby's birth length with a value of  $p = 0.003 < 0.05$  and  $r = -0.239$ , showing that both variables have a low correlation and a negative relationship. The higher the cortisol level, the shorter the baby's birth length. Maintaining the mental health of pregnant women, primarily through family support and health workers, is essential to avoid excessive stress and depression during pregnancy.

### Introduction

Stress, depression, and anxiety are the most commonly reported mental health disorders during pregnancy (Agung Suwardewa *et al.*, 2022). Anxiety and pregnancy stress both had a relatively high prevalence of 32.6% and 92.8%, respectively. The majority of these ailments result from low self-esteem brought on by pregnancy-related bodily changes, increased pain aversion, labor pains, and birth-related problems, which all contribute to anxiety, especially in nulliparous women. (Camerota & Bollen, 2016) but also have lifelong health implications. Despite widespread interest in this

hypothesis, few methodological advances have been proposed to improve the measurement and modeling of fetal conditions. A Statistics in Medicine paper by Bollen, Noble, and Adair examined favorable fetal growth conditions (FFGC).

The research results show that stress increases the risk by 8,229 times of experiencing labor complications. According to Su *et al.*, (2015) research, pregnant stress can result in low birth weight and a small head circumference ( $p$ -value 0.01). Additionally, neurobehavioral development, ACTH, cortisol, norepinephrine, and epinephrine levels in newborns will be

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impacted by stress throughout pregnancy (p 0.001). (Crane *et al.*, 2003; Pan *et al.*, 2019) including: respiratory distress syndrome, intraventricular hemorrhage, infection, adrenal suppression, somatic and brain growth; perinatal mortality; and maternal morbidity, including infection and adrenal suppression. EVIDENCE: MEDLINE and PubMed searches 1996 to August 2002 for English-language articles related to antenatal corticosteroid therapy for fetal maturation, the Cochrane Library, and national statements including that of the National Institutes of Health (NIH).

Prenatal maternal stress is typically measured using physiological or psychological self-report methods. Cortisol is a frequently used biomarker to measure maternal stress levels during pregnancy for the later (Nath *et al.*, 2017) mid and late pregnancy. Follow up visits after delivery will be done on day 10, 3 months, 8 months and 12 months. The Bayley Scales of Infant and Toddler Development [BSID] (Third edition by analysis of maternal saliva, urine, blood serum, amniotic fluid, or hair samples. In reaction to stresses, the hypothalamic-pituitary-adrenal (HPA) axis releases the glucocorticoid hormone cortisol (Hwang *et al.*, 2019). It is essential for the body's proper operation and controls a wide range of activities, including immunity, inflammatory response, and metabolism (Shriyan *et al.*, 2023).

For proper acclimatization to extrauterine life, enough endogenous cortisol synthesis is necessary. Among their many impacts are the development of the lungs, the preservation of glucose homeostasis, the management of postpartum hormonal adjustments, and the control of body temperature (Arafa *et al.*, 2020). The hypothalamic-pituitary-adrenal (HPA) axis is immature in premature newborns; this may be because the hypothalamus is unable to identify stimulatory signals or because adrenal steroidogenesis is inefficient. Age during pregnancy and after birth are related to how immature the HPA axis is. Antenatal corticosteroids and intrauterine development restriction (Ng *et al.*, 1997) yet little is known about their effects on the hypothalamic-pituitary-adrenal axis in these infants. We

prospectively evaluated pituitary-adrenal function in 61 preterm (<32 gestational weeks

## Method

This study used a prospective design with a cohort study approach. The population in this study were all third-trimester pregnant women in the Makassar City area. The sample in this study was pregnant women in the third trimester and was followed until delivery to assess the anthropometry of newborns. The number of samples in this study was 152 pregnant women. The sampling technique used purposive sampling with the criteria of pregnant women in the third trimester (gestational age 28-30 weeks), the mother's hemoglobin level of at least 10 gr/dL, and mothers who did not experience complications during pregnancy, did not experience depression and were willing to be taken blood. Blood collection is carried out by analysts who have a registration letter. Take three cc of venous blood sample and store it using a purple cap EDTA tube.

The dependent variables in this study are birth weight and birth length of newborn babies. Meanwhile, the independent variable is the mother's serum cortisol level during pregnancy. Characteristic data collected were the mother's age, occupation, education, and number of children. Hemoglobin levels were measured to avoid biased research results due to the influence of hemoglobin levels on the anthropometry of newborn babies. The research instrument used an observation sheet to record birth measurement results for newborns and hormone levels, and laboratory tests were carried out using the enzyme-linked immunosorbent assay (ELISA) method to assess cortisol levels in the mother's blood serum. The resulting data was processed using the unpaired t-test to assess differences between the two groups and the Pearson correlation test to assess the relationship between variables.

## Results and Discussions

The results of the study on 152 third-trimester pregnant women who were followed until delivery in the work area of the puskesmas in Makassar City obtained the following results:



Table 1. Characteristics of Respondents

Variables	N(%) / Mean ± SD
Mother's age ( years )	
<20	11 (7.23)
20-35	117 (76.97)
>35	24 (15.8)
Mother's job	
Work as a housewife	83 (54.6)
Private employees	48 (31.57)
Government employees	21 (13.83)
Education	
Primary school	5 (3.28)
Junior High School	13 (8.55)
Senior High School	107 (70.39)
College	27 (17.78)
Parity	
Primigravida	65 (42.76)
Multigravida	87 (57.24)
Mother's Hb Level	10.81 ± 0.74
Total	152

Table 1 shows the age of most respondents in the 20-35 year category, namely 117 respondents (76.97%). Most mothers are housewives, namely 83 respondents (54.6%). The most education was in the high school category, namely 107 respondents (70.39). Most respondents with multigravida status were 87 people (57.24%)—furthermore, the mother's Hb level averages 10.81 gr/dL.

Table 2. Frequency Distribution of the Variables Researched

Variables	Min-Max	Mean ± SD
Mother's Cortisol Levels	47.0- 479	102.64 ± 51.23
Baby's Birth Weight (grams)	2300-3800	2810 ± 355.35
Body Length at Birth (cm)	43-50	47.76 ± 1.49

Table 3. Analysis of Differences in Cortisol Levels Based on Birth Weight and Birth Length

Variable	Mean ± SD	P
Cortisol Levels (nmol/L)		
Newborns (n= 119)	94.47 ± 12.97	0.000*
LBW (n=33)	132.07 ± 103.07	
Cortisol Levels (nmol/L)		
Normal Body Length (n=85)	94.78 ± 12.30	0.033*
Short body length (n=67)	112.59 ± 75.05	

\*p = Unpaired T test

Table 2 shows that the average cortisol level of the respondents was 102.64 nmol/L, the average birth weight of the baby was 2810 grams, and the average birth length of the baby was 47.76 cm.

Table 3 shows that cortisol levels in the group of babies with average birth weight had a mean ± SD of 94.47 ± 12.97 nmol/L, while those in the group of babies with low birth weight had a mean ± SD of 132.07 ± 103.07 nmol/L. For cortisol levels in the group of babies with standard birth length, the mean ± SD was 94.78 ± 12.30 nmol/L, while those in the group with short body length had a mean ± SD of 112.59 ± 75.05 nmol/L. The analysis results used the t-independent test. For birth weight, the value was p = 0.000 < 0.05, and for body length at birth, the value was p = 0.033 < 0.05. These results show differences in cortisol levels in babies with low birth weight and standard and birth length. There are significant differences in cortisol levels in children born with standard body length and short birth length.

Table 4. Analysis of the Correlation Between Cortisol and Hemoglobin Levels with Birth Weight and Body Length at Birth

Variable	Mark	
	P	R
Cortisol levels with baby's birth weight	0.004	-0.230
Cortisol Levels with Baby's Birth Length	0.003	-0.239
Hemoglobin Level with Birth Weight	0.930	0.007
Hemoglobin level with baby's birth length	0.118	0.127

p = Pearson Correlation Test

Table 4 shows the results of the Pearson correlation test, where there is a correlation between cortisol levels and birth weight with

a value of  $p = 0.004 < 0.05$  and a value of  $r = -0.230$ , indicating that both variables have a low correlation and a negative relationship. This result means that the higher the cortisol level, the lower the baby's birth weight. There is a correlation between cortisol levels and the baby's birth length with a value of  $p = 0.003 < 0.05$  and  $r = -0.239$ , showing that both variables have a low correlation and a negative relationship. This result means the higher the cortisol level, the shorter the baby's birth length. This study had no correlation between hemoglobin levels on birth weight and birth length, with  $p = 0.930 > 0.05$  and  $p = 0.118 > 0.05$ .

The results of our study contribute to the expanding body of evidence showing that maternal psychological stress during pregnancy affects the child's growth and development in the years that follow (Prabhu *et al.*, 2020). While maternal endogenous cortisol estimate can serve as a biomarker of prenatal psychological stress, mother anxiety, and depression can be assessed using self-reporting tools. The above-mentioned subjective and objective measurements might be combined to offer a more accurate assessment of mental stress during prenatal care (Woolhouse *et al.*, 2014). The study's findings can be utilized to emphasize the burden of mental health issues during pregnancy that have negative effects and to think about ways to enhance prenatal mental health care in both public and private health settings (Hall *et al.*, 2020) and its impact on symptoms of antenatal anxiety, stress and depression. Methods A feasibility randomised controlled trial was conducted to compare partner-delivered relaxation massage (intervention).

The hypothalamus releases Corticotropin Releasing Hormone (CRH) in response to persistent and continuous stress, which prompts the anterior pituitary to release ACTH. Adequate ACTH can stimulate the adrenals to secrete the hormones cortisol, epinephrine, and norepinephrine in the body's response to suppressing the stress it receives (Peterson *et al.*, 2020). The mother's body's rejection response by increasing cortisol levels in the blood to increase energy catabolism processes can directly affect the placenta and fetus. In an advanced state, the hormone cortisol will increase catabolism in

the pregnant woman's body, eventually leading to a decrease in maternal nutrition that the fetus will receive (Heckmann *et al.*, 1999). An increase in the body's cortisol levels will affect all physiological activities of the body down to the biomolecular level, this results in improper prenatal growth, including low birth weight and short stature; increased cortisol levels cause this in response to increased levels of progesterone in pregnancy which is needed for homeostasis, with an increase in the hormone cortisol can affect the entire body's metabolism (Caparros-Gonzalez *et al.*, 2022). This condition is what can occur during pregnancy. There are many changes in the increase in hormones to maintain the results of conception until birth occurs. This syndrome is brought on by a rise in cortisol levels in response to a rise in progesterone levels during pregnancy, which is essential for maintaining homeostasis. An increase in cortisol can impact the metabolism of the entire body (Shim, 2023).

This condition is what can occur during pregnancy. There are many changes in the increase in hormones to maintain the results of conception until birth occurs. This is caused by an increase in cortisol levels in response to an increase in progesterone levels in pregnancy which is necessary for a state of homeostasis, with an increase in the hormone cortisol can affect the entire body's metabolism (Pitri & Hirowati, 2019). This condition is what can occur during pregnancy. There are many changes in the increase in hormones to maintain the results of conception until birth occurs. Besides hurting the mother, stress also impacts the fetus (Phillips *et al.*, 2000). This impact is the risk of Low Birth Weight Babies (LBW), increased risk of congenital heart defects, as well as the risk of children with autism. If the mother's cortisol increases, the fetus's cortisol will also increase, affecting the function of specific brain parts. This condition will affect their growth. A region of the baby's brain involved in their emotional and social development, the amygdala, may undergo "structural changes" as a result of the mother's higher cortisol levels, according to a new study (Hwang *et al.*, 2019).

Placental growth becomes stunted when pregnant women experience stress. In conditions

of severe stress, the body will produce excessive cortisol. "Excessive production of cortisol in the body will result in decreased growth of the placenta (Magee *et al.*, 2018). As a result, the placenta in stressed pregnant women will be smaller than in healthy pregnant women. The placenta supplies oxygen and nutrients to the fetus and removes metabolic waste that is not needed by the fetus (Brummelte *et al.*, 2011).

## Conclusion

The findings from our research conclude that exposure to stress, assessed in the form of cortisol levels, can affect growth in the fetus. Infants' different birth weights and lengths provide evidence for this disorder. Babies with lower body weights and shorter body lengths were found to have greater cortisol levels. So that these findings can be used as information by policymakers to develop policies to protect pregnant women's mental health. The importance of providing support to mothers during pregnancy, especially from family and health workers, so that pregnancy can usually occur.

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## Mapping the Sociocultural Implication on Tuberculosis Management and Control Programs

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### Abstract

The effectiveness of tuberculosis (TB) management and control programs is influenced by several factors, including sociocultural problems that affect delays in diagnosis and treatment and increased transmission risk in the community. How people viewed diseases and seeking behavior was socially constructed. The scoping review aimed to understand the extent and type of evidence about the sociocultural implications of TB management and control programs. To address the research questions, a scoping review was conducted following PRISMA ScR as a guideline. Articles were searched in PubMed, Scopus, Science Direct, and Google Scholar databases. Searches were conducted in October 2022. The CASP checklist was used to measure the article's quality before being reviewed. A total of 15 articles were included, nine (9) studies conducted in Africa, two (2) studies in Papua New Guinea, one (1) study in India, one (1) study in Brazil, one (1) study in Yemen, and one (1) study in Nepal. Most studies were based on individual interviews (7), and three (3) studies included traditional/faith healer perspectives. Three main themes had been identified; sociocultural factors affected TB prevention, sociocultural factors affected TB-seeking behavior, and sociocultural factors affected treatment adherence. The review discovered that community practices, norms, and attitudes regarding perceived sickness impact TB care and control. To be effective and meaningful for the target population, the intervention must be attentive to cultural differences.

### Introduction

Tuberculosis is a disease caused by *Mycobacterium tuberculosis*, commonly infected lungs. According to WHO, TB infects more than 10 million people yearly, and 1.5 million people die caused of TB. It is also considered the disease of poverty that mostly affects adults in their most productive years. Globally, the largest number of TB cases is located in Southeast Asia (43%) where two-thirds of the cases are contributed by Indonesia and the Philippines (World Health Organization, 2022). To end the global TB epidemic WHO released the 2015 End TB program as a guideline for countries to combat

TB infection (World Health Organization, 2015). The target is to decrease TB incidence by 80% and TB-related death by 90% in 2030 (Merk *et al.*, 2019).

Research reveals that TB management and control face challenges, and the main challenge remains in delayed TB detection and treatment, especially in developing countries (Chiang *et al.*, 2013; Wynne *et al.*, 2014; Adebisi *et al.*, 2019). Based on Global TB Report 2021, the number of case notifications of newly diagnosed in Southeast Asia significantly dropped with the largest contribution the shortfall by India (41%) and Indonesia (14%). At the same time, the number of deaths caused

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by TB in the regions is rising (World Health Organization, 2021). That might be the result of delaying seeking treatment among patients (Cheng *et al.*, 2013).

A study has identified that diagnostic delays among TB patients were for 37 days. The delay is associated with inadequate knowledge about TB and self-medicated symptoms (Paramasivam *et al.*, 2017). Self-medication was found to be common among people with TB diagnosis delay and become a factor prolonging the delay (Rabin *et al.*, 2013; Paramasivam *et al.*, 2017; Dantas *et al.*, 2018). While access to traditional healers also influences TB's delay in diagnosis and treatment (Verhagen *et al.*, 2010). The practice of traditional healers is common in developing countries (Shankar *et al.*, 2012; Huff, 2020; Chali *et al.*, 2021). A study found that 76% of the respondents strongly believe in their culture and religion and prefer to visit traditional healers for health seeking (Matakanye *et al.*, 2021). It indicates that TB management and control need to deeply understand the sociocultural context of a targeted community.

Sociocultural factors affect how people perceive health and seeking behavior. To complete the biomedical model intervention for TB, a deep understanding of how social factors in the community affect how people perceive their health, their illnesses, and their behavior while seeking health is required (Mason *et al.*, 2015). The recent study aims to evaluate, analyze, and document existing evidence about the sociocultural factors on their implication on tuberculosis management and control programs.

## Method

Arksey and O'Malley's approach was chosen for the planned review (Daudt *et al.*, 2013). Briefly, the framework involves (i) identifying the research question, (ii) identifying relevant studies, (iii) study selection, (iv) charting the data, and (v) collating, summarizing, and reporting the results. The scoping review question was "What is the available evidence of sociocultural factors affecting tuberculosis management and control?" The research sub-questions were:

1. Is there evidence that shows how sociocultural factors affect tuberculosis prevention?
2. Is there evidence of sociocultural practices affecting tuberculosis-seeking behavior?
3. Is there evidence of types of sociocultural practices affecting tuberculosis treatment adherence?

Searches for a peer-reviewed journal were done in October 2022. The first step was a preliminary search in four databases (PubMed, Scopus, Google Scholar, and Science Direct). The search terms included "socio-cultural" OR "sociocultural" AND "tuberculosis". All 2585 studies found were downloaded and exported to Mendeley and identified duplicate studies. The study used inclusion criteria based on PCC (Population, Concept, Context) recommended by the Joanna Briggs Institute for scoping reviews (Aromataris & Munn, 2020). The inclusion criteria were as follows:

1. Population: human participants, all ages, all sex.
2. Concept: any socio-cultural and tuberculosis research carried out between 2012 and 2022.
3. Context: Research articles are limited to original research (any methods), all settings considered, and published in the English language.

The study involved other diseases and lacked discussion of the implication of sociocultural factors and TB was excluded. The inclusion and exclusion criteria were consistently applied throughout the search and analysis stages (Swift & Wampold, 2018). The papers extracted from the four databases (PubMed, Scopus, Science Direct, and Google Scholar) were checked for duplicates. After duplications were eliminated, the articles' titles were examined to establish whether the study qualified under the inclusion criteria. Studies that didn't answer the research questions were all eliminated. The steps were recorded in Fig. 1. A total of 1598 studies were after removed duplication included in initial screening by title and abstract. The first screening resulted in 37 articles for full paper review. After checking the eligibility for the next step based on inclusion and exclusion criteria, 15 studies met eligibility for synthesis.

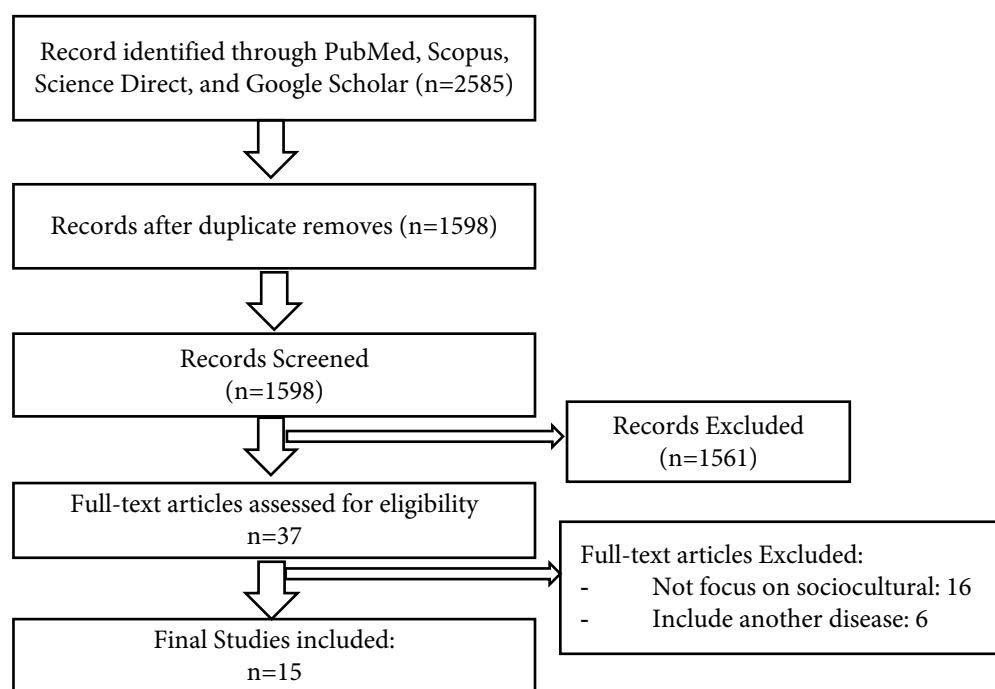


Figure 1. PRISMA

The charting process aimed to generate a descriptive summary of the results that correspond to the aims and research questions of the scoping review. Bibliography information: article title, year, authors

1. Aims and method: study aims, method,
2. CASP checklist (appendix 1)
3. A priori theme: sociocultural and TB prevention, sociocultural and TB-seeking behavior, and sociocultural and TB treatment adherence.

The three themes were identified during the analysis process. The theme was considered relevant to the research questions of this scoping review. The strategy for reporting these results followed PRISMA ScR provided by the Joanna Briggs Institute for scoping reviews (Aromataris & Munn, 2020). The central section of the review comprised a thematic summary of the findings that relate the a priori and emergent categories extracted from the included studies to the research questions stated above. The table of data extraction results is shown in Appendix 2.

## Results and Discussion

Fifteen papers have been reviewed; there were nine (9) studies conducted in Africa, two (2) studies in Papua New Guinea, one (1) study

in India, one (1) study in Brazil, one (1) study in Yemen, and one (1) study in Nepal. Most studies were based on individual interviews (7), and three (3) studies included traditional/faith healer perspectives. Most of the studies focus on TB patients. The latest article was published in 2021 (2 articles) and the oldest article was published in 2013 (1 article).

### ***Theme 1: The impact of sociocultural on TB prevention***

Three (3) studies showed how sociocultural impacted TB prevention in the community. A study in Africa showed that wearing a mask refers to something wrong with someone who comes to them and leads to social stigma. People will not come close to people who wear a mask, and this condition makes the health provider not wear a mask during the practice (Adu *et al.*, 2021). The *wantok* cultural system in which health staff respect and are concerned about patients' feelings influences TB prevention, patients with TB symptoms and other patients were not separated in the health facility's practices, in particular (Marme, 2018). In Papua New Guinea, the mask has become part of the culture and has a different meaning. Each mask reflects the region of origin. Masks are predominantly worn by men

after being initiated by traditional leaders who produce the masks. These masks are kept secret from women when not used. Others showed that wearing a mask led to social exclusion behavior by family and relatives (Marme, 2018). This culture has the opposite practice of TB prevention which requires wearing masks to prevent transmission. Another study stated that the community culture did not absorb the concept of prevention. It affects patients who access the medication directly to the hospital when they develop severe symptoms (de Paula *et al.*, 2014).

**Theme 2: The impact of sociocultural on tuberculosis-seeking behavior**

Over half of the reviewed studies (13) showed how sociocultural beliefs and practices affected TB-seeking behavior. The belief among patients is that TB caused by witchcraft, sorcery, curses, and misbehaving will not be cured by biomedical treatment; only traditional healers can heal. This belief leads to patients accessing traditional/faith healers when they develop TB first symptoms (Oshi *et al.*, 2016; Diefenbach-Elstob *et al.*, 2017; Tabong *et al.*, 2021). When the health staff informs the patients of positive TB, they will refuse treatment and seek help from a traditional healer (Marme, 2018). The use of home remedies to relieve the discomfort the symptoms impacted patients going to a health facility in severe condition and directly going to a hospital, not primary care (de Paula *et al.*, 2014).

Commonly the first symptom of TB is cough, which is often misleading by a community based on their local belief of cough. A study in Ghana showed the local name of cough “*kɔ̃rongkpong*”, “*kɔ̃rongpilah*”, “*kusibine*”, and “*Kaaki*”. The community believed herbs are highly beneficial in treating long-lasting, productive coughs, which can cause chest pain and weight loss (Tabong *et al.*, 2021). A study in Nigeria also found that the local language of cough is “*ukwaranta*” which means prolonged coughing, loss of weight, loss of appetite/emaciation, and weakness, and cannot be cured with medications bought from the patient’s medicine vendor. The condition is caused by witchcraft, punishment for breaking a taboo, poisoning of food or drink by an enemy, and a

germ (Oshi *et al.*, 2016). Research also showed that communities divide TB into two kinds, white TB and Black TB. This means if patients detect negative results on blood samples caused by black TB, they only can get better from a traditional healer (Cremers *et al.*, 2013).

The practice of self-medication is commonly found in the community (Mhalu *et al.*, 2019). The study revealed that to treat their cough, community members did not go to a clinic but instead used locally available herbal treatments in the “*Kanyama*” local market. If the treatment was ineffective, the second step was going to a market or “*Kantemba*”, a cheap unlicensed pharmacy (Cremers *et al.*, 2016). The community also mentions that the traditional healing system was thought to be effective, took a shorter treatment period, was supportive, kept the patient away from evil spirits, and could be obtained at a low cost. Patients also stated that traditional healing systems were preferable to health facilities because they were more accessible (Gugssa Boru *et al.*, 2017). Also, the community believes that clinics are only for females and children, whereas the men are considered as strong and never contacted by female diseases (Miller *et al.*, 2017; Adu *et al.*, 2021).

Community practice on arranged marriage also becomes a burden, especially for female patients. Positive TB impacted them cannot participate in household chores. As a result, the neighborhood will see her as a lazy female, which affects her marriage prospects. Because marriage has become one of the ways the family to increase their economic status, they commonly disclose TB and access treatment from a traditional healer that is considered safer (Anderson De Cuevas *et al.*, 2014; Oshi *et al.*, 2016). Since the community believes TB is inherited and will not disappear from the family history, the family will disclose and refuse the visit by a health provider (Miller *et al.*, 2017). Females also found more delay in seeking behavior and treatment due to the need for permission from husbands or extended family to seek treatment (Kumar *et al.*, 2014).

TB has a strong impact on social life. A study showed that TB patients would lose their status in the community and could not be elected as elders (Miller *et al.* 2017). Religious gathering



practices in Ghana required people to sit close to each other. People with TB will disclose their status and choose to use the traditional herb to treat the symptoms (Tabong *et al.*, 2021). Patients are afraid of being recognized as TB patients because of the social impact following (de Paula *et al.*, 2014). Another study found that TB patients often avoid social gatherings and visit traditional healers to treat the symptoms to avoid social exclusion. The patients do not trust health providers because they feel to have a better understanding of the illness based on their cultural beliefs (Asemahagn *et al.*, 2020).

***Theme 3: The impact of sociocultural on tuberculosis treatment adherence***

Four (4) studies indicated the impact of sociocultural beliefs and practices on tuberculosis treatment adherence. Multiple treatments are commonly used to treat illness in Papuan New Guinea. The use of herbal or natural remedies was reported before, during, and after TB treatment. The practice is resulting in TB patients non adhering to their treatment due to multiple medications (Diefenbach-Elstob *et al.*, 2017). Research also found the conflict between their cultural tradition of vegetarianism and the recommendation to consume eggs and milk under directly observed treatment (DOT). Also, patients traditionally observed fasting but were encouraged to eat while taking medicines (Shiotani & Hennink 2014). Others showed that patients believe insufficient food during treatment will increase the chance of side effects and that the medication will be useless. As a result, they will prioritize the basic need for food before adhering to the medication (Gugssa Boru *et al.*, 2017). Other findings showed TB stigma results in the patients refusing to access treatment in a short period, which they ask to get more medication and leads to a loss of follow-up treatment (Kumar *et al.*, 2014).

We found there are three major themes on how sociocultural affected TB management and control: (i) affected TB prevention, (ii) affected TB-seeking behavior, and (iii) affected TB treatment adherence. This study is in line with a study conducted by Gibson among immigrants in Canada (Gibson *et al.*, 2005).

In terms of TB prevention, infection control was found as the direct and effective

way to prevent TB transmission. The use of personal protective equipment (mask) plays an important role in preventing airborne disease transmission, including TB (Li *et al.*, 2017). This scoping research found that the prevention principle does not exist in cultures (de Paula *et al.*, 2014) where the practice of prevention may be considered unnecessary in daily life. To create a prevention culture, people and society are encouraged to think differently about prevention and its importance to society's health (Petras *et al.*, 2021). Other cultures see wearing masks as prevention is quite difficult due to the cultural belief that a mask is an identity of origin and cannot be worn by women (Marme, 2018). The cultural practice challenge in prevention is also found in a study during the Ebola outbreak in Sierra Leone, in which the practice of African traditional burial presents a potential danger in Ebola transmission (Lal, 2021). From this finding, we can assume that culture has a strong impact on the success of TB prevention in the community. A study similarly found that culture has impacted health practice (Levesque & Li, 2014). This finding implies that TB prevention programs should consider the sociocultural of the targeted community. This finding is supported by a publication in which the model program of one size fits all is not matched for the TB prevention program (Bhargava *et al.*, 2019).

This scoping study also found that to respect and be concerned about patients' feelings; the health facility did not separate patients with TB symptoms and other patients. Also, they did not wear masks during services (Adu *et al.*, 2021). This practice can accelerate TB transmission in healthcare settings. This demonstrated the importance of developing and delivering culturally safe services that are safe and acceptable to community members if health inequities are to be reduced. (Latif, 2020).

In terms of health-seeking behavior, misconceptions of TB causation were found to commonly mislead health-seeking behavior in this study (Cremers *et al.*, 2013; Oshi *et al.*, 2016; Diefenbach-Elstob *et al.*, 2017; Marme, 2018; Tabong *et al.*, 2021). The belief in supernatural causes is also found in HIV (Seid & Ahmed, 2020). A study in rural North-Eastern

Ethiopia revealed that illness is perceived to have supernatural causation, including the will of God, spirit, and human supernatural agent (Kahissay *et al.*, 2017). This belief leads to seeking treatment from traditional/faith healers. The cough is often seen as a common and not severe illness that can be treated by self-medication. A study also found that the perception of their illness will improve over time, preventing patients from seeking health treatment immediately (Taber *et al.*, 2015). This misconception of illness is commonly found in the community. The misconception affected patients in seeking health treatment, which the use of traditional herbs and visiting traditional healer practices are commonly found. The strong belief that disobeying the community rule will affect their health also becomes a major challenge in changing health-seeking behavior in the community (Juhannis *et al.*, 2021). This indicated that primary health care needs to integrate with the cultural system to meet the community's needs. Also, develop culturally sensitive language for an education program to minimize the misconception of TB.

The transmission in the community will remain high; this study found that high stigma led patients to disclose TB status and access traditional healers that are considered safer. The chance to meet neighbors during treatment is small compared to health care services (Mhalu *et al.*, 2019). Stigma led the patient to refuse to be supervised by health staff or a community cadre which was considered easy to notice (Shiotani & Hennink, 2014). A study found stigma affected people's to decide the seeking treatment resulting in a negative impact on treatment (Corrigan *et al.*, 2014; Cerully *et al.*, 2018). This study revealed that stigma occurred both from the community and the patients themselves. The stigma arises because the cultural belief exists in the community. Gender norms were also found to influence delay-seeking behavior. This review found women find difficulties in seeking healthcare because of the masculinity norm that women cannot make decisions without men's approval (Kumar *et al.*, 2014). This condition is resulting in a barrier to early detection of TB, especially among women. However, in Western culture, women are more likely to make decisions about their health

(Acharya *et al.*, 2010). This indicated that the TB program needs to integrate the prevention system with the cultural system, such as empowering traditional/faith healers that are commonly used by patients to seek services immediately as part of active case finding in the community.

The failure to detect TB in the early stage will reduce transmission through prompt treatment. At the same time, TB treatment requires a long time, with a minimum of six (6) months of treatment (Centers for Disease Control and Prevention, 2023). The treatment commonly recommends that patients take good food intake (Lönnroth, 2013). This research found the diet required during treatment has opposite beliefs and practices in some cultures. A study in India showed that patients face challenges due to vegetarianism and fasting practices. This resulted in conflict among patients and led to non-adherence to treatment (Shiotani & Hennink, 2014). This finding is similar to research among diabetes patients on how they face difficulty in changing their diet (Vanstone *et al.*, 2013). Health staff must understand food available in the community that can be considered as food recommended during the treatment to minimize treatment loss follow-up due to the reason. This study has several limitations which only included published articles in the English language, which may exclude relevant literature in other languages. The queries used in the study were limited to socio-cultural, and other studies may use different terms that were not identified.

## Conclusion

The socio-cultural aspects of tuberculosis have a significant impact on community health behavior. This scoping review demonstrates how the sociocultural context influences tuberculosis management and control. This review provides evidence that policymakers must consider local beliefs when promoting TB programs, particularly prevention and treatment. The prevention and behavior change approach should consider how sociocultural factors are embedded in the community's daily life and their impact on how illness is perceived and related behavior is practiced.

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## Portrait of Periodontal Disease Risk Factors among Adults

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### Abstract

Periodontal disease is still a common oral disease all over the world. The yearly report from the Wonosobo District Health Office revealed that 17,807 out of 780,667 people had dental problems, with 5,422 of them having periodontal disease. This number was higher compared to the national number in Central Java Province. The study aimed to identify periodontal disease risk factors. A cross-sectional study was conducted using subjects aged 20-50 years old who resided in Wonosobo District. The data were analyzed using chi-square and logistic regression. A total of 440 subjects were included in the study. Independent variables consisted of demographic and oral conditions namely sex, age group, education level, economic status, smoking, salivary flow rate, plaque accumulation, crowded teeth, and oral hygiene. The result of the study indicated that higher education level (OR 2.09; 95% CI 1.266-3.463) and lower plaque accumulation (OR 3.61; 95% CI 2.310-5.640) were found to be significant risk factors, whereas uncrowded teeth (OR 0.54; 95% CI 0.342-0.852) and good oral hygiene (OR 0.07; 95% CI 0.036-0.152), and fair oral hygiene (OR 0.28; 95% CI 0.142-0.572) were found to be significant protective factors for the occurrence of periodontal disease among adults in Wonosobo District.

### Introduction

Periodontal disease remains a prevalent oral health issue, second only to untreated dental caries in terms of prevalence (Chen et al., 2021; Kassebaum et al., 2015). It is distinguished by inflammation of the gingiva and adjacent tissues that support the teeth. Gingivitis is an early infection characterized by swollen and reddish gums, which can evolve to periodontitis as the infection progresses. Periodontitis is characterized by the deterioration of the periodontal ligament, which can later result in pocket formation and clinical attachment loss. It is also distinguished by the loss of the alveolar bone. Thus, periodontitis can cause tooth mobility and loss (Caton et al., 2018). According to the World Health Organization (WHO), severe periodontal disease affects around one million population. In the last three decades, the number of cases of severe

periodontitis has risen by 8.44%; thus, in 2019, it was up to 1.1 million cases (Chen et al., 2021). In Indonesia, there were 95.21 percent of adults who had periodontal disease in 2013, and the number decreased to 74.1% in 2018 (Indonesia Basic Health Research, 2018). In 2013, the prevalence of oral health problems in Wonosobo District was higher than the national average in Central Java Province. There were 17,807 people with oral health problems out of 780,667 people, and 5,442 had periodontal disease (Wonosobo District Health Office, 2013).

Although it is avoidable, periodontal disease has the potential to harm not just masticatory function but also the quality of life and self-esteem (Barbe et al., 2020; Bulut et al., 2023; Shamim et al., 2022). Many studies also suggested that periodontal disease, mainly periodontitis, was linked to several

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non-communicable diseases (NCDs), namely cardiovascular disease, diabetes, cancer, and respiratory diseases (Dörfer et al., 2017; Lee et al., 2017; Peres et al., 2019). The inflammation associated with periodontal disease could contribute to the development or worsening of these conditions (Lee et al., 2017; Peres et al., 2019). A bidirectional relationship was also found between periodontitis and diabetes mellitus (Păunică et al., 2023; Preshaw et al., 2012).

According to Jiao et al (2021) periodontal disease became more common and more severe as people aged. By identifying the risk factor, periodontal disease can be prevented before it occurs. One of the main causes of periodontal disease was plaque bacteria (World Health Organization, 2023). Several studies found that socio-demographic factors also contributed to the occurrence of periodontal disease. Kassier (2016) indicated that the most prevalent NCDs and periodontitis had similar social determinants and risk factors. The purpose of the current study is to identify possible risk factors that might eventually result in periodontal disease.

## Method

A cross-sectional study was conducted in the public health centers (PHCs) in Wonosobo District from March to May 2018. Four PHCs were identified as a result of a cluster random sample: Selomerto I, Kalikajar I, Sukoharjo I, and Garung. Patients over the age of 20 who resided in the Wonosobo District and visited a PHC dental clinic were considered the subjects. 440 participants were determined to be the sample size. The following were the exclusion requirements: Diagnosed with diabetes, use of a medication that decreased salivary flow, menstruation or pregnancy, and use of a fixed orthodontic appliance. The study was approved by the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health, and Nursing at Universitas Gadjah Mada under protocol number KE/FK/0504/EC/2018.

Periodontal disease was identified by the PHC dentist as ICD X code K.05. Through the use of a questionnaire, the socio-demographic information (age, gender,

socioeconomic status, and degree of education) and smoking habits were gathered. The dental hygienist documented the status of oral hygiene, plaque accumulation score, unstimulated salivary flow rate, and crowded teeth status. Oral hygiene status was measured using the Oral Hygiene Index-Simplified (OHI-S) of Greene & Vermillion (1964). The OHI-S score is calculated by adding the debris and calculus indices collected on six index tooth surfaces. There are three horizontal divisions on each tooth surface. The OHI-S score ranges from 0 to 6, depending on the amount of debris or calculus present on each index tooth surface. This rating can be divided into three categories: good oral hygiene (OHI-S score 0-1.2), fair oral hygiene (OHI-S score 1.3-3.0), and poor oral hygiene (OHI-S score 3.1-6.0). On the other hand, the plaque accumulation score was measured using the Patient Hygiene Performance Modified (PHP-M) of Martens & Meskin (1972). The buccal/labial and lingual/palatal surfaces of six index teeth were inspected for plaque after being treated with a disclosing agent in this examination. This examination separates the tooth surface into five sections instead of the three that the OHI-S does. Plaque presence in each area is assigned a score of 1, while the absence of plaque in the area is assigned a score of 0. The PHP-M score goes from 0 to 60. Data were analyzed in bivariate and multivariate using chi-square and logistic regression using STATA.

## Result and Discussion

Only 440 of the 480 subjects who agreed to take part in the study were used in the analysis. The largest percentage of the subjects (76.59%) were female, had a mean age of 31.558.87, were non-smokers (85.68%), had a higher level of education (57.73%), and were in a higher economic status (66.14%). Furthermore, half of them had a normal salivary flow rate (55.68%), higher plaque accumulation score (51.59%), crowded teeth (58.64%), and good oral hygiene (40,91%). Among these demographic and oral condition variables, age group 20-29 years old, higher education level, being a current and former smoker, had lower plaque accumulation level, had a normal salivary flow rate, had good and moderate oral hygiene were linked to the

development of periodontal disease ( $p < 0.05$ ), according to the Chi-square test shown in Table 1. On the other hand, sex and economic status were not associated with the occurrence of periodontal disease ( $p > 0.05$ ). These results were in contrast with the previous study that showed a significant association between sex and economic status. Shiau & Reynolds (2010) demonstrated that males had higher rates of severe periodontal disease than females. This difference in prevalence may be due to hormonal, genetic, and behavioral reasons (Lipsky et al., 2021). Kim (2018) found that lower economic status increased the risk of

developing periodontal disease symptoms. According to Park (2016), socioeconomic status is associated with oral health behavior. This is attributed to the higher socioeconomic group's usage of a wider range of tooth-cleaning devices and the higher frequency of dental cleaning and visits. However, this finding was not in line with those previous studies.

The multivariate analysis in Table 2 showed that only four variables were substantially linked with the occurrence of periodontal disease among adults in the Wonosobo District, namely crowded teeth, plaque accumulation, oral hygiene status,

Table 1. Bivariate Analysis of The Demographic and Oral Conditions Variables

Variables	Periodontal disease		OR (95% CI)	p-value
	Yes n (%)	No n (%)		
<b>Sex</b>				
Female	167(49.55)	170 (50.45)	1.08 (0.695 - 1.675)	0.736
Male	53(51.46)	50(48.54)	1	
<b>Age group</b>				
20-29 years	67(31.02)	149(68.98)	0.15 (0.039 - 0.571)	0.005
30-39 years	86(66.15)	44(3.85)	0.65 (0.168 - 2.528)	0.536
40-49 years	58(70.73)	24(29.27)	0.80 (0.200 - 3.236)	0.761
50-59 years	9(75.00)	3(25.00)	1	
<b>Education level</b>				
Higher	46(38.66)	73(61.34)	1.88 (1.224 - 2.881)	0.004
Lower	174(54.21)	147(45.79)	1	
<b>Economic status</b>				
Higher	142(48.80)	149(51.20)	1.15 (0.777 - 1.710)	0.481
Lower	78(52.35)	71(47.65)	1	
<b>Smoking</b>				
Current smoker	180(47.75)	197(52.25)	0.22 (0.094 - 0.516)	0.000
Former smoker	11(40.74)	16(59.26)	0.17 (0.054 - 0.512)	0.002
Nonsmoker	29(80.56)	7(19.44)	1	
<b>Plaque accumulation</b>				
Lower	75(33.04)	152(66.96)	4.32 (2.901 - 6.439)	0.000
Higher	145(68.08)	68(31.92)	1	
<b>Unstimulated salivary flow rate</b>				
Normal	134(54.69)	111(45.31)	0.65 (0.448 - 0.954)	0.027
Low	86(44.10)	109(55.90)	1	
<b>Crowded tooth</b>				
No	98(53.85)	84(46.15)	0.77 (0.526 - 1.124)	0.175
Yes	122(47.29)	136(52.71)	1	
<b>Oral hygiene status</b>				
Good	47(26.11)	133(73.89)	0.06 (0.032 - 0.127)	0.000
Fair	102(57.95)	74(42.05)	0.25 (0.130 - 0.489)	0.000
Poor	71(84.52)	13(15.48)	1	

Source: Primary data, 2018



and education level. Whereas age group and smoking status were not significantly associated with the occurrence of periodontal disease. Different from this result in the age group, a study from Relvas (2022) found that increased age was a risk factor for periodontal disease occurrence. Jiao (2021) & Susanto (2020) discovered that as people aged, periodontal disease became more common and more severe. On the other hand, a similar result in smoking status was found in Gayatri (2021), which shows no significant association between smoking and periodontal disease after logistic regression. Jiang (2020) showed smoking enhanced plaque accumulation, which can lead to calculus buildup and interfere with the subgingival microflora. As a result, smoking is linked to the degradation of the periodontal tissues, including the alveolar bone, which can lead to tooth mobility and ultimately tooth loss. Other than that, smoking reduces the response of the immune system to infections, causing periodontal disease to progress rapidly. Additionally, smoking lowers blood flow to the gums and inhibits the body's capacity to provide necessary nutrients and immune cells to the oral tissues, called microvascular dysfunction which can prolong the healing process (Silva, 2021).

According to the result of this study, adults who had higher education levels had a 2.09 times higher risk of having periodontal disease than adults who had lower education levels. It can be assumed that higher level education showed a greater chance of experiencing periodontal disease than lower education level. This result was in contrast with a systematic review by Boillot (2011) that demonstrated low education level as a predictor of chronic periodontitis which is also similar to a recent study that showed higher education level lowered the risk for periodontal disease (Baumeister *et al.*, 2022; Walther *et al.*, 2022). Low education affects the likelihood of using dental services, regardless of an individual's oral health behavior and status. Moreover, people with lower education levels are more likely to receive emergency care and treatment than routine dental check-ups or examinations (Ghanbarzadegan *et al.*, 2022). The different results shown in this study might be linked to

poor oral health behavior, which in this study was not identified and became a limitation of the study.

Table 2. Multivariate Analysis of The Variables

Variables	OR (95% CI)	p-value
Education level		
Higher	2.09(1.266-3.463)	0.004
Lower	1	
Plaque accumulation		
Lower	3.61(2.310-5.640)	0.000
Higher	1	
Crowded tooth		
No	0.54(0.342-0.852)	0.008
Yes	1	
Oral hygiene		
Good	0.07(0.036-0.152)	0.000
Fair	0.28(0.142-0.572)	0.000
Poor	1	

Source: Primary data, 2018

This study also revealed that adults who had lower plaque accumulation were 3.61 times more susceptible to developing periodontal disease than those with higher plaque accumulation. This result was different from the theory and previous study which stated that the absence of dental plaque was consistent with the presence of healthy gingiva and increased dental plaque was associated with the occurrence of gingivitis (Carvajal *et al.*, 2016; Mostafa & El-Refai, 2018). Gingivitis is recognized as the most common form of periodontal disease affecting most adults. Bacterial plaque that builds up close to the gingival border is the primary contributory factor of gingivitis. Without proper oral hygiene, these bacteria can build up and penetrate the gingiva and cause inflammation. Contrary to this, oral hygiene behaviors such as toothbrushing before the examination were not identified which might be biased in this study. As reported by Lertpimonchai (2017) & Relvas (2022) there was a protective effect of regular toothbrushing on the occurrence of periodontitis since toothbrushing is effective in plaque control removal. In other words, a lack of oral hygiene habits such as brushing teeth and flossing might increase the probability of experiencing periodontal disease.

Additionally, it was discovered that poor dental hygiene increased the risk of periodontal disease. The odds ratio for good oral hygiene was 0.07 (CI 95%;  $p$ -value <0.001) which means adults with good oral hygiene had a 93% lower risk of experiencing periodontal disease than adults with poor oral hygiene. The odds ratio for fair oral hygiene was 0.28 (CI 95%;  $p$ -value <0.001) which means adults with moderate oral hygiene had a 72% lower risk of experiencing periodontal disease than adults with poor oral hygiene. It can be assumed from the results that poor oral hygiene had a greater risk of experiencing periodontal disease than good and fair oral hygiene. This result was similar to the study of (Susanto *et al.*, 2020) in the severity of periodontal disease increased as oral hygiene deteriorated. In contrast to good dental hygiene, several studies have revealed that fair and poor oral hygiene greatly increases the chance of developing periodontitis (Lertpimonchai *et al.*, 2017).

Other than that, the findings of the study additionally revealed a link between periodontal disease and crowded teeth. Adults who had crowded teeth were 46% less likely to have periodontal disease than adults without crowded teeth. The formation of dental plaque, which is known to play a key role in the development of periodontal disease, was influenced locally by crowded teeth. Crowded teeth can cause less optimal plaque cleaning since they enhance food retention and plaque accumulation in that area (Arora & Bhateja, 2015; Bahirrah, 2018). Furthermore, crowded teeth were found to be associated with higher dental calculus, which is one of the predisposing factors for periodontal disease as it provides a retentive surface for plaque attachment (Arora & Bhateja, 2015; Farooq *et al.*, 2019). However, another study found that crowded teeth did not contribute to the progression of gingivitis when people practiced proper oral care. Therefore, maintaining good dental hygiene might lessen the likelihood of food retention and plaque buildup.

## Conclusion

Higher education levels, lower plaque accumulation, crowded teeth, and poor oral hygiene were significantly associated with the

occurrence of periodontal disease among adults in the Wonosobo District. Periodontal disease management and treatment are expected to be optimized by modifying some of the risk factors. However, it is vital to improve the oral health prevention program in the population.

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## The Effect of Smoking Habit on Vitamin D Status of Adults in Indonesia

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### Abstract

Smoking will reduce the metabolism of vitamin d in the body. Indonesia, as a tropical country that has a high level of sun exposure, is one with a high prevalence of smokers. Early identification of vitamin D status can be used as a preventive measure for risks associated with vitamin D deficiency. This study aimed to determine smoking behavior with vitamin D status. This research was conducted in April -November 2021. The research design was cross-sectional, using a purposive sampling method. Variables were smoker behavior, vitamin D status, and vitamin D deficiency. The differences between vitamin D status and smoker behavior in the smoker and non-smoker group used the chi-square test and the relationship used the contingency coefficient. This study involved 144 subjects, consisting of 73 non-smokers and 71 smokers. The groups at risk for vitamin D deficiency were 17 non-smokers (23.29%) and 31 smokers (43.66%). The smokers' group had a 2,553 times higher risk of vitamin D deficiency than non-smokers. There was a significant difference between smokers and non-smokers on 25(OH)D level vitamin D status. There was a significant relationship between vitamin D status in smokers and non-smokers. There was a weak relationship between smokers and non-smokers on vitamin D status.

### Introduction

Tobacco smoking is one of the biggest health problems in the world. The 21st-century hazards reveal that smokers who start smoking early in adult life and do not quit lose a decade of life expectancy versus non-smokers (Jha, 2020). The prevalence of smoking in Indonesian society is 58% and 95% is dominated by men. Indonesia is the second-largest cigarette market in the world by retail volume and is one of the largest tobacco-consuming countries in the world (Kusumawardani *et al.*, 2018). Exposure to secondhand smoke is known to significantly increase the risk for the development of respiratory distress, which is characterized by markedly elevated baseline levels of proinflammatory cytokines (Azargoon *et al.*, 2022; that not only affects the users but also endangers the health of people inhaling the

smoke (passive smoking/secondhand smoke Bhat *et al.*, 2018). Damage to the alveolar walls and loss of elasticity that occurs in respiratory disorders are caused by chronic inflammation and an imbalance of antioxidants (Hikichi *et al.*, 2019; Liguori *et al.*, 2018). Oxidative stress is increased in patients with respiratory distress. This oxidative stress causes a protease/antiprotease imbalance and is believed to be a contributing factor to the pathogenesis of respiratory disorders (Thimmulappa *et al.*, 2019; Marginean *et al.*, 2018).

Vitamin D deficiency or vitamin D deficiency can increase the incidence of respiratory diseases such as COPD or asthma which occupy the top 10 chronic diseases in Indonesia. This is because vitamin D deficiency causes a decrease in lung function (Ghosh *et al.*, 2020; but the relationship between vitamin

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D levels and COPD exacerbations remains controversial. In addition, the effect of vitamin D levels on imaging characteristics remains mostly unexplored. Using cross-sectional and longitudinal follow up data from the COPD Gene Study, we assessed the association between vitamin D levels on respiratory symptoms, exacerbations, and imaging characteristics. We hypothesized that vitamin D deficiency will be associated with worse respiratory-related outcomes. Methods: Current and former smokers between ages 45-80 were enrolled the COPD Gene Study. Subjects completed questionnaires, spirometry, six-minute walk test, and chest computed tomography scans. A subset of subjects had measurement of serum concentration of 25-hydroxyvitamin D (25(OH)Wannamethee *et al.*, 2021). Low blood levels of vitamin D are associated with decreased lung function, increased inflammation, and infectious or neoplastic disease. The mechanism underlying the emergence of respiratory disease due to low vitamin D levels is unclear, but it is suspected that vitamin D affects the function of inflammatory and structural cells. Many studies have shown that vitamin D deficiency causes more susceptibility to respiratory diseases and requires a longer recovery time than patients with normal vitamin D (Vitamin D Council, 2017). Vitamin D supplementation can also reduce COPD worsening when it is given for a prolonged period (Khan *et al.*, 2017; Gupta & Ramadass, 2019).

Respiratory disease can be prevented by paying attention to vitamin D intake. Vitamin D contributes to preventing a person from experiencing respiratory disease. Vitamin D is most easily obtained from direct sunlight (Khan *et al.*, 2017; Gupta & Ramadass, 2019). In tropical countries in Asia, such as Indonesia, the need for sunlight should be sufficient, but in reality, it is estimated that the prevalence of vitamin D deficiency is quite high in their productive age (Lorensia, *et al.*, 2022; Suryadinata *et al.*, 2021). Modernization also brings changes in lifestyle and diet to be low in vitamin D. In addition, increasing pollution prevents sunlight from reaching the earth which results in blocking sun exposure on human skin (Manisalidis *et al.*, 2020; Dominguez *et al.*, 2021). Asian people's daily behavior can

also be associated with vitamin D deficiency, where the assumption is that white people look more beautiful than dark-skinned people. So that most Asian people choose to protect their skin from sun exposure with sunscreen, which can prevent sun exposure to the skin (Lowe & Bhojani, 2017; Divakar *et al.*, 2019) where vitamin D deficiency is common despite the presence of sunlight all year round in most places. We examined the prevalence of vitamin D deficiency and its associated work-related factors among indoor workers using the data of 213 participants (aged  $\geq 21$  years. Modern lifestyles such as excessive eating patterns and limited physical activity will trigger obesity, which also causes low levels of vitamin D in the blood. Excess body weight that causes obesity can cause a decrease in the bioavailability of vitamin D from the skin and food because it accumulates in body fat (Migliaccio *et al.*, 2019; which is the biologically-inactive intermediate and represents the predominant circulating form. Different mechanisms have been hypothesized to explain the association between hypovitaminosis D and obesity, including lower dietary intake of vitamin D, lesser skin exposure to sunlight, due to less outdoor physical activity, decreased intestinal absorption, impaired hydroxylation in adipose tissue and 25(OH)Khosravi *et al.*, 2018) fish oil supplements are produced commercially to complement low fish intake. It is not clear if both interventions have similar effects. The aim of this trial was to compare the anti-hyperlipidemic effect of omega3 fatty acid supplements with fresh fish. Method: A total of 106 patients with hyperlipidemia were randomized. One group received 2 g/day of omega-3 capsules for a period of 8 weeks and the other group received a mean of 250 g trout fish twice weekly (for dinner and lunch).

Vitamin D deficiency is due to several infectious diseases, with effects on breathing and lung function. Supplementation with vitamin D improves many lung conditions. There is an association between vitamin D and chronic disease (Zisi *et al.*, 2019; like cathelicidin, in response to both viral and bacterial stimuli. The aim of this review is to summarize the more recently published data with regard to potential associations of 25-hydroxyvitamin

D [25(OH Ganji *et al.*, 2020). The data show a significant association between vitamin D deficiency and decreased pulmonary function tests in a large outpatient population. Chronic lung diseases such as asthma and chronic obstructive pulmonary disease (COPD) are also genetically linked to vitamin D. Immune and genetic influences of vitamin D may influence the pathogenesis of chronic lung disease (Martineau *et al.*, 2019) antibiotics or both. Our secondary objectives are to evaluate the impact of Vitamin D supplementation on other effectiveness outcomes, including severe AECOPD, i.e. Those requiring emergency department (ED).

Early identification of vitamin D status can be used as a preventive measure for risks associated with vitamin D deficiency (Aji *et al.*, 2019; pregnancy profiles, dietary intake, and maternal anthropometry measurements Pilz *et al.*, 2019). Indicators used to determine vitamin D status include blood tests, intake of foods containing vitamin D (Aji *et al.*, 2019; pregnancy profiles, dietary intake, and maternal anthropometry measurements Pilz *et al.*, 2019; Lorensia *et al.*, 2020a), and questionnaires (Larson-meyer *et al.*, 2019; winter (n = 49 Bolek-Berquist *et al.*, 2009). Evaluation of vitamin D status using a questionnaire is easier and more economical to do than a blood serum examination. In addition, when compared to blood tests, clinical questionnaires can be used to identify long-term vitamin D status (Aji *et al.*, 2019; pregnancy profiles, dietary intake, and maternal anthropometry measurements Bolek-Berquist *et al.*, 2009; Annweiler *et al.*, 2017) without resorting to a blood test, older adults with low vitamin D concentrations. Our objective was to determine whether a self-administered VDSP was concordant with the VDSP administered by a physician, and to examine the concordance of every single item of the VDSP. Methods: A total of 349 older in- and outpatients (mean, 83.2±7.2 years; 59% female. Questionnaires can be used to identify patients at high or low risk of vitamin D deficiency (Bolek-Berquist *et al.*, 2009). Smoking habits as a risk factor for vitamin D deficiency (Yang *et al.*, 2021; Nwosu & Kum-Nji, 2018) 263 subjects of ages 3 to 17 years. Subjects were categorized into two groups

based on their age: children, if <10 years; and youth if 10 to 17 years. Descriptive and multiple logistic regression analyses were conducted to determine the effect of serum cotinine-verified tobacco smoke exposure on vitamin D status after controlling for key sociodemographic confounders. Vitamin D deficiency was defined as 25(OH need prevention efforts as early as possible considering the dangers of vitamin D deficiency and low physical activity as causes of obesity that affect the development of chronic diseases and decreased quality of life (Kim *et al.*, 2018; Oh *et al.*, 2017). This study aimed to determine smoking behavior with vitamin D status.

## Method

The design of this study was cross-sectional. The research location was in the southern part of the city of Surabaya, Rungkut district, East Java, Indonesia, and was carried out from April to November 2021. Ethical test No. 001-QL/KE/IV/2021 at the Universitas Surabaya. The independent variable in this study was a group of smoker and non-smoker respondents. The dependent variables in this study were vitamin D status and vitamin D deficiency. Vitamin D status can be defined as the presence of vitamin D in a certain amount in the body which is influenced by the intake of foods containing vitamin D, sun exposure, and consumption of vitamin D supplements. A person was said to be positive (+) at risk of vitamin D deficiency if the total answer score was >8, and negative (-) if the total answer score was ≤8. Vitamin D deficiency is a health problem related to vitamin D status. A smoker is a person who has smoked at least 100 cigarettes during his life and is currently smoking at least 1 cigarette per day or has smoked in the last 30 days. A non-smoker is a person who has never smoked in his life or has smoked but less than 100 cigarettes in his life.

The population used in this study were all young adults with student status who live in the southern city of Surabaya. The sample used in this study were those who met the criteria, which were male, 18-25 years old and did not have certain diseases such as cardiovascular disorders such as angina, renal and hepatic disorders. (such as cirrhosis of the liver), and have no

motor problems. The sampling technique used was the purposive sampling method in which the sampling process was based on previously known characteristics or characteristics of the population and the consideration of the researcher. The national prevalence of obese adults was 15.4%, and the prevalence of the obese adult population in the city of Surabaya was 27.3% (Kementerian Kesehatan Republik Indonesia, 2018). To calculate the sample size in this study, the formula for the number of samples was used to estimate the proportion. The P value (proportion of the desired variable) used was 27.3% which was obtained from the basic health research data of East Java province in 2013 regarding the prevalence of adult obese people with a value of  $Z_{\alpha}=1.96$  because  $\alpha=0.05$  with a value of  $d=10\%$ . Then the study sample size (n) at least for each group in this study was 76 people.

Measuring instruments used in the study were the vitamin D status questionnaire to identify vitamin D status. Measurement of weight and height using a digital weight scale and a microtoise stature meter for height. The questionnaire was namely vitamin D status questionnaire (Bolek-Berquist *et al.*, 2009; Cairncross *et al.*, 2017). Assessment of respondents related to vitamin D status was carried out using a questionnaire consisting of 17 questions. The questionnaire assessed attitudes towards sun exposure including the time and duration of the subject's exposure to sunlight, how to dress, and the use of skin protection such as hats, jackets, and sunscreen. Conducted a trial or pilot study where data collection was preceded by testing research instruments on 30 respondents. The questionnaire was validated using internal and external validity methods. Internal validity was enforced in a review step based on professional opinion judgments in the field of community pharmacy. External validation was done by testing the questionnaire on the subject then the results were analyzed using the SPSS version 24.0 computer program. The questionnaire was said to be valid if the value of  $r_{\text{count}} > 0.361$ . The questionnaire was reliable if the Chronbach alpha value was  $> 0.60$ . Comparative analysis of the risk of vitamin D deficiency based on vitamin D status in the smoker and non-smoker group of respondents

using the prevalence odds ratio. Meanwhile, differences in vitamin D status and smoker behavior in the smoker and non-smoker respondent groups used the chi-square test. Then proceed to test the relationship between vitamin D status and smoker behaviour in the group of smoker and non-smoker respondents using a contingency coefficient.

## Result and Discussion

Data collection was carried out from April to November 2021 by filling out a questionnaire. During the search process, 158 people were found, and only 144 were respondents, consisting of 73 non-smokers and 71 smokers. A validation test was done by comparing the values of  $r_{\text{count}}$  and  $r_{\text{table}}$  on each question item. If the  $r_{\text{count}}$  correlation between the scores of each item and the total score was greater than  $r_{\text{table}}$  (0.361) then the item was valid, with a significance level of 5% with a sample of 30 people (Table 1). In addition, the measurement scale was said to be reliable if it had a Cronbach's alpha value of 0.6. The value in the study was 0.812.

Table 2 shows that the characteristics of the research respondents consist of age and body mass index (BMI). Most of the non-smoker group (n:73) were 20 years old (27.40%) with an average age of 21.03 years. Most of the smoker group (n:71) were 17 years old (23.94%) with an average age of 22.00 years. Based on the difference test between groups, it showed that the age factor was a difference between smoker and non-smoker groups. The severity of smoking based on the Brinkman index showed that all respondents (100%) from the smokers group were light smokers. Table 3 shows the profile of respondents' answers to vitamin D status from the questionnaire.

Table 4 showed that most of the respondents were in a non-smoker condition and were not at risk of deficiency as many as 56 people (76.71%). The groups at risk for vitamin D deficiency were 17 non-smokers (23.29%) and 31 smokers (43.66%). Odd ratio (OR) test with a P value of 2,553, meaning that the smokers group had a 2.553 times risk of vitamin D deficiency than non-smokers. Chi-square test with a P value of 0.010 ( $P < 0.05$ ), meaning that there were differences in vitamin D status



Table 1. The Results of the Validity Test of the Vitamin D Status Questionnaire

No.	Question	rcount
1	How long per day are exposed to direct sunlight?	0.415
2	Do you use skin protection equipment from direct sun exposure?	0.432
3	Do you often wear closed clothes such as wearing long sleeves and long pants every day?	0.517
4	Which body parts should be protected from direct sun exposure with protective equipment?	0.536
5	How often to use sunscreen cream when exposed to direct sunlight?	0.650
6	Do you use sunscreen repeatedly in a day?	0.662
7	Do you use cosmetic products with SPF content?	0.507
8	Have you eaten fish in the past week?	0.560
9	How often did you eat fish in the past week?	0.723
10	Have you consumed milk in the past week?	0.368
11	How often have you consumed milk in the past week?	0.461
12	Have you eaten eggs in the past week?	0.605
13	How often have you eaten eggs in the past week?	0.432
14	What are the most processed eggs consumed in the past week?	0.530
15	Do you take fish oil?	0.419
16	Do you take supplements?	0.454
17	Do you often experience condition symptoms due to vitamin D deficiency?	0.409

Source: Primary Data, 2021

Table 2. Characteristics of Respondents

Characteristics of Respondents	Group					P-value
	Non-smoker (n: 73)		Smoker (n: 71)			
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Age (years)	18	7	9.59	3	4.23	0.027*
	19	10	13.70	3	4.23	
	20	7	9.59	9	12.68	
	21	20	27.40	10	14.08	
	22	15	20.55	15	21.13	
	23	9	12.33	17	23.94	
	24	3	4.11	10	14.08	
	25	2	2.74	4	5.63	
BMI (kg/m <sup>2</sup> )	Kurus (<18.5)	14	19.18	10	14.08	0.412
	Normal (18.5-22.9)	59	80.82	61	85.92	

Source: Primary Data, 2021

BMI: Body mass index

\*P value&lt;0.05, it meant that there was a difference between smoker and non-smoker groups

Table 3. Profile of Respondents' Answers Regarding Vitamin D Status.

No	Question	Answers	Group					
			Non-smoker (n: 73)		Smoker (n: 71)			
			Freq	Percentage (%)	Freq	Percentage (%)		
1	How long per day are you exposed to direct sunlight?	<5 minutes	07.00-09.00	0	0.00	0	0.00	
			10.00-11.00	0	0.00	0	0.00	
			12.00-14.00	1	1.37	2	2.82	
			15.00-17.00	0	0.00	0	0.00	
		5-10 minutes	07.00-09.00	5	6.85	6	8.45	
			10.00-11.00	2	2.74	6	8.45	
			12.00-14.00	0	0.00	2	2.82	
			15.00-17.00	0	0.00	1	1.41	

No	Question	Answers	Group			
			Non-smoker (n: 73)		Smoker (n: 71)	
			Freq	Percentage (%)	Freq	Percentage (%)
		07.00-09.00	17	23.29	7	9.86
	10-15 minutes	10.00-11.00	5	6.85	4	5.63
		12.00-14.00	3	4.11	4	5.63
		15.00-17.00	1	1.37	0	0.00
	15-30 minutes	07.00-09.00	14	19.18	17	23.94
		10.00-11.00	12	16.44	12	16.90
		12.00-14.00	10	13.70	7	9.86
		15.00-17.00	3	4.11	3	4.23
2	What time do you usually get direct sunlight?	Yes	62	84.93	69	97.18
		No	11	15.07	2	2.82
	What skin protection equipment is used? (*)	Umbrella	0	0.00	0	0.00
		Hat	14	19.18	26	36.62
		Jacket	57	78.08	57	80.28
		Sunblock	17	23.29	23	32.39
	When do you use the protective equipment?	When leaving the house	24	32.88	28	39.44
		Midday	17	23.29	10	14.08
		Driving	21	28.77	31	43.66
		Never	11	15.07	2	2.82
	How often do you use the protective equipment?	Every day	32	43.84	31	43.66
		Sometimes (4-6x per week)	22	30.14	31	43.66
		Rarely (1-3x per week)	8	10.96	7	9.86
		Never	11	15.07	2	2.82
3	Do you usually wear closed clothes such as long-sleeved shirts and trousers every day?	Yes	24	32.88	35	49.29
		No	49	67.12	36	50.70
4	Which body part would you like to protect from direct sunlight with the protective equipment of your choice in question no. 2? (*)	Face	25	34.25	41	57.75
		Arm	53	72.61	59	83.09
		Foot	59	80.82	61	85.92
		Back and Shoulders	38	52.05	36	50.70
		Never	13	17.81	4	5.63
5	How often do you use sunscreen cream when exposed to direct sunlight?	Always or almost every day (>3 times a week)	5	6.85	3	4.23
		Sometimes (≤3 times a week)	6	8.22	8	11.27
		Rarely (2 times a month)	6	8.22	12	16.90
		Never	56	76.71	48	67.61
6	Do you use sunscreen repeatedly in a day?	Yes	2	2.74	5	7.04
	If "yes", how many hours do you use sunscreen in a day?	No	71	97.26	66	92.96
		Every hour	0	0	0	0
		Every 2 hours	0	0	3	4.23
		Every 4 hours	2	2.74	2	2.82
		Never	71	97.26	66	92.96
7	Do you use cosmetic products (face moisturizer, hand and body cream, powder, etc.), with SPF content?	Yes	17	23.29	23	32.39
		No	56	76.71	48	67.61
	Do the cosmetics you use contain protection from UVA and UVB?	Yes	14	19.18	14	19.72
		No	1	1.37	6	8.45
		Don't know	2	2.74	3	4.23

No	Question	Answers	Group			
			Non-smoker (n: 73)		Smoker (n: 71)	
			Freq	Percentage (%)	Freq	Percentage (%)
8	Have you consumed fish in the past week?	Yes	59	80.82	64	90.14
		No	14	19.18	7	9.86
	What type of fish have you consumed the most in the past week?	Fish that contain vitamin D	54	73.97	54	76.06
		Fish that do not contain vitamin D	11	15.07	10	14.08
	How processed fish do you consume? (*)	Fry	43	58.90	45	63.38
		Grill	11	15.07	9	12.68
		Sauté	5	6.85	3	4.23
		Steam	2	2.74	2	2.82
		Can	4	5.48	4	5.63
		Sushi/raw	2	2.74	1	1.41
	Where did you get the fish from? (*)	Food stall	34	46.58	36	50.70
		Homemade/ Cook yourself	31	42.47	28	39.44
	What is your goal in consuming fish? (*)	Love the taste	21	28.77	27	38.03
		Benefit for Health	27	36.99	31	43.66
		Diet to lose weight	2	2.74	4	5.63
		The price is low. More affordable	11	15.07	15	21.13
		Incidentally fish dishes available to eat	23	31.51	26	36.62
		Don't eat fish	8	19.18	7	9.86
9	How often have you eaten fish in the past week? (*)	1-3 times per week	51	69.86	49	69.01
		4-6 times per week	7	9.59	5	7.04
		>6 times per week	1	1.37	1	1.41
		Never	14	19.18	16	22.54
10	Have you consumed milk in the past week?	Milk contains vitamin D	60	82.19	53	74.65
		Milk does not contain vitamin D	3	4.11	3	4.23
		Don't consume milk	10	13.70	16	22.54
	What kind of milk have you consumed in the last week? (*)	Cow's milk	12	16.44	14	19.72
		Soy milk	9	12.33	7	9.86
		Canned milk liquid/powder	16	21.92	23	32.39
		Milk box liquid or powder	38	52.05	23	32.39
11	How often have you consumed milk in the past week?	1-3 times per week	32	43.84	36	50.70
		4-6 times per week	19	26.03	9	12.68
		>6 times per week	9	12.33	8	11.27
		Never	10	13.69	15	21.13

No	Question	Answers	Group			
			Non-smoker (n: 73)		Smoker (n: 71)	
			Freq	Percentage (%)	Freq	Percentage (%)
12	Have you eaten eggs in the past week?	Yes	71	97.26	68	95.77
		No	2	2.74	3	4.23
	Which part of the egg do you eat?	egg whites	4	5.48	3	4.23
		egg yolk	3	4.11	2	2.82
		all	64	87.67	63	88.73
13	How often have you eaten eggs in the past week?	1-3 times per week	43	58.90	43	60.56
		4-6 times per week	21	28.77	20	28.17
		>6 times per week	7	9.59	5	7.04
		Never	2	2.74	3	4.23
14	What kind of processed egg have you consumed the most in the past week? (*)	Fry	63	86.30	61	85.92
		Boiled	31	42.47	30	42.25
		Traditional herbs	3	4.11	9	12.68
15	Do you take fish oil?	Yes	6	8.22	5	7.04
		No	65	89.04	68	95.78
16	Do you take vitamin D supplements?	Yes	2	2.74	0	0.00
		No	71	97.26	71	100
17	Do you often experience this condition? (*)	Muscle pain including lower back pain	18	24.66	19	26.76
		Pain in the pelvis. Back and legs	17	23.29	12	16.90
		Muscle weakness	5	6.85	6	8.45
		It's easy to have a bad mood or depression	8	10.96	19	26.76
		Low immunity like frequent colds in winter	22	30.14	26	36.62
		Never	20	27.40	15	21.13

Source: Primary Data, 2021

in smokers and non-smokers. Spearman's test with a P value of 0.009 ( $P < 0.05$ ) and  $r = 0.216$ , meaning that there was a significant relationship between vitamin D status in smokers and non-smokers. Even though the relationship was weak.

The prevalence of smoking in Indonesia is quite high among men than women. Generally,

in Indonesia, smoking is done by men, while smoking among women in Indonesia is less socially acceptable. As a result of the negative view and great pressure from society on female smokers have caused the desire to quit smoking in women is greater than in men (Ayuningtyas *et al.*, 2021). So that respondents in this study will be more open in providing information

Table 4. Risk Analysis of Vitamin D Deficiency on Smokers and Non-Smokers.

Vitamin D status category	Non-smoker (n: 73)		Smoker (n: 71)		TOTAL
	Freq.	Percentage (%)	Freq.	Percentage (%)	
No risk of deficiency ( $\leq 8$ )	56	76.71	40	56.34	96
Have a risk of deficiency ( $> 8$ )	17	23.29	31	43.66	48

Source: Primary Data, 2021

about smoking status.

Respondents tend to be young, so no one has comorbidities, such as liver and kidney disease. Comorbidities can affect vitamin D status. In the liver, vitamin D will be hydroxylated by 25-hydroxylation to 25(OH)D or calcidiol so that in patients with liver disorders, calcidiol levels were low due to disturbances in its synthesis. Liver disease will also interfere with the absorption of vitamin D because liver damage will also affect the production of bile acids which function to convert non-polar forms of vitamin D into water soluble so that it can be absorbed by the intestinal wall. In addition, the liver is an organ for protein synthesis or vitamin D binding protein (DBP) which is the main carrier for 25(OH)D and 1,25(OH)<sub>2</sub>D into the circulation, DBP will also facilitate 1,25(OH)<sub>2</sub>D to enter the circulation, target cells and bind to receptors (Wannamethee *et al.*, 2021; Henríquez & Romero, 2020). The availability of vitamin D in the body was influenced by kidney function because 25(OH)D will undergo hydroxylation by 1-hydroxylase to the active form 1,25-dihydroxyvitamin D (calcitriol). So that chronic kidney disorders associated with structural and functional abnormalities of the kidneys can affect the decrease in the active form of 1,25(OH)<sub>2</sub>-D (Wannamethee *et al.*, 2021; Vitamin D Council, 2017; Henríquez & Romero, 2020).

Body mass index also affects vitamin D status. Based on the source of vitamin D, which includes fat-soluble vitamins, it can come from food intake and synthesis through the skin, then it will be stored in adipose tissue which will be released and undergo metabolism when the production of vitamin D in circulation is reduced. Weight gain causes vitamin D to be trapped in fat and unable to get out into circulation. Individuals with a BMI who are obese and overweight have a risk of decreased bioavailability of vitamin D in the body, so they have a risk of vitamin D deficiency twice as large as individuals with a normal BMI and underweight (Orces, 2019). Obese individuals need to consume larger amounts of vitamin D than non-obese individuals to get enough vitamin D.

Measurement of vitamin D status was

based on the value of the total score of each respondent's response to smokers and non-smokers. Each answer number that included the deficiency criteria will be given a score of 1 and money including the non-deficiency criteria will be given a score of 0. The category for the conclusion was through a total score based on the median cut-off point criteria, the answer to the total score of the questionnaire was 8 categorized as not having a deficiency risk while having a deficiency risk if the total score was >8 (Bolek-Berquist *et al.*, 2009; Cairncross *et al.*, 2017). Although a high intake of dietary nutrients can cause weight gain, proper and healthy nutritional intake can increase vitamin D levels in the blood. Intake of calcium and vitamin D can have an effect on body weight, but this still requires further research and will depend on a person's healthy lifestyle (Vranic, 2019).

- a) Fish. Respondents of smokers who consumed fish in the last week were 55 smokers (78.88%) and 59 non-smokers (80.82%). Meanwhile, the number of respondents who smoked fish containing vitamin D in the past week were 54 smokers (76.06%) and 54 non-smokers (73.97%). Fish that contain vitamin D are fatty fish such as tuna, salmon, eel, mackerel, sardines, tuna, tilapia, mackerel, catfish, tilapia, snapper, carp, and shrimp. The greatest content of vitamin D was found in fresh/raw fish. But cooking did not significantly affect the decrease in vitamin D content in food, cooking, or baking in an oven at 172°C or 200°C induces a decrease in vitamin D<sub>3</sub> <10% (Ložnjak & Jakobsen, 2018). The answer to the frequency of eating fish in the last week was 1-3 times, 49 people (69.01%) were smokers and 47 people (64.38%) were non-smokers.
- b) Milk. Of respondents who consumed milk containing vitamin D, 53 people (74.65%) were smokers, and 60 non-smokers (82.19%). Generally, milk that contains vitamin D is soy milk, cow's milk, and goat's milk (Collard & McCormick, 2021). The vitamin D content in raw milk is 0.57 IU/ml lower than 0.80 IU/ml fortified milk. In the making process of pasteurized dairy products in high milk, no loss of vitamin D content was found, while the stability

of vitamin D3 remained stable during the appropriate storage life for each product (Mandrioli et al., 2020).

- c) Egg. The highest consumption of eggs was 68 smokers (95.77%) and 71 non-smokers (97.26%). Eggs had a high content of vitamin D, which was found in all types of egg yolks. The average weight of egg yolk in duck eggs was greater than that of chicken eggs (18 grams), where the weight of duck egg yolk is about 23-28 grams. In addition, duck egg yolk has 6 times more vitamin D, 2 times vitamin A, and 2 times more cholesterol than chicken eggs (Kuang et al., 2018).

Previous research by Lorensia *et al.* (2022), on 143 student respondents in Surabaya. The results showed that there was a significant difference in physical activity ( $p=0.047$ ) and vitamin D status ( $p<0.05$ ) between the non-obese and obese groups. There was a significant relationship ( $p<0.05$ ) between vitamin D status and physical activity, although the relationship was low (correlation coefficient=0.326). Therefore, increased physical activity can improve vitamin D status while still paying attention to other factors that affect vitamin D, such as diet and lifestyle. The condition of vitamin D also needs to be confirmed by measuring the 25(OH)D blood test. Meanwhile, in different subjects with a lower socio-economic tendency, namely construction workers, it shows that most of the respondents also have heavy physical activity (48.73%). Meanwhile, regarding lung health, as many as 50% of people do not have lung function disorders, and some have mild (37.34%) and severe (12.66%). Builders are at risk for vitamin D deficiency and impaired lung function, despite having a strenuous level of physical activity (Lorensia *et al.*, 2020<sup>b</sup>). Another study that supports the results of this study by Suryadinata *et al.* (2021), There was a relationship between the level of knowledge ( $p=0.000$ ) and attitude ( $p=0.000$ ) toward sun exposure levels related to vitamin D and lung function. There was a relationship between the level of knowledge to attitude on sun exposure levels related to vitamin D ( $p=0.000$ ). Therefore, knowledge and attitudes on sun exposure related to vitamin D were important concerns to maintain healthy lung function.

One of the most common symptoms of vitamin D deficiency is fatigue. Symptoms of easy weakness are not specific symptoms of vitamin D deficiency and need to be assessed from vitamin D levels in the blood. Identification of genetic variations that arise as a consequence of diet as selective pressure helps identify alleles of genes that affect nutrient utilization. Understanding the molecular mechanisms underlying gene-nutrient interactions and their modifications with genetic variation is expected to lead to dietary recommendations and nutritional interventions that optimize individual health (Indraswari *et al.*, 2018).

## Conclusion

There was a significant difference between smokers and non-smokers on vitamin D status. There was a weak relationship between smokers and non-smokers on vitamin D status. Early identification of vitamin D status can be used as a preventative measure for risks associated with vitamin D deficiency. Assessment of vitamin D status includes living habits. However, many factors can influence vitamin D status, such as variations in sun exposure due to latitude, season, time of day, atmospheric components, clothing, use of sunscreen, and skin pigmentation, as well as age, obesity, and the onset of several chronic diseases. Therefore, it is necessary to develop further research by observing each factor that influences in more detail than vitamin D levels.

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## Effect of Accompaniment-Trained Peer Neighbor on Exclusive Breastfeeding Duration and Prevalence: A Quasi-Experimental Study

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### Abstract

**Introduction:** Although WHO has recommended that all babies get exclusive breastfeeding (EBF), until now EBF practice in Indonesia is still low (38%). Therefore, more efforts are needed for successful of EBF. This study aimed to examine the effect of accompaniment by trained peer neighbor (ATPN) on EBF duration and prevalence. **Methods:** Quasi-experiment was used to compare the duration of EBF between intervention and control. The intervention group (n=49) received ATPN by scheduled home visits 15 times providing informational and practical support. The control group (n=49) received postpartum care standards. Duration of EBF was measured weekly to 24th week postpartum. Data collection was carried out in June-December 2022. Survival analysis continued with Cox proportional hazards used to analyze the effect of intervention on EBF duration. **Results:** The median duration of EBF in the intervention and control group were 21.63 weeks and 15.85 weeks respectively ( $p < 0.001$ ). The prevalence of EBF at 24 weeks of the intervention versus control groups was (59.1% vs. 12.2%). The intervention group had risk cessation of EBF 0,32 times compared to the control group (CI: 0.197, 0.528). **Conclusion:** The ATPN was easy to implement in increasing EBF duration.

### Introduction

Many studies have shown that exclusive breastfeeding provides health benefits for both the baby and the mother. Exclusive breastfeeding can reduce the risk of diarrhea, the risk of acute respiratory infections, and the risk of death of infants aged 0-5 months (Sankar *et al.*, 2015; Ogbo *et al.*, 2017). Furthermore, mothers who breastfeed their babies for more than 12 months can reduce the risk of breast and ovarian cancer incidence (Chowdhury *et al.*, 2015). The WHO has recommended that all babies in the world be exclusively breastfed. But until now only 41% of babies in the world are exclusively breastfed. Therefore, WHO set a target of achieving 70% exclusive breastfeeding by 2030 (WHO & UNICEF, 2019). The achievement of exclusive breastfeeding in some countries was still low. As is the case in low- and middle-income countries, only about 37%

of babies are exclusively breastfed (Victora *et al.*, 2016).

National survey in Indonesia shows that the number of mothers who breastfed babies were exclusively aged 1 month after birth (67%), 2-3 months after birth (55%), aged 4-5 months after birth (38%). Furthermore, it was reported that the median of exclusive breastfeeding was 3.0 months and the median duration of breastfeeding was 21.8 months (SDKI, 2013). Regarding the findings of these data, several research results in Indonesia found that low knowledge about breastfeeding (Susiloretni *et al.*, 2013), poor attitudes towards breastfeeding, and lack of support health workers (Yulidasari *et al.* 2017) are determining factors for the success of exclusive breastfeeding.

Several interventions to increase the success of exclusive breastfeeding have been carried out such as family support, but these

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interventions have not been optimal because the support provided by families is more in the form of emotional support (Februhartanty *et al.*, 2006; Emmott & Mace, 2015). Other intervention models are education and counseling provided by health workers, including lactation counselors (van Dellen *et al.*, 2019), nurses (Tseng *et al.*, 2020), and midwives (RM *et al.*, 2019). However, the intervention has been ineffective. Until now in Indonesia, the number of breastfeeding counselors is 4.314, midwives 336.984, and nurses 563.739 while the number of infants is 14.188.458 (Kemenkes, 2019). The amount of health workers was limited and the time available was inadequate to assist due to the high workload in healthcare facilities (Pemo *et al.*, 2020).

Another intervention model is the accompaniment of trained peers (Nankunda *et al.*, 2010). Although this intervention was able to improve exclusively breastfeeding, However, the methods of support and forms of support were still very diverse (Sudfeld *et al.*, 2012). This study aimed to measure the effect of accompaniment provided by trained peer neighbors on the duration of exclusive breastfeeding up to 6 months and its prevalence. In addition, it also measures the characteristic factors of lactating mothers who are predictors of cessation of exclusive breastfeeding. The novelty of this study was its accompaniment intervention, where the companion is a peer neighbor closest to the lactating mother. Companions are trained using validated guidelines (Irmawati *et al.*, 2022). The implementation of this research is expected to provide accessible accompaniment, plenty of time available, and consistency in providing support to breastfeeding mothers, to increase the success of more exclusive breastfeeding up to 6 months.

## Method

This study used a quasi-experimental design. Purposive sampling was used to select respondents, namely breastfeeding mothers of single babies with normal delivery. A total of 98 breastfeeding mothers were selected as respondents. A total of 49 trained peers were selected as accompaniment of lactating

mothers with inclusion criteria, having to read and having previous infant breastfeeding experience. One trained peer neighbor accompanies one lactating mother. Before providing accompaniment, peer neighbors were given breastfeeding training by local primary health care midwives using validated modules. The study received permission from the ethics committee of the Faculty of Public Health Diponegoro University No. 22/EA/KEPK-FKM/2022.

The intervention group (n=49) received breastfeeding accompaniment from childbirth to 6 months postpartum. Meanwhile, the control group (n=49) received standard postpartum services. Accompaniment was carried out through scheduled home visits 15 times, with the following details: (a) 5 visits one month after birth, with details of 2 times in the first week and once a week in the 2-4th week after birth; and (b) 10 visits, carried out every 2 weeks at the age of 2-6 months after birth. Activities at the first five visits to infants aged 1 month after birth were to provide informational support and practical assistance. The duration of exclusive breastfeeding is monitored weekly by giving 3 questions to lactating mothers including: (1) Is the mother still breastfeeding her child this week? (2) Has your baby been given food or drink other than breast milk in the last 24 hours? If given, what is the type? The monitoring results are recorded in the breastfeeding cohort sheet. A survival analysis with Kaplan Meier's plot was used to compare the survival curve of exclusive breastfeeding between the two groups during the 24 weeks postpartum. Cox proportional hazard regression was used to analyze the effect of predictor variables on cessation of exclusive breastfeeding. Statistical analysis using SPSS 26.0.

## Result and Discussion

A total of 147 participants consisting of 49 trained peer neighbors and 89 lactating mothers completed the study for 24 weeks, the unit analysis in this paper focused on lactating mothers as many as 89 respondents were divided into two groups, the intervention group (n=49) and the control group (n=49). The homogeneity test of respondent characteristics

Table 1. Baseline Characteristics Associated With Maternal Factors in the Intervention and Control Groups

Category	Intervention		Control		p
<b>Marital Age</b>					
< 20	1	2,0	0	0	
20-35	41	83,8	48	98,0	
>35	7	14,2	1	2,0	
<b>Education</b>					
Elementary	7	14,2	4	8,2	0,101
Intermediate	29	59,2	36	73,5	
High	13	26,6	9	18,3	
<b>Employment</b>					
Unemployment	31	63,3	28	57,1	0,239
Employment	18	36,7	21	42,9	
<b>Parity</b>					
First	15	30,6	20	40,8	0,097
Second	19	38,8	26	53,1	
Third	15	30,6	3	6,1	
<b>Baby gender</b>					
Male	23	46,9	26	53,1	1,000
Female	26	53,1	23	46,9	
<b>Baby birth weight</b>					
2500-3500 gr	31	63,3	29	59,2	0,523
>3500 gr	3	6,1	1	2,0	

Source: Primary Data, 2022

showed that there was no significant difference in respondent characteristics between the two ( $p > 0.05$ ), except for the maternal age ( $p=0.001$ ) (see Table 1).

Kaplan Meier's curve showed that the intervention group consistently had a higher probability of exclusive breastfeeding at all measurement time points than the control group (Log-rank test;  $\chi^2: 28.6$   $p < 0.001$ ) (see

Figure 1).

The average duration of exclusive breastfeeding in the intervention group was longer, namely 21.63 weeks (CI=20.50-22.76) than the control group was 15.85 weeks (CI=14.86-17.62). The prevalence of EBF in the control group began to decrease at week 6 while the intervention group at week 10. At week 14, the prevalence of EBF in the control

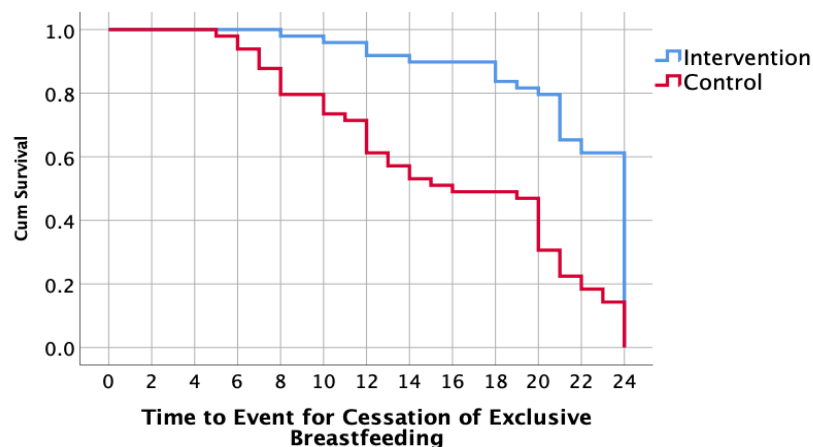


Figure 1. Kaplan Meier Curve Survival estimates the duration of Exclusive Breastfeeding.

group continued to decrease when compared to the intervention group (79.5% vs. 44.8%). At week 22 the intervention group's EBF prevalence was 3.1 times higher than that of the control group (63.2% vs. 20.4%). In the last week of measurement (week 24) the prevalence of the EBF intervention group was almost 5 times higher than the control group (59.1% vs. 12.2%). The prevalence of cessation of EBF in the control group was highest at week 12 as much as 11.9% and at week 22 as much as 54.5%.

We used the Cox Proportional Hazard Test to indicate several maternal characteristic variables that were predictors of cessation of exclusive breastfeeding. The results of the Cox Proportional Hazard test showed that the intervention group had cessation of exclusive breastfeeding 0.32 times ( $p < 0.001$ ) compared to the control group. Lactating mothers with higher education had cessation exclusive breastfeeding 0.18 times ( $p < 0.001$ ) compared to lactating mothers with elementary education. Unemployment lactating mothers had cessation exclusive breastfeeding 0.53 times ( $p = 0.026$ ) compared to employment lactating mothers.

We also found trend consistency in the Kaplan-Meier curve between the intervention and control groups based on the classification of maternal characteristics. The prevalence

of EBF within 24 weeks in the intervention group was associated with lactating mothers who had higher education (22.6%) and unemployed lactating mothers (22.8%). The lowest achievement in the intervention group was associated with lactating mothers with elementary education (18.8%).

Several interventions were carried out to increase the duration of EBF, such as group consultations by lactation counselors (van Dellen *et al.*, 2019), consultations through online websites by professional support groups (Gonzalez-Darias *et al.*, 2020), and counseling education program group by nurses in the hospital (Lee *et al.*, 2019). The types of interventions provided by health professionals were group accompaniment to lactating mothers. The results of the study found that obstacles that were often encountered in assisting lactating mothers were too much workload, and insufficient time and material to provide individual counseling (Dubik *et al.*, 2021). Interventions to increase the duration of exclusive breastfeeding were also carried out by peers, accompaniment by one peer in a group of lactating mothers carried out on a paid basis can increase the duration of exclusive breastfeeding (Ara *et al.*, 2018). Similarly, the support provided by a group of community leaders succeeded in increasing the duration

Table 2. Cox Proportional Hazard Ratio Analysis for Exclusive Breastfeeding

Variables	Category	Hazard Ratio	95% CI		Sig
			Lower	Upper	
Group	Intervention Control (*)	0.32	0.19	0.52	0.000
Maternity Age	Reproductive Non-reproductive (*)	0.68	0.32	1.44	0.319
Education	Higher Elementary (*)	0.18	0.07	0.44	0.000
Employ	Employment (*) Unemployment	0.53	0.31	0.92	0.026
Parity	Multipara Primipara (*)	0.92	0.92	0.55	0.757
Baby age	1month (*) 2month 3month	0.78 0.67	0.49 0.40	1.23 1.12	0.293 0.133
Baby gender	Male Female (*)	0.911	0.61	1.36	0.648

Source: Primary Data, 2022

Table 3. EBF Prevalence Rates at 24 Weeks Stratified by Maternal Factors According to the Intervention Type

Category	Intervention		Control		Log Rank
	No	% (95% CI)	No	% (95% CI)	
Maternity Age					
Reproductive	10	21.6 (20.2 - 22.8)	1	15.9 (11.00-11.00)	0.000
Non-reproductive	39	21.7 (20.6 - 22.9)	48	11.0 (14.16-17.75)	0.000
Education					
Higher	13	22.6 (20.7 - 24.4)	9	11.5 (5.07-17.92)	0.000
Elementary	7	18.8 (15.0 - 22.6)	4	15.0 (10.97-19.02)	0.000
Employment					
Employment	31	22.8 (22.2 - 23.4)	28	16.0(13.65-18.41)	0.000
Unemployment	18	19.8 (17.8 - 21.8)	21	15.6 (12.91-18.31)	0.000
Parity					
Multipara	11	21.6(19.8 - 24.1)	20	15.3 (12.53-18.06)	0.000
Primipara	38	21.9 (20.6 - 22.7)	29	16.2 (13.91-18.56)	0.000

Source: Primary Data, 2022

of exclusive breastfeeding (Susiloretni *et al.*, 2015). The reviewed literature found that the accompaniment carried out by lay workers was still very diverse concerning who the companion is, the method, and the schedule of the visit (Sudfeld, Fawzi and Lahariya, 2012).

ATPN is effective in increasing the duration of exclusive breastfeeding, this finding is also in line with several previous studies, that the accompaniment of lay workers can increase knowledge, skills, and success of exclusive breastfeeding (Assibey-Mensah *et al.*, 2019). Good knowledge and skills contribute to the success of exclusive breastfeeding. As well as the results of research conducted by Nugraheni that the breastfeeding training provided can increase the knowledge and skills of breastfeeding lay workers as companions for breastfeeding mothers for the success of exclusive breastfeeding (Nugraheni *et al.*, 2022). The study also found that the education and employment status of breastfeeding mothers were predictors of exclusive breastfeeding success, as were previous studies that lactating mothers who had higher education were more likely to breastfeed exclusively than those with lower education (Thu *et al.*, 2012). Similarly, the results of other studies found that lactating mothers who returned to work were less likely to breastfeed exclusively (Agboado *et al.*, 2010), after postpartum became one of the determinants of the failure to breastfeed exclusively (Khan and Kabir, 2021).

## Conclusion

ATPN intervention effectively increases the duration of exclusive breastfeeding by up to 6 months. The implications of this study are very important in designing more effective intervention programs, with companions being peers who live closest to lactating mothers, so that accompaniment can continue on an ongoing basis. Accompaniment materials according to the needs of breastfeeding mothers. Where the companion has been trained using a validated breastfeeding module.

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## Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus

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### Abstract

Dietary behavior is one of the components of self-care that is difficult for people with type 2 diabetes mellitus (T2DM) to perform. The study aimed to determine the sociodemographic factors that influence the dietary behavior of people with T2DM. The study method is an analytic observational study with a cross-sectional design. The subjects of this study were people with T2DM in the Jember Regency, with a sample size of 130 respondents using a multistage random sampling technique. This study had two variables: dietary behavior as a dependent variable, measured using Self-Management Dietary Behavior Questionnaire (SMDBQ), and sociodemographic factors (age, gender, marital status, income level, education level, ethnicity, and family type) as an independent variable measured using a sociodemographic questionnaire. Data were analyzed using a multiple logistic regression test ( $\alpha = 0.05$ ). The results of the study showed that most of the respondents were 55 – 65 years old (51.5%), female (71.5%), married (85.4%), a primary education level (50.8%), low-income level (73.1%), Madurese (54.6%), and nuclear family type (37.7%). Most of the respondents had dietary behavior in the medium category (66.9%), and the sociodemographic factors that influenced diabetes diet behavior were education level ( $p = 0.001$ ) and family type ( $p = 0.001$ ) with  $R^2 = 0.241$ . Efforts to improve self-care regarding adherence to diabetes diet behavior must pay attention to sociodemographic factors to prevent complications and improve the quality of life of people with T2DM.

### Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease, one of the four non-communicable diseases that are a priority for handling by world leaders. Globally, the prevalence of T2DM in 2021 is 537 million people. This figure is expected to reach 643 million in 2030 and 783 million by 2045 (International Diabetes Federation, 2021). Nationally, the prevalence of T2DM is 8.4%, or around 21,3 million people, especially in East Java, with as many as 2.6 million cases. In Jember Regency, the prevalence of T2DM cases in 2018 was 1.5 million, indicating an increase in cases from 2013 (Kementerian Kesehatan RI, 2019). T2DM management consists of four pillars: education, diet, physical exercise, and pharmacological management. Changes in

lifestyle patterns, such as dietary arrangements, have an essential role in the success of T2DM management. Regulating diet diabetes is the most challenging thing for people with diabetes mellitus (American Diabetes Association, 2021a) general treatment goals and guidelines, and tools to evaluate quality of care. Members of the ADA Professional Practice Committee, a multidisciplinary expert committee (<https://doi.org/10.2337/dc21-SPPC>). The results of previous studies in several countries showed that most people with T2DM do not adequately manage their diet. Only 8.6% - 24.1% of people with T2DM adhere to a diabetes diet program (Ouyang *et al.*, 2015; Mogre *et al.*, 2017; Bongor *et al.*, 2018; Mirahmadizadeh *et al.*, 2020) self-efficacy, and the absence of psychological problems.

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Dietary regulation is one of the essential components of T2DM management (American Diabetes Association, 2021a) general treatment goals and guidelines, and tools to evaluate quality of care. Members of the ADA Professional Practice Committee, a multidisciplinary expert committee (<https://doi.org/10.2337/dc21-SPPC>). Good dietary regulation impacts weight loss, increasing glycemic control and triglycerides, reducing the need for treatment regimens, preventing complications, and improving the quality of life (American Diabetes Association, 2021b; International Diabetes Federation, 2021) general treatment goals and guide-lines, and tools to evaluate quality of care. Members of the ADA Professional Practice Committee, a multidisciplinary expert committee (<https://doi.org/10.2337/dc21-SPPC>). Control measures for type 2 diabetes mellitus with the control of dietary behavior compliance often experience obstacles. One factor that affects non-compliance to the diabetic diet is that many people with T2DM feel bored. In addition, sociodemographic, psychosocial, and other conditions also influence the regulation of diabetes diet in people with T2DM (Gonzalez-Zacarias *et al.*, 2016; American Diabetes Association, 2021a) Type 2 DM (T2DM).

Sociodemographic factors are one of the predisposing factors that shape behavior. Sociodemographic factors that influence the dietary behavior of diabetes include age (Bonger, Shiferaw and Tariku, 2018; Aga *et al.*, 2020; Xie *et al.*, 2020) which adversely affects their disease control. Therefore, identification of the factors related to patient adherence is warranted. In this study, we aimed to examine (i, gender (Gonzalez-Zacarias *et al.*, 2016; Boakye *et al.*, 2018; McKinnon *et al.*, 2019; Mirahmadizadeh *et al.*, 2020; Xie *et al.*, 2020) those who are older, male, of low socioeconomic status, and uninsured, and marital status (Gonzalez-Zacarias *et al.*, 2016; Kim and Lee, 2019; Lasari *et al.*, 2021) Type 2 DM (T2DM. Other sociodemographic factors are income level (Gonzalez-Zacarias *et al.*, 2016; Assari *et al.*, 2017; Mogre *et al.*, 2017; Bonger, Shiferaw and Tariku, 2018; McKinnon *et al.*, 2019; Orr *et al.*, 2019) participants were 112 patients with type 2 DM who were prescribed insulin (ns = 38 Black women, 34 Black men, 14 White women, and 26

White men, respectively, education level (Mogre *et al.*, 2017; Boakye *et al.*, 2018; McKinnon *et al.*, 2019; Orr *et al.*, 2019; Adam *et al.*, 2021) and to examine trends in socioeconomic disparities in diet quality. Methods: Repeated cross-sectional analysis of eight National Health and Nutrition Examination Survey (NHANES, ethnicity (Anders and Schroeter, 2015; Gonzalez-Zacarias *et al.*, 2016; McKinnon *et al.*, 2019) and thus contribute to lifestyle improvement. However, previous research suggests that dietary adherence is arguably among the most difficult cornerstones of diabetes management. The objectives of this study are (1, and family support (Anders & Schroeter, 2015; Gonzalez-Zacarias *et al.*, 2016) and thus contribute to lifestyle improvement. However, previous research suggests that dietary adherence is arguably among the most difficult cornerstones of diabetes management. The objectives of this study are (1.

Older people with T2DM have poor care management skills (Xie *et al.*, 2020). The elderly tend to have poor diabetes diet management (Aga *et al.*, 2020). Women have difficulty carrying out diabetes diet management (Assari *et al.*, 2017; Mogre *et al.*, 2017; Aga *et al.*, 2020) participants were 112 patients with type 2 DM who were prescribed insulin (ns = 38 Black women, 34 Black men, 14 White women, and 26 White men, respectively. The low income level makes it difficult for people with T2DM to access health services and determine the type of food suitable for diet management (Assari *et al.*, 2017; Mogre *et al.*, 2017; Boakye *et al.*, 2018) participants were 112 patients with type 2 DM who were prescribed insulin (ns = 38 Black women, 34 Black men, 14 White women, and 26 White men, respectively. The marital status of people with T2DM affects the management of diets related to support from spouses (Gonzalez-Zacarias *et al.*, 2016; Kim and Lee, 2019; Lasari *et al.*, 2021) fat and protein metabolism associated with absolute or relative deficiency of insulin action and/or secretion. It is estimated that between 2010 and 2030, developed and developing countries will experience a 20% and 69% increase in the number of adults with diabetes, respectively. This research is a quantitative analytic study with a cross sectional design. Utilizing secondary data at the Health Office

of Banjarbaru City as of January-March 2020, in particular the five health centers, namely the South Banjarbaru Health Center, the Sei Besar Health Center, the Sei Ulin Health Center, the Liang Anggang Health Center and the Guntung Manggis Health Center. The sampling method is quota sampling and data analysis using chi square. The result is that there is no relationship between gender ( $p$ -value=0.742. Ethnic groups influence diabetic diets linked to beliefs in selecting healthy foods based on cultural habits (Anders and Schroeter, 2015; Gonzalez-Zacarias *et al.*, 2016; McKinnon *et al.*, 2019) and thus contribute to lifestyle improvement. However, previous research suggests that dietary adherence is arguably among the most difficult cornerstones of diabetes management. The objectives of this study are (1. Highly educated people with T2DM have extensive knowledge and better diet management behavior (McKinnon *et al.*, 2019; Orr *et al.*, 2019) and to examine trends in socioeconomic disparities in diet quality. Methods: Repeated cross-sectional analysis of eight National Health and Nutrition Examination Survey (NHANES. Based on the description above and the data from previous studies, researchers want to analyze related sociodemographic factors that affect diabetic dietary behavior in people with T2DM in the Jember Regency.

## Method

This study is an analytic observational design with a cross-sectional approach on March 28-April 22, 2022, in Jember Regency, East Java, Indonesia. The study population was people with T2DM with a sample size of 130 calculated using G power ( $f^2= 0.15$ ;  $\alpha = 0.05$  and power 0.9) using multistage random sampling. Researchers divided the Jember Regency public health based on the regional map, then randomly chose two public health in each region. Then, randomly select five villages in each public health and choose 2-3 people with T2DM in each village randomly. The inclusion criteria were 40 - 65 years old and who had diabetes for more than a year. The study's independent variables were sociodemographic factors, and the dependent variable was dietary behavior. The instrument used is a questionnaire.

Sociodemographic questionnaires were used to identify the characteristics of the people with T2DM, consisting of 7 items (age, gender, marital status, education level, income level, ethnicity, and family type). Diabetic dietary behavior variables were measured by the SMDBQ (Self-Management Dietary Behaviors Questionnaire) developed by Primanda, Kripracha, and Thaniwattanon (2011) and modified by Putri Mei Sundari (2018). Researchers conducted validity and re-reliability tests on questionnaires. The SMDBQ consists of 16 items with four determinants of statements, namely the attitude of recognizing the needs of the number of calories (1 item), food selection (7 items), schedule settings (6 items), and setting dietary behavior challenges (3 items). The results of the questionnaire assessment consisted of 3 classifications, namely low < 32, medium 32-48, and high > 49. Data collection in previous respondents provided information (informed) where the researcher explained the objectives, benefits of management procedures, and study risks. Then, the respondent will provide a signature on the consent sheet. Data were analyzed using descriptive and inferential analysis with an ordinal multiple logistic regression test ( $\alpha= 0.05$ ). This study had approval by the Health Study Ethics Commission of the Faculty of Nursing with the number 035 / UN25.1.14 / KEPK / 2022.

## Result and Discussion

Based on Table 1, most respondents were 56 - 65 years old (51.5%), female (71.5%), married (85.4%), with a primary education level (50.8%), income level less than UMK (73.1%), Madurese (54.6%) and family type were nuclear families (37.7%). Most dietary behaviors were in the category of moderate behavior (66.9%) (Table 1).

Table 1. Characteristics of Type 2 Diabetes Mellitus Respondents (n= 130)

Characteristics of respondents	N	%
Age (year)		
36 - 45	12	9.23
46 - 55	51	39.23
56 - 65	67	51.54

Characteristics of respondents	N	%
<b>Gender</b>		
Male	37	28.46
Female	93	71.54
<b>Marital Status</b>		
Married	111	85.38
Widow/widower	19	14.62
<b>Education Level</b>		
No School	23	17.69
Primary education	66	50.77
Secondary education	33	25.38
Higher education	8	6.16
<b>Income Level</b>		
≥ UMK	35	26.92
< UMK	95	73.08
<b>Ethnic</b>		
Madurese	71	54.62
Java	59	45.38
<b>Family Type</b>		
Nuclear family	49	37.69
Extended family	48	36.92
Single parent	11	8.47
Middle age	22	16.92
<b>Dietary Behavior</b>		
Good	25	19.23
Medium	87	66.92
Bad	18	13.85
Total	130	100

Table 2 shows that sociodemographic factors influence diabetic dietary behavior (chi-square p-value= 0.004 < α = 0.05). This study's results align with a study conducted by (Xie *et al.*, 2020), which said that the sociodemographic characteristics of people with diabetes mellitus affect the adherence to self-care of people with T2DM. Based on the partial test, sociodemographic factors that influence the behavior of diets are education level and the type of family (p-value << α=0.05). The regression equation obtained is:

$$\text{Logit P1} = 0.824 - 0.605_{(36-45)} + 0.674_{(46-55)} + 0.172_{(male)} - 0.126_{(married)} + 3.473_{(no\ school)} + 1.868_{(primary\ school)} + 1.558_{(secondary\ school)} + 0.181_{(\ge\ UMK)} - 0.042_{(Madurese)} + 0.467_{(nuclear\ family)} + 0.054_{(extended\ family)} + 2.803_{(single\ parent\ family)}$$

$$\text{Logit P2} = 4.768 - 0.605_{(36-45)} + 0.674_{(46-55)} + 0.172_{(male)} - 0.126_{(married)} + 3.473_{(no\ school)}$$

$$+ 1.868_{(primary\ school)} + 1.558_{(secondary\ school)} + 0.181_{(\ge\ UMK)} - 0.042_{(Madurese)} + 0.467_{(nuclear\ family)} + 0.054_{(extended\ family)} + 2.803_{(single\ parent\ family)}$$

P1 is the probability of good dietary behavior, and P2 is the probability of moderate dietary behavior. Then, the formed model is the predictive model:

$$a) \text{Log} \frac{\pi_1}{1-\pi_1} = 0.824 + 3.473_{(education\ level)} + 2.803_{(family\ type)}$$

$$b) \text{Log} \frac{\pi_2}{1-\pi_2} = 4.768 + 3.473_{(education\ level)} + 2.803_{(family\ type)}$$

The model of the equation:

$$a) \pi_1 = \frac{\exp(0.824 + 3.473(education\ level) + 2.803(family\ type))}{1 + \exp(0.824 + 3.473(education\ level) + 2.803(family\ type))}$$

$$b) \pi_2 = \frac{\exp(4.768 + 3.473(education\ level) + 2.803(family\ type))}{1 + \exp(4.768 + 3.473(education\ level) + 2.803(family\ type))}$$

Interpretation: On the variables of education level and family type simultaneously, both positively affect diabetic dietary behavior. If the people with T2DM are in no school, it will provide an opportunity to reduce their diabetic dietary behavior by 3,473. If the family type of people with T2DM is a single-parent family, eating will offer the chance to reduce diabetic dietary behavior by 2.803.

Table 2 also explains the value of R<sup>2</sup> = 0.241, which shows that sociodemographic factors can explain variations in diabetic dietary behavior by as much as 24.1%. In contrast, other factors explain 75.9%. This study analyzed seven sociodemographic characteristics of people with T2DM.

Age did not significantly affect the dietary behavior of people with T2DM (Table 2). This study's results align with previous studies that state there was no significant association between age and adherence to diabetic dietary behavior in people with T2DM (Bonger, Shiferaw and Tariku, 2018; Aga *et al.*, 2020; Xie *et al.*, 2020) which adversely affects their disease control. Therefore, identification of the factors related to patient adherence is warranted. In this study, we aimed to examine (i. However, the results of this study are not in line with previous studies, which stated that there was a relationship between age and diabetic dietary behavior (Kim & Lee, 2019). Age is one of the factors that affect personal knowledge.

Table 2. Multiple Logistic Regression Test Results Ordinal

Variable	Multiple Logistic Regression Test Results Ordinal						
		Estimate	Wald	P	X <sup>2</sup>	R <sup>2</sup>	95% CI
Dependent	Dietary behavior: good	0.824	0.456	0.499			-1.589 – 3.218
	Dietary behavior: medium	4.768	13.162	0.000			2.192 – 7.345
Independent	36 – 45	-0.605	0.773	0.379			-1.953 – 0.743
	46 – 55	0.674	2.215	0.137			-0.214 – 1.561
	56 - 65	0					
	Male	0.172	0.143	0.705			-0.719 – 1.064
	Female	0					
	Married	-0.126	0.029	0.865			-1.583 – 1.331
	Widow/widower	0					
	No school	3.473	11.180	0.001			1.437 – 5.509
	Primary education	1.868	4.450	0.085			0.132 – 3.604
	Secondary education	1.558	3.110	0.078			-0.174 – 3.290
	Higher education	0					
	≥ UMK	0.181	0.155	0.694	0.004	0.241	-0.722 – 1.085
	< UMK	0					
	Madurese	-0.042	0.008	0.927			-0.945 – 0.980
	Java	0					
	Nuclear family	0.467	0.563	0.453			-0.756 – 1.685
Extended family	0.054	0.008	0.930			-1.156 – 1.264	
Single parent family	2.803	6.741	0.001			0.687 – 4.919	
Middle age	0						

Increasing age positively impacts understanding and correlates to certain attitudes and behaviors. However, younger people with T2DM tend to have better diabetes diet behavior, including the type, amount, and schedule of the diabetes diet (Ouyang *et al.*, 2015). There is no significant relationship between age and diabetes diet behavior, which might be because young and elderly respondents can perform diabetes diet behavior. Younger people with T2DM use many sources, both directly and digitally. In contrast, older people get information from health workers and families.

Gender did not significantly affect diabetic dietary behavior in people with T2DM (Table 2). The results of this study are inconsistent with previous studies that state females have better dietary behavior than males (Gonzalez-Zacarias *et al.*, 2016; Boakye *et al.*, 2018; McKinnon *et al.*, 2019; Mirahmadizadeh *et al.*, 2020; Xie *et al.*, 2020) those who are older, male, of low socioeconomic status, and uninsured. However, the results of this study follow previous studies that stated a relationship between gender and adherence to a diabetic diet (Orr *et al.*, 2019; Matsunaga *et al.*, 2021) and to examine trends in socioeconomic disparities in

diet quality. Methods: Repeated cross-sectional analysis of eight National Health and Nutrition Examination Survey (NHANES). There is no significant effect because gender is not the main factor in forming healthy behavior. The main predictors of the formation of chronic disease behavior are experience, habits, motivation, cognitive and functional impairment, social support, and access to health services (Riegel *et al.*, 2019).

The study showed no significant effects of marital status on diabetic dietary behavior in people with T2DM (Table 2). Marital status can affect the treatment of type 2 diabetes mellitus. The existence of support from a spouse can improve adherence to the treatment regimen to promote optimal glycemic control. (Gonzalez-Zacarias *et al.*, 2016) Type 2 DM (T2DM). Previous studies showed that people with T2DM who have partners have better diabetic dietary behavior (Gonzalez-Zacarias *et al.*, 2016; Kim and Lee, 2019; Lasari *et al.*, 2021) fat and protein metabolism associated with absolute or relative deficiency of insulin action and/or secretion. It is estimated that between 2010 and 2030, developed and developing countries will experience a 20% and 69%

increase in the number of adults with diabetes, respectively. This research is a quantitative analytic study with a cross sectional design. Utilizing secondary data at the Health Office of Banjarbaru City as of January-March 2020, in particular the five health centers, namely the South Banjarbaru Health Center, the Sei Besar Health Center, the Sei Ulin Health Center, the Liang Anggang Health Center and the Guntung Manggis Health Center. The sampling method is quota sampling and data analysis using chi square. The result is that there is no relationship between gender (p-value=0.742, so they have better glycemic control. People with T2DM have a social support system as well as a safe place for individuals to help promote a healthy lifestyle (Liu *et al.*, 2016). Marital status is also not one factor influencing type 2 diabetes mellitus (Gonzalez-Zacarias *et al.*, 2016; Kim and Lee, 2019; Lasari *et al.*, 2021) fat and protein metabolism associated with absolute or relative deficiency of insulin action and/or secretion. It is estimated that between 2010 and 2030, developed and developing countries will experience a 20% and 69% increase in the number of adults with diabetes, respectively. This research is a quantitative analytic study with a cross sectional design. Utilizing secondary data at the Health Office of Banjarbaru City as of January-March 2020, in particular the five health centers, namely the South Banjarbaru Health Center, the Sei Besar Health Center, the Sei Ulin Health Center, the Liang Anggang Health Center and the Guntung Manggis Health Center. The sampling method is quota sampling and data analysis using chi square. The result is that there is no relationship between gender (p-value=0.742. The study's results showed no significant relationship between marital status and diet because respondents who did not have a partner were also likely to get social support from other family members.

The results of this study showed that education level had a significant effect on diabetic dietary behavior in people with T2DM (Table 2). This study's results align with several previous studies that stated education level affected diet behavior (Mogre *et al.*, 2017; Boakye *et al.*, 2018; McKinnon *et al.*, 2019; Orr *et al.*, 2019; Adam *et al.*, 2021) and to examine trends in socioeconomic

disparities in diet quality. Methods: Repeated cross-sectional analysis of eight National Health and Nutrition Examination Survey (NHANES. Highly educated individuals can behave in better health than those with low education. Individuals with higher education will have broader and more knowledge because education becomes the primary basis of success in medication regimens (McKinnon *et al.*, 2019; Orr *et al.*, 2019; Adam *et al.*, 2021) and to examine trends in socioeconomic disparities in diet quality. Methods: Repeated cross-sectional analysis of eight National Health and Nutrition Examination Survey (NHANES. This study's results showed that respondents with a non-school education level had diabetic diet behaviors that tended to be poor and moderate. In contrast, people with T2DM who had a primary school education level had diabetic diet behaviors with moderate and good categories. The higher the education of respondents, the better their dietary behavior. It means there is a significant relationship between the education level and the behavior of the diabetic diet in people with T2DM in the Jember Regency. This statement aligns with previous studies that stated that people with T2DM with a higher education level have enough knowledge and behavior to receive health information from health workers (McKinnon *et al.*, 2019; Orr *et al.*, 2019; Adam *et al.*, 2021) and to examine trends in socioeconomic disparities in diet quality. Methods: Repeated cross-sectional analysis of eight National Health and Nutrition Examination Survey (NHANES. The ability to receive information about diet, especially the ability to understand the directives of health workers, can influence dietary behavior.

The results showed that the level of income affected the behavior of the diabetic diet in people with T2DM, but the value was not significant (Table 2). The results of the study are in line with the previous studies that state the income level of each individual is different, causing economic inequality that causes stress in individuals with low incomes (Assari *et al.*, 2017; Mogre *et al.*, 2017; Boakye *et al.*, 2018) those who are older, male, of low socioeconomic status, and uninsured. Low income makes people with type 2 diabetes mellitus experience poor diet behavior that causes poor glycemic

control (Gonzalez-Zacarias *et al.*, 2016; Matsunaga *et al.*, 2021) Type 2 DM (T2DM). In addition, people with T2DM with low income have limitations in accessing health services that lead to increased problems in self-care independently (Gonzalez-Zacarias *et al.*, 2016; Assari *et al.*, 2017; Mogre *et al.*, 2017; Boakye *et al.*, 2018) exercise, self-monitoring of blood glucose (SMBG). People with T2DM with enough income can provide foodstuffs that follow more varied diabetic dietary standards compared to low-income people with T2DM. People with T2DM with low incomes can also manage the diabetic diet by modifying the diet food menu so as not to feel bored and still meet the needs of calories and nutrients. There was no relationship between income levels and diabetic dietary behavior because most people with T2DM could adjust the selection of healthy foods according to respondents' financial capabilities.

Ethnicity affects diabetic dietary behavior in people with T2DM, but it is insignificant (Table 2). The results of this study are not in line with the previous studies that stated ethnicity influenced the management of the diabetic diet of people with T2DM (Boakye *et al.*, 2018; Matsunaga *et al.*, 2021) those who are older, male, of low socioeconomic status, and uninsured. Race is one of the causes of inhibition in the formation of diabetic dietary behavior due to the habit of each culture in serving food and communication that is difficult to do due to language differences (Anders dan Schroeter, 2015; Gonzalez-Zacarias *et al.*, 2016; Park *et al.*, 2016) it is not known whether EAI's perspectives are addressed in diabetes self-management interventions developed for EAI's. Therefore, a mixed-study review was conducted to identify EAI's perspective from qualitative research (n = 9 studies). Based on the study, the two ethnic groups (Madurese and Javanese) had diabetic diet behavior in the moderate category. Madurese and Javanese ethnic groups have habits that are not too different, so the people's diet is also relatively the same; besides that, Jember Regency has a Pandalungan culture that combines two ethnic groups. Currently, health services originating from Jember Regency have the same mother tongue as people with T2DM so that two-way communication can remain

well established, and people with T2DM can receive health information properly.

This study showed that family type significantly influenced diabetic dietary behavior in people with T2DM (Table 2). Respondents from single-parent families have diet behavior tends to be a moderate and poor category. In contrast, the other type of family tends to have diabetic diet behaviors that tend to be a moderate and good category. Families have an essential role in the health status of people with T2DM. Family members will provide support that will positively impact the compliance of care management of people with T2DM. People with complete family members tend to change health behaviors towards healthier ones more quickly than those without family members and who do not get family support (Pierce and Lutz, 2013). The previous study states that people with T2DM with good family support tend to have diabetic diet adherence behaviors (Anders & Schroeter, 2015; Gonzalez-Zacarias *et al.*, 2016) and thus contribute to lifestyle improvement. However, previous research suggests that dietary adherence is arguably among the most difficult cornerstones of diabetes management. The objectives of this study are (1. Family support is essential for people with T2DM to improve adherence to chronic disease management. The authors assumed that respondents with a single-parent family type had poor diabetic dietary behavior due to a lack of family support.

## Conclusion

Sociodemographic factors (age, gender, marital status, level of income and education, ethnicity, and family type) simultaneously influence the diabetic diet in people with T2DM. Partially, sociodemographic factors that influence the dietary behavior of diabetes in T2DM patients are education level and family type. Efforts to improve diabetic dietary behavior as part of diabetes self-management must be carried out correctly. This effort must pay attention to sociodemographic factors, especially the level of education and type of family with T2DM. Using simple language that is easy to understand by patients is essential in diabetes education. In addition, efforts to increase social support from family and others

considered necessary by people with T2DM are crucial to improving dietary behavior. It can enhance diabetes self-management and metabolic control, reduce complications, and improve the quality of life of people with T2DM.

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## Kencur Supplementation for Attenuating Exercise-Induced Muscle Damage and Delayed-Onset Muscle Soreness

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### Abstract

Delayed Onset Muscle Soreness (DOMS) is a pain that occurs after uncustomized eccentric exercise and can happen to anyone, both those who are athletes and other individuals. DOMS is usually felt 24-72 hours after exercise or activities that use eccentric movements, which interfere with the athlete's training activities and other individuals' daily activities. This study aimed to determine the effectiveness of kencur extract supplementation (*kaempferia galanga linn*) on DOMS and creatine kinase (CK) plasma levels after eccentric exercise. This research is quasi-experimental, using a randomized control group design as the design in this study. Research subjects ( $n = 28$ ) were randomly divided into 2 groups, namely the kencur extract group (200 mg/day) and the placebo group (corn flour). The supplementation process in both groups was carried out for 5 days (3 days before and 2 days after) the eccentric exercise. DOMS pain (VAS) and blood samples (CK plasma) were taken 24 hours (pre) and 48 hours (post) after eccentric exercise. The destructive drill uses the 5 x 20 Eccentric depth jump drill. The data obtained in the form of changes in DOMS pain and CK plasma were then analyzed using ANOVA with sig.  $<0.005$ . Supplementation of galingale extract was effective in reducing DOMS pain with  $p = 0.008$  ( $<0.05$ ) and CK plasma value  $p = 0.000$  ( $<0.05$ ) compared to placebo after eccentric exercise. Supplementation of galingale extract (*Kaempferia Galanga Linn*) for 5 days is effective as an effort to reduce the risk of DOMS pain sensation and reduce the increase in muscle damage with CK as a marker after eccentric exercise.

### Introduction

Nowadays, more and more people are doing sports activities to maintain health and improve their fitness level. In line with this trend, sports nutritionists are increasingly recognizing the need for different nutritional techniques to address metabolic adaptation challenges for athletes as well as sports enthusiasts. Delayed Onset Muscle Soreness (DOMS) is a phenomenon with negative consequences for physically active individuals as well as for people with a sedentary lifestyle who want to re-engage in exercise activities, or for individuals who simply want to improve their fitness level. Delayed Onset Muscle Soreness (DOMS) can be experienced by anyone, both athletes and non-athletes when doing eccentric activities or exercises with higher intensity than usual.

DOMS is a sensation of pain or discomfort that occurs after eccentric exercise that is not usually performed (uncostumed) or performed with high intensity (Sulistyarto *et al.*, 2022). DOMS pain will be felt for the first time 12-24 hours after doing eccentric exercise activities or eccentric muscle contraction activities and will gradually recover within 5-7 days. DOMS pain is caused by metabolic waste such as lactic acid in the muscles and extracellular fluid, which further irritates the ends of sensory fibers (Zulaini *et al.*, 2021). Poorly controlled exercise can cause muscle breakdown, inflammation, and muscle soreness. Symptoms of DOMS include swelling, stiffness in the muscles, decreased ROM ability, loss or decrease in muscle strength, and the appearance of pain (Angelopoulos *et al.*, 2022).

The most common symptom of DOMS

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is the sensation of muscle pain, this painful sensation can interfere with and reduce muscle ability (Fedewa *et al.*, 2019). Several theories suspect to be a factor causing the DOMS pain sensation. Some studies suspect this pain sensation correlates with increased stressors within muscle tissue (Kodesh *et al.*, 2022), another study suspected that increased prostaglandin production led to increased sensitivity of free nerve endings of irritated muscle tissue (Sonkodi, 2021). DOMS pain levels are higher in individuals who are not trained or participate in unusual activities and can result from excessive and prolonged eccentric muscle contractions. DOMS is thought to result from mechanical disruption of muscle fibers at the cellular level, decreased maximal muscle strength, increased plasma concentration of Creatine Kinase (CK), and decreased PCr/Pi ratio (Lund *et al.*, 2007).

DOMS generally results in a significant decrease in muscle ability (Ringuet *et al.*, 2021). Individuals who experience DOMS due to unusual exercise activities experience decreased eccentric, concentric, and isometric strength (Yoshida *et al.*, 2022). DOMS will gradually recover and subside after 5-7 days post-workout (Konrad *et al.*, 2022). DOMS pain felt by individuals will interfere with training activities, competitive performance, and other activities, so efforts are needed to prevent and treat DOMS. Currently, several strategies have been pursued to overcome DOMS pain, including massage (Davis *et al.*, 2020), cryotherapy (Nogueira *et al.*, 2020), active recovery (Akinici *et al.*, 2020), accounting (Chang *et al.*, 2020), ultrasound therapy (Koeda *et al.*, 2019), vitamin C and antioxidants (Budgeti & Irawan 2020; Torre *et al.*, 2021), and turmeric (Curcumin)(Amalraj *et al.*, 2020). Nutritional interventions with antioxidant and anti-inflammatory properties have the opportunity to reduce DOMS, in particular the consumption of biologically active components.

Intervention through nutrition can be considered as a natural alternative to address DOMS. Kencur (*Kaempferia Galanga linn*) in recent years has been recognized as an important nutritional intervention due to its wide range of biological activities, including antimicrobials (Kumar, 2020), Anticancer (Ichwan *et al.*,

2019), anti-inflammatory (Irawan *et al.*, 2022), Antitumor (Yang *et al.*, 2018), Antioxidant (Khairullah *et al.*, 2021), and various other biological activities of kencur. Based on this, kencur can be considered to have a beneficial effect on muscle damage, pain, and recovery. can positively impact DOMS, excessive stress from high-intensity exercise, and trigger biochemical and hormonal responses. Therefore, kencur with all these bioactive molecules would be a prospective approach to improve recovery from exercise and exercise for individuals who follow training or exercise programs. This study aimed to determine the effectiveness of extract supplementation Kencur (*Kaempferia Galanga Linn*) in DOMS and muscle damage characterized by plasma Creatine Kinase (CK) post eccentric exercises.

## Method

This research is a quasi-experiment, with a randomized control study design approach. This design was conceived to measure the effectiveness of kencur extract supplementation for 5 days against DOMS and changes in Creatine Kinase after eccentric exercise. This research has been approved by the Health Research Ethics Committee of Universitas Airlangga No: 104/EA/KEPK/2023.

The subjects in this study were 28 students of the Bachelor of Sports Science, at Universitas Negeri Surabaya. The subjects of this study had been informed and expressed willingness to participate as research subjects through informed consent. Based on the criteria of inclusion (male, able-bodied, active student, non-smoker, and non-alcoholic) and exclusion (in treatment, post-surgery, in injury condition) that had been determined, so that a total of 28 students were declared to have met the criteria and participated in this study. The research subjects were then divided randomly (simple random with the help of online applications) into 2 groups, namely the kencur extract group (KG) and placebo group (PL) with the number of KG 14 people and PL as many as 14 people.

The supplementation process was carried out for 5 days (3 days before and 2 days after eccentric exercise). The KG group received 200mg/day of kencur extract capsules, and the PL group received 200mg/day of cornstarch

capsules. The kencur extract capsules given were kencur extract capsules that were sold freely in the community. Study subjects took capsules after breakfast daily for 5 days. Consideration of dosage use based on studies by Khairullah (2021) and Abdullah (2020) conducted on the effectiveness of kencur extract as an antioxidant.

On the 3rd day the subjects of the study conducted Damaging exercises, namely eccentric exercises consisting of 5 sets x 20 eccentric depth jumps with a bench height of 60 cm, individual intervals of eccentric depth jump for 10 seconds, and pause the rest of each set for 2 minutes (Kirby *et al.*, 2012). DOMS pain

measurement using Visual Analog Scale (VAS) (Chang *et al.*, 2021). VAS is a horizontal line of 10 cm, marked with 1-10 with descriptors from the left end (0) no aches and pains (10) on the right end used to monitor changes in pain felt. Measurement of perceived VAS in quadricep muscle in post-study subjects' eccentric depth jump. Measurement of Creatine Kinase (CK) levels using the Elisa method. DOMS pain measurement and CK blood sampling in study subjects were carried out 24 hours and 48 hours post eccentric depth jump. The design of this study can be seen in Figure 1.

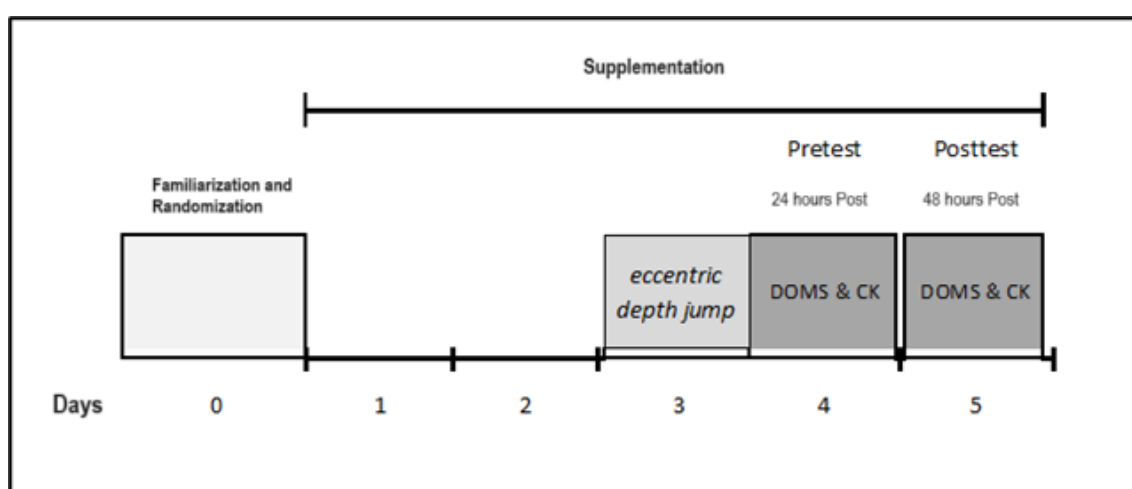


Figure 1. Research Design

The data that has been obtained is then analyzed statistically. Descriptive statistical analysis was used to display the characteristics of the study subjects, DOMS and CK. The data normality test was performed with the Kolmogorov-smirnov test to see the distribution of data distribution. The normality test was used to determine the hypothesis test. If the data is normally distributed, then the hypothesis test uses the paired sample t-test, while if the data is not normally distributed, the hypothesis test uses the Mann Whitney test. The hypothesis test was used to analyze differences between groups, with the value of the degree of meaning if the value of Sig.<0.05 with a confidence interval of 95%. Furthermore, to obtain a large size of the effect, Cohen's d test was used to determine how big the difference was between the intervention group (KG) and the control group (PL).

**RESULTS AND DISCUSSION**

This research was conducted at the FIO Unesa Campus, in May 2023. The research subjects were active students of the S1 Sports Science study program who had met the inclusion and exclusion criteria, so the number of participants was 28 people. Participants were then randomly divided into 2 groups, namely the kencur group (KG) and the placebo group (PL) with the number of each group as many as 14 people. The characteristics of participants including age, height, weight, and Body Mass Index (BMI) can be seen in Table 1.

Table 1. Participant Characteristics

	N	Min	Max	Mean
Age	28	18	21	19,46
Height	28	156	177	167,71
Weight	28	47	66	59,25
IMT	28	18,38	23,03	21,05

Primary Data Source

Based on Table 1 shown above, it can be seen that the average age of participants was 19.46 years ( $\pm 0.793$ ), average height was 167.71 cm ( $\pm 4.59$ ), average body weight was 59.25 ( $\pm 4.96$ ) and BMI was 21.05 ( $\pm 1.30$ ). Data on changes in DOMS pain sensation and plasma CK levels in the kencur supplement group (KG) and placebo group (PL) between 24 hours and 48 hours post (Post) eccentric depth jump obtained data that there was an average difference in DOMS pain sensation between 24 hours and 48 hours after eccentric depth jump, namely 1.5 ( $\pm 0.720$ ) in the Kencur (KG) group and 0.5 ( $\pm 0.536$ ) in the placebo (PL) group. In Table 2 above, we can also see the difference in plasma CK between 24 hours and 48 hours after the eccentric depth jump, namely 33.65 ( $\pm 19.712$ ) in the Kencur (KG) group and 13.01 ( $\pm 14.020$ ) in the placebo (PL) group.

Furthermore, a data normality test was carried out to determine the distribution of data from each DOMS and CK variable. The normality test in this study used the Kolmogorov-Smirnov test. The results of the normality test showed data that all variables in this study had a p-value of  $> 0.05$ . It can be said that all variable data in both DOMS and CK have a normal distribution. Based on the results of the normality test that has been presented above which shows that the data on all variables are normally distributed, then the paired t-test is used to test the hypothesis. This paired t-test aims to determine the average difference of the variable changes in DOMS and CK pain sensation between the Kencur group (KG) and the control group (PL). The results of the Paired t-test on the DOMS variable can be seen in Table 2.

Table 2 shows the results of the difference test on the mean of the variable change in

DOMS pain between the intervention group (KG) and the control group (PL). Based on the paired t-test, a p-value of 0.008 ( $< 0.05$ ) was obtained, which can be assumed that there is a significant difference in the average DOMS pain between the kencur (KG) group and the placebo (PL) group.

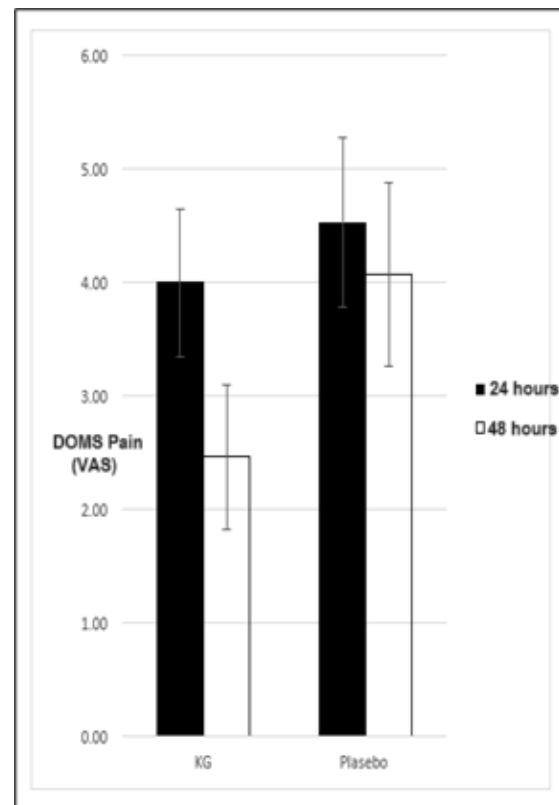


Figure 2. Changes in DOMS Pain at 24 Hours and 48 Hours Post-Workout Eccentric Depth Jump

Based on Figure 2 above, it can be seen that there is a decrease in DOMS pain at 48 hours after eccentric depth jump exercise between the kencur (KG) group and the placebo group (PL). Figure 2 shows that the KG

Table 2. Differences in DOMS Pain Sensation Study Subjects.

DOMS		Mean	$\pm$ SD	$\Delta$	p
KG	24 hours (Pre)	4,000	$\pm 0.650$	1,571	0,000
	48 hours (Post)	2,464	$\pm 0.634$		
PL	24 hours (Pre)	4,536	$\pm 0.805$	0,464	0,006
	48 hours (Post)	4,071	$\pm 0.978$		
$\Delta$ KG - $\Delta$ PL		1,536	$\pm 0.720$		0,001
		0,464	$\pm 0.536$		

Primary data source

Table 3. Differences in Plasma Creatine Kinase (CK) Study Subjects

CK (U/L)		Mean	±SD	Δ	p
KG	24 hours (Pre)	154,04	±13,870	33,65	0,000
	48 hours (Post)	120,39	± 8,303		
PL	24 hours (Pre)	174,10	± 14,212	(-)13,01	0,000
	48 hours (Post)	187,10	± 14,357		
ΔKG - ΔPL		33,65	± 19,712		0,000
		(-)13,01	± 14,020		

Primary data source

kencur group experienced a greater reduction in DOMS pain compared to the placebo group ( $p = 0.008 (<0.05)$ ). This can be interpreted that 5 days of kencur extract supplementation is effective in reducing post-exercise DOMS pain eccentric depth jump. The paired t-test results were also used to determine the average change in *Creatine Kinase* (CK) levels between 24 hours and 48 hours after eccentric *depth jump* exercise in the kencur (KG) group with the placebo group (PL). The changes from CK are shown in Table 3.

Table 3 shows the results of the difference test on the mean of the variable change in *Creatine Kinase* (CK) between the intervention group (KG) and the control group (PL). Based on the *paired t-test*, a p-value of 0.000 ( $<0.05$ ) was obtained, which can be assumed that there is a significant difference in the average *Creatine Kinase* (CK) between the kencur (KG) group and the placebo (PL) group.

Based on Figure 3, it can be seen that there was a decrease in plasma at 48 hours after eccentric depth jump exercise in the kencur (KG) group, but the results were different in the placebo group (PL) who experienced an increase in plasma CK. Figure 3 shows that the KG kencur group had a greater reduction in DOMS pain compared to the placebo group ( $p = 0.000 (<0.05)$ ). This can be interpreted that 5 days of kencur extract supplementation is effective in reducing post-exercise DOMS pain eccentric depth jump. To determine the magnitude of the effect of the difference between the intervention group (KG) and the control group (PL) on the variables DOMS and CK in this study, a large effect test was carried out using Cohen's d formula. Based on the results of the large effect test shown in Table 7 above, Cohen's d score for the DOMS pain

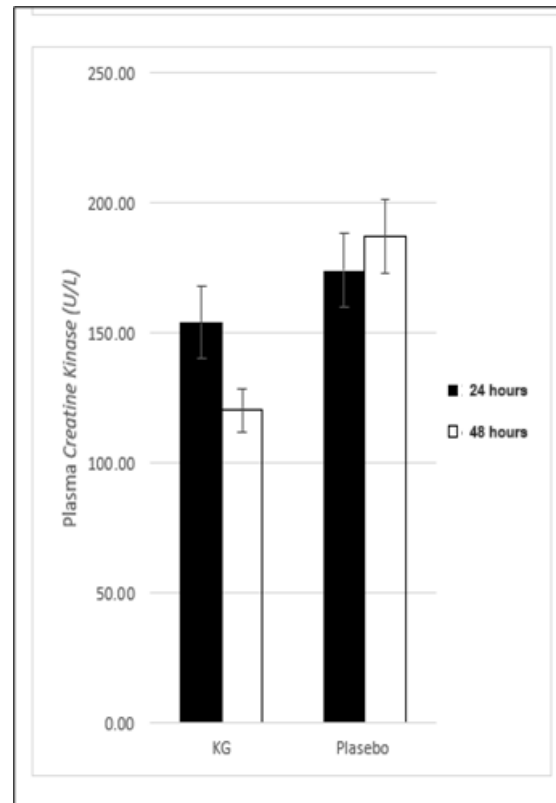


Figure 3. Changes in Plasma CK at 24 hours and 48 hours post-workout eccentric depth jump.

variable was 1.70, while for the CK variable Cohen's d test results showed a score of 2.73, based on these results, it can be interpreted that the effect of kencur extract supplements on DOMS and CK pain is in the high category.

This study aims to determine the effectiveness of kencur extract supplementation (*kaempferia galanga linn*) for 5 days against DOMS pain and muscle damage characterized by *Creatine Kinase* (CK) caused by eccentric exercise in students of the Bachelor of Sports Science, Universitas Negeri Surabaya. Based on the results of the study above, information was obtained that there was a significant decrease in the average pain of DOMS and plasma CK in

the kencur extract (KG) group measured at 24 hours and 48 hours after eccentric depth jump. Different results were shown in the placebo group which found that although there was a significant decrease in mean DOMS pain between 24 hours and 48 hours after eccentric depth jump, there was a significant increase in mean plasma CK in the placebo group. So the data concluded that supplementation of kencur extract (*kaempferia galanga linn*) for 5 days against DOMS pain and muscle damage characterized by Creatine Kinase (CK).

Several previous studies have shown that there is a correlation between the incidence of DOMS and muscle damage due to exercise and sports activities (Amalraj *et al.*, 2020; McFarlin *et al.*, 2016; Nakhostin-Roohi *et al.*, 2016; Sulistyarto *et al.*, 2022). Eccentric training can result in DOMS resulting in impairment or a large decrease in strength and can last 5 – 7 days, with conditions peaking 24-48 hours after exercise (Konrad *et al.*, 2022; Lewis *et al.*, 2012; da Silva *et al.*, 2018). Delayed-onset muscle pain (DOMS) is a multifactorial process associated with muscle pain, stiffness, swelling, tenderness, altered joint kinematics, muscle fiber disorders, acute tissue damage, and decreased strength and strength. DOMS is a multifactorial process associated with muscle pain, stiffness, swelling, tenderness, altered joint kinematics, muscle fiber disorders, acute tissue damage, and decreased strength (Matsumura *et al.*, 2015; Rynders *et al.*, 2014). DOMS, which presents as tenderness and muscle soreness that occurs after eccentric exercise, is also associated with sarcomere disorders and the inflammatory response that ensues (Connolly *et al.*, 2003). The mechanism of DOMS is still unknown, but inflammation and reactive oxygen species (ROS) are thought to be the main causes of DOMS and other possible causes include disruption of the excitation/contraction sequencing process, myofilament disorganization, z-line dilation and streaming, and a resistant response that creates a collection of mononuclear cells (Jenkins *et al.*, 2013). Several strategies have been put in place to reduce DOMS such as hyperbaric oxygen, anti-inflammatory drugs, massage, cryotherapy, homeopathy, stretching, electrotherapy modalities, ultrasound, rest, and moderate exercise (Mickleborough *et al.*, 2015;

Pumpa *et al.*, 2011).

Nutritional interventions that have antioxidant and anti-inflammatory properties are relevant efforts to reduce DOMS, especially the consumption of nutrients that have bioactive components (Howatson *et al.*, 2010; Lamb *et al.*, 2019; Lorensia *et al.*, 2022). Through consideration of natural alternative therapies to overcome DOMS, kencur (*Kaempferia galanga linn*) in recent years has been recognized as an important natural intervention due to its wide range of biological activities, including antimicrobial, anticancer, anti-inflammatory, antitumor, antioxidant, radioprotective, cardioprotective, and neuroprotective properties (Irawan *et al.*, 2022). The results of this study have shown that consumption of kencur extract has the potential to relieve DOMS pain and markers of Creatine Kinase (CK) muscle damage. Based on observations in this study, kencur extract supplementation for 5 days against eccentric depth jump, potentially reduced DOMS occurring, and muscle damage reactions compared to placebo.

Increased Creatine Kinase (CK) in blood plasma is generally considered an indirect marker of muscle injury (Baird *et al.*, 2012). CK levels decreased in the kencur extract supplement group, conversely, CK levels increased in subjects with placebo, meaning that kencur extract may lower the risk of DOMS-related muscle damage caused by eccentric exercise and may also speed up DOMS recovery. Several studies have reported that kencur has anti-inflammatory and antioxidant effects that are believed to significantly reduce oxidative stress levels and inflammatory responses (Sagita *et al.*, 2022; Samodra & Febrina, 2020; Yao *et al.*, 2018). Kencur causes a significant decrease in DOMS-related pain symptoms, which is associated with a decrease in plasma CK due to the bioactivity activity of kencur (Banwo *et al.*, 2021). The kencur formulation also acts as an anti-inflammatory and analgesic therapy to manage rheumatoid arthritis by reducing inflammation (Shi *et al.*, 2020). Studies conducted on kencur ethanol extract found that the bioactive of kencur also has a function as a pain reliever by acting as an antinociceptive (Riditid *et al.*, 2008). This data shows that consuming kencur extract can

reduce muscle damage due to eccentric muscle activity and facilitate the restoration of muscle function. Antioxidant and anti-inflammatory activity contained in kencur (*Kaempferia Galanga* Linn) is thought to be a factor causing the reduction in post-DOMS and plasma CK pain eccentric depth jump on this study. This is because kencur contains phenolic compounds and compounds diarylheptanoid which functions as an antioxidant (Ali *et al.*, 2018; Kumar, 2020) and anti-inflammatory (Wang *et al.*, 2013; Yao *et al.*, 2018).

### Conclusion

Supplementation of kencur extract (*Kaempferia Galanga* linn) for 5 days was able to reduce the risk of pain Delayed onset muscle soreness DOMS and muscle damage characterized by increased Creatine Kinase (CK) after eccentric exercise with high intensity. This is due to the antioxidant and anti-inflammatory content of kencur extract. The suggestion for future research is to develop research on the bioactive content of kencur extract (*Kaempferia Galanga* Linn) and develop other markers such as antioxidants and anti-inflammatory.

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## Improving Pandemic Integrated Care Using Digital Technology for Health Care Organization: A Qualitative Study

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### Abstract

Studies for exploring the pandemic integrated care through the implementation of health information systems using digital technology are very limited. Thus, the research findings provide genuine information regarding the system integration assessment for the regulators and provide an integrated COVID-19 system design sample as a robust solution. The authors evaluated the implementation of the current COVID-19 information system to explore and describe the barriers and challenges from the perspective of the COVID-19 Task Force Team of the South Tangerang District, Indonesia, and to propose an effective design of the COVID-19 functional integrated system. A qualitative form of research was conducted in the South Tangerang District in May 2020. The research informants chosen purposively, work related to the information system from the district health office, health center at the sub-district level, and from the community, which accommodates the adequacy and appropriateness principles. Seven respondents were selected based on their involvement and knowledge of the COVID-19 monitoring and reporting process. Rapid Assessment Procedures (RAP) were used to gather, analyze, and interpret the data. As a result, three (3) themes of barriers were identified as involved in functional integration through the implementation of the COVID-19 information system, namely individual behavior, data governance in the organization, and communication and networks.

### Introduction

Integrated system during the pandemic is an essential approach of the health care organization to create a single monitoring system that integrates several data sources, monitors the health indicator, and reports the current health condition on a real-time basis (Farias *et al.*, 2010). The World Health Organization recommends functionally integrated care through an Integrated information system that links all network members with data disaggregated according to relevant indicators (World Health Organization, 2016). The information system for coronavirus disease (COVID-19) pandemic development was introduced worldwide after it was declared on 30 January 2020 as a Public Health Emergency of International Concern (PHEIC)

by the World Health Organization through the website address: <https://covid19.who.int/>. The WHO COVID-19 dashboard elaborates on the current global situation such as confirmed cases, and death cases from country or territory.

Indonesia, with the 4th largest population in the world, was confirmed to have a COVID-19 Pandemic on 11 March 2020, and the pandemic has spread to all provinces in the country. The largest escalation of new cases in the first wave was in May 2020 followed by the second wave which started on May 2021 with more than 50 thousand cases per day and also the highest number of deaths in the South East Asia Region since then (Iuliano *et al.*, 2021; Puno *et al.*, 2020). A review of the epidemiologic data indicated that the number of cases or deaths may be much higher than

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reported (Dhar Chowdhury & Oommen, 2020) an infectious respiratory illness caused by the severe acute respiratory syndrome–corona virus 2 (SARS-CoV2).

The Indonesian government has started to develop a national web-based COVID-19 reporting system to monitor the cases (Setiati & Azwar, 2020) suppress the spread by imposing lockdown on a large scale, improve healthcare service, and increase the availability of personal protective equipments (PPE. A local web-based information system has been launched which can be used by the public to avoid red zones or danger areas exposed to COVID-19 and also to access the statistical data of suspected, confirmed, and death cases (Sevindik *et al.*, 2021). The National Task Force has also developed a new application named *Bersatu Lawan COVID-19* (BLC) or *Together Against COVID-19* and *Pedulilindungi* which is developed by the Ministry of Communication and Information. The applications have the purpose of accelerating the data flow starting from the public primary health carers, hospitals, laboratories, and district health offices and also a vaccination monitoring system (Kurniawati *et al.*, 2020). The apps can determine the distribution of COVID-19 cases, as well as the availability of healthcare facilities such as public primary health carers, referral hospitals, laboratories, and district health offices. Through this application, the public is also able to find out the: high-risk areas, and self-isolation features, and undertake an online consultation with doctors and psychologists.

A quick response during the COVID-19 pandemic requires systems that can directly detect and investigate cases on a real-time basis. The implementation of a Health Information System for COVID-19 in an urban area of Indonesia as the epicenter of the virus, including the South Tangerang District, has to be assessed in terms of constraints or barriers. The application through the integration field of the organization is relatively rare in health studies (Kaehne, 2019) it has now developed into a mature field of scientific inquiry with its own associations and think tanks, special interest groups and dedicated policies focussing on designing and implementing integrated care solutions within and across professional sectors.

It has also spawned an enormous amount of conceptual and empirical research. Despite all the progress, there remains a lingering question at the heart of the discipline. Why do organisations do integrated care? This is not to question personal motives for integrated care. We know that integrated care solutions deliver better conditions for professionals, which ultimately may lead to improved patient care. A recent systematic review indicated that integrated care models demonstrated positive impacts in at least two of the triple aims, access and patient care quality (Baxter *et al.*, 2018). Therefore, an evaluation of the COVID-19 information system is necessary to provide genuine information regarding the functional integrated care of the system.

Studies for exploring health information management for pandemic purposes are very limited. Thus, the objective of this study is to explore the barriers and challenges of functional integrated care implementation during the COVID-19 pandemic and to propose an effective design for integrating COVID-19 care through an information system. The outcome of this study is to encourage the readers, professionals, and scholars to understand the COVID-19 integrated system for contributing to the improvement of COVID-19 management in Indonesia which can be applied by other low-middle-income countries with large populations.

## Method

This research was a qualitative study accomplished by conducting in-depth interviews. A qualitative study was chosen to explore the opinions, views, and experiences of individuals through the Rapid Assessment Procedures (RAP) including gathering, analyzing, and interpreting data so that action can be taken as rapidly as possible (Sargeant, 2013) and the term is inconsistently applied. We propose the concept “information power” to guide adequate sample size for qualitative studies. Information power indicates that the more information the sample holds, relevant for the actual study, the lower amount of participants is needed. We suggest that the size of a sample with sufficient information power depends on (a. To further establish the

trustworthiness of the results, we also compare and examine the data by triangulation of the data source to produce a more comprehensive view for confirming the validity of the research.

The research informants chosen purposively, work related to the information system from the district health office, health center at the sub-district level, and from the community, which accommodates the adequacy and appropriateness principles. The study was conducted in the South Tangerang District, Province of Banten, Indonesia in May 2020. Seven respondents were selected based on their involvement and knowledge of the COVID-19 monitoring and reporting process. Selected organizations were from 1) the COVID-19 task force team of the District Health Office (DHO), 2) the COVID-19 task force team of a Public Primary Health Care facility, and 3) the COVID-19 task force team in the community (see table 1).

A semi-structured questionnaire was developed to explore barriers during the implementation of the COVID-19 monitoring system. The question related to information system management, from data collection from the community and health center through the reporting mechanism to the district health office. Interviews were conducted for approximately 30-45 minutes using the national language by phone and WhatsApp messages due to the Large-Scale Social Restriction since the 18th of April 2020.

The interviews were using semi-structured questionnaires and it was recorded and transcribed verbatim. This step continued by the process of coding which classified the ideas and similarities that were exposed through the descriptions given by the respondents. The coding text was analyzed using theming where each theme was built as the heading of a section in the report (Sutton & Austin, 2015).

## Results And Discussion

The objective of this research is to describe experiences during the implementation of a COVID-19 information system and to provide information on the lessons learned concerning various interferences to improve awareness of the issues. From the available literature, the

key issues and practical solutions have been extracted to inform policy-makers and planners as to what to consider when analyzing certain factors or when developing strategies to enhance an effective and efficient information system for pandemic purposes. The current research aims to evaluate the barriers and challenges of the implementation of a COVID-19 information system from the perspective of a pandemic task force of a District. Some barriers have been recognized as a result of the interview and classified into three major themes:

### Individual Behavior

The predisposition factor of the health care staff plays an important role in the health care organization to form the strengths to run the work process because qualified and motivated human resources are important for adequate health service provision. This includes genetics, attitudinal, personality, and environmental factors that are associated with health, or the lack of it, in a person which correlates to his/her performance. Performance is considered to be a combination of staff being available (retained and present) and staff being competent, productive, and responsive (Van De Velde *et al.*, 2016). Based on earlier research, individual performance such as behavior, knowledge, and competency influences organizational performance (Guo *et al.*, 2017).

One of the major determinants of individual performance is behavior. Negative behavior such as demotivation leads to a poor attitude towards their work by not following the standard protocols and reporting with unstandardized data. The current monitoring and report system during the COVID-19 pandemic in South Tangerang District is described in Figure 1. Based on the interview, all of the respondents agreed that they need an effective information system to simplify their work. Furthermore, competence is defined as the ability to perform a specific task based on knowledge and skills to obtain the desired outcomes. A PHC management staff stated:

*“Our problem is in case tracing because we do not have surveillance officers who have the knowledge, commitment, and responsiveness to do the monitoring and report to the system.”*

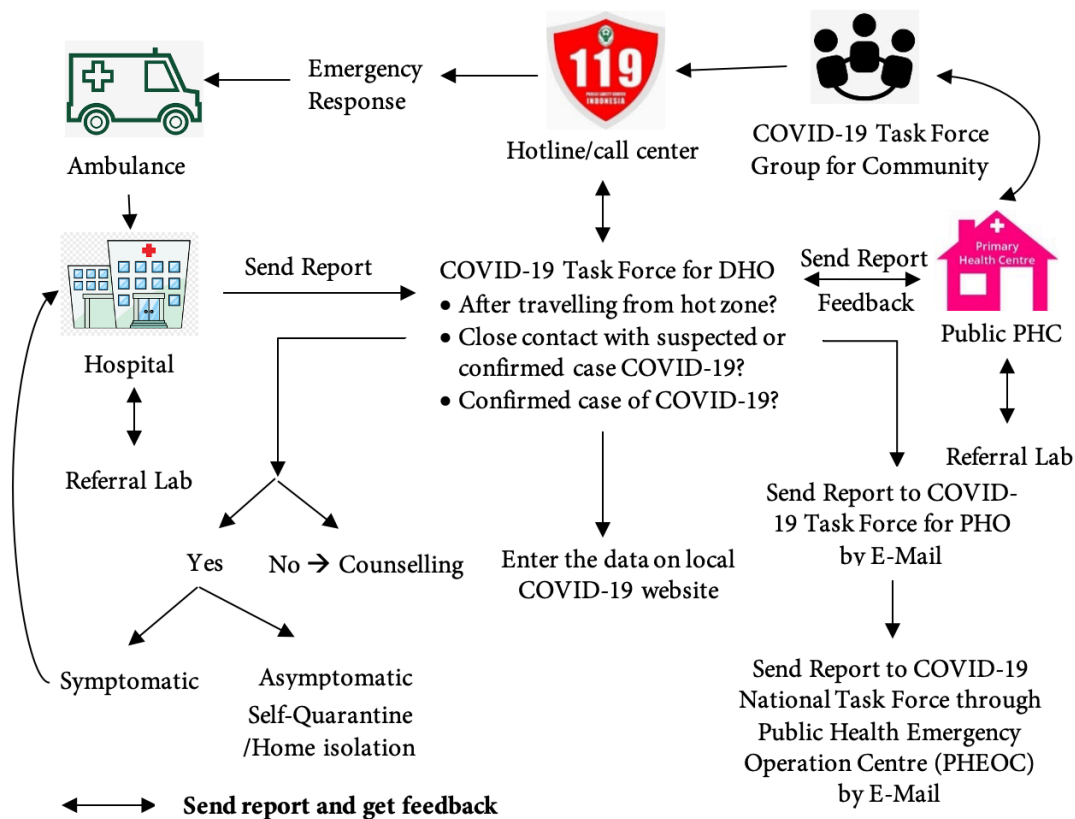


Figure 1. The Current COVID-19 Information System Workflow in District Level

Staff shortages also may limit accessibility to health services and programmes which in turn affect the health outcomes. Poor performance results from too few staff, or from staff not providing care according to standards and not being responsive to the needs of the community and patients (Bradley *et al.*, 2015). As the pandemic highlighted the healthcare system's human resource challenges, medical staff are insufficient to deal with potentially increasing demands (Mahendradhata *et al.*, 2021).

**Data Governance in the Organisation**

Data governance consists of a set of processes, roles, policies, and standards that ensure an organization follows an effective and efficient way to use the available information to achieve its goals. It also defines the processes and responsibilities that ensure the quality and security of data used throughout a company or organization. Data governance specifies who can take what actions, on what data, in what circumstances, and with what methods. Respondents from the DHO Task Force stated:

*“Public PHCs and hospitals report cases directly to surveillance in the DHO. If someone, let’s say went to the laboratory by himself, and obtained a lab result, he should report it to the Public PHC.”*

The performance of health workers depends not only on their competence, knowledge, and skills but also on the availability of facilities or infrastructure to help the work process. Such facilities may increase the motivation of the staff (Forson *et al.*, 2021). Motivation is a driver for better organizational performance. Working conditions in health care organizations such as effective workflow, and supportive operating policies and procedures are related to the staff work motivation.

**Communication and Networks**

The organizational performance is set to monitor and improve the quality of work. To meet the standards of the organization, health workers need a working environment that allows them to work without problems that may prevent them from achieving outstanding performance. Several factors

within the working environment such as access to information, network, and multi-sectoral communication, may affect the performance of the staff (Bonache & Noethen, 2014). The management of a PHC stated:

*“I am so happy that we’ve got support from multi-sectoral coordination to collect the data from the patients. So, we can submit the data on time.”*

Lack of public awareness also influences the satisfaction of the health workers. Access to information amongst organizations is also important to increase awareness. According to the WHO framework during the COVID-19 pandemic, coordination and communication among the community elements is critical for effective response to public health emergencies and increased awareness (Stratil *et al.*, 2020). The activation of a Health Emergency Operations Centre (EOC) or other coordination systems such as multi-sectoral coordination is an indication of an adequate pandemic information system. After transcribing, coding, and categorizing the data, we built a thematic schema of the problems using a root cause analysis as seen in Figure 2.

At the very beginning of the pandemic,

it clearly showed there was a failure of the management and organization system behavior in crises. Health personnel play an important role in patient care to management information systems. Earlier research concluded that employee behavior has a significant role to play concerning organizational growth and performance (Guo *et al.*, 2017). Moreover, the combination of experience and competency is essential which must be explored and valued (Vosloban, 2012). Improving personal performance to the highest level becomes a challenge, given the continuous improvement of the healthcare organization (Khan *et al.*, 2019; Sears *et al.*, 2014). In the current research, the lack of awareness, the shortage of staff, a lack of competencies, and heavy workload are identified as barriers which are associated with individual behavior. Earlier studies have proved that individual awareness is an important determinant of organizational achievement (Okpara & Edwin, 2015) and it may have implications for COVID-19 awareness among the healthcare staff. It has been argued that having high self-awareness allows health professionals to comply with a routine surveillance system in a healthcare organization.

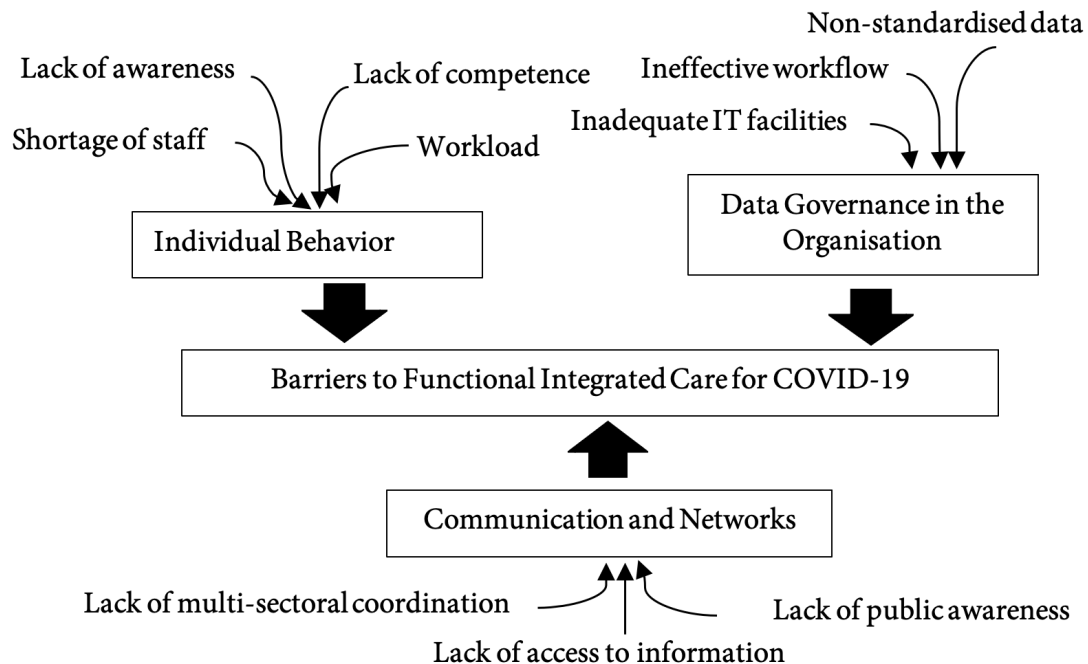


Figure 2. Barriers to Functional Integrated Care for COVID-19 in Indonesia

Furthermore, the importance of the workload on staff performance has been widely acknowledged. The health care workers are human resources with skillful and competent staff with planning, controlling, leading, and staffing functions within the health care organization. Previous research has concluded the negative impact of insufficient personnel is increasing the workload, and decreasing the productivity which brings about inadequate implementation of the work system and reduces its function (Asamani *et al.*, 2015). During the COVID-19 escalation in Indonesia, the health workers form the frontline to perform clinical work as well as trace the confirmed cases which may increase the workload. The evidence of the competencies amongst the health care staff is a different issue. Healthcare organizations are required to prove that the skills of the staff meet the requirements of the workplace. Maintaining a skilled and motivated healthcare workforce during the COVID-19 pandemic is also of major concern as the staff can comply with the existing procedures (Mahendradhata *et al.*, 2021).

Besides the healthcare workforce, data governance during the pandemic is necessarily adequately provided by the government through local to national regulations. From this current research, several factors such as

inadequate facilities, ineffective workflow, and non-standard protocols are identified as barriers associated with good data governance. The limitation of facilities in the district such as clinical laboratory testing brings about difficulty in detecting the confirmed cases. The laboratory staff must send the clinical samples to the referral lab and will only get the result within a week. Earlier research stated that inadequate facilities and the lack of material, which are seen as being beyond the control of health professionals were found to be a source of frustration for many health workers and this affects their motivation, which in turn affects their performance and readiness (Dagne *et al.*, 2015; Merlin & Vanchapo, 2021).

Furthermore, ineffective workflow issues can interfere with productivity and patient care, so addressing such issues may improve organizational performance to enhance the pandemic information system. The workflow of an organization involves a set of procedures that have to be completed, the set of people or other resources available to accomplish the steps, and the interactions among them (Tanzini *et al.*, 2021). People who are involved in health information management should admit the importance of health data and the accessibility of the classifications to provide the information for the public (Shepherd & Groom, 2020).

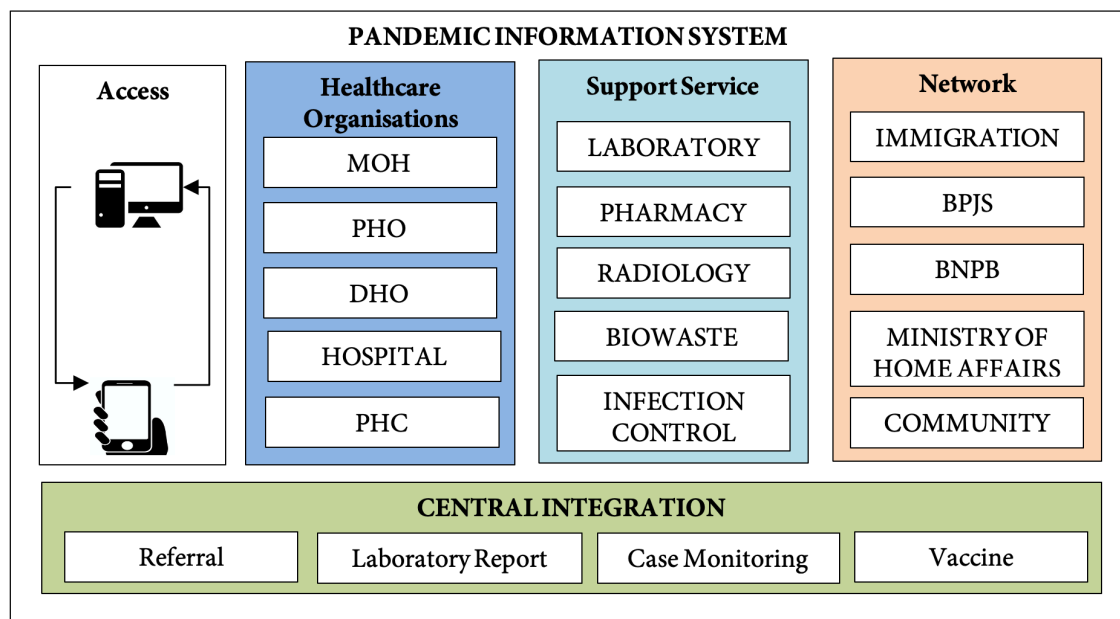


Figure 3. Proposed Design of Pandemic Integrated System (MOH=Ministry of Health, BPJS= Social Health Insurance Administration Body, BNPB= National Disaster Mitigation Agency)

A good workflow will help achieve the goals promptly, deliver more consistently, reliably, safely, and comply with the protocol standards (Nugroho *et al.*, 2021).

The current research shows that there are several barriers related to communication and networks such as a lack of multi-sectoral coordination, a lack of public awareness, and a lack of access to information and these have become barriers to the implementation of the pandemic information system. According to the Framework for a Public Health Emergency Operation Centre (PHEOC) from WHO, a multi-sectoral coordination mechanism has key components such as immediate plans and actions, procedures, infrastructure, information technology (IT) infrastructure, information systems and standards, and human resources (Zhussupov *et al.*, 2022). The use of electronic information systems during the COVID-19 pandemic in the South Tangerang District has been carried out through the local web. However, the website can only be used by the health officers in the District Health Office to manually input the case-reported data by the Public PHC. This may imply that non-real-time data by a healthcare organization is difficult to respond to quickly. Therefore, we proposed an integrated information system design as seen in Figure 3 as the solution for the effective workflow of the COVID-19 monitoring and reporting system.

### Conclusion

Certain factors are important to be evaluated for the effective implementation of an integrated system against pandemics such as COVID-19 in Indonesia including individual behavior, data governance in the organization, and communication. To improve the system performance in the organization, there is a need to evaluate the barriers among the above-mentioned factors. The current research involves the Task Force Team of a District in an Indonesian urban area; therefore, the problems cannot be generalized to apply to all regions. It is suggested that a national survey should be conducted to address any gaps in the present study and to include coverage of all the other provinces. Recommendations would be required for multi-sectoral involvement to

support the implementation of a pandemic information system to monitor health data and to build an effective integrated system to improve the information system. A proposed design to improve the effectiveness of the pandemic-integrated system has been developed to enhance the current system. Thus, further research in the IT field for designing, developing, and implementing the national pandemic information system requires urgent attention. The use of Information Technology can find ways to improve the multi-sectoral integration, quality of the health data, and efficient health services during the COVID-19 pandemic.

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## Education with Video and Flyer Improving Pregnant Women's Behavior of Sleep Hygiene: Which Is More Effective?

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### Abstract

No study related to sleep hygiene education with digital technology for pregnant women in Indonesia has been conducted. This study aims to determine the differences in the effect of education with animated videos and digital flyers on increasing pregnant women's sleep hygiene behavior. This quasi-experimental study was conducted on 108 who pregnant women were selected and assigned consecutively to the animation video and flyer groups and received education on sleep hygiene for 18 days. The validated behavior questionnaires were completed by both groups. Mann-Whitney U and Wilcoxon tests were used for the analysis. The mean (SD) behavior score was 69 (13.3) and 86.2 (11) in the video group and 68 (8.7) and 76.8 (10.5) in the flyer group on the first and 19th days, so there was a significant difference in terms of sleep hygiene behavior between the animation video and flyer group on the 18th day ( $p < 0.000$ ). Pregnant women who had sleep hygiene education with an animation video had more behavioral enhancement than flyers ( $20.5 > 11.5$ ). Sleep hygiene education with an animation video as a first-line strategy is important and more effective in preventing insomnia.

### Introduction

Pregnancy is a special condition characterized by anatomical, physiological, biochemical, and psychological changes in a woman's body (Cunningham *et al.*, 2018). One of the basic needs of pregnant women to be able to adapt to changes in pregnancy is rest and sleep. Sleep is one of the important biorhythms that helps optimize recovery for many functions at the level of systems, organs, and even cells in the human body (Warland *et al.*, 2018). Every woman of reproductive age needs about 7-9 hours of sleep, and so do pregnant women. Pregnancy is often associated with problems such as difficulty falling asleep, waking up frequently during the night, not falling asleep easily when waking up, and feeling unrefreshed and lethargic in the morning (Sedov *et al.*, 2021).

Insomnia is dissatisfaction and discrepancy in terms of quantity and quality of sleep that occurs at least three times a week for at least three months and is not related to a specific condition or under the influence of other substances (Mindell *et al.*, 2015). The results of a meta-analysis by Sedov *et al.* showed that 38.2% of pregnant women experienced insomnia which increased with increasing gestational age, namely 25.3% in the first trimester, 27.2% in the second trimester, and 39.7% in the third trimester. Insomnia in pregnancy is associated with back pain, increased frequency of micturition, fetal growth and movement, inadequate breathing, incorrect body position during sleep, stress, psychological disorders, and decreased quality of life (Tsai *et al.*, 2012). Slow handling of insomnia increases the risk of preeclampsia, sectio caesarean delivery,

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prematurity, gestational diabetes mellitus, postpartum depression, obesity in children, and hyperglycemia in children, which ultimately affects family welfare (Sedov *et al.*, 2021; Li *et al.*, 2017; Emamian *et al.*, 2019; Letourneau *et al.*, 2013). The non-pharmacological treatment of insomnia is behavioral therapy (relaxation, sleep restriction, cognitive therapy, cognitive behavioral therapy) and sleep hygiene (Hashmi *et al.*, 2016).

Sleep hygiene is a first-line strategy to prevent insomnia. Sleep hygiene is the practice of establishing healthy sleep habits. The concept of sleep hygiene, which was developed to address sleep problems, was first used by Peter Hauri (Hashmi *et al.*, 2016). Sleep hygiene education has been widely studied for its benefits in children and adolescents to working women (Chung *et al.*, 2017; Chung *et al.*, 2018; Shriane *et al.*, 2020), but it was limited to pregnant women in Indonesia. In addition, providing education in traditional ways, such as during antenatal care or using media flyers or pamphlets, requires larger resources and previous studies showed that video intervention can modify health behaviors (Tuong *et al.*, 2014). Therefore, this study aims to develop an animation video of sleep hygiene education that describes the importance of practicing sleep hygiene to prevent insomnia in pregnancy and the steps of sleep hygiene to

enhance the behavior of pregnant women. In a quasi-experimental study, we compare the efficacy of an animation video of sleep hygiene education to that of a flyer.

**Method**

This study was a quasi-experimental design with a non-equivalent control group design approach in three locations. That's Primary Health Care of Mojopanggung Banyuwangi, Primary Health Care of Tanjungsari Surabaya, and Primary Health Care of Banyuputih Situbondo. This study began with a literature review on sleep hygiene. The results of the literature review were used as the basis for preparing scripts for sleep hygiene education. The contents of the video and flyer were the same, but the explanation in the video was more detailed. The duration of the sleep hygiene animation video was five minutes.

In this study, Cronbach's alpha of the sleep hygiene behavior questionnaire was found to be 0.822. 21 of 26 questions that were valid and reliable were used to measure the behavior of pregnant women before and after providing education. The sleep hygiene behavior questionnaire was about sleep duration, nap time, fluid consumption at night, caffeine consumption, cell phone use habits, and others. The animation videos and flyers for sleep hygiene education have received creation

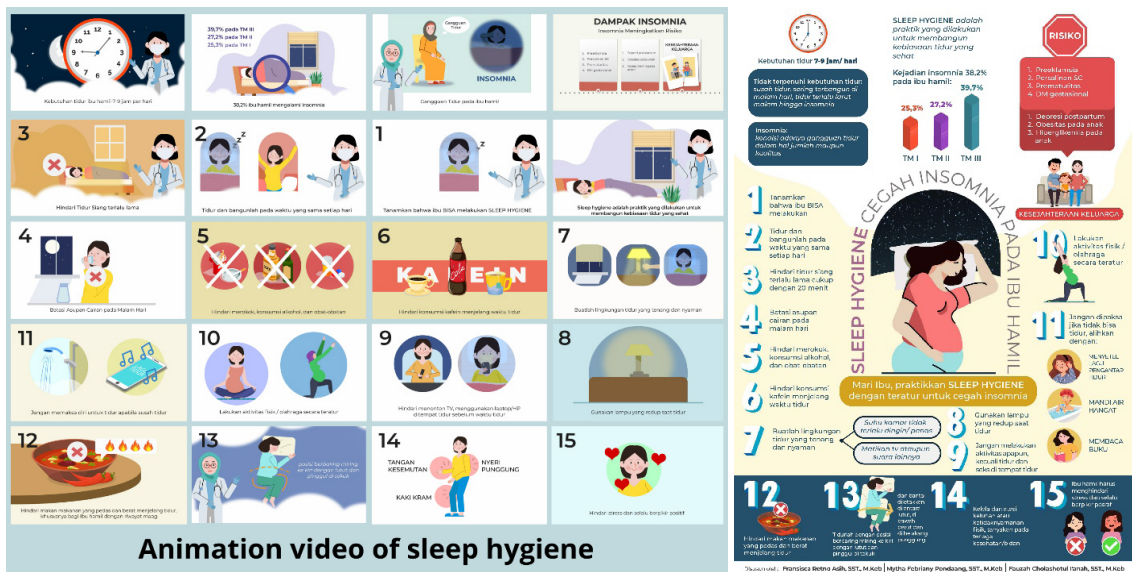


Figure 1. Figure, Animation Video, and Digital Flyer on Sleep Hygiene. (a) Capture of an Animation Video of Sleep Hygiene. (b) The Digital Flyer on Sleep Hygiene

registration from the Directorate General of Intellectual Property of the Ministry of Law and Human Rights of Indonesia.

The target population of this study was pregnant women who lived in Banyuwangi, Surabaya, and Situbondo. The affordable population of this study was all of the pregnant women who lived in Banyuwangi, Surabaya, and Situbondo and met the inclusion and exclusion criteria. The sample size was determined using a table based on a 95% confidence level ( $Z\alpha = 1.96$ ), a power test of 90% ( $Z\beta = 1.282$ ), and the effect size was determined at 0.60, plus 10% in anticipation of dropout, so the number of subjects was 49 in each group. Pregnant women who have come consecutively from one of the primary health care centers in Banyuwangi, Surabaya, and Situbondo during September-December 2021 and have smartphones that access WhatsApp and Zoom meetings were assigned to the study. Pregnant women who worked at night took medication for sleep, had mental disorders, had intimate partner violence experience, and blind women were excluded from this study. Also, the subjects who withdrew dropped out of this study.

A total of 108 subjects were divided into two groups without randomization, resulting in 54 subjects in the video group and 54 subjects in the flyer group. Both groups underwent a pretest in the form of a sleep hygiene behavior questionnaire using the Google form. After that, the video group was given sleep hygiene education using animated video media, while the flyer group was given sleep hygiene education using flyers through Zoom meetings, and then the animated videos and flyers were distributed via the WhatsApp group. We monitored and reminded subjects in each group to watch videos and read flyers about sleep hygiene for 18<sup>th</sup> days through WhatsApp groups. All subjects in both groups were given a posttest in the form of a sleep hygiene behavior questionnaire on the 19<sup>th</sup> day. In this study, the independent variable was sleep hygiene education (categorical data), it was an education given to pregnant women in the form of animated videos and flyers. The dependent variable was sleep hygiene behavior (numeric data), which was the behavior of pregnant women in carrying out sleep hygiene using a sleep hygiene behaviors

questionnaire measurement tool. In addition to behavior, researchers also collected data on the characteristics of research subjects, namely age, gestational age, gravida, education, and occupation.

Categorical data on subject characteristics were displayed in the form of frequency and percentage distributions and analyzed using chi-square for the 2x2 table and the Mann-Whitney test for the 2x3 table so that it was known whether the two groups were feasible to be compared. The research data was numerical, so before being analyzed, it was necessary to test the normality of the data using the Shapiro-Wilk test. The data is normally distributed if  $p > 0.05$ . The results of behavioral data measurements in the form of scores before and after the intervention in each group were analyzed using the Wilcoxon test, while to find out the comparison of the two groups at each stage, both the pretest and posttest used the Mann-Whitney test. To find out which intervention was most effective, the percentage increase in behavior scores in the animated video and flyer groups was analyzed using the Mann-Whitney test. Data analysis using the SPSS 25 application. The Ethics Committee of the Institute of Health Science Banyuwangi has carefully reviewed and approved this study no. 579/KEPK/STIKES-BWI/IX/2021.

## Result and Discussion

The subjects of this study were 54 pregnant women who were assigned the video animation group (18 pregnant women from the Primary Health Center of Mojopanggung Banyuwangi, 18 pregnant women from Primary Health Center Tanjungsari Surabaya, and 18 pregnant women from Primary Health Center Banyuputih Situbondo) and 54 pregnant women were assigned the flyer group (18 pregnant women from the Primary Health Center of Mojopanggung Banyuwangi, 18 pregnant women from Primary Health Center Tanjungsari Surabaya, and 18 pregnant women from Primary Health Center Banyuputih Situbondo). There were no subjects who dropped out of this study. The characteristics of the study subjects are shown in Table 1. Pregnant women who participated in this study had an age range from 19-38 years. Most

of the pregnant women in both groups were multigravidas. The occupational groups of the study subjects were teachers, health workers, private company employees, and traders. The results of the analysis showed that there were no differences in characteristics between the animated video and flyer groups ( $p > 0.05$ ).

Table 1. Characteristics of the Study Subject

Characteristics	Animation video (n=54) n (%)	Flyer (n=54) n (%)	p
Age during the intervention (years)			0.661 <sup>a</sup>
<20	2 (3.7)	1 (1.9)	
20-35	50 (92.6)	53 (98.1)	
>35	2 (3.7)	0 (0)	
Age of pregnancy (weeks)			0.915 <sup>b</sup>
<16	9 (16.7)	9 (16.7)	
16-28	25 (46.3)	23 (42.6)	
>28	20 (37)	22 (40.7)	
Gravid			0.820 <sup>b</sup>
Primigravida	12 (22.2)	13 (24.1)	
Multigravida	42 (77.8)	41 (75.9)	
Education			0.089 <sup>b</sup>
Elementary school to junior high school	17 (31.5)	22 (40.7)	
High school	10 (18.5)	16 (29.6)	
College	27 (50)	16 (29.6)	
Occupational status			0.174 <sup>b</sup>
Employed	27 (50)	20 (37)	
Unemployed	27 (50)	34 (63)	

Source: author's calculating using SPSS, 2022

Notes: <sup>a</sup>Mann *Whitney test*; <sup>b</sup>Chi *Square test*

The result of this study indicates that an animation video about sleep hygiene education for 18 days increased the behavior of pregnant women ( $p < 0.001$ ) (table 2). The result of this study also indicates that education about sleep hygiene with a flyer for 18 days increased the

behavior of pregnant women ( $p < 0.001$ ) (table 2). Based on Table 2, the percentage increase in behavior in pregnant women who were given sleep hygiene education with animated videos was higher than education with flyers, and it was statistically different.

Our findings showed that sleep hygiene education using animation videos and flyers for 18 days had a positive effect on increasing pregnant women's behavior of sleep hygiene practices. This statement is known from the enhancement of behavior scores before and after education (table 2). The subjects of the animation video group had significantly higher behavior of sleep hygiene than the subjects of the flyer groups, and there are statistically significant differences in behavior after sleep hygiene education. This result agrees with the study conducted by Armstrong *et al* (Armstrong *et al.*, 2011), that video-based learning is a more effective educational tool for teaching and encouraging behavior than written materials. Our results were also consistent with the study by Chen *et al* (Chen *et al.*, 2010), which found that a sleep hygiene education program was effective in improving sleep quality in working women with sleeping problems. But, a systematic review by Tuong *et al* (Tuong *et al.*, 2014) showed that video interventions were variably effective in modifying health behaviors depending on the target behaviors to be influenced (Tuong *et al.*, 2014).

Some reasons can explain this outcome. Firstly, we provided sleep hygiene education for pregnant women with technology that can be shared on social media. In this era, pregnant women and mothers seek information in the social media (Zhu *et al.*, 2019). The internet is a reliable source of information about health and pregnancy. Pregnancy-related information is especially easy to find on the internet (Sinclair *et al.*, 2018). Secondly, videos use more senses,

Table 2. The Effect of Animation Video and Flyer on Sleep Hygiene in 18 Days

Sleep hygiene education	Behavior (before) mean (SD)	Behavior (after) mean (SD)	P	Enhancement (median %)
Animation video (n=54)	69 (13.3)	86.2 (11)	<0.001**	20.5
Flyer (n=54)	68 (8.7)	76.8 (10.5)	<0.001**	11.5
p	0.443*	0.000*		0.014*

Source: author's calculating using SPSS, 2022

Notes: SD=Standard Deviation; \*Mann *Whitney*; \*\*Wilcoxon

namely the senses of sight and hearing, compared to flyers, which only involve the senses of sight, thus increasing the absorption and memory of as much as 50% of the information conveyed because it is influenced by the intensity of attention and perception of objects. In addition, audio-visual media has several advantages, namely that the message conveyed is packaged attractively so that it will be easily remembered by the audience, is not limited by distance and time, and can be repeated (Maramis, 2013). In the era of the industrial revolution 4.0 towards industrial society 5.0, providing education is an easy thing to do with technology. The limited time for health workers to provide education can be helped by the existence of technology-based educational media such as animated videos and digital flyers. Even though the existence of the media does not mean that it can replace the role of health workers when providing health services, it can be a complement to health services. In addition, these educational media can be accessed by pregnant women wherever they are (Javanmardi *et al.*, 2019).

According to Phillipia, *et al.*, a person needs 18-254 days to be able to adapt to new behaviors (Lally *et al.*, 2010). Therefore, in this study, the intervention of sleep hygiene education was given for 18 days, so it is expected that pregnant women can practice sleep hygiene. This educational intervention also indirectly provides knowledge for pregnant women about insomnia, its effects, and how to prevent it. Education on sleep hygiene given early in pregnancy is expected to reduce complaints of insomnia when contacting antenatal care and to avoid and reduce unnecessary interventions so that the WHO principles of perinatal care are met, namely care for women with a normal pregnancy and birth should promote normal reproductive processes and women's inherent capabilities (Chalmers *et al.*, 2001).

This research has several limitations. During the COVID-19 pandemic, all research activities were carried out online, starting from filling out the behavior pretest questionnaire, sending animated videos and flyers, following up, and filling out the posttest behavior questionnaire. Therefore, there was a possibility of bias when filling out the pretest and posttest.

In addition, the behavior studied in this study was the result of the research subject's answers, not direct observation. During follow-up, we sometimes experienced some difficulties because some subjects were unresponsive, even though all subjects had completed well. In this study, it was not known whether the research subjects experienced sleep disturbances or insomnia because the data was not collected by the researchers. Future recommendations are necessary; likely, further studies should be conducted to learn about the effect of sleep hygiene on preventing insomnia and its impact on pregnant women. Also, another more likely method is a randomized controlled trial.

### Conclusion

To prevent the adverse effects of insomnia in pregnancy, feasible preventive methods were needed for various backgrounds of pregnant women. The findings of this study showed that an animation video of sleep hygiene education enhanced the positive behavior of pregnant women to practice sleep hygiene. Sleep hygiene education is important and needed for pregnancy to prevent insomnia. Sleep hygiene education with animation video at the beginning of pregnancy is recommended and can be a complement to midwifery services during antenatal care.

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## Vaccination with the Incidence of Post-Acute Sequelae COVID-19

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### Abstract

Post-acute sequelae COVID-19 (PASC) symptoms are present in the vast majority of COVID-19 survivors, even those who have received the COVID-19 vaccine. Until now, vaccines against PASC are still controversial. Some previous findings suggest that vaccines can reduce or worsen PASC symptoms. In addition, there has been no related research in North Maluku Province, especially in Ternate City. This study aims to determine the relationship between vaccine administration and PASC based on the total dose and type of vaccine obtained using a questionnaire-based cross-sectional design questionnaire. The study population was COVID-19 patients diagnosed with RT-PCR or RDT-Ag in 2020–2022, domiciled in Ternate City. The respondents were 133 people. Bivariate analysis showed no effect of vaccine dose administration on the incidence of PASC ( $P=0.111$ ). Similarly, the type and dose of vaccine based on the did not affect (first dose,  $P = 1.000$ ), (second dose  $P = 0.732$ ), and (booster  $P = 0.434$ ) PASC. In terms of the timing of booster doses, pre- and post-COVID-19, there was no significant effect ( $P=0.384$ ). However, there was a higher incidence of PASC in responders who received the booster dose post-COVID-19. There is no association between vaccine administration and the incidence of PASC.

### Introduction

The respiratory illness called Coronavirus Disease 2019 (COVID-19) is caused by the SARS-CoV-2 coronavirus. COVID-19 has created an extremely hazardous and lethal threat to public health around the world, including in Indonesia (Madabhavi *et al.*, 2020; Shi *et al.*, 2020). According to the Republic of Indonesia's Ministry of Health, as of September 24, 2022, 6.4 million positive cases have been confirmed, and 158 thousand COVID-19 deaths have been reported in Indonesia (Infeksi Emerging, 2022). Positive cases of COVID-19 in Ternate City as of September 21, 2022, were 3.4 thousand, and 88 of them died (Dinas Kesehatan Kota Ternate, 2022). Most SARS-CoV-2 virus-infected individuals recover within 14 days (Madabhavi *et al.*, 2020). This is in line with research conducted at Dr. H. Chasan Boesoirie Ternate Hospital showing that most

patients infected with COVID-19 recovered after treatment (Masrika *et al.*, 2022). However, several studies have shown that the majority of individuals can still experience symptoms weeks or even months after the COVID-19 acute phase has passed. This disease is referred to as "post-acute sequelae COVID-19" (PASC) (Lerner *et al.*, 2021; Logue *et al.*, 2021).

PASC is most commonly reported in Asia with a prevalence of 49%, while the lowest prevalence in North America is 30% (Chen *et al.*, 2021). Meanwhile, the prevalence of PASC in Indonesia was reported as 66.5% (Susanto *et al.*, 2022). Symptoms of PASC that arise can affect several systems in the human body, for example, cardiovascular, respiratory, musculoskeletal, and neurological (Hayes *et al.*, 2021). A meta-analysis showed that 80% of COVID-19 survivors experienced at least one PASC symptom, the most common being

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fatigue, headache, impaired concentration, hair loss, and shortness of breath (Leon *et al.*, 2021). Ninety percent of PASC patients had continuing symptoms nine months after the COVID-19 acute phase, and 67% had not resumed their prior levels of activity (Davis *et al.*, 2021; Tran *et al.*, 2022).

An influential way of struggling against COVID-19 is developing a vaccine (Zheng *et al.*, 2022). More than 12.4 billion doses of the COVID-19 vaccine have been administered globally as of August 2022 (COVID-19 Dashboard, 2022). Meanwhile, in September 2022, COVID-19 vaccine coverage in Indonesia reached 437 million doses, with 246 thousand doses including vaccine administration in Ternate City (Global Situation Report, 2022). It has been shown that receiving a COVID-19 vaccine lowers the risk of contracting a serious illness and passing away from COVID-19 (Zheng *et al.*, 2022). Given that the COVID-19 vaccination only partially prevents the spread of the SARS-CoV-2 virus, it is possible for people who have received it to acquire PASC (Wang *et al.*, 2022). In actuality, PASC can have an impact on a variety of patients, from those who are asymptomatic to those who experience severe symptoms during an acute COVID-19 infection and require critical care (Sudre *et al.*, 2021; Tenforde *et al.*, 2020). It is still unclear how vaccination affects a wide range of PASC.

In the literature, the vaccination effect on PASC is controversial. Findings from one study showed that vaccination reduced some symptoms 6 months after infection, but not all symptoms of PASC (Antonelli *et al.*, 2022). According to American studies, even if a patient just receives one dose of the vaccination, they are less likely to acquire PASC than those who receive the vaccine after contracting COVID-19 (Simon *et al.*, 2021). However, another study reported that 20% of individuals infected after the vaccine experienced PASC for more than 6 weeks (Hoque *et al.*, 2021). Furthermore, there is a lack of studies to explore the impact of booster vaccines on PASC. Studies that identified differences in response between vaccine types showed that the Pfizer vaccine was more effective than the Janssen vaccine in reducing the risk of PASC (Notarte *et al.*, 2022). Based on the above problems, research

on the association of vaccine administration with the incidence of PASC needs to be carried out, considering that this is still a question because the results of previous studies are still controversial and there has been no related research in North Maluku Province, especially Ternate City.

## Method

The research being conducted was quantitative and employed a cross-sectional technique with an analytical observational design. The research was located in the city of Ternate and conducted for two weeks in February 2023. The study's population consists of patients who had a COVID-19 diagnosis by RT-PCR or RDT-Ag in 2020–2022, and who were either born in or had lived in Ternate City. A population that satisfies the inclusion and exclusion criteria constitutes the sample for this investigation. Being diagnosed with COVID-19 by RT-PCR or RDT-Ag, receiving at least one dose of COVID-19 vaccination, being younger than 18 years old, agreeing to participate in the trial by signing an informed consent form, and being able to read and speak coherently were the inclusion criteria for the study. The exclusion category in this study was that the questionnaire was not filled in completely and the respondent was diagnosed with COVID-19 <4 weeks before filling out the questionnaire. Demographic factors, vaccination status (including time, doses, and time to administer vaccine) as well as comorbidities were collected from the participants using the questionnaire. The PASC is defined as any self-reported residual symptoms linked to COVID-19.

The sample size was estimated from a different proportion of patients having any residual symptoms that belong to PASC between fully vaccinated and non-fully vaccinated from one study in Indonesia (Herman, Wong, *et al.*, 2022). Assuming 5% type 1 error and the proportion of fully-vaccinated people who experienced PASC was 18.5% and unvaccinated people with PASC was 34.6%, power study 99% with one tail hypothesis and dropout response of 15%, the number of research subjects needed was 133 respondents, taken using the purposive sampling technique. Research subjects were taken by visiting patients' homes. The data

that has been obtained is processed using the SPSS 26.0 program with univariate and bivariate methods. Bivariate processing used chi-square analysis and Fisher's exact test. The implementation of this research has received approval from the Ternate City National and Political Unity Agency with number 070/864/BKBP/2022 and the University of Sebelas Maret Faculty of Medicine Research Ethics Commission with number 28/UN27.06.11/KEP/EC/2023.

## Result and Discussion

This study is a type of observational analytic study that was conducted in Ternate City in February 2023 with 133 respondents who met the inclusion and exclusion criteria. The research findings are shown in the table below based on the data collected and analyzed:

Table 1. Distribution of Respondents Based on Incidence

Distribution of respondents based on the incidence of PASC	Frequency	Percentage
PASC	91	68,4
Non PASC	42	31,6
Total	133	100%

Based on Table 1, the research subjects who experienced PASC were 91 (68.4%) people, and the research subjects who did not experience PASC were 42 (31.6%) people. These results are in line with research conducted in Indonesia, which stated that 66.5% of COVID-19 patients experienced PASC (Susanto *et al.*, 2022). Meanwhile, PASC is most commonly reported in Asia, with a prevalence of 49% (Chen *et al.*, 2021).

Table 2. Distribution of Respondent Characteristics

Respondent characteristics	PASC (n=91)		Non-PASC (n=42)		Total	P value
	F	%	F	%		
Age (years old)						
18-25	59	71,1%	24	28,9%	83	
26-35	17	70,8%	7	29,2%	24	
36-45	10	55,6%	8	44,4%	18	0,605*
46-55	5	62,5%	3	37,5%	8	
56-65	0	0%	0	0%	0	
>65	0	0%	0	0%	0	
Gender						
Female	60	71,4%	24	28,6%	84	0,433*
Male	31	63,3%	18	36,7%	49	
Pe Comorbid disease						
None	85	69,1%	38	30,9%	123	
Mental disorders	0	0%	0	0%	0	
Diabetes mellitus	0	0%	0	0%	0	
Hypertension	3	50%	3	50%	6	
Heart disease	0	0%	1	100%	1	
Kidney disease	1	100%	0	0%	1	0,570**
Autoimmune disease	0	0%	0	0%	0	
Tuberculosis	1	100%	0	0%	1	
COPD	0	0%	0	0%	0	
Cancer	0	0%	0	0%	0	
HIV/AIDS	0	0%	0	0%	0	
Asthma	1	100%	0	0%	1	
T Total Vaccine Dose						
Dose 1	5	55,6%	4	44,4%	9	0,111*
Dose 2	14	53,8%	12	46,2%	26	
Dose booster	72	73,5%	26	26,5%	98	

Respondent characteristics	PASC (n=91)		Non-PASC (n=42)		Total	P value
	F	%	F	%		
Type of first dose vaccine						
In-active	3	60%	2	40%	5	1.000**
Adenovirus vectors	0	0%	0	0%	0	
m-RNA	2	50%	2	50%	4	
Type of second dose vaccine						
In-active	11	50%	11	50%	22	0.732**
Adenovirus vectors	1	50%	1	50%	2	
m-RNA	2	100%	0	0%	2	
Type of booster dose vaccine						
In-active	7	53,8%	6	46,2%	13	0,434*
Adenovirus vectors	14	73,7%	5	26,3%	19	
m-RNA	39	59,1%	27	40,9%	66	

**Abbreviations:** \*, chi square; \*\*, fisher exact text

Based on Table 2, the age group of 18-25 years experienced the most PASC. The analysis between age and PASC incidence showed non-significant results, which indicates that there is no significant association between age and PASC incidence. This finding is consistent with a New York prospective cohort study that showed no association between age and symptoms after COVID-19 (Wisnivesky et al., 2022). The study data showed that females experienced more PASC than males. The analysis of gender and the incidence of PASC yielded non-significant results. This demonstrates that there is no apparent association between gender and the prevalence of PASC. This finding is in line with research in New York showing that there is no relationship between gender and symptoms after COVID-19 (Wisnivesky et al., 2022). In opposition, the findings of a study conducted at Milan's San Paolo Hospital suggest that women are three times more likely to develop PASC than men (Bai et al., 2022). This is thought to be related to the hormone estrogen, which can prolong the acute inflammatory phase even after recovery. In addition, it has been reported that women produce strong IgG antibodies early in the disease phase. This may result in a more favorable outcome, but may also prolong earlier disease manifestations (Bai et al., 2022; Rudroff et al., 2022).

Based on Table 2, the most common comorbid diseases owned by patients with PASC are kidney disease, tuberculosis, and asthma. The results of the analysis of comorbid diseases with the incidence of PASC showed

$p=0.729$  ( $p>0.05$ ). This means there is no meaningful association between comorbidities and the incidence of PASC. The findings of a retrospective study showed that comorbid diseases are one of the risk factors for PASC (Abdelwahab *et al.*, 2022). Different results were found because most of the respondents in this research were in the late adolescent age group. Therefore, the majority of PASC patients did not have comorbidities.

According to the results of Table 2, the total vaccine dose received by respondents was not significantly associated with the incidence of PASC. This finding was not linear with a local study showing that people with two-dose vaccination significantly reported lower post-COVID-19 chronic cough (adjusted Odds Ratio 0.244 95% CI OR 0.071-0.838) (Masrika *et al.*, 2023) However a cohort study done in Norway, demonstrated no appreciable difference in PASC presentation between those who had the vaccine and those who hadn't after 3 to 15 months of acute COVID-19 infection (Brunvoll *et al.*, 2022). According to the prospective Amsterdam cohort study, there isn't any conclusive proof that vaccination reduces the symptoms of PASC. This is supported by serological data demonstrating no difference between responders with and without PASC in baseline neutralizing antibody titers at three months after disease onset or in antibody decay at nine months after disease onset (Wynberg *et al.*, 2022). In addition, no research has been conducted to investigate the impact of booster vaccines on PASC (Notarte *et al.*, 2022).

Based on the vaccination's mechanism of action in the first, second, and booster doses, there is no statistically significant link between the incidence of PASC and the vaccine types given in Table 2. The observational cohort analysis revealed that, regardless of the vaccine type, there is little statistical support for a connection between immunization and PASC symptoms. These findings concur with observational studies conducted in the UK, which found that giving PASC patients the COVID-19 vaccine via mRNA or adenoviral vectors did not enhance their symptoms or quality of life (Arnold *et al.*, 2021). The uneven distribution of respondents' vaccine types may reduce the generalizability of the findings. One problem in recruiting respondents with different vaccine types is vaccine procurement in Indonesia, where some vaccines with different mechanisms of action were not widely available to the public during the recruitment period. In addition, the decline in cases in Indonesia hampered recruitment with different

vaccines (Herman, Viwattanakulvanid, *et al.*, 2022).

The symptoms that a significant number of respondents reported following an acute episode of COVID-19 were fatigue (57.2%), anosmia (52.8%), cough (50.5%), sore throat (45.1%), and fever (39.6%), according to the study findings in Table 3. Similar findings in India indicated that the most frequently reported symptoms were fever (64.9%), cough (45.4%), headache (18.3%), difficulty breathing (16%), olfactory dysfunction (12.9%), and taste dysfunction (12.3%) (Arjun *et al.*, 2022). Moreover, most neurological and psychiatric symptoms did not persist for more than 4 weeks, contrary to a previous study showing the presence of neuropsychiatric symptoms more than four weeks after COVID-19 (Herman, Bruni, *et al.*, 2022). There is strong evidence that many viral infections resolve months or even years after recovery from COVID-19 tiredness that develops a few weeks after an acute sickness. SARS-CoV, West Nile, Ebola,

Table 3. Distribution of Clinical Symptoms of PASC Based on Duration Experienced

Criteria	No Symptoms	Lasts up to 4 weeks from symptom onset or diagnosis	Persist >4-8 weeks from symptom onset or diagnosis	Persist >8-12 weeks from symptom onset or diagnosis	Persist >12 weeks from symptom onset or diagnosis	Total
Fatigue	39 (42,9%)	44 (48,4%)	3 (3,3%)	1 (1,1%)	4 (4,4%)	91
Fever	55 (60,4%)	33 (36,3%)	1 (1,1%)	0 (0%)	2 (2,2%)	91
Headache	57 (62,6%)	30 (33%)	0 (0%)	1 (1,1%)	3 (3,3%)	91
Vertigo	81 (89%)	10 (11%)	0 (0%)	0 (0%)	0 (0%)	91
Cough	45 (49,5%)	38 (41,8%)	6 (6,6%)	0 (0%)	2 (2,2%)	91
Sore throat	50 (54,9%)	38 (41,8%)	2 (2,2%)	0 (0%)	1 (1,1%)	91
Hoarseness	72 (79,1%)	18 (19,8%)	1 (1,1%)	0 (0%)	0 (0%)	91
Dyspnea	74 (81,3%)	15 (16,5%)	1 (1,1%)	0 (0%)	1 (1,1%)	91
Anosmia	43 (47,3%)	41 (45,1%)	3 (3,3%)	1 (1,1%)	3 (3,3%)	91
Runny nose	59 (64,8%)	28 (30,8%)	1 (1,1%)	0 (0%)	3 (3,3%)	91
Chest pain	81 (89%)	9 (9,9%)	1 (1,1%)	0 (0%)	0 (0%)	91
Muscle pain	57 (62,6%)	32 (35,2%)	1 (1,1%)	0 (0%)	1 (1,1%)	91
Abdominal pain	83 (91,2%)	8 (8,8%)	0 (0%)	0 (0%)	0 (0%)	91
Diarrhea	85 (93,4%)	5 (5,5%)	1 (1,1%)	0 (0%)	0 (0%)	91
Loss of consciousness	90 (98,9%)	1 (1,1%)	0 (0%)	0 (0%)	0 (0%)	91
Concentration disorder	77 (84,6%)	12 (13,2%)	1 (1,1%)	0 (0%)	1 (1,1%)	91
Depression	84 (92,3%)	7 (7,7%)	0 (0%)	0 (0%)	0 (0%)	91
Anxiety	75 (82,4%)	15 (16,5%)	0 (0%)	0 (0%)	1 (1,1%)	91
Others	84 (92,3%)	2 (2,2%)	1 (1,1%)	0 (0%)	4 (4,4%)	91

and influenza A (H1N1) virus outbreaks have all been linked to chronic fatigue in the past, particularly in people under the age of 30. This may be due to miscommunication in the pathways of inflammatory response, especially tissue cytokines (Shukla and Misra, 2022). The olfactory bulb is very important

in eliminating pathogens invading prone entry sites early and quickly. According to Imam *et al.* (2020), the post-viral olfactory impairment linked to COVID-19 is comparable to that linked to other viral infections such as metapneumovirus, parainfluenza, influenza, and rhinovirus (Imam *et al.*, 2020).

Table 4. The Relationship between the Timing of Vaccine Administration and the Incidence of Post Acute Sequelae of COVID-19

PASC occurrence	Time of vaccine administration#		Total	Significance
	Pre-COVID-19	Post-COVID-19		
PASC	15 (20,8%)	57 (79,2%)	72 (100%)	0,384**
Non-PASC	3 (11.5%)	23 (88.5%)	26 (100%)	
Total	18 (18,4%)	80 (81,6%)	98 (100%)	

**Abbreviations:** #, doses booster; \*\*, fisher exact test.

The results in Table 4 show that respondents who received boosters after COVID-19 experienced more PASC compared to respondents who received a booster vaccine before COVID-19. The time of administration of the booster vaccine had no significant association with the incidence of PASC. This study supports the findings of a literature analysis showing those who have received a vaccination before having a lower risk of developing PASC. This is based on two hypotheses. First, vaccinations might diminish the severity of an acute COVID-19 infection, reduce the chance of developing systemic illnesses, or hasten the development and duration of PASC symptoms. The second hypothesis is that the vaccine accelerates the elimination of residual SARS-CoV-2 virus in humans or reduces excessive inflammatory and/or immune responses related to PASC symptoms (Notarte *et al.*, 2022). A Japanese study showed that individuals who experienced worsening PASC symptoms after vaccination were individuals who experienced an increase in antibody titer rates, resulting in an excessive immune response to vaccination (Tsuchida *et al.*, 2022).

A study in France suggested that vaccination after COVID-19 infection reduced symptom severity at 120 days (Tran *et al.*, 2021). Other findings in Switzerland showed that the vaccine was associated with a reduced prevalence of PASC symptoms (Tran *et al.*, 2021). Other findings in Switzerland suggest that vaccination

is associated with a reduced prevalence of PASC symptoms (Nehme *et al.*, 2022). The hypothesis is the possible amelioration of immune or inflammation response dysregulation, or the possible removal of surviving viruses or SARS-CoV-2 viral remnants (Nehme *et al.*, 2022). The disparity in these results is probably caused by the fact that COVID-19 infection can result in the production of a large number of autoantibodies and that the effectiveness of COVID-19 vaccinations depends on the host's immunological response. By destroying the viral reservoir and resetting the immune system's response to the initial acute infection, the COVID-19 vaccine reduces PASC. The effect may vary depending on the host (Notarte *et al.*, 2022).

## Conclusion

Based on the results of the study, the researchers concluded that there was no significant link between vaccination and the occurrence of post-acute sequelae of COVID-19. However, a higher incidence of PASC was found in respondents who received a total dose of the vaccine up to a booster dose, the adenovirus vector vaccine type, and obtained the booster vaccine after being infected with COVID-19.

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## Smoking and Alcohol Consumption Behavior Among Male Senior High School Students

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### Abstract

Smoking and alcohol consumption behavior prevailed greater among adolescents' periods. This behavior could cause health risks. About 1 of every 4 adolescents in Indonesia were smokers and 3% of adolescents were drinking alcohol. This study aimed to analyze the association between self-efficacy with smoking and alcohol consumption among adolescents. This was a cross-sectional study carried out in July-September 2022. The study population was high school male students in Yogyakarta. A multistage random sampling technique was employed, involving 163 respondents. The instrument used was a questionnaire that has been tested. Data was analyzed in chi-square. Almost half of males had smoking behavior (39,3%). Males who were smoking started their behavior at the mean age of 15 years old. Most of them had low self-efficacy (70,6%). All male adolescents who had high self-efficacy do not have alcohol drink behavior. There was a relationship between self-efficacy with smoking behavior ( $p=0,001$ ) and alcohol consumption ( $p=0,004$ ). Strengthening self-efficacy is essential for adolescents. The government, family, and peers have an important role in increasing self-efficacy.

### Introduction

Adolescence was characterized by significant physical and psychosocial changes. Adolescents were at high risk of the threat of death, illness, and injury. In this phase, adolescents have certain behavior patterns related to diet, physical activity, tobacco use, alcohol use, drug use, and sexual activity that can protect or harm their health now and in the future (World Health Organization, 2021). In 2022, about 24% of Indonesia's total population is adolescents. The population of adolescents in Indonesia is 6.5 million (UNICEF (United Nations Children's Fund), 2021). Male senior high school students are at higher risk for accessing pornography rather than female students (Meilani, Setiyawati, and Barasa, 2020).

Tobacco use and alcohol use are risky behaviors related to reproductive health in adolescence. Tobacco use and alcohol use

behavioral patterns could cause health risks. Tobacco kills more than 8 million people each year. More than 7 million of those deaths are the result of direct smoking while around 1.2 million are the result of non-smokers being exposed to second-hand smoke (World Health Organization, 2022b). On the other hand, about 3 million deaths every year from the harmful use of alcohol. The number represents 5.3% of all deaths (World Health Organization, 2022a).

The analysis study in 2022 stated that Indonesia's Crude Mortality Rate (CDR) decline is slower than the world. Smoking is one of the leading causes of death among adolescents. Most smoking habits are carried out by males and only a small proportion of females (Satriawan, 2022). About 1 of every 4 adolescents in Indonesia were smokers, and the majority of them smoke every day (24%). Adolescent smokers were dominated by males (47.06%) (Statistik, 2022). In identifying

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alcohol use among Indonesian youth was found that 3% of them were drinking alcohol which is the psychoactive substance most used by adolescents. Even though, the use of alcohol causes a high burden of disease and has significant social and economic consequences (Kementerian Kesehatan RI, 2018).

Smoking and drunk behavior of classmates, parents, and siblings were related to smoking and alcohol-drinking behavior among adolescents. Smoking and drinking are contagious habits that are enabled by social norms that are established by family and peer groups. A strong positive association was also found between ever having smoked cigarettes and ever having tried alcohol ( $p < 0.001$ ) (Getachew *et al.*, 2019). The influence of friends was the most significant reason for initiating smoking and drinking behavior. Adolescents who have close friends drinking were more likely to drink in a year. Parents' ambivalent attitudes toward their child's drinking were the risk factor for unhealthy behavior (Hossain *et al.*, 2017; Chi *et al.*, 2022). Mental health variables such as anxiety, stress, loneliness, and depressive symptoms were the most common psychosocial risk factors for tobacco smoking and drinking. Smoking and alcohol drinking cause addiction. Adolescents' smoking behavior was associated with daily smoking in adulthood. Lifestyle factors which include smoking and alcohol drinking had a strong association with lifetime drunkenness (Dutra and Glantz, 2018; Asante and Quarshie, 2022).

Smoking and alcohol drinking are the leading causes of preventable disease, disability, and death among adolescents. Reducing current smoking rates is essential. Smoking is estimated to lead to premature death. A premature death from smoking is defined as a death from a smoking-related disease. Smokers who do not stop smoking lose an average of 10 years of life expectancy compared with never-smokers and they start to suffer diseases of old age around 10 years earlier than non-smokers (West, 2017). Prevention strategies that address the increases in alcohol consumption are also needed. Alcohol use has an impact on health and negative social effects (Miradj, 2020).

Smoking behavior was associated with

hypertension cases with a risk of 2.2 times. The toxic chemicals such as nicotine and carbon monoxide that are inhaled through cigarettes into the bloodstream can damage the endothelial lining of arteries, resulting in atherosclerosis and high blood pressure (Sutriyawan, Apriyani, and Miranda, 2021). Smoking caused various cancers that were reported as follows lung cancer, bladder cancer, mouth cancer, and stomach cancer (Adeniyi *et al.*, 2017). Smoking impairs immune function, resulting in an increased risk of chronic pulmonary disease, pulmonary infections, and rheumatoid arthritis. For maternal, smoke binds to hemoglobin, depriving the fetus of oxygen, ultimately resulting in low birth weight (Onor *et al.*, 2017).

Alcohol use was a major risk factor for communicable and non-communicable diseases, maternal, perinatal, and nutritional diseases, and injury deaths (Shield *et al.*, 2020). Alcohol consumption increases the risk of liver inflammation, cardiovascular disease, memory blackouts, hangovers, and certain cancers (White, 2020). Alcohol drinking is behavior that deviates from the norm. Alcohol abuse results in some forms of social problems such as fighting, juvenile delinquency, immoral acts of adolescents, and an increased risk of spousal divorce (Miradj, 2020).

One way to prevent adolescent smoking and alcohol drinking is by strengthening individual skills to reduce adolescents' likelihood of experimenting. An essential individual factor is self-efficacy. Self-efficacy in this study referred to the self-assessment belief of adolescents in facing the threat of reproductive health problems, which include magnitude, generalizability, and strength of belief (Bandura, 1977). Self-efficacy refers to adolescents' confidence in their ability to stay a non-smoker and refuse cigarettes (Hiemstra *et al.*, 2011). Lower self-efficacy was found in males who smoked and drank alcohol (Karatay and Baş, 2019). High self-efficacy influences adolescents to decrease unhealthy behavior (Mee, 2014). This study goal's was to analyze the association between self-efficacy with smoking and alcohol-drinking behavior among adolescents.

## Method

This study was a quantitative descriptive analytic study with a cross-sectional approach. This study was conducted in Yogyakarta in July-September 2022. The population in the study was high school students in Yogyakarta. A multistage random sampling technique was used to identify study subjects. The first stage was to choose the high school that will be used in the study. The second stage was to select respondents from each school. All of these stages use a random technique. The sample was 163 male adolescents from 5 senior high school XI in Yogyakarta.

Smoking behavior and drinking among male adolescents were the dependent variables. The independent variable tested was the male adolescents' self-efficacy. Self-efficacy was measured by 24-item questions consisting of 10-item regarding the magnitude, 7-item regarding generalizability, and 7-item for the strength of belief. The question's item of magnitude form is about adolescents' belief to face difficulties with reproductive health threats. Generalizability is adolescents' belief about the strength or ability to maintain reproductive health and avoid risky behavior. Strength of belief is about self-ability to improve health which includes improving the knowledge about reproductive health. High self-efficacy was categorized with an average score  $\geq 80$ .

Data were collected by questionnaires that have been tested. Data were analyzed by statistical testing software. The data were analyzed using the frequency distribution and the Chi-square test. Ethical approval for this study was e-KEPK/POLKESYO/0531/VI/2022 from the ethical committee Poltekkes Kemenkes Yogyakarta.

## Results and Discussion

This study showed that male adolescents who were smoking with a percentage of 39.3%. A previous study showed that smoking behaviors among males were higher than females ( $p$ -value=0.002). In male adolescents, high smoking behavior may occur because there is a belief that smoking makes young men look more attractive. Males were more likely than females to believe that parents found smoking acceptable (Chinwong *et al.*, 2018).

Males who were smoking started their behavior at the mean age of 15 years old. In identifying the number of cigars they used per day, the average number of cigarettes they used was 3 cigarettes. Meanwhile, the high number of cigarettes reached 12 cigarettes per day. A study in The United States by the year of 2019 showed that smoking behavior prevailed greater among 15-year-olds (Creamer *et al.*, 2020). Smoking parents and peers increased the inclination in adolescents aged 11 to 15 to smoke. The social environment can be separated into parents and peers which is the major factor in their taking up smoking. As the social learning theory suggests, young people observe and learn by watching the behaviors, and their consequences, of others with whom they live. The adolescents' decision to embark on a particular behavior depends on the exposure to norms, values, and behavioral attitudes of other humans with whom they interact (Scalici and Schulz, 2017). Table 1 explains smoking behavior among male adolescents.

Table 1. Smoking Behavior Among Male Adolescents

Variables	F	%
Smoking		
Yes	64	39.3
No	99	60.7
Minimum	10 years old	
Maximum	19 years old	
Number of cigarettes per day		
Minimum	1	
Maximum	12	
Mean	3.33	

This study also showed that male adolescents who drank alcohol with a percentage of 9.2%. Males and females experience unique neurobiological paths of development, and although there is debate regarding the specific nature of these differences, literature suggests that these differences in turn influence gender differences in psychiatric comorbidity and risk for binge drinking as a part of alcohol use. Males are more likely to endorse more permissive or pro-drinking norms (injunctive norms) and perceive higher prevalence rates of alcohol use compared to females (Dir *et al.*, 2017).

Males who have alcohol-drinking behavior started their behavior at the mean age of 16 years old. Adolescents start their risky behavior may influenced by the social environment around them. Social bonds with family and peers are the most important predictor of delinquency (Sanchagrin, Heimer, and Paik, 2017). The earlier age of starting drinking behavior may occur by the age of school. Adolescents who reported having more problems at school were more likely to engage in experience drunkenness. Here, school problems (e.g. problems with studying, problematic relationships with friends and/or teachers, bullying, etc.) proved to be the strongest contextual influence, especially for those who do not have a supporting system at home. More frequent meetings with friends, and a preference for going out to clubs, bars, or pubs, proved to be significant predictors to be particularly relevant in the context of adolescent alcohol use (Grevenstein, Nikendei and Nagy, 2020).

Table 2. Alcohol Consumption Among Male Adolescents

Variables	F	%
Alcohol consumption		
Yes	15	9.2
No	148	90.8
Minimum	15 years old	
Maximum	19 years old	
Mean	years old	

Table 3 showed that most male adolescents had low self-efficacy toward adolescents' smoking behavior. About 70.6% of them had low self-efficacy. The percentage of high self-efficacy in males was lower with several 29.4%. Low self-efficacy predicted smoking behavior among adolescents. Whereas, high self-efficacy significantly predicted avoidance of tobacco use behavior (Sabzmakan *et al.*, 2018). A strong association was found between smoking behavior among adolescents and risky dating behavior, and also between smoking behavior and alcohol use. This finding reflects an adolescent's lack of understanding about healthy living and the effects of unhealthy behavior. Self-efficacy

was the individual potential protective factor of doing risky behavior such as smoking and alcohol use. Smoking and drinking are associated with multiple risk behaviors among adolescents (Shaluhayah *et al.*, 2020).

Depression is a common mental health problem in adolescents. The consequences of depression include educational impairments, substance misuse, alcohol drinking, and cigarette smoking. Smoking and alcohol drinking are usually considered as a coping mechanism to alleviate adolescents' condition due to psychosocial problems. Adolescents should have high self-efficacy to avoid unhealthy behavior for all conditions. Self-efficacy helps to cope with stress (Shah *et al.*, 2020). Adolescents with depression who smoke report lower confidence in their ability to resist smoking. Strengthening self-efficacy is essential for adolescents (Weinberger *et al.*, 2017).

Table 3. Male Adolescents' Self-Efficacy

Variables	F	%
Self-efficacy		
Low	115	70.6
High	48	29.4
Total	163	100

The relationship between smoking behavior, alcohol-drinking behavior, and self-efficacy among male adolescents was tested at the bivariate analysis stage. The statistical test of the relationship was carried out with the Chi-square test. The statistical test results can be seen in Table 4 and Table 5. Male adolescents' self-efficacy was related to smoking behavior among males (p-value=0.001). Adolescents who had high self-efficacy have a higher percentage of do not have smoking behavior. A total of 81.3% of adolescents who had high self-efficacy have no smoking behavior. Only 18.8% of those who had high self-efficacy were in smoking behavior. On the other hand, almost half of the male adolescents who had low self-efficacy were in smoking behavior with a percentage of 47.8%.

This study also showed that there was a relationship between male adolescents' self-efficacy and drinking among males (p-value=0.004). All adolescents who had high self-efficacy do not have alcohol-drinking behavior. Most of the male adolescents who

Table 4. Smoking Behavior and Self-Efficacy Among Adolescents

Variables	Smoking				Total		P- value
	No		Yes		F	%	
	F	%	F	%			
Self-efficacy							
Low	60	52.2	55	47.8	115	100	0.001
High	39	81.3	9	18.8	48	100	
Total	99	60.7	64	39.3	163	100	

Table 5. Alcohol Consumption and Self-Efficacy Among Adolescents

Variables	Drunk				Total		P- value
	No		Yes		F	%	
	F	%	F	%			
Self-efficacy							
Low	100	87	15	13	115	100	0.004
High	48	100	0	0	48	100	
Total	148	90.8	64	39.3	163	100	

had low self-efficacy were in alcohol-drinking behavior with a percentage of 87%.

High self-efficacy decreases of initiation of cigarette smoking among adolescents (McKelvey *et al.*, 2015). Self-efficacy was also associated with quitting smoking in adolescents. The higher the self-efficacy, the intention to quit smoking is higher. Self-efficacy determines the amount of effort that is made by individuals to stay a nonsmoker or cessation of smoking even though there is a temptation to smoke (Panjaitan, Astuti, and Widanarti, 2020). Smokers were more likely to believe that it is difficult to quit smoking. Some studies showed that there was a difference between smokers and nonsmokers regarding their beliefs related to the easiness of quitting smoking. Smoker adolescents were three times more likely to hold the belief that it is difficult to quit smoking, compared to non-smokers (Alsubaie, 2020).

Self-efficacy is also established as a predictor of coping and not consuming alcohol. Higher levels of self-efficacy decrease alcohol consumption (Quiroga-Sánchez *et al.*, 2022). Self-efficacy is the individual factor that affects someone's behavior. Adolescents with high levels of self-efficacy were able to protect themselves from risky and unhealthy behavior. No barrier for adolescents who have a high level of self-efficacy to do healthy behavior every day and avoid alcohol drinking (Koerniawan, 2023).

Smoking causes addiction that can cause illness and premature death among adolescents. Nicotine exposure during adolescence may have long-term adverse consequences for brain development and could lead to nicotine dependence and initiation or sustained use of more harmful tobacco products (McCabe *et al.*, 2017). Most adolescents perceived that cigarette smoking was harmful and that passive smoking was dangerous to their health. Smoking affects the lungs, heart, and chest pain. On the other hand, the smokers' group brings the opinion that smoking has more beneficial effects compared to harmful effects. Smoking relieves any stressful circumstance or problem that may be passing through. The perception informed their choice to be a smoker (Gana *et al.*, 2018).

Hypertension is one of the non-communicable diseases which is significantly associated with smoking and alcohol drinking. Smoking caused earlier onset of adult hypertension. Cigarette smoking activates the sympathetic nervous system and oxidative stress associated with increased markers of inflammation leading to endothelial dysfunction, vascular injury, plague progression, and increased arterial stiffness leading to the development of hypertension (Pantell *et al.*, 2019; Roba *et al.*, 2019). Chronic Pulmonary Disease (COPD) and other pulmonary dysfunction were also associated with smoking behavior (Wheaton *et al.*, 2019). On the other

hand, alcohol has a similar effect to carbon monoxide which increases blood acidity. The blood becomes thicker, and the heart is forced to pump blood more strongly so that the blood reaches the tissues sufficiently. The process affects the increase in blood pressure (Rahardjo and Samudera, 2021).

Smoking and drinking have a negative impact on digestion. Both of them damage cells in the digestive system. Smoking increases gastric acid secretion which makes smokers suffer from gastritis to peptic ulcer. Nicotine damages bicarbonate acid which has to decrease gastric acid (Wahyudi, Kusuma, and Andinawati, 2018). Ethanol from alcohol damages gastric mucose which allows pepsin acid to diffuse back into the stomach tissue. This process causes inflammation as a cause of gastritis (Yulius Tiranda, 2021).

Tobacco harm reduction from tobacco use such as cigarette smoking is based on similar principles as harm reductive strategies for other drugs. The goals of tobacco harm reduction are to minimize the adverse health, social, and economic consequences of tobacco use without expecting complete abstinence. In the context of tobacco, a form of harm reduction that has become popularized recently is the use of e-cigarettes or 'vaping' devices which are collectively termed Electronic Nicotine Delivery Systems (ENDS) as a substitute for cigarette smoking. In terms of their harm potential, ENDS contain lower levels of harmful chemicals than cigarettes. However, toxicants such as formaldehyde and acrolein are present in some varieties of ENDS, and studies indicate that ENDS can cause inflammation in the lungs which could result in chronic, fatal conditions such as emphysema. ENDS are heavily marketed by the Tobacco Industry (TI) which is problematic for smokers as ENDS adverts can trigger cigarette cravings. Furthermore, marketing and information sources for ENDS are often misleading as they promote ENDS as a safe cessation option. Impartial safety information on ENDS is rarely communicated to smokers. The owners of vaping stores often get the 'facts' from industry sources, and end up promoting ENDS as safe and healthy. Reducing the use of ENDS could be done, for instance, by the government by restricting the supply

of ENDS. It can be done through a doctor or pharmacist, who is then trained to disclose up-to-date and unbiased information. With this approach, access to the most harmful varieties of ENDS such as those containing carcinogenic additives may be restricted (van der Eijk, 2016).

Reducing smoking behavior led to ongoing debates on whether a market for tobacco products should be permitted. Although some argue that the market for tobacco products should be permitted because of the needs of the industry, others maintain that tobacco products should be restricted as they are widespread and their use would have important public health impacts. Liberal theories consider freedom to be the pre-eminent principle of morality that policies should protect. Mill's liberal theory has been particularly influential, also in the public health context. Individual's actions should only be restricted if they are harmful to others. This causes the marketing of tobacco products to have an ethical dilemma (van der Eijk, 2016).

Family and peers have an important role in motivating adolescents in smoking cessation and avoiding risky behavior. The role of parents such as a Directly Observed Treatment (DOT) as a "buddy" or accompanying girls to consume iron tablets to reduce the incidence of anemia (Meilani and Setiyawati, 2023). Adolescents who knew the dangers of smoking from their families had as much as twice the desire to stop smoking behavior (Sari, Ayunin, and Setyowati, 2022). The peer education process about smoking was shown to increase student satisfaction, motivation, and learning to the desire to stop smoking. The strongest risk factor of adolescent smoking was peer influence. Peer education affects the smoking cessation behavior of the students positively (Bilgiç and Günay, 2018). Following the identifying social factors of alcohol use, self-efficacy and having social network support such as family and peers were recognized as protective factors of alcohol drinking. Family plays a key role in motivating people to recognize the need to change, providing support for change, and supporting long-term recovery from risky behavior (Sliedrecht *et al.*, 2019). Relationship to parents was a significant predictor of risky behavior among adolescents. Parental ambivalence of adolescents' smoking and alcohol use predicted

both of them. Parents are still able to modulate adolescent behavior and provide guidance based on a positive parent-child relationship. Peer group influence was also evident. Even though, some researchers have argued that family constitutes the most important influence on adolescent risky behavior and that parental monitoring is critical.

### Conclusion

Males who were smoking started their behavior at the mean age of 15 years old. About 39.3% of males had smoking behavior. The majority of them had low self-efficacy with a percentage of 70.6%. All male adolescents who had high self-efficacy do not have alcohol-drink behavior. Self-efficacy was associated with smoking behavior and drinking among adolescents. Self-efficacy refers to adolescents' confidence in their ability to stay a nonsmoker and to refuse cigarettes. Self-efficacy increased male adolescents' confidence in their ability to avoid smoking and alcohol drinking.

Self-efficacy is the individual factor that affects someone's behavior. Strengthening self-efficacy is essential for adolescents. The government, family, and peers have an essential role in increasing self-efficacy that can reduce smoking behavior and drinking. The integration of providing healthy lifestyle information is needed to prevent risky behavior among adolescents. Our findings can become reference material for the development and improvement of future research.

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## Nutritional Literacy as An Effect Modifier on Undernutrition Incidence among Poor Urban Family in Semarang City

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### Abstract

Poverty is the root cause of malnutrition. The Gunung Brintik area, Randusari Village, Semarang City is a pocket of poverty in the center of Semarang City with a poor population of 28.48% and a prevalence of undernutrition of 60%. This study was conducted to analyze the risk factors for undernutrition and analyze maternal nutritional literacy as a modifying effect of undernutrition events in toddlers. The study was conducted with a cross-sectional design involving 97 toddlers in the Mount Brintik RW III and IV areas of Randusari Village, Semarang City. The results showed that 12 variables had associations with the incidence of malnutrition in toddlers, namely gender, history of IMD, history of immunization, history of infectious diseases, energy intake, protein intake, fat intake, carbohydrate intake, maternal education, father's education, family opinions, and nutritional literacy. The results of the multivariate analysis showed an interaction between family income and nutritional literacy as an interaction variable (p-value: 0.044). OR adjusted family income and nutritional literacy to the incidence of undernutrition obtained OR = 2.37 (1.07-9.38). Families that are economically able but have less nutritional literacy are 2.37 times more likely to have under-five children who are undernourished than families that are economically capable and have good nutritional literacy.

### Introduction

Poverty and undernutrition are the main agenda of national development and are targets of the Sustainable Development Goals (SDGs) (UN, 2023). The problem of poverty and undernutrition is a population problem, especially in developing countries. Poverty is at the root of the problem of undernutrition. The impact of undernutrition in the long term is the decline in the quality of human resources (Kassie & Workie, 2020). Therefore, overcoming the problem of poverty and undernutrition needs to be done comprehensively.

Gradually from year to year, Indonesia has been able to reduce the prevalence of malnourished toddlers. During the period 2016 to 2019, Indonesia was able to reduce the prevalence of malnutrition in toddlers from

17.83% to 16.29%. Based on the results of the Indonesian Nutritional Status Study (SSGI), stunting prevalence also shows a downward trend, from 24.4% in 2021 to 21.6% in 2022. The decline in the prevalence of malnutrition and stunting achieved by the Indonesian nation shows a positive trend, but the decline is not following the SDGs target. The stunting prevalence target is 14% by 2024. Therefore, Indonesia has the challenge of reducing stunting by 10.4% in the next three years (Ministry of Health, 2022).

The challenge of efforts to reduce the problem of undernutrition and stunting is not only the responsibility of the central government. Provincial and district/city governments must also take responsibility for reducing stunting. Central Java Province

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has shown a significant downward trend in stunting, from 27.68% in 2019 to 20.9% in 2021. Semarang City also showed a positive stunting reduction trend, from 26.01% in 2019 to 21.3% in 2021. However, the reduction in stunting at the provincial level of Central Java and Semarang City still has not reached the SDGs target of 10.4% (Ministry of Health, 2022).

Reducing stunting is not only the responsibility of the government but also the responsibility of all elements of society. Research has proven that poverty is at the root of the problem of undernutrition (Panda *et al.*, 2020; Rahman *et al.*, 2021; Siddiqui *et al.*, 2020). This means that efforts to reduce stunting must focus on alleviating and empowering poor families. Socioculturally, poor families in rural areas still have better access to food than poor urban families. Social care in rural communities is a social capital that supports poor families to access food from the surrounding environment. This is often not owned by poor families in urban areas (Rochmayani, 2018; Sabale *et al.*, 2021).

Undernourished risk factors consist of direct causes, namely low nutrient intake and the incidence of infectious diseases (Fitzpatrick *et al.*, 2019). Indirect causes, namely nutritional parenting, household food availability, maternal education, and nutritional literacy (Tekile *et al.*, 2019). Mount Brintik is one of the pockets of poverty in the Randusari Village area of Semarang City. Most residents in the Mount Brintik area are stigmatized related to their work as beggars on the streets. Based on monograph data from Randusari Village, the community of Gunung Brintik residents live in RW 3 and RW 4 with 653 families. Based on the integrated database, 28.48% of families in Gunung Brintik are categorized as poor families. A preliminary study conducted at posyandu RW 04 on March 12, 2021, showed a fairly high prevalence of undernutrition. As many as 21 out of 35 (60%) toddlers fall into the category of malnutrition status.

The government has made various efforts to overcome malnutrition. Poverty alleviation and assistance for poor families is one of the sensitive efforts made by the government to support the reduction of malnutrition problems (Sabale *et al.*, 2021). Nutrition education also

continues to be carried out to improve the nutritional literacy of the community, especially in the target of mothers under five. Good nutritional literacy is a capital for accelerating the reduction of malnutrition problems. Mothers with good nutritional literacy have a higher chance of finding solutions to fulfilling the nutrition of their toddlers. This study was conducted to find evidence that nutritional literacy is a very important modifier. This evidence can then be used as a basis for the development of undernutrition reduction programs, especially in the urban poor.

### Method

This research is quantitative research with a cross-sectional design. The study population was toddlers in the Gunung Brintik area, Randusari Village, Semarang City. The Mount Brintik area covers 2 RW areas, namely RW III and IV in Randusari Village, Semarang City. This population was chosen because of its existence in the center of Semarang City, Central Java Province, with the background of almost 30% of the population included in the category of poor villages. Samples were taken from all toddlers living in the Mount Brintik area, Semarang City, with as many as 97 respondents. Data collection will be carried out for 2 weeks in June 2023. Informed consent was obtained from all research subjects, namely by mothers of toddlers. The research has received an ethical clearance assessment from the Health Research Ethics Commission of Semarang State University, with registration number 042/KEPK/EC/2023.

Data on the nutritional status of toddlers are taken from the results of anthropometric measurements carried out in Posyandu activities in June 2023 at the research site. Determination of nutritional status is carried out using the weight index according to age. Interviews were conducted with respondents of mothers under five to obtain data on early breastfeeding initiation history, exclusive breastfeeding history, immune history, history of infectious diseases, energy, and nutritional intake, maternal education, mother's employment status, father's education, status of social assistance recipients, family income, number of families, and nutritional literacy.

The nutritional literacy instrument in this instrument covers 3 domains, namely: Functional nutrition literacy (FNL), Interactive nutrition literacy (INL), and Critical nutrition literacy (CNL). FNL domains include themes about the capability to understand nutritional terms and the capability to understand the nutritional message conveyed. INL domains include themes about capabilities to access nutritional information and motivation, and self-belief to do things based on the advice received. CNL domains include themes about the capability to sort out true and false nutritional information and the capability to promote healthy eating in other people. These instruments have been tested for validity and reliability. There are a total of 21 nutritional literacy question items, all of which are valid with grades Cronbach's alpha FNL= 0.73, INL= 0.70, and CNL= 0.71 (Dewi *et al.*, 2023). Data were processed and analyzed univariately, bivariately, and multivariately. The univariate analysis uses frequency distribution analysis, the bivariate analysis uses the chi-square test, and while multivariate analysis uses multiple logistic regression analysis.

### Result And Discussion

Mount Brintik as a research location is part of Randusari Village, South Semarang District, Semarang City. Randusari Village consists of 6 RW (Neighbourhood) areas, where Mount Brintik is located in RW 3 and 4. Gunung Brintik has 653 households, of which 28.48% are categorized as poor families. This region has characteristics as an enclave of urban poverty. This is because the research location is only about 2 km from the Semarang mayor's office. Geographically, the research location is on a hill adjacent to the cemetery complex. Poverty and limited housing land cause many people of Gunung Brintik to live in the middle of the cemetery area.

The distribution of respondent characteristics in this study is shown in Table 1. Based on Table 1, it is known that the number of respondents who have undernourished status is 34 (35.1%) respondents. Meanwhile, the number of respondents who had normal nutritional status was 63 (64.9%) respondents. When viewed from the distribution of gender,

male respondents have a higher percentage, namely 51.5%, compared to women with a percentage of 48.5%. Furthermore, for the mother's last level of education, it is known that 53.6% of mothers have taken higher education, namely graduating from high school and college (S1, S2, and S3).

Table 1. Distribution of Respondent Characteristics

Variable	Freq.	Pct. (%)
Nutritional status		
Less	34	35,1
Normal	63	64,9
Gender		
Man	50	51,5
Woman	47	48,5
IMD History		
No	52	53,6
Yes	45	46,4
History of exclusive breastfeeding		
No	41	42,3
Yes	56	57,7
Immunization history		
Incomplete	31	32,0
Complete	66	68,0
History of infectious diseases		
Yes	31	32,0
No	66	68,0
Energy intake		
Less	26	26,8
Enough	40	41,2
More	31	32,0
Protein intake		
Less	29	29,9
Enough	34	35,1
More	34	35,1
Fat intake		
Less	26	26,8
Enough	34	35,1
More	37	38,1
Carbohydrate intake		
Less	28	28,9
Enough	43	44,3
More	26	26,8
Mother's education		
Low	45	46,4
High	52	53,6
Mother's employment status		
Work	40	41,2
Housewives	57	58,8

Variable	Freq.	Pct. (%)
Father's education		
Low	45	46,4
High	52	53,6
Social aid beneficiary status		
Yes	48	49,5
No	49	50,5
Family income		
Less	33	34,0
High	64	66,0
Number of family members		
> 4	48	49,5
≤ 4	49	50,5
Nutritional literacy		
Bad	30	30,9
Good	67	69,1

Source: Primary Data, 2023

Similar to the last level of education of fathers, it is known that 53.6% of fathers have also taken higher education, namely graduating from high school and college (S1, S2, and S3). Then, for the employment status of mothers, as many as 41.2% of working mothers and 58.8% of mothers as housewives. Furthermore, families who received social assistance (social aid) and did not receive social assistance also had a balanced proportion, namely 49.5% of families receiving social assistance and 50.5% of families not receiving social assistance. Then, family income is categorized based on Semarang City MSEs, which is IDR 2,800,000. Families who have an income less than equal to Rp 2,800,000 are as much as 34%. While families who have an income of more than Rp 2,800,000 are 66%. Furthermore, judging from the number of family members, families with more than 4 members are 49.5% and those less than equal to 4 are 50.5%. Then, the nutritional literacy variable consists of good and bad literacy categories. The number of respondents who had good literacy was 30.9% and respondents with poor literacy was 69.1%.

The bivariate analysis in this study is shown in Table 2. Based on statistical tests using the Chi-Square test, it is known that 12 variables have associations with the incidence of malnutrition in toddlers, namely 1) gender, 2) history of IMD, 3) history of immunization, 4) history of infectious diseases, 5) energy intake, 6) protein intake, 7) fat intake, 8)

carbohydrate intake, 9) maternal education, 10) father's education, 11) family opinion, and 12) nutritional literacy. The sex variable was statistically shown to have an association with the incidence of undernutrition indicated by a p-value of less than 0.05. The indicator of strength of the relationship used is PR, the sex variable has a PR of 2.61 (IK 95% 1.36-4.99). That is, toddlers of the male sex have a risk of 2.61 times more to experience undernutrition than women. This is in line with previous research which states that sex variables are proven to have an association with the incidence of undernutrition, where male toddlers have more risk of experiencing less nutrition than women (Dabar *et al.*, 2020; Jeyakumar *et al.*, 2019). Other studies have also found that boys are 1.9 and 1.8 times more likely to be stunted and underweight than girls. This can partly be explained since boys are more prone to health disparities than girls in the same age group. (Gebre *et al.*, 2019).

The IMD history variable was statistically proven to have an association with the incidence of undernutrition in toddlers. This is evidenced by a p-value of less than 0.05. The indicator of relationship strength used is PR where this variable has a PR of 2.08 (IK 95% 1.12-3.86). That is, toddlers who did not have IMD at birth had a risk of 2.08 times to experience undernutrition than toddlers who succeeded in IMD. This is in line with research that proves that early initiation of breastfeeding is a significant factor and estimates the likelihood of wasting (Satapathy *et al.*, 2021). Studies conducted in Indonesia show that the higher the practice of early initiation of breastfeeding, the lower the malnutrition rate in a province (Laksono & Chalidyanto, 2021). A baby is said to have early initiation of breastfeeding if he has been breastfed within an hour of his birth. The breast milk consumed by newborns during the first few days – called colostrum – is very rich in nutrients and antibodies and acts as the child's first 'vaccine', providing important protection against illness and death. (Laksono & Chalidyanto, 2021).

Immunization history variables are statistically proven to have an association with the incidence of undernutrition in toddlers. This is evidenced by a p-value of less than

0.05. The indicator of relationship strength used is PR, where this variable has a PR of 2.39 (IK 95% 1.42-4.03). That is, toddlers with a history of incomplete immunization have a risk of 2.39 times to experience malnutrition than toddlers with a history of complete immunization. This is also in line with previous research that explains that not getting fully immunized is a risk factor for undernutrition (Maidelwita, 2019). Toddlers who are not fully immunized for their age are more likely to be acutely malnourished than other children (Tut & Tsegaye, 2020). Immunization of children aims to reduce the risk of morbidity (pain) and mortality (death) in children. Immunization status is also an indicator of contact with health services, meaning that complete immunization status will improve new nutritional problems, so immunization status is also expected to have a positive effect on long-term nutritional status. (Fitzpatrick *et al.*, 2019).

The variable history of infectious diseases has a PR value of 2.44 (IK 95% 0.98-6.05). That is, toddlers with a history of infectious diseases have a risk of 2.44 times to experience malnutrition than toddlers who do not have a history of infectious diseases. Previous research also explained that toddlers with a history of infectious diseases have a 2.81 times higher risk of experiencing malnutrition than toddlers without a history of infectious diseases (May Kim *et al.*, 2022). Toddlers with a history of the disease generally have symptoms of illness that can affect the reduction of the average protein absorbed by toddlers. The average protein lost when a child has an infection can reach about 0.6-1.2 grams per kilogram per day (Fitzpatrick *et al.*, 2019). In addition, infectious diseases will also generally cause toddlers to experience a significant decrease in appetite which also has an impact on toddler weight loss (Handu *et al.*, 2021). Then, the healing process against infectious diseases can also absorb proteins that should be used as material for child growth (Calder & Yaqoob, 2020; Fitzpatrick *et al.*, 2019).

Variables that also have associations with the incidence of undernutrition in toddlers are energy intake, protein, fat, and carbohydrates. The four variables had PR values, for less than more categories, respectively 4.47 (IK 95% 1.69-

11.82), 3.52 (IK 95% 1.61-7.67), 3.25 (IK 95% 1.56-6.77), and 2.60 (IK 95% 1.09-6.21). That is, toddlers with less intake of energy, protein, fat, and carbohydrates had a sequential risk of 4.47; 3,52; 3,25; and 2.60 times for malnutrition than toddlers with more energy, protein, fat, and carbohydrate intake. Previous research explained that toddlers with less energy intake do affect the not optimal brain development which results in the inhibition of cognitive development. This is because when energy consumption is less, the body will meet its needs by using energy reserves such as muscle and fat to continue metabolism, resulting in toddlers losing weight and becoming thinner than their peers (Dipasquale *et al.*, 2020; Ozer *et al.*, 2022). Intake of energy, protein, fat, and carbohydrates are factors that are directly related to the nutritional status of toddlers. In addition to having a direct impact on weight loss, lack of intake of these substances can also make toddlers easily infected with disease-causing pathogens (David *et al.*, 2020; Kamil *et al.*, 2021; Nakahara *et al.*, 2021).

The maternal education variable has a PR value of 2.77 (IK 95% 1.49-5.16). That is, mothers of toddlers with low last education levels (not in school, graduating from elementary school, and graduating from junior high school) have a risk of 2.77 of having toddlers with less nutrition than mothers of toddlers with high last education levels (graduated from high school and college). Previous research explained that the level of education of mothers can affect parenting and the quality and quantity of intake given to toddlers (Berhe *et al.*, 2019; Verma & Prasad, 2021). Mothers with a higher level of education are generally more literate about information related to nutrition in children (Gagebo *et al.*, 2020). So, they provide intake according to the nutritional needs of their children. In addition, mothers with a higher level of education are considered more concerned about the availability of health facilities as the main reference when experiencing health problems (Ekholuenetale *et al.*, 2020; Murarkar *et al.*, 2020).

In addition to maternal education factors, the incidence of malnutrition in toddlers is also influenced by the father's education level. Based on the results of the analysis, it was found that

the PR value for the father's education variable was 2.77 (IK 95% 1.49-5.16). That is, fathers of toddlers with low last education levels (not in school, graduating from elementary school, and graduating from junior high school) have a 2.77 risk of having toddlers with less nutrition than fathers of toddlers with high last education levels (graduated from high school and college). These results are in line with previous research that states that fathers' education levels also have an association with the incidence of undernutrition (Chowdhury *et al.*, 2021; Dabar *et al.*, 2020). This is because the father as the head of the family can determine attitudes to regulate food intake preferences and health services used in the family. If the father as the head of this family has a high education and cares about the growth and development of his children, it can affect the level of family health, especially children (Karkappanavar *et al.*, 2020).

Furthermore, a variable that also has an association with the incidence of undernutrition in toddlers is family income. The results of the analysis showed a PR value for this variable of 5.39 (IK 95% 2.85-10.17). That is, families with less income than MSEs in Semarang City have a risk of 5.39 times having undernourished toddlers than families with more income than MSEs in Semarang City. Previous research has

also explained that family income levels are associated with the incidence of undernutrition (Kassie & Workie, 2020; Tekile *et al.*, 2019). This can happen because families who have high-income levels tend to be able to meet nutritious food intake for the family, especially their children (Boah *et al.*, 2019; Sultana *et al.*, 2019). In addition, families with high incomes can also more easily access health services (Workie & Tesfaw, 2021).

The last variable that has an association with the incidence of undernutrition in toddlers is nutritional literacy. This variable has a PR value of 3.61 (2.10-6.19). That is, families with poor nutritional literacy have a 3.61 times higher risk of having undernourished toddlers than families with good nutritional literacy. Previous research also explained that good nutritional literacy levels are a protective factor against undernutrition events in toddlers (Hoteit *et al.*, 2022). This is because families with a good level of literacy about nutrition are considered to have a higher awareness of the importance of nutritious food intake and good parenting for children to prevent malnutrition (Fagbamigbe *et al.*, 2020; Kumeh *et al.*, 2020). In addition, good literacy about nutrition also allows families to realize early when children experience symptoms of malnutrition so that it can be treated earlier (Lindberg *et al.*, 2022).

Table 2. Bivariate Analysis

Variable	Undernutrition n (%)	Normal nutrition, n (%)	PR (IK 95%)	P value
Gender				
Man	25 (50,0)	25 (50,0)	2,61 (1,36-4,99)	0,001*
Woman	9 (19,1)	38 (80,9)		
IMD History				
No	24 (46,2)	28 (53,8)	2,08 (1,12-3,86)	0,014*
Yes	10 (22,2)	35 (77,8)		
History of exclusive breastfeeding				
No	18 (43,9)	23 (56,1)	1,54 (0,89-2,64)	0,178
Yes	16 (28,6)	40 (71,4)		
Immunization history				
Incomplete	18 (58,1)	13 (41,9)	2,39 (1,42-4,03)	0,001*
Complete	16 (24,2)	50 (75,8)		
History of infectious diseases				
Exist	18 (58,1)	13 (41,9)	2,44 (0,98-6,05)	0,002*
No	16 (24,2)	50 (75,8)		
Energy intake				
Less	15 (57,7)	11 (42,3)	4,47 (1,69-11,82)	<0.001*
Enough	15 (37,5)	25 (62,5)	2,91 (1,07-7,89)	0,04*
More	4 (12,9)	27 (87,1)		



Variable	Undernutrition n (%)	Normal nutrition, n (%)	PR (IK 95%)	P value
Protein intake				
Less	18 (62,1)	11 (37,9)	3,52 (1,61-7,67)	<0.001*
Enough	10 (29,4)	24 (70,6)	1,67 (0,68-4,07)	0,39
More	6 (17,6)	28 (82,4)		
Fat intake				
Less	16 (61,5)	10 (38,5)	3,25 (1,56-6,77)	<0.001*
Enough	11 (32,4)	23 (67,6)	1,71 (0,75-3,90)	0,31
More	7 (18,9)	30 (81,1)		
Carbohydrate intake				
Less	14 (50)	14 (50)	2,60 (1,09-6,21)	0,037*
Enough	15 (34,9)	28 (65,1)	1,81 (0,75-4,41)	0,26
More	5 (19,2)	21 (80,8)		
Mother's education				
Low	24 (53,3)	21 (46,7)	2,77 (1,49-5,16)	<0.001*
High	10 (19,2)	42 (80,8)		
Mother's employment status				
Work	14 (35)	26 (65)	0,99 (0,58-1,73)	0,993
Housewives	20 (35,1)	37 (64,9)		
Father's education				
Low	24 (53,3)	21 (46,7)	2,77 (1,49-5,16)	<0.001*
High	10 (19,2)	42 (80,8)		
Social aid beneficiary status				
Yes	17 (35,4)	31 (64,6)	1,02 (0,59-1,76)	0,941
No	17 (34,7)	32 (65,3)		
Family income				
Less	25 (75,8)	8 (24,2)	5,39 (2,85-10,17)	<0.001*
High	9 (14,1)	55 (85,9)		
Number of family members				
> 4	17 (35,4)	31 (64,6)	1,02 (0,59-1,76)	0,941
≤ 4	17 (34,7)	32 (65,3)		
Nutritional literacy				
Bad	21 (70)	9 (30)	3,61 (2,10-6,19)	<0.001*
Good	13 (19,4)	54 (80,6)		

Furthermore, the data analysis carried out is an interaction test. This test was conducted to determine the modification of the effect of nutritional literacy variables and family income variables on the incidence of undernutrition in urban poor families. Previous studies have explained that the incidence of undernutrition is strongly influenced by family income (Akombi *et al.*, 2019; Kassie & Workie, 2020). Therefore, this interaction test was conducted to prove whether economically capable families and having good nutritional literacy contribute to a reduced risk of undernutrition events. Conversely, economically capable families, but have less nutritional literacy are associated with an increased risk of malnutrition events.

After an interaction analysis with

multiple logistic regression tests in Table 3, there was an interaction between family income and nutritional literacy as an interaction variable (p-value: 0.044). It can be concluded that there is an interaction between family income and nutritional literacy in estimating the incidence of undernutrition in urban poor families. Table 3 shows the overall OR value of family income to the incidence of undernutrition, amounting to 101.91 (4.84-2147.49). However, because there is an interaction with nutritional literacy, the overall OR does not reflect the adjusted OR value of family income variables. This is because the OR value of family income has not considered nutritional literacy as an interaction variable. Therefore, to show the modification of the effect of risk factors of low-income families

Table 3. Multivariate Analysis and Interaction Test

Variable	Beta	S.E.	Wald	OR (IK 95%)	P value
IMD History	2,32	1,20	3,73	10,19 (0,97-107,52)	0,053
Immunization history	2,06	0,99	4,33	7,86 (1,13-54,79)	0,037
Energy intake (less vs more)	2,76	1,28	4,64	15,84 (1,28-195,59)	0,031
Energy intake (enough vs more)	2,64	1,23	4,58	13,94 (1,28-155,73)	0,032
Fat intake (less vs more)	1,84	1,08	2,91	6,28 (0,76-51,93)	0,088
Fat intake (enough vs more)	-1,48	1,31	1,27	0,23 (0,02-2,98)	0,259
Carbohydrate intake (less vs more)	2,59	1,38	3,51	13,35 (0,88-200,75)	0,061
Carbohydrate intake (enough vs more)	0,65	1,08	0,36	1,91 (0,23-15,76)	0,549
Mother's education	-1,84	0,93	3,94	0,16 (0,03-0,98)	0,047
Family income	4,62	1,56	8,84	101,91 (4,84-2147,49)	0,003
Nutritional literacy	4,70	1,51	9,77	110,73 (5,79-2119,07)	0,002
Family income*Nutritional literacy	-4,00	1,99	4,06	0,02 (0,00-0,89)	0,044

on the chances of malnutrition, the calculation of the OR adjusted value of family income needs to consider nutritional literacy as an interaction variable.

The results of calculating the OR adjusted value of the family by taking into account the nutritional literacy variable were obtained that the OR adjusted was 0.25 (0.03-2.41). This means that family income in respondents who have good nutritional literacy is not a significant deterrent factor to the incidence of undernutrition because it is not statistically related. Furthermore, the OR adjusted value of family income in respondents who have malnourished literacy is 2.37 (1.07-9.38). This means that family income in respondents who have malnutrition literacy is a risk factor that increases the chances of malnutrition in the family. In other words, families that are economically able, but have less nutritional literacy contribute to an increased risk of having undernourished children than families that are economically capable and have good nutritional literacy. Thus, the risk effect of undernourished family income on the incidence of malnutrition is modified by nutritional literacy as an effect modifier.

**Conclusion**

This study concludes that 12 variables have an association with the incidence of malnutrition in toddlers, namely: gender, history of IMD, history of immunization, history of infectious diseases, energy intake, protein intake, fat intake, carbohydrate intake, maternal education, father's education,

family income, and nutritional literacy. The nutritional literacy variable was shown to be a modification of the effect on the family income variable. Economically able families, who had poor nutritional literacy contributed to an increased risk of having children who were undernourished than families who were economically capable and had good nutritional literacy. Thus, the risk effect of undernourished family income on the incidence of malnutrition is modified by nutritional literacy as an effect modifier.

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