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Editorial Team

Editorial Address
Piet A.Tallo Street, Liliba-Kupang, East Nusa Tenggara, Indonesia
Phone/fax: (0380) 8800256
Email: jurnalinfokesehatan@gmail.com
Website: http://jurnal.poltekeskupang.ac.id/index.php/infokes

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TABLE OF CONTENTS

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a) Contain conclusions and recommendations.
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RESEARCH **Open Access**

Toddler Growth in the Working Area of Kuok Public Health Center, Kampar Regency

Erlinawati[1a*], Apriza[2b], Joria Parmin[1c]

[1] Department of Midwifery, Faculty of Health Sciences, Universitas Pahlawan Tuanku Tambusai, Kampar, Riau, Indonesia
[2] Department of Nursing, Faculty of Health Sciences, Universitas Pahlawan Tuanku Tambusai, Kampar, Riau, Indonesia

[a] Email address: erlinawatilubis4@gmail.com
[b] Email address: suksesspenting@gmail.com
[c] Email address: joriaparmin@gmail.com

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Abstract

Toddler Growth in the Working Area of Kuok Public Health Center, Kampar Regency. The first five years of a child's life are critical for growth and development because these years assist in generating the adult they will become. Data from WHO discovered that in developing countries, almost 45% of children under five suffer from growth and development disorders. Data from Kuok Public Health Center also demonstrated that in the last three years, there was an increase in the cases of malnutrition were 27 toddlers in 2018. Meanwhile, the were 32 cases in 2019 and 44 in 2020. This study aims to examine factors associated with toddler growth in the working area of Kuok Public Health Center, Kampar Regency. It was a cross-sectional study conducted in the working area of Kuok Public Health Center, Kampar regency, Riau Province. It was performed in January 2021. The samples are 60 toddlers aged 12-60 months with a growth chart. They were selected to be the sample of the study through consecutive sampling. A Chi-square test was administered to evaluate the bivariable. Bivariable analysis displayed a relationship among nutritional status (p-value 0.003, OR 8.321), parenting (p-value 0.003, OR 7.342), exclusive breastfeeding (p-value 0.002, OR 9.201), and parental income (p-value 0.031, OR 4.486) with the growth in toddler. In conclusion, the relationship among nutritional status, parenting, exclusive breastfeeding, and parental income with toddler growth was revealed.

Keywords: Toddler, Growth, Factors Associated.

Corresponding Author:

Erlinawati
Department of Midwifery, Faculty of Health Sciences, Universitas Pahlawan Tuanku Tambusai, Kampar, Riau, Indonesia.
Email: erlinawatilubis4@gmail.com

1. INTRODUCTION

The objective of health development is to escalate awareness and implement healthy living behavior in the community to formulate quality health degrees as an investment for human resource development, one of which is to realize this starting from the necessity for special attention to the period of growth and development of toddlers (Arfan et al., 2021). Growth is a physiological change that occurs as a result of the normal maturation of physical functions in children and healthy people over time. Growth is merely temporary and lasts until people are physically mature. If the body's growth threshold has surpassed the point of maturity, it signifies that the person will not grow larger or taller (Musthofa, 2022).

The infant growth period is critical for development because these years assist in generating the adult they will become (Yunita et al., 2020). The growth and development of a toddler's brain during this period influence the inability to perform intellectual tasks that should be completed if normal development is not disrupted by damage to brain development due to malnutrition (Setiawati et al., 2020).

In 2015, the numbers of cases of growth disorders by toddlers were still high (27.5%) or around 3 million toddler experienced growth and development disorders (UNICEF, 2015). The World Health Organization (WHO) revealed that almost 45% of toddlers in developing countries experience disorders and delays in growth and motor development (WHO, 2015).

Data from Basic Health Research in 2018 reported that in Indonesia, the percentage of severely underweight toddlers was 3.9%, while the percentage of underweight was 13.8% (Kementerian Kesehatan Republik Indonesia, 2018). In 2020, the nutritional surveillance for two-year-old infants were discovered to be 58.425 (1.3%), two-year-old infants with very low body weight, and as many as 248.407 (5.4%) two-year-old infants with underweight. The province with the highest percentage of malnutrition in two-year-olds is East Nusa Tenggara, while the lowest is Bali (Kementerian Kesehatan Republik Indonesia, 2021).

Data from Riau Province Health Profile uncovered that the nutritional status of the toddler with weight index presented an escalating trend in 2017 by 6.9%. In 2018, it escalated to 10.7%, while the nutritional status of children in 2017 by 3.3%, and in 2018, it exceeded 3.5% (Dinas Kesehatan Provinsi Riau, 2018). Data from Kuok Public Health Center unveiled that malnutrition cases increased in the last three years. In 2018, there were 27 toddlers, and as many as 32 toddlers in 2019, and in 2020 increased to 44 toddlers suffering from malnutrition (Dinas Kesehatan Kabupaten Kampar, 2020).

Several factors associated with toddler growth disorders are nutritional intake, nutritional status, early stimulation, parenting, and exclusive breastfeeding. Nutritional status, parenting patterns, and exclusive breastfeeding are the major influential factors in the growth disorders of the toddler. Riau Province Health Profile data revealed that toddlers experience growth and development delays. One of the primary factors is nutrition, which is 18.83% of toddlers (Dinas Kesehatan Provinsi Riau, 2018).

The growth and development of toddlers are significantly affected by nutritional status. Poor dietary quality could significantly inhibit physical, mental, and thinking abilities, ultimately diminishing toddlers' working abilities in performing their activities (Setiawati, Yani and Rachmawati, 2020). The study conducted by Solecah & Fitriahadi's in 2017 presented that there was a relationship between nutritional status and the growth of toddler aged 1-3 years in the working area of the Jetis Public Health Center, Yogyakarta City, which indicates that the better the nutrition of toddlers, the better their development (*p-value* 0.000) (Solechah & Fitriahadi, 2017).

A study conducted by Masyudi, Mulyana, and Rafsanjani in 2019 uncovered that there was a relationship between parenting (p = 0.021; OR = 3.6) and weaning age (p = 0.042; OR = 3.5) with the nutritional status of the toddler, in which parenting was not excellent and fast. Weaning age impacts high cases of malnutrition in toddlers under five years in Muara Batu District, North Aceh (Masyudi, Mulyana, & Rafsanjani, 2019). Another research by Hendrawan, Hernawan, and Saleh (2020), displays a significant relationship between exclusive breastfeeding and child growth based on weight with a p-value of 0.004.s

In accordance with a preliminary survey in the Kuok Health Center Work Area, it was revealed that there are problems in growth and delays in the development of toddlers. 15 of 20 toddlers possess poor nutritional status, resulting in developmental delays such as speaking, walking, drawing and interacting with others. Therefore, numerous factors are associated with growth disorders in toddlers and the dreadful impact that the researchers are interested in examining toddler growth in the working area of Kuok Public Health Center, Kampar Regency.

2. RESEARCH METHOD

It was an analytic observational study with a cross-sectional design. The study was performed in the working area of Kuok Public Health Center, Kampar regency, Riau province. The study was conducted in January 2021. The formula acquired the total sample size as follows: NZ(1- α/2) 2 P (1 - P) / Nd2 + Z(1 - α/2) 2 P (1 - P) with n= sample size, N= population size a number 148, Z(1-α/2) = 1.96, P= proportion (0.5), 1-P= 0.5, d= desired level of precision (0.05) (Riyanto, 2019). The research samples were selected through consecutive sampling. This study's sample number was 60 toddlers aged 12-60 months with a growth chart. Kuok Public Health Center officially acknowledges this research through research permit letter number: 445/PKM-KUOK/I/2021/190.

The data obtained in this research were primary data. The independent variable measurement of nutritional status employed an anthropometric examination of Body Weight per Age (WW/U) in accordance with the nutritional status category of the Ministry of Health of the Republic of Indonesia in 2020. Researchers evaluated the weight of toddlers by administering a scale with an accuracy of 0.1 cm, while the age of toddlers was administered a growth chart. The categorization of nutritional status is as follows; 1) Undernourished if it is in the >-2SD range, 2) Good nutrition if it is in the >-2SD -1SD range, 3) Over nutrition, if > 1SD.

To collect the data on parenting, the researcher employed a questionnaire accommodating 20 questions which have been examined for validity and reliability. The categorization of parenting patterns is as follows; 1) Good Parenting, if you answer 16-20 questions correctly, 2) Bad Parenting, if you answer <16 questions correctly. The exclusive breastfeeding data collection tool employs a questionnaire with two questions under the categories; 1) Yes, exclusive breastfeeding, 2) No, exclusive breastfeeding. The data collection tool for parents' income utilizes a questionnaire incorporating two questions with categories 1) High, if income is > Rp.2,500.00/month 2) Low if income is Rp.2,500.00/month.

The dependent variable is the growth chart, classified into a) Good is the growth chart increase (bodyweight crosses the growth line above or in accordance with and body weight increase is higher than minimum weight obtained). b). The growth chart decrease is poor (body weight crosses the growth line under or horizontally or decreases, and minimal weight is lower than minimum weight gain). A Chi-square test was performed to examine the bivariable.

3. RESULTS AND DISCUSSION

The research was conducted in January 2022 with 60 infants as a sample. The characteristics of parents and toddlers are displayed in Table 1, while the research results on the relationship between nutritional status, parenting, exclusive breastfeeding history, basic immunization history, and family income with toddler growth are presented in Table 2 below.

Table 1. The Characteristics of Parents and Toddler

Characteristic	**Number**	**Percentage (%)**
Mother Age		3.3
<20 years old	2	81.7
20-35 years old	49	15
>35 years old	9	3.3
Mother Educational Level		
No School	1	1.7
Elementary (Elementary-Junior High School)	17	28.3
Middle (Senior High School)	28	46.7
Higher (Diploma-Bachelor)	14	23.3
Mother's Job		
Working	10	16.7
Not Working	50	83.3
Parental Income		
High	42	70.0
Low	18	30.0
Parenting		
Good	43	71.7
Poor	17	28.3
Gender of Child		
Male	30	50.0
Female	30	50.0
History of Exclusive Breastfeeding		
Yes	19	31.7
No	41	68.3
Nutritional Status of Child		
Abnormal (Lower than-Higher than)	20	33.3
Normal	40	66.7
Basic Immunization History		
Complete	34	56.7
Incomplete	26	43.3
Toddler Growth		
Good	40	66.7
Poor	20	33.3
Characteristics	**Mean (Month)**	**Std. Deviation**
Toddler Age	27,4	13.34

Table 1 reveals that the majority of toddler mothers are aged 20-35 years, possess high school education, do not work, own high income, and possess good parenting patterns. Most toddlers received exclusive breastfeeding, normal nutritional status, and complete immunizations.

Table 2. Relationship among Nutritional Status, Parenting, Exclusive Breastfeeding History, Basic Immunization History, and Family Income with Toddler Growth.

Study Variable	Toddler Growth		Total	p-value	OR (CI 95%)
	Good (%)	Poor (%)			
Nutritional Status					
Normal	32 (53.3)	8 (13.3)	40 (66.7)	0.003	8.3 (2.101-32.121)
Abnormal	4 (6.7)	16 (26.7)	20 (33.3)		
Parenting					
Good	32 (53.3)	11 (18.3)	43 (71.7)	0.003	9.4 (2.542-35.161)
Poor	4 (6.7)	13 (21.7)	17 (28.3)		
Exclusive Breastfeeding History					
Yes	11 (18.3)	8 (13.3)	19 (31,6)	0.002	2.8 (1.963-8.139)
No	25 (41.7)	16 (26,7)	41(68,4)		
Parental Income					
High	35 (58.3)	7 (11.7)	42 (70)	0.031	4.4 (3.926-16.278)
Low	2 (3.3)	16 (26.7)	18 (30)		

Table 2 shows that 32 (53.3%) toddlers with normal nutritional status experienced good growth, while 16 (26.7%) toddlers with abnormal nutritional status experienced poor growth. The Chi-Square test of the bivariable analysis revealed a p-value of 0.003 ($p<0.05$), which indicates that there was a relationship between nutritional status and infant growth with an OR value of 8.3 (CI 95%; 2.101-32.121). It implies that the toddler's abnormal nutritional status was eight times the risk of experiencing poor growth compared to the normal nutritional status.

Bivariate analysis on parenting shows that 32 (53.3%) toddlers with good parenting encountered good growth, while 13 (21.7%) toddlers with poor parenting experienced poor growth. The Chi-Square test of bivariable analysis unveiled a p-value of 0.003 ($p<0.05$), which indicates that there was a relationship between parenting and child growth with an OR value of 9.4 (CI 95%; 2.542-35.161). It implies that poor parenting was seven times possessing greater risk of experiencing poor growth compared to good parenting.

Bivariate analysis of exclusive breastfeeding history displays those 11 (18.3%) infants with exclusive breastfeeding encountered good growth, while 16 (26.7%) toddlers with poor exclusive breastfeeding encountered poor growth. The Chi-Square test of bivariable analysis acquired a p-value of 0.002 ($p <0.05$), which signifies that there was a relationship between exclusive breastfeeding and toddler growth with an OR value of 2.8 (CI 95%; 1.963-8.139), which implies that poor exclusive breastfeeding was nine times possessing greater risk of experiencing poor growth compared to good exclusive breastfeeding.

Bivariate analysis on parental income displays that 35 (58.3%) of toddler parental with high income experienced possess good growth, while 16 (26.7%) of toddler parental with low income encountered poor growth. Chi-Square test of bivariable analysis

unveiled p value of 0.031 (p <0.05), which indicates that there was a relationship between parental income with the toddler growth with an OR value of 4.4 (CI 95%; 3.926-16.278) which signifies that toddler low family income was 4 times having greater risk of experiencing poor growth compared to high income.

a. The Relationship between Nutritional Status and Toddler Growth.

The bivariable analysis illustrates a relationship between nutritional status and toddler growth with an OR value of 8.3 (CI 95%; 2.101-32.121), which implies that toddlers with abnormal nutritional status possess eight times greater risk compared to normal. The results of this study corroborate previous research performed by Insani and Latifah, (2015), which discovered that multivariable analysis on the most dominant factor associated with great toddler growth is the nutritional status with p value 0.000 and OR=122.213, indicating toddler nutritional status obtaining 122 times significantly impacted toddler growth as nutritional plays essential role on body defense (Insani & Latifah, 2015).

The findings unveiled that the nutritional status of toddlers is associated with growth, that is, toddlers who possess normal nutritional status experience appropriate growth, while toddlers who have abnormal nutritional status (undernutrition and overnutrition) experience inappropriate growth. It emerges as the quality of food intake is not good; it significantly affects nutritional status problems. Toddlers who are malnourished do not possess balanced nutritional content such as vegetables, side dishes, and fruits, while toddlers who are undernourished are frequently provided with fast food, such as instant noodles and frozen food. This undernutrition and overnutrition are the causes of inappropriate growth in toddlers, which can be observed in physically unfit toddlers and weak muscle tone. The findings are in accordance with the theory proposed by Capriani et al. (2021). Toddler nutritional status is enormously affecting toddler growth because parents believe that providing adequate nutrition for toddlers is crucial to corroborate and optimize toddler growth. On the other hand, the low nutrition food will tremendously influence the toddler's growth, affecting their growth. Therefore, it is necessary for parents to put serious attention to toddlers' nutritional status because malnutrition during this period is an additional critical (Capriani et al., 2021).

Nutritional status is considered by the quality and quantity of nutritional intake, which does not merely influence the process of toddler growth but also toddler health as they grow up. Nutritional intake is significantly essential, particularly in the first five years of life, as it is the critical time of brain and physical growth (Kementerian Kesehatan Republik Indonesia, 2016). Toddler nutritional status is considered by the food intake, in accordance with a study performed by Widyaningsih, Kusnandar, and Anantanyu, that there was a relationship between various food intakes and toddler growth experiencing stunting, and the most dominant factor associated with stunting is numerous food intakes (Widyaningsih, Kusnandar & Anantanyu., 2018).

In accordance with the results of research by Azizah, Darmawansyih, and Fauziah, it is revealed that there was a relationship between nutritional status and development of preschool children in the age period of 3-5 years in the working area of the Batua Raya Public Health Center (Azizah, Darmawansyih, & Fauziah., 2021). The finding is corroborated by the theory that when a child obtains enough food intake but frequently suffers from infectious diseases, their nutritional status will be severely affected. Likewise, children who were provided with inappropriate food may have a weak immune system, ultimately affecting their nutritional status (Siddiq, 2018).

b. The Relationship between Parenting and Toddler Growth.

Bivariable analysis displays a relationship between parenting and toddler growth with an OR value of 9.4 (CI 95%; 2.542-35.161). It indicates that poor parenting possesses a nine times greater toddler growth risk than good parenting. It is in accordance with research conducted by Masyudi, Mulyana, and Rafsanjani in 2019, poor parenting corroborated by a quick weaning age influences malnutrition cases in Muara Batu, North Aceh. It is also uncovered that poor parenting poses 3.6 times great risk to nutritional status compared to good parenting (Masyudi, Mulyana & Rafsanjani, 2019).

The findings revealed that good parenting causes appropriate growth of infants. On the contrary, bad parenting patterns cause inappropriate growth in toddlers. In accordance with the results of the questionnaire, parents implement good parenting by getting children to sleep regularly with a duration of 8-9 hours, getting children to wear footwear when playing outside the house, providing colostrum to toddlers when they are born until they are three days old, providing complementary foods. Breast milk with nutrition and texture appropriate for the child's age, hand-washing with soap before distributing food to children, hand-washing with soap after eating food, taking sick children to medical facilities, taking children to Integrated Health Unit for immunizations, and giving children vitamin A capsules are all things that can assist. According to the stages of age supported by the theory Rizyana and Yulia, (2018), parenting is the expression of behavior and attitude conveyed by parents through an interaction, encompassing teaching discipline and also controlling. The care provided causes the toddler's growth to be normal. It possesses a robust connection to toddler growth. Food, health, and psychosocial factors play a significant role in infant growth and contribute to optimum development. (Rizyana & Yulia, 2018).

Parenting is the associated factor that contributes to toddler growth, encompassing stunting. The roles were providing food intake, raising education, implementing healthy life, and providing health services to ensure adequate nutrition for toddlers (Gunardi et al., 2017). A study by Ahmad, Azis, and Fadli., 2021, on parenting discovered that several factors correlated with lower parenting are working activities and poor knowledge of infant parents. It was uncovered that 33.3% of infant parents were actively working, and 33.3% of toddler parents were poor knowledge. The Chi-Square test unveiled that the p-value was $<\alpha=0.000$ that there was a relationship between parenting and stunting cases.

c. The Relationship between Exclusive Breastfeeding History and Toddler Growth.

The bivariable analysis uncovered that p-value was 0.002 ($p<0.05$). It indicates a relationship between exclusive breastfeeding history and toddler growth with OR value of 2.8 (CI 95%; 1.963-8.139), meaning that children with poor exclusive breastfeeding possess a twice greater risk of poor growth than the exclusive one. The results of this study corroborate previous research performed by Sampe, Toban & Madi in 2020, that there was a relationship between exclusive breastfeeding and stunting. The odds ratio test obtained an OR = 61. It implies that toddlers who are not exclusively breastfed possess a 61-fold chance of experiencing stunting compared to toddlers who are exclusively breastfed. Exclusive breastfeeding can reduce the risk of stunting (Sampe, Toban & Madi, 2020).

Toddler growth could encounter a problem due to poor exclusive breastfeeding for six months. Most of the toddler growth process is affected by the provision of breastfeeding intake incorporating other nutrition. Therefore, a case of malnutrition was associated with toddler growth. Another problem was low brain development as well as

decreased or low body resistance to infectious diseases (Yuanta, Tamtomo & Hanim, 2018).

Mother is the closest person to the child in providing care. The mother's parenting determines the quality of infant growth. Early detection is crucial in discovering growth disorders in toddlers. Growth and development disorders that are revealed early will receive tremendous valuable interventions to prevent permanent disability (Indrayani, Legiati & Hidayanti, 2019)

A study performed by Abbas et al. on the history of breastfeeding patterns incorporating breastfeeding, colostrum, exclusive breastfeeding, and breastfeeding schedules obtained a p-value <0.05. It indicates a significant relationship between breastfeeding history and the nutritional status of toddlers under five years. A toddler should be exclusively breastfed for at least four months and, if possible, until six months. Breastfeeding provides all the energy and nutrients required for healthy growth. Breastfeeding incorporates anti-infective ingredients which protect the toddler from diarrhea and other diseases (Abbas et al., 2020).

d. The Relationship between Parental Income and Toddler Growth

The chi-square on bivariable analysis revealed that the p-value was 0.031 ($p<0.05$). It indicates a relationship between parental income and toddler growth with an OR value of 4.4 (CI 95%; 3.926-16.278), which indicates that low parental income poses a four times greater risk in toddler growth compared to high family income.

Growth disorders such as stunting could be stimulated by low parental income. Parental income affects the level of nutrition intake availability. Therefore, low-income parental is more at risk of encountering stunting due to the minimum nutrition intake. The provision of inadequate intake of nutrients associated with the amount, type, and frequency, particularly of the long-term total macronutrients and micronutrients, will result in malnutrition and lead to physical growth deficits in toddlers (Juwita et al., 2019).

A study conducted by Chipili et al. (2018), discovered that high-income mothers associate with good weight toddler growth. It indicates that the financial factor is essentially associated with food availability and optimizing toddler nutrition, educational services, and health services (Chipili et al., 2018).

A Study by Mulazimmah (2017) discovered that statistically, family income possesses a significant relationship with toddler nutritional status with a p-value was = 0.014 (< 0.05). Family income significantly influences toddler's nutritional status. A family with a high income could provide adequate nutrition (Mulazimmah, 2017). It is in accordance with a study conducted by Illahi (2017), Spearman correlational analysis revealed that the p-value was 0.08 ($p<\alpha=0.05$) and that there was a relationship between family income and stunting in Ujung Piring Village. The theory corroborates it; the high-income family could provide adequate nutrition. Conversely, low-income families find it challenging to provide sufficient nutrition (Illahi, 2017).

4. CONCLUSION

The findings revealed a relationship between nutritional status, parenting, exclusive breastfeeding, and parental income with the growth of a toddler in the working area of Kuok Public Health Center. For future research, it is recommended to conduct research on other variables correlated with toddler growth by employing different research designs, such as prospective cohort designs, to complete future research.

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RESEARCH **Open Access**

The Effect of Anemia in Pregnancy on Postpartum Hemorrhage

Ririn Ariyanti[1a*], Selvia Febrianti[1b], Muhammad Qasim[2c], Nurul Hidayatun Jalilah[1d]

[1] Department of Midwifery, Faculty of Health, Universitas Borneo Tarakan, Tarakan, North Kalimantan, Indonesia
[2] Department of Nursing, STIKES Amanah Makassar, Makassar, South Sulawesi, Indonesia

[a] Email address: ririn_ariyanti@borneo.ac.id
[b] Email address: selvia.febri11@borneo.ac.id
[c] Email address: qasimwelonge@gmail.com
[d] Email address: nurulhamzar240987@gmail.com

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Abstract
Eighty percent of maternal deaths are caused by complications during pregnancy and childbirth. Furthermore, twenty-five percent of maternal deaths is affected by postpartum hemorrhage which is estimated 100,000 deaths annually. Indonesia places at the second ranks of the highest maternal deaths country after Laos. The cause of death in Indonesia is 28% by hemorrhage. The hemorrhage in maternity is due to anemia in pregnancy. It occurs because when the mother gives birth, there will be adequate uterine contractions so that the hemorrhage is inevitable. The objective of the study is to identify the effect of anemia in pregnancy on the incidence of postpartum hemorrhage. The type of research employed is an analytic survey with a retrospective design. The research location was at Juata Tarakan Health Center. The population in this study were all pregnant women who visited the obstetrics and gynecology polyclinic in 2020 which was obtained from secondary data, the patient's medical record book at the Juata Public Health Center with a sample of 271 on June 23 to August 31, 2021. Sampling employed a non-probability sampling technique, total sampling, and the data analysis was administered univariately, and bivariate with chi-square test. The incidence of postpartum hemorrhage in women giving birth in the working area of the Juata Tarakan Health Center is 12.9%. Anemia in pregnancy possesses a significant effect on the risk of postpartum hemorrhage with p value (OR=11,253, 95%CI 5,120-24,732). Meanwhile, parity, age, type of delivery did not possess significant effect on postpartum hemorrhage. Mothers with anemia in pregnancy own a higher risk of postpartum hemorrhage which was 11.253 times greater than mothers who were not anemic in pregnancy. Therefore, it is necessary to perform proper handling of anemia in pregnant women to prevent postpartum hemorrhage.

Keywords: Anemia, Hemorrhage, Pregnancy.

Corresponding Author:

Ririn Ariyanti
Department of Midwifery, Faculty of Health, Universitas Borneo Tarakan, Tarakan, North Kalimantan, Indonesia.
Email: ririn_ariyanti@borneo.ac.id

1. INTRODUCTION

Maternal Mortality Rate (MMR) is one indicator to perceive the success of maternal health efforts (Sassanarakkit, Kaiwong & Chittacharoen, 2019). MMR is the ratio of deaths during pregnancy, childbirth, and the puerperium affected by pregnancy, childbirth, and the postpartum period or its management but not due to other causes as accidents or falls in every 100,000 live births (Ariyanti, Yulianti & Padlilah., 2021). In addition to calculating maternal health programs, this indicator is also able to calculate the degree of public health due to its sensitivity to enhance health services, both in terms of accessibility and quality (Kementerian Kesehatan Republik Indonesia, 2019). In general, there was a decrease in maternal mortality during the period 1991-2015 from 390 to 305 per 100,000 live births. Although there is a downward trend in MMR, it has not succeeded in acquiring the MDGs target which must be attained at 102 per 100,000 live births in 2015 (Kementerian Kesehatan Republik Indonesia, 2019). Efforts to accelerate the decline in MMR can be performed by assuring that every mother is able to access quality maternal health services, such as health services for pregnant women, delivery assistance by skilled health personnel in health care facilities, postpartum care for mothers and babies, special care and referrals if complications occur and family planning services, encompassing postnatal family planning (Kementerian Kesehatan Republik Indonesia, 2019).

According to WHO, the cause of MMR is 81% due to complications during pregnancy and childbirth, and 25% of maternal deaths are affected by postpartum hemorrhage and an approximately 100,000 deaths each year (World Health Organization, 2020). MMR in Indonesia is quite high. In Southeast Asia, Indonesia ranks second after Laos. The causes of death in Indonesia are hemorrhage which was 28%, eclampsia 24%, infection 11%, abortion 5%, prolonged labor 5%, embolism 3%, puerperal complications 8%, and the rest because of other causes (Kementerian Kesehatan Republik Indonesia, 2020). In accordance with the research administered by the University Teaching Hospital during 2000-2014 in Brazil, the most mortality complications in cases of severe aplastic anemia were hemorrhage and infection (Putra & Aprijadi, 2019). Several studies have uncovered that anemia in pregnant women affects postpartum hemorrhage (Subratha, 2022). Meanwhile in Tarakan, North Kalimantan, hemorrhage is the largest contributor to MMR, which is 50% (Dinas Kesehatan Kota Tarakan, 2020)

Hemorrhage in childbirth is due to anemia in pregnancy. It occurs because when the mother gives birth, adequate uterine contractions occur for the baby to be born. Pregnant women who are anemic with Hb below 10, experience a significant high risk of hemorrhage due to hypotonia or atony, about 20-25 percent (Subarda, Hakimi & Helmyati, 2011). Postpartum hemorrhage is bleeding exceeding 500 ml after the baby is born in vaginal delivery and exceeding 1000 ml after abdominal labor before 6 weeks of delivery (Oktariza, Flora & Zulkarnain, 2020). Iron needs escalate exponentially during pregnancy to fulfill the increased demands of the fetoplacental unit, to expand maternal erythrocyte mass, and to compensate for iron loss at delivery in more than 80% of countries in the world (Lee & Okam, 2011). The Hb level drops as bleeding increases. The blood provides the uterus with the oxygen and energy required to contract. The ability to contract is weakened as the supply of these needs becomes thinner (McLean et al., 2009). Anemia in pregnant women not only increases the risk of maternal death but also of preterm birth, infant mortality, and infectious diseases. The growth and development of the fetus or child both during pregnancy and after delivery can be impacted by the mother's iron deficiency anemia (Fitriany & Saputri, 2018). According to a preliminary study at Juata Public Health Center, there were 11 cases of anemia among pregnant

women in 2021 (January through February), and 25 pregnant women were affected by 1 case of primary postpartum hemorrhage. This research aims to a study the Relationship of Anemia during Pregnancy with Primary Postpartum Hemorrhage Incidence in Juata Tarakan Public Health Center.

2. RESEARCH METHOD

The type of research employed is an analytic survey with a case-control design. The research location is at Juata Tarakan Public Health Center. The independent variable in this study was the incidence of anemia, and the dependent variable was primary postpartum hemorrhage. The population were all pregnant women who visited the obstetrics and gynecology polyclinic in 2020 which was obtained from secondary data, the patient's medical record book at Juata Public Health Center with a sample of 271. The sampling administered a non-probability technique understood as total sampling since this study employed secondary data. The researcher collected samples from the entire population, data analysis was performed univariately and bivariately with chi-square test. This study implements ethical principles and has acquired ethical approval at Universitas Borneo Tarakan, with ethical test number 06/KEPK-FIKES UBT/III/2021.

3. RESULTS AND DISCUSSION

The subjects of this study were 271 pregnant women who checked themselves at Juata Tarakan Public Health Center, North Kalimantan in 2020.

Table 1. The characteristic of the subjects.

Characteristics	Frequency (n)	Percentage (%)
Parity		
Primigravida	77	28.4
Multigravida	194	71.4
Age		
20-35	213	78,6
<20 & >35	58	21,4
Anemia		
No anemia	226	83,4
Anemia	45	16,6
Type of Delivery		
Vaginal	250	92,3
Sectio Caesarea	21	7,7
Delivery Place		
Hospital	78	28,8
Public Health Center	151	55,7
Clinic	13	4,8
Independent Midwife Practices	29	10,7
Labor Complications		
No Complications	254	93,7
Complications	17	6,3

Characteristics	Frequency (n)	Percentage (%)
Postpartum Bleeding		
No Bleeding	236	87,1
Bleeding	35	12,9

Table 1 show that the frequency distribution of research subjects uncovered that most of 194 (71.4%) were pregnant more than once or multigravida, most of the pregnant women were of reproductive age 20 -35 years old 213 (78.6%), most of the pregnant women did not experience anemia 226 (83.4%), most of pregnant women gave birth normally 250 (92.3%), almost half of the respondents gave birth at the health center 151 (55,7%), a small proportion of respondents 17 (6.3%) suffered from complications during delivery and 35 (12.9%) experienced bleeding during delivery.

Table 2. Effect of Anemia in Pregnancy on Postpartum Hemorrhage

Pregnancy	Postpartum Bleeding		Odds Ratio	CI 95%
	No Bleeding n=236	Bleeding N=35		
No Anemia	211 (93,4%)	15 (6,6%)	11,253	5,120-
Anemia	25 (55,6%)	20 (44,4%)	1	24,732

Table 2 show that the results of the statistical tests demonstrated that pregnant women with anemia owned an 11,253 times greater risk of hemorrhage during labor than women without anemia.

Table 3. Effect of Confounding Variables on Postpartum Hemorrhage

Variable	Postpartum Bleeding		Odds Ratio	p-value
	No Bleeding n=236	Bleeding N=35		
Parity				
Primigravida	71(92,2%)	6 (7,8%)	2,080	0,159
Multigravida	165 (85,1%	29(14,9%)	1	
Age				
20-35	87(87,8%)	26(12,2%)	1,321	0,511
<20 & >35	49 (84,5%)	9(15,5%)	1	
Type of Delivery				
Vaginal	215(86%)	35 (14%)	0,860	0,134
Sectio Caesaria	21(100%)	0 (0%)	1	

Table 3 show that the result of the statistical test showed parity, age, and type of delivery did not affect Postpartum Hemorrhage. The incidence of postpartum hemorrhage in pregnant women with anemia at Juata Public Health Center in Tarakan throughout 2020 was 44.4%. Pregnancy anemia possessed a significant effect on the incidence of postpartum hemorrhage with p-value = 0.000 and OR = 11.253. It indicates that mothers with anemia in pregnancy experience a risk of postpartum hemorrhage 11.253 times greater than mothers who are not anemic. It is in accordance with research administered by Wardani in 2017 in which the research she conducted demonstrated a significant relationship between anemia and postpartum hemorrhage, with anemia at risk of experiencing postpartum hemorrhage 17.6 times for postpartum hemorrhage compared to mothers who did not experience postpartum hemorrhage due to anemia (Wardani, 2017), (Onyeneho & Igweonu, 2016). There is 8 to 10-fold increase in MMR when the Hb falls below 5 g/dl. Early detection and effective management of anemia in pregnancy may affect substantially to decrease the maternal mortality (Al-Khaffaf et al., 2020). It is in

accordance with this study because anemia experienced during pregnancy escalates the risk of hemorrhage in childbirth.

Pregnant women with anemia are not able to fulfill the iron requirements of the body. It may affect interference and inhibition of body cells encompassing brain cells, and cause health problems for the mother and fetus. Iron deficiency anemia accounts for 75% of all anemias in pregnancy. Hence, it is recommended to administer oral iron supplementation treatment of iron deficiency anemia in pregnancy (Igbinosa, Berube & Lyell., 2022). The following are the impact of anemia in pregnancy associated with various sources and experts, encompassing anemia in pregnancy which leads to miscarriage, premature birth, low birth weight, hemorrhage before and after childbirth can even cause maternal and child death (Onyeneho & Igweonu, 2016). The impact of anemia on pregnancy varies from tremendous mild complaints to disturbances in the pregnancy continuity (abortion, immature or premature labor), disorders of the delivery process (uterine atony, prolonged labor, hemorrhage), disorders during puerperium (subinvolution, resistance to infection, stress, and low breast milk production), and fetal disorders (dysmaturity, microsomia, low birth weight, perinatal death, etc.). Perception plays a pivotal role in determining health-seeking behavior (Risnawati & Ningrum, 2015)

Mothers suffering from anemia in pregnancy possess fewer red blood cells than required. Without enough red blood cells or a reduced effective number of red blood cells, the blood will not clot. It implies that a person may experience hemorrhage excessively even if it is only slightly injured. Mothers who are in labor condition with low hemoglobin (Hb) concentrations may experience an even faster decrease in Hb if bleeding happens, no matter how small it is (Yasin, Hannan & Wahyuni, 2021), (Maesaroh & Iwana, 2018). Anemia occurs in 1/3 of women during the third trimester of pregnancy (Nuryawati & Budiasih, 2017). General causes are iron and folic acid deficiency (Sharifzadeh et al., 2018). The amount of blood in the body of a pregnant woman expands by 20-30%, thus requiring an increase in iron supply. It is crucial in this period to conduct a Hb check to detect anemia. Anemia in pregnant women greatly influences the condition of mother and fetus during the delivery process. Pregnant women suffering from severe anemia increase the risk of maternal and infant morbidity and mortality. The possibility of giving birth to babies with low birth weight (LBW) and premature is also more prominent (Subarda, Hakimi & Helmyati, 2011) (Stephen et al., 2018).

Mothers with anemia can precede the postpartum hemorrhage occurrence. This condition is affected by the process of hemodilution during pregnancy causing the blood to occur diluted (Lee & Okam, 2011)The effect of this event affects less oxygen bound in the blood, hence, the amount of oxygen delivered to the uterus is decreased. It may cause the uterine muscles enable to contract adequately. Therefore, it affects postpartum hemorrhage. In progressive iron deficiency anemia, there are changes in hematological and biochemical values. The first thing happening is a decrease in iron stores in the tissues. This decrease is signified by a decrease in serum ferritin, a protein which binds iron in the body as storage (Sumiaty, Udim & Aminuddin, 2018). Then, if the amount of serum iron will decrease, the iron-binding capacity of the serum (serum transferrin) will increase, and transferrin saturation will also decline below normal. As stores decrease, iron and protoporphyrin fail to form heme. Free erythrocyte protoporphyrin (FEP) accumulate, and hemoglobin synthesis is disrupted (Fibrila, 2018), (Pratiwi, Santoso & Wahyuningsih, 2018).

At this point, iron deficiency progresses to iron deficiency anemia. With a decreased amount of hemoglobin in each cell, the red cells become smaller. These morphological changes most frequently occur in conjunction with a decline in the mean corpuscular

volume (MCV) and the mean corpuscular hemoglobin (MCH) (Sulistyoningtyas & Cahyawati, 2020). Changes in the size variation of red blood cells occur with the replacement of normocytic cells with microcytic cells. This variation is signified by the increase in red blood cell distribution width (RDW). The number of red blood cells will also decrease (Nur, Rahman & Kurniawan, 2019) (Yasin, Hannan & Wahyuni, 2021). The number of reticulocyte percentages increases slightly or maybe normal. A blood smear will present hypochromic and microcytic red blood cells with constant cell variation. The elliptical or cigar-like shape of the blood cells is generally identified. The detection of an increase in transferrin receptors and a decline in reticulocyte hemoglobin concentration corroborates the diagnosis of iron deficiency (Fitriany & Saputri, 2018), (Moya et al., 2022)

However, the variables of age, parity, and type of delivery in this study did not possess an influence on the incidence of postpartum hemorrhage at Juata Tarakan Public Health Center. It was not in accordance with the research performed by Wardani in 2017 which the three variables possessed a relationship with the incidence of postpartum hemorrhage. Furthermore, numerous studies evidence that pregnancy anemia affects the incidence of postpartum hemorrhage and it is a special concern for health workers particularly midwives, to generally examine the hemoglobin as a supporting examination in the 1st and 3rd trimesters. If anemia occurs in pregnancy, it can be immediately detected and treated. Furthermore, pregnant women are also required to consume a minimum of 90 tablets for blood during pregnancy (Kementerian Kesehatan Republik Indonesia, 2020) , (Hayati, Maidartati & Amelia, 2019).

4. CONCLUSION

The incidence of childbirth bleeding in pregnant women with anemia at Juata Public Health Center in Tarakan throughout 2020 was 44.4%. Anemia of pregnancy significantly caused the postpartum hemorrhage incidence with a value in which mothers with anemia in pregnancy experienced a risk of postpartum hemorrhage 11.253 times more significant than mothers who were not anemic. Suggestions for pregnant women and their families should be to maintain their pregnancy by performing routine efforts to apply antenatal care under antenatal care service standards such as administering examinations with the 10 T standard in healthcare workers. Health workers should also perform preventive treatments of anemia in pregnancy to prevent postpartum hemorrhage.

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RESEARCH **Open Access**

Comparison of Body Mass Index and Behavior of CERDIK of Individuals as Risk Factors of Suffering from Non-Communicable Diseases

Sri Mugianti[1a*], Bastianus Doddy Riyadi[2b], Juin Hadi Suyitno[2c], Suprajitno[1d]

[1] Department of Nursing, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang City, East Java, Indonesia.
[2] Department of Nutrition, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang City, East Java, Indonesia.

[a] Email address: sri_mugianti@poltekkes-malang.ac.id
[b] Email address: b.doddyriyadi@gmail.com
[c] Email address: juinhadi@gmail.com
[d] Email address: suprajitno_skp@poltekkes-malang.ac.id

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Abstract

Non-communicable diseases (NCDs) occur in individuals of the productive age and its risk can be diminished if such individuals possess healthy behaviors. BMI is a calculation which is frequently administered to express individuals at risk of suffering from NCDs. Predicting the risk of an individual from suffering from non-communicable diseases is possible by employing CERDIK behavioral (knowledge, attitude, and actions) questionnaires, but it does not yet elaborate the role of body mass index (BMI). The objective of this study is to compare the body mass index and behavior with individuals' risk factors suffering from non-communicable diseases. The study administered a cross-sectional design. The sample amounted to 200 individuals in the productive age who generally fast-food establishments in Blitar from April to June of 2022. Sample was selected by administering the simple random sampling method. The results demonstrated that merely few individuals experienced a high risk of contracting non-communicable diseases. Behavioral factors are no longer used to determine an individual's risk of developing non-communicable diseases when body mass index is taken into account as a contributing factor. Therefore, body mass index is not a risk factor. According to research, adopting healthy lifestyle habits can lower the risk of developing non-communicable diseases.

Keywords: NCDs, Body Mass Index, Knowledge, Attitude, Actions, CERDIK.

Corresponding Author:

Sri Mugianti
Department of Nursing, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang City, East Java, Indonesia.
Email: sri_mugianti@poltekkes-malang.ac.id

1. INTRODUCTION

The four major non-communicable diseases (NCD) in Indonesia are cardiovascular disease, diabetes mellitus, cancer, and chronic obstructive pulmonary disease, responsible for 60% of the nation's total deaths, with the underlying causes being poor diet (unbalanced diet, low consumption of vegetables and fruits, high consumption of sugar, high salt intake, and high fat intake), lack of physical activity, smoking, and alcohol consumption (Kementerian Kesehatan Republik Indonesia, 2017). On the other hand, non-communicable diseases because of lifestyle changes which tend to occur at the age of 15 encompass cardiovascular disease, diabetes mellitus, and chronic obstructive pulmonary disease. Individual effort to prevent non-communicable diseases is possible through the practices of CERDIK: Cek kesehatan secara berkala (routine medical checkups), Enyahkan rokok (stop tobacco use), Rajin berolahraga (exercise regularly), Diet sehat seimbang (have a healthy and balanced diet), Istirahat cukup (adequate sleep), and Kelola stres (manage stress well) (Kementerian Kesehatan Republik Indonesia, 2019a),(Kementerian Kesehatan Republik Indonesia, 2019b).

According to the WHO, risk factors for non-communicable diseases incorporate poor diet, tobacco consumption, air pollution, alcohol consumption, and lack of physical activity (Kamaruddin, 2020; P2PTM Kemenkes RI, 2021; WHO, 2022), which can be employed as an indicator of an individual physical condition. Several studies have uncovered the correlation between physical activity (or lack thereof) and body mass index (Ariani & Masluhiya, 2017; Candrawati, 2011; Mahali & Indahsari, 2019). Research in Tangerang Selatan revealed that aged 15-18 years who consume fast food and drinks and lack activity possess an expanded risk of being overweight and obese (Nisa et al., 2020).

One aspect of CERDIK with regard to one's physical condition is regular exercise. However, studies conducted on individual risk factors for non-communicable diseases embody behavioral indicators (knowledge, attitude, and actions) towards CERDIK and did not become the major factor their body mass index, which is signified as body weight in kilograms divided by height in square meters and administered to measure an individual's nutritional status in relation to their blood pressure (Andalangi, Warouw & Umboh., 2013; Dewi, Rimbawan & Agustino, 2013). High blood pressure is one of the non-communicable diseases in the cardiovascular category (Sagaro, Caniob, & Amenta, 2021).

A study on the impact of body mass index on behavioral risk factors for people with non-communicable diseases is required for the aforementioned reasons above. Although factors of contemporary lifestyle changes and the body in terms of body mass index (BMI) are frequently employed to elaborate the risk of non-communicable diseases, the behavior that can cause these diseases has never been examined. Knowledge, attitudes, and behaviors associated with the prevention and reduction of suffering from non-communicable diseases, particularly CERDIK, are examples of behavior that can be changed. The objectives of this well-designed study are to compare body mass index with a person's behavior, or their knowledge, attitude, and behavior toward CERDIK, with risk factors of people who possess non-communicable diseases.

2. RESEARCH METHOD

The study administered a cross-sectional design. The population of the study was obtained from individuals aged of 15-59 years old at risk of non-communicable diseases who consume fast food regularly in Blitar. The sampling method employed was simple random sampling which amounted to 200 subjects. The data collection was conducted in April to June 2022.

The calculation of body mass index employed the BMI formula with measurements of weight and height, meanwhile, individual behavior about CERDIK administered a questionnaire (Suprajitno & Mugianti, 2020). Analysis of body mass index data employed the

implementation of categorical data analysis, meanwhile, logistic regression was administered for the analysis of the body mass index data in reference with the individual's behavior towards CERDIK against the risk of non-communicable diseases. Ethical approval of the research was granted by the Ethics Committee of Poltekkes Kemenkes Malang Number: 304/KEPK-POLKESMA/2022 dated January 17, 2022.

3. RESULTS AND DISCUSSION

Table 1. Respondents' profiles and behavior (knowledge, attitude, and actions) towards CERDIK.

Profiles and behavior towards CERDIK	Minimum	Maximum	Mean	SD
Age (year old)	15	57	26.16	11.27
Body weight (kg)	36	140	58.85	15.26
Stature (cm)	142	187	161.28	8.40
Body Mass Index	14.87	51.42	22.51	4.98
Systolic Pressure (mmHg)	80	190	113.92	15.25
Diastolic Pressure (mmHg)	60	109	76.86	9.74
Knowledge	35	60	51.91	5,05
Attitude	59	116	94.63	10.19
Actions	30	60	46.15	5.97
Risk of NCD	44.89	85.93	67.73	8.56

The profiles and behavior in Table 1 describe the conditions of the 200 respondents. Based on gender, there were 86 male respondents (43.0%) and 114 female respondents (57.0%). Based on the city of origin, 64 (32.0%) were from Blitar City, 75 (37.5%) from Blitar Regency, 19 (9.5%) from Kediri City/District, 22 (11.0%) from Tulungagung Regency, and 20 (10.0%) from Jombang Regency.

Table 2. Behavior Category of CERDIK,

Variable	f	%
Body mass index		
Severe underweight	19	9.5
Underweight	23	11.5
Normal	109	54.5
Overweight	16	8.0
Obese	33	16.5
Knowledge		
High	140	70.0
Moderate	55	27.5
Low	5	2.5
Attitude		
Positive	132	66.0
Negative	68	34.0
Action		
Good	60	30.0
Moderate	104	52.0
Poor	36	18.0

Table 2 show that the risk of non-communicable diseases in accordance with the individuals' behavior (knowledge, attitude, and action) towards CERDIK in the low-risk group amounted to 40 (20.0%) respondents, 148 (74.0%) respondents in the moderate risk group, and 12 (6.0%) respondents in the high-risk group. Calculation of respondent behavior (knowledge, attitude, and actions) by employing the questionnaire of CERDIK behavior (Suprajitno & Mugianti, 2020).

Table 3. Results of logistic regression analysis on the behavioral variables and BMI

Variable	Coefficient	df	sign
Knowledge	.075	1	.117
Attitude	.020	1	.374
Actions	-.105	1	.006
BMI	.021	1	.599
Constant	-3.312	1	.224

df: degrees of freedom; sign: significance level.

The results of logistic regression analysis (Table 3) show the individual risk of suffering from non-communicable diseases by adding the BMI factor results in the regression coefficient values on knowledge, attitudes, and actions being not significant. But asthma, cancer, diabetes mellitus, heart conditions, hypertension, stroke, chronic kidney failure, and joint disease are the recognized non-communicable diseases in Indonesia (Kementerian Kesehatan Republik Indonesia, 2019). Modifiable behaviors may contribute to NCDs. Diet, body mass index, exercise, sleep, sexual behavior, substance use, and use of information technology are the influencing factors (Farhud, 2015).

The average age of 26.16 ± 11.27 years (Table 1) reflected the highly diverse age of the respondents, considered to be in the productive age group. Individuals in the productive aged group must be supervised as they are prone to NCDs. Today's productive aged population owns a tendency to change their lifestyle because of the influx of the latest cultures and technology. Some of the identifiable consequences incorporate a westernized lifestyle, late night gatherings, and consumptive behaviors. Cultural shifts and technological sophistication affect a sedentary lifestyle which potentially result in the piling up of calories, that, in turn, causes formation of body fat.

The large spectrum of origins of the respondents indicates that people's mobility is no longer restricted to the distance and amount of time required to travel to other cities. Each individual, as solitary beings, possesses particular needs that can only be fulfilled through movement. According to the article, mobility is possible due to a number of factors in the area of the destination that enable it to fulfill the needs of the person, with the reason being that the place of destination has significantly larger utility value than the place of origin (Agusta, 2013). Another factor that might influence mobility is the travel distance and time, which, in their case, amounted to merely about an hour's drive.

In accordance with their weight and height, about half (54.5%) of the respondents owned their body mass index (BMI) in the normal range, while the ones in the underweight and overweight were of equal proportions (Table 2). Body mass index was acquired through the $BMI = \frac{Weight\ (kg)}{(Height\ (m))^2}$ formula but with different classifications, since Indonesia categorized BMI into five classifications: severely underweight, underweight, normal, overweight, and obese (P2PTM Kemenkes RI, 2021) and in accordance with the Center for Disease Control and Prevention, and the BMI is categorized into four classifications: underweight, normal, overweight and obese (CDC, 2022). Therefore, when categorizing an individual's BMI, it is necessary to take into account the individual's factors, which are race, and ethnicity. BMI can also be administered to predict levels of obesity. A tremendous high BMI generally

encompasses high body fat. However, a relatively high BMI can also possibly be affected by high body fat or high lean body mass (muscles and bones) (CDC, 2022). Therefore, providers of medical services must be trained in performing health assessments in order to assess the health status and risks of an individual.

The gender of an individual cannot be employed when calculating BMI. Some factors in considering when the BMI value is identical incorporate: (1) women tend to possess more body fat than men, (2) the amount of body fat may be higher or lower depending on the individual's race or ethnicity, (3) young adults tend to possess more body fat than older individuals, and (4) athletes own less body fat than non-athletes (CDC, 2022). In accordance with the explanations above, BMI is not an absolute calculation of individual obesity as there are other factors that should be considered.

Although some respondents - within the productive aged range - had their systolic and diastolic pressure beyond the normal range, which can be attributed to high blood pressure, the respondents' blood pressure, which was recorded as 113.92 15.25 mmHg for the systolic pressure and 76.86 9.74 mmHg for the diastolic pressure (Table 1), was interpreted to be within the normal range (hypertension). According to the Basic Health Research report from 2018, 8.01% of East Java residents and 8.36% of people nationwide over the age of 18 (the productive age range) had hypertension (Kementerian Kesehatan Republik Indonesia, 2019). Thus, stakeholders and individuals should concern this situation in order to prevent non-communicable diseases.

Knowledge about NCDs as much as 70.0% (Table 2) is classified as high because respondents have acknowledged of NCDs from information sources, which are television, radio, and health workers. Information escalates perception and self-awareness to behave and act. The results of this study are consistent with research in Ethiopia which elaborates the factors influencing self-awareness and knowledge about NCDs being affected by information sources (Legesse et al., 2022). In fact, knowledge is the basis for everyone to behave and act (Notoatmojo, 2011). Knowledge in the low category (Table 2) because of an erroneous perception of NCD. The level of knowledge in accordance with Bloom's taxonomy is modified into three, which are low, medium, and high (Adesoji, 2018). Individual perception after receiving information is highly influential in managing the information obtained by the senses (Gibson et al., 2011; Irani et al., 2022).

Attitude is identified as an intermediary factor between knowledge and action. Individuals act if they possess a positive attitude. Two thirds (66.0%) of respondents who are productive aged own a positive attitude (Table 2). Respondents' attitudes are affected by internal processes encompassing attention, understanding, and acceptance (Azwar, 2022). A positive attitude makes respondents able to act well to do CERDIK (Azwar, 2022; Mahali & Indahsari, 2019; Notoatmojo, 2011; Ojo et al., 2017).

Actions or practices are the major crucial part of behavior. A healthy lifestyle by administering CERDIK can be employed as a daily habit to prevent and decrease the risk of suffering from NCDs. The actions of respondents classified as high risk of suffering from NCDs were 36 (18.0%) respondents (Table 2). Action in this study is the primary risk factor for suffering from NCDs (Suprajitno & Mugianti, 2020). Bloom's taxonomy elaborates that hierarchical behavior comprises of knowledge, attitude, and actions or practices or psychomotor (Adams, 2015; Adesoji, 2018; Hackert et al., 2022).

Health behaviors are the responses of an individual to a stimulus, or object, which is associated with illness, disease, health care, food, beverage, and the environment. Behavioral domains are classified into three major parts: knowledge, attitude, and actions (skills) (Notoatmojo, 2011). Knowledge, attitudes, and actions influence behavior and efforts which can be generated to enhance the health education efforts (Pratiwi et al., 2021) on CERDIK.

Preventing non-communicable diseases is possible through the practices of CERDIK: *Cek kesehatan secara berkala* (routine medical checkups), *Enyahkan rokok* (stop tobacco use), *Rajin berolahraga* (exercise regularly), *Diet sehat seimbang* (have a healthy and balanced diet), *Istirahat cukup* (adequate sleep), and *Kelola stres* (manage stress well). CERDIK is referred to as an Indonesian healthy lifestyle that requires attention (Kementerian Kesehatan Republik Indonesia, 2018).

The measurements employed the CERDIK behavioral questionnaire and obtained a Goodness of Fit Index (GFI) score of 0.70. Meanwhile, the influence value of every behavioral domain, encompassing knowledge of 0.011 (95% CI: 0.007 to 0.015; p = 0.001), attitude of -0.008 (95% CI: -0.014 to -0.003; p = 0.001), and actions of 0.067 (95% CI: 0.060 to 0.073; p = 0.001) (Suprajitno & Mugianti, 2020). Respondents' behavioral scores were calculated by employing the CERDIK behavioral questionnaire, which are: a knowledge score of 51.91 ± 5.05, an attitude score of 94.63 ± 10.19, and an action score of 46.15 ± 5.97 (Table 1). Meanwhile, the risk of NCD, in accordance with the respondents' behavior towards CERDIK, was 67.73 ± 8.56; merely 6.0% were in the high-risk group. The body mass index values were then taken into account in the risk calculation for non-communicable diseases. When body mass index was examined along with the behavioral variables (knowledge, attitude, and actions), the results of the logistic regression analysis (Table 3) produced a probability value of 0.599, which also rendered the behavioral variables insignificant. According to other studies, body mass index filters' weight categories can be employed to screen for health issues (CDC, 2022). A research in a hospital in Karachi on outpatients revealed that body mass index is correlated negatively to high blood pressure (Sagaro, Caniob, & Amenta, 2021), to high blood pressure being one type of non-communicable disease. Moreover, a research in Bali from 2017 uncovered that excess body mass index merely influences blood pressure in the elderly (Rastiti et al., 2018), while in this study, the respondents were 26.16 ± 11.27 years old (Table 1), categorized as being in the productive age range. Based on the analysis, BMI with p value 0.599 (Table 3) is not a factor administered to calculate an individual's risk of suffering from NCDs. The reason being that BMI is the result of a calculation between weight and height. If, it is recommended to compare with other measurements and not insert a variable to the existing formula (Gupta et al., 2021). Thus, BMI only illustrates an individual condition which requires attention so that individuals do not suffer from NCDs.

4. CONCLUSION

Body mass index cannot be utilized as a factor affecting risk of non-communicable diseases when combined with behavioral factors (knowledge, attitude, and actions), as it is the result of a measurement between weight and height. In accordance with the research, in preventing and reducing the risk of suffering from non-communicable diseases, it is recommended to behave in a healthy life by reducing the consumption of fast food and drinks, not smoking, and exercising regularly for at least 30 minutes a day.

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R E S E A R C H **Open Access**

Determinants of the Support System and Quality of Life for Post-COVID-19 Patients

Irfan[1a], Syaputra Artama[2b*], Aris Wawomeo[2c]

[1] Department of Nursing, Poltekkes Kemenkes Kupang, Kupang City, East Nusa Tenggara, Indonesia
[2] Department of Nursing Ende, Poltekkes Kemenkes Kupang, Ende, East Nusa Tenggara, Indonesia

[a] Email address: irfan1971kupang@gmail.com
[b] Email address: syaputraartama@gmail.com
[c] Email address: wawomeoaris2017@gmail.com

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Abstract
The impact of the COVID-19 pandemic has caused a change in habits for post-COVID-19 patients in Indonesia. Support system, both informal and formal, are very important for the successful treatment and recovery of post-COVID-19 patients. The level of knowledge, attitudes and behavior of the patient's family is also significantly influential on the support system, especially for comorbid patients who undergo a longer recovery process. The objective of this study to determine the determinants of the support system and quality of life in post-COVID-19 patients in Ende Regency. The type of research used is analytic observational using a cross sectional study design. The sampling method used cluster random sampling. The sample used proportional allocation technique with a sample of 110 respondents. The results of the study found that the variables that had a significant relationship with the support system and quality of life of post-COVID-19 patients were the respondent's age (p=0.001), quality of life (p=0.001), family attitudes (p=0.001), family behavior (p=0.001), health status (p=0.001) and the patient's comorbid history (p=0.001), while for family knowledge variables (p=0.051) and (p=0.129), and there is no significant relationship for symptoms when suffering from COVID-19 (p=0.078) and (p=0.717). The conclusion is that the support system provided to people with various determinants when facing the situation after the coronavirus pandemic is very important in improving the physical and psychological dimensions. A good support system can reduce various forms of stress, improve coping mechanisms and improve the quality of life of post-COVID-19 patients.

Keywords: Support System, Quality of Life, Post-COVID-19 Patients.

Corresponding Author:

Syaputra Artama
Department of Nursing Ende, Poltekkes Kemenkes Kupang, Ende, East Nusa Tenggara, Indonesia.
Email: syaputraartama@gmail.com

1. INTRODUCTION

Worldometer reported that there are about 157 million cases of COVID-19 worldwide from 223 countries today, of which about 18 million are active cases (Djalante et al., 2020; Singhal, 2020; Worldometer, 2021). The Pusdatin (Pusat Data dan Informasi) of the Indonesian Ministry of Health reported that as of May 9, 2021, the number of COVID-19 sufferers was 1,7113,684 cases, 1,568,277 people had recovered and 47,012 people had died (Kementerian Kesehatan Republik Indonesia, 2022). The number of COVID-19 sufferers in East Nusa Tenggara (ENT) Province on May 9, 2021 was 15502 cases, 13,977 people recovered and 427 people died. Data on COVID-19 sufferers in one of the districts of East Nusa Tenggara Province, that is Ende Regency, on March 22, 2021, the number of positive cases of COVID-19 was 661 cases and on May 9, 2021, the number of cases had increased to 827 cases, 747 people recovered and 12 people died (Kementerian Kesehatan Republik Indonesia, 2022; Worldometer, 2021).

Corona virus is transmitted through droplets or saliva from patients with confirmed COVID-19 to other people and causes symptoms of dry cough, fever, shortness of breath, loss of sense of smell, loss of sense of taste, nausea, vomiting, weakness, headache, red eyes, redness on the skin, and diarrhea (Djalante et al., 2020; Singhal, 2020). Patients undergoing self-quarantine/isolation could feel stress, loneliness, causing psychosocial stress, anxiety and worsening physical and mental illness (Liu et al., 2020; Kementerian Kesehatan Republik Indonesia, 2022). Many post-COVID-19 patients with comorbid conditions have to struggle with getting this treatment that affects their quality of life. This influence will have an impact not only on the physical health aspect, but also on the patient's mental health and social relationships (Wenham et al., 2020).

Support system is support in the form of verbal or nonverbal information or advice that is indispensable for the success of patient care (Giebel et al., 2021; Rosyanti & Hadi, 2020). Many studies revealed that support system can have a positive impact on the immune, neuroendocrine, and cardiovascular systems (Artama et al., 2017). In the research of Kaligis et al., (2020), explained that people's thought processes, behaviors, and emotional responses to an outbreak vary greatly according to their own background and the community where they live. For some people, misinformation, uncertainty, and fear of contagion can increase stress and anxiety, which can lead to mass panic. Mental health education and psychological support from all stakeholders, such as governments, health professionals, and communities, are essential during the pandemic. People with low support system are at a higher risk of death than those with high social support, an increased chance of survival and a better quality of life for a person (Xu et al., 2020; Yang et al., 2020). Good support system certainly has a positive effect on the physical and psychological recovery process for post-COVID-19 patients, particularly in patients with comorbidities. However, the current conditions in Ende district are still many family members who do not understand the importance of the support system for post-COVID-19 patients. Thus, this research is to answer this gap by analyzing the pattern of the support system and then making improvements through direct intervention to the patient's family. The objective of this study is to determine the determinants of the support system and quality of life in post-COVID-19 patients in Ende Regency, East Nusa Tenggara Province.

2. RESEARCH METHOD

The research method used is analytical observation using a cross sectional study design where all subjects and research variables are observed and measured at the same time (point time approach). The study was conducted in the four highest sub-districts with COVID-19 in Ende Regency, which were Central Ende, East Ende, North Ende and South Ende Districts. Respondents are post-COVID-19 sufferers who live in the sub-district area with the inclusion criteria residing in The Districts of Ende Tengah, Ende Timur, Ende Utara, and Ende Selatan,

respondents have a history of suffering from COVID-19 with the lowest age of adolescents and can communicate well. The population in this study were all patients with post-COVID-19 in Ende Regency. The sampling method used cluster random sampling with a total sampling of 110 respondents. Collecting data were conducted through interviews using a demographic data questionnaire, a support system questionnaire and the WHOQOL-BREF was employed to measure the quality of life. Moreover, other data obtained through direct measurements of the health status of respondents. Data analysis used computer application. Bivariate analysis applied Spearman test and Mann Whitney test (value $\alpha = 0.05$) because the distribution of the data obtained was not normal. This research has also received ethical approval from the Section of the Research Ethics Committee of Poltekkes Kemenkes Kupang No. LB.02.03/1/0110/2022 dated April 1, 2022.

3. RESULTS AND DISCUSSION

Based on data obtained from February 23 to April 30 2022. The selected respondents were patients who have been diagnosed with COVID-19 infection in accordance with the inclusion criteria. The measuring tools used were the support system questionnaire, quality of life, family knowledge, family attitudes, family behavior related to COVID-19 prevention and the health status of the respondents. After the data was collected, the researchers grouped and analyzed the data. The results of the univariate analysis describe the distribution of respondents according to age, gender, marital status, education level, occupation, symptoms when suffering from COVID-19, comorbid history, health status, support system, quality of life, family knowledge, family attitudes and family behavior related to COVID-19 prevention.

Table 1. Distribution of Respondents by Gender, Marital Status, Education Level, Occupation, Symptoms when Suffering from COVID-19, Comorbid History, Health Status in Ende Regency, Nusa Tenggara Timur Province (n=110).

Variable	Category	Total	Percentage (%)
Gender	Man	37	33.6
	Woman	73	66.4
Marital status	Married	57	51.8
	Not married yet	48	43.6
	Widow/widower	5	4.5
Level of education	Elementary school/equivalent	12	10.9
	Junior high school/equivalent	6	5.5
	Senior high school/equivalent	29	26.4
	University/Higher education	63	57.3
Occupation	Civil servants/National armies/National policemen	19	17.3
	Private employees	18	16.4
	Farmers/Fishermen	3	2.7
	Honorary	3	2.7
	Self-employed	50	45.5
	Not working/Activities at home	17	15.5
Symptoms when suffering from COVID-19	Asymptomatic	35	31.8
	Symptomatic	75	68.2

Variable	Category	Total	Percentage (%)
History of comorbid disease	Yes	20	18.2
Health status	Well	91	82,7
	Not good	19	17,3

Table 1 show that illustrates the proportion of respondents by gender, the majority are women (66.4%) with the most marital status, which are married status (51.8%), tertiary education level (57.3%), employment status mostly as self-employed (50%) and seen from the symptoms of the respondent's illness when suffering from COVID-19, the most were symptomatic (68.2%). Moreover, the majority of respondents did not have a history of comorbidities (81.8%) and about (82.7%) were in good health status.

Table 2. Distribution of Respondents by Age, Support system, Quality of life, Family Knowledge, Family Attitudes and Family Behavior related to COVID-19 prevention in Ende Regency, Nusa Tenggara Timur Province (n=110)

Variable	Mean	Median	SD	Min-Max	95% CI
Age	37.94	35.00	15.062	15-76	35.09-40.78
Support system	43.80	42.00	6.428	33-68	42.59-45.01
Quality of life	94.00	92.00	15.246	61-128	91.12-96.88
Family knowledge	8.45	9.00	1.386	5-10	8.19-8.72
Family attitude	11.34	11.00	2.499	6-18	10.86-11.81
Family behavior	19.21	19.50	2.943	12-30	18.65-19.77

Table 2 shows that the mean age of the respondents is 37.94 years with a standard deviation of 15,062. The youngest is 15 years old and the oldest is 76 years old. The results of the interval estimation can be concluded that it is 95% believed that the average age of the respondents is between 35.09-40.78 years. The average respondent's support system is 43.80 with a standard deviation of 6.428. Quality of life was measured by the WHOQOL questionnaire with the average quality of life being at a score of 94.00 with a standard deviation of 15.246. The average score of family knowledge related to COVID-19 prevention is 8.45 with a standard deviation of 1.386. The average score of the respondent's family attitude regarding COVID-19 prevention is 11.34 with a standard deviation of 2,499. The average behavior of the respondent's family regarding the prevention of COVID-19 is 19.21 with a standard deviation of 2,943.

Bivariate analysis was employed to determine whether there was a significant relationship between respondent characteristics, anxiety, depression, coping and social support with quality of life analyzed using the Man Whitney test and the Spearman correlation test. Prior to the correlation test, normality tests were conducted on the variables of age, support system, quality of life of post-COVID-19 patients, family knowledge, family attitudes, and family behavior related to COVID-19 prevention using the Kolmogorov-Smirnov. The results of the normality test for all variables presented that the data distribution was not normal ($p < 0.05$), thus, the tests used were the Mann Whitney test and the Spearman test.

Table 3. Distribution of post-COVID-19 patient support systems according to age, quality of life, knowledge, attitudes and family behavior related to COVID-19 prevention in Ende Regency, East Nusa Tenggara Province (n=110).

Variable	**r**	***p-value***
Age	-0.350	0,001[a]
Quality of life	0.567	0,001[a]
Family knowledge	0.187	0.051[a]*
Family attitude	0.370	0,001[a]
Family behavior	0,280	0,003[a]
Health Status	0.391	0,001[a]

[a]*Spearman test*
**p-value > 0,05*

Table 3. above shows that the relationship between age and the patient support system after COVID-19 is obtained with p value = 0.001 meaning that there is a significant relationship between the age of the respondent and the support system. The Spearman correlation value of -0.350 has a weak relationship strength with a negative correlation, meaning that the older you get, the less the support system. In the quality-of-life variable, a p value = 0.001 is obtained which indicates there is a significant relationship between the respondent's quality of life and the post-COVID-19 patient support system. The Pearson correlation value of 0.567 shows that the relationship between quality of life and the support system has a moderate relationship with a positive correlation, meaning that the larger the support system, the better the quality of life. The results of the analysis of the relationship between family knowledge regarding the prevention of COVID-19 and the support system for post-COVID-19 patients obtained p value = 0.051 which shows that there is no significant relationship between family knowledge and the support system. The correlation value of 0.187 indicates a very weak relationship strength with a positive correlation meaning that the higher the knowledge is, the more the support system will increase. The results of the analysis of family attitudes and behaviors and the health status of respondents related to the prevention of COVID-19 with the patient's support system after COVID-19 obtained a value of $p<0.05$ which showed that there was a significant relationship with the support system with the value having a weak relationship with a positive correlation, meaning that the better the attitude and behavior of the family, the greater the support system.

Table 4. Distribution of post-COVID-19 patient support system according to symptoms when suffering from COVID-19 and history of comorbidities in Ende Regency, East Nusa Tenggara Province (n=110).

Variable	**Category**	**Mean Rank**	**p-value**
Symptoms when suffering from COVID-19	Asymptomatic	63.33	0,078[a]*
	Symptomatic	51.85	
History of comorbid disease	Yes	27.70	0,001[a]
	Not	61.68	

[a]*Man-Whitney test*
** p-value > 0,05*

In table 4, it can be identified that the relationship between symptoms of illness when suffering from COVID-19 and the support system of post-COVID-19 patients obtained a p value of 0.078, meaning that there is no significant relationship between these variables and the support system of post-COVID-19 patients. However, for the relationship between a history

of comorbid disease and the support system of post-COVID-19 patients, a p value = 0.001 was obtained which indicates that there is a significant relationship between the history of comorbidities and the support system of post-COVID-19 patients.

Table 5. Distribution of Quality of life by Age, Knowledge, Attitudes and Behavior of Families related to COVID-19 prevention and Health Status in Ende Regency, East Nusa Tenggara Province (n=110)).

Variable	r	p-value
Age	-0.551	0,001[a]
Family knowledge	0.145	0,129[a]*
Family attitude	0.393	0,001[a]
Family behavior	0.352	0,001[a]
Health Status	0.337	0,001[a]

[a]*Spearman test*
**p-value > 0,05*

Table 5. above shows that the relationship between age and quality of life of patients after COVID-19 is obtained p value = 0.001 meaning that there is a significant relationship between the age of the respondent and the quality of life of patients after COVID-19. The Spearman correlation value of -0.551 has a moderate relationship strength with a negative correlation, meaning that the older it is reached, the less the quality of life for post-COVID-19 patients. The results of the analysis of the relationship between family knowledge related to COVID-19 prevention and the quality of life of post-COVID-19 patients obtained a p value of 0.129 which indicates that there is no significant relationship between family knowledge and the support system. The correlation value of 0.145 indicates a very weak relationship strength with a positive correlation meaning that the higher the knowledge, the higher the quality of life of post-COVID-19 patients. The results of the analysis of family attitudes and behaviors as well as the health status of respondents related to the prevention of COVID-19 with the quality of life of patients after COVID-19 obtained a value of p = 0.01 which showed that there was a significant relationship with the support system with the value of having a weak relationship with a positive correlation meaning that the better the attitudes and behaviors of the family and the health status of the respondents the greater the quality of life of the respondents.

Table 6. Distribution of quality of life of post-COVID-19 patients according to symptoms when suffering from COVID-19 and history of comorbidities in Ende Regency, East Nusa Tenggara Province (n=110)

Variable	Category	Mean Rank	*p-value*
Symptoms when suffering from COVID-19	Asymptomatic	53.89	0,717[a]*
	Symptomatic	56.25	
History of comorbid disease	Yes	31.48	0,001[a]
	Not	60.84	

[a]*Man-Whitney test*
** p-value > 0,05*

In table 6, it can be seen that the relationship between symptoms of illness when suffering from COVID-19 and the quality of life of patients after COVID-19 obtained p value = 0.717, meaning that there is no significant relationship between symptoms of illness when suffering from COVID-19 and the quality of life of patients after COVID-19. However, it is different for the relationship between the history of comorbid diseases and the quality of life of patients after COVID-19, the p value = 0.001 which shows that there is a significant relationship between the history of comorbidities and the quality of life of patients after COVID-19.

Since the COVID-19 pandemic has hit the whole world, it is undeniable that COVID-19 is not just a physical health problem. However, COVID-19 is also with mental health. There are even some things that are detected as mental health problems that are commonly experienced by COVID-19 patients, such as sleep disorders, high anxiety, and even depression. Therefore, a good support system is needed from other parties such as family, friends, relatives and even related agencies to reduce the potential for patients experiencing mental health. Through this study, determinants were found that can influence the provision of a support system, namely age, family attitudes and behavior, patient health status and a history of comorbid diseases. The support system is a form or encouragement from the surrounding environment in the form of attention, affection or appreciation to prevent, overcome and reduce negative effects that can harm each individual, so that the individual feels comfortable and cared for, and can reduce the emergence of stress (Qi et al., 2020; Xiao et al., 2020; Szkody et al., 2021). Based on this explanation, it can be implied that the existence of a support system in the form of caring can reduce negative things in individuals. Until recent time, there is a few research that present data on support systems and quality of life in post-COVID-19 patients.

Based on the test results, it was discovered that age is related to the support system and the quality of life of patients after COVID-19, such is the case with several studies that have found that a person's age has a relationship with the needs of the support system and the quality of life of the patient (Cao et al., 2020; Greenhalgh et al., 2020). The physical condition of the post-COVID-19 patient is associated with the condition of the age and health status experienced. It is a natural process that increasing age will be accompanied by changes in physical, psychological and social conditions that interact with each other (Cao et al., 2020; Ornell et al., 2020; El-Zoghby, Soltan and Salama, 2020). This situation tends to have the potential to cause health problems in general and mental health in particular. The decline in physical condition and weakness after suffering from COVID-19 can raise concerns about social functions in the family or community. If this worry is excessive, it will have an impact on the onset of depression and a decrease in quality of life. It is as stated by Wu et al., (2021), which states several risk factors that support the occurrence of health problems, comprising of poor physical health, separation from spouse or family due to independent isolation from COVID-19 disease, reduced financial resources, and reduced social support. Meanwhile, several studies have shown an association between the impact of isolation at home and higher rates of depression in young adults (Qi et al., 2020; Serafini et al., 2020), which means that the younger age required to self-isolate is more impactful and related to their mental well-being (Cai et al., 2020).

Support system is very effective in dealing with psychological stress in difficult and depressed situations (Hou et al., 2020). For instance, support system helps strengthen the body's immune function, suppress physiological responses to stress and strengthen functions to respond to disease. Traumatic experiences usually occur from the initial period of suspicion of being infected with COVID-19 to during quarantine before treatment. Loneliness as a result of separation from loved ones, fear of death, worries about the physical health of their family (Cai et al., 2020), and uncertainty about future life, causes or worsens physical and mental health conditions. Anxiety and fear occur so that the patients were not able to sleep through the night even after COVID-19 treatment (Cai et al., 2020). Patients with COVID-19 and post-COVID-19, will have the potential to have continued traumatic experiences due to the continuous sense of disturbance that is felt and negative reactions from the community, thereby worsening the quality of life of sufferers after COVID-19.

Post-COVID-19 patients usually still accept negative views and feel deliberately avoided by their families and society. Abdillah (2020), explained that post-COVID-19 patients have

suffered stigma from society leading to a form of 'social death'. Many patients tend to internalize the exclusionary behavior and attitudes of their family or society towards them, which results in decreased self-esteem and feelings of increased prejudice that lead to decreased physical and mental health. Unclear knowledge, attitudes and behavior of families related to COVID-19 are parameters that lead to negative responses to post-COVID-19 patients which in the end has the potential to cause misunderstandings and spread inaccurate information about post-COVID-19 sufferers. However, in this study, the relationship between family knowledge and the support system and quality of life of post-COVID-19 patients did not find a significant relationship, but the relationship between family attitudes and behavior with the support system and quality of life of post-COVID-19 patients had a significant relationship. It can be identified that good knowledge without being accompanied by family attitudes and behavior will not have a good positive impact on providing family support systems and quality of life in post-COVID-19 patients. Thus, we require a clear model or guide on family health management for post-COVID-19 sufferers (Zhao et al., 2020).

The family support system in terms of motivating and minimizing anxiety after suffering from COVID-19 is tremendously crucial in supporting the physical and emotional needs of sufferers. With a good family support system, anxiety resulting from negative stigma and the period of separation when doing self-isolation can be overcome so that patients will feel comfortable while undergoing follow-up care, particularly in patients with a history of comorbidities or sequelae of the COVID-19 virus infection (Peprah and Gyasi, 2021). Patients who feel comfortable during treatment and recovery of disease prevent a decrease in the immune system so that it affects the healing process and improves their health status. The support system in dealing with the situation after the current coronavirus pandemic is significantly essential in the human health dimension. The support system can come from close family, friends, coworkers, neighbors and friends in activities. Social contact is also crucial for physical and mental health (Yu et al., 2020).

Support systems are required in every important process and crisis in life, many people withdraw because they do not know what to say and do and how to help others. While at home, post-COVID-19 patients are considered patients who have been cured but still need informal care. Home is a sanctuary from the outside world, where people feel belonging. Hence, families or relatives who are in the home environment with post-COVID-19 patients can find out all correct and appropriate information about the prevention and care of post-COVID-19 patients. The attitudes and behavior shown by the family will have a positive impact on providing support systems to post-COVID-19 patients (Artama & Owa, 2022). It is as stated by El-Zoghby et al., (2020), that supports from family is the most important element in helping individuals solve problems if there is support, self-confidence and motivation to deal with problems that occur will increase. People with high support system will be able to reduce the stress they experience (they know that there is someone who will be able to help them) so that someone who does not care about the amount of stress or anxiety that will be experienced can support in improving their quality of life. Social contact and support can help reduce stress, depression, anxiety and isolation, and improve self-esteem, normal life, well-being and quality of life, while a lack of social support has the opposite effect.

The positive effect of a good support system can be explained that this support has a direct impact on health and well-being because it provides comfort, a sense of purpose in life and security. Support systems can reduce various forms of stress, improve coping mechanisms and improve quality of life (Kaligis, Indraswari, & Ismail, 2020). Support when the relationship is sporting can help psychological relationships, strengthen healthy living practices and aid recovery from illness (DePierro, Lowe, & Katz, 2020). Therefore, the support provided is closely related to determinants of the patient's family such as and family behavior towards patients or patients post-COVID-19. Another determinant factor that influences the support

system and quality of life of COVID-19 patients is the symptoms and health status of patients when suffering from COVID-19. Patients with this condition seem to get a good support system compared to COVID-19 patients without symptoms or other health problems.

Patients who are in a period of healing and recovery will recover faster if they get a support system that comes from the social environment, such as family and friends who have both suffered from illness so that they will feel cared for and not alone (Xu et al., 2020). The support system can make it easier for post-COVID-19 patients to adapt to their conditions so that they have high enthusiasm to recover from illness and improve their health status. Thus, with the support system, it is hoped that some post-COVID-19 patients can adapt to their new situation very quickly, without anxiety or negative self-stigma. It is hoped that post-COVID-19 patients can understand the social impact of the COVID-19 pandemic.

4. CONCLUSION

There is a relationship with a negative correlation between age and the support system and the quality of life of post-COVID-19 patients. Other test results, there is not relationship between family knowledge and the support system and the quality of life of patients after COVID-19, but there is a relationship between attitudes and behavior of families with the support system and quality of life of patients after COVID-19. There is a relationship with a positive correlation between the support system and the quality of life and the health status of post-COVID-19 patients. The support system provided to people with various determinants when facing the situation after the coronavirus pandemic is very important in improving the physical and psychological dimensions. A good support system can reduce various forms of stress, improve coping mechanisms and improve the quality of life of post-COVID-19 patients.

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RESEARCH **Open Access**

Ex-Migrant Nurses Empowerment after Recovery from Covid-19 Pandemic: An Analysis of Reflective Cycle Gibbs Model

La Jumu[1a*], Syaifoel Hardy[2b], Sugeng Riyadi[3c], Dharmawan Arief[4d], Ridha Afzal[2e], Sukatemin[1f]

[1] Department of Nursing, Poltekkes Kemenkes Jayapura, Jayapura City, Papua, Indonesia
[2] Indonesian Nursing Trainer, Malang City, East Java, Indonesia
[3] Department of Healthcare, Qatar Energy, Qatar
[4] Special Elderly Nursing Homes, Bungkyo, Tokyo, Japan

[a] Email address: lajumu_akper@yahoo.co.id
[b] Email address: saderun@gmail.com
[c] Email address: s_riyadi@qatarenergy.qa
[d] Email address: ariefdharmawan09@gmail.com
[e] Email address: ridhaafzal.rj@gmail.com
[f] Email address: soekad3rma@gmail.com

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Abstract

During the Covid-19 outbreak, many ex-migrant nurses who had resigned and were living in Indonesia were unable to return to work. The objective of this study is to develop strategies for empowering ex-migrant nurses in the sustainable healthcare sector following the recovery from the Covid-19 pandemic. The Reflective Cycle Gibbs (RCB) model was employed during the research, which comprised six stages that began with a document review and PRISMA analysis. The PRISMA Analysis utilized Google search engines to filter documents from Google Scholar, Research Gate, and other sources. The RCB model examined 10 eligible journals and discovered records of nurses who returned to their home country due to inadequate pay, career development, workforce protection policy, and empowerment facilities. We concluded 4 problems encountered by returnee nurses i.e. lack of protection policy, poor wages, less career development, and lack of empowerment facilities.

Keywords: Empowerment, Ex-Migrant Indonesian Nurses, Reflective Cycle Gibbs.

Corresponding Author:

La Jumu
Department of Nursing, Poltekkes Kemenkes Jayapura, Jayapura City, Papua, Indonesia.
Email: lajumu_akper@yahoo.co.id

1. INTRODUCTION

At the beginning of 2022, there were no signs that Covid-19 would disappear soon (Karim & Karim, 2021). Moreover, the occurrence of a new variant of Omicron can be a challenge for the employment sector (Torjesen, 2021). The movement of demand and supply for nurses abroad was one of the labor sectors affected (Lin et al., 2021). Nurses are the dominant healthcare workforce in the market (Philip et al., 2018). Nurses possess the highest demand and supply of health workers in Indonesia (Hardy, Hadi & Tokayo, 2021). In Indonesia, nurse recruitment overseas began in the early 1990s in the Middle East and has since moved to numerous other countries such as Japan, Australia, the Netherlands, and is recently in the process of expanding to Germany (Farah & Choi, 2019). The program offers not only an increase in the welfare of nurses but also the enhancement of the service quality of the profession, additional insight, science and technology, sharpening skills, as well as boosting bilateral cooperation between nations (Calenda & Bellini, 2021). Working abroad for nurses is a professional needs requiring our attention (Mujiati et al., 2020). Therefore, ex-migrant workers are national assets that require to be empowered (Qawiyurrijal, Zainul & Kurniawati, 2021; Zulfikar, 2016).

Numerous studies have been conducted to investigate the issue of migrant and ex-migrant employees (Calenda & Bellini, 2021; Uwabuke, 2021; Inter-Parliamentary Union, 2015). The significant amount of them emphasized ex-migrant female workers' empowerment, welfare difficulties, and domestic violence encountered by ex-migrant employees (Koczan et al., 2021; Tankwanchi et al., 2019). As one of the countries that exports the most workers overseas, the Philippines discusses not only the impact of such enormous research on the national economy (Nortvedt, Lohne, & Dahl, 2020). They investigated the concerns of their relatives who are working overseas or who are left behind (Adebayo, 2021), similarly, in nations such as India and Africa, where many of its inhabitants work abroad, particularly in Europe, America, Canada, and Australia (Moyce & Schenker, 2018). The existence of diaspora associations is a concrete evidence of migrant workers' aspirations in accommodating various positive interests for their future (Hastuti et al., 2019). The future of migrant workers is interesting to study, both during their stay in the country where they work and after returning to their country. These are some of the differences between earlier studies and this article.

This research is a document review employing Reflective Cycle Gibbs model (RCB) concerning more on empowering ex-migrant Indonesian nurses in the health sector, particularly after the Covid-19 period. Some of the major problems experienced by migrant nurses during the Covid-19 period encompass the inability to go back home or on leave. As on leave, they cannot return to their country of work, it is difficult to find work with a decent salary, there is no institution to accommodate their aspirations or potential, and there is no empowerment effort (Calenda & Bellini, 2021; Efendi et al., 2021; Adebayo, 2021). Numerous studies have indicated the amount of job opportunities for nurses, but none have specifically addressed how to empower ex-migrant employees in Indonesia, the number of whom is growing. This question is not effectively addressed, increasing the danger of infection with Covid-19. As a result, the objective of this study was to assist in the formulation of strategies for empowering ex-migrant nurses following the pandemic so that they can continue to have jobs for their welfare and play a vital role in the growth of the health sector. The implication is to contribute to the scholarly interest, diaspora strategy, input, and benefits for ex-migrant nurses, private employment recruitment agencies (PPTKIS), educational institutions, relevant government institutions (BP2MI), and the ministry of manpower.

2. RESEARCH METHOD

This study employed the Reflective Cycle Gibbs (RCB) to examine the problem after selecting documents with the support of PRISMA analysis. There were four stages administered in this research after identifying the keywords in utilizing PRISMA. The reflection method was employed as it provides a framework for examining ex-migrant nurses experiences, and provided its cyclic nature lends itself particularly well to repeated experiences, allowing us to learn and plan from things that either went well or did not run well (Adeani, Febriani & Syafryadin, 2020). It is extensively administered in health research and is considered one of the most effective and efficient research, particularly during the Covid-19 pandemic (Adeani, Febriani & Syafryadin, 2020; Adebayo et al., 2021; Souza et al., 2021).

The study began by examining relevant papers about ex-migrant nurses, reflective practice, and Covid-19, conducted from January to June 2022. The key studies in the research title were administered to create a synthesis matrix. The PRISMA Analysis matrix assists the researcher in classifying numerous arguments of several articles and combining diverse aspects to generate an impression/conclusion about the entire article in general. Excluded articles were those that were more than 5 years old (before 2017), did not match the topic, or were irrelevant. The matrix incorporates a column that summarizes 10 publications that are highly applicable to the research topic, encompassing the research title, researcher, year of publication, research methods, and results.

The data collection employing the google search engine. The documents sought were journals, reports, or other related documents and in accordance with the title keywords (ex-migrant, Indonesian nurses, and Covid-19). In the second stage, the relevant data was grouped (Google Scholar, ResearchGate, and others), while the irrelevant, or duplicated documents were discarded. The third stage was screening, which was grouping more specific documents, associated with ex-migrant Indonesian nurses.The years of publishing ranged from 2017 to 2022, in either English or Indonesian. The Reflective Cycle Gibbs was the dependent variable in this study, while ex-migrant nurses were the independent variable. Ex-migrant Indonesian nurses, introspective, and Covid-19 were the eligibility requirements. Non-nursing articles/journals, non-healthcare professional migrant workers, and other papers unrelated to the issue are included in the exclusion criteria. The final stage is the grouping of documents that should be reviewed (category Included). All researchers participating in the creation of this study searched for data in trustworthy journals. The lead researcher summarized and analyzed the data, which was then reviewed and validated by all team members until it was finalized. The specifics are shown in diagram 2 below.

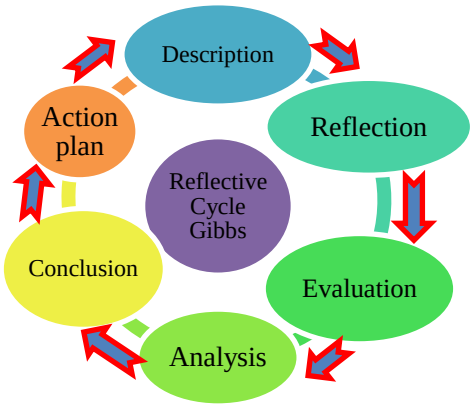

Diagram 1. Reflective Cycle Gibbs

The instrument administered as a systematic in dealing with employment problems of ex-migrant nurses was the RCG model. The systematics incorporates 6 stages, starting from

description, reflection, evaluation, analysis, conclusion, and action plan. More details are demonstrated in the following diagram:

3. RESULTS AND DISCUSSION

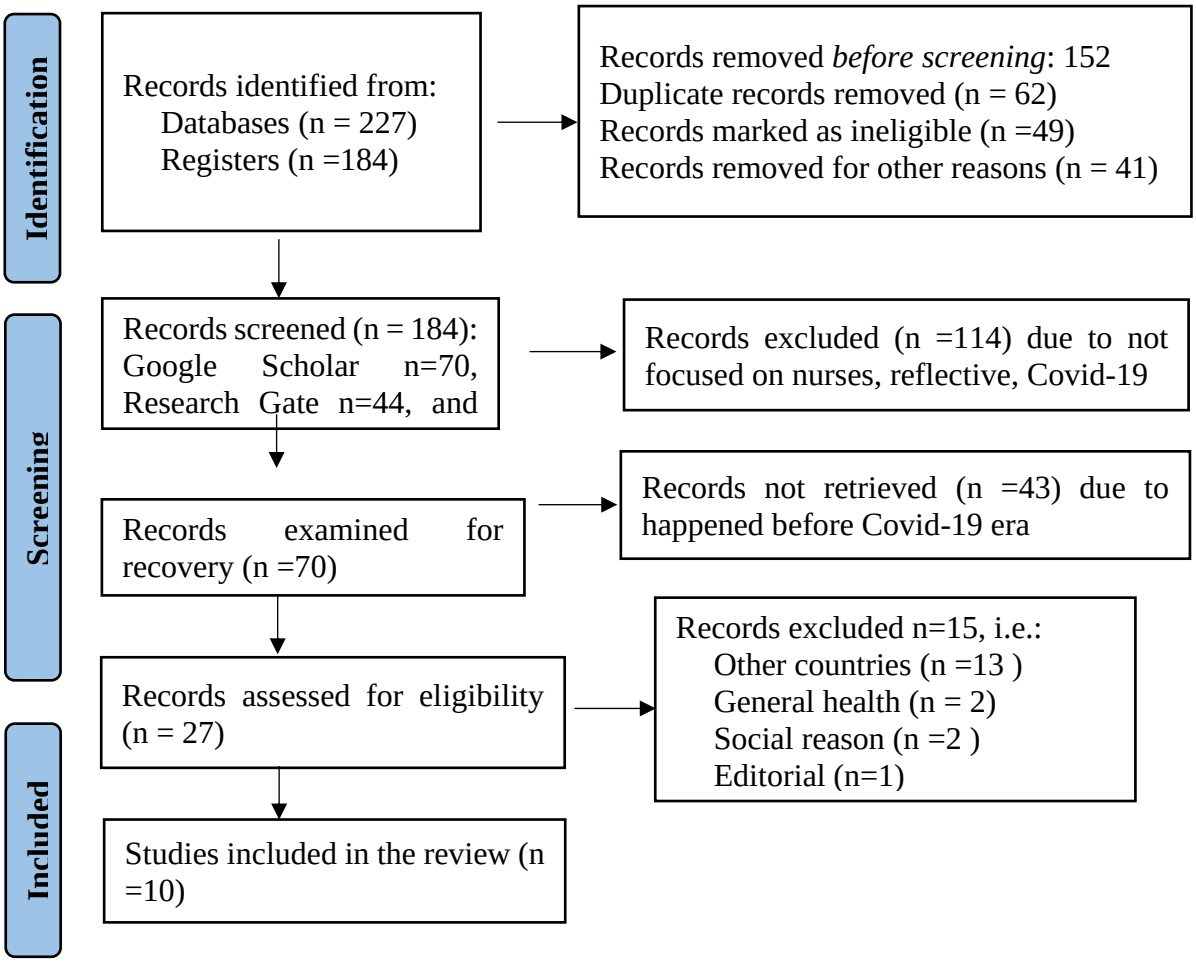

Diagram 2. Results of PRISMA Analysis

Diagram 2 depicts the results of early-stage Google search engine document searches: n=563 records were collected, of which n=411 were incorporated into the database and registered, and n=152 were rejected. Documents were discovered through Google Scholar (n=70), Research Gate (n=44), others (n=40), and a total of n=184 documents. There were 152 documents that were eliminated because they were irrelevant, duplicated, or for other reasons. Documents incorporated in the record retrieved category were n=70 and assessed n=27, invalid records (excluded) n=17, while those reviewed in the study n = 10. The 10 records of this study 100% incorporating ex-migrant nurses, occurred in various countries in the Covid-19 era. The summary is in Table 1 below:

Table 1. Reviewed records with the detailed result and identified problems of ex-migrant Indonesian nurses

No.	Title, Authors, and Year of publication	Country of ex-migrant nurses worked	Results	Identified Problems and Challenges
1	Prevalence of Depression, Anxiety, and Stress Among Repatriated Indonesian Migrant Workers during the COVID-19 Pandemic, Harjana, et.al, 2021	Internatio-nal	Most respondents had worked as migrant workers for more than 5 years and more than half of them had not received compensation from their company or employer when they arrived back in Indonesia due to the COVID-19 pandemic. Only 2.09% of the survey participants had ever been diagnosed with COVID-19 (Harjana et al., 2021).	- They did not receive compensation during the pandemic - 2.09% infected by Covid-19
2	Going Global: Insights of Indonesian Policymakers on International Migration of Nurses, Efendi, et al., 2021	Internatio-nal	The issues involving nurses' migration policy are quite complex and sectoral. Themes emerging from the study incorporate the move towards global market orientation, addressing challenges on international nurses migration, strengthening coordination among stakeholders and formulating the most of opportunities (Efendi et al., 2021).	- Nurses migration policy i.e before, during, and after migration.
3	The Role of the National Commission on Human Rights of the Republic of Indonesia Related to the Impact of COVID-19 Pandemic on Human Rights and Sustainable Development Goals in Indonesia, The	Internatio-nal	The COVID-19 epidemic has also resulted in an impact on human rights, with some abuses occurring. Some human rights implications were directly (and unavoidably) generated by the pandemic, while others were the product of how the authorities administered it. It demonstrates that the authorities are not sufficiently implementing human rights standards. (The Indonesian National Human Rights Commission, 2021).	Human rights violations are not adequately adopted by the authorities.

	Indonesian National Human Rights Commission, 2021.			
4	Are Indonesian Nurses Ready for Healthcare Robots during the Covid-19 Pandemic? Betriana, et al., 2020.	Japan	Healthcare robots are administered in Indonesia and other countries to combat the COVID-19 pandemic (Betriana et al., 2020).	Educating nurses about healthcare robots, programming, and assurance of its safe and secure use can advance robot appreciation as partners in healthcare.
5	Transformational Leadership and Job Satisfaction Variabel as Factor that Decrease Organizational Citizenship Behavior of Nurses in Private Hospitals in Manado City, Manoppo, et al., 2021.	Indonesia	Transformational leadership possesses a positive effect on job satisfaction and transformational leadership owns a positive significant effect on organizational citizenship behavior. Job satisfaction possesses a positive significant effect on organizational citizenship behavior (Manoppo et al., 2021).	Ex-migrant nurses are potentials to work in major hospitals as leaders, yet job satisfaction has to be answered concerning wages.
6	Migration and Development: A Case Study of Indonesian Migrant Workers, Hastuti et al., 2019.	Internatio-nal	Most suggestions proposed more and more responsibility to the government, such as the revisited regulation, restructuring organization, and intergovernmental agreement (Hastuti et al., 2019).	The question is about the independency of migrant-worker organization on how the organization criticizes the policy-maker if they wish to participate in the project.
7	Empowering Women Ex-Migrant	Hongkong, Malaysia, Saudi	There are several problems in the implementation of development programs,	Lack of funding, facilities,

	Workers and Domestic Violence Victims through Komunitas Perempuan Singkong Jaya, Chawa, Nugroho, Sutopo, 2020.	Arabia, and Taiwan	incorporating the lack of capital and facilities, packaging and marketing, as well as product license problems. Addressing these problems, some intervention programs conducted, encompassing training and funding which have generated intended outputs (Chawa, Nugroho, Sutopo, 2020) .	training, and licenses
8	Factors Related the Job Satisfaction among Migrant Nurses in Qatar, Uddin, S., 2019.	Qatar	Indonesian migrant nurses working in Qatar are satisfied with the work of 51.3%. The results of the analysis demonstrated no correlation between length of service and working time arrangements with job satisfaction, whereas there was no correlation between age, education degree, and family status with job satisfaction (Uddin, 2019).	Professional development and incentives increase on shift duty
9	Nursing Home's Measures during the COVID-19 Pandemic: A Critical Reflection, Goh et al., 2022.	Singapore	Nurses have been critical in the fight against COVID-19 by ensuring continuity of patient care and providing clinical leadership in pandemic activities (Goh et al., 2022).	Long-term care facilities are vulnerable to the pandemic, but little has been reported about the nursing homes' measures in handling the pandemic.
10	Nurse Migration and Career Development: The Indonesian Case, Nugraha, Raharjo & Hirano, 2021.	Taiwan, Hongkong, Singapore, Saudi Arabia	Working overseas is advantageous for gaining experience, improving skills, and advancing one's career. Most of them were unwilling to work abroad owing to family obligations (Nugraha, Raharjo & Hirano, 2021).	Career development seems to be a problem although they have fulfilled requirements as they a lack of satisfaction.

Table 1 above demonstrates a summary of eligible journals encompassing the country in which the ex-migrant nurses worked, experience the nurses, benefits, challenges, risks, and problems encountered, both before, during, and after working abroad. The question is on how to empower them after returning to Indonesia.

From the 10 journal descriptions above associated with the problems encountered by ex-migrant nurses of Indonesia, it can be indicated and grouped that there are 4 major problems, which are having a job with a decent salary, poor career development, lack of workforce

protection policy, and shortage of empowerment facilities. We examined these four problems in 6 stages in accordance with the Reflective Cycle Gibbs (RCG) as follows:

The first stage is description. At this point, a discussion of who the problem is, what problem was discovered, when the problem occurred, and what the immigrant nurse acts about the problem. Before the Covid-19 pandemic, nurses (article numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10) faced issues with job remuneration and earnings, human rights, job placement, and professional growth. It was inferred from the four groups of difficulties that the primary ones they encountered were in four areas, incorporating the issue of earnings n=5 (journals no. 1, 3, 5, 8, 10) and career development n=6 (journals no. 1, 5, 7, 8, 9, 10), protection policy n=7 (journals no. 1, 2, 3, 4, 6, 7, 8) and empowerment facilities n=5 (journals no. 1, 2, 5, 6, and 9).

The second stage of RCG is reflection. Reflection in health is one theory which has evident effective in dealing with a problem (Galutira, 2018). This theory is administered in the health empowerment issues (Nukpezah et al., 2021; Oliveira et al., 2020). We require to ask why the 4 problems associated with wages, career development, workforce protection policy, and empowerment still exist and need to be reviewed. To develop a solution, this assessment step necessitates thinking. At this point, the writers' opinion was that, as one of the most essential parts of the health-care system, ex-migrant nurses are valuable state assets. However, there is still no system in place, and their empowerment is unequal, thus the contribution of ex-migrant nurses is not visible.

The third stage is evaluation. Evaluation programs are tremendously general for all professionals (Wiseman et al., 2018). In the nursing process, the evaluation stage is also understood as the fourth stage (Rouleau et al., 2017). The evaluation stage in accordance with the RCG concerns the significance of evaluating the experience of ex-migrant nurses. The existence of learning to deal with the problem of ex-migrant nurses during the epidemic is a positive aspect of the existing situation. The disadvantage is that properly addressing these issues necessitates thought, time, and money. The difficulties in the ten existing journals were classified according to their category (wages, career development, workforce protection policy, and empowerment facilities). The problem provided a positive experience in terms of knowledge advancement, practical experience, and the transcultural lives of ex-migrant nurses. Meanwhile, the unfavorable experience was that not all ex-migrant nurses received the desired financial benefits, knowledge, and skills while working abroad.

The fourth stage requires analyzing. Adeani, Febriani, & Syafryadin, (2020) elaborate that analysis is an effort formulated with a particular method to observe something in detail. At this stage, we examined what happened to the ex-migrant nurses based on the findings of the researchers, the causes, and the recommendations from their research results. According to some academics, the causes that produce the problem of ex-migrant workers encompass the ineffectiveness of the operations of nursing professional organizations overseas, the inadequacy of an organized system in the country, and the unavailability of a platform that accommodates the goals of ex-migrant nurses (Chawa, Nugroho, & Sutopo, 2020; Adebayo et al., 2021; Hastuti et al., 2019).

The fifth stage is conclusion. Gibbs' model presents two conclusions: general and specific. The overall conclusion is that ex-migrant nurses confront financial, social, and technical challenges. The conclusion is supported by several researchers' opinion on similar subject (Chawa, Nugroho, & Sutopo, 2020; Uwabuike, 2021). There are four findings in this study that are specific to the nursing profession, particularly empowerment associated with their competency as professional nurses.

The sixth stage is action plan. Empowerment in the health sector entails incorporating them into the training of abroad nurses, entrepreneurs, independent nurse clinics, and medical tourism (Hardy, Hadi, & Tukayo, 2021). Those industries have never been without a

requirement for nurses (Al-Ashwal et al., 2020; Hardy, Hadi, & Tukayo, 2021; Zulfikar, 2016). In this step, we planned what we would do differently in similar or related situations in the future. This step was tremendously helpful to think about how we are able to assist the profession, ex-migrant nurses, community, ministry of manpower, and the state (Nortvedt, Lohne, & Dahl, 2020). Therefore, we did not simply anticipate what we would perform differently, but also how we ensit happened. The next step is to compile a proposal that incorporates the background, objectives, program agenda and timeframe, organization, funding, and a SWOT analysis. The proposal should explain the plan and objectives of the activity clearly and in detail that requires the approval of other parties. As suggested by many research finding, to create proposals for this issue, we suggested organizing a small pilot project committee comprised of government representatives, manpower agents, community representatives, professional groups, university representatives, and ex-migrant nurses (Hardy, Hadi, & Tukayo, 2021; Philip et al., 2018). According to various research findings, the objective of the proposal is to discover exceedingly essential challenges and solutions associated with the empowerment of ex-migrant nurses by concerning all available potentials, incorporating supportive and inhibiting variables (Efendi et al., 2015; Espino-Díaz et al., 2020).

The limitation of this study is that we did not perform direct research with more ex-migrant Indonesian nurses who resigned from different countries. It was owing to financial, geographical, energy, and time constraints, particularly during the Covid-19 pandemic. There has also been little research on ex-migrant nurses in Indonesia (Tukayo & Hardy, 2020). The subject of empowering returnee nurses can be discussed further in the future. For instance, ex-migrant nurses' work in various parts of Indonesia, or their membership in a returnee nurse organization.

4. CONCLUSION

We obtained the problem of employment compensation and wages, human rights, job placement, and professional development among ex-migrant nurses by employing Reflective Cycle Gibs design based on 10 appropriate documents out of 27 records. This study suggests that returnee nurses' problems should be addressed through job placement, career development, nursing workforce protection policies, and the formation of empowerment facilities/agencies. As a result, based on the 6-stage Gibbs Reflective Cycle Model, this study suggested the formation of a small committee comprised of representatives from diverse aspects, such as the government, private, and professional organization sectors, to develop tangible initiatives.

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RESEARCH **Open Access**

The Effect of Multimedia-Based Education on Knowledge, Attitudes, and Behavior Hypertension Patients in Stroke Prevention

Santa Manurung[1a*], Suratun[1b], Wartonah[1c], Ni Luh Putu Ekarini[1d], Raden Siti Maryam[1e]

[1] Department of Nursing, Politeknik Kesehatan Kementerian Kesehatan Jakarta III, Bekasi City, West Java, Indonesia

[a] Email address: santamanurung@yahoo.com
[b] Email address: suratunharyono@yahoo.com
[c] Email address: wartonah03@yahoo.co.id
[d] Email address: ekaputu98@yahoo.com
[e] Email address: raden.maryam@poltekkesjakarta3.ac.id

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Abstract
The prevalence of hypertension continues to increase, and various epidemiological studies revealed an increase in the incidence of hypertension in different parts of the world. According to the American Heart Association (AHA), The number of Americans over the age of 20 who suffer from hypertension has risen to 74.5 million, while nearly 90% of cases have no identified cause. If not treated effectively, hypertension may cause damage to blood vessels throughout the body, the most prominent of which is the danger of damage to the brain, eyes, heart, and kidneys. An introduction to stroke is essential for reducing the risk of stroke in people with hypertension. Multimedia is one of the developments in health education media, which is in accordance with the advancement of digital technology, incorporating stroke prevention. This study aims to examine the impact of multimedia-based education on hypertension patients' knowledge, attitudes, and behavior toward stroke prevention. This research is a quasi-experiment with a pre-posttest with a control group design. The sampling technique employed was simple random sampling, and the sample size determination utilized a hypothesis test of the average difference in two independent groups of 60 respondents. Data analysis in this study administered paired t-test and independent t-test. The results unveiled that there were significant differences in knowledge (p=0.022), attitudes (p=0.001), and behavior (p=0.008) of hypertension patients in preventing stroke after intervention in the form of multimedia-based education. Therefore, it is recommended that the community can perform hypertension treatment independently frequently, and the implementation of the prolanis program can be enhanced so that people can receive services easily and regularly to prevent stroke.

Keywords: Multimedia, Education, Hypertension, Stroke Prevention.

Corresponding Author:

Santa Manurung
Department of Nursing, Politeknik Kesehatan Kementerian Kesehatan Jakarta III, Jakarta, Indonesia
Email: santamanurung@yahoo.com

1. INTRODUCTION

Hypertension, well-known as high blood pressure, is a health problem frequently discovered in developing and developed countries (Malik et al., 2014). In adults with hypertension, the systolic pressure is more than 140 mmHg, and the diastolic pressure is more than 90 mmHg (Yano et al., 2015). High blood pressure can be perceived as a symptom, a risk factor, or a disease. Hypertension is generally referred to as the silent killer in which symptoms can vary in every individual and are almost similar as symptoms of other diseases, or even several sufferers do not experience any symptoms (Bell et al., 2015).

According to the World Health Organization (2013), the global population of hypertension sufferers has surpassed 1.13 billion persons. WHO estimate that over 1.56 billion persons will have hypertension by 2025. Meanwhile, the prevalence of hypertension in Indonesia is 31.6% in the 31–44-year age group, 45.5% in the 45–54-year age group, and 45.35% in the age group (World Health Organization, 2013). The age group of 55 to 64 years old accounted for 55.2% (World Health Organization, 2013). WHO asserted that the number of people affected by high blood pressure escalates with age, with 1 in 10 in their 20s and 5 in 10 in their 50s (World Health Organization, 2013). Hence, early detection is critical, and every adult should be aware of their blood pressure and keep it within normal ranges.

In Indonesia, the problem of hypertension is a robust challenge, as hypertension is frequently discovered in primary health services with a high prevalence. In accordance with Basic Health Research in 2013, it obtained around 25.8%. This presents that there is an increase in the prevalence of hypertension from 7.6% in 2007 to 9.5% in 2013, and the figure is higher in the elderly (Kementerian Kesehatan Republik Indonesia, 2013). Furthermore, hypertension control has not been adequate even though effective drugs are extensively available. Meanwhile, Basic Health Research (2018) demonstrates that 34.1% of the Indonesian population aged 18 years suffer from hypertension, with an estimated number of cases of 63,209,620 people. Meanwhile, the cases of death due to hypertension in Indonesia are at 427,218 deaths (Kementerian Kesehatan Republik Indonesia, 2018).

The elderly population is a vulnerable group in society, which is at risk and is more sensitive to exposure to various risk factors, incorporating economic, social, physical, biological, genetic, and lifestyle factors (Lionakis et al., 2012). Factors associated with vulnerability encompass low socioeconomic status, an unhealthy lifestyle, low self-esteem, helplessness, and inability to take care of oneself. Meanwhile, risk factors predisposing to health problems incorporate environmental, nutritional, and sociocultural factors (Ungar et al., 2013).

Hypertension is a disease which generally affects the elderly, characterized by blood pressure above normal, frequently does not cause symptoms, thus it is referred to as the silent killer (Cherubini et al., 2010). It is predicted that there are 76% cases of hypertension in the community that have not been diagnosed, in this case a person does not understand that he or she suffers from hypertension. These diseases are the prior causes of disability in the elderly, hence, they become a burden for families, communities and governments (Rayanti et al, 2021).

Data obtained from the Cipayung Sub-district Health Center, East Jakarta, illustrates that in 2016 hypertension patients who came for treatment with new visits were 96 people, and old visits were 533 people, thus, the total visits were 629 people. In 2017, this ailment perceived a significant increase, with 119 new hypertension patients visiting, 1636 old hypertension patients visiting, for a total of 1755 hypertension patients visiting for treatment. It is a tremendously significant issue that necessitates care, particularly from health experts, to administer prevention and treatment programs for patients. Complications from untreated hypertension encompass stroke, coronary heart disease, diabetes, kidney failure, and blindness.

Stroke is the leading cause of death (51%), whereas targeting organ damage from hypertension consequences can vary depending on the size of the increase in blood pressure and the length of undiagnosed and untreated blood pressure issues.

Research associated with stroke has been conducted by numerous researchers, but the combination of multimedia-based education, which is the development of non-pharmacological therapy, is deemed necessary for further research. This research is done by developing a multimedia-based educational model for people with hypertension. Hence, it can enhance the health status of the sufferers through stability or decreasing blood pressure to near normal. This study aims to examine the impact of multimedia-based education on hypertension patients' knowledge, attitudes, and behavior toward stroke prevention.

2. RESEARCH METHOD

This study employed a quasi-experimental pre-posttest control group design. This research was conducted in the DKI Jakarta area. The study population was all hypertensive patients who visited Cipayung Village Health Center, East Jakarta. The sampling strategy administered simple random sampling. The sample size utilized the hypothesis test of the mean difference in two independent groups (Lemeshow et al., 1990). The sample in this study was 60 people incorporating 30 people in the intervention group and 30 people in the control group. For sampling, simple random sampling technique was performed from an affordable population. The inclusion criteria in this study were patients suffering from hypertension who came for treatment at the Cipayung Village Health Center, the age of the patient was 35-60 years, could write and read, at least graduated from elementary school, and was willing to be the subject of the study. Meanwhile, the exclusion criteria formulated were hypertensive patients with complications and patients who withdrew to become respondents.

The first stage of this research involved developing educational instruments, which included activities such as creating modules/pocket books and educational videos, testing multimedia-based education, training enumerators in implementing multimedia-based education, and administering pre-tests to respondents (intervention and control groups). The second stage comprises of implementing multimedia-based education in the intervention group and administering a post-test to all respondents at week 9.

To avoid misconceptions, the data collection instrument was a questionnaire produced by researchers that was constructed with closed and open questions employing simple language and easy to comprehend by respondents. Researchers created the teaching instrument utilized in multimedia-based education in the form of modules and videos.

Data analysis will be performed to examine the effect of multimedia education on knowledge, attitudes, and behavior of hypertensive patients in preventing stroke before and after the intervention by employing paired t-test and independent t-test statistical tests. Meanwhile, to analyze the effect of the characteristics of hypertension patients on the knowledge, attitudes, and behavior of hypertensive patients, the Multiple Logistics Regression statistical test was conducted. This research has passed the ethical test from the Ethics Committee of the Jakarta Health Polytechnic III Number KEPK-PKJ3/055/VII/2021.

3. RESULTS AND DISCUSSION

Table 1. Distribution of respondents' characteristics based on age and duration of illness hypertension

Variable	Group	N	Mean	Median	Min-Max
Age	Intervention	30	63.77	63	49 - 71
	Control	30	54.33	53.50	31 - 69
Duration of illness	Intervention	30	6.47	5	2 – 28
	Control	30	3.73	3	1 - 12

Based on Table 1, the average age of the intervention group respondents was 63.77 years, with the youngest being 49 years old and the oldest being 71 years old. Meanwhile, the average age of patients with hypertension in the control group was 54.33 years, with the youngest being 31 years and the oldest being 69 years. In the intervention group, the average length of illness was 6.47 years, with a minimum of 2 years and a maximum of 28 years, whereas in the control group, the average length of illness was 3.73 years, with a minimum of 1 year and a maximum of 12 years.

Table 2. Distribution of respondents' characteristics by gender and education.

Variable	**Intervention**		**Control**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Gender						
Man	12	40	9	30	21	35
Women	18	60	21	70	39	65
Education						
Elementary school	11	36.7	5	16.7	16	26
Junior high school	8	26.7	11	36.7	19	31.6
Senior high school	8	26.7	12	40	20	33
College	3	10	2	6.7	5	8.4

Table 2 demonstrated that the genders in both groups of hypertension sufferers were frequently women. The educational background of the majority of respondents is elementary school for the intervention group, while the control group is the majority of respondents with junior high school education.

Table 3. Analysis of gender equality and education of patients with hypertension.

Variable	**Intervention**		**Control**		**p-value**
	N	**%**	**N**	**%**	
Gender					
Man	12	40	9	30	0.588
Women	18	60	21	70	
Education					
Elementary school	11	36.7	5	16.7	0.293
Junior high school	8	26.7	11	36.7	
Senior high school	8	26.7	12	40	
College	3	10	2	6.7	

Table 3 illustrated that there was no difference in the variables of gender and education between the intervention group and the control group. Thus, it can be concluded that the respondent's gender and education between the two groups were equivalent.

Table 4. Analysis of equality in age and duration of hypertension between groups.

Variable	**Group**	**N**	**Mean**	**SD**	**p-value**
Age	Intervention	30	63.77	6.942	0.000
	Control	30	54.33	9.407	
Duration of illness	Intervention	30	6.47	5.151	0,014
	Control	30	3.73	2.888	

Table 4 displayed that there was a difference in age between the intervention group and the control group, as well as the variable duration of hypertension. The results of the analysis presented that there was a difference between the intervention group and the control group.

Table 5. Analysis of knowledge, attitudes and behavior in stroke prevention before and after multimedia-based educational intervention in the intervention and control groups.

Variable	Group	Mean	SD	95% CI	T	p-value
Knowledge	Intervention					
	Pre-test	18.2000				
	Post-test	19.2667	4.118	-2.604 – 0.471	-3.419	0.022
	Difference	-1.0666				
	Control					
	Pre-test	17.9333				
	Post-test	17.7667	1.0199	-0.214 - 0.547	.895	0.378
	Difference	0.16667				
Attitudes	Intervention					
	Pre-test	34.0667				
	Post-test	36.1000	3.156	-3.212 – -0.854	-3.528	0.001
	Difference	-2.0333				
	Control					
	Pre-test	33.1667	1.142	-0.493 – 0.360	-0.320	0.752
	Post-test	33.2333				
	Difference	-0.6667				
Behavior	Intervention					
	Pre-test	9.3000	1.162	-1.034 – -0.165	-2.827	0.008
	Post-test	9.9000				
	Difference	-0.6000				
	Control					
	Pre-test	8.0333	0.944	-0.285 – 0.419	0.387	0.702
	Post-test	7.9667				
	Difference	0.6667				

Table 5 indicates that there is a significant difference in knowledge scores between the intervention and control groups before and after the multimedia-based educational intervention (p value = 0.022), with the difference in the average score of increasing health status scores in the intervention group being significantly larger (difference value = 1.066), while the difference in score in the control group is 0.166. The table above also demonstrates that there is a significant difference in attitude scores before and after the multimedia education intervention in the intervention group (p value = 0.002), and the difference in the average value of the increase in attitude scores in the intervention group is significantly increased (difference value = 2.033), whereas the average difference in attitude scores in the control group is 0.667. Similarly, there was a significant difference in behavioral scores in the intervention group before and after the multimedia education intervention (p value = 0.008), and the difference in the average behavioral score in the intervention group was 0.600, while the difference in the control group was 0.600. It indicates that respondents in the control group had an increase in hypertension treatment behavior, which can be acquired through a variety of other media.

Table 6. Analysis of knowledge, attitudes and behavior in stroke prevention between groups.

Variable	Group	N	Mean	SD	95% CI	F	p-value
Knowledge	Intervention	60	-1.07	2.421	-2.203- -0.263	8.561	0.014
	Control	60	0.17	1.020			
Attitudes	Intervention	60	-2.03	3.157	-3.109 - -0.624	14.582	0.004
	Control	60	-0.17	1.262			
Behavior	Intervention	60	-0.60	1.163	-1.214 – 0.119	2.945	0.018
	Control	60	0.07	0.944			

Table 6 demonstrates that there are significant differences in the knowledge, attitudes and behavior scores of hypertension sufferers in preventing stroke between the intervention group and the control group after the multimedia education intervention with p value = 0.014; 0.004; and 0.018. In accordance with the results of this study, it can be implied that there is a significant effect of multimedia education intervention on hypertension treatment on escalating knowledge, attitudes and behavior of hypertensive patients to conduct hypertension treatment in order to prevent stroke.

The results illustrated that the lowest age of patients with hypertension in the intervention group was 49 years and the oldest was 71 years, while in the control group, the lowest was 31 years and the highest was 69 years. The results of this study are in accordance with research performed by Saputri & Indrawati (2011) which explains that the majority of respondents are aged between 60-74 years, both in the control group and in the intervention group. Hypertension is associated with age, the older a person is, the greater the risk of developing hypertension (Gao et al., 2013). Increasing age affects a loss of elasticity of the arteries due to natural changes in the heart, blood vessels and hormones. Large arteries lose their elasticity, thus, they become stiff and blood with each heartbeat is insisted to pass through the narrow blood vessels and eventually affects an increase in blood pressure (Dinata, 2015).

Increased blood pressure can also be affected by various risk factors, including: age, gender, family history, obesity, high salt levels, and poor living habits such as smoking and drinking alcohol (Pinto & Martins, 2017). If a patient has risk factors, they should be more vigilant and take preventive steps immediately. For instance, the easiest efforts involve frequently controlling blood pressure more than once, exercising, and avoiding other hypertension trigger factors (Suratun et al., 2018).

The results of the study discovered that the majority of respondents were female, both in the intervention group and in the control group. The results of this study are corroborated by research conducted by Sulastri et al. (2012) which revealed that the gender characteristics of the majority of respondents are women. Sani, Ramadhani & Pitriani, (2019) discovered that hypertension in young women is relatively low, but that does not imply they are protected forever from hypertension when they are older, which is when they enter the age of 50, they have to begin to be more alert to the threat of this disease which is frequently understood as the silent killer. When women reach menopause, they begin to lose estrogen, resulting in a higher prevalence of hypertension in women between the ages of 45 and 55. Women who have not experienced menopause are protected by the hormone estrogen, which plays a pivotal role in boosting levels of High-Density Lipoprotein (HDL). High HDL levels are protective in the prevention of atherosclerosis. Women are also more likely to suffer from hypertension since they possess a higher risk of increasing their body mass index. Monthly cycle syndrome (premenstrual syndrome), post-menopause which generates the distribution of body fat is easy to accumulate due to the hormonal process (Larasiska, 2017). The results of Basic Health Research in 2013 unveiled that the prevalence of hypertension in Indonesia tends to be higher for women than men.

The level of education is one of the factors influencing a person's perception of being more receptive to latest ideas and technologies (Notoatmodjo, 2010). The results revealed that the majority of the respondents in the intervention group possessed an elementary education background. Meanwhile, in the control group, the majority of respondents are Junior High Schools. The results of this study are in accordance with research administered by Wijayanto & Satyabakti (2014) which illustrates that the majority of respondents' education is elementary school education. Similarly, the results of research by Pangestuti, Larasati & Vitani, (2022) elaborated that most of the respondents owned junior high school education, both in the intervention group and in the control group. The level of education possesses an influence on the incidence of hypertension, in which people who possess a high level of education will frequently possess a lot of knowledge about health and will have awareness in maintaining their health.

The study revealed that the intervention group's knowledge score about hypertension care increased by 1,066 points, with a p value of 0.022. It may be indicated that hypertension care education intervention through multimedia has a substantial effect on raising knowledge of hypertension patients. This finding is in accordance with the results of research by Sumah (2019) which elaborates that there is an effect of health education on a low salt diet on changes in knowledge of hypertension patients, with a p value of 0.001. Furthermore, the results of Mardhiah et al. (2015) research also asserted that there was an effect of health education on increasing respondents' knowledge with a p value of <0.05. Likewise, (Ulya et al., 2018) explained that there is an effect of health education on hypertension on increasing respondents' knowledge with a p value = 0.000, and in the control group, there is no significant effect with a p value = 0.194. Suratun et al., (2018) also elaborated in their research that there was a significant effect of the continuous nursing service approach intervention through health education about hypertension diet on escalating the knowledge score of respondents.

Knowledge is the consequence of a person's senses observing a thing. The intensity of attention and perception of the item is significantly affected by itself at the moment of sensing to develop knowledge. The senses of hearing and sight provide the majority of a person's knowledge. The intensity or amount of a person's understanding of objects varies. Knowledge is a crucial domain in the formulation of one's activities (Notoatmodjo, 2010). Increased knowledge is tremendously influenced by the factor of health workers who possess experience in providing good information in elaborating simply but easily understood by patients and administering adequate media considering that most hypertensive patients are in the elderly. Education about hypertension treatment and anti-stroke exercise in this study was performed in groups by employing videos and guide modules accompanied by exercises and discussions/questions and answers.

The results of the analysis revealed that there was an increase in the attitude score of hypertension sufferers about hypertension care in the intervention group by 2,033 with a p value of 0.001. It can be indicated that there is a significant effect of hypertension care education intervention through multimedia in enhancing the attitude of hypertension sufferers. This finding is in accordance with the research results obtained by Haryono, Krisanty & Manurung, (2018) who elaborated in their research that there was a significant effect of a sustainable nursing service approach through health education about hypertension diet on changes in the positive attitude of respondents with hypertension patients with a value of p = 0.000. Similarly, the results of Sabouhi et al., (2011) uncovered that there is a significant relationship between the attitudes of hypertension patients and efforts to control hypertension (p value = 0.001). Furthermore, Agustini, (2019) in his research also asserts that attitudes towards hypertension can influence the actions of a person (hypertension patients) to prevent hypertension. Attitude cannot be identified to be an action or activity, but it is a predisposition to the action of a behavior. Attitudes to individuals are not necessarily manifest in a real action,

attitudes cannot be directly identified, but can only be interpreted in advance of closed behavior (Notoatmodjo, 2010). As a result, attitude is one of the most influential variables on individual health values in order to effectively manage hypertension and prevent stroke. The results of this research demonstrate that if a person or respondent has a positive attitude, the hypertension therapy they receive is extremely effective. It is consistent with Green's theory, which claims that various factors, including attitude, have a major influence on health behavior.

The results of the analysis of the behavioral variables of patients performing hypertension treatment illustrated that there was a significant difference in the intervention group with p value = 0.008, the average difference in increasing foot exercise compliance in the intervention group was 0.600. It indicates that educational intervention on hypertension treatment in hypertension patients via multimedia has a substantial effect on hypertensive patients' behavior to organize hypertension. The results of this study are in accordance with the research result of Haryono et al. (2018) who elaborated in their research that with a p value of 0.000, the intervention of a sustainable nursing service strategy through health education regarding hypertension diet had a significant influence on changes in respondents' favorable attitudes. However, the results of this study are different from the research conducted by Suyoto, Agushybana & Suryoputro, (2020) which asserted that There was no difference in compliance between the intervention and control groups before and after receiving health education regarding hypertension diet (p => 0.05). Behavior is robustly associated with compliance, which refers to the degree to which a patient follows the treatment and behavior recommendations of his doctor or others. Safitri, (2013) also demonstrates compliance which is also understood as adherence is the degree to which the patient follows the clinical advice of the treating doctor. In the medical context, the concept of compliance is a level that presents the patient's behavior in obeying or following procedures or medical expert advice. Nita, (2018) also illustrates that compliance is the extent to which the patient's behavior is in accordance with the provisions provided by health professionals. Adequate patient understanding regarding hypertension therapy enables patients to act in accordance with directives issued by authorized individuals such as doctors, nurses, and other health workers.

4. CONCLUSION

Based on the results of the study, it is possible to conclude that multimedia-based education has an influence on enhancing hypertension patients' knowledge, attitudes, and behavior in stroke prevention. The recommended that the community can perform hypertension treatment independently frequently, and the implementation of the prolanis program can be enhanced so that people can receive services easily and regularly to prevent stroke.

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RESEARCH **Open Access**

The Effect of Progressive Muscle Relaxation Therapy on Anxiety in Hypertension Patients

Nasihin[1a*], Diah Ayu Pertiwi[1b], Khayan[2c], Widyana Lakshmi Puspita[3d], Muhammad Ifham Hanif [4e]

[1] Department of Nursing, Poltekkes Kemenkes Banten, Tangerang, Banten Province, Indonesia
[2] Department of Medical Laboratory Technology, Poltekkes Kemenkes Banten, Tangerang, Banten Province, Indonesia
[3] Department of Nutrition, Poltekkes Kemenkes Pontianak, Pontianak, West Kalimantan, Indonesia
[4] Dr. Hasan Sadikin General Hospital, Faculty of Medicine, Universitas Padjadjaran, Bandung, West Java, Indonesia

[a] Email address: ihin50@yahoo.com
[b] Email address: Pertiwidiahayu7@gmail.com
[c] Email address: mkhayan@yahoo.co.id
[d] Email address: widyanalakshmi96@gmail.com
[e] Email address: muhammadifhamhanif@gmail.com

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Abstract

Anxiety is a condition in which an individual experiences a concern about something that is not certain to happen, even some people experiencing anxiety but do not understand the specific cause of the anxiety source they feel. Anxiety problems, which are common in people, can be treated non-pharmacologically with deep muscle relaxation techniques, which do not require guided imagination or cause side effects in patients undergoing progressive muscle relaxation therapy. The objective of this study is to identify how progressive muscle relaxation techniques affected the anxiety levels of hypertension patients at the Kedaung Wetan Public Health Center. The study was conducted to determine if there was a difference in the level of anxiety experienced by hypertensive patients before and after receiving progressive muscle relaxation therapy. The design in this study employed a quasi-experimental pre-post-test with a control group with a progressive muscle relaxation therapy intervention. Result: there is a significant relationship between the period of occurrence of hypertension with anxiety experienced by respondents. Anxiety in hypertensive patients is more prevalent in those who are unfamiliar with hypertension. Thus, anxiety can arise from a sense of concern and fear of more serious complications which occur from the hypertension they are experiencing. The experimental group who received treatment in the form of progressive muscle relaxation therapy had a lower level of anxiety than the control group at the Kedaung Wetan Public Health Center in Tangerang City, with a p-value of 0.000.

Keywords: Progressive Muscle Relaxation, Anxiety.

Corresponding Author:

Nasihin
Department of Nursing, Poltekkes Kemenkes Banten, Tangerang, Banten Province, Indonesia.
Email: ihin50@yahoo.com

1. INTRODUCTION

Health is a condition in which an individual is in good physical, social, emotional, and spiritual condition without any disturbance to perform the daily life productively (World Health Organization, 2008). Healthy means someone possessing a perfect state ranging from physical, mental, and social; it can be indicated that a person is identified to be healthy if he does not possess a disease, weakness, or disability problems in himself. Mental health is a condition in which an individual can develop physically, emotionally, and spiritually in the sense of being able to realize the expertise he possesses in himself and overcome the problems encountered in his life. A person is identified to be mentally healthy if he is able to contribute to the surrounding environment. In other words, he or she is able to socialize in the community (Thirunavurakasu, Thirunavurakasu & Bhugra, 2013). People With Mental Problems is a condition in which an individual encounters problem physically, emotionally, and spiritually; where in this situation, a person can experience the risk of receiving to a more serious stage, which is mental disorders (Carter, 2014; Gamm, Stone & Pittman, 2010; Kementerian Kesehatan Republik Indonesia, 2019).

Indonesian Health in 2017 stated that there are numerous forms of mental disorders that the Indonesian population is expected to encounter, one of which being anxiety (Kementerian Kesehatan Republik Indonesia, 2017). Anxiety is a condition in which a person suffers fear and worry about something that is not guaranteed to happen; even someone who has uneasiness does not know where the source of his anxiety stems from (Gale & Davidson, 2007; Wells & Carter, 2016). The fear and worry that an anxious person feels is frequently a response or output of a warning signal that shows that he is in danger and provides a stimulus to strengthen someone to take the right step or take the appropriate action to reduce the possible threat (Rowa & Antony, 2008; Stein & Sareen, 2015; Tyrer & Baldwin, 2006).

The anxiety most frequently experienced by the surrounding community is anxiety affected by physical illness, particularly diseases that can cause various diseases such as complications. One of the anxiety problems generally suffered by the public regarding physical illness is hypertension (Bajkó et al., 2012; Grimsrud et al., 2009; Kretchy, Owusu-Daaku, & Danquah, 2014; Wei & Wang, 2006). Hypertension is a non-communicable disease, but it is one of the diseases which causes death. It is also frequently referred to as the Silent Killer or can be interpreted as a disease that can kill without any symptoms (Lackland & Weber, 2015; World Health Organization, 2013; Sawicka et al., 2011). The World Health Organization informs that recently, cases of hypertension globally acquire 22% of the world population. As the matter of fact, of the 22%, only one-fifth made efforts to control their hypertension. A person is identified as hypertensive if the blood pressure presents a systolic pressure of more than 140 mmHg and a diastolic pressure of more than 90 mmHg (Kementerian Kesehatan Republik Indonesia, 2019).

In accordance with the case of hypertension at the Information Data Center of the Indonesian Ministry of Health, with the increasing number of hypertension cases in Indonesia, numerous people with hypertension experience anxiety. Anxiety in a person with hypertension is frequently generated by a sense of fear about hypertension; even many people who have recently been diagnosed with hypertension are concerned that their hypertension would produce problems such as stroke, coronary heart disease, and kidney failure (Hamrahian & Falkner, 2016; Yu et al., 2011). As a result, many people are concerned that their elevated blood pressure may exacerbate the situation and lead to the development of undesirable diseases (Kretchy, Owusu-Daaku, & Danquah., 2014; Wei & Wang, 2006).

Anxiety disorders caused by hypertension can be treated non-pharmacologically, one of which is progressive muscle relaxation therapy (Atmanegara & Suhita, 2021; Brauer et al.,

1979; Cottier et al., 1984; Ermayani, Prabawati, & Susilo, 2020; Li et al., 2015; Pender, 1985). Progressive muscle relaxation therapy is a deep muscle relaxation approach that does not require a guided imagination and does not have any negative side effects in people who utilize it. This therapy involves simply a concentration on a muscle activity by tensing the muscles and then releasing muscle tension so that it is felt calm when releasing muscle tension, as directed. This therapy is tremendously effective for reducing anxiety experienced by a person as it is able to reduce muscle tension that occurs. It is also helpful in producing a relaxation for the patients (Rosdiana & Cahyati, 2019; Sheu et al., 2003; Shinde et al., 2013). Therefore, the researcher was willing to identify the effect of progressive muscle relaxation techniques on the anxiety experienced by hypertensive patients at the Kedaung Wetan Public Health Center.

2. RESEARCH METHOD

This research is a quantitative study with a quasi-experimental design and employs a pre and post-test method with a control group design. This experimental study incorporated two groups, which were the intervention group totaling 36 people, and the control group, amounting to 36 people. The sampling method in this study administered a purposive sampling technique. This research was conducted at the Kedaung Wetan Public Health Center, Tangerang City. The instrument utilized was to measure anxiety levels was the zung Self-rating Anxiety Scale (ZSAS) calculating instrument designed (Zung, 1971). Questions totaled 20 items, comprising of 5 positive questions and 15 negative statements demonstrating anxiety symptoms.

Data analysis was performed univariately, and bivariate was employed to determine anxiety scores in hypertensive patients before and after being given the application, while bivariate analysis administered the t-dependent test (with Sig <= 0.05) to determine the effect of progressive muscle relaxation therapy on anxiety in hypertensive patients.

Ethical approval the research proposal was approved by the Health Ethics Commission of the Poltekkes Kemenkes Banten and informed consent was obtained from research respondents. Aspects of research employed the general principles of research ethics in humans, which is: Respect for human dignity, beneficence, and justice. Number of the ethical protocol: No. DP.02.01/5.1/2499/2022.

3. RESULTS AND DISCUSSION

Table 1. Distribution of the Number of Respondents Experiencing Anxiety in the Experimental Group.

Group	No anxiety	Mild Anxiety	Moderate Anxiety	Severe Anxiety
Pre-test Experiment	0	0	9	27
Post-test Experiment	0	9	27	0

Table 1 demonstrates that in the pre-test experimental group, there was 1 respondent who experienced moderate anxiety and 27 people with severe anxiety. In the post-test experimental group following therapy, 27 respondents reported moderate anxiety and 9 reported mild anxiety. As a result, it can be stated that progressive muscle relaxation therapy has an effect on reducing anxiety in hypertension patients at the Kedaung Wetan Public Health Center.

Table 2. Distribution of the Number of Respondents Experiencing Anxiety in the Control Group.

Group	No anxiety	Mild Anxiety	Moderate Anxiety	Severe Anxiety
Pre-test	0	0	30	6
Post-test	0	0	30	6

Table 2 illustrates that in the pre-test control group, 6 respondents experienced severe anxiety and 30 respondents experienced moderately anxious. Meanwhile, in the post-test control group, the results of severe anxiety were 6 respondents who were moderately anxious, amounting to 30 respondents. Therefore, it can be identified that there was no change in the decrease of anxiety in the control group.

Table 3. Anxiety Score Difference Respondents Before and After Provision of Progressive Muscle Relaxation Therapy in the Experimental Group.

Variable	N	*Mean*	SD	SE	p-value
Anxiety Level pre-test experiment	10	29,40	1.265	0,400	0,000
Anxiety Level post-test experiment		22,50	1.179	0,373	
Difference		6,9	0,086	0,027	

Table 3 demonstrates the anxiety scores of respondents before providing progressive muscle relaxation therapy to the experimental group with a mean value of 29.40 with a standard deviation of 1,265 and after providing progressive muscle relaxation therapy to the experimental group. The result is a mean of 22.50 with a standard deviation 1,179. The test results obtained the p-value in the experimental group 0.000 (p-value <0.05*)*.

Table 4. Anxiety Scores in the Pre-Test and Post-Test Control Groups.

Variable	N	*Mean*	SD	SE	p-value
Anxiety Level pre-test control	10	26,80	1,687	0,533	0,168
Anxiety Level post-test control		26,60	1,647	0,521	
Difference		0,2	0,04	0,012	

Table 4 illustrates the anxiety scores of respondents before providing progressive muscle relaxation therapy in the control group with the mean value of 26.80 with a standard deviation of 1.687 and after providing progressive muscle relaxation therapy in the control group. The mean result is 26.60 with a standard deviation 1,647. The test results obtained a p-value in the experimental group of 0.168 (p-value > 0.05).

Based on the research findings, the average score in the pre-test experimental group before receiving progressive muscle relaxation therapy was 29.40, while the post-test score after receiving progressive muscle relaxation therapy was 22.50. It implies that there is a difference between the average values of the pre-test and post-test. The variations that happened in the experimental group after progressive muscle relaxation therapy revealed that previously 27 respondents had severe anxiety and 9 respondents experienced moderate anxiety. The respondents experienced severe anxiety changed to 27 moderate anxiety and 9 moderate anxieties. The difference obtained by progressive muscle relaxation therapy can inhibit the occurrence of an increase in the sympathetic nervous system. Hence, the hormone causing body dysregulation can be decreased in number so that it can result in a decrease in

blood pressure, and can also reduce hormone levels that cause stress and anxiety (Mawardika, Aniroh, & Lestari, 2020; Pramono, Hamranani, & Sanjaya, 2019).

Anxiety encountered by hypertensive patients is closely associated with blood pressure conditions that must be continuously controlled, encompassing a good lifestyle, diet, activity, and rest patterns. This research is in accordance with research Nova and Tumanggor, (2018) who conducted a study of providing progressive muscle relaxation therapy to breast cancer patients with the results of the average value possessing a significant difference with the mean pre-test value of 26.46 and post-test with a mean value of 15.62 (Nova & Tumanggor, 2018). Anxiety is an emotional response without an object, manifested as feelings of fear or worry that are not clear and excessive in origin, and are accompanied by the presence of summative symptoms, which can cause significant disruptions in social function or obvious suffering for a patient. Anxiety may be experienced by a hypertensive patient since hypertension requires relatively long therapy.

Based on the findings of the research conducted in the pre-test control group, the results obtained are 26.80, while the post-test in the control group is 26.60, with the results of the pre-test anxiety score of 30 moderate anxiety and 6 severe anxiety t and post-test anxiety score of 30 moderate anxiety and 6 severe anxiety t. It indicates that there is no significant change in the control group. Thus, it is possible to conclude that there is no statistically significant difference between the pre-test and post-test in the control group. In There was no significant difference in the control group since the control group in the study did not receive intervention or therapy, and this control group can be identified as a comparison material to evaluate whether progressive muscle relaxation therapy can reduce the anxiety experienced by hypertension patients. The modifications in the control group were produced by the patient's family's support, but the changes in the patient could be perceived as insignificant. The results of this study are in accordance with research conducted by Nova & Tumanggor, (2018) which presented results that had no significant difference between the pre-test and post-test in the control group as the changes that occurred in the control group were not significant (Nova & Tumanggor, 2018).

Based on the research that has been performed, there is a decrease in the anxiety level score by administering progressive muscle relaxation therapy encountered by hypertensive patients. This progressive muscle relaxation therapy is provided for 20 minutes. Progressive muscle relaxation therapy is able to reduce heart rate, cardiac dysrhythmias, oxygen demand and oxygen consumption, muscle tension, metabolic rate, and can increase brain alpha waves that occur when hypertensive patients are conscious, not focus attention and can relax, enhance fitness, and escalate concentration and ability to deal with anxiety (Cottier et al., 1984; Pramono, Hamranani, & Sanjaya, 2019; Rosdiana & Cahyati, 2019; Sheu et al., 2003; Shinde et al., 2013).

4. CONCLUSION

Based on the research which has been conducted regarding the effect of progressive muscle relaxation therapy on anxiety in hypertensive patients at the Kedaung Wetan Public Health Center, Tangerang City, it can be concluded that there was a decrease in the level of anxiety in hypertensive patients at the Kedaung Wetan Public Health Center, Tangerang City in the experimental group who had received treatment in the form of progressive muscle relaxation therapy than the control group with the resulting p-value 0,000.

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Knowledge as a Factor Associated with Lifestyle in Controlling Hypertension

Pramita Iriana[1a*], Nelly Yardes[1b], Ace Sudrajat[1c], Munifah Syamara Mahanani[1d], Paulus Hotmatua Malau[2e],

[1] Department of Nursing, Politeknik Kesehatan Kementerian Kesehatan Jakarta III, Bekasi City, West Java, Indonesia
[2] Clinical Nurse Consultant at Royal Prince Alfred Hospital, Missenden Road, Camperdown, New South Wales 2050, Australia

[a] Email address: pramitairiana70@gmail.com
[b] Email address: nellyyardes@yahoo.co.id
[c] Email address: ace.sudrajat1963@gmail.com
[d] Email address: munifah_sym@yahoo.com
[c] Email address: paul.malau@health.nsw.gov.au

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Abstract
Hypertension is also understood as the "silent killer" as the symptoms of hypertension are frequently not experienced by the sufferer, hence, the majority of hypertension patients are unaware that they suffer from hypertension. Uncontrolled hypertension can harm multiple organs. Hypertension cannot be cured; however, it can be managed such that blood pressure stays within normal limits. Changes in lifestyle and pharmacological therapy are employed to control hypertension. The objective of this study is to investigate the association between hypertension patients' characteristics and amount of awareness about lifestyle in controlling hypertension. A descriptive analytic design with a cross sectional approach was administered in this investigation. This study included all hypertension patients who visited the Cibubur Village Health Center. Purposive sampling was utilized in this study, yielding 115 respondents. The analysis technique involved the Chi-Square test. Results: There was a relationship between age and lifestyle (p=0.044), the last education and lifestyle (p = 0.017), and the level of knowledge with lifestyle (p=0.000). Meanwhile, gender, occupation, and family history of hypertension did not possess a significant relationship with lifestyle in controlling hypertension. Future studies are suggested to examine the role of external environmental support in influencing lifestyle to control hypertension.

Keywords: Hypertension, Knowledge Level, Lifestyle.

Corresponding Author:

Pramita Iriana
Department of Nursing, Politeknik Kesehatan Kementerian Kesehatan Jakarta III, Bekasi City, West Java, Indonesia.
Email: pramitairiana70@gmail.com

1. INTRODUCTION

Hypertension or frequently recognized as high blood pressure is a disease affecting numerous people in the world (Baradaran, Nasri, & Rafieian-Kopaei, 2014). Hypertension is a serious health problem which owns the potential to cause the chance of stroke, coronary heart disease, and kidney failure (Aburto et al., 2013). Because hypertension symptoms are frequently not experienced by sufferers, the majority of people with hypertension are unaware that they suffer from the disease. As a result, hypertension has earned the nickname "silent killer" (Bell et al., 2015).

Hypertension is one of the prior risk factors for global death. It is estimated that 9.4 million people in the world have died from hypertension and 7% of the disease burden is calculated in the Disability Adjusted Life Year (DALY). The prevalence of hypertension in United States is 47% or nearly half of adults (World Health Organization, 2014). Data from basic research conducted in 2018 discovered that the prevalence of hypertension in accordance with the results of measuring blood pressure in people aged >18 years in Indonesia is 34.1%. The prevalence has escalated in comparison with the prevalence in 2013 with a figure of 25.8%.) (Kementerian Kesehatan Republik Indonesia, 2018).

The prevalence of hypertension by measurement in DKI Jakarta Province obtained 33.4% in 2018 (Kementerian Kesehatan Republik Indonesia, 2018). DKI Jakarta Province is one of Indonesia's major cities as well as the country's capital. The close competitiveness of living as the city with the most people might have an impact on the lifestyle of DKI Jakarta residents. In our modern and fast-paced lifestyle, lifestyle modifications might become less nutritious, such as the rise of high-sodium foods, foods containing preservatives, and fast food with a high fat content. DKI Jakarta people like to consume salty cuisine more than once a day, smoking is 22.9% daily with an average of 12.6 cigarettes per day, and residents who have less physical activity habits are 47.8% (Kementerian Kesehatan Republik Indonesia, 2019). This unhealthy way of living might lead to the emergence of noncommunicable diseases like hypertension.

The results of a study conducted by Ekaningrum (2021) associated with the incidence of hypertension in DKI Jakarta, respondents consuming sodium >2000 mg a day acquired 67.4%. Fat consumption >67 grams per day was 426 people (47.8%). The vast majority of responders (95.3%) reported no mental or emotional illnesses. The percentage of respondents who engaged in physical exercise in the low, medium, and high categories was about average. A total of 37.6% of respondents engaged in little or no physical activity. Sedentary behavior is practiced by 43.2% of respondents for 3-5.9 hours each day. Meanwhile, Musliana, & Meutia, (2022) claims that additional factors like sleep quality and caffeine use are correlated to uncontrolled blood pressure in hypertensive patients. If it is associated with the incidence of hypertension, there is a connection between age, gender, work status, and mental emotional illnesses. Socioeconomic level, fat intake, sodium intake, physical activity, and sentatory behavior were not observed to be correlated to the prevalence of hypertension in the DKI Jakarta population.

The research at the Cilincing Regional General Hospital, a primary referral hospital in North Jakarta, provides an example of medication adherence and control of hypertension patients. This study revealed a significant rate of non-adherence to hypertension treatment in polyclinic patients. More hypertensive individuals with hypertension degrees 2 and 3 present to the emergency department. In addition to having higher blood pressure than normal, hypertensive individuals who visit the ER have problems that require emergency attention. This occurrence demonstrates that these individuals are at a higher risk of noncompliance with treatment than patients who visit the polyclinic. There are, however, scientific limits in determining the relevant components (Darnindro & Sarwono, 2017).

Another study conducted by Emiliana et al. (2021) at the Pisangan Health Center in 2019, the factors influencing the compliance of hypertensive patients to come to control their disease encompass the category of blood pressure, ownership of health insurance, and comorbidities.

The objective of the hypertension control visit is to monitor blood pressure to maintain it under control and also to have the medication. Respondents who possess normal blood pressure tend to adhere to treatment and control their blood pressure to keep it normal. Respondents with health insurance have a 29% higher probability of receiving hypertension treatment than those without health insurance. Thus, having health insurance can assist hypertension patients in living healthy lives and adhering to health control. Respondents with comorbidities are more liable to be obedient to their doctor's control of their disease and are aware of the routine control functions to preserve their health status.

The success of hypertension treatment in addition to concern on routinely having medication, visiting health care providers to control health, also requires be accompanied by lifestyle modifications to control hypertension. In accordance with the guidelines issued by the International Society of Hypertension (ISH), treatment of hypertension is performed for life, both with drug consumption and lifestyle modification. Lifestyle modification possesses several activities incorporating decreasing salt consumption, selecting healthy foods and beverages, reducing alcohol consumption, controlling body weight to stay ideal, not smoking, performing regular physical activities, managing stress, employing complementary/alternative medicine, and decreasing pollution exposure air (Unger et al., 2020).

The significance of lifestyle modification for hypertension patients is also affected by several factors (Murray et al., 2012). Lifestyle in controlling hypertension is influenced by the level of knowledge, gender, and age. Research administered by Qodir (2020) presents that knowledge owns the highest relationship strength to lifestyle modification (OR = 4.9; IK 2.1-11.5) in comparison with other factors that affect lifestyle such as gender, age, and education level. Research conducted by Wahyuni & Susilowati, (2018) demonstrates that there is a relationship between the level of knowledge and the level of hypertension (p = 0.001). Individuals with a low level of knowledge have more hypertension than hypertensive patients with a high level of knowledge.

Nurses perform roles such as counselors and nursing researchers as part of their nursing practice. Nurses, as counselors and health educators, educate hypertension patients about their disease and the attempts made to stay healthy. Providing appropriate information by nurses can help hypertension patients understand how to live a healthy lifestyle (Masi & Silolonga, 2018). It is in accordance with the results of research performed by Sumah (2019) in which nurses who provide education affect the decrease in systolic and diastolic blood pressure in hypertension patients (p = 0.000). In compliance with the regulations and professional ethics, nurses as researchers are entitled to use hypertension patients as research subjects (Nelson et al., 2014). Thus, the objective of this study is to identify a relationship between the level of knowledge about hypertension and a lifestyle which can control hypertension.

2. RESEARCH METHOD

This type of research is quantitative with a descriptive analytic research design with a cross sectional approach. The objective of this study is to identify the relationship between the level of knowledge, characteristic and lifestyle in controlling hypertension. This research was conducted at the Cibubur Village Health Center. The technique of selecting sampling was with non-probability with purposive sampling, as many as 115 respondents. Sample inclusion criteria in this study encompass; hypertension patient diagnosed by a doctor, lives in the working area of the Cibubur Village Health Center, agrees or signs the informed consent, is able to read and write.

The independent variables in this study were the level of knowledge and characteristics of hypertensive patients, while lifestyle was the dependent variable. The level of knowledge is

the extent to which hypertensive patients recognize their disease. The independent variable was calculated by employing an instrument in the form of an adapted HK-LS (Hypertension Knowledge-Level Scale) questionnaire.

The validity and reliability test of the questionnaire were administered on 30 respondents of hypertension patients at Jatijajar Health Center. Content validity test by employing a comparison of the correlation values obtained with table r with a significance level (α) and degrees of freedom. In the HK-LS knowledge questionnaire (Erkoc et al., 2012) which has been modified, there are several invalid questions with the results of -0.086 - 0.867 and a reliable value of 0.688. The modified lifestyle questionnaire (Saraswati et al. 2018) obtained an R value of 0.054 – 0.682 and a Cronbach Alpha value of 0.712. Invalid questions were sentence structure modified and re-tested until they were considered valid and reliable. R count 0.367-0.651 or greater than R table (0.361) and Cronbach's Alpha score = 0.844 in the knowledge questionnaire. The Lifestyle Questionnaire seems to have a R value of 0.363-0.641, which was greater than the R table value of 0.361, and a Cronbach's Alpha score of 0.650. Univariate and bivariate data analysis was employed in research. The characteristics of each variable were explained utilizing univariate analysis. Bivariate analysis was utilized to examine the relationship between two variables. Chi-Square analysis was implemented in the statistical test. This research has received ethical approval from the Health Research Ethics Committee of the Health Polytechnic Jakarta III No.LB.02.02/KEPK/024/2022.

3. RESULTS AND DISCUSSION

Table 1. Distribution of respondents' characteristics based on age, gender, occupation, education and family history of hypertension (n=115).

Characteristics	Frequency	Percentage
Age		
21-60 years	50	43.5
>60 years	65	56.5
Gender		
Male	67	58.3
Female	48	41.7
Occupation		
Working	14	12.2
Not working	101	87.8
Education		
Higher education	50	43.5
Low education	65	56.5
Family history of hypertension		
Yes	45	39.1
No	70	60.9

Table 1 demonstrates that the majority of respondents' characteristics in the category of old age (>60 years) are 65 people (56.5%), female are 67 people (58.3%), not working are 101 people 87.8%, educated 65 people (56.5%) and did not possess history of hypertension in the family of 70 people (60.9%).

Table 2. Distribution of respondents by knowledge and lifestyle in hypertension patients (n=115).

Variable	Frequency	Percentage
Knowledge		
Sufficient	59	51.3
Less	56	48.7
Lifestyle		
Good	59	51.3
Not good	56	48.7

Table 2 reveals that the majority of respondents in the category of sufficient knowledge level are 59 people with a percentage of 51.3%, while a good lifestyle category are 59 people with a percentage of 51.3%.

Table 3. The relationship between respondent characteristics and lifestyle in hypertension patients (n=115).

Independent Variable	Dependent Variable						*p- value*	Nilai OR CI 95%
	Lifestyle				Total			
	Good	%	Not good	%	n	%		
Age								
21-60 years	31	62.0	19	38.0	50	100	0.044	2.155 (1.015-4.578)
>60 years	28	43.1	37	56.9	65	100		
Gender								
Female	39	58.2	28	41.8	67	100	0.080	1.950 (0.920-4.135)
Male	20	41.7	28	58.3	48	100		
Occupation								
Working	9	64.3	5	35.7	14	100	0.300	1.836 (0.575-5.861)
Not working	50	49.5	51	50.5	101	100		
Education								
Higher education	32	64.0	18	36.0	50	100	0.017	0.400 (0.187-0.854)
Low education	27	41.5	38	58.5	65	100		
Family history of hypertension								
Yes	25	55.6	20	44.4	45	100	0.465	1.324 (0.624-2.807)
No	34	48.6	36	51.4	70	100		
Total	59	51.3	56	48.7	115	100		

Table 3 demonstrated that the chi-square analysis test obtained a p-value = 0.044 (p <0.05) or it is understood that there is a relationship between age and lifestyle where the OR value = 2.156 which indicates that respondents with adult age possess a 2.156 times greater chance of possessing a good lifestyle than with older respondents.

There are 28 genders (41.8%) and 28 men (58.3%) who own an unfavorable lifestyle. The results of the bivariate chi-square test obtain p value = 0.080 (p>0.05) OR = 1.950 which implies there is no significant relationship between gender and lifestyle in controlling hypertension and male sex possesses a 1.950 times greater chance to lead an unfavorable lifestyle compared to female.

A bad lifestyle is performed by 51 people (50.5%) who are not working, while 5 people who work (35.7%). The results of the chi square test obtain p value = 0.300 (p>0.05) OR = 1.836 or there is no relationship between work and lifestyle in controlling hypertension and people who are not working possess 1.836 times greater possibility of living a bad lifestyle than respondents working.

Respondents who possess a bad lifestyle with low education category are 38 people (58.5%) and 18 people are in the higher education category (38.0%). The results of the chi-square test revealed that p value = 0.017 (p <0.05) OR = 0.400 which can be considered to be a relationship between recent education and lifestyle in controlling hypertension and respondents with low education possessing 0.4 times greater risk of having lifestyle which is not good than with a highly educated.

For respondents who lead an unfavorable lifestyle, 20 people (44.4%) possess a family history of hypertension and 36 people (51.4%) own no family history of hypertension. The results of the chi-square test obtained a p value = 0.465 (p>0.05) OR 1.324 or it can be indicated that there is no association between a family history of hypertension and lifestyle in controlling hypertension, and those with no family history of hypertension are 1.324 times more likely to engage in a terrible lifestyle than respondents with a family history of hypertension.

Table 4. The relationship between respondent knowledge and lifestyle in hypertension patients (n=115).

Independent Variable	**Dependent Variable**						***p- value***	**Nilai OR CI 95%**
	Lifestyle				**Total**			
	Good	**%**	**Not good**	**%**	**n**	**%**		
Knowledge								
Sufficient	46	78.0	13	22.0	59	100	0.000	11.704 (4.884-28.028)
Less	13	23.2	43	76.8	56	100		
Total	59	51.3	56	48.7	115	100		

Table 4 demonstrates that there are results of the analysis of the relationship between the variable level of knowledge and lifestyle. The results of the Chi-Square test obtained p value = 0.000 (p <0.05) OR = 11.704 indicating that there is a relationship between the level of knowledge and lifestyle in controlling hypertension and people with sufficient knowledge possess 11.704 times greater possibility of possessing a good lifestyle than those who own a level of knowledge in the less category. World Health Organization, (2014) explains the social determinants that are the main contributing factors to high blood pressure and its complications, namely aging, income, and education.

In accordance with the results of the analysis in the previous chapter, it was uncovered that the majority of adult respondents possessed a good lifestyle. The majority of respondents who are older possess a bad lifestyle. The results of the chi square test obtained p value = 0.044 (p <0.05) indicating that there is a relationship between age and lifestyle in controlling hypertension. Akbarpour et al., (2018) conducted research which revealed that the age ranges from adult to the elderly possesses a significant relationship to the healthy lifestyle of hypertensive patients.

This study is not in accordance with research performed by Qodir, (2020) in which age does not possess a significant relationship with lifestyle modification adherence in hypertension patients, and hypertension patients with the elderly category own a greater chance of non-adherence. This study possesses similarities with this study, in which hypertension patients who are in the old category experience a greater possibility of possessing a bad lifestyle. Yang et al., (2017) in their study also discovered that age produced a significant relationship with the success or failure of patients in controlling hypertension.

The results of this study are in accordance with the results of research conducted by Nurhidayati et al., (2019) in which the age group owns a relationship with adherence to hypertension treatment. The value of the prevalence ratio between the categories of adults and the elderly is 81.4%: 59.5%. It is implied that respondents in the category of the adult age group possess a higher adherence rate than the elderly in medication adherence. Adherence to treatment is part of controlling hypertension.

The majority of hypertension patients in this study were elderly or older than 60 years. There is a decline in the elderly's ability to receive and process information, as well as a decline in memory to remember. Meanwhile, age can have an impact on knowledge (Sunarti & Patimah, 2019).

The majority of hypertension patients in the adult age group live a healthier lifestyle than hypertension patients in the elderly age group. According to researchers, it occurs because hypertension patients in their golden years begin to age, resulting in a decline in physical, biological, psychological, and social conditions. Older hypertension patients require family assistance in their daily lives, including managing and processing food, reminding them to take medicine, or accompanying them when visiting health facilities.

The results of this study are in accordance with the study Qodir, (2020) in which gender does not possess relationship with lifestyle modification adherence in hypertensive patients and women own a higher chance of not complying with lifestyle modifications. This research is not in accordance with the statement from (Notoatmodjo, 2012) where gender influences individual behavior patterns when sick, with women attempting to treat themselves more than men. Gender plays a crucial role in the lives of both men and women in society. The theory is consistent with the findings of this study. It demonstrates that the majority of female hypertensive patients maintain a healthy lifestyle in order to control their hypertension. According to the researcher, it occurs because female hypertensive patients have positive social interactions with other hypertensive patients and health professionals. Women must also manage their diets at home in order to implement an appropriate diet, which is one method of controlling hypertension. Women, as opposed to men, do not smoke or consume alcoholic beverages. In this study, the majority of male hypertension patients performed a bad lifestyle.

The results of this study are not in accordance with research conducted by (Pratiwi & Harfiani, 2020) which revealed that socioeconomic possesses a relationship with hypertension medication adherence. It happens as hypertension patients require to perform routine control and to consume hypertension drugs regularly which costs money to have the treatment. The results of this study are also not associated with (Rasajati, Raharjo & Ningrum, 2015) in which work owns a relationship with hypertension medication adherence. (Notoatmodjo, 2012) asserted that people who work do not possess enough time to visit health facilities.

In this study, the majority of hypertension patients who are working owned a good lifestyle than those who did not work. According to researchers, it occurs as hypertension patients who are working tend to care more about their health, hence, they are able to work optimally. Hypertensive patients who work are also able to fulfil the necessities that corroborate a lifestyle that can control hypertension such as purchasing good food for controlling hypertension and drugs or utilizing health insurance.

In this study, the majority of hypertensive patients with low education category performed a bad lifestyle. Meanwhile, the majority of hypertensive patients who are in the category of highly educated possess a good lifestyle. The results of the chi square test obtained p value = 0.017 ($p < 0.05$) implying that there is a relationship between recent education and lifestyle in controlling hypertension, and hypertension patients with higher education categories possess a greater possibility of possessing a good lifestyle.

The results of this study are in accordance with the research of (Pratiwi & Harfiani, 2020) in which the latest education owns a relationship with adherence to treatment for hypertension. The results of this study are also associated with research by (Novian, 2014) in which the level of education possesses a relationship with adherence to the hypertension diet. Adherence to medication and diet is an appropriate effort in controlling hypertension.

The results of this study are not in accordance with the research of (Rasajati, Raharjo & Ningrum, 2015) which discovered that formal education does not possess a significant relationship with medication adherence. The majority of hypertension patients with low education did not work and adhered to treatment in this study as they had time to obtain treatment at the public health center and received hypertension health education.

In this study, the majority of hypertension patients owned low education. Associated with the efforts made by individuals, (Nurhidayati et al., 2019) asserted that someone who possesses a higher education is able to produce decisions and create the right efforts to maintain their health in comparison with people who possess low education. This statement is in accordance with this study in which the majority of hypertension patients who possess low education own a bad lifestyle. Meanwhile, the majority of hypertension patients with high education possess a good lifestyle in controlling hypertension.

According to researchers, hypertension patients with higher education have better abilities in processing information, analyzing information, and determining how to make lifestyle changes that can control hypertension. Based on the results of the previous chapter's analysis, the chi square test yielded a p value of 0.465, indicating that there is no relationship between a family history of hypertension and a healthy lifestyle in terms of controlling hypertension. These result differs from those of Zaenurrohmah, & Rachmayanti, (2017), who discovered a correlation between a family history of hypertension and hypertension control measures in the elderly. The results of this study also differ from those of Indriani et al (2021), who discovered a connection between genetic factors and controlled hypertension. In this study, hypertension patients were dominated by the participants who did not possess a family history of hypertension. Zaenurrohmah & Rachmayanti, (2017) discovered that hypertension patients who own a family history of hypertension tend to have taken blood pressure control measures for generations.

It habituates hypertension patients to maintaining normal blood pressure levels. This statement is consistent with the findings of this study, which discovered that hypertension patients with a family history of hypertension have a good lifestyle for controlling hypertension. According to researchers, hypertensive patients with a family history of hypertension tend to encounter family support to both maintain their lifestyle and control their hypertension. According to the results of the previous chapter's analysis, the majority of respondents with a high level of knowledge led a healthy lifestyle. The results of the chi square analysis test demonstrated that the value of $p = 0.000$ ($p < 0.05$) implies that the level of knowledge possesses a relationship with lifestyle in controlling hypertension. Abu et al., (2018) in their study revealed that patients with a low level of knowledge about hypertension are less likely to reduce their salt intake and consume foods that do not help them lose weight than patients with a high level of knowledge.

The results of the study are different from those obtained by Zaenurrohmah & Rachmayanti, (2017) with the results of knowledge not producing a relationship with hypertension control measures in the elderly. In this study, the majority of the elderly underwent good control measures, even though they owned good knowledge categories and sufficient knowledge categories. It occurs as the elderly have taken control actions consciously or unconsciously.

This research is in accordance with the research of Sunarti & Patimah, (2019) who uncovered that the level of knowledge possesses a relationship with blood pressure control

efforts. This study is also in accordance with the results of research administered by Herawati, (2020) with the results that there is a relationship between knowledge and efforts to control hypertension. The study conducted by Qodir, (2020) is also associated with this study in which the level of knowledge has a relationship with lifestyle modification compliance in hypertension patients and hypertension patients who possess high knowledge tend to be more obedient.

A person's behavior is constructed by knowledge, which forms values and attitudes. Unconsciously, knowledge and attitudes will shape behavior and actions. Continuously performed actions will become a habit. This theory is supported by the findings of this study, which demonstrate that the majority of hypertension patients have adequate knowledge and lead a healthy lifestyle. According to researchers, it can happen to hypertension patients who already understand how to regulate their blood pressure. Health workers, health cadres, and other sources of information can provide information on hypertension. This knowledge has a positive impact on hypertension patients, encouraging them to make lifestyle changes that will help them control their blood pressure (Saraswaty, Abdurrahmat & Novianti, 2018).

4. CONCLUSION

According to the results of the study, there is a correlation between age, last education, and knowledge of lifestyle and hypertension control. Researchers can conduct lifestyle research in the context of hypertension control. It is expected that they will investigate external factors influencing lifestyle, such as the role of health workers, family support, or support from health cadres.

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RESEARCH **Open Access**

The Effect of Using Endorphin Massage for Decreasing Pain at First Stage in Normal Labor

Siti Choirul Dwi Astuti[1a*], Riana Trinovita Sari[2b]

[1] Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Gorontalo, Gorontalo City, Gorontalo Province, Indonesia
[2] Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Kalimantan Timur, Samarinda City, East Kalimantan, Indonesia

[a] Email address: sitichoirul13@yahoo.co.id
[b] Email address: rianats@gmail.com

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Abstract
Labor pain is a subjective experience of physical sensations associated with uterine contractions, dilation, thinning cervix and fetal descent during labor. To resolve the pain of labor, it has been implemented in a nonpharmacological method which is endorphin massage, in understanding endorphin massage for pressing pain in the first stage, in an active phase of normal multiparous mothers' deliveries. This research aims to research endorphin massage's influence on suppressing pain during the active phase of normal labor of multiparous mothers. This study is quasi-experimental with a cross-sectional approach. The study population of all women giving birth administered the purposive sampling data capture techniques, and it was obtained 132 multiparous mothers with normal labor in the observation sheet. Data were examined by administering a T-test. The majority of the pain intensity in the first stage of active phase multiparous mothers with normal labor, before the breath relaxation, is severe, with up to 49% experiencing severe pain. The majority of the percentage of moderate pain in the first stage of active phase multiparous mothers with normal labor, after breath relaxation, is as high as 42%. Meanwhile, the pain intensity of the first stage in active phase multiparous mothers with normal labor, prior to endorphin massage, is as high as 73.3%. Pain intensity of the first stage in active phase multiparous mothers normal labor after endorphin massage, the majority of the percentage is moderate pain up to 53.3%. Statistical test results obtained p-value is 0.004 endorphin massage. In conclusion, there is an effect of breath relaxation on the intensity of pain during normal labor in multiparous mothers. Furthermore, researchers can do a combination of endorpine massage with other treatments to treat pain during the I active phase of labor and pain intensity checks can be done by testing cortisol levels.

Keywords: Hypertension, Knowledge Level, Lifestyle.

Corresponding Author:

Siti Choirul Dwi Astuti
Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Gorontalo, Gorontalo City, Gorontalo Province, Indonesia.
Email: sitichoirul13@yahoo.co.id

1. INTRODUCTION

Childbirth and birth are physiological processes that accompany almost every woman. Although physiological processes are generally frightening as they are accompanied by severe pain, frequently even providing rise to life-threatening physical and mental conditions (Al-qerem, 2020). Labor pain is caused by myometrial contractions incorporated by physiological and biochemical change mechanisms (Aminisaman et al., 2020). Furthermore, psychological factors, emotions and motivation also affect the beginning of childbirth (Bintang et al., 2021). Mothers who give birth desire to be free of pain caused by contractions; it should be emphasized to mothers that without pain, childbirth will not progress as one of the signs of childbirth is painful contractions (Bruton, 2008).

Physical and psychological barriers in the mother during childbirth may also contribute to the pain (Neige et al., 2020). The most exhausting and hard time is when mothers begin to experience pain during the first stage of the active phase. In this phase, most mothers encounter severe pain as the activities of the uterus begin to be more active (Hong & Shin, 2020). In the contraction phase, the longer it is, the stronger and more frequent it will be (Jarrah et al., 2022).

Various nonpharmacological methods, such as distractions, hypnosis, relaxation, and simulation of cutaneous pain, have been employed to alleviate pain during childbirth (endorphin massages, warm baths and hot compresses) endorphin massage (Liao et al., 2021). Nonpharmacological pain control is cheaper, simpler, effective, and without adverse effects (Cojocaru, & Mârza-Dănilă, 2014). This method can also escalate satisfaction during childbirth as the mother is able to monitor her feelings and fears (Liu et al., 2021).

Relaxation is resting the body and mind from all physical and psychological burdens in becoming calmer (Liu et al., 2021). Furthermore, relaxation can also produce blood circulation in the uterus, placenta and fetus smooth. Hence, oxygen and fetal food are maintained (Fasihi et al., 2022). Smooth blood circulation will also cause the muscles directly related to the uterus to weaken and sag, allowing contractions to occur naturally, smoothly, safely, and more quickly (Meer et al., 2020).

One of the methods of nonpharmacological management is to decrease labor pain with endorphin massage (Nunes et al., 2016). Endorphin massage is a touch therapy/light massage which is crucial to be provided in the time leading up to the labor time (Page et al., 2022). It is because massage stimulates the body to release endorphin compounds as pain relievers and produce a comfortable feeling (Quinlan-Colwell et al., 2022).

According to a preliminary study conducted on ten maternity mothers, six mothers experienced severe pain, three mothers suffered moderate pain, and one mother encountered mild pain. As a result, the mother will experience pain during childbirth. Relaxation and endorphin massage during childbirth are two methods for overcoming it (Apryanti, & Astuti., 2020). This research aims to research endorphin massage's influence on suppressing pain during the active phase of normal labor of multiparous mothers.

2. RESEARCH METHOD

This is a quasi-experimental study with only pretest and posttest control groups. The location where this research was performed. The research was conducted between May and June of 2022. This study included all maternity mothers who fulfilled the inclusion criteria. From January to August, an average of 66 mothers were obtained. In this study, 66 pregnant women will be provided a breath relaxation treatment and a endorphin massage. Maternity mothers numbered 1 to 66 will receive breath relaxation treatment, while those numbered 66 to 132 will receive endorphin massage treatment. This study employs a purposive sampling technique that is associated with a specific balance determined by the researcher utilizing

previously identified population characteristics or traits endorphin massage. The object of research in this study was to match the two groups by establishing several inclusion criteria. In this study, the free variables were breath relaxation techniques and endorphin massage. The presence of free variables affects or results in dependent variables. The bound variable in this study is pain intensity during the first stage of normal labor.

Data collected in this study encompass primary data collected directly by researchers on covering respondents' identities, health issues, and obtaining permission to be respondents. Secondary data is information obtained from the register book of pregnant women. The data in this study were descriptively examined by calculating the minimum, maximum, mean, and standard deviations of the intensity of pain during the first stage of normal labor in the groups provided breath relaxation and the group provided endorphin massage. Bivariate analysis was performed by administering t-test (t-test). This study has obtained ethical permission from Research Ethic Committee (LB.01.01/KEPK/198/2022).

3. RESULTS AND DISCUSSION

Table 1. Respondent Characteristics (n=132).

Characteristics	**Frequency Distribution**	
	Amount	**Percentage**
Age		
<20 Old	7	5%
21-35 Old	112	85%
>35 Old	13	10%
Occupation		
Working Women	32	24%
Housewife	100	76%
Number of children		
1	47	36%
2	54	41%
≥3	31	23%

Table 1 demonstrates that the majority of 112 respondents (85%) possess the aged of 21-35 years, 100 (76%) respondents are working mothers, and 54 (41%) respondents own 2 children.

Table 2. Pain Intensity during the Frist Stage of Normal Labor in the Breath Relaxation Group (n=66).

Pain Intensity	**Pre**		**Post**	
	Frequency	**%**	**Frequency**	**%**
0 (painless)	0	0	12	18%
1- 3 (mild pain)	10	15%	15	23%
4- 6 (moderate pain)	24	36%	28	42%
7-10 (severe pain)	32	49%	11	17%

Table 2 illustrates the intense pain during normal labor before breathing relaxation results which discovered some of the 32 respondents (49%) who possessed severe pain, and the intensity of pain during normal labor after breathing relaxation obtained the results which is most of the 28 respondents (42%) experienced moderate pain.

Table 3. Effect of Breath Relaxation on Pain during the Frist Stage of Normal Labor (n=66).

	Mean	Min	Max	SD	p-value
Pre	7,00	4,00	9,00	1,41	0,001
Post	5,40	3,00	8,00	1,63	

Table 3 illustrates that before the breath relaxation treatment, the intensity of pain during the first normal labor was the lowest at 4.00 and the highest was 9.00, with an average of 7.00 and a standard deviation of 1.41. Meanwhile, after the breath relaxation treatment, the lowest pain intensity was 3.00 and the highest was 8.00, with an average of 5.40 and a standard deviation of 1.63. The difference between the first and second measurements is 1.60 on average, with a standard deviation of 0.63. The sample-related magnitude p-value is 0.00 according to the results of statistical tests by employing the T-test. The magnitude of the $p<0.05$ value demonstrates that there is an effect of breath relaxation on the intensity of pain during normal labor.

Table 4. Pain Intensity during the First Stage of Normal Labor with Endorphin Massage Group (n=66).

Pain Intensity	Pre		Post	
	Frequency	%	Frequency	%
0 (Painless)	4	6%	16	24%
1- 3 (Mild Pain)	11	17%	33	50%
4- 6 (Moderate Pain)	12	18%	12	18%
7-10 (Severe Pain)	39	59%	5	7%

Table 4 presents that pain intensity during the first stage of normal labor before the application of endorphin massage uncovered that some of the 39 respondents (49%) possessed severe pain, and the intensity of pain during normal labor after endorphin massage obtained the most of the 33 respondents (50%) in mild pain.

Table 5. Effect of Breath Relaxation on Pain during the First Stage of Normal Labor (n=66)

	Mean	Min	Max	SD	p-value
Pre	7,00	5,00	9,00	1,00	0,001
Post	3,80	2,00	6,00	1,08	

Table 5 displays that before the application of endorphin massage treatment, the intensity of pain during normal labor was 5.00, 9.00, and 7.00 with a standard deviation of 1.00. Meanwhile, after the application of endorphin massage treatment, the lowest pain intensity was 2.00, the highest was 6.00, and the average was 3.80 with a standard deviation of 1.08. The difference between the first and second measurements is 3.20 on average, with a standard deviation of 0.94. The sample associated with the magnitude of the p-value is 0.00 in accordance with the results of statistical tests with the T-test. The magnitude of the p0.05 value indicates the effect of endorphin massage on pain intensity during normal labor.

Table 6. Differences in Endorphin Massage with Pain Intensity during the First Stage of Normal Multiparous Labor.

Treatment	N	Mean	SD	p-value
Breathing relaxation	15	5,40	1,63	0,004
Endorphin massage	15	3,80	1,08	

Table 6 demonstrates that the average pain intensity during the first stage of normal labor after respiratory relaxation was 5.40 with a standard deviation of 1.63. Meanwhile, the average pain intensity during the first active phase of normal labor of multiparous mothers after

endorphin massage was 3.80, with a standard deviation of 1.08. Statistical tests obtained a p-value of 0.004 in alpha 5%. Large $p<0.05$ values revealed a significant difference in the average pain intensity during first stage normal labor in the breath relaxation group with the endorphin massage group.

In general, maternity mothers experience pain at the time of labor, but the intensity of this pain is different from each maternity mother (fear and attempting to fight the pain of childbirth) as well as the presence or absence of support from people around the labor process (Sangeethalaxmi & Hankey, 2022). Parity also influences the perception of pain (Scuteri et al., 2022). In primipara, it will be more painful at the beginning of labor, while in multiparous, the pain increases when the labor has been advanced (when the labor of the fetus takes place quickly at time II) (Sorel et al., 2022).

Multiparous mothers have given birth to a baby several times (up to 5 times) (Timmers et al., 2021). They experienced pain in previous childbirth, hence, multiparous possesses a mechanism to overcome the pain of childbirth in contrast to primipara (Triansyah et al., 2021). This mother had never given birth and had a child before, and the labor process she has encountered was the first experience causing emotional tension, anxiety and fear that can aggravate the pain (Urio et al., 2019). The intensity of labor pain in primiparous is frequently more severe than in multiparous as it experiences effacement (thinning of the cervix) along with cervical dilatation, while in primipara, effacement used to occur earlier than cervical dilatation (Vilc et al., 2021).

Factors affecting a person's pain encompass physiology, psychological factors, perception factors and pain tolerance (Valente et al., 2020). Physiological (physical) factors incorporate opening, thinning of the cervix, the lower segment of the uterus tensing, peritoneum attracted by the bladder depression, hypoxia, vaginal distress, parity (primiparous/multiparous), then psychological factors encompass fear, panic, low self-esteem, anger, fear, anxiety, and impaired sexual activity (Mulhaeriah et al., 2018). Furthermore, the perception factor which triggers receptors and pain tolerance factors are closely associated with the intensity of pain which is able to affect a person to endure pain and someone who owns previous pain experiences (Fitri et al., 2021).

From the results of the study, it was revealed that the distribution of pain intensity in the breath relaxation group before treatment was in majority the percentage of severe pain 66.7% (10 respondents) and moderate pain 33.3% (5 respondents). After the breath relaxation treatment, most of the percentage was moderate pain 60.0% (9 respondents), severe pain 26.7% (4 respondents) and mild pain 13.3% (2 respondents). Moreover, the distribution of pain intensity in the endorphin massage group before treatment was generally 73.3% severe pain (11 respondents) and moderate pain 26.7% (4 respondents). After the endorphin massage treatment, most of the percentages were moderate pain 53.3% (8 respondents) and mild pain 46.7% (7 respondents).

Pain impulses can be regulated or inhibited by defense mechanisms along the central nervous system (Fitri et al., 2020). Theoretically, low-level activity on small fibers that transmit nonselective data impulses is inhibited and spliced first synapses by the activity of large ascendant fibers, and the activity in the decedent fibers of the higher center is tinkered (Zhu et al., 2021). Intense activity in small fibers triggered by painful stimuli opens the gates in the first disincentive activity in heavy fibers 'closes the gates' against pain stimuli.

An activity balance of sensory neutrons and sensory control fibres of the brain maintains defense processes (Alhafez & Berghella, 2020). Delta-A and C neurons released substance P to transmit impulses through defense mechanisms (Churakov et al., 2021). Furthermore, mechanoreceptors are thicker beta-A neurons faster than they release inhibitory neurotransmitters (Häggsgård et al., 2021). If the dominant input originates from beta-A fibers, it will close the defense mechanism. It is identified that this closure mechanism can be

perceived when the labor companion gently rubs the client's back (Kahrs & Eggebø, 2021). The resulting message will stimulate mechanization, if the dominant input originates from delta A fibers and C fibers, it will open up those defenses, and the client perceives pain sensation pain (Kim et al., 2021).

Even if pain impulses are transferred to the brain, a higher cortex center in the tinker modifies the pain (Li & Zhao, 2021). The decent nerve groove releases endogenous opiate, a natural pain killer originating in the body (López-Fernández et al., 2022). This neuromodulator closes the defense mechanism by inhibiting the suppression of the substance of P. distraction techniques, breath relaxation, endorphin massage, hypnosis and placebo administration. Pain during childbirth is affected by stimuli of adnexa receptors, uterus and pelvic ligaments. Stimulation during one labor is transmitted from the afferent tissue through the lower, middle and upper parts of the hypogastric plexus, lumbar and lower thoracic sympathy chains to the lower nerve root ganglia at T10-L1 (Murphy et al., 2021). Pain can be delivered from the pelvic region to the navel (umbilicus), upper thigh and mid-sacrum region (Raana & Fan, 2020).

Pain during labor is affected by a combination of stretching of the lower segment of the uterus (and subsequently) and ischemia (hypoxia) of the uterine muscles with an increase in the strength of cervix contractions will be attracted (Raana & Fan, 2020). This strong contraction also limits the flow of oxygen in the uterine muscles, hence, ischemic pain arises (Saldanha-Gomes et al., 2022). Pain due to uterine contractions is extensively affected by ischemia in the myometrial fibers because the fibers are more numerous, and the contractions are more robust in the upper segments of the uterus (Shen et al., 2021). The pain is experienced more intensely in stimulated cutaneous T12 and L (Talukder et al., 2021).

In accordance with the results of statistical tests by employing independent t-tests, the results ($p<0.05$) demonstrated that a p-value of 0.000 indicates that breath relaxation owns a significant effect on the intensity of pain during the active phase of normal childbirth of multiparous mothers.

During labor, the muscles on the uterine wall tighten in a tight pulling position with full force to deliver the baby out of the womb (Briozzo et al., 2016). Supposing the mother possesses difficulty in being relaxed or even panics, the muscles throughout the body tightly, hence, the labor process tends to hurt more than it should (Al-qerem, 2020). On the contrary, if the maternity mother is able to relax during the contraction, she will experience comfort during the labor process by employing the right breath relaxation technique, and it will escalate the mother's ability to control her pain and decrease anxiety, lower catecholamine levels, stimulate blood flow to the uterus and decrease muscle tension (Aminisaman et al., 2020). The breath relaxation technique is inhaling through the nose and exhaling through the mouth when the contractions occur (Neige et al., 2020).

The pain intensity when first stage maternity before and after breathing relaxation is generally different (Liao et al., 2021). It is to the theoretical concept demonstrated that breath relaxation is able to reduce the pain experienced by the mother (Jarrah et al., 2022). The mother still experiences contractions in her womb as these contractions are necessary for the progress of childbirth, but the mother should enjoy contractions as something that feels comfortable (Liao et al., 2021).

With the concept that the state of relaxation, comfort, calm, and coordination between the mind and body results in the muscles of labor working in an integrated manner, the muscles of the circle relax and are pulled upwards causing the cervix thins and opens, which eventually occurs and childbirth can occur easily (Bukenya & Golooba-Mutebi, 2020).

According to the findings of statistical tests using the independent t-test, a p-value of 0.000 indicates that massage endorphin significantly affects the intensity of pain during the

first active phase of normal childbirth in multiparous mothers. Nonpharmacological pain control methods are very essential for overcoming pain during childbirth because they do not harm the mother or fetus, do not slow down labor if given massive pain control, and do not have allergic or drug effects (Burgess et al., 2020). Nonpharmacological methods are categorized into three components that interact with each other, hence, they influence the response to pain, which is motivational-effective strategies (the central interplay of messages residing in the brain affected by one's feelings, memory, experiences and culture), cognitive-evaluative (the central interplay of messages which are in contact influenced by knowledge, one's attention, the use of cognitive strategies, and cognitive evaluation of situations) and sensory-discriminatory (provision of tinkering information in accordance with physical sensations) (Cassaglia et al., 2020).

The intensity of pain during the first stage respondents before and after performing endorphin massage is generally different (Chakhtoura et al., 2019). It is followed the concept of the theory demonstrated that endorphin massage can inhibit the course of pain stimulation at higher center in the central nervous system (Yasar & Uysal, 2021). Furthermore, tactile stimuli and positive feelings developing when conducted forms of attention full of touch and empathy act in strengthening the effects of endorphin massage to control pain (Liao et al., 2021).

It was further elaborated with the concept that endorphin massage is physical contact providing a sense of comfort by stimulating the release of endorphin hormones which will corroborate balance energy and prevent disease (Liu et al., 2020). Physiologically stimulates and regulates the body, and enhances blood flow and lymph nodes, hence oxygen, food substances and food waste are effectively delivered the tissues of the body and the placenta by relaxing tension and supporting to lower emotions (Fasihi et al., 2022). Endorphin massage also calms the nerves as well as assists lower blood pressure (Meer et al., 2020).

In accordance with the study's results above, it is understood that the average intensity of pain during the first active phase of normal labor of multiparous mothers after breath relaxation is 5.40, with a standard deviation of 1.63. Meanwhile, the average pain intensity during the first active phase of normal labor of multiparous mothers after endorphin massage was 3.80, with a standard deviation of 1.08.

Result statistical tests employing the independent t-test obtained results ($p<0.05$) demonstrated that a p-value of 0.004 indicated a significant difference in the average pain intensity during the I active phase of normal childbirth of multiparous mothers in the breath relaxation group with the endorphin massage group.

Multiparous mothers have given birth to a baby several times (up to 5 times) (Nunez et al., 2016). Multiparous mothers had experienced pain in previous childbirth, thus, multiparous possesses a mechanism to overcome the pain of childbirth in contrast to primipara (Page et al., 2022). This mother had never given birth and had a child before, and the labor process she encountered was the first experience causing emotional tension, anxiety and fear that can aggravate the pain (Quinlan-Colwell et al., 2022).

At the time of the first stage, it was divided into 2 phases. The latent phase of a cervical opening lasts 7-8 hours until the opening of 3 cm, and the active phase of a cervical opening lasts 6 hours from the opening of 4 cm to 10 cm. At the time, the first stage of the maternal labor process was affected by power, passenger (fetus and placenta), passage (birth canal), and psychology (Sangeethalaxmi & Hankey, 2022). Psychology in childbirth encompasses fear and anxiety that can make the mother stressed. Stress in childbirth affects increased catecholamines (Adrenaline and non-adrenaline), which reduces uterine contractions and causes long partus and vasoconstriction of uterine blood vessels. Blood flow from the uterus to the placenta is decreased (Scuteri et al., 2022).

The relaxation of breath produces the maternity mother self-suspense during labor by regulating the breath coming out and enters through the nose slowly and regularly (Sorel et al., 2022). Furthermore, relaxation can also produce blood circulation in the uterus, placenta and fetus smooth, thus, oxygen and fetal food are fulfilled (Timmers et al., 2021). Smooth blood circulation will also create the muscles directly associated with the uterus which becomes weak and sagging, thus, the pain intensity can be reduced when the mother gives birth (Triansyah et al., 2021). This technique relieves pain and emotional stress during childbirth without using anesthetics (Urio et al., 2019).

Endorphin massage is physical contact that provides comfort by stimulating the release of endorphin hormones (Vilc et al., 2021). Endorphins are protein molecules produced by cells from the nervous system and some parts of the body which are beneficial for working together with sedative receptors to decrease pain encompassing 30 units of stress-relieving amino acids such as corticotropin, cortisol and catecholamines (Valente et al., 2020). This technique triggers a feeling of comfort through the surface of the skin (Sangeethalaxmi & Hankey, 2022). Endorphin massage for 20 minutes during labor helps the mother be comfortable and pain-free as it is able to stimulate the body to release endorphin compounds which are natural pain relievers and create a feeling of comfort and goodness (Scuteri et al., 2022). The effectiveness of this method generates stimulation to the brain smaller and slower than the extensive tactile fibers (Sorel et al., 2022). When touch and pain are stimulated together, the sensation of touch running to the brain closes the inner gate (Liao et al., 2021). The presence of endorphin massage, which possesses a distraction effect, can also escalate endorphins' formation in muscle relaxation (Fasihi et al., 2022).

Efforts to decrease the number of maternal pain during childbirth for multiparous mothers who experience pain before health workers should introduce breath relaxation techniques and endorphin massage in the community. Hence, multiparous mothers have the means to improve their knowledge of reducing pain during childbirth in a cheap, easy and effective way (Torkiyan et al., 2021).

4. CONCLUSION

It was concluded that there is an effect of breath relaxation on the intensity of pain during normal labor in multiparous mothers. There is an effect of endorphin massage on the intensity of pain during normal labor in multiparous mothers. There was a significant difference in the average intensity of pain during I normal labor between mothers who implemented the breath relaxation method and mothers who performed endorphin massage, with the average result of pain intensity during I normal labor after breathing relaxation being 5.40 with a standard deviation of 1.63. Meanwhile, the average pain intensity of multiparous mothers during the first stage of normal labor after the application of endorphin massage was 3.80, with a standard deviation of 1.08, a p-value of 0.004. Furthermore, researchers can do a combination of endorpine massage with other treatments to treat pain during the I active phase of labor and pain intensity checks can be done by testing cortisol levels.

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The Effect of Service and Satisfaction of Pregnant Women on Antenatal Visits to Midwives

Tirza Vivianri Isabela Tabelak[1,2a*], Firda Kalzum Kiah[1b], Nurlaelah Al Tadom[1c]

[1] Department of Midwifery, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia
[2] Center of Excellent, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia

[a] Email address: tirzatabelak27@gmail.com
[b] Email address: firdakiah26@gmail.com
[c] Email address: lailaaltadom01@gmail.com

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Abstract

The utilization of antenatal services for pregnant women can be determined based on the achievements of K1 (first contact) and K4 (4 times contact) during pregnancy with competent and authorized health workers. The World Health Organization asserts that the attitude and performance of health workers are an essential elements of service quality as it affects the understanding and satisfaction of women, partners, and families in seeking ANC, delivery, and postnatal services. The objective of this research is to examine the effect of antenatal care by midwives and the satisfaction of pregnant women on antenatal visits. The type of this research is analytic observational with a cross-sectional design, performed from March - June in Kupang City. The research subjects were 120 pregnant women with a gestational age of 36 weeks. Data collection employed questionnaires and MCH Handbook. The analysis conducted was univariate and bivariate by employing the Chi-square test with Alpha = 0.05. The results of the study on 120 pregnant women demonstrated that most of the pregnant women received good service (98.3%) and most of whom (60%) were satisfied with the services they experienced. Seventy-one people (59.2%) possessed complete visits. The Chi-square test results revealed relationship between service and satisfaction of pregnant women with antenatal visits (p = 0.652, p = 0.324). The majority of pregnant women had thorough consultations, received adequate antenatal care, and were pleased with the services they received. In addition to satisfaction, health services and programs must be performed in accordance with local culture and language in order to be accepted by the community, encompassing a decision-making culture that can influence pregnant women's visits to health facilities. Distance, education, profession, parity, and the husband's support can all have an impact on the mother's adherence to antenatal visits.

Keywords: Service, Satisfaction, Antenatal Visits.

Corresponding Author:

Tirza Vivianri Isabela Tabelak
Department of Midwifery, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia.
Email: tirzatabelak27@gmail.com

1. INTRODUCTION

Antenatal care (ANC) is one of the four pillars of the safe motherhood initiative, which are services obtained by pregnant women before birth, including health promotion, screening and diagnosis, and disease prevention which are conducted comprehensively and concerned on service quality (Akowuah, Agyei-Baffour & Awunyo-Vitor, 2018; WHO, 2016). ANC aims to decrease maternal and infant mortality and morbidity directly through the detection and treatment of complications in pregnancy, furthermore, indirectly through early examination and management of problems in pregnancy (WHO, 2018).

The World Health Organization (WHO) formulated guidelines for ANC visits and clinical examinations to prevent complications (Lattof et al., 2020). In Indonesia, antenatal care programs are integrated and encompassing promotive, preventive, rehabilitative, and curative components, such as controlling infectious diseases (sexually transmitted diseases/STDs, Hepatitis B, HIV/AIDS, syphilis, malaria, TB), Maternal and Child Health (MCH) services, nutrition, immunization, noncommunicable diseases, and other local and specific programs as required. Antenatal care utilization for pregnant women can be determined based on K1 (first contact) and K4 (4 times contact) with competent and authorized health workers during pregnancy (Kementerian Kesehatan Republik Indonesia, 2014; Dinas Kesehatan Kota Kupang, 2018). Pregnant women who receive services in the first trimester should continue to obtain services until the third trimester as according to research result, numerous mothers do not frequent health facilities (Iryani, 2020).

Obstacles to implementing health services for pregnant women comprise not only access, but also the quality of services administered, incorporating the availability of infrastructure in health facilities and the fulfillment of all components of health services for pregnant women (Kementerian Kesehatan Republik Indonesia, 2014). According to the World Health Organization, the attitude and performance of health workers is a crucial component of service quality since it can affect women's, partners', and families' comprehension and satisfaction with ANC, childbirth, and postnatal services (Mannava et al., 2015).

K4 coverage data for East Nusa Tenggara Province in 2018 is still low at 52.01 percent (Kementerian Kesehatan Republik Indonesia, 2019). Kupang City as the capital city of East Nusa Tenggara Province possesses an achievement of 87.60 percent in 2018 and has surpassed the K4 target in accordance with the Strategic Plan of the Kupang City Health Office, which is 85 percent. However, not all public health centers in Kupang City have acquired the target due to the 11 public health centers in Kupang City, only 54.5 percent (6 public health centers) have attained the K4 target, while 45.5 percent (5 public health centers) acquiring the target still possesses low coverage (Dinas Kesehatan Kota Kupang, 2018).

The results of another study revealed that maternal health disorders such as hypertension, resulting in the incidence of pre-eclampsia, anemia gravidarum (mild to moderate degree), heart failure, and women with chronic infectious diseases such as STIs and hepatitis were the leading causes of maternal mortality in Kupang City. There are also pregnant women who do not receive ANC as they believe that pregnancy is a normal state, even though they are pregnant with hypertension, causing severe pre-eclampsia. This issue was detected by the midwife during a home visit (Tabelak & Boimau, 2018). Moreover, there are also pregnant women who perform pregnancy checks in the final quarter, hence, early detection of complications cannot be performed (Tabelak & Yurissetiowati, 2022). The objective of this study is to examine the effect of antenatal care and the satisfaction of pregnant women on antenatal visits to the Midwife at the Public Health Center in Kupang City.

2. RESEARCH METHOD

This research is an analytic observational with a cross-sectional design, conducted from March to June 2020 at the Public Health Center in Kupang City. The research subjects were pregnant women with a gestational age age of 36 weeks, a total sample size of 120 people, the inclusion criteria being pregnant women with a gestational age of more than 36 weeks and possessing an MCH Handbook, and the exclusion criteria being pregnant women who did not live permanently and declined to be respondents. The sample method employed was sequential sampling. Data on antenatal treatment, satisfaction, and antenatal visits were obtained by employing questionnaires and Maternal and Child Health Books were used to collect data. The chi-square test with Alpha 0.05 was performed to analyze the data. This research has received ethical approval from the ethics committee of the Kupang Health Polytechnic with the code number LB.02.03/1/0032/2020.

3. RESULTS AND DISCUSSION

This study included 120 pregnant women who visited the Kupang City Health Center for health checking. Kupang city, with an area of 180.27 km2, is the capital of the province of East Nusa Tenggara. It shares borders with Kupang Regency on the south, Kupang Bay on the north, Semau Strait and Kupang Regency on the west, and Kupang Regency on the east. Kupang contains six sub-districts and 51 urban villages with diverse population characteristics, as well as 11 health clinics and 42 sub-districts distributed over the 6 sub-districts.

Table 1. The Frequency Distribution.

Variable	**n = 120**	**%**
Age		
< 20 years	5	4,2
20-35 years	100	83,3
>35 years	15	12,5
Education		
High school	34	28,3
Senior high school	63	52,5
Elementary school	23	19,2
Occupation		
Household	91	75,8
Employee	29	24,2
Parity		
Primigravida	52	43,3
Multigravida	68	56,7
ANC Visits		
Complete (≥4)	71	59,2
Incomplete (<4)	49	40,8
ANC Service		
Good (10T)	118	98,3
Less (<10T)	2	1,7
Satisfaction		
Satisfied	72	60
Not Satisfied	48	40

Table 1 demonstrates that most of the respondents 100 people (83.3%) of reproductive age 20-35 years, possess a high school education 63 people (52.5%), do not work 91 people (75.8%), own more than 1 child, which are 68 people (56,7%), possessed a full pregnancy visit, encompassing 71 people (59.2%), received good antenatal care as many as 118 people (98.3%), and were satisfied with the antenatal services acquired at health facilities (public health center) as many as 72 people (60%).

Table 2. Analysis result of the Relationship between ANC Services and Satisfaction with Antenatal Care Visits.

Variable	ANC Visits				Total	p-value	OR
	Complete		Incomplete				
	n	%	n	%			
ANC Service							
Good	70	59,3	48	40,7	118	0,770	0,657
Less	1	50	1	50	2		(0,040-10,921)
Satisfaction							
Satisfied	40	55,6	32	44,4	72	0,325	1,459
Not Satisfied	31	64,6	17	35,4	48		(0,688-3,095)

Table 2 reveals that 59.3% of respondents who received complete antenatal care visits received good antenatal care, while 50% of women who received less antenatal care experienced incomplete visits. The value of p = 0.770 (> 0.05) indicates that no relationship exists between service and antenatal visits. The Sipatana Health Center in Gorontalo City discovered that there was no correlation between the quality of antenatal care and K4 antenatal visits, but that the mother's education and knowledge, as well as family support, possessed a substantial relationship with the visits (Laminullah, 2015).

Health workers (doctors, midwives, and competent trained nurses) in integrated antenatal care services must be able to ensure that pregnancy is in normal condition, detect early diseases and problems experienced by pregnant women, and intervene according to authority so that pregnant women are prepared to undergo the delivery process normally and safely. However, because every pregnancy has a risk of complications, antenatal care must still be of high quality and administered routinely, in accordance with standards, and in an integrated manner (Kementerian Kesehatan Republik Indonesia, 2021). Antenatal services at all health centers in Kupang city have been implemented based on the 10 T standard, which are weighing weight and measuring height, measuring blood pressure, assessing nutritional status, measuring uterine fundal height, determining fetal presentation and fetal heart rate, screening and administering TT immunization, administering iron tablets, laboratory tests, case management, and interviews. Services are also corroborated by available facilities and antenatal care standards. Dimensions of service quality are more associated with the assessment of the quality of health services in accordance with the perception of each individual (Tjiptono, 2014). Therefore, the behavior of pregnant women to make visits depends on the mother herself and other factors influencing it.

The results of other studies also discovered that in addition to providing standardized antenatal care, midwives also require to enhance health education for women of childbearing age by administering communication media and technology, hence they are able to monitor the schedule of visits and the health of pregnant women continuously (Kiah, Zuhriyah & Indrawan, 2020). Pregnant women could be monitored employing tactics such as involving health workers, implementing mobile health services, and integrating mass media communication (Peahl et al., 2021).

According to the World Health Organization, the attitude and performance of health workers is a crucial component of service quality because they can influence the understanding and happiness of women, partners, and families seeking ANC, childbirth, and postnatal services (Mannava et al., 2015). It is crucial to enhance health services by health facilities to increase patient satisfaction (Handayani, Suprapto & Sari, 2019). Result of the satisfaction analysis in table 3 demonstrates that most of the respondents whose antenatal visits were complete were not satisfied, which was 64.6%, while most of the respondents whose visits were not complete were satisfied with the antenatal services as much as 44.4%. In accordance with the research result, some pregnant women are dissatisfied with the length of time it necessitates to have a prenatal check-up. Because of the COVID-19 pandemic, pregnant women who visit are limited and arranged in a queuing system for services in order to adhere to health protocols and prevent COVID-19 transmission. The value of $p = 0.325$ (> 0.05) demonstrates that there is no relationship between antenatal visit satisfaction. Mothers who are satisfied with the services they receive are more likely to comply with their medicine, take responsibility for their pregnancy care, and have regular visits (Pricilla et al., 2016). Citra, Lubis and Nurseto, (2013) asserted that health service is identified as quality if it is able to satisfy the patient. Anikwe et al., (2020) added that satisfaction is a person's feeling after comparing the perceived performance with the expectations. Essential determinants of pregnant women's satisfaction are waiting time, privacy during examinations, and perceptions of the service providers competence (Pricilla et al., 2016).

This study revealed that most respondents were satisfied with the available facilities. However, there were still several pregnant women who were dissatisfied with the length of time they were waiting to have a pregnancy check-up. It is due to the Covid-19 pandemic, hence, pregnant women visiting were limited and a queuing system was arranged in services to keep them by health protocols in preventing the transmission of Covid-19. This situation also emerges in other parts of Indonesia, one of which is revealed by the result of the study that the Covid-19 pandemic has resulted in changes to rules in health services encompassing adaptation of procedures, contact restrictions, and improvement of technology to telemedicine which possesses on changing the behavior of pregnant women and decreasing antenatal visits (Mardikawati, et al., 2022). Time spent in antenatal clinics is a major disincentive for pregnant women and a barrier to the administration of ANC. Long waiting times and poor patient satisfaction may cause poor utilization (Abdus-salam, Adeniyi & Bello, 2021).

Pregnant women are a vulnerable population during the Covid-19 pandemic who require special attention in protecting them from the Covid-19 transmission by implementing good health protocols (Nurfitriyani and Puspitasari, 2022). It is conducted in order pregnant women feel comfortable and are not anxious about the transmission of Covid-19 (Romdiyah & Resmi, 2021). WHO has also recommended 6 in-person visits and 2 virtual visits (3rd and 4th) during the pandemic in reducing the number of times pregnant women require to travel and seek treatment at hospitals/clinics (Uwambaye et al., 2020). Guidelines for Antenatal Care Services during the pandemic were socialized to all midwives in Indonesia (Dodal, Dinengsih & Siauta, 2021).

Furthermore, health services and programs must be implemented in accordance with local culture and language. Hence, they are more easily accepted by the community, such as a decision-making culture that might effect pregnant women's antenatal visits to health facilities (Rahman, Ngadan & Arif, 2016; Djano, Laksana & Utomo, 2021). The reality in society is that there are numerous patriarchal civilizations in which men dominate all decision-making. It is encouraged by a high regard for the husband as the family's head and a lack of wealth of mother, which causes the mother powerless to oppose men's decisions (Djano, Laksana & Utomo, 2021). Several literature studies in Indonesia explained that husbands possess full autonomy in the decision to select antenatal care (Laksono, Wulandari & Matahari, 2020). Due to financial

dependency and cultural traditions, numerous patriarchal societies in Bangladesh also deny women autonomy and prevent them from seeking antenatal care services without the approval of their husbands (Ghose et al., 2017).

Therefore, the husband's support is required to assist pregnant women in checking their pregnancy. Men's participation in ANC had a positive impact on health-care utilization and early antenatal care visits (Tesfaye et al., 2017). The community should also be educated on primary health care services through participation so that they can live independently and select their own destiny (Tabelak et al., 2022).

4. CONCLUSION

The results of this study suggest that antenatal visits to midwives at public health centers in the city are indeed beneficial, while there are still a few who have not performed them completely. Antenatal services provided by midwives are of high quality, and most pregnant women are content with the existing facilities. However, they are disappointed with the long wait times for services due to limits imposed to prevent the spread of COVID-19. Statistically, antenatal care by midwives and pregnant women's satisfaction had no significant relationship with antenatal visits. As a result, it is vital to conduct study on other factors such as distance, education, occupation, parity, husband support, and culture, which can all influence the mother's adherence to antenatal visits.

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RESEARCH **Open Access**

Utilizing Go-Yoga Smartphone Application to Prevent Preeclampsia in Pregnant Women

Rabia Zakaria[1a], Siti Choirul Dwi Astuti[1b*]

[1] Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Gorontalo, Gorontalo City, Gorontalo Province, Indonesia

[a] Email address: rabiasubarkah@gmail.com
[b] Email address: sitichoirul13@yahoo.co.id

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Abstract
After bleeding, hypertension is the second leading cause of maternal death. Hypertension is caused by a combination of factors, including increased stress and a low level of albumin. All of these changes will cause complications and necessitate long-term medication therapy. As a result, complementary therapies such as family roles and yoga are required. Many people are unfamiliar with yoga movements, so this study provides innovation by incorporating yoga into a smartphone application. The objective of the study is to determine the differences in the implementation of the Go-Yoga smartphone application and the role of the family in pregnant women in the III trimester on blood pressure and albumin levels. This type of research is quasi-experimental involving 60 pregnant women in the third trimester. In Group I, 20 pregnant women practiced yoga with books; in Group II, 20 pregnant women exercised yoga with the Go-Yoga app without their families; and in Group III, 20 pregnant women practiced yoga with their families. The study's results revealed significant blood pressure, with the third group having the highest average (p = 0.000 1). Pregnant women who utilize the Go-Yoga app with their families have lower blood pressure than other groups. Furthermore, pregnant women who employ the Go-Yoga app with their families have higher albumin levels than other groups. Therefore, this study suggests employing the Go-Yoga application with the family prevents hypertension in pregnancy.

Keywords: Go-Yoga Application, Supportive Therapies, Hypertension.

Corresponding Author:

Siti Choirul Dwi Astuti
Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Gorontalo, Gorontalo City, Gorontalo Province, Indonesia
Email: sitichoirul13@gmail.com

1. INTRODUCTION

Prevalence of hypertension continues to increase from 972 million people with hypertension, 333 million are in developed countries, and the remaining 639 are in developing countries, incorporating Indonesia (Bektas et al., 2020). In Indonesia, hypertension during pregnancy is the second leading cause of maternal death after miscarriage. In Gorontalo Province, after bleeding, hypertension is the second leading cause of maternal mortality after diabetes.

Pregnancy hypertension is caused by physical, psychological, and biochemical changes. The changes that occur determine the growth and development of the fetus. Pregnant women in their third trimester will be at risk of albumin deficiency. Pregnant women with low albumin levels possess a higher risk of developing preeclampsia, seizures, and high blood pressure due to fluid accumulation in the tissues, such as oedema (Fox et al., 2020).

Increased protein intake and drug administration can be employed to increase albumin in pregnant women, but this method necessitates a long time, so a more effective solution is required (Hopkins et al., 2021). To prevent hypertension, supportive therapies such as yoga by also involving family are tremendously needed. Numerous yoga people do not understand the movement; thus, innovation is also necessitated to overcome this problem.

Smartphones are evident to enhance the quality of health services (Burgess et al., 2020). Hence, the solution offered is by developing a smartphone application containing yoga movements to make it easier for pregnant women to perform yoga. This smartphone application also allows pregnant women to perform yoga in pairs with their families. Research on the role of the family has also been conducted, and the results of Skor anxiety in pregnant women giving birth accompanied by a family are lower than in pregnant women giving birth alone. As a result, researchers are interested in developing a smartphone app that incorporates a modification of yoga movements in the form of an android app that allows pregnant women to perform yoga with their families while still paying attention to the objective of each movement supported by timing and information in English, Indonesian, and Gorontalo language (Burton et al., 2020).

This study is to develop practical innovations to enhance the role of families in preventing hypertension in pregnant women by employing smartphone-based applications. Furthermore, the objective of this study is also to identify the characteristics of pregnant women which affect albumin levels and blood pressure, to discover the differences in the implementation of the Go-Yoga application to the albumin levels of pregnant women in the III trimester and to unveil the differences in the implementation of yoga applications to the blood pressure of pregnant women in the III trimester.

2. RESEARCH METHOD

This type of research is quasi-experimental involving 60 pregnant women in the third trimester. This study possessed three groups: I, II and III. Each group comprises of 20 pregnant women. Group I performed yoga by employing books, group II practiced yoga by utilizing the Go-Yoga app without a family, and group III did yoga by employing the Go-Yoga app with the family. Pregnant women administered in the study following the inclusion criteria had given birth once, had a single pregnancy and owned a smartphone and exclusion criteria experienced an emergency. In this study, the free variables were smartphone-based Go-Yoga apps with the role of the family and the variables connected to blood pressure and albumin levels. From February 2021 to November 2021, this study was conducted at the Tapa and South Bulango Health Centers. Before and after utilizing go-yoga application, blood pressure was measured with a sphygmomanometer and albumin levels were evaluated with bromocresol green (BCG).

The sample in this study comprises of several trimester pregnant women who fulfilled the inclusion and exclusion criteria of 60 pregnant women. Respondents 1-20 were performed into group I conducting yoga by administering books, numbers 21-40 were created into group II by employing the Go-Yoga application without a family and numbers 41 to 60 utilizing the Go-Yoga application with a family. Pregnant women practiced the yoga 3 times a week until 1 month.

Smartphone development was conducted by creating yoga movements in the form of an android application to make it more convenient for pregnant women to follow along with timings and information in English, Indonesian, and Gorontalo language. The family's role is a supportive therapy in the context of utilizing applications in pairs with pregnant women. Hypertension was discovered by administering albumin and blood pressure indicators. Albumin is a type of protein discovered in blood. How to measure albumin with bromocresol green (BCG), with results expressed in grams per deciliter (g / dL) and average values in pregnant women in the third trimester ranging from 2.3 to 4.2 g/dL. Meanwhile, a sphygmomanometer with mmHg units and a common value of < 139 mmHg is being administered to measure blood pressure.

The descriptive analysis encompasses the characteristics of respondents by observing the minimum, maximum and mean. The data obtained was first conducted by administering a normality test using the Kolmogorov Smirnov test for blood pressure and albumin levels. One Way Anova was employed to analyze the data. This study has obtained ethical clearance with number LB.01.01/KEPK/66/2021..

3. RESULTS AND DISCUSSION

Table 1. Respondent Characteristics (n=60)

Characteristics	**Frequency Distribution**		**p-value**
	Number	**Percentage**	
Age			0,002
Healthy Reproduction (20-35)	53	88	
High Risk (<20/>35)	7	12	
Body Mass Index			0,001
Not Normal (<18,5 or >22,9)	12	21	
Normal (18,5-22,9)	48	79	

Table 1 demonstrates that the homogeneity test displayed no significant difference in the control and intervention groups (p > 0.05).

Table 2. Albumin Levels (n=60).

Group	**Data Analysis**			
	Min	**Max**	**Mean**	**p-value**
Group 1	2	3	2,14	0,0001
Group 2	2	4	2,65	
Group 3	3	6	4,35	

Table 2 presents that the main findings of this study discovered significant albumin levels, and the third group revealed the highest average (p = 0.000 1).

Table 3. Blood Pressure (n=60).

Blood Pressure	Data Analysis			
	Min	**Max**	**Mean**	**p-value**
Group 1	120	160	139,95	0,0001
Group 2	110	140	130,50	
Group 3	110	120	117,00	

Table 3 demonstrates that the main findings of this study uncovered significant blood pressure, and the third group revealed the highest average (p = 0.0001).

Based on table 1, it is identified that the majority of maternal age in the study possessed a normal category (20 years to 35 years) as much as 88% and another 12% of the pregnant women's generation owned a high-risk category (less than 20 years and more than 35 years).

The prevalence of hypertension occurs 29% at the age of 25-44 years, at the age of 45-64 years by 51%, and at the age of >65 years by 65%. At the age of 60-64 years, compared to the age of 55-59 years, an increased risk of hypertension occurred by 2.18 times, 65-69 years by 2.45 times and age > 70 years by 2.97 times (Itoh & Tanaka, 2022). In addition to being related to maternal age hypertension, it is also associated with albumin levels. Pregnant women over 35 years of age will have lower albumin levels and experience an almost double increased risk of hypertension in primiparous and multipara (Ding et al., 2021). Moreover, young people less than 19 years old can also escalate the risk of low albumin levels (Deng et al., 2021).

Based on table 2, it is discovered that the majority of maternal body mass indexes in the study possessed a normal category (18.5 to 22.9), as much as 79% and another 21% of pregnant women owned an abnormal body mass index category (less 18.5 and more than 22.9). Every one unit of increase in body mass index escalates systolic blood pressure by 0.72 in women. The value between body mass index and blood pressure possesses a positive correlation. Although hypertension is not yet identified with certainty, the factors which frequently cause hypertension encompass heredity, individual characteristics and life habits (Wildman et al., 2022). Life habits generally affect hypertension, one of which is obesity or overeating (Kane et al., 2012). Although the mechanism of how obesity affects hypertension is not yet apparent, it has been evident that weight loss can lower blood pressure (Xiong et al., 2022). A high-calorie diet, fatty, smoking and drinking alcohol are one of the behaviors causing several diseases, encompassing hypertension (Parashar et al., 2022). The factors which cause blood pressure incorporate dietary factors and weight factors (Herrera et al., 2020). People with obesity may possess high blood pressure as arterial or venous blood vessels are most likely filled with fat, causing blood pressure to enhance. Furthermore, nutritional status as health indicator also becomes a factor affecting albumin levels (Roesmono et al., 2017). Pregnant women with low albumin levels were also incorporated in the high-risk group as in pregnant women experiencing eclampsia, laboratory results with low albumin levels were also revealed, hence, pregnant women with lower albumin levels presented a higher prevalence of increasing mortality rates than pregnant women with normal albumin levels (Tumas et al., 2022). Pregnant women with low albumin levels are a significant problem, but if the management is not good, it may possess a direct effect on the occurrence of the fetus.

Based on table 3 above, it can be perceived that there is a difference in the implementation of the Go-Yoga smartphone application against albumin, which demonstrates a p-value more minor than the alpha value (0.0001< 0.05), then H0 is rejected. Utilizing Go-Yoga applications and family roles can produce albumin levels higher than in other groups.

Albumin is a protein present in human blood. The proteins created by this liver organ regulate osmotic pressure in the blood (Thomas et al., 2021). The amount of albumin in the blood has to be balanced so as not to affect the fluid in the blood to spread to other parts of the

body (Rafie et al., 2022). Moreover, albumin also plays a significant role in transporting nutrients in the body and can repair the damage to cell tissue (Sukesi, 2020). Albumin possesses an essential role in maintaining the health and balance of fluids in the body (Yaping et al., 2020). Hence, it is necessary to assure that the body owns sufficient albumin levels. Pregnant women with low albumin levels possess higher risk in developing preeclampsia (Yamada et al., 2018), seizures, high blood pressure, and fluid accumulation in the tissues, aka oedema. If the albumin is low, the nutrients are not able to be perfectly conducted (Wardoyo et al., 2021). Less albumin can also cause damage to nerve cells in the brain. Other conditions such as fatigue, anxiety, and lack of energy until premature ageing are also affected by low intake of albumin (Metri et al., 2021). The paucity of albumin levels in the blood is typical as the supply of amino acids is inadequate, affecting suboptimal protein absorption (Vlachopoylou et al., 2021). The average level of this protein in the blood is as much as 3.4 - 5.4 liters (Cagnacci et al., 2022). Pregnant women should also routinely perform regular health and gynecological check-ups (Chikowore et al., 2021).

Based on table 3 above, it can be revealed that there is a difference in the implementation of the Go-Yoga smartphone application on blood pressure, which illustrates a p-value more minor than the alpha value (0.0001< 0.05), then H0 is rejected. The utilization of the Go-Yoga app and the role of the family affects blood pressure lower than in other groups.

The Go-Yoga application is able to suppress the performance of the sympathetic nervous system, creating impediments to the adrenal medulla stimulus to secrete catecholamines (epinephrine and norepinephrine). Every minute, the decrease in catecholamines causes vasodilation of the blood vessels of the kidneys and nearly the entire visceral organ, lowering blood pressure and facilitating blood distribution (Chakhtoura et al., 2019). The Go-Yoga app can also assist in lowering blood pressure and oxidative stress. Since the movements in the Go-Yoga application are simple, it is secure and simple for pregnant women to use. The Go-Yoga application can increase blood flow, enhance the supply of oxygen and nutrients, and strengthen the respiratory muscles and heart, resulting in a decrease in systole blood pressure. Breathing exercises with the Go-Yoga app can improve lung capacity and strengthen the heart muscle.

Family support is a behavior performed by the family in the form of emotional support, appreciation/judgment, and informational and instrumental (Cox, 2018). The family is a safe and peaceful place to help people fulfilled physical and psychological necessities and provide social support in which they come from the family (Freedman, 2016). Health problems experienced by one of the family members may influence the rest of the family and the entire system. The family is a vital support system in maintaining health. Furthermore, family members who work in the health sector must be able to recognize health issues and make decisions. To overcome health issues, families must modify their environment in order to remain healthy and optimal, and they have to take advantage of the health facilities that are available in their area (Hammadi et al., 2021).

Families who care about their members will pay attention to feeding, invite exercise together, and accompany and remind them to check their blood pressure on a regular basis. The assistance provided demonstrates the family's attention and care in order to increase motivation. Attempts to prevent hypertension in pregnant women by increasing family support and working together to control blood pressure should be implemented. It is because the better the family support, the better the efforts to control blood pressure, hence, hypertension can be prevented. Family support can be the best preventive strategy for assisting family members in maintaining and enhancing their health (Perriman & Davis, 2018). A happy family possesses a positive impact. Emotional support, reward support, information support, and family instrumental support all play a significant role in hypertension control. The presence of family support provides strength and encourage a sense of mutual belonging in meeting needs (Thomas et al.,

2021). Family emotional support influences a person's feelings and motivations. The better the family support, the more preventable hypertension will be. It should also be understood that families possess a power structure that allows them to change health-promoting behaviors. Thus, researchers assume that family support is good, but hypertension cannot be prevented as motivation is still lacking, and family support is not satisfactory, but hypertension can be prevented since the patient is motivated and concerned about his condition.

4. CONCLUSION

Utilizing Go-Yoga applications and family roles can affect albumin levels more than other groups. Moreover, by employing Go-Yoga application with the family can prevent hypertension in pregnancy if completed three times per week for one month. The utilization of the Go-Yoga app and being a part of a family can result in lower blood pressure than in other groups. To prevent hypertension in pregnant women, midwives are expected to be able to implement the Go-Yoga application and increase the role of the family in providing care. Furthermore, for pregnant women, I hope to be able to utilize the Go-Yoga app and apply it at home to make childbirth easier for pregnant women and to manage hospital can be an issue as evidence based practice.

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RESEARCH **Open Access**

Characteristics and Physical Workload of Nurses on Night Shifts with Work Fatigue

Ari Dian Octavia[1a], Demes Nurmayanti[1b*], Darjati[1c], Winarko[1d], Hadi Suryono[1e]

[1] Department of Enviromental Health, Politeknik Kesehatan Kementerian Kesehatan Surabaya, Surabaya, East Java, Indonesia

[a] Email address: aridianoctav25@gmail.com
[b] Email address: demes@poltekkesdepkes-sby.ac.id
[c] Email address: darjati.poltekes@gmail.com
[d] Email address: win_bonang@yahoo.co.id
[e] Email address: hadisur@poltekkesdepkes-sby.ac.id

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Abstract
At RSUD Sidoarjo, it was discovered that 44% of nurses experienced fatigue. Fatigue occurs due to several factors, one of which is the physical workload. The objective of this study is to examine the physical workload and characteristics of nurses on night shifts on the fatigue of inpatient tulip nurses at RSUD Sidoarjo in 2022. The number of samples was 30 respondents with the sampling technique encompassing all of population of nurses on night shifts. The results demonstrated that there was no influence between physical workload on work fatigue with a value of 0.717, as well as characteristics incorporating age, length of service and gender which had no effect on work fatigue with a value of 0.636, respectively; 0.747 and 0.235. The result of the study indicates that workload, age, working period, and gender of nurses have no effect on nurses' work fatigue. The conclusion is there was no influence between physical workload and characteristics of nurses on night shifts on the fatigue of inpatient tulip nurses at RSUD Sidoarjo in 2022. It is recommended that future researchers will conduct research on nurse fatigue employing various variables such as mental workload on nurses, hospital physical environment, distance of residence, and marital or family status.

Keywords: Work Fatigue, Physical Workload, Nurses, Night Shift.

Corresponding Author:

Demes Nurmayanti
Department of Enviromental Health, Politeknik Kesehatan Kementerian Kesehatan Surabaya, Surabaya, East Java, Indonesia.
Email: demes@poltekdepkes-sby.ac.id

1. INTRODUCTION

Work fatigue is a condition where individuals and groups experience a decrease in body resistance in performing an activity (Hijriahni, 2017). Fatigue decreases efficiency and performance in conducting a job and reduces physical endurance (Rosmiati, Abdullah & Nurlinda, 2021). Work fatigue can be affected by several factors encompassing individual factors, work factors, environmental factors and psychological factors (Perwitasari & Tualeka, 2017).

Individual factors involving age, gender and nutritional status possess a significant relationship with work fatigue on nurses at RSUD Dr. H. BOB Bazar Kalianda South Lampung (Natizatun, & Nurbaeti, 2018; Allo et al., 2020; Oksandi & Karbito, 2020). In addition to individual factors, physical workload also produces a significant relationship with nurse fatigue at Kalideres Hospital (Handayani & Hotmaria, 2021). However, it is contradictory to the results of research conducted on nurses at RSJD Dr. Amino Gondohutomo Semarang that physical workload is not associated with work fatigue (Astuti, Ekawati & Wahyuni, 2017). Meanwhile, sleep patterns also create a significant relationship with work fatigue in nurses (Allo et al., 2020; Sari, Setyaningsih & Suroto, 2020). Workers performing job on night shifts, rarely possess optimal sleep quality. Poor sleep quality increases the risk of 2098 times higher experiencing fatigue (Rizky, 2018). Another factor in the occurrence of fatigue in nurses is mental workload (Ardiyanti, et al., 2017). The workload provided required to be adjusted to the psychological and physical abilities of the worker. Mental coaching which is performed periodically can change the level of worker fatigue (Ardiyanti, et al., 2017).

Work fatigue can occur in employees who work in industries that produce goods as well as industries that provide services or products, one of which is health care, specifically hospitals. The hospital is a full-service health-care facility that offers inpatient, outpatient, and emergency services 24 hours a day, seven days a week (Kementerian Kesehatan Republik Indonesia, 2020). Hospital services require resources in patient care administered by health workers (Hijriahni, 2017). Health workers providing health services with their knowledge are nurses (Muslimah, 2015). Nurses in performing their work cannot be separated from the work shift system divided into three rotations, encompassing morning shifts, afternoon shifts and night shifts (Presiden Republik Indonesia, 2020). It makes nurses feel exhausted with various burdens provided for 24 hours.

Nurses possess responsibility of providing nursing care, counseling and being a counselor to patients and their families, managing nursing services, implementing tasks in accordance with the authority provided and completing tasks in certain limited circumstances (Kementerian Kesehatan Republik Indonesia, 2019). In general, nurse workload involves offering direct care, administering treatments and evaluating patients, administering medical programs such as drug administration, laboratory examinations, radiology, and preparing patients for surgery, attending to patients' physical, mental, and spiritual needs, and training patients to be able to help themselves based on their abilities that the patient has and not conflicting with the treatment the patient is undergoing, immediately providing assistance to patients who are experiencing death or in an emergency condition, maintaining the cleanliness, safety and comfort of the patient's room, accompanying visiting doctors and recording the program to be implemented, reporting the patient's condition both verbally and in writing to doctors, compiling daily reports, maintaining good relations with patients, patient families, team members and doctors, conducting responsibilities both verbally and in writing and assisting the head of the room in room management administratively (Maharja, 2015).

In a preliminary survey conducted on tulip inpatient nurses at RSUD Sidoarjo (Sidoarjo Public Hospital), RSUD Sidoarjo is a class B Government General Hospital which has

officially assigned as a Regional Public Service Agency for more than 4 (four) years. Tulip hospitalization is an inpatient treatment categorized as class 1. Tulip hospitalization is incorporated in the category of one of the inpatients with the largest bed capacity in Sidoarjo Hospital with 154 beds (RSUD Sidoarjo, 2022). The rooms in the tulip inpatient installation are divided into five categories, according to the results of a preliminary survey conducted on November 9, 2021, including the western 2 tulip room, the eastern 2 tulip room, the HCU room, the western 3 tulip room, and the eastern 3 tulip room, with an average of 547 patients treated at the tulip inpatient facility in the last three months, with August (436 patients), September (564 patients), and October (641 patients) in 2021.

The results of interviews have been administered conducted on nurses who were taken randomly on August 6, 2021 from 9 nurses, where in each shift there were 3 respondents. According to the findings, 44% of nurses experience fatigue, with 50% experiencing fatigue on shift with an average age of 33 years and an average working period of 8 years, and 25% experiencing fatigue on shift with an average age of 32 years. It is consistent with research conducted on inpatient installation nurses at Herna Hospital Medan in 2018, which revealed that the highest level of fatigue is in nurses who work on shifts, which is due to a lack of rest for nurses, causing nurses to become exhausted (Aini, 2019). The objective of this study is to examine the physical workload and work characteristics of nurses on night shifts on work fatigue of inpatient tulip nurses in Sidoarjo Hospital.

2. RESEARCH METHOD

This research employed analytic method with cross sectional. This research was conducted at the Tulip Inpatient Installation in 2022. The number of samples comprises of 30 respondents with the sampling technique which is all of population of nurses working on night shifts. The variables studied encompassed physical workload, age, gender, length of service and work fatigue on nurses. Data collection techniques utilized the IFRC (Industrial Fatigue Research Committee) sheets and daily log.

Subjective self-rating test from the Industrial Fatigue Research Committee (IFRC) is a questionnaire which can evaluate the level of subjective fatigue incorporating weakened activities, weakened motivation and the description of physical fatigue (Tarwaka, 2019). The assessment data is classified into levels and categories of fatigue according to following the table:

Table 1. Classification of levels and categories of subjective fatigue based on individual

Total score of each individual	Fatigue level	Category	Improvement
0-21	0	Low	No corrective action is required
22-44	1	Medium	There may be a need for corrective action in the future
45-67	2	High	Corrective action is required
68-90	3	Very high	Comprehensive action is required as soon as possible

Source: Tarwaka (2019)

Sheet daily log about tasks conducted in one day written independently according to the number of patients treated and in 1 working day. the nurse was active in handling patients assessed by administering pulse. Pulse rate measurements can be determined by employing a digital watch (smartwatch) (Tarwaka 2019). Recording of pulse is evaluated before and after performing activities while working in 1 day. The percentage of a nurse's pulse is determined by the Cardiovascular Load (CVL) formula.

$$\% \text{ CVL} = \frac{100 \text{ x (work pulse} - \text{rest pulse)}}{\text{maximum pulse} - \text{rest pulse}}$$

The percent CVL results are converted in accordance with the category of workload received by the night shift nurse in 1 day.

Table 2. Categories of workloads based on % CVL

Level of loading	Category % CVL	Value % CVL	Remarks
0	Mild	< 30%	No significant loading occurs
1	Moderate	30-60%	Loading and repairs may be performed
2	Somewhat heavy	61-80%	The load is rather heavy which requires repairment
3	Heavy	81-100%	Heavy loading, thus, repairs are required to be performed as soon as possible and can only work for a short time.
4	Very heavy	>100%	The load is so heavy that it is necessary to stop work until repairs are completed.

Source: Tarwaka (2019)

The data that has been obtained is evaluated by employing simple linear regression test and Mann Whitney to determine the effect of physical workload, age, gender and tenure on work fatigue in night shift nurses. This research was approved by RSUD Sidoarjo Number 893.3/010/438.6.7/2022.

3. RESULTS AND DISCUSSION

Distribution of research result which incorporate work fatigue, workload and characteristics encompassing age, gender and length of service of nurses on night shifts at the Tulip Inpatient Installation of RSUD Sidoarjo.

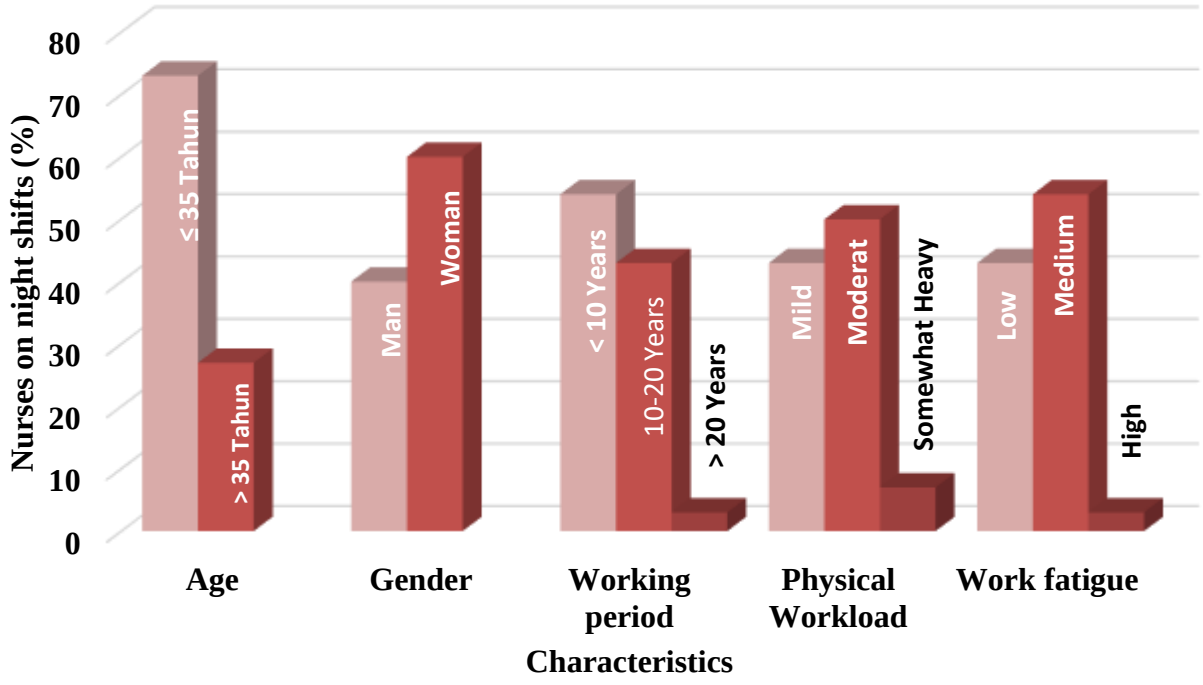

Figure 1. Distribution of the frequency of night shift nurses.

Based on Figure 1, it was discovered that most of the night shift nurses at the Tulip Inpatient Hospital Sidoarjo possessed an age group of 35 years by 73%, with a service period of <10 years by 54%, female by 60%, possessing a workload in the moderate category of 50% and having work fatigue in the moderate category by 54%.

Table 3. The result of characteristic and physical workload against work fatigue.

Variable	***p-value***	**α**
Characteristics of age	0,636	0,05
Characteristics of gender	0,235	
Characteristics of working period	0,747	
Physical workload	0,717	

The results of data analysis illustrate that physical workload on work fatigue possesses no effect with a large *p-value* of 0.717. Likewise, the characteristics encompassing age, gender and working period of nurses have no effect on work fatigue on night shift nurses at the Tulip Inpatient Installation of RSUD Sidoarjo with *p-value* respectively of 0.636; 0.235 and 0.747.

Physical Workload with Work Fatigue in Nurses. The weight and lightness of the workload can be employed in determining how long a worker can perform his work activities in accordance with the ability of the worker. It is interrelated, in which the heavier the workload, the faster the employees will feel exhausted and the shorter the working time of workers in performing their work without feeling exhausted and vice versa (Tarwaka, 2019).

The result of the research which has been conducted demonstrate that the physical workload has no effect on nurses' work fatigue with most nurses possessing a workload in the moderate category. The physical workload conducted by nurses encompasses observing vital sign in each patient, removing patient urine, conducting patient swabs, providing injections to patients, installing and repairing infusions in patients, doing verbed, taking patient laboratory results, distributing drugs to patients, changing infusion fluids in patients, taking patient blood samples, performing surgeries, performing SOAP (Subjective, Objective, Assessment and Plan), transferring patients to the PICU, assisting patients in changing diapers, removing *nephrostomy pods* on patients, changing spooling patients, recording the patient's ECG, conducting visits, providing diet to patients, and handing over responsibilities to nurses serving in the next shift.

Workload is an activity which must be completed within a certain period of time (Rolos, Sambul & Rumawas, 2018). The workload experienced by each worker is different as they possess different abilities to deal with it. The workload can be in the form of physical, mental or social workload. The greater the workload possessed by a person; the more energy required since the contractions in the muscles will also take longer to fight the load obtained. The number of patients was 141 patients from the 154 available beds (91% of the total beds). Of the 141 patients treated, nurses treated a maximum of 10 patients. The number of patients resulted in complaints to nurses on night shifts who felt exhausted.

The more patients treated by nurses; the less free time nurses receive to rest. It affects the sleeping hours of the nurses themselves. Work fatigue can be significantly associated with sleep disturbance factors (*Cirradian rhythm*) as a result of the work shift being conducted (Juliana, Camelia & Rahmiwati, 2018; Allo et al., 2020; Sari, Setyaningsih & Suroto, 2020). This It is in accordance with the nurse's irregular work schedule, hence, it can disrupt sleep patterns which cause the occurrence of work fatigue for nurses (Allo et al., 2020). With poor sleep quality, it is reluctant to cause risk of 2098 times higher to experience fatigue (Rizky, 2018). It can be overcome by enhancing the quality of sleep by utilizing free time to rest (Kuswana, 2014).

Furthermore, work stress is also one of the causes of fatigue. It is because numerous nurses complain that working under pressure is tremendously disturbing as it is affected to

anxiety, tension, loss of enthusiasm, irritability, hence, it triggers fatigue at work (Rahadhi & Sriyanto, 2016; Rudyarti, 2021). In each shift, only 4 nurses were assigned on each floor, while the number of patients on each floor was 20 patients. Therefore, each nurse managed an average of 5 patients, and this number was experienced to be unbalanced and made nurses quite burdened in accompanying patients. Moreover, nurses also experience burdened by unruly patient behavior, such as lack of discipline when taking medication, frequently complaining about the illness, and the presence of pediatric patients who are used to be fussy (Handarizki, 2019). This work stress can be overcome by relaxing tense muscles and stiff limb functions, thus, the body is refreshed (Rudyarti, 2021).

Physical problems such as responsibilities, worries and conflicts are one of the factors affecting work burnout (Tarwaka, 2019). Conflicts experienced by workers both between individuals and groups may cause *burnout*, bad-tempered, depression or even frustration. Conflict between workers owns a negative influence on work fatigue. The higher the conflict between workers, The higher the fatigue experienced (Pretirose, 2018).

Characteristics of Age with Work Fatigue in Nurses. Peak muscle strength in men and women is around the age of 25-35 years. Generally, at the age of approaching 45 years, the muscle strength is decreased (Dewi, Surono & Sutomo, 2016). Increasing age will be followed by a decrease in VO_2 max, sharpness in vision, hearing and speed in performing things such as the ability to remember short-term and the ability to produce decisions (Ardiyanti, et al., 2017).

The results revealed that there was no influence between the age of nurses on work fatigue of nurses. It is in accordance with the research result on nurses at PKU Aisyiyah Hospital Boyolali in which age is not a factor affecting fatigue in nurses (Fatona, Tarwaka & Werdani, 2015). A fatigue can be caused by the numerous activities in the age group of 25-35 years, although theoretically, fatigue is more easily experienced by nurses who possess an older age as at the age of 50-60 years, muscle strength in humans will decrease by approximately 15-25% (Tarwaka, 2019). It can be overcome by providing management regarding the division of tasks or workloads for each nurse, hence, it can be divided evenly for each nurse.

Characteristics of Gender on Work Fatigue in Nurses. In general, women possess physical strength only 2/3 of the physical abilities possessed by men, but in terms of accuracy, women own higher accuracy than men (Perwitasari & Tualeka, 2017). Women have a maximum oxygen volume that is 15-30% lower than men's maximum oxygen volume when working. It is due to the female body having more fat than the male and having lower Hb blood levels than the male. As a result, women are more likely than men to experience fatigue.

The findings revealed that there was no effect of gender on nurses' work fatigue. It indicates that gender has no direct effect on fatigue in nurses who work night shifts. This happens because male nurses do not become tired as easily as female nurses do when performing nursing tasks that require extra energy, such as pushing wheelchairs and beds, assisting with patient lifts, and other emergency actions. It is consistent with the findings of a study conducted by nurses at RSUD directed by Dr. Mohamad Soewandhie, who discovered that gender has no relationship with work fatigue in nurses (Perwitasari & Tualeka, 2017).

Working Period with Work Fatigue in Nurses Working. Period can affect performance both positively and negatively. The period of service can have a positive influence because the longer the period of service, the experience in carrying out their duties will also increase. However, tenure can have a negative influence that can make the workforce appear habitual along with increasing years of service (Soedirman & Prawirakusumah, 2014; Suma'mur, 2014).

The results unveiled that there was no influence between the length of service for nurses on nurses' work fatigue. It implies that the working period is not a factor directly affecting

fatigue in nurses working on night shifts. This result is in accordance with research conducted on nurses at the Haji Makassar Hospital which revealed that the tenure of nurses does not produce a significant relationship with work fatigue in nurses (Mallapiang, Alam & Suyuti, 2016). It is due to a variety of factors, including age. Respondents who have worked for more than 5 years but are still categorized as maximum age own a lower body resistance, making it difficult to feel exhausted. Other factors to consider include work-related habits. Workers with a longer working period and more experience already understand the ideal and most comfortable work position for themselves, reducing the occurrence of fatigue at work.

4. CONCLUSION

The study concluded that physical workload and characteristics such as age, gender, and length of service for night shift nurses at Tulip inpatient installation of RSUD Sidoarjo have no effect on work fatigue. As a result, it is hoped that the hospital concerns more on management in the division of tasks based on each nurse's physical and health conditions.

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RESEARCH **Open Access**

Effectiveness of Kemangi (*Ocimum basilicum*) Leaf Methanol Extract against Candida albicans Colonies

Tarsikah[1a], Erni Dwi Widyana[1b], Lisa Purbawaning Wulandari[1c*]

[1] Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang, East Java, Indonesia

[a] Email address: tarsikah@poltekkes-malang.ac.id
[b] Email address: erni_dwi@poltekkes-malang.ac.id
[c] Email address: lisa_purbawaning@poltekkes-malang.ac.id

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Abstract
Candida species, for women are the foremost common cause of parasitic contaminations. Candida species affect contamination in 75% of women and at slightest 6-9% of women involvement repetitive vulvovaginal candidiasis. *Candida albicans* (CA) accounts for 85-95% of yeast strains separated from the vagina. The treatment which has been administered for candida infections is antifungal drugs such as clotrimazole and fluconazole. When applied topically, synthetic antifungal drugs cause allergic reactions, resistance, and a burning sensation. It is necessary to conduct research on plant-based herbal medicine as an alternative treatment. Kemangi, also recognized as *Ocimum Basilicum* (OB), is a plant native to Indonesia which has medicinal properties. The objective of this study is to examine how effective OB methanol extract is against CA colonies. The study was performed at Brawijaya University's Microbiology Laboratory in Malang. The experimental laboratories with Posttest Only Control Group Design were employed in this study, with four repetitions of OB concentrations of 15%, 20%, 25%, 30%, and 35% against CA colonies. One-way ANOVA was utilized as the hypothesis test, with a significance level of 0.05. The results demonstrated that OB extract with a concentration of 15% was able to inhibit the growth of CA colonies. In the OB extract with a concentration of 35%, no CA colony growth was revealed. One-way ANOVA test obtained p 0.000 <0.05. Conclusion OB owns adequacy in restraining the development of CA organism with negligible murdering rate at a concentration of 35%. Research required to be performed to identify the antifungal potential of OB extract in vivo.

Keywords: Kemangi Leaf Methanol Extract (*Ocimum basilicum*), Candida albicans.

Corresponding Author:

Lisa Purbawaning Wulandari
Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Malang, Malang, East Java, Indonesia.
Email: lisa_purbawaning@poltekkes-malang.ac.id

1. INTRODUCTION

Candida albicans (CA) might be a pathogen causing contagious diseases. CA spreads broadly, affects skin, mucosal surfaces, and causes systemic diseases. As numerous as 400.000 systemic parasitic diseases are affected by candida species (Mukaremera et al., 2017). CA is the foremost general causative specialist of diseases of all species and is mindful for 70% of contagious diseases around the world (Morad et al., 2018). CA possesses several morphological forms, encompassing blastospores, pseudohyphae and hyphae (Talapko et al., 2021).

Candida species are the most frequent cause of yeast diseases in women. Candida species affect contamination in 75% of women, and 6-9% of women experience recurrent vulvovaginal candidiasis (Jang et al., 2019). The primary cause of candida infection in most countries is CA. CA accounts for 85-95% of yeast strains separated from the vagina (Sobel, 2007). The treatment performed for candida infections is antifungal drugs comprising of clotrimazole and fluconazole (Sobel, 2014). The antifungal inhibition mechanism of these medicinal compounds functions by inhibiting the formation of ergosterol which is a constituent of fungal cell walls, for instance in azole drugs such as ketoconazole. However, treatment by employing oral azoles illustrates drug interactions which leads to an allergic response. Resistance of candida strains to antifungal treatment is also frequently unveiled (Sobel, 2007). It is due to gene mutations, continuous inhibition of linisterol 14-dimethylase (14C -demethylase) by antifungal drugs will generate 14C-reductase which then became a wall barrier of fungal cells (Fitria, 2020). Another treatment administered is the utilization of topical azoles, although it is safer but some patients experience a burning sensation (Wang et al., 2010). Due to the resistance and effects of synthetic antifungal drugs, it is necessary to possess a novelty within the treatment of parasitic diseases. Along with the development of plant-based herbal medicine as a community-based alternative treatment, research on plants with antifungal properties is required. Because, aside from being inexpensive and employing traditional medicine, it rarely possesses side effects (Adiyasa & Meiyanti, 2021).

Indonesia may be a tropical nation incorporating differences of plants which possess the potential to be administered in the health sector. Previous research has been conducted to examine the antifungal potential of several types of plants in Indonesia. Plants examined against CA encompass cinnamon bark (*Cinnamomum burmanii Blume*) (Aini & Mardiyaningsih, 2018; Rangel et al., 2018; Apriliyani, Priani & Hidayat, 2021), moringa (*Moringa oleifera lamk)* (Verma et al., 2020; Santos et al., 2021), turmeric (*Curcuma longa linn*)(Murugesh et al., 2019), *Sansevieria trifasciata prain* (Seniwati, et al., 2021), white frangipani (*Plumeria acuminata*)(Sari et al., 2020), noni (*Morinda citrifolia linn*) (Hardani et al., 2020; Ene, Enweani-Nwokelo & Obaji, 2021), green tea (*Camelia sinensis*) (Akroum, 2018; Rahayu et al., 2018), alamanda (*Allamanda cathartica L*)(Tun et al., 2020), cashew nuts (*Anacardium occidentale L*)(Costa et al., 2021) and *Acorus calamus* (Febrianti, Khairina & Alisa, 2018).

Kemangi, recognized as *Ocimum basilicum* (OB), is a plant which is generally discovered in Indonesia. Kemangi leaves are frequently utilized by the community as a vegetable consumed. OB in the world of health can be employed as an antipyretic, antifungal, analgesic, antiseptic, antibacterial, hepatoprotector, immunomodulator, antirepellant and anti-expectorant (Kumalasari & Andiarna, 2020). Kemangi leaves are widely available, relatively inexpensive, and have numerous health benefits. As a result, kemangi leaves merit further investigation as an alternative herb for treating candidiasis. Although kemangi leaves have been extensively researched as an antifungal, there has been no recent research on the effectiveness of basil leaf extract against candida albicans, the cause of vaginal discharge. The objective of this study is to determine how effective OB methanol extract is against CA colonies.

2. RESEARCH METHOD

The research was conducted at the Microbiology Laboratory, Brawijaya University, Malang in 2021. The method administered in this study was experimental laboratories with Posttest Only Control Group Design by applying four repetitions of OB concentrations of 15%, 20%, 25%, 30% and 35% against CA colonies. The hypothesis test utilized is One-way ANOVA with a significance level of 0.05. An ethical test from the Health Research Ethics Committee of the Malang State Polytechnic of Health with number 206/KEPK-POLKESMA/2021 was administered to qualify this research.

This research employed a sample of kemangi plants acquired from the Malang Regency, East Java. The simplicia of the kemangi plant applied is a group of dried fresh kemangi leaves. The manufacture of kemangi leaf extract (OB) was performed at the Pharmacology Laboratory, Faculty of Medicine, Universitas Brawijaya Malang. Vaginal CA ATCC 1023 colonies were obtained from the Microbiology laboratory of Brawijaya University, Malang, cultured in petri dishes with Sabouraud Dektrose Agar (SDA) medium. The concentration test of kemangi leaf extract (OB) against CA was performed at the Microbiology Laboratory of Brawijaya University, Malang. This study utilized the Tube Dilution Test to examine the antifungal effect of kemangi leaf extract (OB) against CA Colonies.

Kemangi leaf extract (OB) is manufactured using the maceration method, which involves providing 1000 g of fresh kemangi leaf petals and drying them at room temperature for 10 days. The dried kemangi leaves are then blended to generate 200 grams of kemangi powder. The powder was placed in a 1-liter Erlenmeyer glass and soaked in methanol to a volume of 900 ml (3 times). It was shaken until completely mixed (+30 minutes), set aside for 1 night to settle, then was placed the top layer of the ethanol mixture with the active substance which has been administered. Then, it was placed in the 1-liter evaporation flask, and on the evaporator and filled the water bath with water until it was full. All series of tools incorporating rotary evaporator, water bath heater was installed (set to 70 C), connect to electricity. The methanol solution was applied to separate from the active substance in the flask. Waiting was required until the methanol flow stops dripping on the reservoir flask (± 1.5 to 2 hours for 1 flask). The results obtained are approximately 1/3 of the dry matter (31 g) then the extract was placed into a plastic bottle and stored in the freezer (Kumalasari & Andiarna, 2020).

Test Phase of Kemangi Leaf Methanol Extract (OB) against CA colonies. The test in this study was conducted to determine the ability to eliminate microorganisms at each concentration of kemangi leaf extract. The test employed a concentration of 15%, 20%, 25%, 30%, 35%. SDA powder in the amount of 65 grams was mixed with 70 ml of distilled water, stirred, then covered with aluminum foil and sterilized in an autoclave for 15 minutes at 121o C. The first layer of SDA liquid was poured into a sterilized petri dish and allowed to solidify. A 1 ml culture of CA ATCC 1023 was administered in an osche heated over a spirit lamp until it smoldered and allowed to cool. Then, 0.1 mL of kemangi leaf extract (OB) was applied at 15%, 20%, 25%, 30%, and 35% concentrations. On 10 µl SDA media, full streaking was performed. Petri dishes were incubated in an incubator at 37o C for 48-72 hours (Mutiawati, 2016). Calculating growth (Colony Counter) by employing the Total Plate Count (TPC) method (Lay, 1994). The experiment was repeated 4 times. Then, the results were examined statistically by administering one way ANOVA.

3. RESULTS AND DISCUSSION

OB is one of the species in the class *Ocimum* spread in tropical and sub-tropical regions (Asia, Africa and America). *Ocimum basilicum* in Indonesia is well-recognized by various names, which are lampes or surawung in Sunda, kemangi or kemangen in Java, kemangih in

Madura, uku-uku in Bali, and lufe-lufe in Ternate. OB are extensively utilized by the people of Indonesia as food and medicine. Kemangi leaf extract is evident to embody chemical compounds of flavonoids, alkaloids, saponins and tannins. Therefore, kemangi leaves can be utilized as an alternative to herbal medicine (Kumalasari & Andiarna, 2020).

Table 1. The results of the calculation of the CA colonies number at each concentration of kemangi leaf extract.

Repetition	**The number of CA colonies growing at each concentration**				
	15%	**20%**	**25%**	**30%**	**35%**
I	1043	601	260	119	0
II	1270	691	317	134	0
III	1077	748	226	107	0
IV	1145	567	215	95	0
Average	1134,4	652,2	255,2	113	0

The results of the calculation of the number of colonies in table 1 reveal that as the concentration of OB leaf extract increased, the number of colonies growing on SDA decreased. The largest and most dense CA colony growth was 1134 CFU/ml at a concentration of 15%. There was no progress of CA colonies at 35% concentration. It is because the more active compounds contained in the OB leaf extract, the higher the concentration of OB extract. Figure 1 depicts the growth of CA colonies after treatment with OB leaf extract.

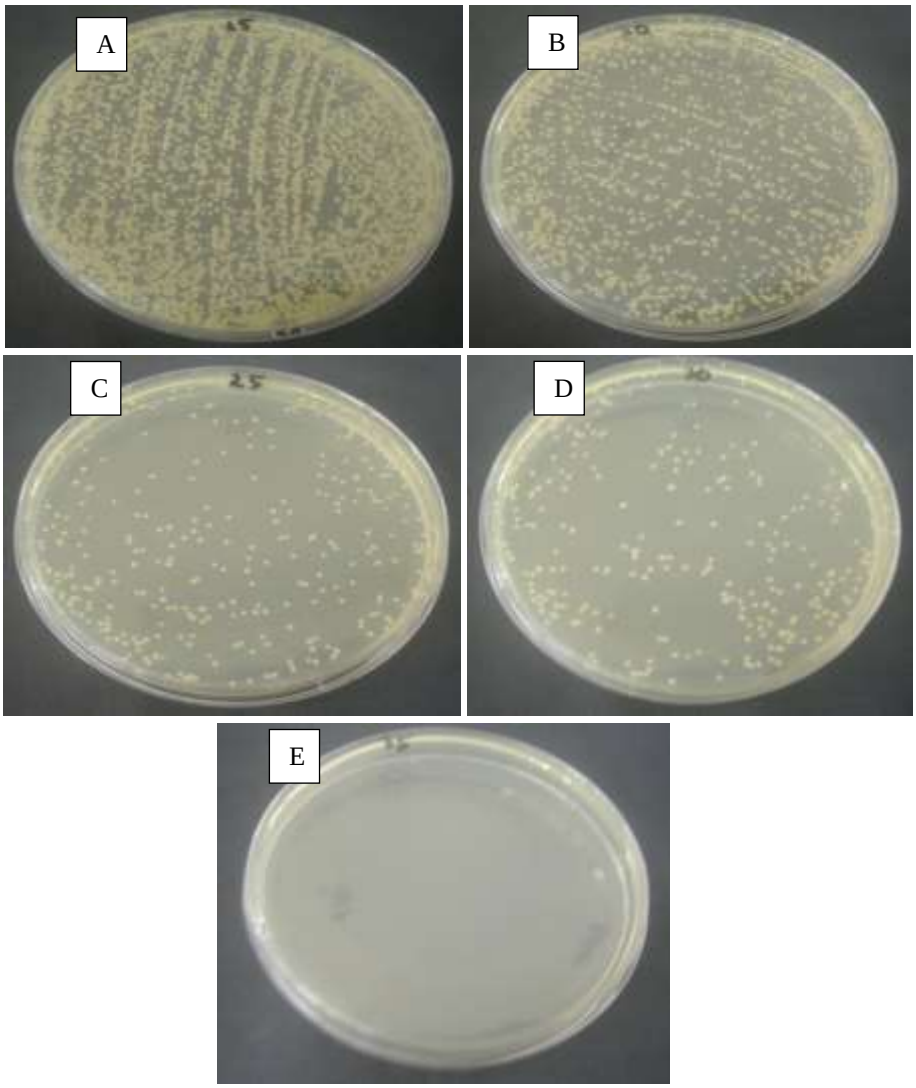

Figure 1. CA colony growth after being applied OB leaf extract, (A) CA colony growth at 15% concentration, (B) CA colony growth at 20% concentration, (C) CA colony growth at 25% concentration, (D) growth CA colonies at a concentration of 30%, (E) growth of CA colonies at a concentration of 35%.

Table 2. ANOVA Test Results Number of CA Colonies at Each Concentration.

Concentration	N	(X)	SD	F	p-value
15%	4	1134,4	2.062	270.439	0,000
20%	4	652,2	6.000		
25%	4	255,2	15.351		
30%	4	113	2.754		
35%	4	.00	.000		

Statistical test by employing One-way ANOVA illustrated p = 0.000 with alpha 0.05, thus, it can be indicated that there are significant differences in each concentration of OB leaf extract. The higher the concentration of OB leaf extract, the lower the number of CA colonies which grow. It demonstrates that OB leaf extract possesses antifungal potential against CA with a minimal killing rate at a concentration of 35%.

Phytochemical tests were administered on fresh dried OB leaves and then extracted by employing ethanol as a solvent, illustrated that the OB leaf extract embodied flavonoids, alkaloids, saponins and tannins. These compounds function as antifungal, antipyretic, analgesic, antiseptic, antibacterial, hepatoprotector, immunomodulatory, antirepellant and anti-expectorant which hinder the development and slaughter CA (Kumalasari & Andiarna, 2020). The mechanism of antifungal activity on alkaloids is by inhibiting the proliferation of protein formation, and respiration in cells which causes fungal death (De Ornay, Prehananto & Dewi, 2017). Alkaloid compounds are alkaline with a pH>7. This alkaline nature suppresses the development of the organism CA as fungus grows at a pH of 4.5 – 6.5 (Sari, Gunadi & Kristiana, 2019).

Furthermore, OB leaf extract encompasses flavonoids. Flavonoids own a mechanism of action as antifungals by interferometer with the penetrability of parasitic cell membranes. The hydroxyl group located in flavonoid compounds affects changes in organic components and nutrient transport which ultimately results in fungal cell lysis (Astutik, Yuswantina & Vifta, 2021). Flavonoids inhibit the growth of fungi by generating complex compounds with extracellular proteins, and flavonoids possess soluble properties which damage fungal cell membranes and are applied after by the discharge of intracellular compounds (Sari & Sumadewi, 2019).

One of the active substances in OB leaves playing a pivotal role in anti-fungal activity is essential oil. The essential oils produced in kemangi encompass methyl chavicol and linalool (Fitria, 2020). The result of another study discovered that the largest component of OB leaf essential oil is citral (Guntur et al., 2021). The essential oil in OB was able to restrain the development of CA cells by 35%. These results indicated a twofold effect when compared to ketoconazole (Bona et al., 2016). OB oil contains MIC80 inhibition against CA NYCY 1363 and CA NYCY 135BM2/94 at a concentration of 0.1% (Serra et al., 2018). The mechanism which plays a significant role in the antifungal activity of OB basic oil is terpene compounds, which are E-citral, Z-citral and linalool (Fitria, 2020). The mechanism of inhibition occurs as terpene compounds such as citral in OB oil are able to damage cell walls and cell membranes of fungi comprising of chitin, mannan (a type of polymer), -1, 6-glucan and -1, 3-glucan proteins. The fungal cell membrane is a polysaccharide connected with glycosidic bonds. Damage to the cell wall implies the occurrence of cytotoxicity then structural damage occurs.

Hence, the cell becomes lysed and causes the release of cell organelles and the death of fungal cells (Leite et al., 2014).

Tannins are dynamic compounds functioning as antifungals (Safrida, Mardiana & Husna, 2021). These antifungal compounds work by neutralizing enzymes involved in fungal invasion, damaging fungal cell membranes, inhibiting fungal enzyme systems, hence, they interfere with hyphae tip arrangement, and affecting nucleic acid and protein synthesis. Tannins possess ability to inhibit fungal development by inhibiting the synthesis of chitin, which is responsible for the arrangement of cell dividers in fungi.

Research conducted by Pasaribu et al., (2018) demonstrates that OB leaf extract owns antifungal action against CA. The concentration of kemangi leaf extract at a volume of 60 µL to 80 µL illustrates more extensive inhibition zone than ketoconazole (Pasaribu, Sudrajat & Buarlele, 2018). The results of this study revealed that kemangi leaf extract can inhibit the growth of CA. Kemangi leaf extract has numerous health benefits, particularly its antifungal properties. Unfortunately, the development of herbal ingredients for the treatment of CA-related vaginal discharge has not been prevalently pursued. This study is an initial study that can be utilized as a foundation for future research to develop herbal medicine as an alternative treatment for vaginal discharge exacerbated by CA in women.

4. CONCLUSION

OB leaf extract possesses antifungal potential against CA with minimal killing rate (MBC) at a concentration of 35%. The antifungal potential of OB leaves warrants further investigation as an alternative treatment for CA-caused vaginal discharge. In vitro research has demonstrated that OB leaf extract possesses antifungal properties against CA. More research is required to determine the antifungal potential of OB leaf extract in vivo.

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RESEARCH Open Access

The Administration of Dutch Teak Leaf Tea Extract (*Guazama Ulmifolia lamk*) in Reducing Cholesterol Levels in Depo Acceptors

Khobibah[1a*], Tri Nurhidayati[1b], Mimi Ruspita[1c], Rozikhan[1d], Listyaning Eko Martanti[1e]

[1] Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Semarang, Semarang, Central Java, Indonesia

[a] Email address: khobibah@poltekkes-smg.ac.id
[b] Email address: trinur.midwife@gmail.com
[c] Email address: mimiruspita@gmail.com
[d] Email address: roykhan64@yahoo.co.id
[e] Email address: listy@poltekkes-smg.ac.id

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Abstract
Depo hormonal contraceptives are significantly effective contraceptives with a low failure rate. Women who apply this contraceptive may experience several side effects on fat metabolism, which is an increase and decrease in total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C). The objective of this study was to identify the influence of Dutch teak leaves (*Guazuma Ulmifolia Lamk*) on the cholesterol levels in the Depo acceptors. Quasi-experiment research design with one group pretest posttest design model. The pretest was completed first by the total number of samples which is 60 respondents. Furthermore, 250 ml of Dutch teak tea is consumed every morning and evening after eating. The intervention lasted two weeks, followed by a retest (posttest). Dutch tea pre and post results were analyzed employing t-test statistics on variable body weight (p = 0.706), systolic blood pressure (p = 0.322), and cholesterol (p = 0.001), and the Wilcoxon test on diastolic pressure variables (p = 0.043) and triglycerides (p = 0.417). With a p-value of 0.001, it demonstrates that there is a significant difference in cholesterol levels after being treated with Dutch teak tea. With a p-value greater than 0.05, there was no difference in triglycerides, weight, or blood pressure after receiving Dutch teak tea treatment. An increase in cholesterol levels is one of the side effects of DMPA acceptors. Therefore, consuming Dutch teak leaves is an alternative treatment option.

Keywords: Dutch Teak Leaf Tea, Cholesterol, Injection Acceptor.

Corresponding Author:

Khobibah
Department of Midwifery, Politeknik Kesehatan Kementerian Kesehatan Semarang, Semarang, Central Java, Indonesia.
Email: khobibah@poltekkes-smg.ac.id

1. INTRODUCTION

Hormonal contraceptives are highly effective contraceptives with a very low failure rate. However, women applying this contraceptive may experience several side effects. Depo Medroxyprogesterone Acetate (DMPA) is a weak androgenic progestin provided as a single 150 mg intramuscular injection contraceptive every 3 months. This contraceptive is a potent inhibitor of gonadotropins. Several studies unveiled the debate about the side effects of DMPA injections on fat metabolism, which is an increase and decrease in total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) in DMPA users. Numerous studies have also revealed a reduction in high-density HDL cholesterol (HDL-C) levels in long- and short-term DMPA users. DMPA can cause serious cardiovascular side effects in women who administer this contraceptive (Affandi et al., 2014; Yadav, 2011).

The primary cause of weight gain after DMPA use is an increase in fat deposits. After a 30-month follow-up, medroxyprogesterone users gained 6.1 kg, which was due to an increase in fat mass. The use of DMPA, a glucocorticoid-like activity which affects fat gain, incorporating visceral fat, as well as injection-induced hypoestrogenism, which may be another factor responsible for the increase in body weight and body fat, is one possible mechanism that could explain weight gain. Body weight and leptin levels fluctuations can contribute to the development of several chronic complications, encompassing obesity, insulin resistance, and diabetes mellitus (Innas, Nurmainah, & Wahdaningsih, 2019).

Increased levels of lipids in the blood, triglycerides and cholesterol are signs of hyperlipidemia (Aman et al., 2019). Hyperlipidemia is managed through lifestyle changes, such as implementing a low-fat diet or healthy food patterns, as well as exercising or participating in appropriate activities. If non-pharmacological treatment fails, patients with hyperlipidemia should be provided anti-dyslipidemic or anti-hyperlipidemic drugs to return lipid levels to normal. Aside from conventional medicine, there is a growing number of medical applications for herbal plants or natural ingredients, as well as traditional medicines, to treat hyperlipidemia (Resti, 2022).

One of the traditional medicines which have been extensively consumed by Indonesian people is the Dutch teak plant. Research conducted by (Ulfah & Iskandar, 2020), revealed that the aqueous extract of Dutch teak leaves at a dose of 50 mg/Kg BW was able to significantly inhibit the increase in total and LDL cholesterol levels in the control group. Quercetin in Dutch teak leaf extract owns a fairly high level and is efficacious in lowering cholesterol levels (Batubara et al., 2017). Supriani's research et al. (2019), uncovered a change in cholesterol levels after administering Dutch teak leaf tea in Kedungsari Hamlet, Balongsari Megaluh Village. Changes in cholesterol levels are affected by sterols which are also discovered in Dutch teak leaves. Sterols bind to cholesterol in the food consumed by humans.

The variables evaluated in this study encompassing age, duration of being a DMPA acceptor body weight, systolic and diastolic blood pressure, cholesterol and triglycerides. The normality test was examined by employing the Kolmogorov Smirnov. The results revealed that weight, systolic blood pressure and cholesterol were normally distributed, hence, the different tests administered the t test, while the diastolic pressure and triglycerides were not normally distributed, thus, the Wilcoxon test was utilized. The objective of this study was to identify the influence of Dutch teak leaves (*Guazuma Ulmifolia Lamk*) on the cholesterol levels in the DMPA acceptors.

2. RESEARCH METHOD

This research is a quasi-experiment study with a one group pretest posttest design model in which the experiment was performed only in one group. The experimental group in this

study encompassing DMPA family planning acceptors treated with Dutch teak leaves (*Guazuma Ulmifolia Lamk*). Before the acceptors consumed the leaves of Dutch teak (*Guazuma Ulmifolia Lamk*), a pretest was administered, which is the measurement of total cholesterol levels. Measurements were conducted by administering blood serum employing an analyzer. Respondents were intervened by providing 250 ml of Dutch teak leaves (*Guazuma Ulmifolia Lamk*) to be drunk every morning and evening after eating, for 2 weeks. Then, it was performed an evaluation test (posttest), the same as during the pretest, to determine the effect of providing Dutch teak leaves (*Guazuma Ulmifolia Lamk*) on cholesterol levels in DMPA family planning acceptors.

Most people in general consume Dutch teak leaves by boiling them until they are dry boiling and brewing. This kind of treatment possesses a negative impact on the nutritious substances embodied in the Dutch teak leaves. Not numerous people understand that boiling or brewing tea at a temperature >90^{o}C is able to eliminate the efficacy of Dutch teak leaves (Hidayat, et al., 2014). Thus, it will be far more beneficial if it is manufactured into teak kombucha tea and utilized as a health drink to lower blood triglyceride levels in humans.

The research was conducted in the area of Patebon 02 Kendal Public Health Center. The total population encompasses 399 people and the sample was selected in accordance with purposive sampling, hence, a total sample of 60 people was obtained with the criteria for DMPA acceptors of more than 2 years, ages 20 to 35 years. The measuring instruments of this research comprise of the tread scales, cholesterol checking tools and observation sheets.

Age, duration of family planning injection, body weight, systolic and diastolic blood pressure, cholesterol, and triglycerides were the variables examined in this study. The normality test was administered by employing Kolmogorov Smirnov. The results discovered that weight, systolic blood pressure, and cholesterol were normally distributed, thus, the different tests performed the t test, but diastolic pressure and triglycerides were not, hence, the Wilcoxon test was conducted. This research has obtained ethical eligibility from the ethics committee Sultan Agung Semarang Islamic University No.348/X/2021/ Commission on Bioethics.

3. RESULTS AND DISCUSSION

In accordance with the results of the observation sheet on 60 DMPA family planning acceptors with age criteria between 20-35 years and having been DMPA family planning acceptors for at least 2 years, the following data were obtained.

Table 1. Distribution of Respondent Characteristics.

Variable	Average (SB)	Median	Minimum	Maximum
Age (years)	35.8 (7.90)	35	20	57
Injection duration (months)	67.92 (56.26)	45	1	204

Table 1 illustrates that the average age of the respondents was 35 years and the duration of injection was 68 months (5.6 years).

Table 2. Distribution of Body Weight, Blood Pressure, Cholesterol, Pre and Post Triglycerides Treatment.

Variable (n=60)	Pre	Post
Weight (kg)		
Average (SB)	58.2 (9.46)	58.35 (8.75)
Median	58	59
Minimum	39	39
Maximum	79	79
Systolic Blood Pressure (mmHg)		
Average (SB)	125.7 (12.82)	124.2 (13.61)
Median	125	122.5

Minimum	90	91
Maximum	160	162
Diastolic Blood Pressure (mmHg)		
Average (SB)	81.6 (7.62)	79.27 (8.84)
Median	82	80
Minimum	60	57
Maximum	100	100
Cholesterol (ml/dl)		
Average (SB)	157.5 (32.73)	175.8 (41.04)
Median	157	171
Minimum	90	105
Maximum	230	280
Triglycerides (ml/dl)		
Average (SB)	134.8 (73.1)	142.6 (94.20)
Median	119.5	113.5
Minimum	48	37
Maximum	363	600

Table 2 illustrates that the average body weight before treatment was 58.2 kg and after treatment 58.35 kg, systolic blood pressure before and after treatment was 125.7 mmHg, diastolic pressure before 81.6 mmHg and afterward was 79.27 mmHg. It was revealed an increase in cholesterol from before treatment, which is 157.5 mg/dl to 175.8 mg dl, triglycerides also increased from 134.8 mg/dl to 142.6 mg dl.

The data was examined for normality first by utilizing the Kolmogorov Smirnov method and then statistically examined employing the t test. The results of the normality test demonstrated that the variables that were normally distributed encompass weight, systolic blood pressure and cholesterol with p-value >0.05, hence, utilizing paired t-test, while data which were not normally distributed were diastolic pressure and triglycerides with p-value. <0.05, hence, employing the Wilcoxon test.

Table 3. Distribution of average levels of cholesterol, triglycerides, body weight and blood pressure pre and post treatment.

Variable (n=60)	**Mean**	**SD**	**SE**	***p-value***
Cholesterol (mg/dl)				
Pre treatment	157.52	32.73	4.23	0.001
Post treatment	175.83	41.04	5.29	
Triglycerides (mg/dl)				
Pre treatment	134.8	73.1	9.43	0.417
Post treatment	142.6	94.20	12.16	
Body weight (kg)				
Pre treatment	58.18	9.46	1.22	0.706
Post treatment	58.35	8.75	1.13	
Systolic BP (mmHg)				
Pre treatment	125.72	12.82	1.65	0.322
Post treatment	124.18	13.61	1.76	
Diastolic BP (mmHg)				
Pre treatment	81.6	7.62	0.984	0.043
Post treatment	79.27	8.84	1.14	

Table 3 presents that there is a significant difference in cholesterol levels after being treated with Dutch teak leaf tea with a p-value of 0.001. However, there was no difference in

triglycerides, body weight and blood pressure after being treated with Dutch teak leaf tea with *p-value* > 0.05.

This study determined the difference in cholesterol and triglyceride levels after being treated with traditional Dutch teak tea provided for 2 weeks/14 days in a row. Dutch teak leaf tea decoction was provided with a frequency of 500 ml, consumed 2 times in 1 day (250 ml in the morning and 250 ml in the evening) after meals with a total of 60 respondents.

Age, injection duration, body weight, and blood pressure were also evaluated in the depo acceptors. The respondents in this study had an average age of 35 years, a duration of injection of 68 months (5.6 years), a body weight of 58 kg, and blood pressure that was still within normal limits. This acceptor's age is in the phase of spacing out pregnancies, so an effective contraceptive method is required to prevent pregnancy, but fertility can return quickly. Furthermore, it was discovered that DMPA acceptors utilized contraception for an average of 5.6 years. In several studies, it is elaborated that the implementation of depo provena injectable contraception in the long term will possess an impact on the increasing BMI to class I obesity classification (on use >12 months) and can also affect a decrease in libido at use >2 years. Therefore, DMPA injection family planning acceptors require to be provided counseling about the side effects of DMPA injection family planning and are advised not to employ it for a long time. After it is experienced to interfere with health, you can immediately change to another contraceptive (non-hormonal) (Innas, Nurmainah, & Wahdaningsih, 2019; Ningsih & Zainiyah, 2020).

This study also discovered that family planning acceptors possessed normal blood pressure. It is probably due to the fact that most of the respondents are still relatively young, which is 20-35 years old, hence, their blood pressure is still within normal limits along with the high fertility rate. Women who have not gone through menopause are protected by the hormone estrogen, which plays a pivotal role in increasing HDL levels (HDL). High levels of HDL cholesterol are a protective factor in the prevention of atherosclerosis. The presence of premenopausal female immunity is understood to be explained by estrogen's protective effect. During premenopause, women gradually lose the hormone estrogen, which has been protecting blood vessels from damage.

However, Mukaromah, (2018) explained that the risk of high blood pressure will escalate with increasing age, length of utilization of contraception and weight gain. This change in body weight is caused by the hormone progesterone, which facilitates the conversion of carbohydrates and sugar into fat, so that a lot of fat accumulates under the skin and is not due to retention (accumulation) of body fluids. Furthermore, depo provera stimulates the appetite control center in the hypothalamus, which can cause acceptors to eat more than usual, thus, people with excess fat (hyperlipidemia) possess the potential to experience blood clots. Hence, this narrowing and blockage by fat causes the heart to pump blood more vigorously in order to supply the tissues with the blood they require. As a result, blood pressure escalataes, then there is high blood pressure. Therefore, it is identified that the utilization of depo provera contraception is one of the supporting factors for the emergence of high blood pressure if this contraceptive is implemented in the long term.

Cholesterol is frequently understood to as blood fat, which is one of the fatty tissues in the body that is naturally produced by the liver. Cholesterol is a component of fatty acids discovered in the blood. This substance is required by the body for certain processes for survival. Among them to generate hormones, cells and treat nerve cells (Manganti, 2017). Generally, cholesterol is tremendously beneficial ffor the body as it aids in the formation of healthy cells, the production of body hormones, and the production of vitamin D. Total cholesterol (LDL and HDL) levels should be less than 200 mg/dl in general. The habits and types of food consumed on a daily basis possess a significant impact on blood cholesterol

levels. Definitely, the better the pattern and quality of daily food, the better the cholesterol balance and overall health (Munarsih & Rini, 2019). On research results (Supriani et al., 2019),

The research revealed that the research subjects experienced a significant reduction in LDL cholesterol levels. This could be due to the diet of the research subjects, who did not eat much or purposefully avoided foods high in saturated fat in order to maximize LDL reduction.

The effect of depo provera on the cardiovascular system causes a slight increase in insulin levels and a decrease in HDL-cholesterol. Cholesterol is not soluble in water or blood. Lipoproteins, which are composed of fats and proteins, transport cholesterol to various tissues in the body (Affandi et al., 2014).

LDL cholesterol (low density lipoprotein) is predominantly reported in arteries. It is a bad situation because if LDL cholesterol levels are greater than >130 mg/dl while HDL levels are lower, suggest <40 mg/dl, there is a risk of an increase in blood pressure (Aman et al., 2019).

This study's findings indicate that there is a difference in average cholesterol levels before and after treatment, with a p value of 0.001. However, this difference indicates that there is an increase in cholesterol levels following administration of Dutch teak leaf tea. This contradicts the findings of several previous studies, which discovered that a water extract of Dutch teak leaves at a dose of 50 mg/kg BW could significantly reduce the increase in total and LDL cholesterol levels compared to the control (Ulfah & Iskandar, 2020). Likewise, research by Supriani et al., (2019) elaborated that there was a change in cholesterol levels after providing Dutch teak leaf tea in *Kedungsari* Hamlet, *Balongsari Megaluh* Village. Sterols, which are also discovered in Dutch teak leaves, cause changes in cholesterol levels. The administration of ethanol extract of Dutch teak leaves reduced plasma LDL cholesterol levels, but the doses of 25 and 50 mg/kgBW/day and vitamin C 1.14 mg/day were thought to be insufficient. One of the reasons that the decrease has not been maximized is that the induction dose of ethanol extract of Dutch teak leaves is only 14 days, which is not enough time, so the induction time must be extended. The longer an ethanol extract of Dutch teak leaves was provided to hypercholesterolemic rats as an induction dose, the more likely the extract's active ingredient was to reduce LDL and increase HDL levels (Na'im et al., 2017).

Dutch teak leaves are understood to contain alkaloids, flavonoids, sterols and phenolic acids. Sterols bind to cholesterol in the food consumed, hence, when teak leaf tea is consumed after eating, the sterols in Dutch teak leaves will bind to cholesterol, hence, the bound cholesterol will be conducted by leftovers and causes cholesterol in the body to change (Supriani et al., 2019). The chemical content of Dutch teak leaves, namely alkaloids, flavonoids, saponins, tannins, lendie and resin, the leaves of this plant are very effective for lowering cholesterol levels (Manganti, 2017). The results of quantitative analysis of alkaloid compounds in the acetone extract were greater, which is 1.925%, in the ethanol extract, only 1.91%, and in the aqueous extract, 0.82%, the saponin content in the ethanol extract was lower, that is 7.74% compared to the aqueous extract, that is 7.88%, the level of phenol as gallic acid in the ethanol extract is 3.9%, and the level of flavonoids as quercetin (Rivai et al., 2019).

Guazuma ulmifolia leaf extract is able to reduce plasma cholesterol concentrations, which is possible through the inhibition mechanism of HMG-CoA reductase. HMG-CoA is an essential enzyme in de novo cholesterol synthesis (Nurrahmanto, Nuri, & Sari, 2016). In the research by Rahmania et al. (2017) who compared the potency of the active compounds from Dutch Teak, Jabon and Mindi as HMG-CoA Reductase Inhibitors, the highest inhibition power of the methanol flavonoid extract was contained in Dutch teak extract (79.85-94.42%) compared to other plants. The maximum inhibition of the Dutch teak ethanol flavonoid extract was 82.8% at a concentration of 10 ppm, which was higher than the pravastatin control (73.91%), which has previously been identified as an HMGR inhibitor (Rahmania, Sulistiyani

& Lelono, 2017). Quercetin is abundant in Dutch teak leaf extract and has properties associated with cholesterol reduction; thus, quercetin may be a distinguishing feature of Dutch teak leaves. A high LDL cholesterol level in the control group is associated with a high cholesterol and saturated fatty acid diet. A high-cholesterol diet can raise blood cholesterol levels by inhibiting the synthesis of LDL receptors. Saturated fatty acids raise cholesterol levels by decreasing liver cholesterol synthesis, increasing free cholesterol transfer, and decreasing LDL affinity for LDL receptors (Na'im, Marianti & Susanti, 2017).

Foods with high levels of saturated fat when consumed continuously tend to escalate triglyceride levels in the blood (Lubis et al., 2021). Hyperlipidemia is defined as an increase in high levels of fat in the blood caused by excessive fat consumption, which can cause an imbalance in fat intake and reshuffling. Hyperlipidemia is defined by elevated blood cholesterol levels and TGD values that exceed normal limits. TGD levels in the blood are normal (<150 mg/dL). TGD has a numerical upper limit (150-200 mg/dL). Excessive triglyceride levels (>200 mg/dL). TGD is associated with an increased risk of atherosclerosis, coronary artery disease, and stroke (Wedro, 2018). Management of hyperlipidemia is performed by modifying lifestyle, incorporating by implementing a low-fat diet or a healthy diet and exercise or performing adequate activities, if non-pharmacological treatment is not successful, hyperlipidemic patients are required to be provided anti-dyslipidemic or anti-hyperlipidemic drugs which is able to decrease lipid levels to normal again (Ulfah & Iskandar, 2020).

In this study, there was no difference between triglyceride levels before and after being provided Dutch teak leaf tea. It indicates that the triglyceride levels in the respondents are the same. It is probably due to the influence of the type and amount of food consumed (containing a lot of fat) and lack of physical activity and exercise. Age factors can also affect the rise or fall of triglyceride levels in the blood. The normal function of body cells begins to decline with age is the cause (Jonathan et al., 2014). The findings of this study differ from previous research that reported that Dutch teak leaf extract reduced triglyceride levels in dyslipidemic people. It is possible due to the presence of alkaloids, tannins, mucilago, flavonoids, and resin in Dutch teak leaf extract. Tannins, which act as astringents, have been discovered to precipitate mucosal proteins on the surface of the small intestine, reducing absorption and cholesterol levels from these foods. Furthermore, alkaloids and flavonoids inhibit pancreatic lipase activity, resulting in decreased fat absorption in the intestine (Jonathan et al., 2014).

Research result (Ulfah & Iskandar, 2020) demonstrated that the Dutch teak leaves are able to reduce triglyceride fat levels. The most effective infusion dose was infusion with a dose of 1250 mg/kgBW with a decrease in triglyceride levels of 41.30% from the quasi-negative control. Another study calculated LDL and triglyceride levels in male Wistar rats by employing the Cholesterol Oxidase-p-aminophenazone (CHOD-PAP) method with the principle of enzymatic colorimetric testing. Dutch teak ethanol extract 30 mg can significantly decrease LDL and triglyceride levels (Prahastuti et al., 2016).

Medicinal plants possess numerous uses and are expected to possess minimal side effects compared to chemical drugs (Supriani et al., 2019). Currently, traditional medicine is quite extensively implemented by the community and is still extensively processed in the form of extracts or powders and still rarely consumes traditional medicine in the preparation of kombucha tea which is a fermented beverage in maintaining health. In addition to conventional medicine, drugs containing herbal plants or natural ingredients, as well as traditional medicine, are increasingly being employed to treat hyperlipidemia (Resti, 2022). Tea is the drink most people understand and most frequently consumed by Indonesians (Krisnawati, 2014). Several processed herbal teas have been marketed in the category of traditional herbal medicine and are claimed to lower cholesterol levels, according to the Decree of the Head of BPOM RI concerning the Basic Provisions for Grouping and Marking Indonesian Natural Medicines.

Traditional medicine, on the other hand, is classified as herbal medicine, with efficacy claims in accordance with empirical data based on experience.

Kombucha tea is one of the well-known functional drinks that provides health benefits. Kombucha tea contains antioxidants that aid in the prevention of oxidation, the inhibition of cancer cell growth, the reduction of cholesterol accumulation in the blood, and the acceleration of cholesterol elimination through feces. Kombucha's microbes convert the tea and sugar solution into various organic acids that are beneficial to the body's metabolism, giving it the potential to act as a natural antibiotic. Furthermore, kombucha can eliminate toxins from the body and acts as an immunomodulator, boosting the immune system (Khamidah & Antarlina, 2020). Kombucha tea is one of the most intriguing traditional drinks as it is the result of fermentation conducted by a symbiotic culture. Kombucha is generally made with black tea leaves, green tea, or oolong tea, but it can also be made with infused water containing fruits, mint leaves, jasmine flowers, and Dutch teak leaves. Wulandari (2018) elaborates that, With increasing fermentation time, the brightness level of kombucha with teak leaf base material changes, as well as a decrease in the average tannin content. Tannins in teak leaf tea kombucha are degraded during the brewing and processing processes.

Dutch teak leaves are effective cholesterol-lowering agents. Caffeine, sterols, and phenolic acids are also discovered in the leaves of the Dutch teak plant. The tannins and mucilage in Dutch teak precipitate the protein mucosa on the small intestine's surface, reducing food absorption. As a result, the Dutch teak plant can be utilized in traditional medicine to lower cholesterol levels (Supriani et al., 2019). The chemical content of alkaloids, flavonoids, saponins, tannins, mucilage, carotenoids, phenolic acids, and resins in Dutch teak leaves is believed to be able to degrade fat and lower blood cholesterol levels. These chemical compounds have been demonstrated to connect to cholesterol and fat molecules contained in food, causing a decrease in the amount of fat and cholesterol absorption in the intestine and, as a result, a decrease in blood cholesterol levels (Permana et al., 2016). The alkaloid content of Dutch teak leaves is chemically similar to Orlistat, a synthetic drug that can suppress appetite by inhibiting the performance of the lipase enzyme, reducing fat absorption in the body. The mucilage compound present in Dutch teak leaves acts by depositing protein on the surface of the small intestine, reducing food absorption and thus inhibiting the absorption process (Ulfah & Iskandar, 2019). The mucilage content also connects bile salts which can reduce the fat emulsification process, thereby decreasing the process of fat absorption in the digestive tract (Amalia et al., 2018).

Guazuma ulmifolia water extract with a dose of 50 mg/kg BW managed to significantly reduce Low Density Lipid (LDL) and total cholesterol levels. Mucilage contained in Dutch teak can swell in the stomach, thus, it suppresses appetite (Ulfah & Iskandar, 2020). Dutch teak leaf extract incorporates higher levels of flavonoids, tannins, and antioxidant compounds than other plants, which make it more effective in lowering one's cholesterol levels. Dutch teak leaves in addition to lowering cholesterol, triglycerides, LDL also escalate HDL, by elevating the work of the lipoprotein lipase enzyme (Hidajat et al., 2019). The longer the induction dose of ethanol extract of Dutch teak leaves is provided to hypercholesterolemic patients, the more likely the extract's compounds are to work in significantly reducing LDL and increasing HDL levels (Naim et al., 2017).

The majority of people consume Dutch teak leaves by boiling them until they are dry boiling and brewing, resulting in a negative impact on the nutritious substances contained in the Dutch teak leaves. Few people are aware that boiling or brewing tea at temperatures above 90 degrees Celsius can render Dutch teak leaves ineffective (BPOM, 2014), thus, it will be much more beneficial if it is made in the form of teak kombucha tea as a health drink to lower blood triglyceride levels in humans.

Previous research demonstrated that Dutch teak leaf tea therapy had a significant effect on changing and stabilizing cholesterol levels. Respondents reacted positively to the provision of Dutch teak leaf tea therapy as it tastes the same as regular steeping tea. Teak leaf tea therapy has the potential to lower cholesterol levels while having fewer side effects than chemical drugs (Supriani et al., 2019).

Another study revealed that high-fat diet (HFD)-induced hyperlipidemia resulted in increased total cholesterol levels. *Guazuma ulmifolia aqueous* extract significantly reduced total cholesterol levels compared to the HFD group. Moreover, the ethanol extract of *Guazuma ulmifolia* fruit significantly inhibited lipase activity higher than orlistat (Ulfah & Iskandar, 2020). In Sholihah's 2016 study, The combination of Dutch teak leaf extract and rosella flower petals reduced total cholesterol, triglyceride, and LDL levels while increasing HDL levels in plasma. This is due to the high levels of flavonoids discovered in ethanol extracts of Dutch teak leaves and water extracts of rosella petals. Previous studies demonstrated that a 45 mg/kg body weight water extract of rosella petals had the highest lipase inhibitory activity of any Indonesian anti-cholesterol herb. Histopathological examination of the heart organ in the combination of Dutch teak leaves and rosella petals revealed no change in the structure of the heart organ, indicating that exposure to this combination had no effect on the heart organ (Hilma et al., 2018).

Previous research determined that the best dose of Dutch teak leaf kombucha tea (*Guazuma ulmifolia Lamk)* for lowering triglyceride levels was 200 ml/g BW orally, with a 37.68% reduction in triglycerides. Providing a dose of 200 ml/g BW of Dutch teak kombucha tea leaves is nearly the same as giving a dose of 20 mg simvastatin suspension with a percentage reduction of triglycerides obtained 35.20%. Thus, it can be indicated that providing Dutch teak kombucha tea leaves can reduce triglyceride levels in the blood. (Lubis et al., 2021).

It It is unidentified whether the findings of this study will differ from previous studies. Giving Dutch teak leaf tea increased cholesterol levels in DMPA acceptors, but there was no significant difference in triglycerides. Before being examined on respondents, treatment products should ideally go through a more thorough process (Lubis et al., 2021). The assumption of the researcher is that simplicia phytochemical screening from Dutch teak leaves is tremendously essential before being processed into medicinal products. It is also evident that there are alkaloids, flavonoids, saponins, tannins, glucosides and steroids in Dutch teak leaves selected in accordance with criteria, hence, strict phytochemical screening is able to produce quality care products. Dutch teak leaf tea can be discovered in pharmacies, supermarkets and online stores.

4. CONCLUSION

There was a significant difference in cholesterol levels after being treated with Dutch teak leaf tea with a p-value of 0.001. However, there was no difference in triglycerides, body weight and blood pressure after being treated with Dutch teak leaf tea with p-value >0.05. Thus, it can be concluded that the alternative hypothesis is acceptable, which indicates that there is a significant effect in consuming Dutch teak leaf tea with cholesterol levels in DMPA acceptors. The recommendation of this research is that further research is required on the effects of Dutch teak leaf tea by controlling the influencing factors.

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Quality of Thorax CT Scan Images among Covid-19 Cases using Variations of Filter

Elok Nur Afiifah[1a*], Shinta Gunawati[1b], Guntur Winarno[1c], Muhammad Irsal[1d], Fahrizal[1e], Rizal Akbar[1f]

[1] Department of Radiodiagnostic and Radioteraphy Technique, Politeknik Kesehatan Kemenkes Jakarta 2, Jakarta Selatan, DKI Jakarta, Indonesia

[a] Email address: eloknuraf12@gmail.com
[b] Email address: shinta.gunawati@poltekkesjkt2.ac.id
[c] Email address: guntur.winarno@poltekkesjkt2.ac.id
[d] Email address: muhammad.irsal@poltekkesjkt2.ac.id
[e] Email address: fahrizal.rizal2703@gmail.com
[f] Email address: akbar.takkanterganti@gmail.com

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Abstract

A typical image of the Thorax CT Scan as a sign of the early stages and development of Covid-19 is the finding of Ground Glass Opacities (GGO). GGO is an insignificant increase in the density of the lungs without occlusion of blood vessels and bronchi. In mild cases, GGO tends to be difficult to identify and requires high-resolution CT scanning. In this study, we intend to improve the resolution of the Thorax CT Scan image through filter settings, to analyze the difference in the variations of filters B50s, B70s, and B90s towards the quality of the CT Scan image and obtain the optimal use of filter in the Thorax CT Scan examination among Covid-19 cases. This was a quantitative analytical study conducted at one of the Regional General Hospital in Jakarta on March-April 2022. The samples were secondary data derived from 10 patients by using MSCT Siemens Somatom Perspective 128 slices. Data were collected through observation and experiment. The images collected were further analyzed using Image j software to find values of Signal to Noise Ratio (SNR) and Contrast to Noise Ratio (CNR). Furthermore, the values were compared by assessing the anatomical image information through various filters. The results of this study indicated that there were differences in the SNR and CNR values of the three filters. The higher resolution of the filter used, the more capable it was to sharper and more detailed the image but the noise level was also higher. Thorax CT Scan examination should be carried out using the B70s very sharp filter that was able to produce images with the optimal information and fairly low noise level. A very thin GGO image in the early stage of the manifestation of Covid-19 could be identified in the Thorax CT Scan examinations for diagnosis of Covid-19 case.

Keywords: Thorax CT-Scan, Signal to Noise Ratio, Contrast to Noise Ratio, Covid-19, Filter.

Corresponding Author:

Elok Nur Afiifah
Department of Radiodiagnostic and Radioteraphy Technique, Politeknik Kesehatan Kemenkes Jakarta 2, Jakarta Selatan, DKI Jakarta, Indonesia.
Email: eloknuraf12@gmail.com

1. INTRODUCTION

Coronavirus Disease 2019 is an infectious disease caused by the Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2). It was first reported in December 2019 in the city of Wuhan, Hubei Province, China (Huang et al., 2020; Perlman, 2020; Wang, et al., 2020; Wang, et al., 2020; Zhu et al., 2020). The first confirmed case of Covid-19in Indonesia was reported on March 2, 2020 (Kementerian Kesehatan Republik Indonesia, 2020). Until the end of August 2021, more than 4 million confirmed cases of Covid-19 were reported in Indonesia and 128,252 people died (Johns Hopkins University & Medicine, 2021).

The standard for establishing a diagnosis to confirm Covid-19 is the Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) examination. However, the results of the RT-PCR examination take a long time and can give false negative results thereby reducing the effectiveness of early identification and isolation of Covid-19 patients (Prokop et al., 2020; Wang et al., 2020; Xie et al., 2020). On the other hand, Thorax CT-Scan has been applied as an essential complementary indicator in Covid-19 screening because of its high sensitivity (Ai et al., 2020; Fang et al., 2020; Gündüz, Öztürk, & Tomak, 2020; Liu, Yu, & Zhang, 2020; Wang et al., 2020).

CT-Scan is a diagnostic technology tool that combines rotating X-rays, detector arrays, and computerized reconstruction to produce cross-sectional images of the body (Bushong, 2017). There are important organs of the respiratory system inside the thorax cavity, such as the lungs, heart, bronchi, and blood vessels (Long, Rollins, & Smith, 2016). Thorax CT scan should be viewed with at least two window settings namely the mediastinum window and the lung window (Seeram, 2016). Lung window is a window that is set to observe the lung parenchyma tissue.

A typical image on Thorax CT-Scan which is considered a marker of the early stages and progression of Covid-19 disease is the finding of Ground Glass Opacities (GGO), with or without consolidation with bilateral peripheral involvement in several lobes of the lung which can develop into a crazy paving pattern (Bernheim et al., 2020; Ye, et al., 2020). GGO is an insignificant increase in lung density without blood vessel and bronchial obscuration, while consolidation is accompanied by clouding of blood vessels. In mild cases, GGO tends to be difficult to identify, therefore high resolution CT-Scan is required (Cozzi et al., 2021).

Images with high resolution and detail are also required in the CT Scan Thorax examination because the lung cavity has a very small structure and is very similar to pulmonary blood vessels and bronchi. One way to increase the resolution of CT Scan Thorax images is by setting filters or reconstruction algorithms. The higher the resolution of the selected algorithm, the higher the resolution of the CT Scan image produced. This method can clearly distinguish images such as bone, soft tissue, and other tissues that are produced on the monitor screen. The higher resolution of the algorithm (lungs and bones) will increase the high spatial frequency. In addition, a softer algorithm (soft network) will reduce the contribution of high frequency (Webb, Muller, & Naidich, 2015).

Thorax CT Scan examination for Covid-19 case is performed by using a high-resolution filter to get the best image resolution (Wu et al., 2020). Siemens MSCT imaging modality provides a variety of high-resolution filter settings for thorax CT scans, especially for lung window condition, namely B50s, B60s, B70s, B80s, and B90s. The higher the resolution of the filter used, the more capable it is to clarify the boundaries/edges of the organ so that the resulting image display will be sharper and more detailed but with a higher noise level (Bequet, et al., 2019; Sutrisno et al., 2021).

According to the results of observations made by researchers at one of the Regional General Hospitals in Jakarta and a journal written by Sanli, & Yildirim, (2021), Thorax CT-Scan for Covid-19 examination was performed using a very sharp filter B70s. Meanwhile, according to the journal written by Zhao et al., (2020) Thorax CT Scan for Covid-19

examination was performed using a medium sharp filter B50s. Furthermore, according to Li et al., (2020), it was performed using an ultra-sharp filter B90s (Li et al., 2020; Şanli & Yildirim, 2021; Zhao et al., 2020). Based of the background, researchers are interested in conducting a study on the use of various filters namely B50s, B70s and B90s on Thorax CT-Scan for lung window condition among Covid-19 cases. There were different image results by the variations of filters B50s, B70s, and B90s analyzed through image j software to find the SNR and CNR values among the three variations of filter. This study aims to obtain the optimal type of filter to produce image with optimal quality to establish a diagnosis.

2. RESEARCH METHOD

This was a quantitative analytical study conducted at one of the Regional General Hospital in Jakarta on March-April 2022. The population of this study was all patients who had CT Scan Thorax at the Radiology Installation as using MSCT siemens Somatom perspective 128 slices. The samples were 10 secondary data of patients with suspected COVIS-19 and the existence of GGO. Data were collected by conducting observations and experiments.

Images from raw data reconstructed with filters B50s, B70s, and B90s were assessed objectively using data derived from DICOM and then one coronal slice was taken from each sample on the filter used. Data derived from the DICOM slices were further analyzed for individual pixel value, mean value, and standard deviation using Image J software. This software performed analysis through ROI (Region of Interest). ROI was placed on the object (right upper lobe of lung, right lower lobe of lung, left upper lobe of lung, and left lower lobe of lung) and outside the object (background) with a size of 10 mm to obtain the object mean HU, background mean HU, object standard deviation, and background standard deviation. These values were used to calculate the SNR and CNR values according to equations (1) and (2) (Kim et al., 2014) which were then applied for statistical analysis of the ANOVA test using statistical data processing software.

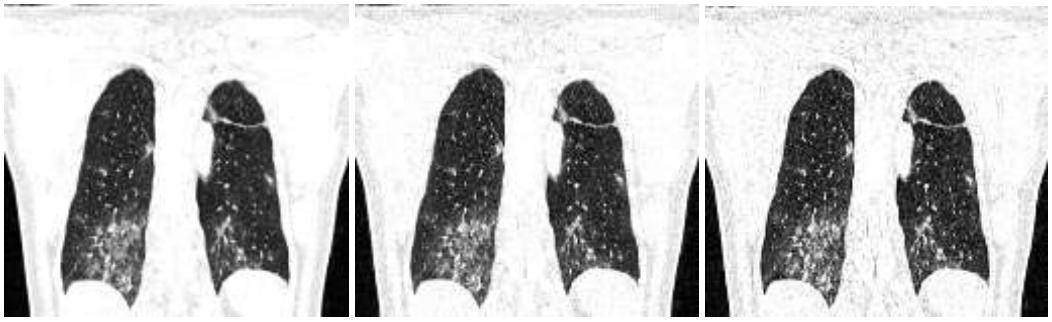
$$SNR = \frac{\text{Object Mean HU}}{\text{Object Standar Deviation}} \quad (1)$$

$$CNR = \frac{\text{Object Mean HU} - \text{Background Mean HU}}{\text{Background Standar Deviation}} \quad (2)$$

Subjective assessment was also carried out by delivering questionnaires containing questions about anatomical information on CT Scan Thorax images to five respondents who were radiology specialists and radiographers. The questions had 5 levels of Likert scale rating namely 1 for very poor, 2 for poor, 3 for moderate, 4 for good, and 5 for very good. Furthermore, statistical analysis through the Kruskal wallis test was conducted using statistical data processing software. This study has obtained ethical approval and ethical review.

3. RESULTS AND DISCUSSION

The research was conducted at one of the Regional General Hospitals in Jakarta on March-April 2022. For further analysis, the raw image data obtained after scanning were then reconstructed using filter variations namely medium sharp filter B50s, very sharp filter B70s and ultra sharp filter B90s. Those filters were applied for a lung window condition with a window width of 1200 HU and a window level of -600 HU. In addition, the examination parameters applied were full helical scan type; 130 kV; Quality reff mAs 100 (Care Dose4D) was active; rotation scan of 0.6 s; pitch of 1.3; length of 512 mm and slice reconstruction of 1 mm as shown in Figure 1.



(A) (B) (C)

Figure 1. Results of Thorax CT Scan Reconstruction Image: (A) medium sharp filter B50s (B) very sharp filter B70s (C) Ultra Sharp filter B90s

The results of the image reconstruction using filter variations of B50s, B70s, and B90s using software image J obtained the mean object HU, background mean HU, object standard deviation, and background standard deviation values with ROI size of 10 mm made on the right upper lobe of lung, right lower lobe of lung, left upper lobe of lung, left lower lobe of lung, and background. The same ROI size was placed to measure the pixel value on the use of the three variations of filter on each organ, as shown in figure 2. These results were then processed using the SNR and CNR equations.

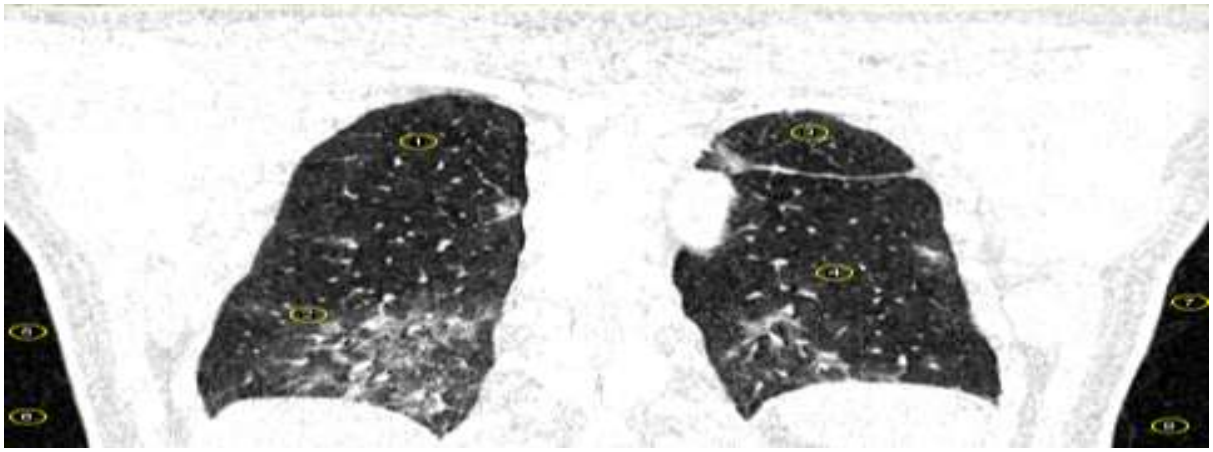


Figure 2. Placement of ROI on CT Scan Thorax image

The SNR and CNR equations obtained the SNR and CNR values on filters B50s, B70s, and B90s as shown in Table 1 and Table 2. Then the values were further analyzed statistically.

Table 1. Signal to Noise Ratio (SNR) Values.

Patient	SNR		
	Filter B50s	**Filter B70s**	**Filter B90s**
1	-19.928	-12.343	-9.393
2	-15.072	-12.644	-8.652
3	-19.778	-18.035	-13.812
4	-19.762	-15.300	-11.648
5	-11.376	-8.640	-7.293
6	-15.370	-11.697	-7.023
7	-10.102	-8.244	-5.416
8	-7.689	-6.230	-4.697
9	-19.015	-13.954	-10.681
10	-16.052	-12.928	-7.799

Table 1 presents the SNR values for filters B50s, B70s, and B90s. Filter B50s obtained the lowest mean SNR value and Filter B90s obtained the highest mean SNR value.

Table 2. Contrast to Noise Ratio (CNR) Values.

Patient	CNR		
	Filter B50s	**Filter B70s**	**Filter B90s**
1	10.354	5.428	4.172
2	13.848	9.730	5.965
3	8.913	6.785	5.062
4	12.455	6.733	5.002
5	4.203	3.548	2.988
6	8.588	6.800	4.332
7	4.979	3.780	2.468
8	11.164	10.315	8.012
9	19.911	10.893	7.809
10	8.567	5.988	3.250

Table 2 presents the CNR values for filters B50s, B70s, and B90s. Filter B50s obtained the highest mean CNR value and Filter B90s obtained the lowest mean CNR value.

Before the statistical test was conducted, the data that had been obtained were tested for normality first to determine whether the data were normally distributed or not and to determine the appropriate statistical test. The Shappiro-wilk test was applied on SNR and CNR of the filters B50s, B70s and B90s which obtained a p-value of >0.05, which indicated that the data were normally distributed. Thus, the statistical test applied to test the differences in the data was the ANOVA test.

After the ANOVA test on the SNR and CNR values of the three filter variations, it was obtained a significance value of 0.001 for SNR and a significance value of 0.003 for CNR. Since the p values were < 0.05, then H0 was rejected. Thus, it can be concluded that there was a difference in the means SNR and CNR values between filters B50s, B70s, and B90s. Furthermore, a post hoc test was conducted to find out group(s) with differences. Since the data were normally distributed, the further test applied was the Bonferroni test.

The results of the Bonferroni test on SNR obtained a significance value between filter B50s and filter B70s of 0.138, a significance value between filter B50s and filter B90s of 0.001, and a significance value between filter B70s and filter B90s of 0.147. The findings indicated that there was a difference in the mean SNR values between filter B50s and filter B90s. Meanwhile, there was no significant difference in the mean SNR values between filter B50s and filter B70s and between filter B70s and filter B90s.

The results of the Bonferroni test on CNR showed a significance value between filter B50s and filter B70s of 0.087, a significance value between filter B50s and filter B90s of 0.002, and a significance value between filter B70s and filter B90s of 0.463. The findings indicated that there was a difference in the mean CNR values between filter B50s and filter B90s. Meanwhile, there was no significant difference in the mean CNR values between filter B50s and filter B70s and between filter B70s and filter B90s.

Table 3. Anatomical Image Information Based on Questionnaire Data.

Respondent	Filter		
	Medium Sharp Filter B50s	Very Sharp Filter B70s	Ultra Sharp Filter B90s
1	4.0	4.4	2.8
2	3.8	4.5	4.5
3	4.5	4.5	3.6
4	3.8	4.7	3.0
5	3.4	5.0	2.0

Table 3 presents the mean value of the questionnaire data among 5 respondents who were radiology specialists and radiographers. Those respondents performed subjective assessments towards the results of the thorax CT-Scan by using 3 variations of filters B50s, B70s, and B90s. Anatomical information of the right upper lobe of lung, the right lower lobe of lung, the left upper lobe of lung, and the left lower lobe of lung were presented in the table. Filter B70s obtained the highest mean value while Filter B90s obtained the lowest mean value.

Table 4. Results of Kruskal Wallis Test.

Kruskal Wallis Test		
Filter	Mean Rank	p-value
B50s	7.30	0.021
B70s	12.20	
B90s	4.50	

Table 4 presents the results of the Kruskal Wallis test for the anatomical image information questionnaire. The Kruskal Wallis statistical test was applied since the questionnaire data for anatomical image information were ordinal data. The Kruskal Wallis test was performed to determine whether there were significant differences between the three variations of filter. After the Kruskal Wallis test was performed, a significance value of 0.021 was obtained. Since the p value was <0.05, then H0 was rejected. It can be concluded that there was a significant difference in anatomical image information of filters B50s, B70s, and B90s. Based on the table, it was also shown that filter B90s obtained the lowest mean rank value of 4.50 and filter B70s obtained the highest mean rank value of 12.20. Such finding indicated that respondents agreed that the use of the B70s filter could visualize the most optimal anatomical image information.

The current study is the first study that presents evidence regarding different image quality by variations of filter using filters B50s, B70s, and B90s. The calculation of the SNR and CNR values applied the image J software on the CT Scan Thorax examination for Covid-19 cases by placing the ROI in the same areas on 10 samples. The coronal sections of the thorax anatomy were chosen, especially the right upper lobe of lung, the right lower lobe of lung, the left upper lobe of lung and the left lower lobe of lung because signs of Covid-19 infection are often found in such areas (Şanli & Yildirim, 2021). Based on the calculation of the statistical test through ANOVA test, it was found p values of 0.001 and 0.003 for SNR and CNR, respectively which indicated that there were differencea in SNR and CNR values. The difference between the SNR and CNR values was found for filter B50s and filter B90s filter. Based on Table 1, it can be seen that filter B90s obtained the highest SNR value. The higher the SNR value, the clearer the radiographic image when there is a small difference between an organ and the surrounding area (Irsal & Winarno, 2020).

Based on Table 2, it was shown that of the three filter variations, filter B50s obtained the highest CNR value and filter B90s obtained the lowest CNR value. The sharper the image produced by a filter, the lower the CNR value. The lower the CNR value, the higher the noise in the image (Irsal & Winarno, 2020). Higher noise value lead to better ability to clarify the

boundaries/edges of the organ so that the resulting image display can be sharper and more detailed (Bequet et al., 2019; Sutrisno et al., 2021). The increased noise is due to the high pass filtering process, specifically when the filter suppresses the low spatial frequency (input raw data image with large pixels that contain little frequency information) so that a prominent difference is obtained between the output pixels of the raw data (Seeram, 2016).

Based on the calculation through the Kruskal Wallis test on the questionnaire filled in byby 5 respondents regarding the anatomical image information of right upper lobe of lung, right lower lobe of lung, left upper lobe of lung and left lower lobe of lung, it was obtained a p value of 0.021. Such finding indicated that there was a significant difference in anatomical image information of the three filter variations. Based on Table 8, it can be seen that filter B70s obtained the highest mean rank value of 12.20 which indicated that respondents agreed that the use of the B70s filter could visualize the most optimal anatomical image information.

In summary, the use of filter B70s was able to optimally visualize anatomical image information, was able to clarify the boundaries/edges of organs, and had a fairly low noise level. This is compatible with the Standard Operating Procedure at one of the Regional General Hospitals in Jakarta and the journal written by Sanli, & Yildirim, (2021), that Thorax CT Scan for Covid-19 examination was performed using a very sharp filter B70s. The study findings are also in accordance with the literature which states that Thorax CT Scan for Covid-19 requires high-resolution images so as to identify GGO which is very thin and has unclear edges in the early stage of CT manifestation of Covid-19 (Chinese Society of Radiology, Chinese Medical Association, 2020; Cozzi et al., 2021).

4. CONCLUSION

The study revealed that there were differences in the quality of the CT Scan Thorax images for Covid-19 cases using the filters B50s, B70s, and B90s. During the CT Scan Thorax examination, especially regarding lung window conditions, image reconstruction should be performed by using very sharp filter B70s to obtain optimal image and information results. A very thin and unclear edge of GGO image in the early stage of the manifestation of Covid-19 could be identified more clearly and sharply in the Thorax CT Scan examinations for diagnosis of Covid-19 case. Future research is recommended to be conducted using different variations of filter.

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RESEARCH **Open Access**

Personal Hygiene and Soil Transmitted Helminth Incidence in Elementary School Students Amanuban Barat District, South Central Timor

Michael Bhadi Bia[1,2a*], Ni Made Susilawati[1b], Agnes Rantesalu[1c], Karol Octrisdey[1d], Winioliski L.O. Rohi Bire[1e]

[1] Department of Medical Laboratory Technology, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia
[2] Center of Excellence, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia

[a] Email address: michaelbia07@gmail.com
[b] Email address: madeanalis@yahoo.co.id
[c] Email address: agnesransh@gmail.com
[d] Email address: octrisdeykarol@gmail.com
[e] Email address: winioliski@gmail.com

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Abstract

Soil-transmitted helminth infection remained a significant public health problem in many developing countries. Elementary school-age children dominated the cases in Indonesia due to poor personal hygiene. South Central Timor had the top three poverty and the highest stunting rates in East Nusa Tenggara. Research to examine the relationship between personal hygiene and the incidence of Soil-Transmitted Helminth infection had never been conducted in South Central Timor. The study population consisted of 279 elementary school students selected from Inpres Nulle Elementary School, Inpres Neonmat Elementary School, and GMIT Nulle Elementary School through the Multistage Random Sampling technique. It was obtained 160 children as the study samples. The study found that 46 children (29.0%) were positive for STH, and 114 (71.0%) were negative for STH. Furthermore, 30 (65.2%) were positive for hookworm, 14 (30.4%) were positive for Ascaris lumbricoides, and 2 (4.4%) children had mixed infections. Multiple Logistic Regression Tests showed a significant effect of washing hands with soap after defecating with p = 0.031 and OR = 7.158. Thus, if a child did not wash his hands with soap after defecating, he had a risk of STH infection by 7.158 times. Furthermore, the effect of eating habits obtained a p = 0.038 and an OR value = 0.133 with the possibility of eating habits that did not protect against STH infection. In addition, the effect of dirty nails obtained a p=0.064 and an OR=5.264, which indicated the risk of contracting STH by 5.264 times. The effect of snacking habit obtained a p = 0.005 and an OR=0.121. It can be concluded that the incidence of STH was simultaneously influenced by the habit of defecating on the ground, washing hands without soap after defecation, eating raw food, having dirty nails, and having poor snacking habits.

Keywords: Effect, Personal Hygiene, Soil Transmitted Helminth.

Corresponding Author:

Michael Bhadi Bia
Department of Medical Laboratory Technology, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia
Email: michaelbia07@gmail.com

1. INTRODUCTION

Soil-transmitted helminth infection remains a major problem in developing countries. More than 1.5 billion people are infected, or 24% of the world's population. The infection is widespread in tropical and subtropical regions, with the highest prevalence in sub-Saharan Africa, the Americas, China, and East Asia (WHO, 2022). A survey conducted in Indonesia reported a Soil Transmitted Helminth (STH) prevalence of 61%. The case was dominated by primary school-age children due to poor personal hygiene (Lee & Ryu, 2019), (Ali, Zulkarnaini, & Affandi, (2016). Helminth species that are of global concern and are often found are Ascaris lumbricoides (roundworm), Trichuris trichiura (whipworm), and hookworm (Necator americanus and Ancylostoma spp., including A. duodenale and A. ceylanicum). Such infection is often found in areas with warm and humid climates, especially those with poor sanitation and personal hygiene (Parija, Meenachi Chidambaram, 2017). One of the important risk factors for hookworm transmission is using human feces as fertilizer and the habit of defecating on the ground. Ascaris lumbricoid generally infects people with poor access to environmental sanitation and personal hygiene and uses human feces as plant fertilizer. Trichuris trichiura is often found among patients who live in areas where human waste is used as fertilizer and people who like to defecate on the ground (Center for Desease Control and Prevention, 2022)

Several studies on STH reported that Ascariasis dominated the number of cases. A study conducted by Lee & Ryu, (2019) reported that Kalena Rongo Village, the poorest village in Southwest Sumba had a higher prevalence of STH: A. lumbricoides by 65.8% (279/424), T.trichiura by 60.4% (256/424), and hookworm by 53.5% (227/424). Furthermore, a study conducted in Southwest Sumba District found the highest prevalence of A. lumbricoides infection by 28.5%, followed by T. trichiura infection by 5.9% and mixed infection by 65.6%. A study conducted in Central Sumba showed A. lumbricoides infection by 30.0%, T.trichiura infection by 17.1% and mixed infection by 46.8%. A study on STH risk factors conducted by Rahmawati et al., (2020) proved that personal hygiene had a significant effect on the incidence of Ascaris lumbricoides and Hookworm infections among garden workers in Jember District. Furthermore, Dahal et al., (2019) reported that clean water supply, personal hygiene, environmental sanitation had an effect on the incidence of STH in Dad in Kowa Nigeria. Different fundings were reported by Kurscheid et al (2020) that the behavior of washing hands with soap after defecation did not affect the incidence of STH transmission. However, the traveling activities of the population to the fields significantly affected the incidence of STH transmission. The impact of STH infection was reported by Paun et al., (2019) in Southwest Sumba which showed that there was an effect of STH worm infection on anaemia among elementary school-age children. Feces examination among 105 children found Ascaris lumbricoides by 31.0%, Trichuris trichiura by 21.4%, Ancylostoma duodenale by 2.4%, Necator americanus by 7.1%, mixed infections of A. lumbricoides and T. trichiura by 38.1%.

South Central Timor is the area with the third largest poverty rate in East Nusa Tenggara by 26.64% (Badan Pusat Statistik Provinsi Nusa Tenggara Timur, 2022). In addition, South Central Timor also contributed to the highest stunting rate in East Nusa Tenggara by 48.3% (Kementerian Kesehatan Republik Indonesia, 2021). Previous study conducted by Paun et al (2021) among 160 elementary school-age children in Amanuban Barat Sub-District found that 14 (8.75%) children were infected with A. lumbricoides, 30 (18.75%) children were infected with Hookworm, and 2 (1.25%) children experienced mixed infections of the two species. In addition, 84 children suffered from stunting. The analysis concluded that worm infection increased the risk of stunting among elementary school-age children in Amanuban Barat, South Central Timor. However, none of the previous studies determined risk factors for STH

transmission. Therefore, researchers are interested to determine the factors regarding personal hygiene that increase the incidence of STH infection transmission among elementary school-age children in Amanuban Barat Sub-District, South Central Timor.

2. RESEARCH METHOD

This study applied a cross sectional design. This study was conducted in elementary schools in Amanuban Barat Sub-District, South Central Timor District from May to October 2021. The study samples consisted of 160 elementary school-age children who were selected using Multistage Random Sampling. The dependent variable was the incidence of STH infection obtained from the results of children's feces examination at the Parasitology Laboratory of Kupang Health Polytechnic, while the independent variable was personal hygiene obtained through interviews (defecation habit, use of footwear, washing hands with soap before eating, washing hands with soap after defecation, eating habit, drinking water habit, play on the ground habit, cutting nails habit, cleaning the house, food storage, snacking habit). Data were analyzed using multiple logistic regressions. The study had obtained approval from the school management, parents as well as the students involved, maintained confidentiality, anonymously and obtained the approval letter issued by the ethical committee of Kupang Health Polytechnic number: LB.02.03/1/0052/2021.

3. RESULTS AND DISCUSSION

This study was conducted in three elementary schools in *Amanuban Barat* Sub-District, South Central Timor District, namely the Nulle Inpres Elementary School and the GMIT Nulle Elementary School located in Tublopo Village and the Neonmat Inpres Elementary School located in Nulle village.

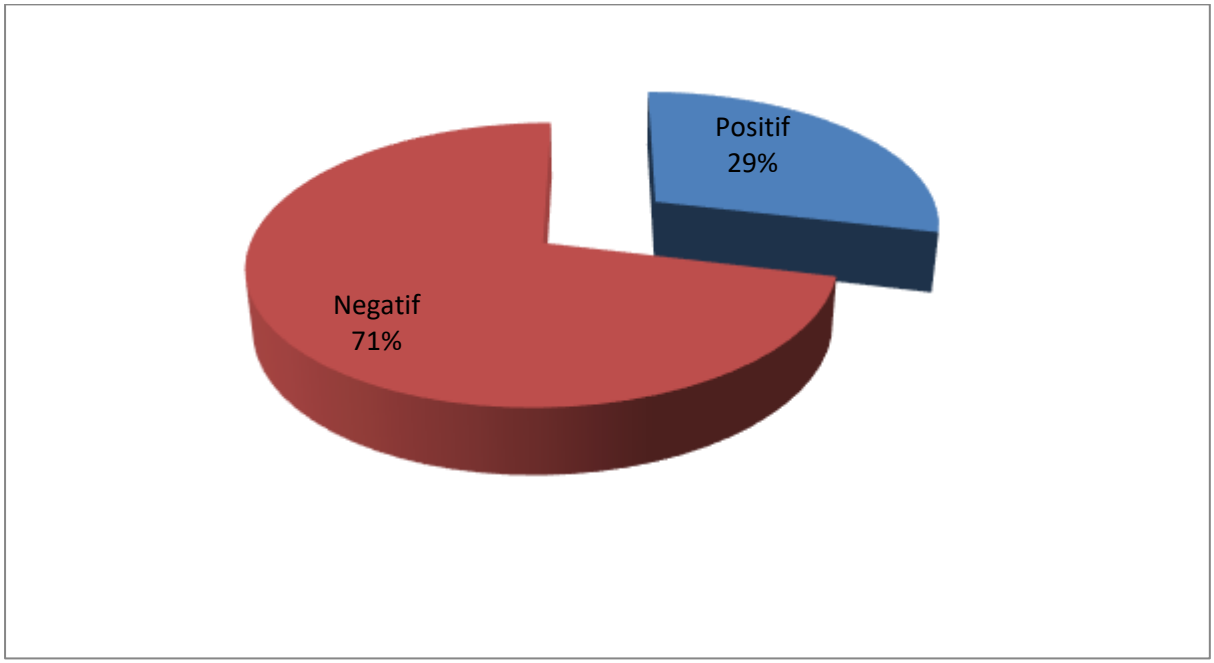

Figure 1. Laboratory Tests Results.

Figure 1 presents the results of laboratory tests. It was found that out of 160 elementary school-age children, there were 46 children (29.0%) were positive for STH infection and 71.0% were negative for STH infection. Types of worms based on the results of the examination are presented in the following figure:

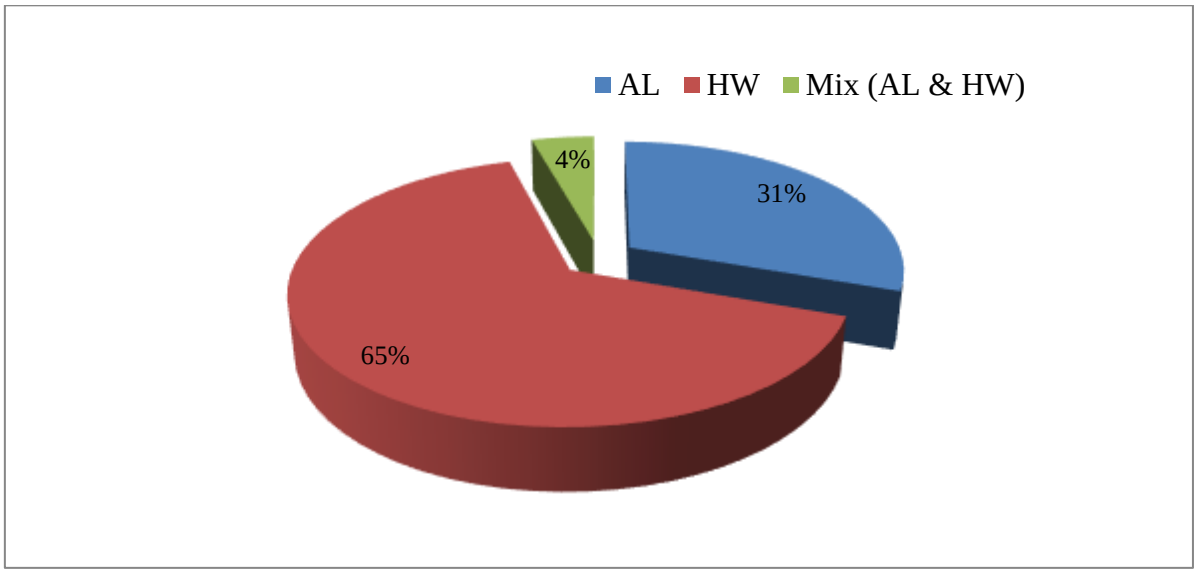

Figure 2. Types of Worms.

Figure 2 revealed that the most common type of worm was Hookworm (HW) by 65%, A. lumbricoides (Al) was found in 31.0% of cases and a mixture of HW and Al was found in 4.0% of cases. Description of STH infection among school-age children at three elementary schools is presented in the following figure:

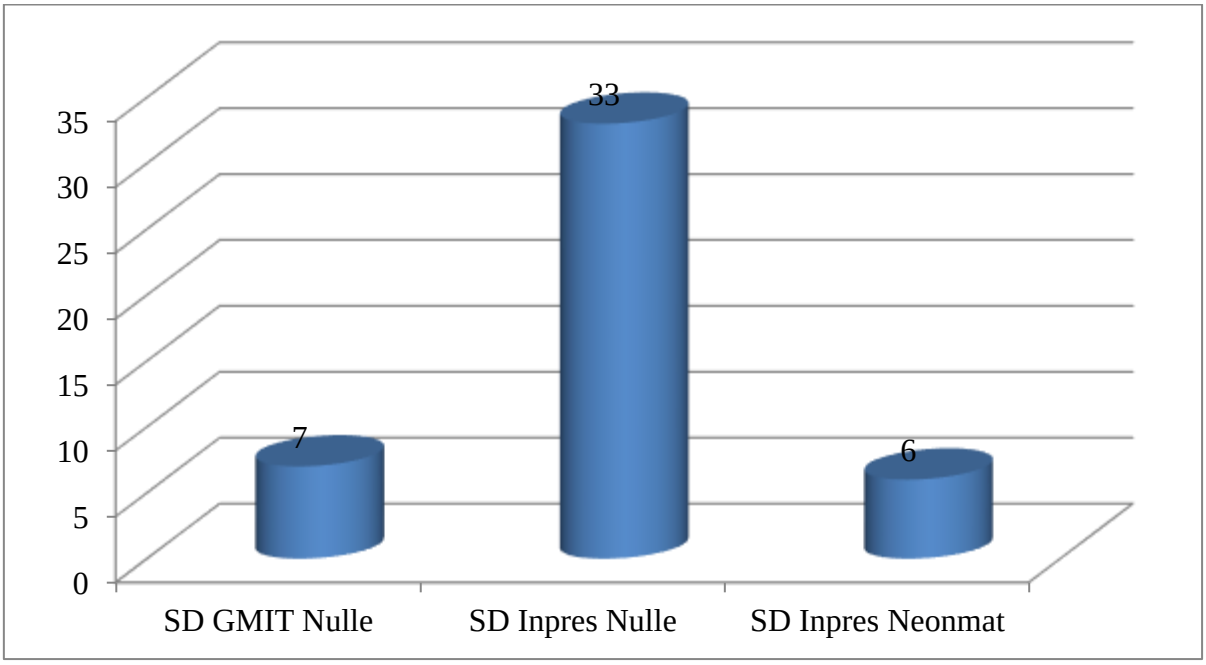

Figure 3. STH Infection by Elementary School.

Figure 3 Revealed that most of STH infection was found among 33 children (45.5%) at Inpres Nulle, Elementary School, among 7 children (22.6%) at GMIT Nulle Elementary School and among 6 children (10.3%) at Inpres Neonmat Elementary School.

Effect of Personal Hygiene on the Incidence of Soil Transmitted Helminth Infection. Data regarding personal hygiene was obtained through interviews with 160 children about

defecation habit, use of footwear, washing hands with soap after defecation, washing hands with soap before eating, eating habit, drinking water habit, playing on the ground, cutting nails, condition nails habit, food storage, and snacking habit. The effect of personal hygiene on the incidence of Soil Transmitted Helmints infection was analysed as presented in table 1 below:

Table 1. Effect of Personal Hygiene on STH Infection.

Personal Hygiene	STH Infection		Total	p-value	PR
	Positive	Negative			
Defecation habit					
On the ground	.28 (73,7%)	10 (26.3%)	38 (100%)	0.000	0.34
Latrine	18 (14.8%)	104 (85.2%)	122 (100%)		
Use of footwear					
No/Seldom	29 (50.0%)	29 (50.0%)	58 (100%)	0.000	0.57
Yes	17 (16.7%)	85 (83.3%)	102 (100%)		
Wash hands with soap before eating					
No/Seldom	31 (41.3%)	44 (58.7%)	75 (100%)	0.001	0,88
Yes	15 (17.6%)	70 (82.4%)	85 (100%)		
Washing hands with soap after defecation					
No/Seldom	31 (47.7%)	34 (52.3%)	65 (100%)	0.000	0.68
Yes	15 (15.8)	80 (84.2%)	95 (100%)		
Eating habit					
Uncooked/Raw	24 (92.3%)	2 (7,7%)	26 (100%)	0.000	0.19
Cooked	22 (16.4%)	112 (83.6%)	134 (100%)		
Water drinking habit					
Unboiled/Raw	27(96.4%)	1 (3.6%)	28 (100%)	0.000	0,212
Boiled/ gallon	19 (14.4%)	113 (85.6%)	132 (100%)		
Playing on the ground					
Yes	43 (37.1%)	73 (62.9%)	116 (100%)	0.000	2.64
No/Seldom	3 (6,8%)	41 (93.2%)	44 (100%)		
Cutting nails habit					
No/Seldom	39 (43.3%)	51 (56.7%)	90 (100%)	0.000	1.29
Yes	7 (10.0%)	63 (90.0%)	70 (100%)		
Nails condition					
Long/dirty	36 (41.4%)	51 (58.6%)	87 (100%)	0.000	1.21
Short/clean	10 (13.7%)	63 (86.3%)	73 (100%)		
Clean the house					
No/Seldom	33 (41.3%)	47 (58.8%)	80 (100%)	0.000	1.00
Yes	13 (16,3%)	67 (83.3%)	80 (100%)		
Food storage					
Open	27 (60.0%)	18 (40.0%)	45(100%)	0.000	0.39
Closed/Cupboard	19 (16.5%)	96 (83.5%)	115(100%)		
Snacking habit					
Yes	42 (42.9%)	56 (57.1%)	98 (100%)	0.000	1.60
No/Seldom	4 (6.5%)	58 (93.5%)	62 (100%)		

Table 1 revealed that there were still many children who defecated on the ground, had the habit of not using footwear when leaving the house, the habit of not washing hands with

soap before eating, the habit of not washing hands with soap after defecation, the habit of eating uncooked food, drinking raw water, habit of playing on the ground, rarely cutting nails, having long and dirty nails, rarely cleaning the house, having open food storage and there were still many children who often bought snacks around school. These habits were dominated by children with STH infection and had a significant effect on STH transmission. This was proven by the Chi-Square test with a *p* value of <α 0.05.

The Chi-Square test results showed that some of the habits of that may protect childre from STH transmission were defecation, using footwear, washing hands with soap before eating, the habit of washing hands with soap after defecation, eating raw food, the drinking boiled water, the habit of covering food/stored in a cupboard. This was proven from the PR value <1.00. Meanwhile, the habit of children who are at risk of causing STH transmission are the habit of playing on the ground, not/infrequently cutting their nails, long and dirty nails and eating habit. This was proven by the PR value of >1.00. The variables mentioned above can be further tested further using multiple logistic regression which can be seen in table 2 below.

Table 2. STH Infection Incidence Model.

Variable	B	p-value	OR	95% CI	
				Low	Upper
Defecation habit	-4.434	0.000	0.012	0.002	0.083
Washing hands with soap after defecation	1.968	0.031	7.158	1.201	42.673
Eating habit	-2017	0.038	0.133	0.020	0.893
Nails condition	1.661	0.064	5.264	0.911	30.428
Snacking Habit	-2.211	0.005	0.121	0.028	0.269

Table 2 describes the results of the multiple logistic regression test which presented the effect of defecation habit, washing hands with soap after defecation, eating habit, and snacking habit on STH infection among elementary school-age children. Habits that may be protective against the transmission of STH infection are proper defecation, eating cooked food, and not eating any snacks. Furthermore, children who were at risk of contracting STH infections did not was hands with soap after defecation as well as long and had dirty fingernails.

The probability of STH infection among elementary school-age children in *Amanuban Barat* Sub-District simultaneously influenced by defecation habit, washing hands with soap after defecation, eating habit, condition of fingernails and snacking habit. Soil-transmitted helminth infections are common in areas with a warm, humid climate and poor sanitation and hygiene (WHO, 2012). Worm eggs excreted with human feces can contaminate the soil and live in warm, moist soil. These will develop into infectious eggs, which can then infect humans through contamination of food, drink, cutlery and drinking (Center for Desease Control and Prevention, 2022)

The results of this study showed that 46 (29.0%) of 160 elementary school-age children were positive for STH. The dominant worm species was Hookworm by 65%, A. lumbricoides by 30.4% and a mixture of Hookworm and A.lumbricoides by 4.3%. The results of other different study found that Ascariasis was a dominant type found. Furthermore, a study conducted by Paun et al., (2019) in Southwest Sumba District among 105 elementary school-age children showed that the most common types of worms found were A. lumbricoides among 13 children (31.0%), T.trichiura among 9 children (21.4%), Ancylostoma duodenale in 1 child (2.4%), Necator americanus among 3 children (7.1%), and a mixture of A. lumbricoides and T. trichiura among 16 children (38.1%). A study conducted by Mau, & Mulatsih, (2017) in West Sumba and Central Sumba showed that 568 elementary school-age children (91.0%)

experienced helminth infection. In a study conducted in West Sumba District showed that the highest prevalence was A. Lumbricoides infection by 28.5%, followed by T. Trichiura infection by 5.9% and mixed infection by 65.6%. In addition, a study conducted in Central Sumba District showed that the highest prevalence was A. lumbricoides infection by 30.0%, followed by T. Trichiura infection by 17.1% and mixed infection by 46.8%. A study in Kupang District conducted by Susilawati & Smaut, (2017) in Batakte Kota Kupang found that out of 59 respondents, 7 children were positive for A. lumbricoides. A study conducted by Bria et al (2021) in children in Manusak Village, Kupang District found Ascariasis infection by 38.46% (50/80). Sinaga et al., (2014) found that there were 38% of Ascariasis infection among children in the Liliba subdistrict, Kupang City. Bia, (2019), reported high worm cases in Noelbaki Village, Kupang District, namely ascariasis by 5.06% and Enterobiasis by 30.04%. A study conducted in Timor Leste in Manufahi by Campbell et al., (2017) found that there was 24% of Ascariasis infection among preschool age children. The prevalence of ascariasis from the mainland of Flores, namely in Nangapanda Ende District was 58.8% (Djuardi et al., 2021). A study conducted by Lee & Ryu in (2019) reported Ascaris lumbricoides infection by 65.8%, T.trichiura infection by 60.4%, and Hookworm infection by 53.5%.

According to psycological theory proposed by Skiner in Notoatmodjo (2012), behaviour is a person's response or reaction to external stimuli (stimulus). Meanwhile, health behaviour is all activities of a person both observable and non-observable related to health and illness in maintaining and improving health. The habit of washing hands is one of the eight important indicators in the clean and healthy behaviour launched by the government (Kementerian Kesehatan Republik Indonesia, 2011). Children who rarely paid attention to hand hygiene were at a high risk og being infected with behaviour- and sanitation-based diseases such as helminthiasis.

This study found that the habit of defecating, washing hands with soap after defecation, eating habit, condition of nails and snacking habit had a simultaneous effect on the incidence of STH infection. Almost the same thing was also found by Avokpaho et al., (2021) that the habit of defecation on the ground was closely related to cases of ascariasis and Hookworm infection. Furthermore, a study conducted by Rahayu et al, (2020) in South Kalimantan found that the behavior of washing hands with soap before eating and after defecation had a significant relationship with the incidence of ascariasis and enterobiasis infections. A study conducted by Dhaka et al, (2019) in Haryana found that the habits of washing hands and washing fruit or vegetables were very influential for the incidence of STH infection. Pasaribu et al, (2019) emphasized that washing hands with soap and taking deworming medicine 2 times a year had a significant effect on reducing cases of helminthiasis among elementary school-age children in plantation areas in North Sumatra. He also found that the habit of washing hands and wearing footwear were very closely related to the incidence of STH infection among children under 12 years of age. Different finding was shown in the study conducted by Kurscheid et al, (2020) which showed that the influential factors were employment status, ground floor condition, and goat ownership.

Another study among elementary school-age children in Ethiopia revealed that personal hygiene affected the incidence of hookworm infection (20%). The influential factors were the habit of using footwear, washing hands before eating and dirty fingernails (Tiruneh et al., 2020). A study conducted in Malaysia by Nisha et al., (2020) found a relationship between hand washing habit and the habit of using footwears very closely with the incidence of STH infection among children under 12 years of age. Different finding was presented by a study conducted by Kurscheid et al, (2020) and Bisara and Mardiana, (2010) which showed that the influential factors were employment status, ground floor condition, goat ownership, and personal hygiene.

The findings of this study emphasize the need for sustainable STH eradication together with other steps such as increasing the knowledge of elementary school-age children and elementary school teachers about the dangers of STH infectious diseases, carrying out a movement to wash hands with soap before eating and after defecating, eating food, eating washed fruits, cleaning nails and cutting fingernails and also teaching how to choose healthy and safe snacks. It is necessary to identify worm eggs on fingernails, snacks around elementary school, vegetables eaten raw, fruits that are usually consumed by elementary school-age children. Mass and routine administration of deworming drugs is required by the South Central Timor District Health Office.

4. CONCLUSION

This study revealed that elementary school-age children were very vulnerable to Ascariasis and hookworm infections. The probability of STH infection among elementary school-age children in Amanuban Barat Sub-District was simultaneously influenced by defecation habit, washing hands with soap after defecation, eating habit, condition of fingernails and snacking habit.

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RESEARCH **Open Access**

The Effect of Promotion with Flipchart Media on Toothbrush Knowledge Levels of Maintaining Dental and Oral Health in Children

Wiworo Haryani[1a*], Siti Sulastri[1b]

[1] Department of Dental Health, Politeknik Kesehatan Kementerian Kesehatan Yogyakarta, Yogyakarta, Indonesia

[a] Email address: haryaniwiworo@gmail.com
[b] Email address: sitisltr7@gmail.com

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Abstract
Elementary school children possess a high risk of dental caries. Based on the Basic Health Research 2018 data, the percentage of dental and oral health problems in the 10–14 year age group is 41.4%. Efforts to reduce dental and oral health problems in children are conducted by health promotion which can be implemented with flipchart media. Flipchart media can be an alternative; hence, elementary school children are able to better understand the importance of knowledge on maintaining oral health. The objective of this study is to determine the effect of promotion with flipcharts on the level of toothbrush knowledge of maintaining oral and dental health in children. This type of research was a quasi-experimental with a pretest-posttest design with control group. The research location is at SD Muhammadiyah Banyuraden, Gamping, Sleman, Yogyakarta. The research sample is 80 children aged 8 to 12 years. The sampling technique employed purposive sampling. The influence variable is promotion with flipchart, and the affected variable is the level of knowledge in maintaining oral health. The treatment and control groups performed pretest and posttest to determine the level of knowledge of dental and oral care in elementary school children. The results of the Wilcoxon Signed Rank Test analysis demonstrated that before and after promotion, the two groups owned a significant difference in toothbrush knowledge level (p=0.00). The results of the Mann Whitney test analysis display that the mean rank of children's toothbrush knowledge level using flipchart media is greater than PowerPoint media, which is 58.03> 20.98 so that it can be stated that the use of flipchart media is more effective than PowerPoint media. The conclusion of the study is that promotion by employing flipchart media can increase the level of toothbrush knowledge on maintaining oral and dental health in children.

Keywords: Promotion, Flipchart, Maintaining Oral Health.

Corresponding Author:

Wiworo Haryani
Department of Dental Health, Politeknik Kesehatan Kementerian Kesehatan Yogyakarta, Yogyakarta, Indonesia
Email: haryaniwiworo@gmail.com

1. INTRODUCTION

The oral health of the Indonesian people still requires serious attention from health workers, both dentists and dental or oral therapists (Femala et al., 2012). Dental and oral health problems of the Indonesian people can be identified based on basic health research data in 2018, in which the percentage of the Indonesian population who owns dental and oral health problems increased for the 5–9-year age group by 54.0%, while in the 10–14-year age group it was 41. ,4% (Kementerian Kesehatan Republik Indonesia, 2019).

Health promotion aims to increase an individual's knowledge and awareness so that they participate actively in enhancing the degree of dental and oral health regardless of age (Albino et al., 2012), (Yufiarti, Y., 2019). School age is an essential age for acquiring health behaviors and practices. Behavior that generated during the school period will continue for the future (Nurhidayat et al., 2012). Health promotion aims to create changes in individual behavior in fostering and maintaining healthy behavior, as well as playing a pivotal role in realizing optimal health degrees (Batras et al., 2016).

Efforts to maintain dental health and foster dental health for school-age children require special attention because at this age, children are experiencing a process of growth and development (Purnama et al., 2019). The condition of children's teeth will affect the development of dental health in adulthood; hence, dental and oral health education for children from an early age is tremendously necessary (Prasko et al., 2016).

Various supporting media can also be employed by health workers in public health promotion, one of which is flipchart (Harsismanto & Sulaeman, 2019). Flipcharts are sheets of paper resembling a calendar, containing abstracted material and learning messages in the form of images, text, and graphics (Nugraheni et al., 2017). Flipchart is utilized by turning the sheets of the image one by one (Koch & Yuliana, 2021).

The advantage of flipcharts is that they are simple and effective print media in conveying information, making it easier for educational targets to understand the content of the material provided (Adeniyi et al., 2017). Flipchart media consists of sheets of paper bundled with ring binding so that they can be reversed, which contain messages and are explained with pictures that explain a topic in sufficient detail so that the delivery of information becomes concise and practical accompanied by direct explanations (Yandi et al., 2020). In general, each particular topic of discussion always consists of 2 pages, one illustrated page with limited text facing the participants while the page facing the facilitator contains key information, so that the presentation of information by extension workers using flipchart media tools can be more optimal (Febriany et al., 2021).

The provision of health promotion using flipchart media is frequently accompanied by a lecture method (Bagaray et al., 2016). Methods and media in health education can increase children's motivation to act or behave in order to meet their life needs (Larasati et al., 2015). The objective of increasing motivation is to encourage children to perform behavioral changes in maintaining and enhancing their health (Notoatmojo, 2010).

Based on this background of the study, the researchers conducted a study aimed at identifying the effect of dental and oral health counseling with flipchart media on the level of knowledge of maintaining oral and dental health in elementary school students. This research is limited to promotive efforts associated with the implementation of dental and oral health care services.

The effect of flipchart as a medium for promoting dental and oral health for researchers, can be utilized as a reference in the implementation of promotive activities, and can increase toothbrush knowledge of maintaining oral health. Hence, it is able to change the elementary school students' degree of dental and oral hygiene to the better. The objective of this study is

to determine the effect of dental and oral health counseling using flipcharts on the level of knowledge of brushing teeth for elementary school students. The significances of the results of this study are as a source of information and reference material for further research on dental and oral health promotion media.

2. RESEARCH METHOD

The type of research conducted by the researcher is a quasi-experimental or quasi-experimental with a pretest-posttest design with a control group. This design was conducted by administering a questionnaire to determine the initial knowledge (pretest). Then, intervention was performed in both groups, and the measurements were utilized by performing a questionnaire to determine the final knowledge (posttest). The study was conducted on fourth and fifth grade students at SD Muh. Banyuraden from June 2021 to November 2021. The sample consisted of 80 students who fit the inclusion criteria in the population, and were divided into two groups, which were 40 students from the experimental group and 40 students from the control group. The sampling technique was conducted with the purposive sampling (Sugiyono, 2013).

Inclusion and exclusion criteria to determine samples that can be and cannot be used encompass: 1. Inclusion criteria, encompassing; a. Students aged 10-11 years, b. Fourth and fifth grade students of SD Muh Banyuraden, c. Willing to be a respondent, d. Students are cooperative during research. 2. Exclusion Criteria, incorporating; a. Students suffer from illness when the research is conducted, b. Not allowed by parents

The tools and materials employed include: 1. Writing utensils, 2. Flipcharts, 3. Pretest – Posttest questionnaires on tooth brushing knowledge, 4. Informed Consent Sheet. The research data were first examined for normality by employing the Kolmogorov-Smirnov test and homogeneity test using the Levene test with homogeneous results. The data were analyzed by employing the Wilcoxon Signed Rank Test to determine the difference in the level of toothbrush knowledge before and after the intervention of each group. Mann Whitney test was also administered to determine the effect of promotion with flipchart on the level of toothbrush knowledge of maintaining oral health in both groups (Sugiyono, 2013). This research has received a certificate of ethical research feasibility (Ethical Clearance) from the Health Research Ethics Commission no. e-KEPK/POLKESYO/0588/VI/2021.

3. RESULTS AND DISCUSSION

Table 1. Frequency Distribution of Respondents by Age and Gender

Characteristics of Respondents	**n**	**Percentage (%)**
Age Group (Years)		
10	38	47,5
11	42	52,5
Total	80	100
Gender		
Man	39	48,8
Woman	41	51,2
Total	80	100

Table 1 displays that the largest number of respondents was 11 years old, that are 42 children (52.5%). The number of respondents based on gender was mostly female, which are 41 children (51.2%). Nurhidayat et al. (2012) explained similarly that the age of 10-11 years is an age group which is significantly critical for the occurrence of dental caries as this period is a transition period for changing deciduous teeth to permanent teeth. At this age, the prevalence of dental caries reaches 60%-80% (Abdullah, 2018).

Table 2. Toothbrush Knowledge Level of Respondents before and after Promotion with Flipchart.

Toothbrush Level Knowledge	***Flipchart***					
	Pretest		***Posttest***		**Deviation**	
	n	**%**	**N**	**%**	**n**	**%**
High	3	7,5	34	85	35	87,5
Moderate	4	10	6	15	2	5
Low	33	82,5	0	0	-33	-82,5
Total	40	100	40	100	0	0

Table 2 displays that the majority of respondents had a poor level of toothbrush knowledge before counselling with Flipchart, which are 33 children (82.5%), and most respondents after counselling with Flipchart had a high level of knowledge, that are 34 children (85%). According to Gayatri (2017), the low initial knowledge of children on dental and oral health is due to low awareness of the importance of maintaining dental and oral health in children.

Table 3. Toothbrush Knowledge Level of Respondents before and after Promotion with Power Point

Toothbrush Knowledge Level	***PowerPoint* (PPT)**					
	Pretest		***Posttest***		**Deviation**	
	n	**%**	**n**	**%**	**N**	**%**
High	0	0	3	7,5	3	7,5
Moderate	21	52,5	37	92,5	16	40
Low	19	47,5	0	0	-19	-47,5
Total	40	100	40	100	0	0

Table 3 displays that the majority of respondents had moderate toothbrush knowledge before counselling with PPT, which are 21 children (52.5%), and 37 children (92%) after counselling with PPT. According to Nurhidayat (2012), the process of health promotion by involving more senses will be more easily accepted and remembered by students. Health promotion will be more effective and the results will be optimal when administering the right media and methods (Nurhidayat, Tunggul & Wahyno., 2012).

Table 4. Cross Tabulation Based on Post Test on Extension with Flipchart and PPT.

Toothbrush Knowledge Level	***Flipchart***		**PPT**			
	Posttest		***Posttest***		**Deviation**	
	n	**%**	**n**	**%**	**n**	**%**
High	34	85	3	7,5	-31	-77,5
Moderate	6	15	37	92,5	31	77,5
Low	0	0	0	0	0	0
Total	40	100	40	100	0	0

Table 4 illustrates that most respondents possess a high level of toothbrush knowledge after counselling with Flipchart, that are 34 children (85%), and 37 children (92.5%) own a moderate level of knowledge after counselling with PPT. These results are comparable to research conducted by Kantohe et al., (2016) about the comparison of the effectiveness of

dental health education by employing video media and flip charts on increasing children's dental and oral health knowledge with a p value = 0.000, thus, it can be concluded that there is an effect of health promotion with flip chart media in enhancing children's oral and dental health.

Table 5. Average Toothbrush Knowledge Level Scores before and after Promotion Using Flipchart and PPT

Knowledge Level	Mean		Deviation
	Before	After	
PPT	6.38	8.68	2,3
Flipchart	8.50	13.13	4,63

Table 5 presents the difference between before and after being provided counselling by employing PPT media which is 2.3, while the difference between before and after being provided counselling by administering Flipchart is 4.63. According to Reis et al., (2014), the use of media in health promotion aims to clarify dental health education, thus, it is not too verbalistic. Health promotion media are also expected to make activities more attractive to educational targets so as to foster motivation to enhance dental and oral health (Nurmalasari et al., 2021). The results of the statistical test of differences in toothbrush knowledge levels before and after promotion by employing the Wilcoxon difference test are as follows:

Table 6. Wilcoxon Test Analysis Results

Pretest - Posttest	n	Positive Rank	Ties	Negative Rank	p-value
Flipchart	40	40	0	0	0,00
PPT	40	39	1	0	0,00

The results of the Wilcoxon test uncovered a significant value of p=0.00 so that there was a significant difference between the level of toothbrush knowledge before and after the promotion of maintaining oral and dental health in elementary school students (Table 6).

The results of the Wilcoxon test analysis (Table 6) demonstrate that there are differences in the level of toothbrush knowledge of maintaining oral and dental health in children before and after promotion. There were 40 children in the flipchart group and 39 children in the PPT group with better dental and oral health knowledge results than before. There was 1 child in the PPT group who possessed permanent knowledge, and none had lower knowledge after promotion.

The results of the Wilcoxon test displayed that there was a significant effect between before and after the promotion of maintaining oral health (p=0.00). The results of the average posttest > pretest presented that the promotion of maintaining oral health using both flipchart and PPT media could increase the level of toothbrush knowledge in elementary school children. This result is similar to the research by Sitanaya, (2019) that the provision of Dental Health Education by employing flipchart media is effective in increasing the level of toothbrush knowledge of children's dental and oral health.

Table 7. Results of the Mann-Whitney Test Analysis

Group	n	Mean Rank	p-value
Flipchart	40	58,03	0,00
PPT	40	20,98	0,00

Table 7 presents that the results of the analysis using the Mann-Whitney test possess a significance of p=0.00 which means that there is a significant difference between promotion with Flipchart media and promotion with PPT on the level of toothbrush knowledge of maintaining oral health in children. The Flipchart group has an average value (mean rank) of

58.03 > 20.98 for the PPT group. It illustrates that promotion with Flipchart media is more influential than promotion with PPT media.

The results of the Mann-Whitney test analysis (Table 7) display that there is an effect of promotion with Flipchart and PPT media on the level of toothbrush knowledge of maintaining oral and dental health in children (p=0.00). Promotion with Flipchart media is more influential than PPT media with an average value of 58.03>20.98. It is because Flipchart media makes children more active and interested in learning. Children are more concerned on learning and with pictures on Flipchart media make it easier for children to remember and understand; hence, it can be recorded in the children's' brain in the long-term memory (Kantohe et al., 2016).

Reinforced by Utami et al. (2021), stated that flipchart is an educational tool that is very simple and effective enough to be used in conveying information, including health messages such as dental health education. Flipchart media can increase knowledge of educational objectives, because it is able to present health messages in a concise and practical manner accompanied by direct explanations from the carrier of the material (Zulfikri & Lisnayetty, 2020). The explanation given will clarify and make it easier to capture the contents of the given dental health education material. Presentation of information using flipchart media tools in this study used interesting pictures, as well as concise and clear sentences of educational objectives (Pratiwi et al., 2019).

The findings are consistent with research conducted by Debrin et al. (2020), which discovered that Flipchart media counseling is more effective at changing actions from negative to positive, can enhance children's memory, and can expose children to a variety of images, colors, and shapes of characters that elementary school students like. This research is also in accordance with the study by Arista et al. (2021) who stated that the use of flipchart media was effective in enhancing dental and oral hygiene in elementary school students. Others Mulyaningtiyas et al. (2020) proved that flipchart media is effective as a learning aid that can improve the learning outcomes of elementary school students.

4. CONCLUSION

The conclusion from the results of this study is that there is an effect of promotion with Flipchart media on the level of toothbrush knowledge on maintaining oral health for elementary school children. Promotion of toothbrush knowledge on maintaining oral health in elementary school children using flipchart media is more effective than PPT media. It is recommended that dental health workers can use flipchart media as a media for promoting dental health and for further researchers it is hoped that they will examine other factors related to dental and oral health in elementary school students using Flipchart technology, such as cavities, tartar. teeth, and nutritious foods that can damage teeth.

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RESEARCH **Open Access**

Comorbid Description and Neutrophil Lymphocyte Ratio in COVID-19 Patients (Suspect and Confirmed Patients)

Subrata Tri Widada[1a], Marta Atik Martsiningsih[1b], Bambang Supriyanta[1c], Sistiyono[1d], Suyana[1e], Siti Nuryani[1f], Budi Setiawan[1,2g*], Dwi Sulistyowati[3h], Muji Rahayu[1i]

[1] Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Yogyakarta, Yogyakarta, Indonesia
[2] Pusat Unggulan IPTEK Inovasi Teknologi Kesehatan Masyarakat, Politeknik Kesehatan Kementerian Kesehatan Yogyakarta, Yogyakarta, Indonesia.
[3] General Hospital of Cilacap Region, Cilacap, Central Java, Indonesia

[a] Email address: subrata.analis@gmail.com
[b] Email address: atikmartsiningsih@gmail.com
[c] Email address: bsupriyanta@gmail.com
[d] Email address: sistiyono@gmail.com
[e] Email address: adiamarta@gmail.com
[f] Email address: suryaniajeng.2014@gmail.com
[g] Email address: budi.setiawan@poltekkesjogja.ac.id
[h] Email address: uwiq16@gmail.com
[i] Email address: hayuningpuji@gmail.com

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Abstract

Neutrophil Lymphocyte Ratio (NLR) is a laboratory available as a marker used for the evaluation of systemic inflammation, NLR is a significant predictor and is a critical prognosis for COVID-19 infection and can serve as a useful factor to reflect the intensity of the imbalance of inflammation and immune response in COVID-19 patients. This study aims to determine the difference in NLR values in negative and confirmed COVID-19 patients and description for comorbid for both. This study is an analytic observational study with a cross-sectional design. The study sample was 423 suspected COVID-19 patients at hospitals in Cilacap district for the period in March – October 2020. The data obtained were analyzed descriptively and using the fisher-exact test. In these results from suspected patients with negative COVID-19, lung illness were present 31.8%, viral infections 22.9%, other respiratory disorders 6.1%, diabetes mellitus 4.7%, and anemia 4.7%. Whereas suspected patients with confirmed COVID-19 were, without comorbid diseases (40.2%), lung disease (12.4%), diabetes mellitus (7.7%), hypertension (6.2%), and other respiratory illnesses (5.2%). The mean of NLR in confirmed patients is 3.57 but not any difference between negative and confirmed patients COVID-19, but there's any a relationship between NLR and ARDS conditions.

Keywords: NLR, RT-PCR, COVID-19.

Corresponding Author:

Budi Setiawan
Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Yogyakarta, Yogyakarta, Indonesia.
Email: budi.setiawan@poltekkesjogja.ac.id

1. INTRODUCTION

In December 2019, a case of pneumonia with an unknown cause emerged in Wuhan, Hubei Province, China. The first case was linked to a fish market in Wuhan (Rothan & Byrareddy, 2020), (Guo et al., 2020). Five patients were hospitalized from 18 December to 29 December 2019 with symptoms of fever, cough, and dyspnea accompanied by complications of Acute Respiratory Distress Syndrome (ARDS) (Ren et al., 2020).

Historically, the majority of investigations on circulating immune cells in disease have centered on the examination of peripheral blood mononuclear cells, ignoring neutrophils and other granulocytes. Consequently, our understanding of the most numerous and technically challenging subpopulation of immune cells in the blood is lagging. Recent breakthroughs in single-cell omics technology have facilitated the study of this cell population in humans, particularly in diseased circumstances, challenging the notion that neutrophils are a homogeneous population of short-lived cells. Granulocytes, which are part of the innate immune system, are among the first cells recruited to a site of infection. They play a crucial role in determining the first response to an insult and in mediating between the innate and adaptive arms of the immune system. However, if not adequately controlled, the potent effector actions of these cells can cause tissue harm (Jaillon et al., 2020), (Xie et al., 2020), (Ballesteros et al., 2020), (Liew & Kubes, 2019).

Neutrophilia is an expression of a cytokine storm and hyperinflammatory state that has an important pathogenetic role in COVID-19 and related infections such as SARS. Lymphopenia commonly found in patients with COVID-19 represents a compromised immune system against the virus (Frater et al., 2020), (Henry et al., 2020). Neutrophil Lymphocyte Ratio (NLR) is one of the necessary parameters for the prognosis of infection, inflammation, and some types of cancer (Retnoningrum et al., 2018), (Wibisana et al., 2019). NLR is a significant predictor of and a critical prognosis for COVID-19 (Liu et al., 2020), infection and may serve as a useful factor to reflect the intensity of the imbalance of inflammation and immune response in COVID-19 patients (Liu et al, 2020).

Since the onset of the COVID-19 pandemic, substantial data has emerged indicating that neutrophils play a key role in the pathogenesis, particularly in individuals with severe illness histories. Neutrophils were once thought to be a very uniform cell type, but recent research has shown their remarkable transcriptional and functional variety as well as their developmental pathways (Reusch et al., 2021). This research is essential for a better understanding of the different elements of neutrophil participation not just in confirmed COVID-19 patient but in negative cases too. This study aims to determine the difference in NLR values in negative and confirmed COVID-19 patients.

2. RESEARCH METHOD

This study is an analytic observational study, with a cross-sectional design. The research sample was 423 suspected COVID-19 patients who were examined for complete blood using the Hematology Analyzer, then examined by RT-PCR using samples taken from nasopharyngeal and oropharyngeal swabs at hospitals in Cilacap Regency in March - October 2020, this research was have ethical clearance statement from Commission Ethic for Health research of Health Polytechnic of Yogyakarta (e-KEPK/POLKESYO/0571/IX/2020). The data used are secondary data obtained from suspected COVID-19 patients with 214 negative patients and 209 confirmed patients. The secondary data obtained were analyzed descriptively and tested with fisher-exact.

3. RESULTS AND DISCUSSION

Table 1 describe that more man patients are infected with COVID-19 compared to women, namely 105 (50.2%) man while 104 (49.8%) women. This result is in line with Hidayati's research (2020) where man dominate the population with confirmed COVID-19, which accounts for more than half of the total number of those who have been confirmed (Susilo et al., 2020), during this pandemic period, women are more disciplined in undergoing health protocols such as implementing physical distancing, diligently washing hands, and using masks compared to with men (Hidayati, 2020). Male was the strongest predictor of increased plasma ACE-2 concentrations. This suggests that man have higher ACE-2 levels, and is consistent with a poorer prognosis in man with heart failure (Chairani, 2020). Meanwhile, from the distribution of the age group of COVID-19 patients, the highest age range was 46-59 years with 69 patients (33%) and the lowest was 0-5 years with 2 patients (1%). In elderly, the risk of various disorders involving the immune system will increase, for example the risk of suffering from autoimmune diseases, malignancies, so that it will be easier to be infected by this disease (Oudit & Pfeffer, 2020). Another research, show that the most severe COVID-19 effects are observed in older adults with various co-morbidities and individuals with complex underlying health issues (McMichael et al., 2020).

Table 1. Distribution of confirmed COVID-19 patients by age group and sex.

Age Group (Years)	**Frequency (%)**		**Total**
	Man	Women	
0-5	2 (1 %)	0 (0%)	2 (1%)
6-18	13 (6.2%)	12 (5.8%)	25 (12%)
19-30	13 (6.2%)	12 (5.8 %)	25 (12%)
31-45	26 (12.4%)	25 (12 %)	51 (24,4%)
46-59	29 (13.9%)	40 (19.1%)	69 (33%)
≥ 60	22 (10.5%)	15 (7.2%)	37 (17.7%)
Total	**105 (50.2%)**	**104 (49.8%)**	**209 (100%)**

Table 2. Overview of NLR in negative and confirmed COVID-19 patients.

	Mean	**Median**	**Min**	**Max**	**SD**	**p-value**
Negative	4.85	2.86	0.09	31.0	5.55	0.219
Confirmed COVID-19	3.57	2.41	0.21	30.3	3.53	

The average NLR in COVID-19 confirmed patients is 3.57 with a significance value of 0.219, which means there is no difference between the NLR value in COVID-19 negative and positive patients. According to (Liu et al., 2020) the limit of normal value or cut off for NLR in COVID-19 patients is 3.13 (Liu et al., 2020). In this research range of NLR values is very wide because this study uses all samples that meet the inclusion and exclusion criteria without eliminating factors that can affect immune mechanisms such as age (Oudit & Pfeffer, 2020). While in this study using patient data from 0 years of age to 60 years and in the study Yang et al., (2020) stated that NLR increased proportionally with increasing age (Yang et al., 2020).

Table 3. NLR of confirmed COVID-19 patients with non-ARDS and ARDS conditions

		Non ARDS		**ARDS**		**Total**		**p-value**
		Freq	**Percentage %**	**Freq**	**Percentage %**	**Freq**	**Percentage %**	
NLR Value	Normal	131	98.5	2	1,5	133	63,6	0.001
	Non-normal	66	86.8	10	13.2	76	36.1	
	Total	197	94.3	12	5.7	209	100	

In table 3, the results of the Fisher-exact test for analysis the NLR values of confirmed patients with non-ARDS comorbid conditions compared to ARDS obtained a significance value of 0.001 (<0.05), which means that there is a relationship between NLR values and ARDS conditions. The results of this study are the same with Liu et al., (2020) stating that NLR is a predictive factor for predicting the early stage of COVID-19-infected patients who are likely to develop critical illness. NLR may be a reliable marker for evaluating the severity of COVID-19 disease (Liu et al., 2020). Lymphocyte count may be useful for establishing the early diagnosis of ARDS in COVID-19 patients (Peng et al., 2020).

In severe COVID-19 patients are able to produce very high amounts of other proinflammatory cytokines in the peripheral blood, namely GM-CSF, IL-1ß, IL-2, IL-6, IL-7, IL-10, IP-10, MCP-1 and IL-4, which have the potential to cause a cytokine storm. The researchers found that in the lungs of COVID-19 patients with severe severity developed a cytokine storm that made the patient's condition very weak, severe and even death (Tarigan & Arum, 2020).

Table 4. Overview of comorbid disease in suspected COVID-19 patients who are negative, confirmed and died.

Diseases	**Frequency (%)**		
	Negative	**Confirmed**	**Died**
Diabetes Melitus	10 (4.7%)	16 (7.7%)	4 (40%)
Hypertension	5 (2.3%)	13 (6.2%)	0 (0%)
Lung Disease	68(31.8%)	26 (12.4%)	3 (30%)
Hearth Diseases	2 (0.9%)	2 (1%)	0 (0%)
Kidney Diseases	3 (1.4%)	0 (0%)	0 (0%)
Other breathing problems	13 (6.1%)	12 (5.7%)	1 (10%)
HIV & TB	2 (0.9%)	0 (0%)	0 (0%)
Dispepsia	3 (1.4%)	3 (1.4%)	0 (0%)
Myalgia	1 (0.5%)	2 (1%)	0 (0%)
Dermatitis	0 (0%)	1 (0.5%)	0 (0%)
Virus Infection	49 (22.9%)	1 (0.5%)	0 (0%)
Septic Shock	1 (0.5%)	0 (0%)	0 (0%)
Pregnancy	6 (2.8%)	0 (0%)	0 (0%)
Anemia	10 (4.7%)	1 (0.5%)	1 (10%)
Hipoksia	1 (0.5%)	0 (0%)	0 (0%)
Myelitis	1 (0.5%)	0 (0%)	0 (0%)
Ischemia	1 (0.5%)	0 (0%)	0 (0%)
Gastroenteritis	1 (0.5%)	0 (0%)	0 (%)
Headec	1 (0.5%)	0 (0%)	0 (0%)
Depression	0 (0%)	1 (0.5%)	0 (0%)
Diabetes Melitus & CHF	0 (0%)	1 (0.5%)	0 (0%)
Diabetes Melitus & HT	0 (0%)	6 (2.9%)	0 (0%)
No commorbid	16 (7.5%)	84 (40.2%)	0(0%)
Not Any Data	20 (9.3%)	40 (19.1%)	1 (10%)
Total	214 (100%)	209 (100%)	10 (100%)

In table 4, it can be seen that the comorbid conditions of suspected patients who were negative for COVID-19 were lung disease by 31.8%, viral infections 22.9%, other respiratory disorders 6.1%, diabetes mellitus 4.7% and anemia 4. 7%. Meanwhile, the comorbid conditions

of suspected patients with confirmed COVID-19 were in the highest order without co-morbidities (40.2%), lung disease (12.4%), diabetes mellitus (7.7%), hypertension (6.2%) and other respiratory disorders (5.7%). This lung disease consists of pneumonia, tuberculosis, bronchitis, Chronic Obstructive Pulmonary Disease (COPD), asthma and Community-acquired Pneumonia (CAP). Infectious diseases consist of Dengue Hemorrhagic Fever (DHF), HIV, other viruses, dengue fever, herpes, urinary tract infection, cellulitis, diapers and coushing diseases. As for other respiratory disorders consist of flu, pharyngitis, ARDS, acute upper respiratory failure, ARI, common cold, cough and shortness of breath. Based on Yang et al., (2020), Fever occurred in only 43.8% of patients on initial presentation and developed in 83.4% after hospitalization (Yang et al., 2020). Based on research by Sun (2022), the most commonly characteristics of COVID-19 are fever, cough and abnormal chest computed tomography (CT) (Sun et al., 2020). This highly transmittable disease causes pneumonia and other severe respiratory illnesses similar to SARS and MERS (Louis-Jean & Aime, 2020). Such patients may be missed if the surveillance case definition focused heavily on fever detection. Significantly high frequencies of severe cases were observed in patients with diabetes or hypertension. According Peng et al., (2020) stated that NLR has been proven as a marker of diagnostic information and disease severity in pneumonia and bacteremia (Peng et al., 2020).

An increase in NLR indicates an increase in pro-inflammatory cytokines. NLR values can increase in cardiovascular disease, malignancy, diabetes mellitus, and chronic kidney failure. The NLR value of TB patients is higher than normal people. When compared with patients with sarcoidosis, the NLR value of TB patients was higher, but still lower than that of patients with bacterial pneumonia (Peng et al., 2020). Various diseases that cause other chronic inflammation such as diabetes mellitus, cancer, hypertension, and smoking can cause an increase in NLR which is thought to be a cellular response due to endothelial dysfunction (Yang et al., 2020). Low levels of albumin (75.8%, 95% CI 30.5–100.0), high C-reactive protein (58.3%) and high lactate dehydrogenase (LDH) (57.0%) were the most prevalent laboratory results in patients with lymphopenia during the clinical trial. High-Erythrocyte Sedimentation rate (ESR) (41.8%) and low lymphocyte count (43.1%) were also found to be concerning (Guan et al., 2020), (Biscayart et al., 2020), (Huang et al., 2020).

In Indonesia, the majority of patients were male, 30-49 years old, and accompanied by hypertension, diabetes, and heart disease (Sutaryono et al., 2020). Patients who died in this study had a history of diabetes mellitus as much as 40% as shown in table 4. COVID-19 patients with diabetes mellitus had a very severe inflammatory response. This is because COVID-19 causes severe lung dysfunction and inflammation. The entry port of this virus is a special surface glycoprotein on ACE2, the spike. ACE2 is abundant in type II alveolar cells of the lungs. If the amount of ACE2 in COVID-19 patients is excessive, the severity of the disease suffered by the patient also increases, such as can cause ARDS, damage to the liver, heart, kidneys, and even cause death (Cahyadi & Steffanus, 2018). COVID-19 is more severe in chronic patients such as old age, cardiovascular disease, diabetes mellitus, chronic respiratory diseases, hypertension, and cancer (Wu et al., 2020). However, in this study is that there is no patient symptom data that can describe the immune response and has not correlated the results of NLR with the results of examination of other inflammatory marker parameters such as hs-CRP. Is more accurate to evaluate the patient's history, chronic diseases, age, symptoms, CT images, laboratory and RT-PCR test results as a whole (Osman et al., 2020).

4. CONCLUSION

In this study, there was no difference in the results of the Neutrophil Lymphocyte Ratio (NLR) in negative and confirmed COVID-19 patients but there is any relationship between

NLR and ARDS conditions. The mean score of patients with suspected negative COVID-19 is 4.85 and patients with suspected confirmed COVID-19 are 3.57. The NLR can be used as a predictive factor for patients infected with COVID-19 who are likely to develop critical illness. Lung illness was present in 31.8% of putative COVID-19-negative patients, with viral infections in 22.9%, and other respiratory disorders in 6.1%. Patients conditions included non-comorbid diseases (40.2%), lung disease (12.4%), diabetes Mellitus (7.7%) and hypertension (6.2%).

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Dengue Control Model, Abate Sowing and Larvitrap Installation in Dengue Endemic Areas of Kupang City

R. H. Kristina[1a*], Ragu Theodolfi[1b], Oktofianus Sila[1c]

[1] Department of Enviromental Health, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia

[a] Email address: kristinaharming@gmail.com
[b] Email address: theodolfi@gmail.com
[c] Email address: fianussila@gmail.com

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Abstract

The bite of the *Aedes sp* mosquito causes nearly 0 million people to be infected with the dengue virus annually, one of areas declared as an endemic area is East Nusa Tenggara Province. 5669 cases and 58 deaths due to dengue hemorrhagic fever (DHF) were found in East Nusa Tenggara Province in 2020 (CFR 1.02%). Highly influential external factors include the availability of clean water, the crisis of drinking water and clean water, and poor condition of water container that do not meet the requirements. This study aims to manage Larvitrap installation movement and abatezation of the water containers in the community/households in Kupang City. This was a observational study with survey design regarding the installation of Larvitrap tool. The density of mosquito larvae was measured based on the House Index (HI), Container Index (CI), and Breteau index (BI). 383 families were involved as the study samples who were selected using the accidental sampling technique. The results showed that there were 866 units of water resevoir (47.8%). Fatululi Village had the highest percentage of indoor water container by 15.7% (140 units), and Oesapa Village had the highest percentage of outdoor water container by 15.5% (143 units). The highest percentage of positive indoor water container was found in TDM and Kelapa Lima by 30.4%, while the highest percentage of positive outdoor water container was found in TDM village by 48.4%. *Aedes aegypti* larvae and Aedes albopictus larvae were identified in the indoor and outdoor water containers in TDM Village, while that were only aedes *aegypti* larvae found in six other villages. The positive larvitrap larvae found in Oebufu Village was 15%, 10% was found in Oesapa Village, while there were no larvae found in 5 other villages. The flick density index obtained the highest House Index (HI) in Kelapa Lima village by 58.33%, the highest Container Index (CI) was found in TDM village by 44.03% and the highest Breteau Index (BI) was found in TDM village by 218.75%. It can be concluded that it is necessary to conduct education on mosquito larvae control that involves active community participation and supervision towards weekly draining of community water containers. In addition, abate sprinkling and dengue vector control activities should be carried out simultaneously throughout Kupang City at the beginning of the rainy season, at the peak of case incidence and at the end of the rainy season.

Keywords: Larvitrap, Indeks Larva, DHF, Water Reservoir.

Corresponding Author:

Ragu Harming Kristina
Department of Enviromental Health, Poltekkes Kemenkes Kupang, Kupang, East Nusa Tenggara, Indonesia.
Email: kristinaharming@gmail.com

1. INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is a disease caused by the dengue virus transmitted through the bite of the *Aedes aegypti* and Aedes albopictus mosquitos which has caused nearly 390 million people to be infected annually (Kementerian Kesehatan Republik Indonesia, 2018), (Nuryati, & Thamrin, 2012). DHF disease causes disorders in the capillary blood vessels and blood coagulation system, resulting in bleeding and death (Tairas, 2015), (Karyanti, & Hadinegoro, 2016). Such disease is usually found in tropical regions such as Southeast Asia, India, Brazil, America including in all corners of Indonesia except at an altitude of more than 1000 meters above sea level (Iriani, 2016), (Candra, 2010).

East Nusa Tenggara (ENT) Province is declared an endemic area of dengue fever. Epidemiological data derived from 22 regencies/cities showed an increase in cases and deaths due to dengue fever in 2018 to 2020 (Hartoyo, 2016) (Hadi, Soviana, & Gunandini, 2012). 5669 cases and 58 deaths due to dengue hemorrhagic fever (DHF) were found in East Nusa Tenggara Province in 2020 (CFR = 1.02%). Kupang city is categorized as an endemic area of dengue fever because the highest number of dengue cases exceeds the national figure. In 2017, there were 43 cases and 1 death due to DHF, in 2018 there were 228 cases and deaths due to DHF, in 2019 there were 629 cases and 3 deaths due to DHF, and in 2020 there were 750 cases and 8 deaths due to DHF (Kelen, Salmun, & Setyobudi, 2022), (Prasetyowati & Ginanjar, 2017). In 2020, Kupang City was designated as experiencing dengue hemorrhagic fever (DHF) outbreak.

The geographical and environmental conditions of Kupang City support the breeding of *Aedes aegypti* mosquitoes so that dengue outbreaks occur every year. Highly influential external factors include the availability of clean water, the crisis of drinking water and clean water, and poor condition of water containers that do not meet the requirements. Based on the study data above, the approach to prevention and control of dengue fever should be carried out across sectors and involve all stakeholders (Kementerian Kesehatan Republik Indonesia, 2017). The expected collaboration strategy is through harmonization of various aspects which include understanding the respective role, sharing knowledge, methods, technologies and resources with each other; having the same goal, certain governance system (effective and efficient management), and community-oriented approach (Palgunadi, & Rahayu, 2011), (Kusuma, & Sukendra, 2016). It is necessary to make a breakthrough and innovation effort by applying a model of eradication of dengue using larvitrap technology as a trap for larvae and mosquitoes, along with abatezation using the sowing method and empowerment of larvae exterminator (Wirayoga, 2014), (Sari, 2013).

This study requires a time series for the sustainability of the study and requires several stages of activities so as to achieve certain goal regarding the decrease in dengue hemorrhagic fever cases or zero growth of dengue fever in East Nusa Tenggara Province. This study aims to implement a simple technology for the eradication of mosquito larvae by installing larvae and mosquito traps in the form of Larvitrap in households and sowing abate, and empowering larvae exterminator from the community as family companions.

2. RESEARCH METHOD

This was a observational study with survey design regarding the installation of Larvitrap tool. The density of mosquito larvae was measured based on the House Index (HI), Container index (CI), and Breteau index (BI). The population of this study was all households (RT) in the endemic area of DHF in Kupang City as many as 95,000 households. 383 families were involved as the study samples who were selected using the accidental sampling technique with a total sample method.

The equipment used here were the Aedes sp flick survey form, drip pipette, flashlight, flick container, microscope, slide, and larvitrap. Abate was not provided since it had been distributed to the community by the health center officers. This study was conducted at the Sanitation Study Program Laboratory, Health Polytechnic of Kupang. The data obtained were recapitulated by name,

location and day in the exel program, which were further tabulated and calculated using standard formulas used in the density survey of aedes larvae species.

3. RESULTS AND DISCUSSION

Table 1. Percentage of Types of Dengue Vector Breeding Ground by Village.

No	Village	Type of Water container							
		Drum	%	Bathtub	%	Crock	%	Non Water container	%
1	Fatululi	47		73		134		35	
	Indoor	10	13.9	48	13.8	82	17.4	7	12.3
	Outdoor	37	10.5	25	14.3	52	13.1	28	21.5
2	Kayu Putih	44		61		115		40	
	Indoor	7	9.7	52	14.9	67	14.3	9	15.8
	Outdoor	37	10.5	9	5.1	48	12.1	31	23.8
3	Oebufu	37		63		140		20	
	Indoor	8	11.1	42	12.0	73	15.5	2	3.5
	Outdoor	29	8.3	21	12.0	67	16.9	18	13.8
4	TDM	117		114		106		58	
	Indoor	19	26.4	50	14.3	64	13.6	32	56.1
	Outdoor	98	27.9	64	36.6	42	10.6	26	20.0
5	Liliba	88		99		72		13	
	Indoor	20	27.8	72	20.6	40	8.5	2	3.5
	Outdoor	68	19.4	27	15.4	32	8.1	11	8.5
6	Oesapa	54		57		157		7	
	Indoor	5	6.9	42	12.0	78	16.6	4	7.0
	Outdoor	49	14.0	15	8.6	79	19.9	3	2.3
7	Kelapa Lima	36		57		142		14	
	Indoor	3	4.2	43	12.3	66	14.0	1	1.8
	Outdoor	33	9.4	14	8.0	76	19.2	13	10.0
	Total	423	23.3	524	28.9	866	47.8	187	
	Indoor	72	100.0	349	100.0	470	100.0	57	100
	Outdoor	351	100.0	175	100.0	396	100.0	130	100

Table 1 revealed the number of mosquito shelters in the form of drums by 423 units (23.3%), bathtubs by 524 units (28.9%) and crocks by 866 units (47.8%).

Table 2. Percentage of Types of Inside & Outside Dengue Vector Breeding Ground by Village.

No	Village	Indoor				Outdoor			
		Water container	%	Non Water container	%	Water container	%	Non Water container	%
1	Fatululi	140	15.7	7	12.3	114	12.4	28	21.5
2	Kayu Putih	126	14.1	9	15.8	94	10.2	31	23.8
3	Oebufu	123	13.8	2	3.5	117	12.7	18	13.8
4	Tuak Daun	133	14.9	32	56.1	204	22.1	26	20.0

	Merah								
5	Liliba	132	14.8	2	3.5	127	13.8	11	8.5
6	Oesapa	125	14.0	4	7.0	143	15.5	3	2.3
7	Kelapa Lima	112	12.6	1	1.8	123	13.3	13	10.0
	Total	891	100.0	57	100.0	922	100.0	130	100.0

Table 2 revealed that Fatululi Village had the highest percentage of indoor water container by 15.7% (140 pieces), and Oesapa Village had the highest percentage of outdoor water container by 15.5% (143 pieces).

Table 3. Percentage of Positive & Negative Dengue Vector Breeding Ground by Village.

No	**Village**	**Indoor**				**Outdoor**			
		Positive	**%**	**Negative**	**%**	**Positive**	**%**	**Negative**	**%**
1	Fatululi	1	1.0	139	17.6	2	0.9	112	16.1
2	Kayu Putih	8	7.8	118	15.0	14	6.2	80	11.5
3	Oebufu	2	2.0	121	15.3	1	0.4	116	16.6
4	Tuak Daun Merah	31	30.4	102	12.9	109	48.4	95	13.6
5	Liliba	6	5.9	126	16.0	22	9.8	105	15.1
6	Oesapa	23	22.5	102	12.9	38	16.9	105	15.1
7	Kelapa Lima	31	30.4	81	10.3	39	17.3	84	12.1
	Total	102		789		225		697	

Table 3 revealed that TDM and Kelapa Lima villages had the highest percentage of positive indoor water container by 30.4% and TDM village had the highest percentage of positive outdoor water container by 48.4%.

Table 4. Aedes Larvae (single larvae) species in Positive Water container by Village.

No	**Village**	**Location of Water Container**	**Species of Larvae**
1	Fatululi	Indoor & outdoor	*Ae. aegipty*
2	Kayu Putih	Indoor & outdoor	*Ae. aegipty*
3	Oebufu	Indoor & outdoor	*Ae. aegipty*
4	Tuak Daun Merah	Indoor & outdoor	*Ae. aegipty & Ae. albopictus*
5	Liliba	Indoor & outdoor	*Ae. aegipty*
6	Oesapa	Indoor & outdoor	*Ae. aegipty*
7	Kelapa Lima	Indoor & outdoor	*Ae. aegipty*

Table 4 revealed the results of the identification of single larvae survey at positive indoor and outdoor water containers. It was found that there were Aedes aegipty and *Aedes albopictus larvae* in TDM Village, while that were only *aedes aegipty larvae* found in six other villages.

Table 5. Percentage of Positive & Negative Larvitrap by Village.

No	Village	Total Larvitrap	Indoor				Outdoor			
			Positive	%	Negative	%	Positive	%	Negative	%
1	Fatululi	80	0	0	40	100	0	0	40	100
2	Kayu Putih	80	0	0	40	100	0	0	40	100
3	Oebufu	80	0	0	40	100	6	15	34	85
4	Tuak Daun Merah	80	0	0	40	100	0	0	40	100
5	Liliba	80	0	0	40	100	0	0	40	100
6	Oesapa	80	0	0	40	100	4	10	36	90
7	Kelapa Lima	80	0	0	40	100	0	0	40	100
	Total	280	0	100	280	0	10	3.6	270	96.3

Table 5 revealed that the percentage of positive larvitrap was found in Oebufu Village by 15% and Oesapa Village by 10%.

Table 6. Flick Density Index by Village

No	Village	Total House	Positive House	HI (%)	Total Count	Positive Count	CI (%)	BI (%)
1	Fatululi	58	14	23.73	254	22	8.66	37.93
2	Kayu Putih	59	5	8.47	220	3	1.36	5.08
3	Oebufu	60	4	6.67	240	3	1.25	5.00
4	Tuak Daun Merah	64	48	75.0	318	140	44.03	218.75
5	Liliba	66	21	31.82	259	28	10.81	42.42
6	Oesapa	60	33	55.0	268	61	22.76	101.67
7	Kelapa Lima	60	35	58.33	245	70	28.57	116.67
	Total	420	160	38.9	1804	327	18.13	18.13

Table 6 revealed that regarding the flick density index, the highest House Index (HI) was found in Lima coconut Village by 58.33%, the highest Container index (CI) was found in TDM Village by 44.03% and the highest Breteau Index (BI) was found in TDM Village by 218.75%.

The type and number of water containers as breeding ground for *Aedes aegypti* larvae variedin some areas. The results of the study in Kupang City found that there were 423 units of drums (23.3%), 524 units of bathtubs (28.9%) and 866 units of crocks (47.8%). These results are not in line with a study conducted by Henry, et al (2010) which found the types of water containers in the Pangandaran Tourism Market in the form of buckets by 57.24%, crocks by 13.54%, bathups by10.93%, dispensers by 4.51%, basins by 3.80%, refrigerator water containers by 2.38%, jerry cans 1.43% barrels by 1.19%, pots by 0.48% and bird drinking cups made of drums, wooden boxes, stereofoam boxes, tires, drinking toll bo, cans and pots by 0.24% (Hendri, RES & Prsetyowati, 2010). Another study conducted by Widyastuti & Rahayu (2018) found that cement bath containers were most widely used as water containers and had the potential to be a suitable breeding ground for *Aedes* sp (Widyastuti, & Rahayu, 2018).

A study conducted by Agustina & Kartini (2018) in Gampong Supervised by Aceh Environmental Health Academy found 20 types water containers and non-water rervoirs as breeding grounds of *Aedes aegypti* mosquitoes where they laid eggs, developed into larvae, pupae and became adult mosquitoes (Agustina & Kartini, 2018). Zubaidah et al, (2014) explained that the most type of containers inside the house that was positive for Aedes sp larvae was bathtub (60.63%), while the most type of containers outside the house that was positive for Aedes sp larvae was drum (54.55%). There were 49 positive containers acted as mosquito shelters (17.44%) out of 281 units examined (Zubaidah, Setiadi & Akbari, 2014). Furthermore,

a study conducted by Wanti & Darman (2014), found that the most larvae-positive containers were containers for daily needs, the containers were not covered, the location of the containers was outside thehouse, made of ceramic material, and white in color (Wanti & Darman, 2014). The results of a study conducted by Zen and Rahmawati (2015) showed that of the 250 containers examined, there were 33 types of containers that became breeding grounds for Aedes spp mosquitoes. The types of containers in the Central Metro District were Basins, Bathtubs, Shards Bottles, Flower Pots, Used Car Toys, Used Tires, Buckets, Plastic Drink Containers, Used Ceramic Drinking Places, Used Ablution Place. Buckets were the most widely used type of containerfor Aedes spp mosquitoes to breed with a total of 9 (27.27%), while plastic containers were the least used containers for Aedes spp mosquitoes to breed (3.030%) (Zen, & Rahmawati, 2015).

The people of Kupang City have many water containers at home, due to the limited water flowof PDAM every day, so the community choise to prepare many water containers to meet water needs for 3-7 days. With open storage conditions, it provides an opportunity for mosquitoes to lay eggs and breed within the period of storage of the water. Table 2 revealed that Fatululi Village had the highest percentage of indoor water container by 15.7% (140 pieces), and Oesapa Village had the highest percentage of outdoor water container by 15.5% (143 pieces). Such findings indicated that community water containers in Kupang City were evenly distributed inside and outside the house. Thus the breeding potential of Aedes sp mosquitoes was even greater which lead the potential to transmit dengue fever.

Table 3 revealed that TDM and Kelapa Lima village had the highest percentage of positive indoor water container by 30,4% and TDM village had the highest percentage of positive outdoor water container by 48,4%. Such findings are supported by the results of a study conducted by Sari (2021) among 99 bathtubs which found 71 (71.71%) larvae-positive bathtubs in the house and 22 (22.22%) larvae-negative bathtubs inside the house. Meanwhile there were 4 (4%) larvae-positive bathtubs outside the house and 2 (2%) larvae-negative bathups outside the house (Sari, 2021). Furthermore, a study conducted by Zubaidah, et al (2014) found 38 (38.00%) indoor containers and 11 (11.00%) outdoor containers (Zubaidah, Setiadi, & Akbari, 2014). Sari (2021) who conducted a study among 99 bathtubs further found 75 (75.75%) larvae-positive bathtubs and 24 (24.24%) larvae-negative bathtubs (Sari, 2021). It can be concluded that there were only a few indoor conteiners, but had a greater chance of becoming a breeding ground for mosquitoes. This result is also due to many hiding sites in the house where mosquitoes can lay eggs.

Table 4 revealed the results of the identification of single larvae survey at positive indoor and outdoor water containers. It was found that there were *Aedes aegipty* and *Aedes albopictus larvae* in TDM Village, while that were only *aedes aegipty larvae* found in six other villages. The study findings indicated that indoor water container was a suitable site for *Aedes aegypti* mosquitoes to live and the outdoor water container was a suitable site for *Aedes aegypti* and *Aedes albopictus* mosquitoes to live. Such findings are supportedby a study conducted by Purnamasari, et al (2016) which found that the Aedes sp species obtained during the study were Aedes aegypti and Aedes albopictus. The Aedes albopictus species was only found in one place, namely the bath (Purnamasari & Kadir, 2016).

Table 5 revealed that the percentage of positive larvitrap was found in Oebufu Village by 15% and Oesapa Village by 10%. Aedes *aegypti* population in ovitraps inside the house was 94.3%, while *Aedes albopictus* population in ovitrap outside the house was 53.4%. The results of this study are in line and clarified with the results presented in tables 3 and 4. The percentage of larvae-positive larvitrap was due to there were still many water containers in Kupang City that had no tight lid, with a larger open space than the open spaceon the larvitrap, and

mosquitoes prefer an open container to lay their eggs. The distributed larvitrap was observed after 7 days of installation. If no water is added for 7 days, the surface where mosquitoes place eggs will be dry so that the eggs cannot hatch. Therefore, it is necessary to add water to the larvitrap to inundate mosquito eggs until they hatch. Arfan and Rizky (2021) found that the use of larvitrap through manual and animated media could increase knowledge. The results of the Wilcoxon alternative test obtained p-value = (0.004) <0.05 which can be concluded that there was a significant increase in knowledge score (Arfan & Rizky, 2021).

Table 6 revealed that regarding the flick density index, the highest House Index (HI) was found in Lima coconut Village by 58.33%, the highest Container index (CI) was found in TDM Village by 44.03% and the highest Breteau Index (BI) was found in TDM Village by 218.75%. The study findings are not in line with the stusy conducted by Widada, et al, (2021) in Bengkulu City, which found that the density of mosquito larvae had an HI value of 90.6%, a CI value of 70.98% and a BI value of 78.23% or cosideres as high density (Widada, Putri, & Sari, 2021). The study findings are similar to a study conducted in several locations such as by Zen & Rahmawati (2015) which found the density of larvae measured through parameters of HI = 27%, CI = 13.2%, BI = 33% (Zen & Rahmawati, 2015). In addition, a study conducted by Khairunisa, et al (2018) in Semarang City and its surroundings obtained a house index (HI) of 44.44% which was categorized in the density figure (DF) category 6 (Khairunnisa, Wahyuningsih, & Hapsari, 2017). The density of Aedes sp larvae inSurgi Mufti Village had an HI of 33%, a CI of 19.93%, a BI of 49%, and DF value of 5, soit was categorized as an area with moderate transmission rate (Zubaidah, et al, 2014). A study conducted by Cahyani, *et al* (2018) which applied the *Chi-square* analysis test showed the density of larvae based on House Index (p value = 0.004, OR = 4.189, CI: 1.660 – 10.568) and Container Index (p-value = 0.002, OR = 4.661 CI: 1.835 – 11.840) (Cahyani, 2018).

The results of a study conducted by Wanti & Darman (2014) showed an HI of 0.887, a CI of 0.146 and a BI of 0.080, which indicated that there was no difference in larvae density between Alak Village (endemic area) and Belo Village (free area) (Wanti & Darman, 2014). In contrast, a study conducted by Inten, et al, (2018) showed a House Index of 16%, a Container Index of *8%*, *a Breteau* Index of *16%*, *ABJ* of *84%* and DF (Density Figure) of 3 which was categorized in the moderate category (Wanti & Darman, 2014). Another study conducted by Sinaga & Simanungkalit (2021) found a house index (HI) of 36.2%, a BI 2.21% and a CI of 19.9% which was included in the Density Figure (DF) of 5 which was categorized in the moderate category. These findings indicated a high transmission of DHF as well as faster and easier spreading of Aedes Aegypti mosquitoes (Sinaga & Simanungkalit, 2021). The high density of larvae was due to most of water containers were not covered, people who had received larvicide (Abate) did not sow it on the container, and household members did not perform weekly draining of water containers.

Ernyasih, et al (2022) explained a process system involving certain activities such as counselling, eradication of mosquito nests, and community involvement, but improvement is still required. The goals of the output system still need to be achieved since the morbidity rate was still high, and the ABJ was 94%. Description of the input system, process system involving specific activities, and output system in implementing dengue prevention and control programs could be better but should consider certain technical obstacles (Ernyasih et al., 2022).

4. CONCLUSION

Based on the study findings, it is necessary to conduct education on mosquito larvae control that involves active community participation and supervision towards weekly draining of community water containers. In addition, abate sprinkling and dengue vector control activities should be carried out simultaneously throughout Kupang City at the beginning of the rainy season, at the peak of case incidence and at the end of the rainy season.

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RESEARCH **Open Access**

Effectiveness of Purple Sweet Potato Extract and Disclosing Substance for Plaque Identification

Aflinda Yenti[1a*], Eka Sukanti[1b], Damhuji[2c], M. Ibraar Ayatullah[3d]

[1] Department of Dental Health, Politeknik Kesehatan Kemenkes Padang, Padang City, West Sumatera, Indonesia
[2] Department of Dental Health, Politeknik Kesehatan Kementerian Kesehatan Pontianak, Pontianak City, West Kalimantan, Indonesia
[3] Department of Dental Health, Politeknik Kesehatan Kementerian Kesehatan Kupang, Kupang City, East Nusa Tenggara, Indonesia

[a] Email address: yenti.aflin@gmail.com
[b] Email address: ekasukanti@gmail.com
[c] Email address: damhuji.ahmad@yahoo.com
[d] Email address: mibraarayatullah21@gmail.com

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Abstract

Oral hygiene is an indicator of oral and dental health which can be assessed based on the presence or absence of organic deposits, such as pellicle, materia alba (dental deposit), food residue, calculus, and dental plaque. Plaque is the cause of tooth decay among the world's population. Plaque on the tooth surface can be used as an indicator of oral hygiene. Poor cleaning can lead to stickier plaque and tartar after calcification. The thin plaque is almost the same as the color of the teeth, so that plaque cannot be seen with the naked eye. The presence of plaque that is formed from contact with oral fluids can be detected by using certain dye. This study aims to determine the Effectiveness of Purple Sweet Potato Extract and Disclosing substance for Plaque Identification among the children in Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District. This was a quasi-experimental study with a post-test-only design. The samples of this study were 30 children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District, with the inclusion criteria of children with permanent teeth and index teeth. The samples were selected through total sampling technique. The results showed that after applying purple sweet potato extract to the children at Aisyah Orphanage in Bukittinggi City, most of them had the Patient Hygiene Performance index (PHP) in the moderate criteria (50%). Furthermore, after applying disclosing substances to the children at Aisyah Orphanage in Bukittinggi City, most of them had the PHP index in the poor criteria (56.7%). The t-test independent statistical test results obtained a p-value of 0.000 ($p < 0.005$), indicating a significant difference between sweet potato extract and disclosing substance. Disclosing substance was more effective than purple sweet potato extract in identifying plaque on the tooth surface. Further study is recommended to apply purple sweet potato extract with different concentrations as an alternative ingredient to identify plaque on the tooth surface.

Keywords: Purple Sweet Potato, Disclosing Substance.

Corresponding Author:

Aflinda Yenti
Department of Dental Health, Politeknik Kesehatan Kemenkes Padang, Padang City, West Sumatera, Indonesia
Email: yenti.aflin@gmail.com

1. INTRODUCTION

According to the World Health Organization, health is a state of perfect balance of physical, mental and social aspects, not only free from disease and weakness (World Health Organization, 2022). Health is the most important aspect of human life, where human should be physically and spiritually healthy (Britani, Ranimpi, & Nusawakan, 2017). Dental and oral health needs optimum care since it can affect overall body health (Lestari, Wowor, & Tambunan, 2016), (Sherlyta, Wardani, & Susilawati, 2017), (Nurhidayat, 2012). Dental and oral health is an integral part of overall body health which inseparable aspect of general body health (Harahap, & Masnawati, 2022). Oral hygiene is an indicator of oral and dental health which can be assessed based on the presence or absence of organic deposits, such as pellicle, materia alba (dental deposit), food residue, calculus, and dental plaque (Arifian, Chairanna, & Prasetyowati, 2022).

Plaque is a cause of caries with the incidence level of 75% to 90% in the world's population (Asura, & Danan, 2021). Plaque is formed from soft deposits that further forms a layer called "biofilm" and adheres tightly to the surface of the teeth, gums and other hard surfaces in the oral cavity. Plaque is made up of dead cells, small food fragments, bacteria, kidney remnants, and a sticky part of saliva called mucin (a substance found in saliva). The main species found in human dental plaque is Streptococcus mutans (Winarni, 2014).

Plaque on the tooth surface can be used as an indicator of oral hygiene. Poor cleaning can lead to stickier plaque and tartar after calcification (Ekoningtyas, Wiyatini & Nisa, 2016). Thin plaque has a color that is almost the same as the color of the teeth so that plaque cannot be seen with the naked eye. The presence of plaque that is formed from contact with oral fluids can be detected by using certain dye. (Murni, & Listrianah, 2020), (Waty, 2022). Plaque will look more gray, yellowish in color when it has matured and accumulated which is a usually found on one-third of the gingival surface and on deformed and rough tooth surfaces (Ekoningtyas, Wiyatini & Nisa, 2016).

The substance used to determine plaque usually has a contrast color with the color of the teeth (Fione, 2020), (Mega, et al., 2019), (Sukendro, Sutomo, & Sariyem, 2016). The dye in question is disclosing substance which can work to change the color of dental plaque so that it becomes contrast with the white color of the tooth surface (Chetruş, & Ion, 2013), (Haryani, Mahmiyah, & Ayatullah, 2019). Disclosing substance can be found in various preparations in the form of solutions, capsules, and tablets . The disclosure material that is currently commonly used is erythrosine (Oktapraja, Murniwati, & Suprianto, 2021). Erythrosine is a coloring agent for food and can also be used to dye bacteria (Utami, Amperawati, & Rizaki, 2022), (Laela, Mulyanti, & Nurnaningsih, 2021). The glycoprotein contained in the plaque can be absorbed by this dye so that the plaque can be seen (Siregar, 2019). This coloring agent is easier to see on the teeth when compared to other colors. However, since erythrosine is a triodin derivative of fluorescein with a high iodine content, it may cause thyroid cancer if ingested in large quantities.

The effectiveness of various kinds of cake plugs as a substitute for disclosing substance for detecting plaque in the mouth cavity found that rose-red, rose pink, and red powder plugs had the same effectiveness as disclosing solutions. Furthermore, a study conducted by Fatmasari et al., (2014) regarding the effectiveness of beetroot (beta vulgaris) as a disclosing substance (plaque identification material) found that beetroot was more effective as a substitute for disclosing substance to see plaque. The comparison between erythrosine and anthocyanin extract of red dragon fruit peel (*hylocereus costaricensis*) as an alternative material for plaque detection solution concluded that red dragon fruit peel as a natural food coloring agent with anthocyanin content concentration of 100% could be applied as an alternative material for

plaque detection, same as the color quality of commonly used disclosing substance and significantly different from the anthocyanin content concentration of 50%.

Sweet potato is a vine that lives in all weather conditions, in mountainous areas as well as on beaches (Winarti, 2008). Sweet potatoes are rich in carbohydrates, vitamins, minerals and dietary fiber. In addition, it has the potential as a functional food in the presence of beta carotene pigments in yellow sweet potatoes and anthocyanins in purple sweet potatoes (Hambali, & Noermansyah, 2015). The purple color in sweet potatoes is caused by the presence of natural anthocyanin dyes which are a group of reddish pigments located in water-soluble cell fluids. The anthocyanin components of purple sweet potato are mono or diacetyl derivatives of 3-(2-glucosyl) glucosyl-5-glucosyl peonidine and cyanidine (El Husna, Novita & Rohaya, 2013).

Anthocyanins are subtype of organic compounds from the flavonoid group. Some of the most commonly found anthocyanin compounds are pelargonidin, peonidin, cyanidin, malvidin, petunidin and delfinidin (Ngete, 2020). The high anthocyanin content in purple sweet potato has high stability compared to anthocyanins from other sources (Ekoningtyas, Wiyatini, & Nisa, 2016). That is why this plant is a healthier choice and in accordance with natural dye alternatives. This study was conducted at the Aisyiyah Orphanage located in Bukittinggi City III. After examining the PHP index on 10 randomly selected children, it was found a mean plaque score in the poor criteria. This was also an alternative study which made disclosing media from natural ingredient of Purple Sweet Potato. This study aims to determine the Effectiveness of Purple Sweet Potato Extract and Disclosing Substance for Plaque Identification among Children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District.

2. RESEARCH METHOD

This was a quasi-experimental study with post-test only design. In this study, treatment or intervention was performed, which was followed by measurement (observation) or post-test. The population in this study were all children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District. The samples for this study were 30 children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District with the inclusion criteria of children with permanent teeth and index teeth. The samples were selected through total sampling technique. Data were collected by visiting the Aisyiyah Orphanage, Tilatang Kamang Sub-District, Agam District to apply for permission to conduct an investigation. Furthermore, the researchers invited respondents according to the date and time that had been determined and approved by the Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District.

Data were analysed using univariate and bivariate analysis. Univariate data analysis was conducted explain the characteristics of each study variable that were presented in the form of a frequency distribution table. In addition, bivariate analysis was conducted to determine the effectiveness of purple sweet potato extract and disclosing substance in identifying plaque which could be assessed using a computer program, namely the Independent t test with a p value <0.05.

3. RESULTS AND DISCUSSION

Table 1. PHP Index after Applying Purple Sweet Potato Extract among the Children at Aisyiyah Orphanage, Bukittinggi City.

PHP Index Criteria	Purple Sweet Potato Application	
	F	%
Good (0 – 1.7)	13	43.3
Moderate (1.8 – 3.4)	15	50
Poor (3.5 – 5)	2	6.7

Sum	30	100
Mean		2

Table 1 showed that after applying purple sweet potato extract, most of respondents had the PHP index in the moderate criteria (50%) and only 2 respondents had the PHP index in the poor criteria (6.7%) with a mean plaque index of 2.1.

Table 2. PHP Index after Applying Disclosing substance among the Children at Aisyiyah Orphanage, Bukittinggi City

PHP Index Criteria	**Disclosing Substance Application**	
	F	**%**
Good (0 – 1.7)	3	10
Moderate (1.8 – 3.4)	10	33.3
Poor (3.5 – 5)	17	56.7
Sum	30	100
Mean		3.3

Table 2 showed that after applying disclosing substance, most of respondents had the PHP index in the poor criteria (56.7%) and only 3 respondents had the PHP index in the good criteria (10%) with a mean plaque index of 3.3.

Table 3. The t-test Results regarding the Effectiveness of Purple Sweet Potato Extract and Disclosing substance on the PHP index among the Children at Aisyah Orphanage, Bukittinggi City

T	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
				Lower	**Upper**
4.316	58	.000	1.1600	.6221	.1.6979

The independent t-test obtained a p-value of 0.000 ($p < 0.005$), which indicated that there was a significant difference between purple sweet potato extract and disclosing in identifying the PHP index among the children at Aisyah Orphanage Children, Bukittinggi City.

The plaque has the ability to retain large amounts of coloring matter. The difference in dye depends on the thickness of the plaque and is not related to bacterial or biochemical factors. The mechanism is that plaque metachromasia will bind to the dye through a diffusion process (Fatmasari, Supriyana, & Sukmawati, 2017).

Based on table 2 and table 3, it can be observed that the dyes used in identifying plaque, both chemical-based dye (disclosing substance) and natural coloring components from plants (purple sweet potato) could indicate the presence of plaque on the tooth surface. Purple sweet potato contains anthocyanin pigment with various amount of content in each plant which ranges from 20mg/100gr to 600 mg/100gr based on base weight. Some of the most commonly found anthocyanin compounds are pelargonidin, peonidin, cyanidin, malvidin, petunidin, and delfinidin (Anggriani et al., 2017), (Ifadah, Wiratara, & Afgani, 2022), (Khatimah, Hasanuddin, & Amirullah, 2022).

To determine the effectiveness of the two ingredients, namely purple sweet potato and disclosing substance as dental plaque identification materials, an independent t-test was performed. It was obtained a p-value of 0.000 ($p<0.005$) which indicated that there was a significant difference in the use of purple sweet potato extract and disclosing substance as ingredients in identifying plaque on the tooth surface.

Anthocyanin pigment in purple sweet potato has a low stability under certain conditions. Anthocyanin stability is influenced by several factors, including pH, temperature, light and oxygen (Irawati, & Mardiana, 2018), (Ismed, Sayuti, & Andini, 2018). Temperature can shift the anthocyanin balance to tend to be a colorless form. Absorption value of anthocyanin color is also affected by pH. The lower the pH value, the higher the absorption value. A pH level of 5 and above may cause damage to the anthocyanin pigment which turns colorless. The color instability of the anthocyanins in purple sweet potato causes the color of the purple sweet potato extract to stick slightly to the plaque (Winarti, et al, 2008).

In addition, purple sweet potato contains anthocyanin dye. Such anthocyanin coloring pigment has water-soluble property, and it has already known that there is oral fluid (saliva) in the environment of the oral cavity. Such condition will surely affect the bond formed between the purple sweet potato and the plaque. Purple sweet potato has the ability to bind fluids around plaque in the oral cavity so that it does not strongly bind glycoprotein as the main component for plaque impact (El Husna, Novita & Rohaya, 2013).

Disclosing substance was better in identifying plaque on the tooth surface compared to purple sweet potato since disclosing substance is a chemical that has been processed in such a way intended to color plaque on the tooth surface. One of the contents of the solution disclosure is iodine which has high electronegativity, which indicates the ability to bind.

The results of this study are in line with the study conducted by Ekoningtyas, et al., (2017) regarding the chemical potential of purple sweet potato (*ipomoea batatas L*) as an identification material for the presence of plaque on the tooth surface. Such study found a p value of 0.000, which indicated that there was a significant difference in the use of purple sweet potato and disclosing substance ingredient as an identification material for plaque on the tooth surface. The mean plaque index value of disclosure solution was higher than the mean plaque index value of purple sweet potato. The results of this study are also in line with a study conducted by Fatmasari et al., (2014) regarding purple sweet potato and beet solutions as identification materials for the presence of dental plaque, which revealed that the mean value of sweet potato in identifying plaque was lower than beets.

4. CONCLUSION

It was found that after purple sweet potato extract, most of respondents had the PHP index in the moderate criteria (50%) and after applying disclosing, most of respondents had the PHP index in the poor criteria (56.7%). Disclosing was more effective than purple sweet potato extract in identifying plaque on the tooth surface. Further study is recommended to apply purple sweet potato extract with different concentrations as an alternative ingredient to identify plaque on the tooth surface.

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