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PREFACE

We thank God Almighty, because of His blessings and grace, we have succeeded in publishing the periodic Scientific Journal of Jurnal Info Kesehatan (Journal of Health Info) for Volume 19 Number 2, December 2021, for 10 articles. Journal of Health Info has officially used the Open Journal System (OJS) process so that publishing articles is also available in printed media with ISSN 0216-504X and available in electronic media with E-ISSN 2620-536X. The issue of the Journal of Health Info has included a Digital Object Identifier (DOI) in collaboration with the Indonesian Journal Volunteers with the prefix: 10.31965. Furthermore, the Journal of Health Info has been indexed by DOAJ and accredited by Sinta 3.

Journal of Health Info was developed with the aim of accommodating all scientific works, from lecturers, students, and other institutions from research results. Along with the development of technological advances such as the Open Journal System, every article submitted to the Journal of Health Info is sent through our online OJS which can be accessed on the web page: http://jurnal.poltekeskupang.ac.id/index.php/infokes.

As the editorial board, we would like to thank the Director of the Health Polytechnic of the Kupang Ministry of Health, who has supported and made a real contribution to the development of this journal, as well as to the authors who have contributed scientific articles and dear readers to be able to produce new works that we can publish in the next edition.

It is hoped that the existence of this Journal of Health Info increases the scientific repertoire and shares the scientific information, particularly the results of research in the health sector which provide numerous benefits, especially for health development in Kupang and Indonesia in general.

Kupang, December 31, 2021
Editor in Chief,

Ni Nyoman Yuliani, S.Si, S.Farm, Apt, M.Si

JURNAL INFO KESEHATAN

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WRITING GUIDE

Title

a) The title is written in English and informative, concise, and not too long or short (10- 25 words).
b) Consists of the variables under study and describes the content of the manuscript.
c) A title does not contain abbreviations or formulas.
d) The title page should include the title of the manuscript only. The names of authors should be deleted to ensure the double-blinding of the paper during the peer review process.

Abstract and Keyword

a) The abstract is concisely written, about the most important ideas and contain the problems or research objectives, research method, and research results.
b) Written in an Indonesian or English language with 300-350 words maximum.
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An introduction is presented in an integrated manner without subtitle. It is written in the form of paragraphs with a contains:

a) Background or research rational.
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a) The study design.
b) Data collection techniques and data sources.
c) Method of data analysis.

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The results represent a major part of scientific articles containing:

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d) Discussion is an important part of the entire scientific article. The purposes of the discussion are: answer the research problem, interpret the findings, integrate the findings of research into the existing knowledge, and formulate a new theory or modify the existing theories.
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a) Contain conclusions and recommendations.
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The main references are national journal, international journals and proceeding. All references should be to the most pertinent and up-to-date sources:

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Fellner, C. (2019, April 7). Time bomb: Two new cases as NSW faces worst measles outbreak in years. *The Sydney Morning Herald*. Retrieved from https://www.smh.com.au.

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

The Effect of Health Education on Mother's Knowledge Attitudes and Behavior in Giving Care to Low Birth Weight Babies

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Abstract
The number of low-birth-weight babies (LBW) who returned to the hospital after returning home had increased from 2015 to 2016. The results of the interview revealed that mothers who had LBW did not thoroughly understand providing care for LBW after returning from the hospital. This study aims to determine the effect of health education on a mother's knowledge, attitude and behaviour in providing care to LBW. This study is quasi-experimental with a pre-posttest approach non-equivalent to the control group, with 66 respondents fulfilling the inclusion criteria. The inclusion criteria in this study were post-partum mothers on the second day who had babies with a birth weight of 1500 grams-2499 grams and were willing to be respondents. The sampling technique was purposive sampling. The statistical test employed independent t-test, paired t-test, and chi-square. Knowledge scores before and after treatment were significantly different in the intervention group and control group, with a p-value in the intervention group 0.00, while the knowledge and attitude scores in the control group were 0.00 and the behavioural scores were 0.11. There was a significant difference in the increase in knowledge, attitudes and behaviour scores in both groups. The p-value of knowledge and attitudes is 0.00, and the p-value of behaviour is 0.01. Hence, there is an increase in mothers' knowledge, attitudes, and behaviour after being provided with health education using a booklet.

Keywords: Health Education, Knowledge, Attitudes, Behavior, Low Birth Weight.

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1. INTRODUCTION

The incidence of low birth weight babies (LBW) contributes 60% to 80% of neonatal deaths worldwide and is more at risk of dying within the first 28 days of life compared to the normal weight babies (WHO, 2017). In 2012, the World Health Assembly Resolution supported a comprehensive implementation plan for mothers, babies and nutrition for children. The policy was set as six global nutrition targets by 2025. One of the WHO global nutrition targets in 2025 is to reduce 30% of babies born with low birth weight (WHO, 2014). Schiffman, et al., (2010) explained that one of the efforts which can be performed to prevent neonatal mortality is by providing quality services to mothers and babies during the antenatal, perinatal and postnatal periods.

The global prevalence of LBW is 15.5% or around 20 million LBW are born every year and 96.5% of them are born in developing countries (Gundani & Mutowo, 2012). In Indonesia, the prevalence of LBW incidence in 2013 was 10.2%. Meanwhile, in Special Region of Yogyakarta in 2015, the prevalence of LBW was 5.32% (Dinas Kesehatan Kota Yogyakarta, 2016). In Bantul Regency, the highest cause of infant mortality after asphyxia and congenital abnormalities is due to low birth weight, which was 22 cases (Dinas Kesehatan Kabupaten Bantul, 2016).

The research of Tarigan et al., (2012) revealed that the involvement of mothers in providing care to LBW greatly impacts the quality of LBW life, and if a mother does not take proper care, it will have an impact on the incidence of infection, malnutrition and LBW mortality. Many mothers do not know how to care for their babies properly, hence, many LBW are not saved due to the lack of knowledge about LBW care. In Panembahan Senopati Hospital, the number of LBW who returned to the hospital after going home has increased from 2015 to 2016. In 2015, there were 4 babies returning to the hospital while there were 11 LBW in 2016. The reason the LBW returned to the hospital was because after being brought home, the baby's condition worsened, hence, he was referred back to the hospital. The results of interviews with mothers who have low birth weight in the Perinatal Ward Panembahan Senopati Hospital discovered that the mother did not understand completely about how to care for LBW. The health promotion team is not directly involved in promoting to patients. The health promotion team is only obliged to create the existing programs in the hospital. The officer responsible for providing health education is the midwife or nurse working in the ward.

Health education on LBW care performed in the Perinatal Ward Panembahan Senopati Hospital, Bantul Regency, was limited to verbal and mostly about the recommendation to breastfeed babies and assist mothers to employ the Kangaroo Mother Care (KMC) method. This health education is frequently provided before the baby is allowed to go home. Hence, when the mother comes home, she is not yet fluent in caring for the baby or sometimes forgets how to care for the baby as taught at the hospital. On average, health education is performed twice, which are once with the counseling method together with other patients and the second time when the mother is going home. Health education which is not conducted individually also causes mothers to be embarrassed to ask about the health condition of their babies. Therefore, this study creates a health education package about LBW care for mothers when the baby comes home from the hospital.

2. RESEARCH METHOD

This research is a quasi-experimental study with a non-equivalent pre-posttest approach with a control group design. This research was conducted in the perinatology room of Panembahan Senopati Hospital, Bantul Regency. The calculation of the number of samples was the formula for different proportions with a significance level of

5% and 95% CI. The sampling technique employed purposive sampling and consisted of 2 groups (intervention group and control group) where each group consisted of 33 respondents. The intervention group was the provision of health education using booklet media provided with lectures and discussions, and the control group was the provision of health education at the hospital without any additional intervention from the researcher. The inclusion criteria in this study were 1) postpartum mothers on the second day with normal delivery, and 2) postpartum mothers who had babies with a birth weight of 1500 grams - 2499 grams. Exclusion criteria in this study were 1) mothers with complications (uterine rupture, puerperal infection) and *sectio caesarea* delivery, 2) babies with complications (neonatal asphyxia, congenital abnormalities, infections), and 3) babies who have passed away.

Intervention health education employed in this study was administered with booklet media. The booklet media in this study is entitled "LBW care after returning from the hospital". The author adjusted this booklet to the needs of the research site by asking for the considerations of several experts such as pediatricians and nurses in perinatal wards and academics. The material in the booklet was not only on LBW care after being discharged from the hospital, but also at the hospital. The author included material about LBW care in the hospital with the hope that the way of LBW treatment can be applied by respondents while in the hospital even though the baby is still being treated. Respondents who are accustomed to caring for low birth weight will not feel awkward anymore holding the baby. Hence, after returning from the hospital, it is hoped that the mother will be ready and independent to care for her baby.

The difference between the health education material in the booklet "care of low birth weight after returning from the hospital" and the one in the hospital is that the material booklet provided is more complete, accompanied by steps and pictures. The material is not only limited to care at the hospital but also LBW care after returning from the hospital, danger signs and referral flow if the baby is discharged from the hospital and the mother may carry out the booklet home so that the contents can be reviewed. Meanwhile, the health education provided in the hospital was completed verbally about the condition of the baby on how to provide exclusive breastfeeding and conduct KMC.

This health education was administered to 30 respondents in the control group and 30 respondents in the intervention group. This research was conducted at Panembahan Senopati Hospital, Bantul Regency and began with the control group first. The control group performed pre-test and post-test at the same time interval as the intervention group for 7 days. Health education in the control group is health education usually conducted in a hospital and is not added with any interventions for 7 days. In this study, health education with booklet media was still provided, which was 1 day before the respondent was discharged from the hospital. The distribution of media booklets at the end is to avoid bias between the intervention and the control group.

Health education in the intervention group employing booklet media was provided once on the second day after delivery. Health education was performed for 45 minutes. Health education was provided by health personnel (midwives and nurses) individually to each respondent by means of lectures and discussions. The pre-test was provided before the respondent received health education and the post-test was administered seven days after receiving health education using booklet media by conducting home visits. A time lag of 7 days is in accordance with the Guidelines for pre and post-testing which identifies that if the research instrument is in the form of multiple-choice, the recommended time interval is one week (I-TECH, 2010).

The booklet in this study was modified from the book "Management of Low Birth Weight Babies for Village Midwives" published by the Directorate General of Nutrition and Maternal and Child Health (Kementerian Kesehatan Republik Indonesia, 2011) and research from Yani (2009) on the Effect of the "Rindu" Health Education Package on the Readiness of Mother Caring for Premature Babies after Returning from the Hospital in Kendari. Apart from the two sources of the book, booklet material was also added according to the needs and input from the hospital, especially associated with the cases which frequently cause LBW to return to the hospital. The measurement of knowledge employed a questionnaire by first performing the validity and reliability test. The questionnaire consisted of 15 items (definition of LBW, causes of LBW, prevention of infection, prevention of hypothermia, breastfeeding, KMC, bathing babies, planning to return home and problems often encountered by LBW). The validity score of the knowledge questionnaire with an r value was between 0.392-0.709 and a Cronbach's Alpha value was 0.705. This research has been approved by the research ethics committee of Universitas 'Aisyiyah Yogyakarta with number 01/KEP-UNISA/VIII/2017.

Data analysis employed independent t-test, paired t-test and chi-square test. Independent t-test and paired t-test were employed to identify the difference in the average knowledge and attitudes of mothers in the intervention group and the control group. The chi-square test was administered to determine the effect of health education on knowledge, attitudes and behavior of postpartum mothers with a categorical data scale. Linear regression test was employed to observe the effect of the independent variables, which were health education, external variables comprising of age, education, occupation and number of children on the variables, which were knowledge, attitudes and behaviors examined together. The calculation of the number of samples was the formula for different proportions with a significance level of 5% and 95% CI.

3. RESULTS AND DISCUSSION

Table 1. Frequency Distribution of Respondent Characteristics and Homogeneity.

Mother's Characteristics	**Group**				**Total**	***P value***
	Intervention		**Control**			
	N	**%**	**N**	**%**		
Mother's age						
< 20 years or> 35 years	11	52.4	10	47.6	21	0.500[a*]
20-35 years	22	48.9	23	51.1	45	
Mother's education						
Low	11	57.9	8	42.1	19	0.294[a*]
High	22	46.8	25	53.2	47	
Mother's job						
Housewife	15	45.5	18	54.5	33	0.311[a*]
Working mother	18	54.5	15	45.5	33	
Parity						
Primipara	14	48.3	15	51.7	29	0.500[a*]
Multipara	19	51.4	18	48.6	37	
Knowledge, average (min-max)	74.94 (60-93)		80.61 (60-93)			0.056[b*]
Attitude, average (min-max)	72.67 (54-91)		74.64 (65-87)			0.075 [b*]
Behavior, average (min-max)	82.27 (55-100)		86.36 (60-100)			0.100 [b*]

[a]*Pearson Chi-Square*
[b]*Levena's Test*
**p-value >0.05*

Table 1 depicts that the majority of respondents were aged 20-35 years (68.18%). The majority of respondents possessed higher education (71.21%). The respondent's employment status was between housewives and working. Most of the respondents were multipara (56.06%). Respondents' knowledge during the pre-test was higher in the group which was not provided with health education (80.61%) than in the group provided with health education (74.94%). The attitude of respondents during the pre-test was higher in the group that was not provided with health education (74.64%) than the group that was provided health education (72.67%). The behavior of respondents during the pre-test in the group provided with health education (86.36%) was higher than the group provided with health education (82.27%).

Table 2. Differences in average knowledge, attitude and behavior of mothers before and after being provided with health education with booklet media.

Variable	***Pre test***	***Post test***	**Δ mean**	**t-test**	**P-value**
	Mean ± SD	**Mean ± (SD)**	**95% CI**		
Knowledge					
Intervention	74.94 ± 9.086	92.00 ± 7.259	17.061 (13.482 – 20.639)	9.710	0.000
Control	80.61 ± 7.471	85.33 ± 8.022	4.727 (2.012-7.443)	3.546	0.001
Attitude					
Intervention	72.67 ± 8.926	83.97 ± 7.573	11.303 (8.417-14.432)	7.691	0.000
Control	74.64 ± 6.494	76.55 ± 5.778	1.909 (0.986-2.832)	4.214	0.000
Behavior					
Intervention	82.27 ± 12.692	91.21 ± 9.273	8.939 (4.956-12.922)	4.572	0.000
Control	86.36 ± 10.700	88.94 ± 8.269	2.576 (-0.624 – 5.776)	1.640	0.111

Table 2 shows the difference in knowledge before and after being provided with health education in the group which was provided with education using booklet media of 17.061 and the group provided with health education from the hospital was 4.727. The attitude score after being provided with the intervention in the form of health education, the increase in the post-test score of the group provided with health education employing booklet media was higher (83.97) than the group provided with health education from the hospital (76.55). The difference in behavior before and after being provided with health education in the intervention group was 8.939 and the control group was 2.576.

Table 3. Differences in the average increase in knowledge, attitudes and behavior of mothers in the intervention group and the behavior control group.

Variable	**Mean (SD)**	**CI 95%**	**Δ mean**	**t-test**	**P-value**
Knowledge					
Intervention	17.06 (10.093)	7.927 – 16.739	12.333	5.592	0.000
Control	4.73 (7.658)	7.921 – 16.745			

Attitude					
Intervention	11.30 (8.559)	6.389 – 12.641	9.515	6.080	0.000
Control	1.90 (2.749)	6.349 – 12.682			
Behavior					
Intervention	8.94 (11.233)	1.353 – 11.375	6.364	2.537	0.014
Control	2.58 (9.024)	1.348 – 11.379			

Table 3 presents that statistically, the average score of increased knowledge, attitudes and behavior in the intervention group is higher than the control group. The statistical test reveals the variable knowledge, attitude and behavior p-value <0.05. Thus, it can be concluded that there are differences in knowledge, attitudes and behavior in the intervention group and the control group. The increase in the score for the behavior variable displayed that the average score increases in the group provided with health education was higher (8.94) than in the group which was not provided with health education (2.58).

Table 4. Linear regression analysis of the effect of health education and external variables on the increasing maternal attitudes in providing care for low birth weight.

Variable	**Model 1**	**Model 2**	**Model 3**
	Coefficient	**Coefficient**	**Coefficient**
	P-value (CI 95%)	**P-value (CI 95%)**	**P-value (CI 95%)**
Health education	9.515	9.383	6.286
Intervention	0.000	0.000	0.000
Control	(6.389 – 12.641)	(6.425 - 12.341)	(2.909 – 9.667)
Parity		4.369	4.620
Primipara		0.005	0.002
Multipara		(1.389 – 7.350)	(1.830 – 7.409)
Difference in knowledge			0.250
			0.002
			(0.094 – 0.407)
N	66	66	66
R^2	0.366	0.442	0.521

From the results of the modeling analysis presented in table 4 and comparing the results of the analysis for each model, model 3 was selected which is good enough to be employed as a consideration in intervening. The selected model fulfills the parsimony and fit principle. Model 3 was selected due to the consideration of the R2 value, the coefficient and the confidence interval.

Table 5. Linear regression analysis of health education and external variables effect on increasing maternal behavior in providing care for low birth weight.

Variable	**Model 1**	**Model 2**	**Model 3**
	Coefficient	**Coefficient**	**Coefficient**
	P-value (CI 95%)	**P-value (CI 95%)**	**P-value (CI 95%)**
Health education	6.364	6.170	4.373
Intervention	0.014	0.013	0.140
Control	(1.353 – 11.375)	(1.374 – 10.966)	(-1.480 – 10.226)
Parity		6.390	6.535

Primipara		0.010	0.009
Multipara		(1.559 – 11.221)	(1.700 – 11.370)
Difference in knowledge			0.145
			0.289
			(-0.127 – 0.417)
N	66	66	66
R^2	0.091	0.182	0.197

From the results of the modeling analysis presented in table 5 and comparing the results of the analysis for each model, Model 3 was selected which is good enough to be utilized as a consideration in conducting intervention. The selected model fulfills the parsimony and fits principle. Model 3 was selected due to the consideration of the R2 value, the coefficient and the confidence interval.

Health education in this study was administered once, which was a day after the baby was born with a pre-test administered to the respondent first. Health education was provided as early as possible, that was after the mother gave birth because the respondent's attitude has not been formed. Niven, (2012), explained that it is easier to influence a person's attitude when forming an attitude than when an attitude is already formed. It is in accordance with the opinion of Grimes (2013) that health education performed earlier tends to increase attitudes and behavior in providing care to LBW and reduces negative behavior of mothers to their babies. This research is the first research at this hospital employing booklets to provide health education to postpartum mothers in providing care to LBW.

The evaluation was conducted 7 days after being provided health education. The concept of a 7-day time lag is in accordance with the pre and post testing guidelines explaining the pre-test and post-test measurement time. If the research instrument is in the form of multiple choice, the recommended time interval is 1 week. Meanwhile, if the evaluation employed is in the form of an essay, the research instrument should be in the form of multiple choices that the interval is 2 weeks (I-TECH, 2010). The time lag in evaluation is the same as the research conducted by Rahmayanti, (2010), that is the time interval between the pretest and posttest is one week.

Measurement of the increased knowledge within one week after health education was conducted with the objective of observing the retention of knowledge after health education was provided. However, this study did not further investigate knowledge retention over a longer period of time. During the period of one week between the pre-test and post-test, no other interventions were received by respondents but the interventions which had been planned.

Health education on care for LBW included a series of teaching and support programs which focus on skills, feelings and duties as parents. The objective of health education is to increase parents' role and health education focusing on knowledge about child development and care (Bornstein, et al., 2010). It is expected that after being provided health education, it may change the behavior and awareness of respondents to care for LBW and consequently improves the quality of life of LBW.

The health promotion media employed recently are various, such as using the Short Message Service (SMS), WhatsApp (WA) and the e-book model. However, in this study, researchers continued to utilize booklets as a medium for health promotion. The process of health education using booklet media is considered effective in increasing knowledge, because booklets contain more information which can be stored and read repeatedly anytime and anywhere (Notoatmodjo, 2010). Booklet is also equipped with attractive pictures,

making it easier for mothers to capture the message in question, remind it and practice it in everyday life. People remember 10% of what they read, 20% of what they heard, 30% of what they saw, 50% of what they saw and heard, 80% of what they heard they saw and were told (Ode, 2014). Research conducted by Peate, et al., (2012), reveal that booklets are effective learning media. As evidenced by 91% of respondents who were satisfied with the information because they were able to understand the material presented and 95% of respondents recommended booklets to others as a learning tool.

This study shows that the majority of post-partum mothers in this study have cellphones. A total of 66 mothers are post-partum, 40 mothers have smartphones, 18 mothers have cellphones and 8 mothers have cellphones shared with their husbands. The results of the interview present that of the 40 mothers using smartphones, only 3 mothers actively use smartphones to search for information on the internet, while others use them for calls, chatting, and social media. Furthermore, mothers who have their cellphones do not use them to seek for information, for instance to ask questions with health workers. Respondents stated it was more comfortable to read with a booklet than from a cellphone or smart phone screen.

The results revealed that the health education provided to mothers could increase their knowledge of LBW care. Table 3 displays that statistically, there is a difference in the increase in knowledge in the group provided with health education compared to the group that did not receive health education ($p < 0.05$). The difference in the increase in knowledge of the group provided with health education was 12,333 higher than the group which was not.

The results of this study are supported by previous research which states that health education possesses effect on knowledge. Research by Hanafi, et al., (2014) on 360 pregnant women in Saudi Arabia presented that the intervention group provided individual health education owned a higher level of knowledge about breastfeeding practices than the control group provided with regular antenatal care. Research by Alkon, et al., (2014), and Yousafzai, et al., (2015), revealed that the provision of health education interventions provides an essential role in increasing knowledge about development and practices in caring and feeding of early childhood. The group provided with health education also experienced an increase in the score of knowledge about LBW care, but the increase was not as high as the group provided with health education. The increase in this score is influenced by age, education and parity.

The majority of mothers in the group provided with health education according to those in the hospital ranged from 20-35 years and were in the productive age group. At the reproductive age, post-partum mothers were mature in both rational and motoric terms. At a young age, mothers possess a stronger memory to discover something unidentified compared to older people (Notoatmodjo, 2014).

The majority of maternal education in the group provided with health education according to those in the hospital was in the higher education group. Notoatmodjo (2014) asserted that education uphold mothers to have a wider education and easier to comprehend the provided information. Respondents who possess higher education are willing to learn on how to care for their babies to be healthier.

More than 50% of the respondents in the group provided with health education according to those in the hospital were multiparous, thus, they probably already experienced in providing care to their children. Research by Rustikayanti, (2011), explained that mothers experienced caring for babies have better knowledge than mothers never experienced caring for babies. The majority of mothers who already have children possess knowledge and experience in parenting compared to those who do not have children.

The use of booklets as a medium in this study is because people prefer to read with books than from cellphone. Research by Kretzschmar, et al., (2013) compared reading efforts from three different media, which were books, e-books and tablets. The result revealed that all participants preferred reading books. It was due to their skepticism towards digital reading media (Myrberg, & Wiberg., 2015). The obstacle in employing e-books is the inconvenience in reading through screen. Thus, reading using e-books was less desirable. Hence, respondents tended to read short sections of books online and also preferred to print the entire book to read (Folb, et al., 2011; Shelburne, 2009).

A study conducted in Norway involved one group who read in the printed media, while another group read the same text in PDF form on a computer. The evaluation results revealed that reading in the printed book was significantly better than reading the digital text. Book media is better because they make students easier to remember what they have read (Mangen, et al., 2013). Hence, the materials of health education which are still in form of e-book should be printed in the form of book. People were arguing on why they had to read the digital version if they experienced more comfortable reading the printed version (Myrberg & Wiberg, 2015). This study is in accordance with Bernaix, et al., (2010), who explained that health education programs should be cost effective, able to recognize the learning styles of each respondent, and should contain strategies for changing positive behavior.

Myrberg, and Wiberg (2015), argued that in order to employ new types of media, initially, it is necessary to familiarize oneself with the media in order to utilize them optimally and comfortably. Myrberg, and Wiberg (2015), stated that in Sweden, 57% of children aged two years employed the internet, especially tablets. They were accustomed to use technology. However, it is not sufficient to become accustomed to reading on digital media. In the current study, respondents explained that the majority owned a smartphone but they did not utilize it to search for health information.

Green explained that the behavior change process is divided into three factors. Predisposing factors are motivating behavior. Mother's behavior in providing care to LBW might be influenced mother's knowledge and attitudes. The provided health education increases maternal knowledge (Bornstein, et al., 2010). Extensive knowledge of LBW care shapes behavior in accordance with the attitudes they possess (Notoatmodjo, 2014).

Mother's behavior based on knowledge of LBW care is more lasting than those not based on knowledge. Parents possessing negative attitudes may encounter difficulties in implementing knowledge about childcare (Saleh, et al., 2014). This statement is corroborated by the WHO and Mannava, et al., (2015), asserted that negative attitudes and behaviors damage the quality of care and the effectiveness of promoting maternal and infant health. The results of the research by Vijayalakshmi, et al.,(2015), revealed that mothers' positive attitudes towards breastfeeding were associated with longer breastfeeding duration and a greater opportunity of success. However, women's negative attitudes towards breastfeeding were considered as the prior obstacle to starting and continuing breastfeeding.

Enabling factors are a continuation of predisposing factors in which motivation for changes in maternal behavior is realized. Enabling factors in this research are health information and media information. At Panembahan Senopati Hospital, health education has already been implemented but it was not performed initially or at the beginning of the baby's entry, on average health education, it was conducted when the baby was approved to KMC and when the mother returned home.

Some of the post-partum mothers in this study who were not provided with health education presented inappropriate behavior in caring for low birth weight such as breastfeeding,

prevention of infection, prevention of hypothermia and treatment of the kangaroo method. The majority of post-partum mothers in this study have already understood about the prevention of infection, one of which was by washing their hands before and after carrying the baby. However, the implementation of washing hands for most mothers was merely washing hands as usual without following the steps provided in the hospital or in the booklet. The respondent's reason was even though these steps have already been presented in the hospital, most of the nurses and midwives had not explained and recommended washing their hands according to these steps.

The material in this study was a material which should have been implemented by mothers in one week such as breastfeeding, proper breastfeeding, bathing babies, KMC and infection prevention. However, in this study, there were several skills which mothers were not able to perform during the study, such as bathing babies and KMC. At the Panembahan Senopati Hospital, bathing the babies was performed by health personnel. Hence, in this study, the mother merely answered through a questionnaire. Furthermore, there were some respondents did not perform KMC on their babies due to the baby's weight constraints and the baby's unstable condition.

The reinforcing factor is the factor obtained from the closest person. In this study, the health worker is able to strengthen the mother in providing care to LBW. Health education in this study was provided by midwives who frequently provide counseling to patients. Hence, they are more expert and trusted.

Knowledge, attitudes and behavior of mothers in providing care to LBW are influenced by several variables. The results of the external variable analysis discovered that parity affected the score for mothers' attitude and behavior. The parity variable possesses a positive relationship with mothers' attitudes and behavior in providing care to LBW. The results revealed that mothers possessing parity of more than one (multiparous) owned higher knowledge scores than primiparous mothers. Multiparous mothers possessed positive attitudes 4,658 times higher than primiparous mothers. Meanwhile, multiparous mothers owned good behavior 6,580 times higher to provide care to LBW.

The results of these studies are consistent with research by Salonen, et al., (2009), which explain that the number of children are associated with childcare because with the increase in the number of children, the mother possesses more experience in parenting. The results of this study are also corroborated by Rustikayanti, (2011) who revealed that the number of children the mother has provide the mother's experience in parenting. Mothers who have ever raised children own better knowledge than mothers who have never raised children. This study shows that parity is a confounding variable towards the increasing maternal attitudes and behavior in providing care to LBW.

4. CONCLUSION

There is an increase in knowledge, attitudes and behavior of mothers after being provided with health education using booklets. The provision of health education employing booklets is tailored to the necessity of patients who are more comfortable reading with booklets than from cell phone or smart phone. It is able to change the behavior and awareness of respondents to care for LBW and consequently improves the quality of life of LBW. It is recommended that the hospitals are able to provide health education with booklets more consistently according to the patients' needs, and further research is required replicating the effects of health education using booklets for LBW outside the institution.

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The Influence of Perceptions of Social Support and Family Health Tasks on HIV/AIDS Prevention Behavior in Adolescents

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Abstract
Adolescents are physically and psychologically vulnerable to the transmission of HIV/AIDS, so that they become the focus of the population for disease prevention programs. This study aims to determine the effect of perceptions of social support and family health tasks on HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. This study employed a quantitative research method with a cross-sectional design. The number of samples was 345 adolescents who were at risk of HIV/AIDS in Baros Village, Serang, Banten. Sampling from each class administering stratified sampling method. Researchers reproduced research questionnaires with an offline system which had previously been examined for the validity and reliability of a number of samples that have been calculated. Furthermore, for research questionnaires with an online system, distribution is conducted via a link from the google form. The chi-square test was administered to examine HIV/AIDS prevention behavior variables. A logistic regression test was used to see the most influential factors on HIV/AIDS prevention behavior. The results revealed a relationship between gender and family health tasks in recognizing HIV/AIDS prevention behavior problems in adolescents in Baros Village, Serang, Banten, with a p-value <0.05. The factor that most influenced HIV/AIDS prevention behavior was the family health task in recognizing problems with a p-value of 0.007 <0.05 with the largest OR value obtained, which is 1.978. Therefore, families should improve their ability to conduct health tasks in communicating and directing adolescents in HIV/AIDS prevention behavior.

Keywords: Adolescents, HIV/AIDS, Family Health Tasks.

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1. INTRODUCTION

According to the World Health Organization, (2012), adolescents are residents in the age range of 10-19 years. The Regulation of the Minister of Health of the Republic of Indonesia Number 2005 of 2014 states that adolescents are residents in the age range of 10-18 years, while from the Population and Family Planning Agency (BKKBN), the age range of adolescents is 10-24 years and unmarried (Kementerian Kesehatan Republik Indonesia, 2014). The number of adolescents in Indonesia is 17% of the entire population of Indonesia (Kementerian Kesehatan Republik Indonesia., 2018). In Banten Province, adolescents reached 3,435,822 people or 29.07% of the total population in Banten (Dinas Kesehatan Provinsi Banten, 2011). This large population of teenagers is a great resource for administering development to realize an advanced, independent, competitive, prosperous and moral Banten in accordance with the vision of the Banten Provincial Government.

However, adolescents generally possess an unbalanced emotional turmoil. Thus, they are easily affected by the influence of the environment. The phenomenon of adolescent health problems if not treated can increase the disease Human Immunodeficiency Virus/HIV and Acquired Immunodeficiency Syndrome/AIDS which is a disease that continues to grow and become a global problem in the world. The incidence of HIV/AIDS is a concern in the Sustainable Development Goals (SDGS), which is stated in the third goal.

Based on data from the Directorate General of P2PL (Disease Control and Environmental Health), statistics on HIV/AIDS cases reported from 2011-2012 have increased, which is in 2011, new cases of HIV were 21,031 cases, then increased to 21,511 cases in 2012. Likewise with AIDS from 2011, it was 37,201 cases, increasing to 42,887 cases in 2012. The proportion of risk factors for HIV/AIDS sufferers through heterosexual intercourse is the mode of transmission with the highest percentage at 77.75%, followed by IDUs or injecting drug users (IDU) at 9 .16% and from mother to child by 3.76% (Kementerian Kesehatan Republik Indonesia, 2014).

The Adolescent Reproductive Health Program is integrated into the Adolescent Health Program in Indonesia. The Youth Care Health Program (PKPR) has been launched since 2003. For more than ten years, this program has been mostly engaged in providing information, in the form of lectures, questions and answers with youth about health problems through the School Health Business (UKS), Karang Taruna (Youth Organization), or other youth organizations and other youth cadres formed by the Puskesmas (Primary Health Center). PKPR activities are in the form of health services for adolescents that access all groups of adolescents, which are acceptable, appropriate, comprehensive, effective and efficient. Banten Province is a province with HIV/AIDS cases with low knowledge of HIV/AIDS prevention in Indonesia (Kementerian Kesehatan Republik Indonesia., 2018). Thus, Banten is an area that requires efforts to prevent and control HIV/AIDS through health education and healthy life skills for its youth. Information about the knowledge, attitudes, and behavior of adolescents is needed to design these prevention and control efforts.

Teenagers spend a lot of time interacting in peer groups. It identifies that the existence of peers is tremendously important for adolescents. Data in Serang District shows that adolescents aged 12-18 years, 16% received information about sex from friends, 35% from pornographic films, and only 5% from parents (Dinas Kesehatan Provinsi Banten, 2011). Hence, in their development period, adolescents require an adaptive social environment so that they are able to create comfortable conditions for asking questions and forming a responsible character for themselves. Adolescents are

also physically and psychologically vulnerable to the transmission of HIV/AIDS. Thus, adolescents are the focus of the population of this disease prevention program. Baros Village, Serang is in the area of the Banten Provincial Health Office where Banten Province is a province with HIV/AIDS cases with low knowledge of HIV/AIDS prevention in Indonesia (Kementerian Kesehatan Republik Indonesia., 2018). Therefore, it is important to know "The influence of perceptions of social support and family health tasks on HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten." Hence, the right health program strategy is implemented in the area.

2. RESEARCH METHOD

This research is a quantitative study, employing a descriptive analytic design with a cross-sectional research method. The population in this study were all adolescent age groups who attended SMAN 1 Baros Serang and SMK/SMA Attaufiqiyyah and were in Baros Village, Serang, Banten. Sampling from each class administering stratified sampling method. After calculating the number of samples obtained as many as 345 teenagers to anticipate dropouts, the researchers added as much as 10% of the total sample so that the total became 380 samples.

This study employed univariate analysis to find the demographic values of the respondents (frequency distribution of age, gender, parental education, parental occupation, family income level, living in the same house, and ethnicity). Furthermore, univariate analysis is also utilized to identify the value of family structure, social culture, perceptions of social support, and family health tasks. Bivariate analysis used was the Chi-Square Test Formula to determine whether there was a relationship between age, gender, parental education, parental occupation, family income level, living in the same house, ethnicity, social culture, perception of social support, family structure, function and family health tasks. Multivariate analysis was performed employing the logistic regression test formula to identify the most influential factors on HIV/AIDS prevention behavior. This research has passed the ethical test from the UPNV Health Research Ethics Committee Number 2672/VII/2020/KEPK.

3. RESULTS AND DISCUSSION

Table 1. Demographic Frequency Distribution in Baros Village, Serang, Banten.

Variable	Frequency	Percentage (%)
Age		
Middle Ages (14-16 years)	267	77,4
Late Adolescence (17-20 years)	78	22,6
Gender		
Woman	197	57,1
Man	148	42,9
Father's Education		
Low Education (No School/Not Finished Elementary/SD/SMP)	300	87
Higher Education (SMA/Diploma/Bachelor/Postgraduate	45	13
Mother's Education		
Low Education (No School/Not Finished Elementary/SD/SMP)	318	92,2
Higher Education (SMA/Diploma/Bachelor/Postgraduate	27	7,8

Father's occupation		
Civil servant	6	1,7
Non civil servant	339	98,3
Mother's Job		
Civil Servant	2	0,6
Non Civil Servant	343	99,4
Ethnic group		
Java	10	2,9
Sunda	110	31,9
Betawi	2	0,6
Other	223	64,6
Family Income		
Less (< Rp. 3,872,551.00)	323	93,6
More (> IDR 3,872,551.00)	22	6,4
Family Structure		
Nuclear family (father-mother-child)	298	86,4
Single parent (lives only with father/mother)	6	1,7
Family of three generations	20	5,8
Extended family	21	6,1

Table 1 above shows that more than half of the teenagers in Baros Village, Serang, Banten in 2020 were the middle group of 267 people (77.44%), while the late teens group was 78 people (22.6%). In conclusion, most of the teenagers in Baros Village, Serang, Banten are middle teens (14-16 years). More than half of adolescents in Baros Village, Serang, Banten in 2020 were female, which were 197 people (57.1%), while adolescents with male sex were 148 people (42.9%). The majority of fathers and mothers have low education (no school/did not finish elementary/elementary/junior high school). The work of the father and mother are mostly non civil servants. Based on ethnicity among adolescents in Baros Village, Serang are mostly ethnic groups other than Javanese, Sundanese, Betawi. Most of the family income is less than the UMK (Minimum Wage), which is Rp. 3,872,551.00. Most teenagers live with their father and mother, which are included in the nuclear family structure.

Table 2. Frequency Distribution Based on Perceived Social Support, Family Health Tasks, and HIV/AIDS Prevention Behavior in Adolescents in Baros Village, Serang, Banten.

Variable	**Frequency**	**Percentage (%)**
Perception of Social Support		
Negative Perception of Social Support	167	48,4
Positive Perception of Social Support	178	51,6
Families Recognize HIV/AIDS Problems		
Unable to recognize the problem	141	40,9
Able to recognize problems	204	59,1
Family Makes Decision		
Unable to make a decision	167	48,4
Able to make decisions	178	51,6

Family Caring for Sick Family Members		
Unable to care for sick family members	181	52,5
Able to care for sick family members	164	47,5
Family Modifies Environment		
Unable to modify the environment	153	44,3
Able to modify the environment	192	55,7
Families Use Health Services		
Unable to take advantage of health services	216	62,6
Able to take advantage of health services	129	37,4
Implementation of Family Health Tasks		
Unable to conduct family health duties	184	53,3
Able to perform family health tasks	161	46,7
HIV/AIDS Prevention Behavior		
Good Behavior	255	73,9
Bad Behavior	90	26,1

In table 2, as many as 48.4%, which were 167 people had negative perceptions and 51.6%, which were 178 people possessed positive perceptions. Family health assignments based on the ability of families to recognize problems showed that most of the adolescents, who were 204 families (59.1%) of adolescents in Baros Village, Serang, Banten were able to recognize problems. Family health tasks based on the ability of families to make decisions show the results of most families as many as 178 families (51.6%). There were teenagers in Baros Village, Serang, Banten able to make decisions for their teenagers. Regarding the task of family health in caring for sick members, the results presented that 181 families (52.5%) of adolescents in Baros Village, Serang, Banten were unable to care for sick family members.

The task of family health related to the ability of families to modify the environment that as many as 153 (55.7%) families of adolescents in Baros Village, Serang, Banten were able to modify an appropriate environment for their adolescent children so that they were able to perform HIV/AIDS prevention behavior. Although overall, the implementation of family health tasks is still a lot, a number of 184 families (53.3%) are unable to perform family health tasks. The description of HIV/AIDS prevention behavior in the table above, as many as 73.9%, which were 255 people, most of whom are teenagers who show good behavior.

Table 3. Analysis of Demographic Relationships with HIV/AIDS Prevention Behavior in Adolescents in Baros Village, Serang, Banten.

Variable	**HIV/AIDS Prevention Behavior**						***p-value***	**OR**
	Good Behavior		**Bad Behavior**		**Total**			
	n	**%**	**n**	**%**	**n**	**%**		
Age								
Middle Ages (14-16 years)	202	76	65	24	267	77,4	0,224	1,466 (0,844-2,545)

Late Adolescence (17-20 years)	53	68	25	32	78	22,6		
Gender								
Woman	155	78,7	42	21,3	197	57,1	0,028	1,771 (1,091-2,876)
Man	100	67,6	48	32,4	148	42,9		
Father's education								
Low education (No school/Not finished elementary school/elementary/ junior high school)	219	73	81	27	300	87	0,415	0,676 (0,312-1,465)
Higher Education (SMA/Diploma/Bachelor/Postgraduate)	36	80	9	20	45	13		
Mother's Education								
Low education (Not in school/Not graduated from SD/SD/SMP)	234	73,6	84	26,4	318	92,2	0,804	0,796 (0,311-2,039)
Higher Education (SMA/Diploma/Bachelor/Postgraduate)	21	77,8	6	22,2	27	7,8		
Ethnic group								
Java	5	50	5	50	10	2,9	0,222	-
Sunda	85	77,3	25	22,7	110	31,9		
Betawi	2	100	0	0	2	0,6		
Other	164	73,1	60	26,9	223	64,6		
Family income								
Less (< Rp. 3,872,551.00)	238	73,7	85	26,3	323	93,6	0,904	0,824 (0,295-2.,01)
More (≥ Rp. 3,872,551.00)	17	77,3	5	22,7	22	6,4		
Family Structure								
Nuclear Family (Father-Mother-Child)	220	73,8	78	26,2	298	100		
Single Parent (Lives Only With Father/Mother)	5	83,3	1	16,7	6	100		
Family of 3 generations (Three generation)	15	75	5	25	20	100	0,949	-
Extended family	15	71,4	6	26,6	21	100		

Table 3 shows that there is no significant relationship between age and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. However, there is a significant relationship between gender and HIV/AIDS prevention behavior in

adolescents in Baros Village, Serang, Banten. However, in the table, it is displayed that there is no significant relationship between father and mother's education with HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. There is no significant relationship between father and mother's work with HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. There is no relationship between ethnicity and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. There is no relationship between family income and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten, and there is no relationship between family structure and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten.

Table 4. Analysis of the Relationship between Perceptions of Social Support and Family Health Tasks with HIV/AIDS Prevention Behavior in Adolescents in Baros Village, Serang, Banten.

Variable	HIV/AIDS Prevention Behavior						*p-value*	OR
	Good Behavior		Bad Behavior		Total			
	n	%	n	%	N	%		
Perception of Social Support								
Negative Perception of Social Support	123	73,7	44	26,3	167	100	1,000	0,974 (0,602 - 1,576)
Positive Perception of Social Support	132	74,2	46	25,8	178	100		
Family Health Tasks Recognize Problems								
Not capable	94	66,7	47	33,3	141	100	0,015	0,534 (0,329 - 0,868)
Capable	161	78,9	43	21,1	204	100		
Family Health Tasks make decisions								
Not capable	121	72,5	46	27,5	167	100	0,635	0,864 (0,534 - 1,397)
Capable	134	75,3	44	24,7	178	100		
Family Health Tasks Caring for Sick Family Members								
Not capable	134	74	47	26	181	100	1,000	1,013 (0,626 - 1,639)
Capable	121	73,8	43	26,2	164	100		
Family Health Tasks Modifying the Environment								
Not capable	108	70,6	45	29,4	153	100	0,258	0,735 (0,454 - 1,190)
Capable	147	76,6	45	23,4	192	100		
Family Health Tasks Utilizing Health Services								
Not capable	154	71,3	62	28,7	216	100	0,192	0,689 (0,413 - 1,149)
Capable	101	78,3	28	21,7	129	100		

Implementation of Family Health Tasks								
Unable to carry out	130	70,7	54	29,3	184	100	0,176	0,693 (0,426 - 1,129)
Able to carry out	125	77,6	36	22,4	161	100		

Based on table 4, there is no significant relationship between perceived social support and HIV/AIDS-AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. Likewise, presented in the table, there is no significant relationship between family health tasks and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten.

Table 5. Feasibility Analysis of Independent Variables for Multivariate Test Model.

Sub Variable	***p-value***
Family ability to recognize problems	0,015
Family decision-making ability	0,902
Ability of the family to care for sick family members	0,537
Family's ability to modify the environment	0,303
Ability of families to use health facilities	0,395
Implementation of Family Health Tasks	0,139
Perception of social support	0,873
Age	0,360
Gender	0,024
Father's education	0,711
Mother's education	0,798
Father's occupation	0,859
Mother's work	0,999
Family income	0,940
Ethnic group	0,737
Family structure	0,993

Multivariate analysis was performed on independent variables including: age, gender, parental education (father and mother), parental occupation (father and mother), ethnicity, family income, family structure, perception of social support, family health tasks (family ability to recognize problems, the ability of the family to make the right decisions, the ability of the family to care for sick members, the ability of the family to modify a healthy environment, and the ability of the family to utilize health services) and the implementation of family health tasks with the dependent variable being HIV/AIDS prevention behavior. The analysis was conducted in this study through 9 steps in selecting independent variables that deserve to be included in the multivariate test model as presented in table 24 above. The feasible variable has a significance level (sig.) or p-value < 0.25 with the "Enter" method in simple logistic regression modeling. The process occurs through one-by-one simple regression analysis stages between each independent variable to the dependent variable. If the results of the table are "variables in the equation" and see the value "sig.". If the significant value is <0.25, the variable is eligible to enter the multivariate model. Based on the results of the selection of variables above, the variables which deserve to be included in the multivariate test are the family health task variable in the ability to recognize problems, perform family health tasks, and gender because it has a p-value <0.25.

Table 6. The Most Influential Factors on HIV/AIDS Prevention Behavior in Adolescents in Baros Village, Serang, Banten.

Variable	B	Wald	*p-value*	OR	(95% CI)
Families know the problem	0,682	7,344	0,007	1,978	1,208-3,239
Implementation of family health tasks	-0,366	2,164	0,141	1	0,426-1,129
Gender	-0,631	6,292	0,012	0,532	0,325-0,871

Logistic regression analysis went through several stages, in table 5 above which is the result of a multivariate test after the 9th stage, the results obtained from all independent variables suspected of influencing HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten that there is one sub variable (task family health in the ability to recognize problems) which is most related to HIV/AIDS prevention behavior with p-value 0.007 <0.05. The largest OR value obtained is 1.978, meaning that families who are unable to recognize the problem are at risk of 1.978 times for the occurrence of poor HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten.

The results of the data distribution display that half of the students of SMA/SMK Attaufiqiyyah, Baros Village, Serang, Banten is the middle age group, which is 77.4%. The sample in this study consisted of high school students in grades 1-3, with an average of students entering their middle and late teens. More than half of the research sample was in the middle age group, in which the middle teens were in grades 1 and 2 of high school. Late teens are less than middle teens because late teens are dominated by 2nd and 3rd grade students. A teenager at the stage of middle adolescence has a character who needs friends, very happy if he has many friends. Furthermore, teenagers begin to like themselves and tend to find friends who have the same nature as them. Adolescents in the late adolescence stage can be implied to have egos that seek opportunities to unite with others and in new experiences.

Gender distribution shows that more than half of the students are female with a percentage of 57.1%. The numbers are not much different. It is because according to the researcher, the number of samples in the sampling who are male and female are almost the same. There is no dominant gender in obtaining the right to education in the school. All genders, both male and female, have the same right to education. Gender inequality occurs when there are different judgments between men and women in a community which causes men and women to get different treatment. It causes inaccuracy in the treatment of adolescents and low ability to access health services.

The distribution of education of fathers and mothers is mostly low education (no school/did not finish elementary/elementary/junior high school) amounting to 87% of fathers and 92.2% of mothers. Educational factors determine whether or not someone easily absorbs knowledge. The level of education can affect a person's health behavior including the ability to prevent HIV/AIDS (Notoatmodjo, 2010; Soetjiningsih, 2010). The condition of a high educational background allows parents to more easily receive all information from outside, especially about good family care, how to maintain their children's health, education and others (Handono & Bashori, 2013).

The distribution of family income levels is less than Rp. 3,872,551.00 as many as 93.6% have family incomes less than the UMK. Low-income levels affect parents' access to increase knowledge in HIV/AIDS prevention. Soekanto, (2012) mentioned that a person's occupation and education also affect the socioeconomic status of the family. In society, there are several layers of society including the lower, middle, and upper social layers. Each layer of society is certainly different, one of which is influenced by the socioeconomic status of a family. Family income will affect the quality of life of family members. Family income is an important aspect for the family

and affects family life. Maulina, et al., (2014) suggested that families who have sufficient income can change the health status of the family. It means that families with sufficient income will be better able to facilitate family members in improving family health, in this case increasing knowledge in HIV/AIDS prevention.

The distribution of adolescent ethnicity is mostly ethnically other than Javanese, Sundanese, and Betawi, (64.6%). Tribe is part of culture. The level of knowledge is influenced by culture, which includes ideas that exist in the human mind and are implemented in everyday life. Each tribe has different customs and norms. The perspective and mindset of a person in behaving towards health is influenced by ethnicity and culture. Culture is a complex whole consisting of knowledge, beliefs, arts, morals, customs, and abilities acquired by a person as a member of society (Isniati, 2012).

Family is tremendously influential for every individual. The family environment is where a person experiences a process of growth and development. Family structure relates to family support for individuals in performing health behaviors. Family support is also associated with a person's quality of life. Relationships between family members have a profoundly strong influence on family members, both physically and psychologically. Undaru, et al., (2015) emphasized that family emotional support can increase the positive impact and reduce the negative impact to improve the quality of life in healthy behavior.

The results of the research on the perception of social support were 48.4%, which were 167 people who had negative perceptions and 51.6%, which were 178 people who had positive perceptions. The perception of social support for adolescents in Baros Village, Serang, Banten can be identified in the results of the study that more or less have a positive perception. This result is in accordance with research of Sari, (2018) which revealed that the difference between negative and positive perceptions is very small. It is because there are 6 components that form perceptions, comprising of: adolescent beliefs that HIV/AIDS is the result of certain behaviors, adolescents' beliefs about the severity of HIV/AIDS, beliefs about recommended methods of preventing HIV/AIDS, beliefs about the cost of HIV prevention behavior, beliefs about the value of HIV/AIDS prevention behavior, support or encouragement from the surrounding environment in taking actions related to HIV/AIDS prevention behavior, and adolescents' self-confidence in HIV/AIDS prevention behavior (Glanz et al., 2008; Priyoto, 2014).

Likewise, it is emphasized from the theory that the perception of social support is a person's ability to organize and interpret the stimulus he obtains from the environment (Marzuki, 2017). Therefore, Zahra, (2017) stated that the environment which supports the formation of adolescent perceptions is parents, friends and people who are involved in providing and forming a sense of comfort, being loved and appreciated. However, regarding the five components of family health tasks that shape the implementation of family abilities in shaping adolescent behavior, particularly for HIV/AIDS prevention when viewed comprehensively and complexly, it can be stated that there are still more who are unable to conduct family health tasks for adolescents in Baros Village, Serang, Banten.

The developmental conditions that adolescents go through make their behavior tends to be at risk of adopting the behavior of others. Adolescent behavior can be assertive if it can fulfill its developmental tasks. If adolescents do not fulfill their developmental tasks, there will be role conflict which results in adolescents having a weakness in personality so that they are easy to adopt negative behavior (Priasmoro, et

al., 2016). Likewise, Dewi, (2012) stated that adolescents will go through a stage of egocentrism which is strongly influenced by their social environment, especially peers, family, and teachers.

The results of the bivariate analysis presented that there was no significant relationship between age and HIV/AIDS prevention sexual behavior, nor was there a significant relationship between gender and HIV/AIDS prevention sexual behavior. It is not in accordance with the research result of Martilova, (2020) which discovered that there is a significant relationship between adolescent age and adolescent knowledge in HIV/AIDS prevention. A person's knowledge is influenced by age, increasing a person's age affects his physical and psychological changes. In this study, there was no relationship between age and HIV/AIDS prevention behavior because there were no differences in the values conducted for the existence of a male and female adolescent, so that the treatment was the same for boys and girls.

Mubarok, (2011) argued that adolescents aged more than 17 years have better knowledge than adolescents aged less than 17 years. Middle age adolescents do not necessarily have good or bad behavior in HIV/AIDS prevention, as well as late teens do not necessarily have good or bad behavior in HIV/AIDS prevention. Adolescence is related to the socialization of adolescents with peers which allows them to imitate the behavior of their peers.

The results unveiled that there was a significant relationship between gender and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. It is not in accordance with the research of Widyoningsih & Sutarno, (2017) that gender has no effect on a person's behavior in preventing free sex. Furthermore, there are several things that influence attitudes including personal experience, culture, mass media, important people in their lives, religion, and one's emotions. These are influenced by anxiety factors. Demak, & Suherman, (2016) emphasized that women have a higher level of anxiety due to excessive autonomic nervous reactions with an increase in the sympathetic system, an increase in norepinephrine, an increase in the release of catecholamines and an abnormal serotonergic regulation disorder. It is in accordance with the results of this study that women have the opportunity greater in HIV/AIDS prevention than men.

The results presented that there was no significant relationship between father's education and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. Parents with high education do not necessarily have children with good behavior in preventing HIV/AIDS, and vice versa parents with low education can also have children with good behavior in preventing HIV/AIDS. The condition of a high educational background allows parents to more easily receive all information from outside, especially about good family care, how to maintain their children's health, education and so on (Handono, 2013). Higher education background causes a person to be exposed to the life of modern society so that the individual will easily accept the development of science and modern health care. Therefore, Kasih, (2016) stated that the attitude of adolescents in preventing HIV/AIDS transmission will increase if there is sufficient knowledge in education in the family.

Stanhope, & Lancaster, (2015) asserted that one of the environmental risk factors that contribute to vulnerability in a population is socioeconomic status. The condition of poverty or low income is the main cause of family vulnerability to health problems. One's perception will affect one's actions in conducting prevention efforts. Moreover, Iqbal, et al., (2019) explained that people living in urban areas have a secondary level of education and have high knowledge of AIDS. It is also influenced by adolescent peers which is enforced in the results of the research by Rini & Noviyani, (2019) which states

that the influence of peers is tremendously significant in preventing bad behavior, including the prevention of HIV/AIDS behavior.

The results display that there was no significant relationship between ethnicity and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. Differences in cultural shifts at this time when an individual does not purely behave in accordance with the cultural norms that exist in his tribe. It is contrary to the opinion of Isniati, (2012) that the cultural perspective of health problems is influenced by changes in relations with the community that have an impact on health behavior. In the current era of 4.0, it is possible that social media access to communication is quite strong. Teenagers can access information around the world from various mass media today. It allows teenagers to no longer behave and behave according to the norms and culture of the teenager. In the current era, there is a cultural shift which allows the influence of the mass media at this time to grow stronger than ever before.

The results demonstrated that there was no significant relationship between family income and HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. Family income is influenced by the work in the family. Family income is influenced by the work in the family. The results of this study are not in accordance with the results of research by Da Costa, et al.,(2014) which illustrates that family income is related to a person's quality of life in the implementation of health behavior. Low family income does not necessarily have bad behavior in HIV/AIDS prevention, as well as high family income does not necessarily have good behavior in HIV/AIDS prevention. It is influenced by several things, including access to social media in the 4.0 era, which can be accessed by teenagers with various conveniences without incurring large costs.

The results showed that there was no significant relationship between perceived social support and HIV/AIDS AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. Romdiyah, (2017) declared that there is a relationship between family support and the behavior of preventing HIV/AIDS transmission. Romdiyah, (2017) specified that support from family members as seen from the family structure makes adolescents more motivated in preventing HIV/AIDS transmission behavior and will decrease their motivation if they do not get support from their families. Family support is required so that it can reduce the risk of HIV/AIDS behavior. The family support demanded for teenagers today is different from before because teenagers are looking for freedom in exploring themselves so that their attachment to their family will be reduced. It is confirmed in the research of Adita, et. al., (2017) which explained that family support is very important in the prevention of HIV/AIDS. Families with adolescents need to adapt in performing family development tasks so that there is no confusion which can lead to the fragility of adolescents' personalities (Priasmoro, et. al., 2016).

It is not in line with research by Sari, (2018) which shows that there is a significant relationship between perception and behavior to prevent HIV/AIDS transmission in Madiun City. Based on research from Rini, & Noviyani, (2019), it is presented that the results above do not match, there is an influence between perception and adolescent health behavior. A person's behavior is determined by the perception of the seriousness of the HIV/AIDS problem. Thus, the source of information has a positive effect on positive perceptions and will shape good HIV/AIDS prevention behavior. However, it should be noted that sources of information come not only from individuals but also parents, peers, health workers, and school teachers (Apollo, & Cahyadi, 2012; Rini, & Noviyani, 2019). Furthermore, perception is formed from

various sources of information obtained by a person so that it is processed and interpreted to provide direction in healthy behavior (Notoatmodjo, 2012).

The results of this study are in accordance with what was stated by Wahyuningtias, (2019) that there is no family functioning with risky sexual behavior in adolescents. The study revealed that family functions are very diverse and not all are related to risky sexual behavior in adolescents. According to Friedman, et al., (2010), the function of the family in shaping the behavior of family members is more emphasized on the function of family health care, which is the ability of the family to perform health tasks to fulfill the task of growing and developing family members as well as adolescents. It is also perceived from the North American Nursing Diagnosis Association (NANDA) that the role of nurses is very necessary in providing education about risky diseases obtained from sexual intercourse, sexual behavior, about self-respect, belief in religious beliefs, and other counseling guidance to adolescents.

In multivariate analysis, the largest OR value obtained is 1,978, meaning that families who are unable to recognize the problem are at risk of 1,978 times for the occurrence of poor HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. Sulistyowati, (2012) mentioned the cause of the family not being optimal in completing family health tasks due to the low level of family ability in recognizing problems. Therefore, the ability of families to recognize problems is the main basis that determines the implementation of family health tasks. Families who are unable to recognize health problems that occur in family members will find it difficult to prevent health problems and perform health care for family members.

4. CONCLUSION

The conclusion of this study is that there is a relationship between gender and family health tasks in recognizing problems with HIV/AIDS prevention behavior in adolescents in Baros Village, Serang, Banten. The factor which primarily influences the behavior of preventing HIV/AIDS is the task of family health in the ability to recognize problems. Researchers hope that adolescents will further enhance their socialization with friends, family, and teachers as well as with people in their environment so that they are able to select and perform positive activities so that they have good perceptions and support in behavior, particularly in the prevention of HIV/AIDS. Moreover, families should pay more attention at home, communicate, and interact with adolescents in order to be able to provide information so that it increases not only knowledge but attitudes and behavior in HIV/AIDS prevention. For community nurses, in particular, conduct health education about HIV/AIDS prevention behavior on a continuous and sustainable basis, not only for adolescents but also for their families and peers as a support system.

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

Survival of Patients on Maintenance Hemodialysis Base on Comorbidity of Cardiovascular Disease in Persahabatan Central General Hospital 2015-2019

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Abstract
Chronic kidney disease is the progressive loss of kidney function over months or years. The significant increase in new cases of chronic kidney disease is in line with the increasing number of patients undergoing hemodialysis as kidney replacement therapy in an effort to survive. Comorbid cardiovascular disease is a major risk factor for morbidity and mortality with chronic kidney disease. The study was conducted to determine the survival of hemodialysis patients in the group with comorbid cardiovascular disease and the group without comorbid cardiovascular disease. This study used a retrospective cohort design. The location of this study was conducted at Persahabatan Central Public Hospital, DKI Jakarta, and used secondary data from the hospital information system data from 2015 to 2019. The variables significantly related to the survival of patients undergoing hemodialysis with comorbid cardiovascular disease were age, complications of anemia, diabetes mellitus, and hypertension. The age variable has a p-value of 0.029 with an HR of 1.54 (95% CI OR 1.043-2.262). The anemia variable has a p-value of 0.013 with an HR of 1.60 (95% CI 1.117-2.515). The diabetes mellitus variable has a p-value of 0.000 with HR2.71 (95% CI 1.780-4.11). The hypertension variable has a p-value of 0.004 with HR1.79 (95% CI 1.208-2.646). In conclusion, patients undergoing hemodialysis with comorbid cardiovascular disease have a risk of death of 0.76 times compared to patients undergoing hemodialysis with the comorbid non-cardiovascular disease. This study's internal validity was not good due to selection bias and non-differential misclassification information bias. Thus, the results of this study cannot be generalized.

Keywords: Survival, Hemodialysis, Cardiovascular Disease.

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1. INTRODUCTION

Chronic kidney disease is the progressive loss of kidney function over months or years (World Kidney Day, 2020). Chronic kidney disease initially does not show signs and symptoms but it can progress to kidney failure (World Kidney Day, 2019). The global prevalence of chronic kidney disease in 2017 was 697.5 million cases (95% CI 649.2-752.0 million) (Bikbov, et al., 2020). According to WHO, worldwide chronic kidney disease currently affects 8%-16% of the world's population (Chen, et al., 2019). In 2017, the Southeast Asia region was ranked 3rd in the world with a prevalence of 69.6 million cases of chronic kidney disease (95%CI 64.2-75.1 million). Indonesia has more than 10 million cases of chronic kidney disease, with a total of 27.2 million cases (Bikbov, et al., 2020). Every year, the number of patients with kidney disease is increasing. Based on Riskesdas 2018, the number of sufferers of chronic kidney disease (CKD) in Indonesia rose from 2.0 per mile in 2013 to 3.8 per mile in 2018 (Kementerian Kesehatan Republik Indonesia, 2018).

Chronic kidney disease is divided into 5 stages in which the last stage is the worst stage. At that stage, the kidneys are no longer functioning optimally so they require renal replacement therapy. One of the most common types of kidney replacement therapy performed by patients with chronic kidney disease is 99% hemodialysis in 2018 (Indonesian Renal Registry, 2018). Chronic kidney disease causes at least 2.4 million deaths per year and is now the sixth leading cause of death (World Kidney Day, 2019). According to research conducted by (Bikbov, et al., 2020), the mortality of chronic kidney disease in the world in 2017 was 1.2 million deaths (95% CI 1.2-1.3 million) while Southeast Asia was ranked 3rd in the world with the number of deaths from chronic kidney disease of 134,459 deaths. Indonesia in 2017 amounted to 35,466 deaths (Bikbov, et al., 2020).

Approximately, 91% of patients who started hemodialysis under the age of 70 years were still alive after 12 months of treatment (Prasad, & Jha, 2015). In Indonesia, the survival study of patients with chronic kidney disease (CKD) with HD in general was 67.84 months at the Soetomo Public Hospital (Yulianto, & Basuki, 2017). Based on the calculations that have been performed, it is known that the survival of patients with kidney failure undergoing hemodialysis is 776 days (Habibah, et al., 2018). One-, two- and three-year survival of patients are 82%, 13% and 10%, respectively. Cardiovascular events are the main cause of death in patients (22.72%) (Msaad, et al., 2019). The most common cause of death in hemodialysis patients is cardiovascular (K1) as much as 42% (Indonesian Renal Registry, 2018). The cause of death among hemodialysis patients 2011-2013 is arrhythmia/cardiac arrest of 28%, other cardiovascular diseases of 12.4%. Patients who are female, and have a history of hypertension, diabetes mellitus and the presence of complications of anemia have a lower average survival (Yulianto, & Basuki, 2017). Patients on hemodialysis with hemoglobin levels <10 g/dL had an increased risk of cardiovascular death, 2.24 (95% CI, 1.40–3.59) in patients with hemoglobin levels <9 mg/dL (Kuo, et al., 2018).

Chronic kidney disease is still a major health problem in Indonesia, which is associated with a high mortality rate. Comorbidities are the dominant factors that influence the survival of chronic kidney disease patients undergoing hemodialysis. Through this retrospective cohort study, researchers determined the survival of hemodialysis patients in the group with comorbid cardiovascular disease and the group without comorbid cardiovascular disease at Persahabatan Central Public Hospital,Jakarta in 2015-2019. The benefits of this study are expected to provide information about the description of the survival rate of hemodialysis patients based on

the presence or absence of comorbid cardiovascular disease and provide information about the effect of comorbid cardiovascular disease and other variables on the survival of hemodialysis patients so that the community can make prevention efforts by controlling these factors.

2. RESEARCH METHOD

This study is an observational analytic epidemiological study with a retrospective cohort study. Observations were conducted within a certain period of time from exposure to events (deaths) that had occurred in the past or before the researcher started the study. Data collection was performed using medical record data in the information system from 2015-2019. The population in the study were patients undergoing hemodialysis at Persahabatan Central Public Hospital. The samples were patients from 2015 to 2019 who had met the inclusion criteria. The inclusion criteria were new patients undergoing hemodialysis at the Persahabatan Central Public Hospital. In this study, the sample used was 290 patients who met the inclusion and exclusion criteria. The inclusion criteria in this study were that the patient was a new case of chronic kidney disease diagnosed during January 2015 to November 2019 and only underwent hemodialysis at Persahabatan Central Public Hospital in Jakarta. The exclusion criteria in this study were patients whose medical records were incomplete.

The data obtained was then administered editing, coding, data entry, and data cleaning. This study employed univariate, bivariate, and multivariate analysis with Kaplan meir analysis, log rank and cox regression with 95% confidence level. In this study, the dependent variable was survival, the independent variable was comorbid cardiovascular disease and the covariates were age, sex, hypertension, diabetes mellitus and anemia complications. This article has received ethical approval from the Ethics Commission of the University of Indonesia with ethical no: 356/UN2.F10.D11/PPM.00.02/2021.

3. RESULTS AND DISCUSSION

Table 1. Characteristics of Patients Undergoing Hemodialysis at Persahabatan Central Public Hospital 2015-2019.

Variable	Cardiovascular Disease Comorbid		Not Comorbid Cardiovascular Disease		Total	
	n	%	n	%	n	%
Chronic Kidney Disease Patient Status						
Sensor	68	36,36	119	63,64	187	64,48
Event	42	40,78	61	59,22	103	35,52
Age (average±sd)	55,4±15,3		54,3±11.4			
< 60	53	31,74	114	68,26	167	58,92
≥ 60	57	46,34	66	53,66	123	41,03
Gender						
Male	60	36,14	106	63,86	166	57,24
Female	50	40,32	74	59,68	124	42,76

Anemia						
No	75	36,95	128	63,05	203	70,24
yes	35	40,23	52	59,77	87	29,76
DM						
No	81	36,99	138	63,01	219	75,52
Yes	29	40,85	42	59,15	71	24,48
Hypertension						
No	63	36,42	110	63,58	173	59,66
Yes	47	40,17	70	59,83	117	40,34

The results of the analysis in Table 1 can be seen, the percentage of events (died) was more in hemodialysis patients without comorbid non-cardiovascular disease (59.22%) compared to comorbid cardiovascular disease patients (40.78%). The mean age of patients in the comorbid cardiovascular disease group was 55.4(±15.3) years while the non-cardiovascular comorbid patients were 54.3(±11.4) years. Age category ≥60 years are more (46.34%) compared to age <60 years in patients undergoing hemodialysis in patients with comorbid cardiovascular disease (31.74%). There are more female patients (40.32%) compared to male ones in hemodialysis patients with comorbid cardiovascular disease (36.14%). Complications of anemia were more in patients undergoing hemodialysis with comorbid cardiovascular disease (40.23%) compared to patients without anemia (36.95%). Diabetes mellitus was more common in patients undergoing hemodialysis with comorbid cardiovascular disease (40.85%) compared to patients undergoing hemodialysis without diabetes mellitus (36.99%). Hypertension was more common in patients undergoing hemodialysis for comorbid cardiovascular disease (40.17%) than patients undergoing comorbid hemodialysis for cardiovascular disease without hypertension (36.42%). It appears that there are differences in characteristics between groups of patients undergoing hemodialysis with comorbid cardiovascular disease and non-comorbid cardiovascular disease. Therefore, it will be controlled in a multivariate analysis.

Table 2. Average Survival of Patients Undergoing Hemodialysis at Friendship Hospital in 2015-2019.

Patients undergoing hemodialysis	***Mean***	***Min-Max***
Cardiovascular Disease Comorbid	32 months	1-78 month
Comorbid Not Cardiovascular Disease	23 months	1-78 month

The results of the analysis in Table 2 can be seen that the average survival of patients undergoing hemodialysis with comorbid cardiovascular disease is longer than patients without comorbid cardiovascular disease. The average survival of patients undergoing hemodialysis with comorbid cardiovascular disease was 32 months, while for non-comorbid cardiovascular disease was 23 months.

Table 3. The relationship between independent variables and covariate variables on the survival of patients undergoing hemodialysis at Persahabatan Central Public Hospitalin 2015-2019 using the Cox Regression Test.

Variable	**HR**	**95%CI**	**P-Value**
Independent			
Cardiovascular Disease Comorbid	0,76	0,513 – 1,134	0,181
Not Cardiovascular Disease	1		
Covariate Variable			
Age			

< 60 years	1,54	1,043 - 2,262	0,029
≥ 60 years	1		
Gender			
Male	0,87	0,587 - 1,276	0,467
Female	1		
Anemia			
Yes	0,68	1,117 - 2,515	0,013
No	1		
Diabetes Mellitus			
Yes	2,71	1,780 - 4.11	0.000
No	1		

The results of the bivariate analysis in table 3 above show that of the 5 variables, which are cardiovascular disease, age, hypertension, comorbid diabetes mellitus and anemia complications. There are 4 variables that have a significant risk for survival of patients undergoing hemodialysis with p <0.05. These variables include age, anemia, diabetes mellitus and hypertension. After selecting the confounding variables on the candidate variables, it was found that there was no change in HR in the independent variables of >10%. Hence, there are no confounding variables that will enter into the final model.

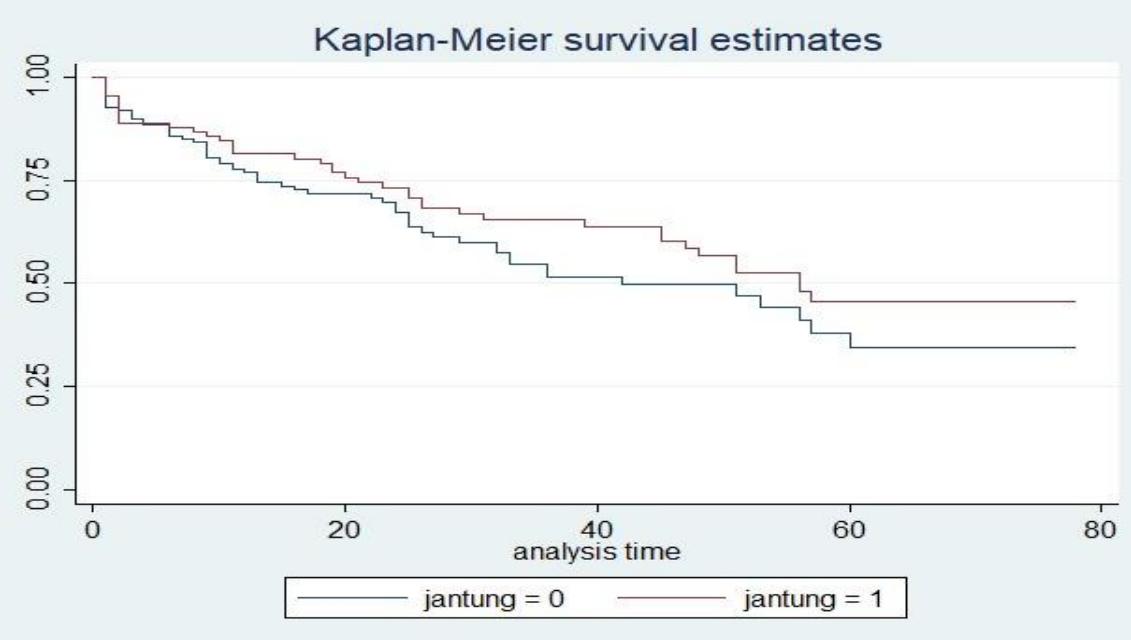

Figure 1. Probability of Survival of Patients Undergoing Hemodialysis Based on Comorbid Cardiovascular Disease at Persahabatan Central Public Hospital 2015-2019.

The curve in Figure1. showed that patients with comorbid cardiovascular disease were more likely to survive than non-cardiovascular comorbid patients. The results of the log rank test with p-value = 0.175 (>0.05) displayed that there was no statistically significant difference in the probability of survival between patients with cardiovascular comorbidities and no cardiovascular comorbidities. To describe the probability of survival of patients undergoing hemodialysis, a survival function with the life table method is used which can be seen in table 4.

Table 4. Life Table of Survival of Patients Undergoing Hemodialysis Based on Comorbid Cardiovascular Disease at Persahabatan Central Public Hospital 2015-2019

Time (month)	Cardiovascular Disease Comorbid (%)	Not Comorbid Cardiovascular Disease (%)
12	81.4	76.8
24	73.3	67.3
36	65.4	51.6
48	56.6	49.8
60	45.7	34.5

Table 4 above shows that the probability of survival of hemodialysis patients is higher with comorbid cardiovascular disease compared to comorbid non-cardiovascular disease. In the first year or 12 months, 81.4% of comorbid cardiovascular disease patients were still alive, while 76.8% of HD patients were not comorbid with cardiovascular disease. Year 5- or 60-months survival of HD patients with comorbid cardiovascular disease is 45% while non-comorbid cardiovascular disease is 34.5%.

Table 5. Final Model of Survival of Patients Undergoing Hemodialysis at Persahabatan Central Public Hospital in 2015-2019 using the Cox Regression Test

Variable	HR	SE	95% CI	P-Value
Cardiovascular Disease	0,76	0,15	0,51-1,13	0,181

Patients undergoing hemodialysis with comorbid cardiovascular disease will have a hazard of 0.76 times for death compared to patients with non-cardiovascular comorbidities.

In this study, the average age of patients with kidney disease undergoing hemodialysis based on comorbid cardiovascular disease was 55.4 years in patients with comorbid cardiovascular disease. The mean age of patients older than the Msaad study (2019), is 44.3 years for comorbid cardiovascular disease patients. The age group of ≥60 years is more than age <60 years. The age of the elderly based on the 2014 Minister of Health is someone who is 60 years old. Various studies regarding the low survival of patients undergoing hemodialysis state that older age is one of the most significant predictors of advanced age (Indonesian Renal Registry, 2018). In chronic kidney disease and some forms of acute renal failure, the GFR falls below the normal value of 125 ml/min. GFR also decreases with age, after the age of 30, the GFR value decreases at a rate of about 1 ml/min (Price, & Wilson, 2005). With increasing age, physiological functions decrease due to the aging process so that non-communicable diseases appear in the elderly (Kementerian Kesehatan Republik Indonesia, 2016). The kidneys cannot regenerate new nephrons so that when there is kidney damage or the aging process, there is a decrease in the number of nephrons. At the age of 40, the number of functioning nephrons decreases by about 10% every 10 years, and at the age of 80 years, only 40% of the nephrons are functioning (Siagian, & Damayanty, 2018).

Female gender was higher than male patients, namely 40.32%. This is in line with research conducted by Msaad, that patients undergoing hemodialysis both with comorbid cardiovascular disease and non-comorbid cardiovascular disease with female sex as much as 54.4%, while patients with male gender 40% (Msaad, et al., 2019). This study is also in line with research conducted by Sikole A which states that women survive more than men (Sikole, et al., 2007). This study is not the same as the research conducted by IRR (Indonesian Renal Registry) in 2016 which explained that there were more males than females.

The results of this study indicate that patients who experience anemia while undergoing hemodialysis are higher in patients with comorbid cardiovascular disease

(40.23%) compared to non-cardiovascular comorbidities (36.95%). Anemia is the most common abnormality in patients with decreased kidney function followed by a decrease in hemoglobin or hematocrit. Hence, the routine hematological examination of patients is important whether there is anemia. More than 85% of patients with chronic kidney disease (CKD), particularly in the advanced stages will experience anemia. Mortality of Chronic Kidney Disease (CKD) will be higher if accompanied by anemia (Syam, 2013).

The results of this study indicate that patients with comorbid diabetes mellitus while undergoing hemodialysis are higher in patients with comorbid cardiovascular disease (40.85%) compared to non-cardiovascular comorbidities (36.99%).

In this study, the survival probabilities of 1 year, 2 years, 3 years, 4 years and 5 years of patients undergoing hemodialysis with comorbid cardiovascular disease were 81.4%, 73.3%, 65.4%, 56.6% and 45.7% while non-cardiovascular comorbidities were 76.8%, 67.3%, 51.6%, 49.8% and 34.5%. From these results, it can be seen that the probability of survival of patients undergoing hemodialysis with comorbid cardiovascular disease is higher than that of non-cardiovascular comorbidities. It is in accordance with research conducted by Mardhatillah, which states that the 1-year survival of chronic kidney failure patients undergoing hemodialysis is 82% each (Mardhatillah, 2020).

Furthermore, based on survival time, patients undergoing hemodialysis with comorbid cardiovascular disease have a longer mean time to death, which is 32 months compared to patients with non-cardiovascular comorbidities. The results of this study are lower than the research conducted at Soetomo Public Hospital which states that patients undergoing hemodialysis are generally 67.84 months old (Yulianto, & Basuki, 2017).

The risk of survival of patients undergoing hemodialysis based on comorbid cardiovascular disease in this study was bivariate and multivariate, the HR value was 0.762 (95% CI 0.513 - 1.134). This is not in accordance with a study conducted in Morocco, that cardiovascular disease can increase 2.9 (95% CI 1.33-7.0) times the occurrence of death in hemodialysis patients compared to patients without comorbid cardiovascular disease (Msaad, et al., 2019). The results of this study are also not in line with research in the United States, that cardiovascular disease can increase 1.31 times the occurrence of death in hemodialysis patients compared to patients without comorbid cardiovascular disease after controlling for age, gender, race, age at first kidney failure, and comorbidities that others (Modi, et al., 2019). This is due to the high loss to follow in both groups (comorbid cardiovascular disease group with non-cardiovascular disease).

Although cardiovascular disease is the most common cause of death in chronic kidney disease (CKD) patients undergoing HD, Jager *et al*. in 2009 reached a different conclusion. In her study, chronic kidney disease (CKD) patients who started HD had a higher risk of death than the general population but was not specifically caused by cardiovascular disease (Umami, et al., 2017). Death in patients with chronic kidney disease (CKD) was 39% with cardiovascular disease and 51% were non-cardiovascular. In the general population, 40% of deaths are cardiovascular and 58% are non-cardiovascular diseases (De Jager, et al., 2009).

Retrieval of data from the hospital information system has several advantages, especially efficiency in terms of time, cost and some field resources. However, it also has limitations related to the observed factors because it must be adjusted to the availability of data which then results in limited determination of variables. Lost to

follow-up in this study was 36.2%, because this lost to follow was more than 20%. Therefore, in this study, there is a selection bias that can affect internal validity. This study employed secondary data so that researchers have not been able to control the quality at the data collection stage. Therefore, researchers have not been able to control the possible bias.

4. CONCLUSION

Patients undergoing hemodialysis with comorbid cardiovascular disease have a risk of death of 0.76 times compared to patients undergoing hemodialysis with the comorbid non-cardiovascular disease. However, the results of this study are influenced by selection bias and non-differential misclassification information bias. Thus, the results of this study cannot be generalized. It is hoped that this study can be developed further by examining the survival of patients undergoing hemodialysis with other variables such as comorbid protein-energy malnutrition, hepatitis, and others.

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RESEARCH **Open Access**

The Effectiveness of Pineapple Extract (*Ananas Comosus*) and Kesum Leaves (*Polygonus Minus*) on the Quality of Coconut Oil (*Coconus Nucifera*)

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Abstract
The processed oil from the coconut plant is generally understood as coconut oil. A method is required to produce a product with a higher oil extraction rate and is able to reduce the water content and free fatty acids in the coconut oil production. It is also necessary to add substances that can delay or prevent fat oxidation reactions by generating substances in the form of antioxidants. The method that can be implemented is the enzymatic method employing the bromelain enzyme in a pineapple with the addition of an antioxidants substance from the kesum leaf. The objective of this research is to describe the quality of coconut oil after the addition of pineapple (*ananas comosus*) and kesum leaves (*polygonus minus*) extracts. The parameters for describing the quality of the oil are the organoleptic test, the degree of acidity, the oil extract rate, the peroxide number, the saponification number, and the acid number. This research is a quasi-experiment. The samples in this research were coconut oil without the addition of pineapple fruit extract, coconut oil with the addition of pineapple fruit extract without the addition of kesum leaves, and coconut oil with the addition of pineapple fruit extract and kesum leaves as much as 20gr, 30gr and 40gr. Based on the statistical results of the linear regression test, it was discovered that p-value = 0.000 <0.05, so it was concluded that there was an effect of the addition of pineapple fruit and leaves of kesum on acid number content with an effect of 76.4% on the acid number, 71.4% on the peroxide number, and 81.5% to the saponification number. It is recommended to test the water content, free fatty acids, and iodine number.

Keywords: Oil Quality, Coconut Oil, Pineapple, Kesum Leaves.

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1. INTRODUCTION

Cooking oil can be produced by employing plants as a source of manufacture, for instance from coconut plants (Lempang, et al., 2016). The processed oil from the coconut plant is generally understood as coconut oil. Coconut oil is a processed oil which is obtained from copra or from the coconut milk juice. Coconut oil is essential for the body's metabolism because it contains fat-soluble vitamins (Effendi, et al., 2012).

Coconut oil production in the traditional way produces products with quality standards and oil extraction rate which are not yet optimal. One of the parameters for the quality of coconut oil products which can be implemented is to examine the water and free fatty acid content. The presence of excess water and free fatty acid can accelerate the process of rancidity of coconut oil. A method is required which produces products with more oil extraction rate and reduces the water content and free fatty acids in coconut oil production (Palilingan & Pungus, 2018). In coconut oil production, it is also necessary to add substances that can delay or prevent fat oxidation reactions, by adding substances in the form of antioxidants (Mahmud, et al., 2021).

The method which can be conducted to obtain more oil extraction rate is by performing enzymatic production. The enzyme frequently employed in the manufacture of coconut oil is the enzyme bromelain (Prihanani, et al., 2013).The bromelain enzyme added to the coconut milk will hydrolyzes protein and make the oil separated from the water in the coconut emulsion maximally (Palilingan & Pungus, 2018). Bromelain enzyme is a proteolytic enzyme which is able to accelerate the process of making coconut oil and the process of destroying the coconut milk emulsion system which is hydrolyzed into amino acids through peptide bonds (Effendi, et al., 2012).

The content of bromelain enzyme in pineapple plants with the highest specific activity is 62.5 U/mg. Research performed by Effendi, et al. (2012) employed pineapple core producing 97 mL of oil with a volume ratio of coconut milk and pineapple core extract, 800:600. The results of the analysis revealed that the volume ratio of coconut milk and pineapple core extract fulfilled the criteria for water content, acid number and saponification number in coconut oil but did not meet the criteria on the iodine number.

The iodine number in coconut oil displays the unsaturated bonds discovered in coconut oil. If coconut oil has less unsaturated bonds than a normal, the oil will be easily damaged because its nutritional value is less than the standard. Hence, when it is utilized for cooking it cannot maintain the nutritional value of what it is cooking, whereas if coconut oil possesses many saturated bonds, the melting point will increase so that it results in rancidity to oil because it is easily oxidized (Novitriani & Sapitri, 2014).

To prevent free radical oxidation reactions in lipid oxidation in the rancidity process, it is necessary to add substances in the form of antioxidants (Tomagola, et al., 2016). Phenolic compounds as antioxidants possess the ability to reduce free radicals (Ahmad, et al., 2018). High antioxidant activity with a large enough phenol content, which are coumaric acid and gallic acid, can be obtained in Kesum plants (Dewi, et al., 2019).

Research conducted by Ratnawati & Indrawati, (2021) revealed that there is a relationship between the addition of 20 gr and 40 g of kesum leaves to the free fatty acid content in applying cooking oil, with an average of free fatty acid content before the addition of kesum leaves which is 7.12% to 6.93% and 5.36%.

The objective of this research is to identify the quality of coconut oil after the addition of pineapple (*ananas comosus*) and kesum leaves (*polygonus minus*) extracts.

2. RESEARCH METHOD

This research employed a quasi-experimental research design. This research was conducted at the Health Analyst Department Laboratory of the Pontianak Health Polytechnic. The samples in this research were coconut oil without the addition of pineapple fruit extract, coconut oil with the addition of pineapple fruit extract but without the addition of kesum leaves, and coconut oil with the addition of pineapple fruit extracts and kesum leaves as much as 20 gr, 30 gr, and 40 replication was administered 5 times in order to obtain a total sample size of 25.

The bromelain enzyme was formulated by taking 600 grams of pineapple for each treatment in a blender, then squeezed and filtered to obtain pineapple juice. The juice obtained was utilized for the process of making coconut oil. The traditional process of making coconut oil was grated the coconut flesh, then squeezed, and coconut milk was obtained. The coconut milk obtained remained to stand for 3 hours so that it was separated into three layers, a layer of cream, skim, and sediment. The cream layer was then heated over low heat for 30 minutes and stirred continuously, then the oil from presscake was separated. The process of making coconut oil enzymatically was obtained by grated coconut flesh, squeezed then coconut milk was obtained. Coconut milk was then added with the bromelain enzyme for the fermentation process by incubating it at room temperature (27^0C) for 24 hours. The fermented coconut milk was separated into two layers, the top layer is coconut oil and press cake, the bottom layer is water. The coconut milk that has been formed into two layers was filtered by implementing filter paper. The cream layers were then heated over low heat for 30 minutes and stirred continuously, then the oil from the press cake was separated. The obtained oil was then added with blended kesum leaves according to predetermined concentration variations. Each treatment on coconut oil was examined organoleptically (color, taste, and smell). The degree of acidity measured employing a pH meter, oil extraction rate of oil per unit weight of wet coconut pulp, peroxide number, saponification number, and acid number.

Peroxide numbers were performed by adding the sample with Glacial-Chloroform Acetic Acid and saturated Potassium Iodide solution (covered with black plastic). Then, it was added with the distilled water and titrate with Sodium Thiosulfate solution 0.05 N until the yellow color disappears. It was also then added with starch indicator and titrate again with Sodium Thiosulfate solution 0.05 N. Next, it was shaken vigorously to release all iodine from the solvent layer so that the blue color disappears. The peroxide number is expressed as milliequivalents of O_2/kg of fat obtained from dividing between {1000 x N x (V0-V1) x 8} and W (Badan Standarisasi Nasional, 2013).

The analysis of the saponification number of coconut oil producing enzymatically was performed by dissolving the oil sample with alcoholic KOH, closed with a back-cooling and boiled it carefully (with a water bath) for 30 minutes. After being cooled and added with the pp indicator, the excess KOH 0.5 N was titrated with a standard solution of 0.5 N HCl (Effendi, et al., 2012).

The test of the acid number was conducted by adding the sample with 95% alcohol then heated for 10 minutes in a boiling flask while stirring with a magnetic stirrer and closed with a back coat to dissolve the free fatty acids. After cooled, the oil solution was titrated with 0.1 N KOH solution by applying the pp standard indicator (phenolphthalein). The end point of the titration was achieved when a pink color was

generated which did not disappear for half of minute (Effendi, et al., 2012). This research has received an approval from the Health Research Commission of the Health Polytechnic of the Ministry of Health Pontianak with No. 061/KEPK-PK.PKP/II/2020.

3. RESULTS AND DISCUSSION

The objective of making coconut oil process with the addition of pineapple juice is to increase the results of oil and accelerate the processing. The bromelain enzyme in pineapple juice was able to break down the emulsion of fat or oil (Wahyusi, et al., 2020). The bromelain enzyme was also able to break the peptide bonds so that the protein could be denatured into simpler parts, which were amino acids and other components, hence, the bound oil came out and coagulated into one. The function of leaving the coconut milk for 3 hours is to separate the cream which is rich of oil from the skim part at the bottom. After that, kesum leaves were added according to the concentration. The sample processing employed the heating method, the temperature was maintained at a temperature of 60-70^{0}C, hence, the substances contained in the oil were not damaged. The oil quality test was administered by organoleptic test, degree of acidity, oil extraction rate, acid number test, peroxide number test, and saponification number test.

Table 1. Recapitulation of Results of Determination of Organoleptic Test Characteristics, Degree of Acidity and Oil Extraction Rate.

Characterization		**Observation result**				
		P1	**P2**	**P3**	**P4**	**P5**
Organoleptic	Aroma	Typical coconut oil	Typical coconut oil and pineapple aroma	Typical coconut oil and pineapple aroma	Typical coconut oil and pineapple aroma	Typical coconut oil and pineapple aroma
	Taste	Normal	Normal	Normal	Normal	Normal
	Color	Clear	Pale yellow	Greenish yellow	Green	Deep green
Acidity		5	4	5	5	5
Oil Extraction Rate (OER)		24,3 %	26,3 %	26,5 %	26,8 %	26,9 %

Information:
P1: Coconut oil without the addition of pineapple and kesum leaves
P2: Coconut oil with the addition of pineapple fruit, without kesum leaves
P3: Coconut oil with the addition of pineapple fruit and 20 grams of kesum leaves
P4: Coconut oil with the addition of pineapple fruit and 30 grams of kesum leaves
P5: Coconut oil with the addition of pineapple fruit and 40 grams of kesum leaves

The highest Oil Extraction Rate (OER) of coconut cooking oil was in the volume of 40gr pineapple extract and kesum leaves. At low substrate concentrations (coconut cream), the reaction speed depends on the substrate concentration. It happens because the more substrates are connected to the active part of the enzyme, the more the reaction speed and the number of reaction products increase (Male, et al., 2014).

Table 2. Acid Numbers Levels in Coconut Oil (Cocos Nucifera) With the Addition of Pineapple Fruit and Kesum Leaves.

	Acid Numbers				
	P1	**P2**	**P3**	**P4**	**P5**
Average	0,3732	0,3088	0,2584	0,2533	0,2547
Reduction	0,00	0,0644	0,1148	0,1199	0,1185
Percentage of Reduction (%)	0,00	17,26	30,76	32,13	31,75

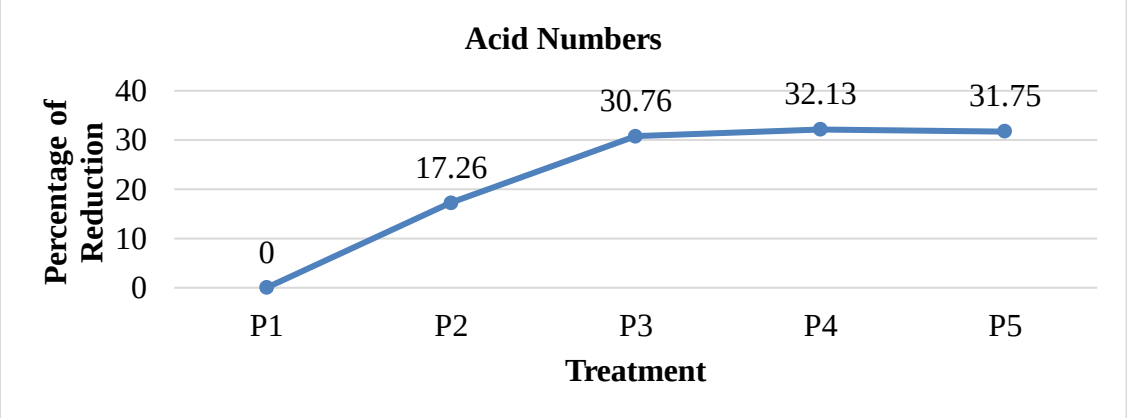

Figure 1. Analysis of Acid Number Levels

The acid number was determined by the titration method. The addition of alcohol and heating was performed so that the oil is more easily dissolved in alcohol and it is easy to titrate (Hernawati & Jirana, 2018). In figure 1, it can be identified that the percentage reduction in acid number levels in the addition of pineapple fruit and 30 grams of kesum provides the largest percentage with a reduction in acid number levels by 32.13%. The presence of antioxidant compounds which are more active in donating hydrogen atoms causes fatty acids with unstable double bonds to react with free fatty acids generated from hydrolysis (Ariono, et al., 2017). The hydrolysis process released short chain fatty acids causing odors. In the presence of water, fat was hydrolyzed to a form of glycerol and free fatty acids (Ngatemin, et al., 2013).

Table 3. Peroxide Numbers Levels in Coconut Oil (Coconus Nucifera) with the Addition of Pineapple Fruit and Kesum Leaves

	Level of Peroxide Numbers				
	P1	**P2**	**P3**	**P4**	**P5**
Average	17,4959	9,9889	6,8697	6,6595	6,6551
Reduction	0,00	7,5070	10,6262	10,8364	10,8408
Percentage of Reduction (%)	0,00	42,91	60,74	61,94	61,96

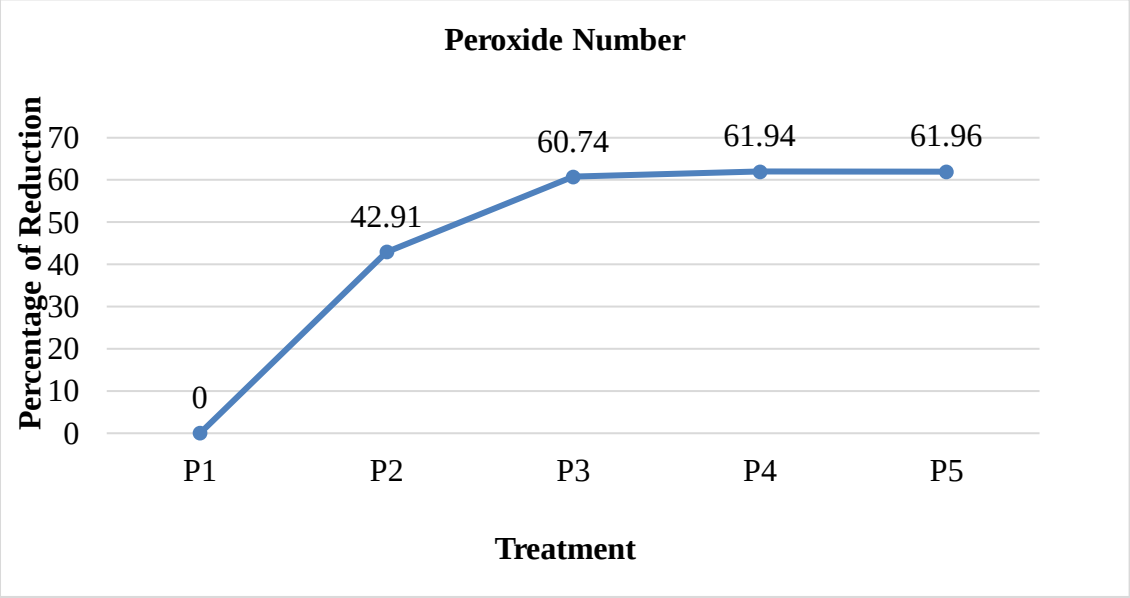

Figure 2. Analysis of Peroxide Number Level.

The peroxide value presents the degree of damage to the oil due to the oxidation process (Khoirunnisa, et al., 2019). The peroxides constructed can be calculated as iodometry. The principle of measurement is to react the sample with a potassium iodide solution at normal temperatures. Iodine liberated by peroxide was titrated with a standard solution of sodium thiosulfate. The reduction percentage in the level of peroxide number in the addition of pineapple fruit and 40 grams of kesum provided the largest percentage with the reduction percentage in the level of peroxide number by 61.96%. The addition of pineapple and kesum leaves reduced the level of oxidation in coconut cooking oil. The mechanism of antioxidants in delaying or preventing fat oxidation was administered through several mechanisms, encompassing reacting with radical compounds and forming more stable compounds as a chelating agent against metal ions. Hence, the formation of reactive compounds or peroxide decomposition, muffled singlet O2 triggering the peroxides formation, and damaging hydroperoxides or regenerating antioxidants cutting off radical reactions could be prevented (Purwaningsih, et al., 2019).

Table 4. Saponification Numbers Levels in Coconut Oil (Coconus Nucifera) with the Addition of Pineapple Fruit and Kesum Leaves.

	Level of Saponification Number				
	P1	**P2**	**P3**	**P4**	**P5**
Average	224,3738	209,9211	202,6926	199,5017	198,1058
Reduction	0,00	14,4527	21,6813	24,8721	26,2681
Percentage of Reduction(%)	0,00	6,44	9,66	11,09	11,71

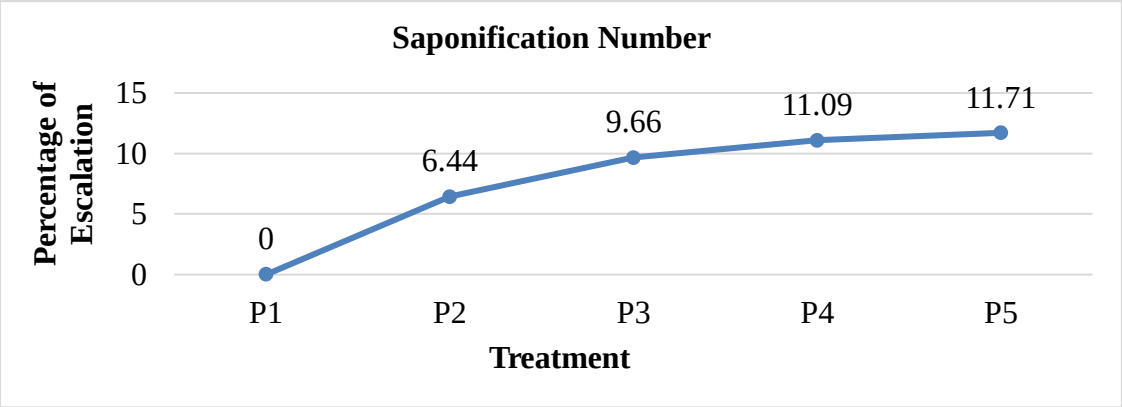

Figure 3. Saponification Number Analysis

The saponification number demonstrates the molecular weight of fat, oil which has a large molecular weight, hence, the saponification number is relatively small, whereas the oil composed of short carbon chain fatty acids possessing a relatively small molecular weight to own a large saponification number (Kurnianingsih, et al., 2020).

The reduction percentage in the level of saponification numbers of pineapple fruit addition and 40 grams of kesum leaves produced the largest percentage with an increase in the level of saponification numbers of 11.71%. The saponification number revealed the molecular weight of fat, in which the oil composed of short carbon chain fatty acids possessing a relatively small molecular weight owns large saponification numbers levels, and vice versa, if the oil possesses a large molecular weight, the level of saponification numbers is relatively small (Azman, et al., 2018).

From the results of the examination, the data were examined by implementing the SPSS program. The univariate test was employed to determine the normality test of the data with the Kolmogorov-Smirnov test so that a significance value> 0.05 could be obtained for each treatment. Bivariate tests with Pearson correlation test and linear regression were also administered. The Pearson correlation test obtained a significance value of 0.000 less than 0.05. It is implied that there is a relationship between the addition of pineapple extract and kesum leaves with the acid number, peroxide number, and saponification number. The r-value for the acid number is -0.874, the peroxide number is -0.845 and the saponification number is -0.903. The r-value presents the direction of the negative relationship, which means that the more pineapple and kesum leaves are added, the lower the acid number, peroxide number, and saponification number are.

Table 5. Model Summary of Simple Regression Analysis Results of Pineapple and Kesum Leaf Addition to Coconut Oil.

	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Acid Numbers	1	,874[a]	,764	,754	,02395
Peroxide Numbers	1	,845[a]	,714	,702	2,33248
Saponification Numbers	1	,903[a]	,815	,807	4,41978

The addition of pineapple and kesum leaves had an effect of 76.4% on the acid number, 71.4% on the peroxide number, and 81.5% on the saponification number.

Table 6. ANOVA Results of Simple Regression Analysis of the Pineapple and Kesum Leaves Addition to Coconut Oil.

		Model	df	Mean Square	F	Sig.
Acid Numbers	1	Regression	1	,043	74,579	,000[b]
		Residual	23	,001		
		Total	24			
Peroxide Numbers	1	Regression	1	312,777	57,491	,000[b]
		Residual	23	5,440		
		Total	24			
Saponification Numbers	1	Regression	1	1981,701	101,446	,000[b]
		Residual	23	19,534		
		Total	24			

ANOVA test revealed the significance of the independent variables on the dependent variable. From this output, it can be identified that the significance level is 0.000<0.005. Thus, a simple linear regression model can be employed to foresee the levels of acid numbers, peroxide numbers, and saponification numbers in coconut cooking oil added with pineapple and kesum leaves.

Table 7. Coefficient Simple Regression Analysis Result of Pineapple and Kesum Leaves Addition to Coconut Oil.

		Model	Unstandardized Coefficient		Standardized Coefficients	t	Sig.
			B	Std. Error	Beta		
Acid Numbers	1	(Constant)	.377	,011		33,597	,000
		Treatment	-,029	,003	-,874	-8,636	,000
Peroxide Numbers	1	(Constant)	17,037	1,094		15,573	,000
		Treatment	-2,501	,330	-,845	-7,582	,000
Saponification Numbers	1	(Constant)	225,806	2,073		108,924	,000
		Treatment	-6,296	,625	-,903	-7,589	,000

Based on the Coefficients table, it is discovered that the regression equation model for estimating the addition of pineapple and kesum leaves affecting the acid number levels, peroxide number, and saponification number is:

$y = a + bx$

$y = 0.377 - 0.029x)$ for the acid numbers

$y = 17,037 - 2,501x)$ for the peroxide numbers

$y = 225.806 - 6.296x)$ for the saponification numbers

Where "y" is the percentage of escalation in acid number, peroxide number, or saponification number, while "x" is the number of added kesum leaves. From the results of simple regression analysis, the t count= 2.687 with a significance value of 0.000<0.05. It means that there is an effect of pineapple and kesum leaves application

on the level of acid numbers, peroxide numbers, and saponification numbers in coconut oil.

4. CONCLUSION

From the result of the study, it can be concluded that the addition of pineapple fruit and *kesum* leaves on acid number content possessed an effect of 76.4% on the acid number, 71.4% on the peroxide number, and 81.5% on the saponification number. However, it is recommended to continue this research to examine the water content, free fatty acids, and iodine number.

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RESEARCH **Open Access**

The Effect of Simplisia Drying Method on Antioxidant Activity of Senggani Fruit Extract (*Melastoma Malabathricum L.*) by DPPH (2,2-Diphenyl-1-picrylhydrazyl)

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Abstract
Senggani fruit (*Melastoma Malabathricum L.*) contains anthocyanin that functioning as an antioxidant. Anthocyanin are tremendously sensitive to thermal processes which trigger phytochemical or photo-oxidation reactions that can open anthocyanin rings. The objective of this study is to identify the effect of the simplicia drying method on the antioxidant activity of Senggani fruit extract. Senggani fruit extract was prepared by obtaining samples of ripe fruit, dry sorting, washing, wet sorting, and drying using two methods; sunlight and oven at 70^{o}C. After the simplicia was dry, it was blended and sifted until smooth. The fine simplicia was macerated with 96% ethanol and evaporated to gain a crude extract. The crude extract was assessed with reagents for phytochemical screening. Furthermore, the crude extract was examined for antioxidant activity by the DPPH method. This study implies that the simplicia and crude extract of Senggani fruit from drying in sunlight and oven possess different organoleptic properties such as color, smell, and taste. In phytochemical testing with reagents, it was discovered that anthocyanin compounds were unveiled in drying utilizing sunlight while employing an oven at 70^{o}C; no anthocyanins were found. The antioxidant testing of Senggani fruit extract revealed that the drying method employing sunlight had an IC_{50} value of 18.8 g/mL while the oven temperature of 70^{o}C owned an IC_{50} value of 28.3 g/mL. Based on the study results, it can be identified that the simplicia drying method affects the antioxidant activity of the Senggani fruit extract. The drying method in the sun produces extracts with greater antioxidant activity while drying in an oven at 70^{o}C results in a degradation process of anthocyanin compounds, thereby decreasing the antioxidant activity of the Senggani fruit extract.

Keywords: Melastoma Malabathricum L., Drying Method, Antioxidant Activity.

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1. INTRODUCTION

People have long employed various types of plants as medicine. Indonesia possesses more than 1,000 species of plants which can be applied as medicine and about 300 species that have been utilized for traditional medicine (Handayani & Rusmita, 2017). The implementation of medicinal plant species is indeed employed for generations, and it is an effort to preserve plant cultivation in the traditional medicine field (Pitoyo & Triwahyudi, 2017).

Senggani is one of the most beneficial weeds. The fruit, flowers, and leaves of this plant are extensively used for medicine and natural food coloring (Ondagau, et al., 2018). Senggani fruit possesses active compounds that can be utilized as traditional medicine. The profound compound in the Senggani fruit is anthocyanin which is a flavonoid derivative compound. Senggani fruit is well-known to possess active ingredients as a source of antioxidants (Kartikasari & Ropiqa, 2018).

The utilization of plants as traditional medicine employs simplicia and crude extract from plants. One of the post-harvest processes that play a significant role in the quality of simplicia is the drying process (Departemen Kesehatan Republik Indonesia, 2000). The drying process and method affect the chemical compounds content and pharmacological effects in a medicinal plant, particularly compounds which are efficacious as antioxidants. Previous research was conducted to determine the drying effect of Senggani leaf administering ovens and dry wind. Research displays the antioxidant activity of oven drying Senggani leaf extract 52.76% and dry wind 54.60% (Luliana, et al., 2016). In this study, the part of the plant employed to measure the difference in antioxidant activity was the fruit in addition to the parameters examined to be IC50 values.

Anthocyanins contained in Senggani fruit are tremendously sensitive to thermal processes. The color disappears and turns to brown as the pigment is degraded and polymerized (Amperawati, et al., 2019). Light and heat degrade anthocyanin pigments and generate colorless chalcones. The energy released by light triggers phytochemical or photo-oxidation reactions to open the anthocyanin ring. Longer exposure causes further degradation and other derivative compounds formation such as 2,4,6 trihydroxy benzaldehyde and substituted benzoic acid (Alappat & Alappat, 2020).

2. RESEARCH METHOD

The tools and materials utilized in this study comprise of desiccator, thermometer, rotary evaporator, hotplate, water bath, UV-Vis 1800 Shimadzu spectrophotometer, 96% ethanol, iron (III) chloride, magnesium powder, concentrated hydrochloric acid, sodium hydroxide, Lieberman-Burchard reagent, DPPH powder.

Senggani plants were obtained from Rawung Village, Tangkiling, Bukit Batu District, Central Kalimantan. The part of the Senggani plant sampled in this study was the ripe fruit. Senggani plants were determined in full on plant parts at the Plant Systematics Laboratory, Faculty of Biology UGM, numbered 014940/S. Tb/I/2021.

Senggani fruit powder was macerated with 1:3 ethanol 96% solvent every 24 hours, filtered to obtain the filtrate, replaced with new ethanol, and repeated for three days, then evaporated utilizing a rotary evaporator to produce a crude extract (Sastrawan et al., 2013).

Phenolic test: Administering 1N FeCl_3 solution as a reagent. The addition of $FeCl_3$ extract produces a blackish green color. This color is generated because phenol compounds react with Fe^{3+} ions to compose complex compounds (Luliana, et al., 2016).

Flavonoid test: crude extract was obtained 2 mL, added 0.1 g of magnesium powder, then added ten drops of concentrated HCL, and shaken slowly. A positive test revealed a red-orange to red-purple color (Sastrawan et al., 2013).

Anthocyanin test: Positive extracts containing flavonoid group compounds were administered with 2N HCl heated at 100°C for 5 minutes. Positive results are obtained when a red color appears. NaOH 2 N was also added drop by drop while observing the color changes occurring. Positive results are obtained when a blue-green color occurs, which fades slowly (Ondagau, et al., 2018).

Saponin test: Crude extract of the Senggani fruit was placed into a test tube. Then, 10 mL of hot and cold water was added and then shaken vigorously for 10 seconds. If it is positive, a solid foam appears for 10 minutes, as high as 1 cm – 10 cm. If 2N HCl is added, the foam appears as well (Martiningsih, et al., 2016).

Triterpenoid & steroid test: Using Lieberman–Buchard reagent (concentrated acetic anhydrous sulfuric acid). A green color change implies positive results in this test for steroids and reddish-brown color for triterpenoids. The color change occurs due to the terpenoid/steroid compound group oxidation through the conjugated double bonds formation (Martiningsih, et al., 2016).

Determining the antioxidant activity of Senggani fruit extract as assessed by the method of Gaulejac et al. (1998), which regulates. A mixed solution (2:1) of 1,1-diphenyl-2-picrylhydrazyl (DPPH) in 0.1 mM methanol with an extract solution of 0.01 mg/mL concentration; 0.02 mg/mL; 0.03 mg/mL; 0.04 mg/mL; and 0.05 mg/mL were prepared. The degree of color reduction of the solution illustrates the radical scavenger efficiency. In the last five minutes of the 30 minutes, the absorbance was calculated by spectrophotometer at λ517 nm (Damanis, et al., 2020; De Gaulejac, et al., 1999).

$$\text{Antioxidant activity (\%)} = 1 - \frac{\text{sample absorbance}}{\text{control absorbance}} \times 100\%$$

3. RESULTS AND DISCUSSION

Simplicia of Senggani fruit was formulated by two drying methods, sunlight, and oven at 70°C. The objective of the two drying methods was to observe the effect of the drying method on the simplicia, extract, and content of the obtained secondary metabolites. The organoleptic test of simplicia powder was administered to determine the distinctive physical properties of the plant by observing the specificity of the shape, color, smell, and taste of simplicia (Kementerian Kesehatan Republik Indonesia, 2017).

The organoleptic test in Table 1 presents the differences between oven-dried simplicia powder and sunlight in the form of shape, color, taste, and aroma. The simplicia powder dried in the sun provided better results because the simplicia powder possessed a sweet taste and a distinctive aroma of Senggani fruit. In contrast, the oven-dried one owned a slightly sweet taste, and there was no distinctive aroma of Senggani fruit. It is because heating with high temperatures or for a long time may result in physical and biochemical changes, thereby reducing the quality of the resulting product.

Senggani fruit crude extract was obtained by cold extraction by implementing the maceration method (Che Omar, et al., 2013). The maceration method is employed because the equipment and machining techniques are relatively simple and easy to conduct. Furthermore, the maceration method is administered to keep the secondary

metabolites of Senggani fruit from being damaged by the heat. 96% ethanol solvent was administered because it is non-toxic and semi-polar, hence, more secondary metabolites were extracted by the solvent. Ethanol solvent encompasses good absorption and is able to inhibit mold growth and germs (Mardina, 2011). It is demonstrated in Table 1 that the comparison of crude extract between oven drying and sunlight was conducted by organoleptic testing. The crude extract obtained by the oven drying method possesses a darker color and is odorless, while the viscous extract obtained by sun-drying owns a lighter color and a distinctive aroma of Senggani fruit.

Table 1. Organoleptic Test of Simplicia and Crude Extract.

No	Drying Method	Organoleptic			
		Consistency	**Colour**	**Taste**	**Odor**
Simplicia					
1.	Oven	Slightly coarse powder	Dark brown	Bittersweet	No odor
2.	Sunlight	Fine powder	Light brown	Sweet	Typical Senggani fruit
Crude Extract					
1.	Oven	Thick	Dark brown	-	No odor
2.	Sunlight	Thick	Light brown	-	Typical Senggani fruit

A **B**

Figure 1. Color of Senggani fruit extract with drying treatment, A: sun-drying treatment; B: oven drying treatment

Phytochemical testing was utilized to determine quickly and simply whether a plant contains certain bioctive compounds or not (Danladi, et al., 2015). This test was performed employing chemical reactions. The results of this study presented that there were differences in the phytochemical test results of the ethanol extract of Senggani oven drying and sun drying. In oven drying, anthocyanin compounds were not discovered or negative. It is because during the simplicia drying process, it utilized an oven administering a high temperature so that the natural dyes from the Senggani fruit are lost due to not being able to withstand high heating (Kho, et al., 2017).

Moreover, steroid and triterpenoid compounds were not unveiled in the extract of the Senggani fruit. Different sampling locations significantly affected the results. The soil structure of a region is different so that it affects the results compared to previous studies explaining that the ethanol extract of Senggani fruit with different species

(*Melastoma affine D. Don*) contains steroids and triterpenoids. The ethanol extract of the Senggani fruit was sun-dried and oven-dried in that it did not contain steroid and triterpenoid compounds. Furthermore, in this study, it was revealed that the ethanol extract of Senggani fruit possessed saponins. In contrast, the ethanol extract of Senggani fruit with another species (*Melastoma affine D. Don*) did not possess saponins (Syafitri, 2014).

Table 2. Phytochemical Test Results of Secondary Metabolite Compounds.

Phytochemical Test	Treatment	Colorreaction	Result (+/-) Sunlight		Result (+/-) Oven	
			I	II	I	II
Phenolic	Added $FeCl_3$	Dark-green	+	+	+	+
Flavonoid	Added concentrated HCl	Red-orange red-purple	+	+	+	+
Anthocyanin	Added Mg powder and 2N HCl, heated at 100 ^{0}C and added 2N NaOH	Blue-green color fading slowly	+	+	-	-
Saponin	Added hot water shake vigorously	A foam lasting ± 10 minutes	+	+	+	+
Steroid	Added Lieberman – Buchard	Green color	-	-	-	-
Triterpenoid	Added Lieberman – Buchard	Sorrel	-	-	-	-

Description: Positive (+) contains a group of compounds.
Negative (-) does not contain a group of compounds.

The antioxidant activity of Senggani fruit extract was examined employing the DPPH method. The DPPH method (2,2-diphenyl-1-picrylhydrazyl) was selected because it is simple, easy, fast, and sensitive and merely requires a small sample to evaluate the antioxidant activity of the compound (Kedare & Singh, 2011). The principle of the DPPH method is to assess the DPPH radical capture by a compound with an antioxidant activity administering UV-Vis spectrophotometry. Hence, the value of free radical scavenging activity is identified. The result is expressed by the IC_{50} (Inhibitory Concentration) value (Damanis, et al., 2020). The IC_{50} value is defined as the concentration of the test compound which is able to decrease free radicals by 50% (Al Ridho, 2013). The antioxidant testing result semploying the DPPH method on both oven-drying and sun-drying Senggani fruit extracts revealed differences in antioxidant activity by perceiving at the IC_{50} value. The different IC_{50} values of Senggani fruit extract with sun and oven drying are demonstrated in table 3.

Table 3. Antioxidant Activity of Senggani Fruit Extract.

Sample drying Method	Concentration (mg/mL)	Absorbance			% Average inhibition	Regression Equation	IC_{50}
		I	II	III			
Sunlight	0.010	0.585	0.590	0.579	37.20	Y = 1283x + 25.87 R^2 = 0.991	0.0188 mg/mL 18.8 µg/mL
	0.020	0.448	0.455	0.442	51.84		
	0.030	0.312	0.309	0.316	66.45		
	0.040	0.180	0.205	0.196	79.20		
	0.050	0.110	0.115	0.112	87.93		
Oven	0.011	0.762	0.766	0.756	18.22	Y = 1680x +	0.0283

0.021	0.575	0.581	0.553	38.81
0.032	0.387	0.385	0.401	58.00
0.042	0.235	0.242	0.244	74.29
0.053	0.095	0.102	0.105	89.29

Table 3 presents the IC_{50} test values for Senggani fruit extract, which was treated with sun drying. The value of the regression equation obtained from the antioxidant activity test was y = 1283x + 25.87 with a value of R^2 = 0.991 for the extract which simplicia was provided a sun-dried, and the regression equation for the extract which simplicia was provided an oven-dried treatment was y = 1680x + 2.491 with a value of R^2 = 0.995. The y-coefficient in the equation is the IC_{50}value of the Senggani fruit ethanol extract , while the x-coefficient in the equation is the concentration amount of the Senggani fruit extract that identified, in which x is the concentration required to reduce 50% of DPPH activity. The value of R^2indicates the level of linear correlation in a test (> 0.990). The R^2 value in the regression results revealed a positive value. It means that the higher the concentration of the Senggani fruit extract, the greater the antioxidant activity (International Conference on Harmonisation, 1994). Linear regression curve graphs of Senggani fruit extract concentration (oven and sun drying) versus antioxidant activity can be perceived in Figure 2 and Figure 3.

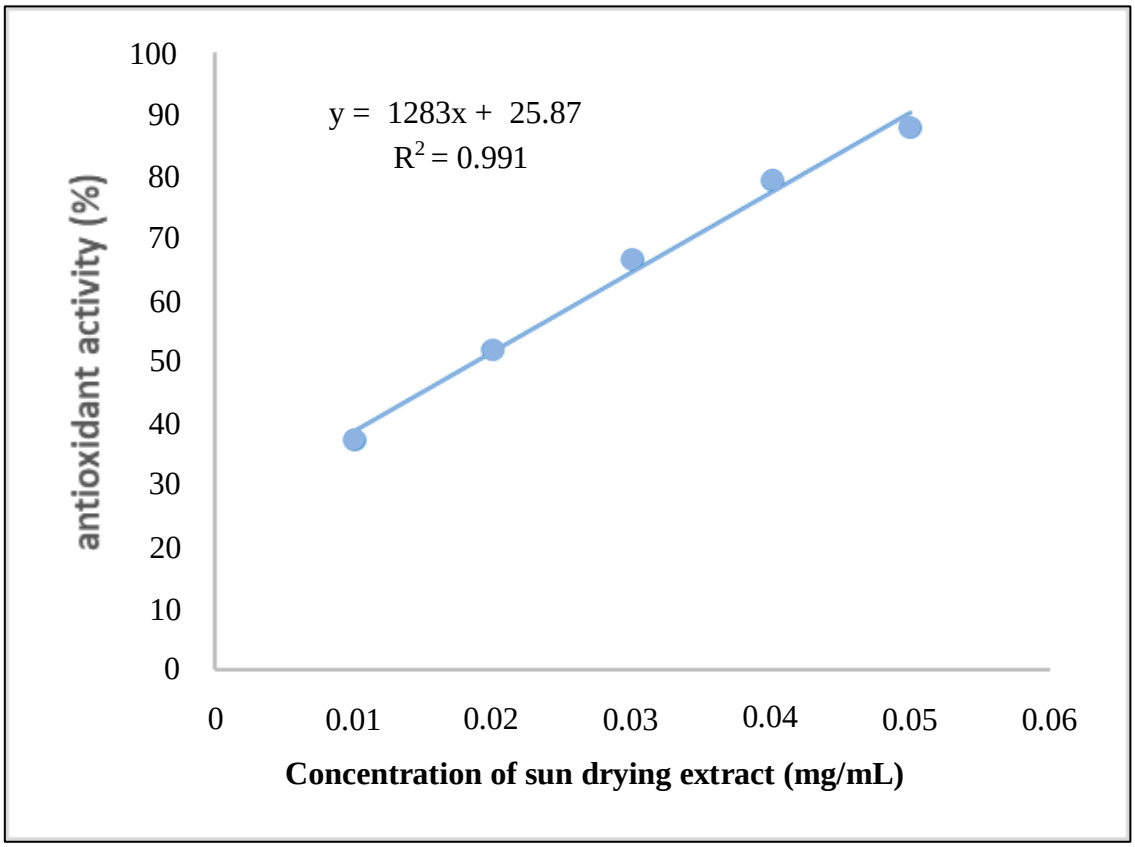


Figure 2. Regression curve of sun-dried Senggani fruit extract

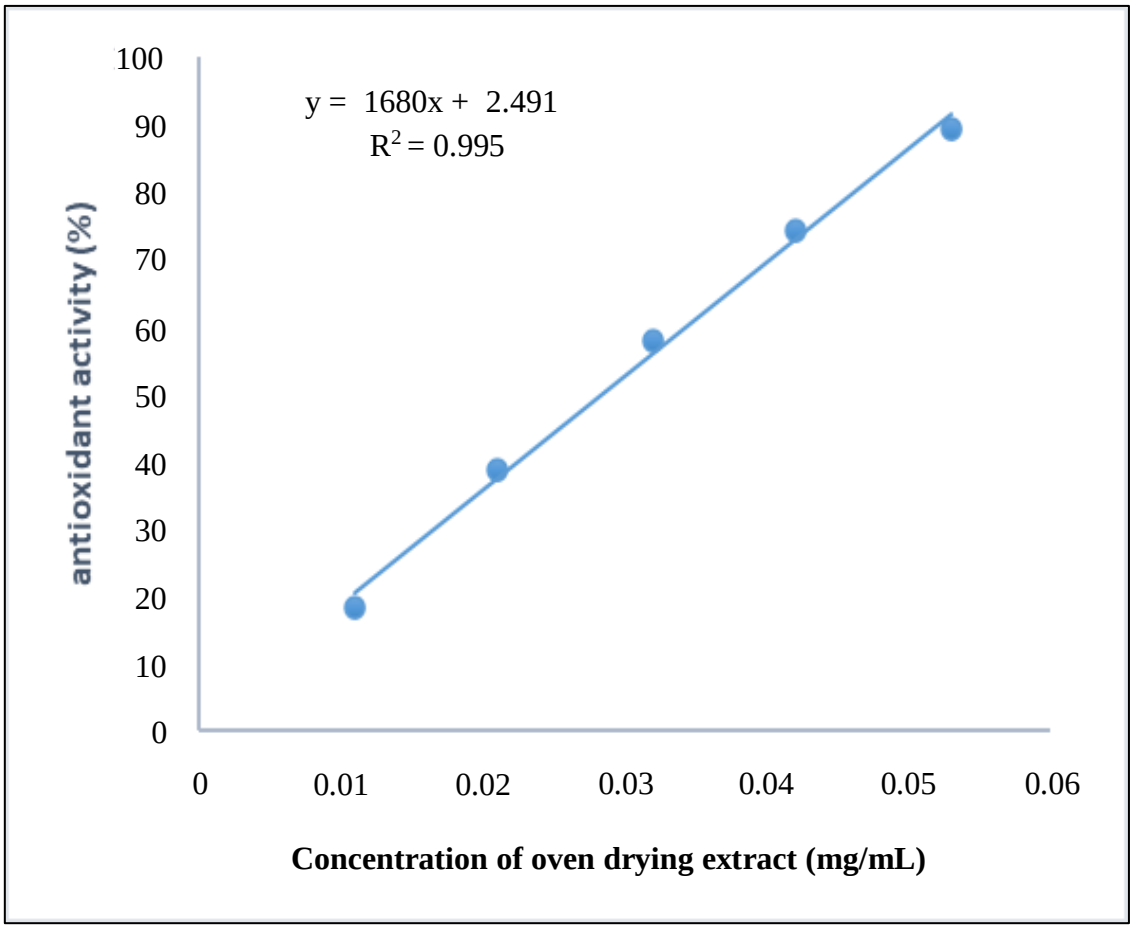
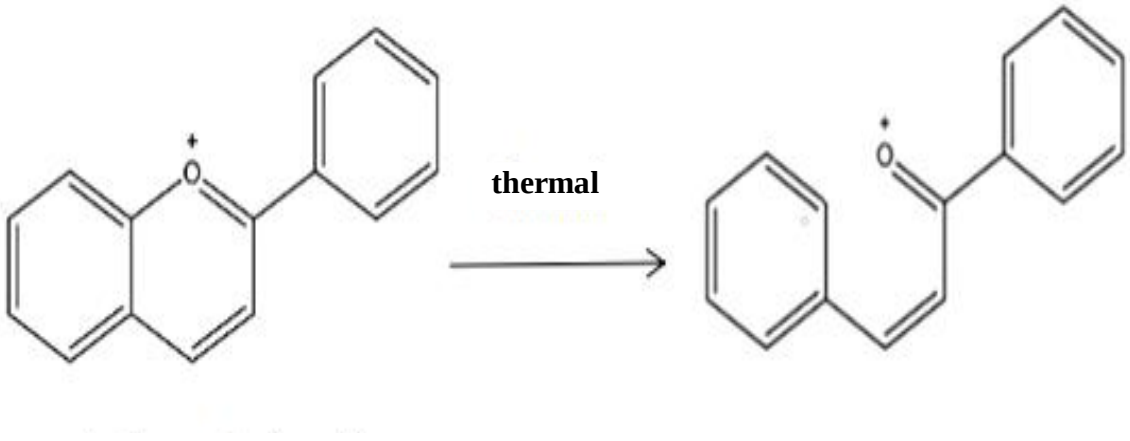


Figure 3. Regression curve of oven-drying Senggani fruit extract

The antioxidant activity of the Senggani fruit extract provided different treatment between sun drying and oven drying revealed different IC_{50} values. The greater the antioxidant activity of the sample calculated, the smaller the IC_{50} value. Sun-dried Senggani fruit extract possessed a greater antioxidant activity with an IC_{50} value of 18.8 µg/mL, implying that the power of sun-dried Senggani fruit extract could decrease 50% DPPH free radical activity with a concentration of 18.8 µg/mL. In contrast,the oven-dried Senggani fruit extract possessed a smaller antioxidant activity with an IC_{50} value of 28.3 µg/mL, indicating that the strength of oven-dried Senggani fruit extract could reduce 50% DPPH free radical activity with a concentration of 28.3 µg/mL.

Oven drying with a temperature of 70^{o}C based on the research results is able to decrease antioxidant activity up to 66.43%. It is caused by the degradation of the active compound acting as an antioxidant in the extract of the Senggani fruit, anthocyanins because these compounds are susceptible to heating or thermolabile (Amperawati, et al., 2019). Anthocyanin degradation occurring due to temperature will change the chemical structure by opening the main anthocyanin ring into chalcone and transform the compound's color from purple to brown (Alappat & Alappat, 2020). The degradation of anthocyanins by thermal processes is demonstrated in Figure 4.



Anthocyanin (purple) **Chalcone (brown)**

Figure 4. Degradation of anthocyanin compounds.

4. CONCLUSION

The antioxidant activity of Senggani fruit extract was affected by the simplicia drying method. Extract drying utilizing sun light possessed a greater antioxidant activity with an IC_{50} value of 18.8 µg/mL, while extract drying in an oven at 70°C possessed a smaller antioxidant activity with an IC_{50} value of 28.3 µg/mL.

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RESEARCH **Open Access**

The Effectiveness of Chocolate in Reducing the Number of Methicillin-Resistant *Staphylococcus aureus* Colonies in *Rattus norvegicus*

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Abstract

Chocolate has long been understood to provide positive emotions and a good mood if consumed in moderation. Chocolate contains prebiotics naturally from its constituent ingredients produced during the production process. Prebiotics, frequently oligosaccharides, are substances which cannot be metabolized by the human digestive system but can be employed by a group of bacteria in the gut, understood as probiotics. The positive relationship among them provides benefits for the host in eliminating pathogens. One of the well-known pathogens which frequently cause infection either in the community or in hospitals is methicillin-resistant *Staphylococcus aureus* (MRSA). Since it was first identified in 1960, MRSA has caused health problems until today. Research conducted on two groups of *Rattus norvegicus* infected with MRSA and then fed chocolate revealed a decrease in the average number of bacterial colonies on the skin compared to the control group. In the group fed chocolate at a dose of 50 mg/day, the bacterial colonies decreased to 1.28 x 10^8 CFU/cm^2 in 7 days, lower than in the control group (1.46 x 10^8 CFU/cm^2) at the same time. While those fed 75 mg/day chocolate decreased to 2.70 x 10^7 CFU/cm^2 and the three groups were significantly different (0.000<0.05). Prebiotics fermented by probiotics release short-chain fatty acids (SCFA), which compete with the pathogens for attaching to the epithelial wall so that pathogens lose space and nutrients to survive. However, the adverse effect of chocolate may occur because it contains sugar which is a nutrient for bacteria, but if the balance of normal flora and adequate intake of prebiotics are administered, the pathogen could be eliminated.

Keywords: Chocolate, Prebiotics, Probiotics, Methicillin-resistant Staphylococcus *aureus*.

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1. INTRODUCTION

Chocolate is a popular food consumed worldwide and able to produce the effect of increasing pleasure sensory and positive emotions (Konar, et al., 2016). Chocolate can be employed as an excellent means of generating prebiotics into the body. Prebiotics are nutrients for beneficial bacteria (probiotics) in the human digestive tract (Ejtahed, et al., 2011; Rad, et al., 2016; Rad, et al., 2012; Rad, et al., 2012; Homayouni, et al., 2012; Homayouni, et al., 2012; Rad, et al., 2013; Rad, et al., 2013). Prebiotics such as inulin, fructo-oligosaccharides (FOS) and galacto-oligosaccharides (GOS) have been assigned as the subject of research for a long time (Gonzalez, et al., 2011; Morais, et al., 2014). Prebiotics have also been revealed contributing to the treatment of diseases encompassing allergic contact dermatitis (ACD), acne and aging primarily by increasing the probiotics growth (Lolou, & Panayiotidis, 2019). With these advantages, chocolate is considered as a healthy food (Rad, et al., 2018; Scheid, et al., 2013). This feature makes chocolate admitted as an attractive non-fermented product which functions as a protector for the probiotic bacteria survival (Granato, et al., 2010; Lahtinen, et al., 2007).

The World Health Organization (WHO) defines probiotics as living organisms providing benefits to their host if they occur in sufficient quantities (Lin, et al., 2014). Probiotics are able to formulate vitamins, antioxidants, short chain fatty acids (SCFA) and compete with pathogens by various mechanisms, for instance through protein defensins (Roberfroid, et al., 2010; Wallace, et al., 2011). *Escherichia coli* strain Nissle, lactic acid producing Lactobacillus and a group of Bifidobacteria are primary probiotic organisms among the many microbes which meet the WHO criteria (Lin, et al., 2014).

One of the well-known pathogens infecting wounds is methicillin-resistant *Staphylococcus aureus* (MRSA) (Sikorska, & Smoragiewicz, 2013). *Staphylococcus aureus* is a spherical, Gram-positive, nonmotile, coagulase-positive bacterium, and a member of the phylum Firmicutes. *Staphylococcus aureus* is a commensal microbe of the nasal mucosa in 20-40% of the total population (Lee, et al., 2018). A year after methicillin was employed in the clinic, MRSA was identified from a hospital patient in 1960 (Turner, et al., 2019).

It has been proven that oligosaccharides, polysaccharides and lactose play a role as a prebiotic and is able to decrease the number of Salmonella in the digestive tract (El-Hack, et al., 2021), and probiotics such as *Lactobacillus acidophilus* and *Lactobacillus casei* which possesses the ability as an antibacterial agent against MRSA (Karska-Wysocki, et al., 2010). However, the reason why chocolate can be a source of prebiotics in reducing the number of bacteria is still not extensively identified.

2. RESEARCH METHOD

The research was conducted from October to November 2020 at the Laboratory of Microbiology, Department of Medical Laboratory Technology of Politeknik Kesehatan Kemenkes Pontianak. The objective of this study is to determine whether chocolate as a source of prebiotics is able to reduce MRSA infections. This study administered an in vivo quasi-experimental approach to healthy male *Rattus norvegicus*, aged 8-10 weeks and weighing 150-250 grams, and received a letter of approval from the Health Research Ethics Commission of Politeknik Kesehatan Kemenkes Pontianak No. 311/KEPK-PK.PKP/X/2020 on October 14, 2020.

The preparation of MRSA suspension: 1 colony was obtained from the MRSA culture stock and mixed into 0.9% sodium chloride solution. The turbidity established was compared to a standard McFarland turbidity 0.5 (0.05 mL of 1.175% barium chloride dihydrate ($BaCl_2.2H_2O$), with 9.95 mL of 1% sulfuric acid (H_2SO_4)). A suspension which turbidity is equivalent to this standard owns a density of 1.5 x 10^8 colony forming units (CFU)/mL (Aryal, 2020).

The preparation of Plate Count Agar: Into an Erlenmeyer containing 1 liter of distilled water, 17.5 grams of PCA were added and dissolved while heated, then sterilized by autoclaving at 121°C for 20 minutes. This medium was stored for up to 7 days at 2-8°C until utilized (Thermo Fisher Scientific, 2001).

A total of 45 rats undergone acclimatization were infected with MRSA on 1 square centimeter of skin. After the infection of wound occurred, each 15 rats not provided any treatment (control, group A), were fed chocolate (Bella, PT Dolphin, Indonesia) at a dose of 50 mg chocolate/day orally (group B) and were fed 75 mg chocolate/day orally (group C) (Eor, et al., 2019). The treatment had been performed for 7 consecutive days.

After the treatment period, the number of bacteria was assessed by the Total Plate Count (TPC) method as follows: swabs were conducted on the injured (and healing) rat skin by employing a sterile and moist cotton swab, placed into a tube containing 9 mL of 0.9% NaCl, then it was diluted in a dilution series of 1/10 to 1/1,000,000. Every 1 mL of the dilution tube was transferred to a sterile petri dish then poured with sterile, 45-55°C PCA. It was then mixed and let solidified at room temperature, then it was incubated at 37°Celsius for 24 hours. Colonies growing after the incubation were counted and considered as CFU/cm^2.

The number of bacterial colonies from the three groups was statistically processed by implementing the Kruskal Wallis and Mann-Whitney U test to determine if there were significant differences between groups. The test was conducted with the SPSS application.

3. RESULTS AND DISCUSSION

The bacteria growing on the skin surface of *Rattus norvegicus* are derived from MRSA suspension with a concentration of 1.5 x 10^8 CFU/mL, and normal skin flora coexisting. After measuring the bacteria by administering the TPC method, various data were obtained from the three treatment groups. Although there were outliers and extreme values (Figure 1), the three groups presented a linear decrease in the average number of bacterial colonies from the original number (Table 1). There was a difference in the number of colonies of 1.81 x 10^7 CFU/cm^2 between the control group and the group fed 50 mg chocolate/day and 1.19 x 10^8 CFU/cm^2 and fed 75 mg chocolate/day.

Table 1. Description of Bacteria Number (CFU/cm^2).

Group	Mean	Median	Standard Deviation
A	1.46 x10^8	1.53 x10^8	3.86 x 10^7
B	1.28 x 10^8	9.82 x 10^7	8.20 x 10^7
C	2.70 x 10^7	2.28 x 10^7	2.50 x 10^7

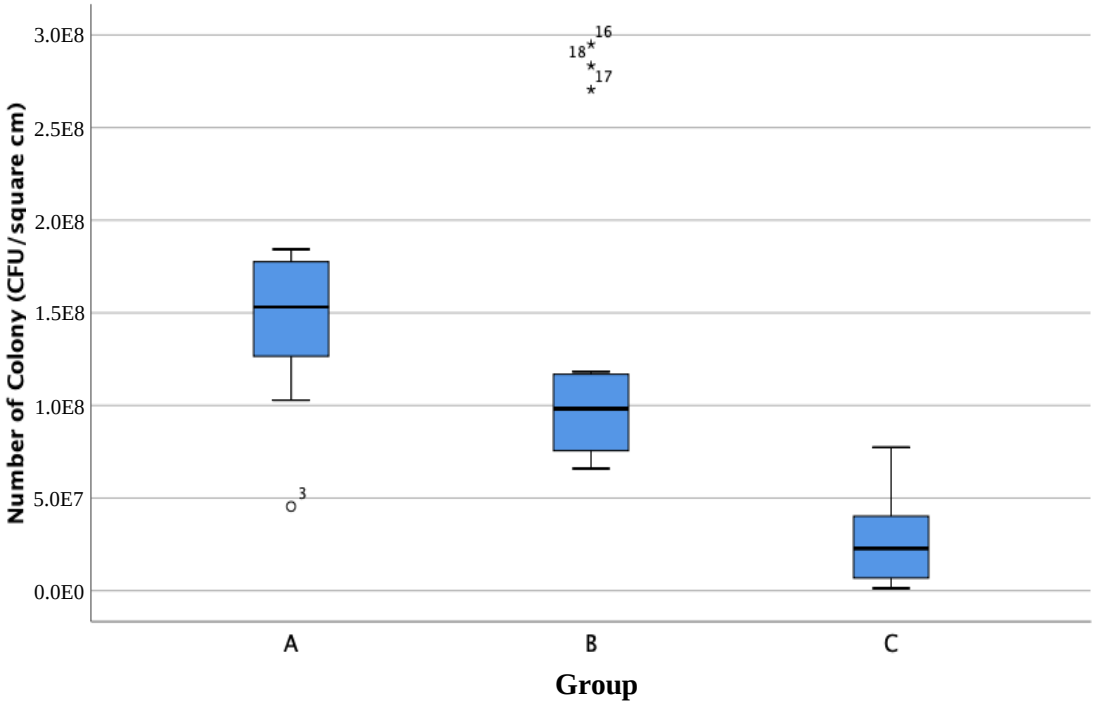

Figure 1. Distribution of research data.

The results of the Shapiro-Wilk test for the three groups presented a significant value of 0.034, 0.000, and 0.046 (< 0.05), respectively, indicating that the data is not normally distributed. After conducting a Levene's test, it was obtained a significant value of 0.004 which means that the data variance is not homogeneous. Hence, the results of these two tests became the assumptions for non-parametric tests. Kruskal Wallis test produced a significant value of 0.000, followed by the Mann-Whitney U test with the results as demonstrated in table 2. The last two tests displayed a significant difference ($\alpha < 0.05$) both between the three groups and between each group.

Table 2. The different of mean rank of test groups.

Group	**A**		**B**		**C**	
	Mann-Whitney U	**Sig.**	**Mann-Whitney U**	**Sig.**	**Mann-Whitney U**	**Sig.**
A			62.000	0.036	3.000	0.000
B	62.000	0.036			5.000	0.000
C	3.000	0.000	5.000	0.000		

Prebiotics in chocolate originate from natural ingredients, such as milk, cocoa and nuts or from synthetic ingredients administered directly to chocolate. Oligosaccharides such as inulin, FOS, GOS, soybean-oligosaccharide (SOS), lactulose, lactosucrose, xylo-oligosaccharides (XOS), isomalto-oligosaccharides (IOS) and resistant starch (Vinayak, et al., 2021) possess low molecular weight and cannot be digested by humans due to the absence of enzymes catalyzing them, but can be utilized by healthy microbes (probiotics) in the digestive tract (Al-Sheraji, et al., 2013; Khangwal & Shukla, 2019; Quigley, 2019; Vinayak, et al., 2021).

Dominant probiotics such as Lactobacillus and Bifidobacteria are able to ferment prebiotics and generate SCFA such as butyric acid, acetic acid, lactic acid and propionic acid (Ahmad & Khalid, 2018; Vinayak, et al., 2021) associated with the increased function of mineral absorption, digestion, glucose regulation, and lipid metabolism (Sarao, & Arora, 2017). If probiotics thrive in the digestive tract, the growth of pathogenic bacteria is inhibited.

The significant decrease in the average number of bacterial colonies revealed in this study indicates the suppression of MRSA growth which might be caused by the prebiotic performance in chocolate. The higher the dose of chocolate provided, the lower the number of bacterial colonies. There are two mechanisms of prebiotics in corroborating the host deal with pathogenic bacteria. The first mechanism is to inhibit pathogens directly through the formation of antimicrobial compounds and compete in attaching to the epithelial wall, for instance the SCFA formation, carbohydrate modulation and lipid metabolism. In the second mechanism, prebiotics help enrich the probiotics growth by increasing the absorption of essential nutrients and minerals such as calcium and magnesium (Slavin, 2013).

As MRSA is infected in the skin, the role of prebiotics which is more frequently to occur in study subjects is the first mechanism. It is because probiotics stimulated by prebiotics (second mechanism) reside in the gastrointestinal tract and reluctantly migrate to the skin and compete directly with MRSA, particularly if the host is in good physiological condition. Meanwhile, with the first mechanism, the compounds of SCFA are able to circulate with the bloodstream and modulate carbohydrate and lipid metabolism thereby inhibiting bacteria from attaching to the epithelium (as described above) and ultimately unable to survive.

However, some research subjects displayed an increase in the number of bacterial colonies. It should be concerned that in addition to containing prebiotics, chocolate also encompasses sugar which possesses nutritional value for bacteria in general. This sugar may originate from milk or administered directly to chocolate. Sugars discovered in chocolate encompass sucrose (the highest, 90% of all sugars), glucose, fructose, mannitol, galactose, sorbose, arabinose, xylose, and inositol (Barišić, et al., 2019). *Staphylococcus* is glucose, lactose, sucrose, and mannitol fermenter (El-Hadedy & Abu El-Nour, 2012; Ribeiro de Souza da Cunha, 2018). Fermentation is one of the metabolic pathways performed by microbes in producing energy. The ability of *Staphylococcus aureus*, including MRSA, in fermenting sugars contained in chocolate provides an advantage in maintaining life. It occurs in the host with unfavorable physiological conditions, such as stress or lack of nutrients so that the balance of normal flora in the digestive tract is disturbed. Instead of decreasing the number of pathogens, this condition produces nutrients and benefits for MRSA so that their numbers increase.

The dynamic conditions between the host and the pathogen cause variations in the response established. In reducing the number of pathogens and the possible risks, the host should be in ideal conditions or homeostasis, hence, it remains in a superior position and controls the pathogen. This condition can be obtained by maintaining the number of probiotics in the digestive tract and assisting it by providing prebiotics. Therefore, it becomes a worthy competitor for pathogens.

4. CONCLUSION

This study has revealed that consuming chocolate can help reduce the number of MRSA colonies on *Rattus norvegicus* skin through the SCFA formation mechanism

which is effective in preventing bacterial attachment to epithelial cells and modulating carbohydrate and lipid metabolism. Furthermore, it should be considered that there may be an adverse effect because chocolate encompasses sugar which is a nutrient for bacteria. However, it can be enhanced if the host possesses a good balance of normal flora, adequate nutrition and is not stressed. Further research is required to conduct on what is the ideal dose of consuming chocolate so that the good effects can be obtained and the adverse effects can be prevented.

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RESEARCH **Open Access**

The Prediction Number of Smear Acid Resistant Bacteria on Positive Pulmonary Tuberculosis Infection Disease at Madiun City in 2021 to 2025

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Abstract
Tuberculosis (TB) is an infectious disease caused by Mycobacterium Tuberculosis Bacillus. The disease spreads in the air when people contract TB bacteria, such as coughing or sneezing. The lack of ability to anticipate the incidence of Acid Resistant Bacteria Positive Pulmonary TB in Madiun City is affected by the time and number of events that have not been appropriately foreseen. There is no map of regional vulnerability based on the time of occurrence. Hence, the incidence of Acid Resistant Bacteria Positive Pulmonary TB in Madiun city increases, determined by the total number of cases in 6 health centers, seven hospitals, and one prison. In 2015, there were 174 cases, then in 2019, 706 cases. The objective of this study is to predict the number of Acid Resistant Bacteria Positive Pulmonary TB suffering in 2021-2025 based on gender, health centers, and prisons in Madiun City and the overall incidence of cases in 2015-2019 is then foreseen in 2021 to 2025. This type of research is descriptive study research by employing Eviews with the ARIMA method. The population and samples in the study were all data of Acid Resistant Bacteria Positive Pulmonary TB case encompassing the sex of patients during 2015-2019 in Madiun City. The study aimed to predict the incidence of Acid Resistant Bacteria Positive Pulmonary TB in 2021-2025. The results of this study revealed the projection of Acid Resistant Bacteria Positive Pulmonary TB cases based on gender, health centers, hospitals, and prisons in Madiun City from 2020-2025, which experienced an increasing trend with the number of 933, 992, 1063, 1120, 1190 incidences respectively. This study is recommended for relevant agencies or health services to perform preventive efforts by involving trained policymakers and Health Cadis, particularly in preventing TB disease and reducing the high rate of predicting positive pulmonary TB smear incidences in the future.

Keywords: Pulmonary TB, Acid Resistant Bacteria Positive, Prediction.

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1. INTRODUCTION

Infectious diseases are caused by pathogenic microorganisms such as bacteria, viruses, parasites and fungi. This disease is frequently transmitted directly or indirectly from the patient to others around it through various media such as the air, vectors in the form of mosquitoes, etc. In Indonesia, infectious diseases which are of concern to the Ministry of Health of the Republic of Indonesia encompass Malaria, Influenza, Dengue Hemorrhagic Fever (DHF), HIV/AIDS, and tuberculosis (Badan Penelitian dan Pengembangan Kesehatan, 2013). These diseases are priorly concerned because the number of cases and impacts is quite high (Omu, 2016).

One of the infectious diseases affected by mycobacterium tuberculosis germ is Tuberculosis (TB). TB was initially discovered by Robert Koch in 1882 and is the most general infectious disease in the world due to its potential for death. TB is also included as a type of fast moving disease in which the drug for this disease is routinely administered every day (Sugiarto, & Harijono, 2000).

The increase in the number of patients in a provided period is not proportional with the number of available medical personnel, and the drugs supply is lacking. Furthermore, the lack of ability to anticipate the occurrence of Acid Resistant Bacteria Positive Pulmonary TB in Madiun city, is due to the time, place and number of events which cannot be predicted. Moreover, there is no map of vulnerability of the region based on the time of occurrence, hence, cases of Acid Resistant Bacteria Positive Pulmonary, especially those occurring in the Madiun city continue to increase every year (Sugiarto, & Harijono, 2000).

Forecasting possesses a significant role in the future decision making such as weather prediction, production planning, staff scheduling, and in terms of business. Thus, in this case with a lot of a field, it is required an accurate forecasting result, so that the forecasting method is significantly developed (Elfajar, et al., 2017).

One method of forecasting is the fuzzy time series method. This method has been implemented since many years ago in forecasting the number of enrollees in the Alabama University based on the existing historical data by employing simple arithmetic operations. The advantages of this method encompass the calculation process which does not require complex systems such as genetic algorithms and neural networks. Hence, this method is easy to develop (Chatfield, 2000).

Fuzzy time series is a method of data forecasting administering fuzzy principles as its basis. Forecasting by employing fuzzy time series is able to capture patterns from historical data which then is utilized to project future data (Omu, 2016). The objective of the study is to predict the number of smear acid resistant bacteria on positive pulmonary tuberculosis infection disease at Madiun city in 2021 to 2025.

2. RESEARCH METHOD

This study is a quantitative descriptive study employing time series analysis, which demonstrates the frequency of disease based on observation series on multiple time sequences. This study merely administered secondary data obtained from six health centers, seven hospitals & one prison analyzed by univariate aiming to descriptively describe the identification of the research results, which is then presented in the form of tables and graphs to identify the proportion of each variable examined. It is further analyzed by employing Eviews as a measuring tool and Autoregressive Integrated

Moving Average (ARIMA) as a projection method (Hyndman, & Athanasopoulos, 2018).

The population and samples in this study encompassed all data on the number of acid resistant bacteria positive pulmonary TB patients in Madiun city in 2015-2019. The sampling in this study was conducted at 14 locations in Madiun city consisting of 6 health centers, 7 hospitals & 1 prison. The data obtained was discovered from several agencies, which were Health Department of Madiun, Primary Health Center, 7 Hospitals and 1 Prison in Madiun city.

Table 1. Data on the number of Acid Resistant Bacteria Positive Pulmonary TB patients in Madiun city in 2015-2019.

No	Location	Year				
		2015	**2016**	**2017**	**2018**	**2019**
1	Primary Health Center of Oro-Oro Ombo	11	11	12	13	27
2	Primary Health Center of Tawangrejo	8	6	2	6	15
3	Primary Health Center of Banjarejo	14	11	18	21	33
4	Primary Health Center of Demangan	18	15	5	16	29
5	Primary Health Center of Manguharjo	13	12	10	13	24
6	Primary Health Center of Patihan	7	9	5	10	11
7	dr. Soedono Central General Hospital	16	14	12	10	65
8	Madiun City District General Hospital	5	11	10	15	156
9	TK. IV Madiun Hospital	2	0	0	3	15
10	Manguharjo Pulmonary Hospital	58	66	60	104	263
11	Siti Aisyah Islamic Hospital	0	3	8	4	51
12	Santa Clara Hospital	0	0	0	1	1
13	Prison Class I Madiun	2	1	5	0	9
14	Griya Husada Hospital	0	0	0	0	3
15	Al Hasanah Mother and Child Hospital	0	0	0	0	7
	Total Cases	**174**	**190**	**147**	**216**	**709**

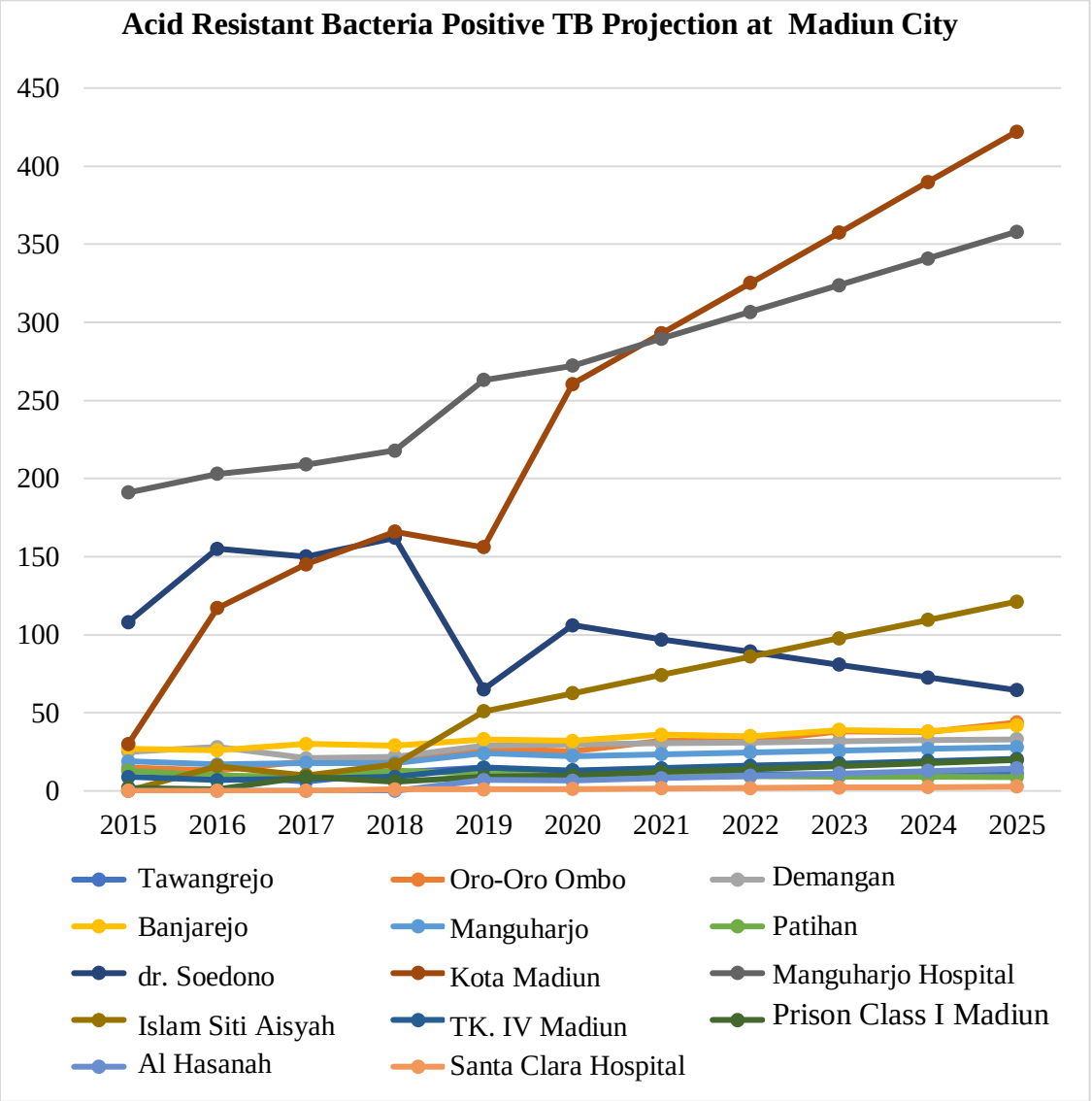
3. RESULTS AND DISCUSSION

Table 2. Acid Resistant Bacteria Positive Pulmonary TB Projection 2021-2025.

No	Location	Year				
		2021	**2022**	**2023**	**2024**	**2025**
1.	Primary Health Center of Tawangrejo	10	11	11	11	11
2.	Primary Health Center of Oro-Oro Ombo	32	32	38	38	44
3.	Primary Health Center of Demangan	31	31	32	32	33
4.	Primary Health Center of Banjarejo	36	35	39	38	42
5.	Primary Health Center of Manguharjo	24	25	26	27	28

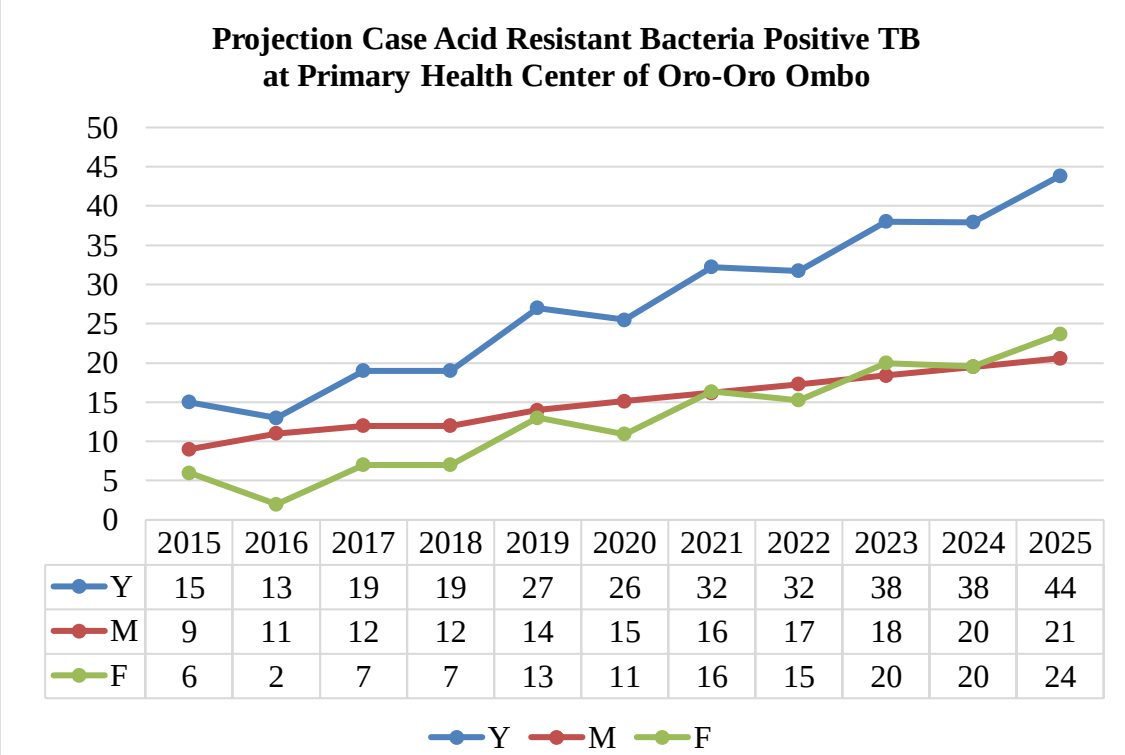
6.	Primary Health Center of Patihan	10	9	9	9	9
7.	dr. Soedono Central General Hospital	97	89	81	73	64
8.	Madiun City District General Hospital	293	325	358	390	422
9.	Manguharjo Pulmonary Hospital	289	307	324	341	358
10.	Siti Aisyah Islamic Hospital	74	86	98	109	121
11.	TK. IV Madiun Hospital	15	16	18	19	21
12.	Prison Class I Madiun	12	14	16	18	20
13.	Al Hasanah Mother and Child Hospital	8	10	11	13	14
14.	Santa Clara Hospital	2	2	2	2	3
	Total Cases	**933**	**992**	**1063**	**1120**	**1190**

Table 2. Above is the result of a time series (projection) of Acid Resistant Bacteria Positive Pulmonary TB cases, if illustrated through the graph to identify the trend picture of cases to be:



Graph 1. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Madiun City in 2015-2025.

Based on Graph 1, it is indicated that almost all acid resistant bacteria positive pulmonary TB case projections occur every year, particularly in the projected cases of acid resistant bacteria positive pulmonary TB at Madiun city hospital, Manguharjo Pulmonary Hospital, and Siti Aisyah Islamic hospital because there were several acid resistant bacteria positive tuberculosis patients recorded in the medical records of domiciled hospitals from outside the Madiun city. Meanwhile, the number of Acid Resistant Bacteria Positive Tuberculosis in some places decreased due to the COVID-19 pandemic. Numerous patients complaining of cough were then suspected as COVID-19 sufferers directed for antigen examination and/or PCR swab test. Thus, it was not recorded as a pulmonary TB patient with Acid Resistant Bacteria Positive Pulmonary TB.

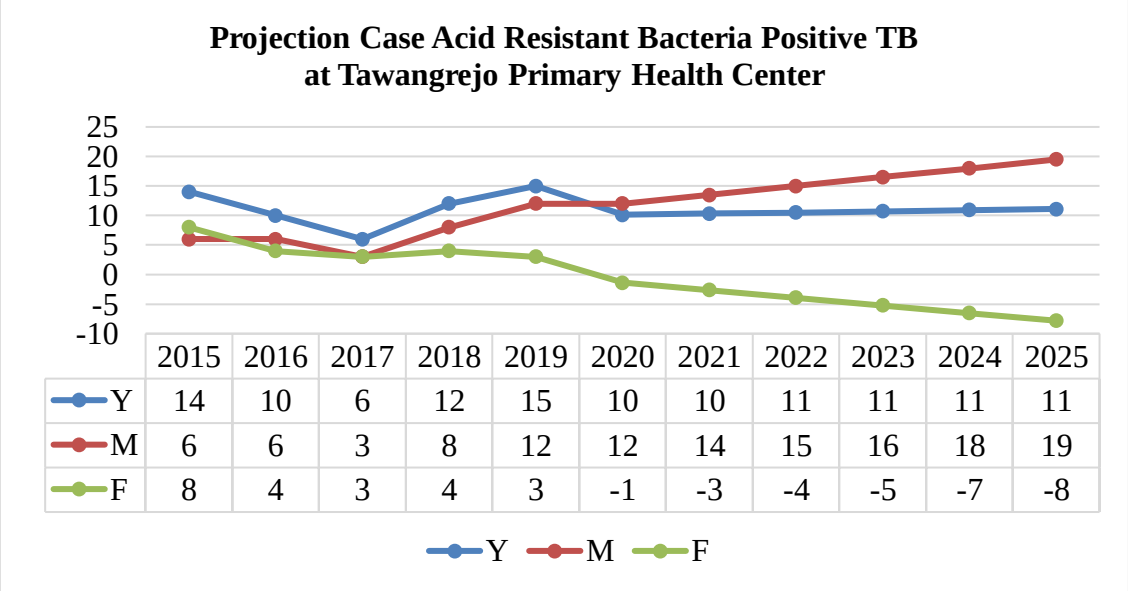


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	15	13	19	19	27	26	32	32	38	38	44
M	9	11	12	12	14	15	16	17	18	20	21
F	6	2	7	7	13	11	16	15	20	20	24

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 2. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Oro-Oro Ombo Primary Health Center in 2015-2025.

Based on the graph above, the projected cases of acid resistant bacteria positive TB in the Oro-Oro Ombo primary health center presented that the number of cases is increasing every year. It is identified that acid resistant bacteria positive pulmonary TB disease is more prevalent in men, with 9 cases reported in 2015, 11 cases reported in 2016, 12 cases reported in 2017, 12 cases reported in 2018, 14 cases reported in 2019, 15 cases reported in 2020, and 16 cases reported in 2021. There will be 17 cases in 2022, 18 cases in 2023, 20 cases in 2024, and 21 cases in 2025.

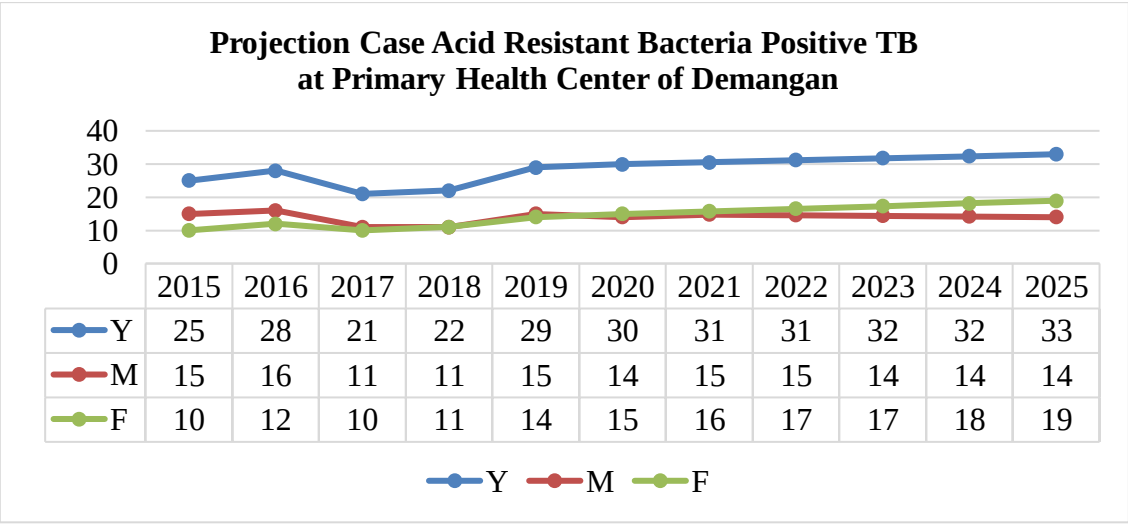


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	14	10	6	12	15	10	10	11	11	11	11
M	6	6	3	8	12	12	14	15	16	18	19
F	8	4	3	4	3	-1	-3	-4	-5	-7	-8

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 3. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Tawangrejo Primary Health Center in 2015-2025.

Based on the graph above, the projected cases of acid resistant bacteria positive pulmonary TB in Tawangrejo primary health center revealed that the number of cases of acid resistant bacteria positive pulmonary TB illness is more prevalent in men, with 6 cases reported in 2015, 6 cases reported in 2016, 3 cases reported in 2017, 8 cases reported in 2018, and 12 cases reported in 2019. There were 12 cases in 2020, 14 cases in 2021, 15 cases in 2022, 16 instances in 2023, 18 cases in 2024, and 19 cases in 2025.

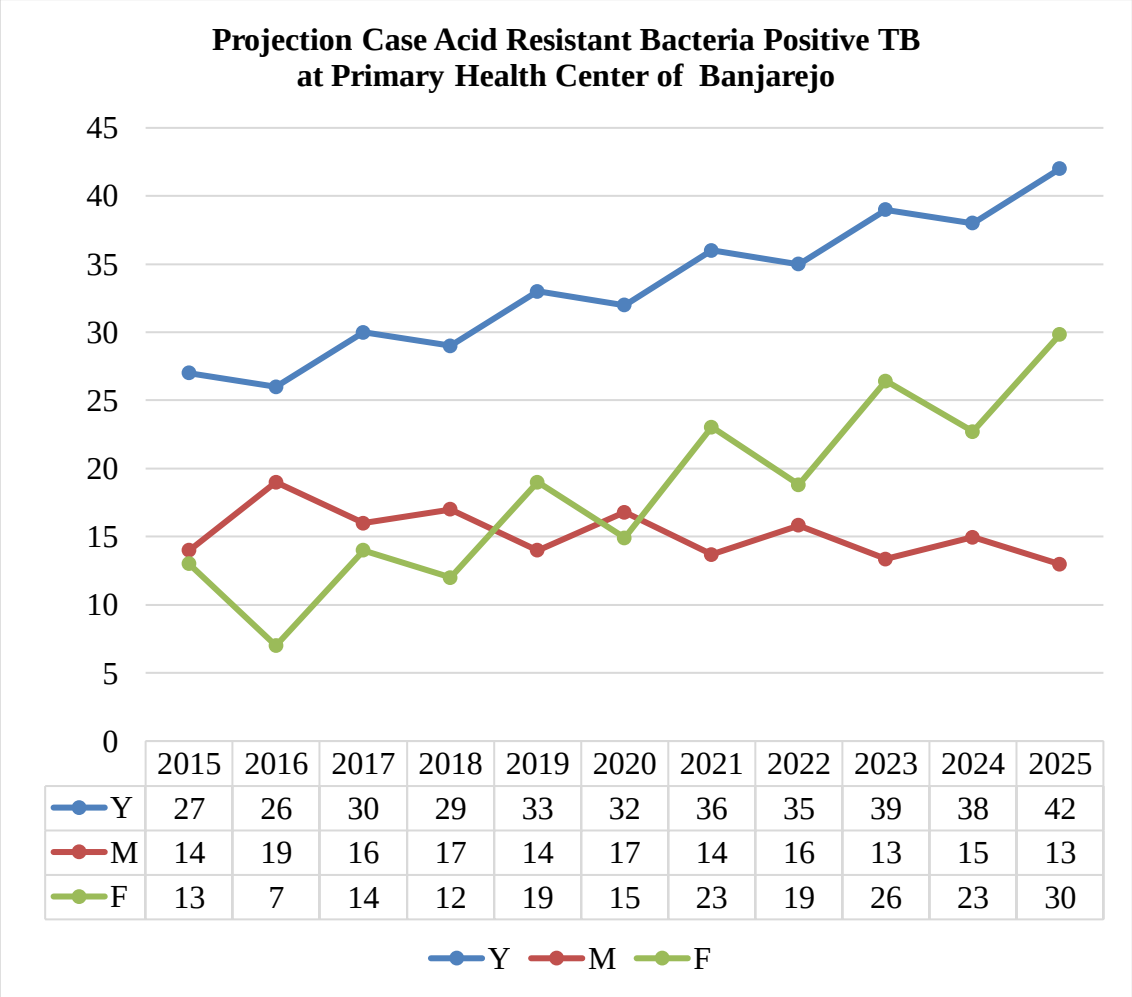


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	25	28	21	22	29	30	31	31	32	32	33
M	15	16	11	11	15	14	15	15	14	14	14
F	10	12	10	11	14	15	16	17	17	18	19

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 4. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Demangan Primary Health Center in 2015-2025.

Based on the graph above, the projected cases of Acid Resistant Bacteria Positive Pulmonary TB in Demangan primary health center displayed that the number of Acid Resistant Bacteria Positive Pulmonary Tuberculosis is more common in women, with 10 cases reported in 2015, 12 cases reported in 2016, 10 cases reported in 2017, 11 cases reported in 2018, and 14 cases reported in 2019. In 2020, 15 cases were reported, followed by 16 in 2021, 17 in 2022, 17 in 2023, 18 in 2024, and 19 in 2025.



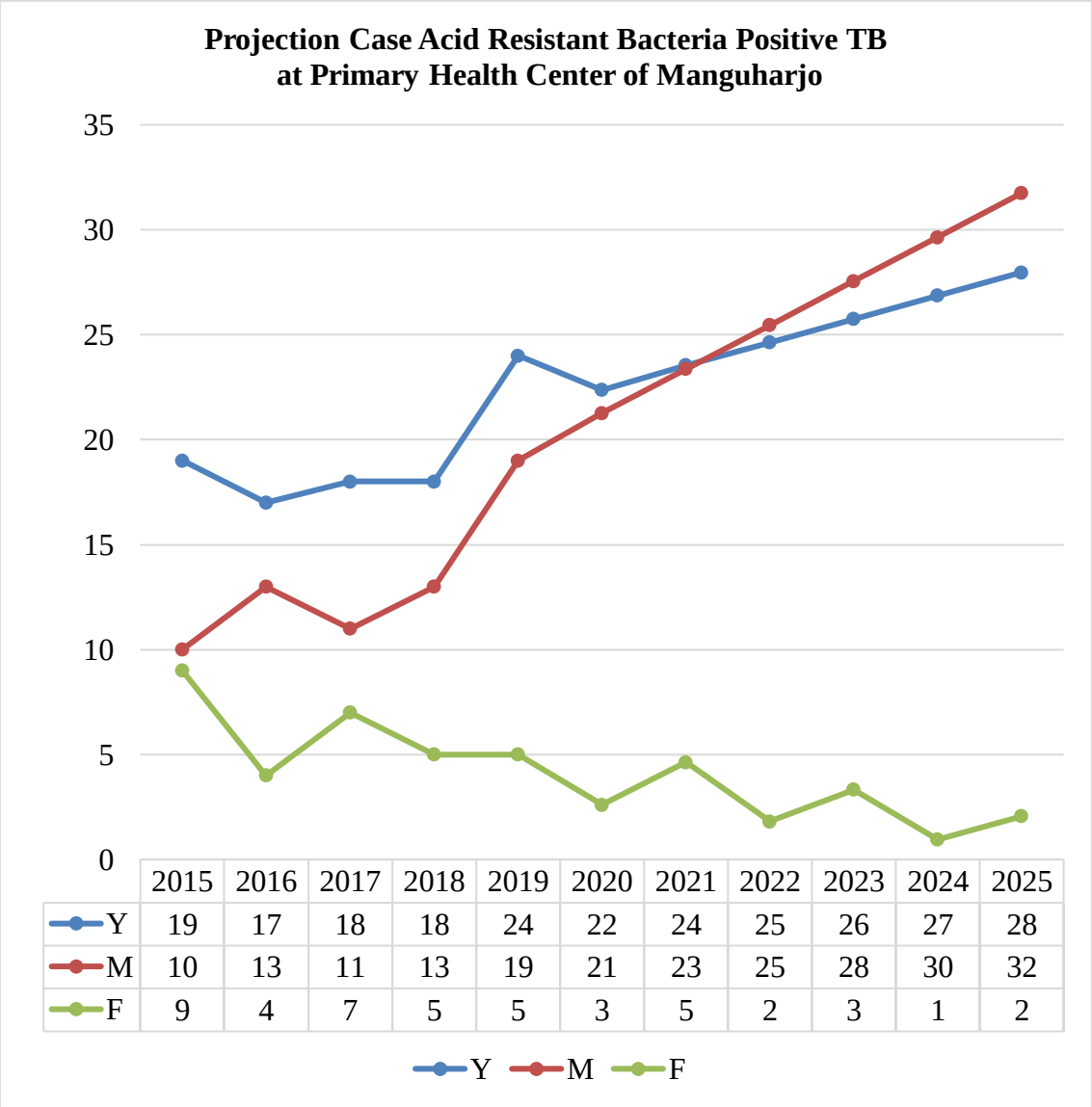
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	27	26	30	29	33	32	36	35	39	38	42
M	14	19	16	17	14	17	14	16	13	15	13
F	13	7	14	12	19	15	23	19	26	23	30

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 5. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Banjarejo Primary Health Center in 2015-2025.

Based on the graph above, the projected cases of acid resistant bacteria positive pulmonary TB in Banjarejo primary health center presented that the number of cases is increasing every year. It can be observed that Acid Resistant Bacteria Positive Pulmonary TB illness is more prevalent in women, with 13 cases reported in 2015, 7 cases reported in 2016, 14 cases reported in 2017, 12 cases reported in 2018, 19 cases

reported in 2019, 15 cases reported in 2020, and 23 cases reported in 2021. There were 19 cases in 2022, 26 cases in 2023, 23 cases in 2024, and up to 30 cases in 2025.

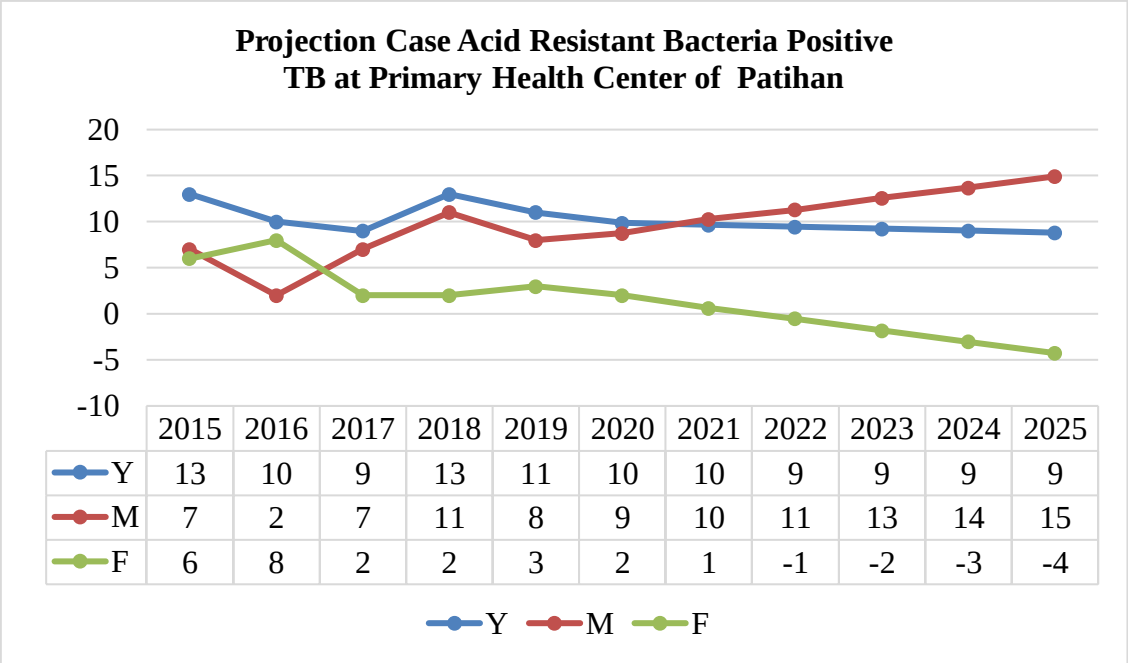


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	19	17	18	18	24	22	24	25	26	27	28
M	10	13	11	13	19	21	23	25	28	30	32
F	9	4	7	5	5	3	5	2	3	1	2

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 6. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Manguharjo Primary Health Center in 2015-2025.

Based on the graph above, the projected cases of Acid Resistant Bacteria Positive Pulmonary TB at Manguharjo primary health center presented that acid resistant bacteria positive pulmonary TB disease is more prevalent in the male sex, with 10 instances reported in 2015, 13 cases reported in 2016, 11 cases reported in 2017, 13 cases reported in 2018, and 19 cases reported in 2019. There will be 21 cases in 2020, 23 cases in 2021, 25 cases in 2022, 28 cases in 2023, 30 cases in 2024, and 32 cases in 2025.

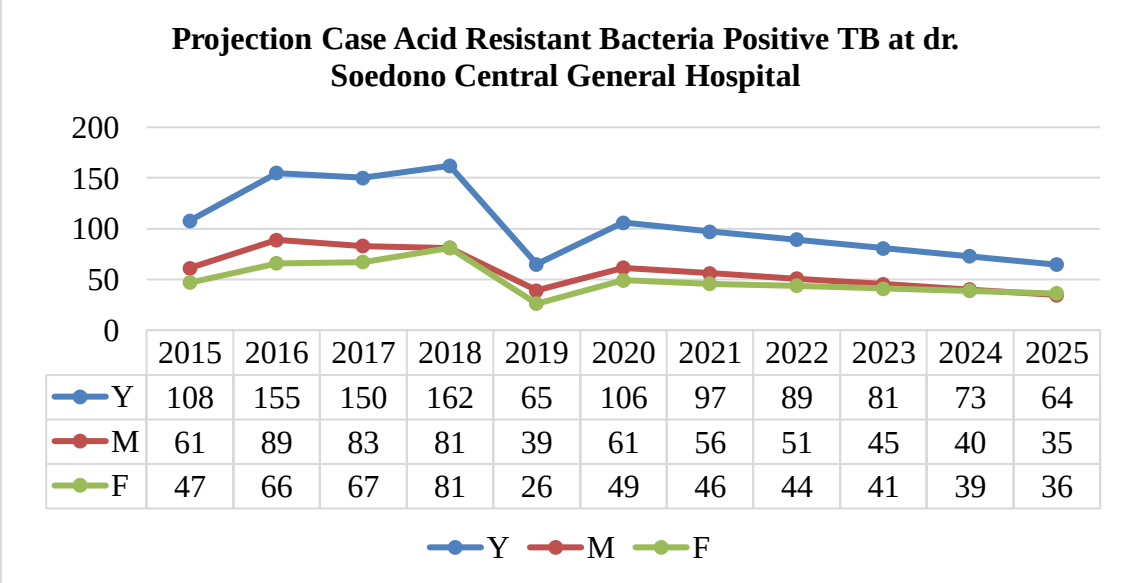


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	13	10	9	13	11	10	10	9	9	9	9
M	7	2	7	11	8	9	10	11	13	14	15
F	6	8	2	2	3	2	1	-1	-2	-3	-4

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 7. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Patihan Primary Health Center in 2015-2025.

Based on the graph above the projected cases of Acid Resistant Bacteria Positive Pulmonary TB in Patihan Primary Health Center displayed that Bacteria Positive Pulmonary TB disease is more dominant in the male sex in 2015, there were 7 cases of Acid Resistant Bacteria Positive Pulmonary TB disease, in 2016 there were 2 cases, in 2017 there were 7 cases, in 2018 there were 11 cases, in 2019 there were 8 cases, in 2020 there were 9 cases, in 2021 there were 10 cases, in 2022 there were 11 cases, in 2023 there were 13 cases, in 2024 there were 14 cases, and in 2025 there were 15 cases.

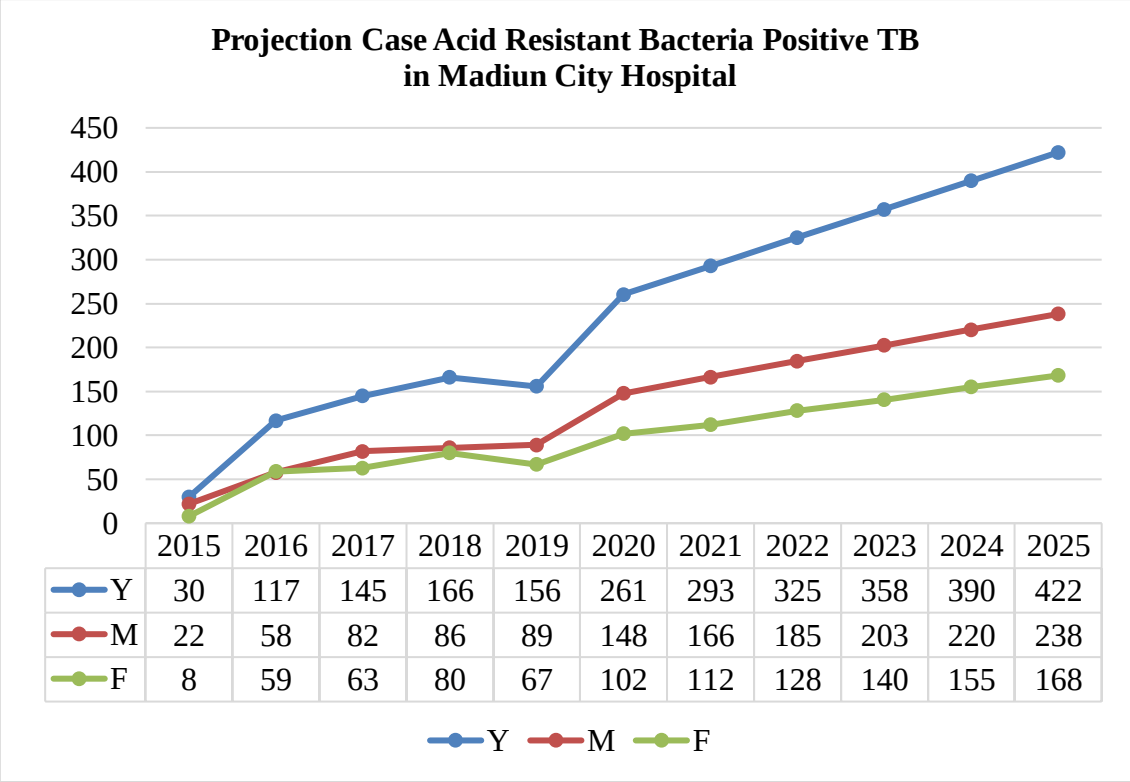


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	108	155	150	162	65	106	97	89	81	73	64
M	61	89	83	81	39	61	56	51	45	40	35
F	47	66	67	81	26	49	46	44	41	39	36

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 8. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at dr. Soedono hospital in 2015-2025.

Based on the graph above the projected case of Acid Resistant Bacteria Positive Pulmonary TB in dr. Soedono central general hospital revealed that the male sex has a higher prevalence of acid resistant bacteria positive pulmonary TB illness, with 61 cases in 2015, 89 cases in 2016, 83 cases in 2017, 81 cases in 2018, 39 cases in 2019, 61 cases in 2020, and 56 cases in 2021. There were 51 instances in 2022, 45 cases in 2023, 40 cases in 2024, and 35 cases in 2025.

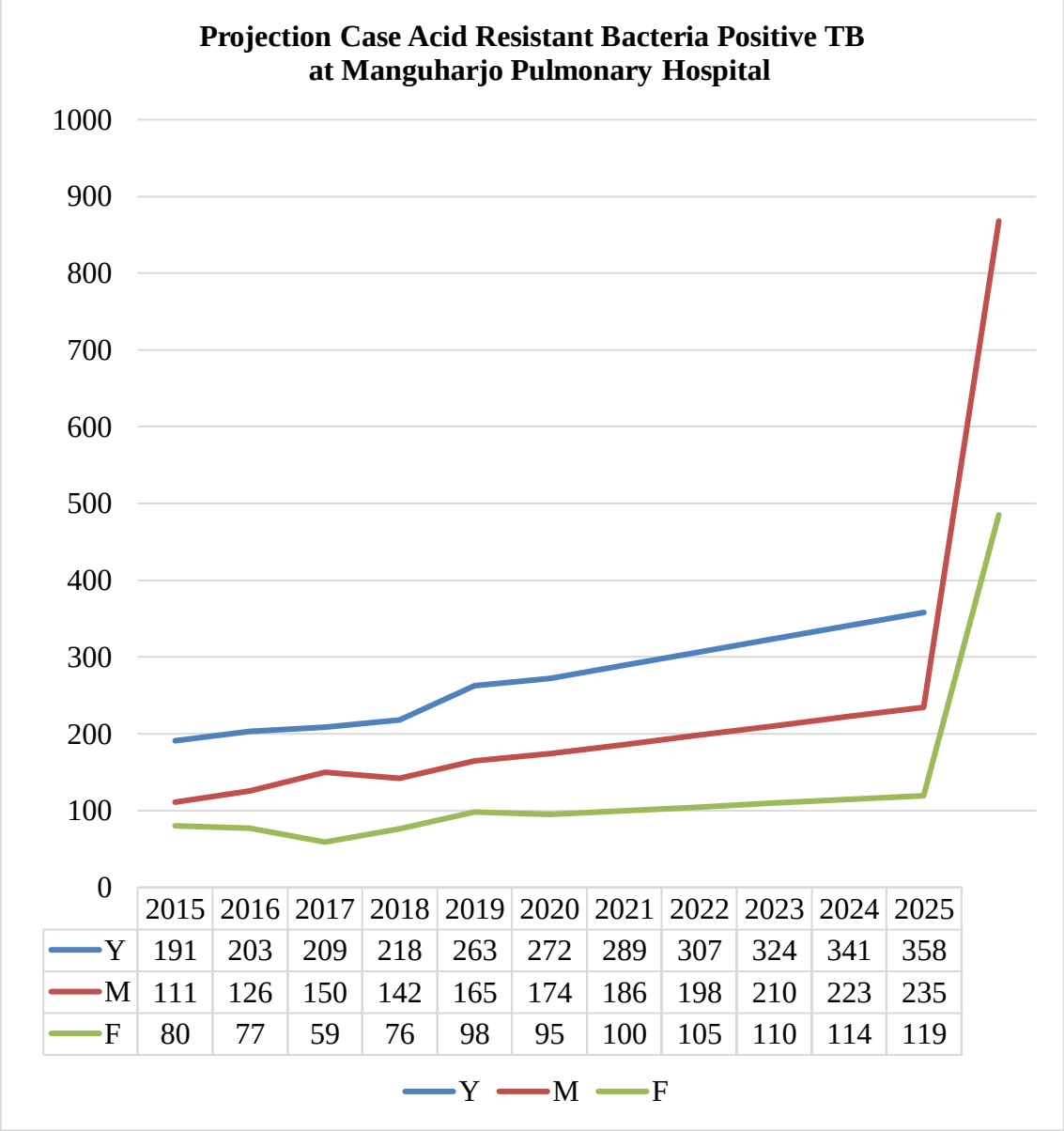


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	30	117	145	166	156	261	293	325	358	390	422
M	22	58	82	86	89	148	166	185	203	220	238
F	8	59	63	80	67	102	112	128	140	155	168

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 9. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Madiun City Hospital in 2015-2025.

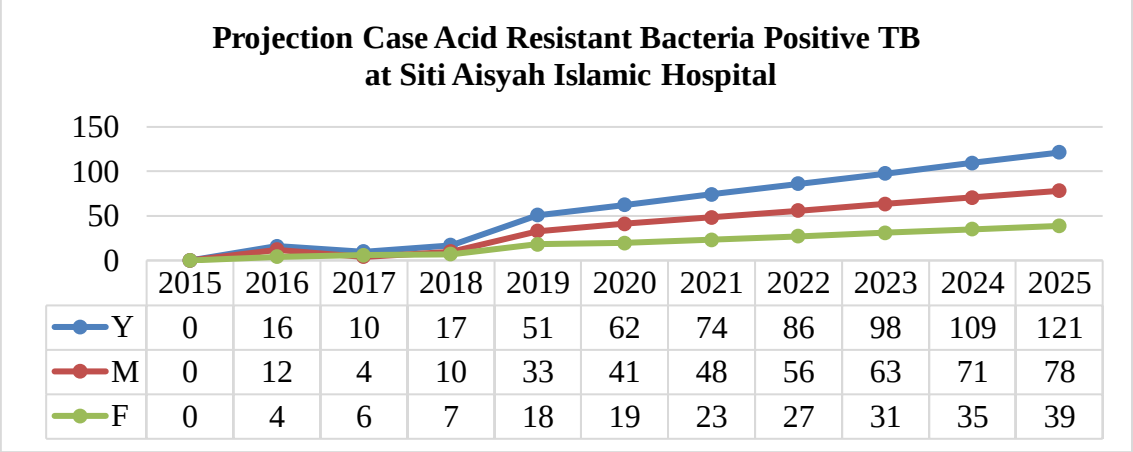
Based on the graph above, the projected cases of acid resistant bacteria positive pulmonary TB in Madiun city hospital presented that acid resistant bacteria positive pulmonary TB illness is more prevalent in males, with 22 cases reported in 2015, 58 cases reported in 2016, 82 cases reported in 2017, 86 cases reported in 2018, and 89 cases reported in 2019. There were 148 cases in 2020, 166 cases in 2021, 185 cases in 2022, as much as 203 cases in 2023, 220 cases in 2024, and 238 cases in 2025.



Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 10. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Manguharjo Pulmonary Hospital in 2015-2025.

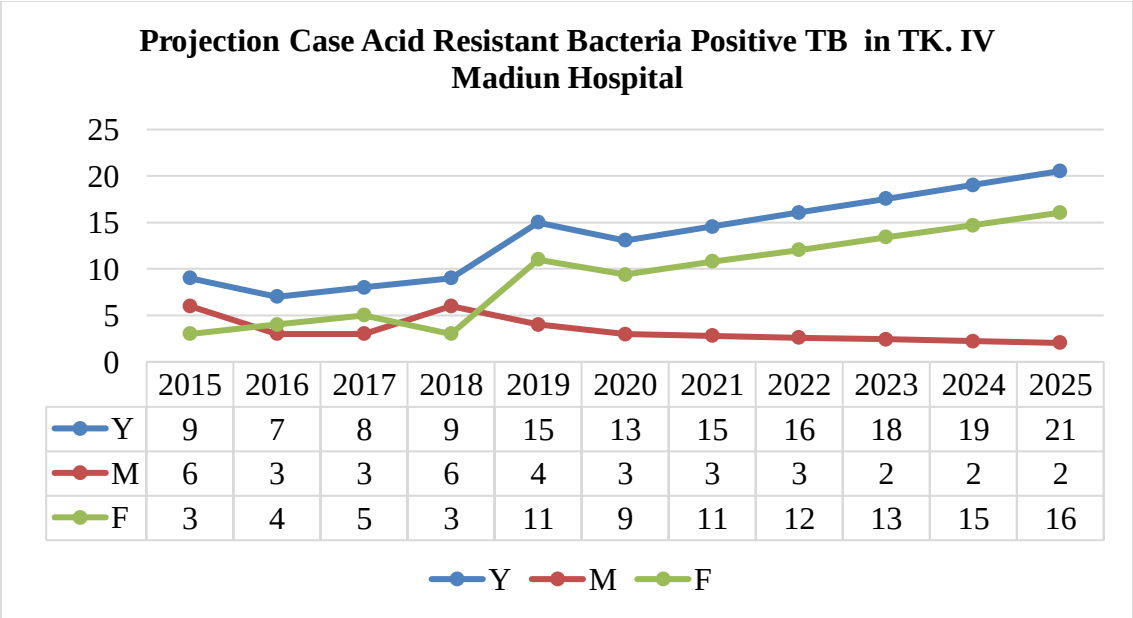
Based on the graph above, the projected cases of acid resistant bacteria positive pulmonary TB in Manguharjo pulmonary hospital revealed that the number of cases increases every year. It can be identified that the male sex has a higher prevalence of Acid Resistant Bacteria Positive Pulmonary TB illness, with 111 cases in 2015, 126 cases in 2016, 150 cases in 2017, 142 cases in 2018, 165 cases in 2019, 174 cases in 2020, and 186 cases in 2021. There were 198 incidences in 2022, 210 cases in 2023, 223 cases in 2024, and 235 cases in 2025.



Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 11. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Siti Aisyah Islamic Hospital in 2015-2025.

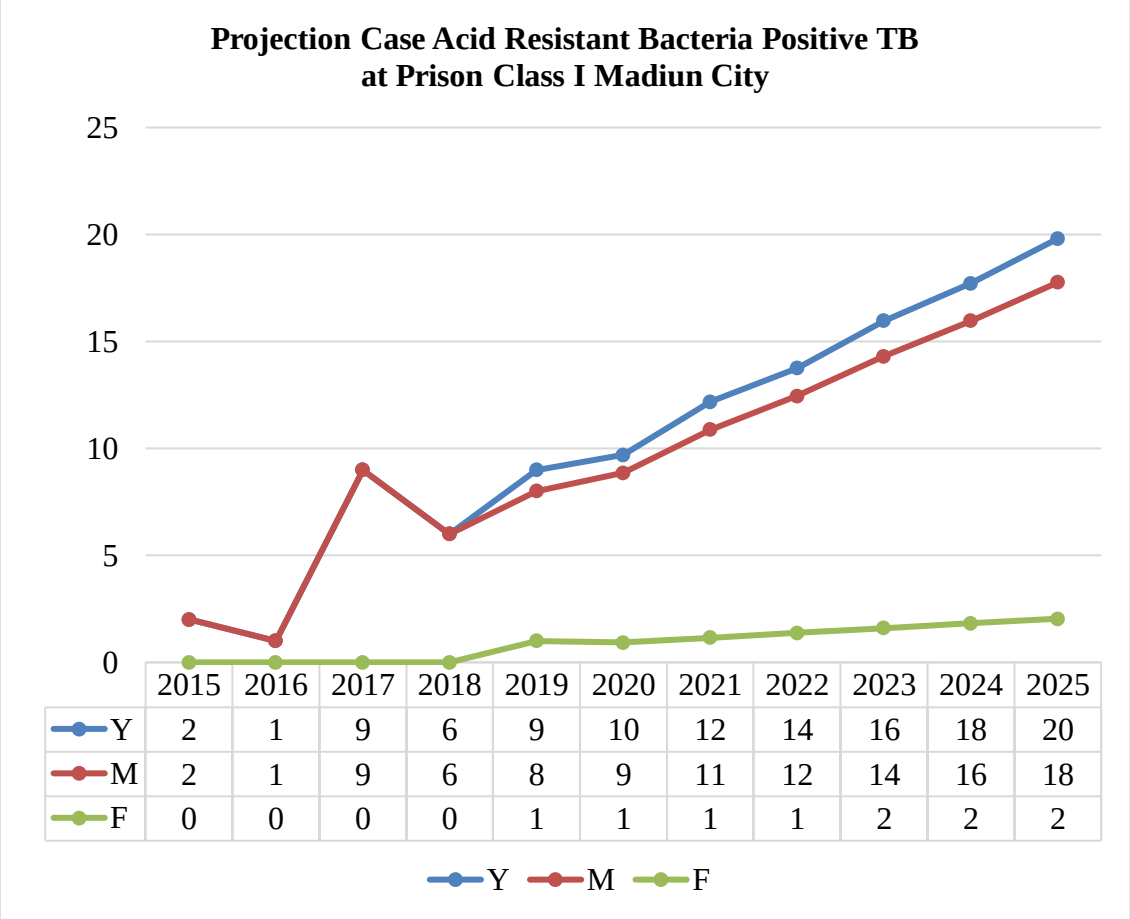
Based on the chart above, the projected cases of acid resistant bacteria positive pulmonary TB in Siti Aisyah Islamic hospital presented that the number of cases increases every year. It can be indicated that Acid Resistant Bacteria Positive Pulmonary TB illness is more prevalent in men, with 12 cases reported in 2016, 4 cases reported in 2017, 10 cases reported in 2018, 33 cases reported in 2019, 41 cases reported in 2020, 48 cases reported in 2021, and 56 cases reported in 2022. There will be 63 instances in 2023, 71 cases in 2024, and 78 cases in 2025.



Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 12. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at TK. IV Madiun Hospital in 2015-2025.

Based on the graph above, the projected case of acid resistant bacteria positive pulmonary TB in TK IV Madiun hospital presented that Acid Resistant Bacteria Positive Pulmonary TB disease was more dominant in the female sex in 2015, there were six cases of Acid Resistant Bacteria Positive Pulmonary TB illness, three cases in 2016, three cases in 2017, six cases in 2018, six cases in 2019, four cases in 2020, and eleven cases in 2021. Twelve cases were reported in 2022, thirteen in 2023, fifteen in 2024, and sixteen in 2025.



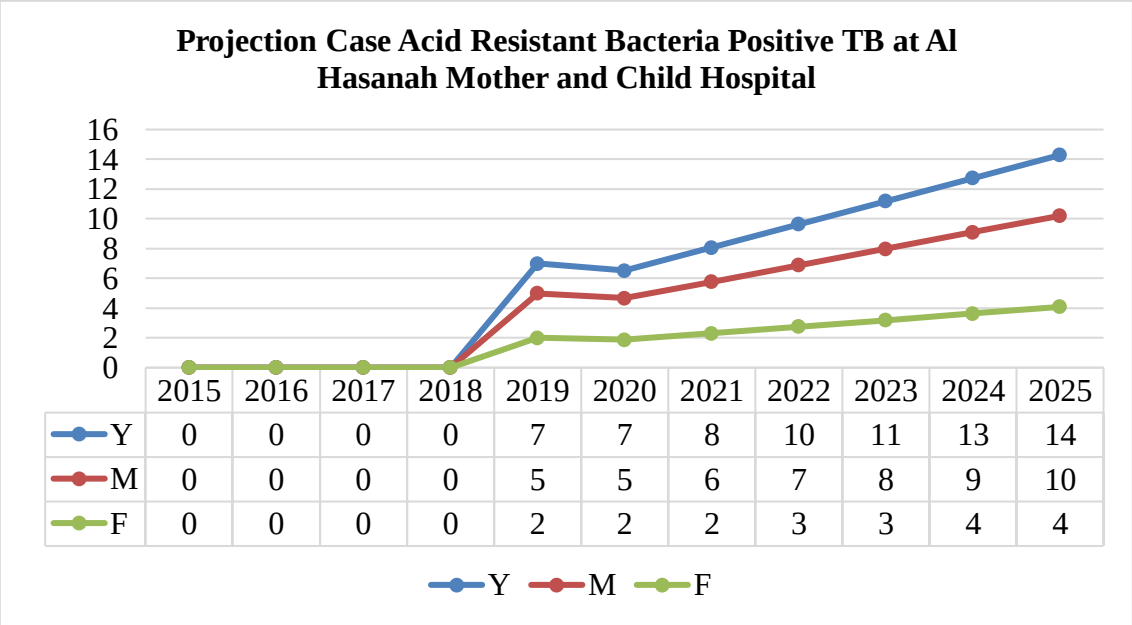
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	2	1	9	6	9	10	12	14	16	18	20
M	2	1	9	6	8	9	11	12	14	16	18
F	0	0	0	0	1	1	1	1	2	2	2

Description
Y: Total Number of Cases Per Year
M: Male
F: Female

Graph 13. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Prison Class I Madiun City in 2015-2025.

Based on the graph above, the projection of acid resistant bacteria positive pulmonary TB cases in the Prison Class I of Madiun city presented that the number of cases increases every year. It can be evident that Acid Resistant Bacteria Positive Pulmonary TB illness is more prevalent in men, with 2 cases reported in 2015, 1 case reported in 2016, 9 cases reported in 2017, 6 cases reported in 2018, 8 cases reported in

2019, 9 cases reported in 2020, and 11 cases reported in 2021. There were 12 cases in 2022, 14 cases in 2023, 16 cases in 2024, and 18 cases in 2025.

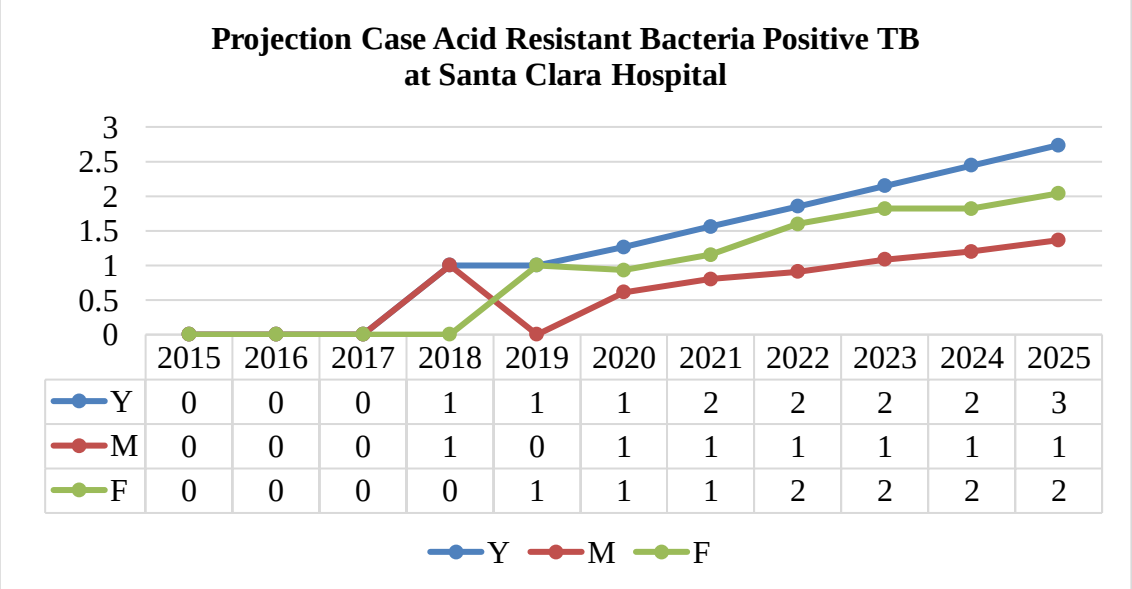


	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	0	0	0	0	7	7	8	10	11	13	14
M	0	0	0	0	5	5	6	7	8	9	10
F	0	0	0	0	2	2	2	3	3	4	4

Description
Y : Total Number of Cases Per Year
M : Male
F : Female

Graph 14. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Al Hasanah Mother and Child Hospital in 2015-2025.

Based on the graph above, the projected cases of acid resistant bacteria positive pulmonary TB in Al Hasanah mother and child hospital revealed that the number of cases increases every year. It can be observed that Acid Resistant Bacteria Positive Pulmonary TB illness is more prevalent in men, with 5 cases reported in 2019, 5 cases reported in 2020, 6 cases reported in 2021, 7 cases reported in 2022, 8 cases reported in 2023, 9 cases reported in 2024, and 10 cases reported in 2025.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Y	0	0	0	1	1	1	2	2	2	2	3
M	0	0	0	1	0	1	1	1	1	1	1
F	0	0	0	0	1	1	1	2	2	2	2

Description
Y : Total Number of Cases Per Year
M : Male
F : Female

Graph 15. Cases Projection of Positive Pulmonary TB Based on Positive Pulmonary TB at Santa Clara Hospital in 2015-2025.

Based on the graph above, the projected cases of Acid Resistant Bacteria Positive Pulmonary TB in Santa Clara hospital presented that Acid Resistant Bacteria Positive Pulmonary TB Disease is more prevalent in women, with 1 case reported in 2019, 1 case reported in 2020, 1 case reported in 2021, 2 cases reported in 2022, and 2 cases reported in 2023. There will be two cases in 2024, and two cases in 2025.

Prediction of acid resistant bacteria positive pulmonary TB Incidence by Gender. Based on the results of research, it is revealed the projected case data of acid resistant bacteria positive pulmonary TB in the Madiun city, which is the male sex, more case data compared to the results of projected cases of female patients. It is in accordance with the research result (Susanto, et al., 2016) displaying that cases of Acid Resistant Bacteria Positive Pulmonary TB based on gender in Kendari city in 2016-2014 frequently increases every year, in which in 2014, there were 247 cases for people with acid resistant bacteria positive pulmonary TB in male, while in female by 163 cases.

In the prediction period, in 2016-2020, it is predicted that acid resistant bacteria positive pulmonary TB cases continue to increase, in 2020, the highest number of cases will be in the male sex with a total of 602 cases. Similar results were also revealed by previous researchers (Hastuti, et al., 2016) that the results of forecasting presented the number of pulmonary TB morbidity rates based on gender from year to year which is increase in which the highest number of cases was male sex.

According to (Dotulong, et al., 2015), the number of Pulmonary TB incidences occurring in men because men prefer high mobility than women. Thus, the possibility to be exposed is greater. Moreover, the habits such as smoking and consuming alcohol may lower the immune system, thus, it is natural that smokers and alcohol drinkers are frequently referred to as agents of pulmonary TB disease. Men possess a heavier workload, less rest, and a less healthy lifestyle.

The results of the study (Andayani, 2020) possess a prediction of pulmonary TB incidence in accordance with the sex of the most sufferers that is the male sex estimated to decrease the pulmonary TB incidences in early 2017, then increase the pulmonary TB incidence in the middle of the year after, while at the end of 2020, there is a decrease in the pulmonary TB cases, but still in small numbers than in the previous year. Meanwhile, the female sex possesses the smallest predicted incidence of pulmonary TB. In 2018 prediction, the highest number of cases was in the male sex with 222 cases, and in the female sex of 141 cases (Korua, et al., 2014).

It is corroborated by research conducted by (Mahfuzhah, 2014) in Pontianak city which revealed that statically, there is a relationship between male sex and people with pulmonary tuberculosis. Results from a (Atik, 2013) study uncovered that cases of acid resistant bacteria positive pulmonary TB disease by gender, discovered that men are 1.5 times more likely than in women.

The results of this study are in accordance with research conducted by (Mangngi, 2019) which unveiled that there is a meaningful relationship between sex and the incidence of pulmonary TB in Naibonat, East Kupang, Kupang Regency, in which the

male sex owns 2.7 times more risk of lung TB disease than the female sex (Samsugito, 2018). It is because men possess higher mobility than women and also other bad habits such as smoking and consuming alcohol causing the immune system to decrease so that it makes it easier for men infected with pulmonary TB (Pangaribuan, et al., 2020).

Research in India also discovered that smokers possess a higher risk of being infected with pulmonary TB disease compared to (Nurjana, 2015). Furthermore, research from (Nurhana, et al., 2010) revealed that there is a meaningful relationship between sex and the incidence of pulmonary TB. This study states that men are more likely to suffer from pulmonary TB than women.

The results of this study as revealed by (Naga, 2012) unveiled that in men, pulmonary TB disease is higher than in women due to the habit of men who frequently smoke and consume alcoholic beverages that lower the body's defense system. Thus, it is natural that smokers and alcohol drinkers are commonly referred to as agents of pulmonary TB disease.

Prediction of acid resistant bacteria positive pulmonary TB incidence according to acid resistant bacteria positive pulmonary TB case data. Based on the results of research demonstrated the results of data analysis time series (projection) cases of acid resistant bacteria positive pulmonary TB experiencing an increase. It is also in accordance with research (Susanto, et al., 2016) presenting that cases of acid resistant bacteria positive pulmonary TB in the period 2010-2014 tend to increase with the cases number of 255, 280, 314, 333, and 410 cases, respectively. In the prediction period, in 2016-2020, it is predicted that cases of acid resistant bacteria positive pulmonary TB continue to increase with cases of 553, 646, 752, 871, and 1003 cases, respectively. The results are in accordance with previous research (Hastuti, et al., 2016) that the results of forecasting pulmonary TB morbidity (forecasting) at the predicted period of 2013-2015 experienced an increase in cases of Acid Resistant Bacteria Positive Pulmonary TB.

Please note that the highest prediction results of acid resistant bacteria positive pulmonary TB patients are assumed if the facilities and infrastructure, existing health facilities are still the same as the state of health facilities in the period before the prediction, hence, it affects the high and low number of cases of prediction results.

Predictions of the rise or fall of Pulmonary TB case data can also be influenced by the COVID-19 pandemic. Many patients complaining of cough pain is then suspected as COVID-19 sufferers directed to have an antigen examination and/or PCR swab test. Thus, it is not followed up for specimen examination of positive Acid Resistant Bacteria sputum (tuberculosis).

Other factors affecting the incidence of acid resistant bacteria positive pulmonary TB are environmental and socioeconomic factors. Soil floor types, for instance, can indicate very basic dwelling conditions that do not match the standards, are difficult to clean, dusty, and tend to be wet and dark. This is a perfect environment for bacteria and viruses to thrive and survive for prolonged periods of time. People who enter the residence with acid resistant bacteria positive pulmonary TB are more easily disseminated to other inhabitants (Crofton, et al., 2002). House contact is a very serious threat to other family members to suffer from tuberculosis because it is a source of intensive transmission which is around the daily lives of other family members. Close contact with people with acid resistant bacteria positive pulmonary TB is at maximum risk for infection. Delays in providing treatment increase the possibility of transmission risk (Apriani, 2001).

Socio-economic factors, such as income per capita, illustrate a person's economic ability which broadly influences other aspects of life, such as healthy behavior, education, housing, and others. From the health aspect, families with high-per-capita income can meet the needs of their family members, such as nutritional needs, healthy housing and health care, in reducing the risk of TB disease (Jaya, & Mediarti., 2017). The relationship between per capita income and tuberculosis may occur reciprocally. Under certain conditions, pulmonary tuberculosis attacking family members who are the backbone of the family economy can directly influence the family's per capita income, due to the lack of productive working days (Aditama, 2005).

Based on the results of (Sarce dan Suarni, 2016), it is explained that during the last 3 years from 2013-2015, there was an increase in acid resistant bacteria positive pulmonary TB cases every year in almost all areas of Kendari city Sub district. The results of the study (Andayani & Astuti, 2017) presented that the distribution of pulmonary TB patients in Ponorogo Regency in 2010-2015 frequently increase every year. At the time of prediction, which is in 2016-2020, it is predicted that pulmonary TB cases keep increasing.

4. CONCLUSION

Based on the results of this study, it can be identified that the time series (projection) data of acid resistant bacteria positive pulmonary tb patients in madiun city in 2021-2025 keep increasing every year in which the most cases are dominated by male community groups. There are several factors influencing the increase or decrease in the incidence of positive smear pulmonary TB. Thus, it is necessary to analyze the risk factors causing the incidence of positive smear pulmonary TB based on the health service work area or community characteristics and conduct preventive and promotive activities to reduce the incidences of positive smear pulmonary TB particularly in the male sex group.

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

Measuring the Antioxidant Effect of *Limnocharis Flava* on Malondialdehyde Activities in Livers of Alloxan-induced Diabetic Rats

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Abstract
Antioxidants are substances counteracting the effects of free radicals. Antioxidants are formed in several forms, encompassing vitamins, minerals, and phytochemicals. *Genjer* or yellow velvet leaves (*Limnocharis Flava*) is an aquatic plant potentially beneficial alternative to natural antioxidants. This study aims to measure the antioxidant effect from the yellow velvetleaf ethanol extract on malondialdehyde (MDA) activities in livers of diabetic rats (*Rattus novergicus*) induced by alloxan in three different doses. The tested animals were randomly divided into five groups comprising six white rats previously induced with alloxan by intra-peritoneal injection. Group 1 was the negative control provided 0.5% CMC Na while group 2 was a positive control administered 0.45 mg glibenclamide. On the other hand, groups 3, 4, and 5 were the experimental groups that provided the extract of yellow velvetleaf as many as 32.5 mg/kg body weight (BW) ethanol, 65 mg/kg BW ethanol extract, and 130 mg/kg BW, respectively. Furthermore, the extracts were administered once on the 7th, 14th, and 21st days; the parameters observed were MDA activities in the rats' livers. The Thiobarbituric Acid Reactive Substances (TBARs) method was then employed to investigate these actions. The one-way ANOVA was administered to examine the acquired data from the examination, followed by a post hoc test. The average points of the MDA level from group 1 to group 5 were 10.78 0.33, 3.71 + 0.19, 7.25 + 0.26, 5.76 + 0.25, and 4.01 + 0.22, correspondingly, according to the results. The one-way ANOVA test revealed that MDA levels in each test group were significantly different (p 0.05). Based on these findings, it may be concluded that feeding ethanol extract from yellow velvet leaves to diabetic rats reduces MDA levels in their livers, therefore preserving cells from harm.

Keywords: Yellow Velvet Leaves, The Liver's MDA Level, Antioxidant Activities, Limnocharis Flava.

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1. INTRODUCTION

Metabolic disease such as diabetes mellitus (DM) is a disease characterized by a high blood glucose level (hyperglycemia) due to insulin work disruption. This kind of disorder is affected by several factors and indicated by symptoms such as hyperglycemia and metabolism disorders of carbohydrates, fat, and protein. A lack of insulin secretion, insulin actions, and glucose transporter results in the development of such a disease (Maulana, 2009).

Multiple organ failures in chronic hyperglycemic diabetes are associated with long-term damage to kidneys, nerves, blood vessels, eyes, and the heart (Prawitasari, 2019). The failure of the pancreas to secrete insulin, which transforms carbohydrates, fats, and proteins into energy, causes this damage. Insulin is the hormone in charge of regulating blood sugar levels (American Dental Association, 2010; American Dental Association, 2011; American Dental Association, 2015).

One of the most reactive radicals is the hydroxyl radical. The lipid membrane will react with this radical to generate Malondialdehyde (MDA) compounds if it comes into contact with it (Oyenihi, et al., 2015). Furthermore, the hydroxyl radical can permeate through cell membranes and is exceedingly hazardous. Malondialdehyde is a lipid peroxidation end product that is employed to measure oxidative stress and the risk of problems in diabetes mellitus. Molecular changes in diverse tissues are the result of oxidative stress, and this state produces an imbalance between the increased generation of free radicals and the formation of protective (endogenous) antioxidants (Widyawati, 2016). As a result of this imbalance, oxidative damage occurs, raising the risk of complications in diabetes mellitus (Mahreen, et al., 2010).

The liver is an organ which is responsible for the gluconeogenesis and glycogenesis processes (Rajendiran, et al., 2018). When insulin resistance occurs, both processes are disrupted and cause hyperglycemia. Hyperglycemia triggers reactive oxygen species (ROS) to re-form (Aprilia, et al., 2018). One of the prior targets of ROS is lipid; when hepatic insulin resistance occurs, numerous lipids accumulate in hepatocyte cells. The hepatocellular lipids acquiring approximately 5.5% are considered nonalcoholic fatty liver (NAFL), a manifestation of DM (Szendroedi, et al., 2012).ROS is able to attack polyunsaturated fatty acids (PUFA), hence, the final product is generated in the form of reactive aldehyde compounds such as Malondialdehyde (MDA) (Tiwari, et al., 2013). Antioxidants can prohibit MDA formation. The antioxidant capacity of DM is reduced, necessitating the use of external antioxidants (Marra, et al., 2002). According to Maisuthisakul, et al., (2008), L. Flava contains phenolics of up to 5.4 mg GAE/g dry weight and flavonoids of up to 3.7 mg RE/g dry weight in Thailand. Yellow velvetleaf (L. Flava) is an aquatic plant that has the potential to be one of the natural antioxidants that may successfully combat free radicals.

The objective of this study is to investigate the effects of the ethanol extract from yellow velvetleaves upon MDA activities in the livers of diabetic rats induced by alloxan, hence scientific information about an alternative natural antioxidant in diabetes mellitus therapy.

2. RESEARCH METHOD

This experimental laboratory research employed diabetic white rats. The rats were the 2-3 months albino lab rats weighing 200-300 grams, randomly divided into five

groups. Each group was comprised of 6 rats. The positive control group was provided 0.45 mg glibenclamide. The negative control group was 0.5% CMC Na, and three testing groups were provided 32.5 mg/kg BW/kg, 65 mg/kg BW 130 mg/kg BW of yellow velvetleaf extracts, respectively. Previously, all rats were provided alloxan by intraperitoneal injection. Each group was supplied treatment according to their respective groups on the 7th, 14th, and 21st weeks. Furthermore, the antioxidant activity tests of MDA activities were performed employing the Thiobarbituric Acid Reactive Substances (TBARs) method. The data were then collected and analyzed statistically, administering the one-way ANOVA.

The tools utilized in this research were syringes (Terumo), 500 ml beaker glass (Pyrex), analytical scales (Mettlertoledo), 10 ml and 25 ml measuring flasks (Pyrex), glucometers (easy touch), porcelain dishes (Haldenwanger), mortars and stampers (Haldenwanger), stirring rods (pyrex), a rotary evaporator (Scilogex), test tubes (Pyrex), TLC vessels (Macherey Nagel), TLC plate silica gel 60 F254 (Merck), an oven (Cosmos), measuring cups (Pyrex), glass pipettes (Pyrex), and spectrophotometers (Shimadzu).

The yellow velvetleaf powder, which included 10% moisture, weighed 500 grams. The powder was then placed in a closed vessel and macerated for four days in 2 liters of 70% ethanol, rotating it back and forth. After that, the sample was concentrated in a rotary evaporator at 400°C until a thick extract was obtained.

There are 30 white labs in all. The rats were separated into five groups, each weighing 200 grams. On the 7th, 14th, and 28th days, the experimental animals were provided the following treatments: group 1 received 0.5 ml Na CMC suspension as a placebo, group 2 received glibenclamide 0.45 mg as a positive control, and groups 3, 4, and 5 obtained yellow velvetleaf extracts at doses of 32.5 per kg/BW, 65 per kg/BW, and 130 per kg/BW, respectively. Afterward, all animals were provided 120 mg/kg BW alloxan injections to induce diabetes.

All test animals were decapitated, and their livers were obtained. The livers were then washed with a physiological 0.9% NaCl solution and chopped under cold conditions. The resulting homogenate was centrifuged at 4000 rpm for 10 minutes until a clear supernatant was collected. The clear supernatant was employed for the MDA testing. In the next process, as many as 0.75 ml H2PO4 was placed in the polypropylene tube containing thiobarbituric acid TBA, and 0.05 ml liver sample and 0.45 ml distilled water were administered. This mixture was mixed for 2 minutes before being heated in a water bath at 1000 C for 60 minutes and then cooled in an ice bath. The solution was then transferred from the ice bath to Sep-Park 18, where the MDA values were measured using a spectrophotometer at 532 nm.

Five series of MDA standard concentration were produced (0, 0.375, 0.75, 1.5 and 3) and the absorbance was calculated by employing a spectrophotometer (0.021, 0.037, 0.068, 0.151, and 0.242). Based on the regression analysis, the equation Y = -0.1479 + 12.45 x was obtained. The absorbancy of the MDA sample was then assessed and substituted in the equation above to formulate MDA levels in nmol/g. This research has received ethical permission from the Medical/Health Research Bioethics Commission, Faculty of Health, Sultan Agung Islamic University Semarang No. 298/IX/2020/Bioethical Commission.

3. RESULTS AND DISCUSSION

Based on the regression analysis of MDA levels in diabetic rats induced by alloxan, the levels of treatment groups were presented in table 1. These data were then analyzed statistically by employing the one-way ANOVA to identify the differences among the treatment groups.

Table 1. The decreased MDA levels in the treatment groups to the control groups

Groups	Average ± SD (nmol/g)	*p-value*
Negative control	10.78 ± 0.33	
Positive control	3.71 ± 0.19	
3.25 mg/kg bw	7.25 ± 0.26	0.05
65 mg/kg bw	5.76 ± 0.25	
130 mg/kg bw	4.01 ± 0.22	

The parameter malondialdehyde (MDA) is employed to measure the extent of tissue damage induced by free radicals. MDA enzyme levels in liver homogenates that had been treated with the extract for 21 days were tested to examine the capacity of the yellow velvetleaf ethanol extract to increase antioxidant activities. Alloxan was utilized as the free radical agent in this investigation to generate oxidative damage to the pancreas of rats. Alloxan injections of 120-150 mg/kg BW resulted in hyperglycemic rats. This chemical can cause diabetes mellitus in experimental animals if they have diabetes mellitus type I symptoms comparable to those seen in people (Yuriska, 2009). Furthermore, hyperglycemia promotes the generation of free radicals.

On the other hand, glibenclamide, employed in the positive control, increases the release of insulin from the pancreas and causes glucose to enter the muscles, which decreases the glucose level in the blood. Glibenclamide also created the balance in the pancreas and created the defense against endogenous enzymes able to neutralize free radicals, as evidenced by the decreased levels of MDA. Flavonoids, alkaloids, and saponins are compounds considered to possess antioxidant activities. Antioxidants in flavonoids occur because the hydroxyl group is attached to the aromatic carbon ring. Hence, it is able to capture free radicals resulting from the reaction of fat peroxidation. Moreover, flavonoid compounds release one hydrogen atom to stabilize the proxy fat radical (Hamid, 2010). Giorgio, (2000) asserted that the ability of flavonoids has been extensively studied recently, and it is identified that flavonoids can change or reduce free radicals, which is functioning as anti-free radicals.

The liver plays a significant role in the detoxification process. Thus, it is necessary to measure MDA levels to determine oxidative damage. The liver desaturated fatty acids to provide unsaturated fatty acids, which are sensitive to free radical compounds (Zacharia, et al., 2012). Given the yellow velvetleaf extracts, the treatment groups possessed significantly lower MDA levels than the negative control provided 0.5% (K-) CMC NA. The high levels of MDA in the negative control indicate that there has been oxidative stress decreasing antioxidant enzyme activities. The high levels of MDA in the negative control create an imbalance between oxidative compounds and endogenous antioxidant components, which affects oxidative stress and reduces antioxidant activities. Therefore, such a condition leads to liver cell damage which diminishes the liver's ability to neutralize the harmful compounds. There was a significant difference in the decreased MDA levels in the treatment groups compared to the negative control ($p < 0.05$). It indicates that the yellow velvetleaf extract is able to inhibit MDA formation in the liver, hence lowering the MDA level. This fact is also in accordance with the research conducted by Lee, et al., (2011), which revealed that

providing the ethanol extract of yellow velvetleaf to rats can reduce MDA levels in the liver and increase the endogenous antioxidant enzyme SOD (Superoxide dismutase).

Thus, there was no significant difference in lowered liver MDA levels between all treatment groups and the positive control ($p > 0.05$) based on the Post Hoc LSD test findings and the Tukey's test. After 21 days of treatment, the ethanol extract of yellow velvetleaf (Limnocharis Flava) and glibenclamide administered to the positive control both reduced MDA levels in the liver.

4. CONCLUSION

The researchers discovered that feeding the ethanol extract of yellow velvet leaves (Limnocharis Flava) to alloxan-induced diabetic mice reduces liver MDA levels, with the highest beneficial dose being 130 mg/kg BW (4.01 ± 0.22 nmol/g). The decrease in MDA levels is a measure of antioxidant activity. Therefore the lower the MDA level, the higher the antioxidant activity.

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

Exercise Program: Tai Chi and Cognitive Stimulation to Improve Health Status of Elderly in Nursing Homes

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Abstract
The structure of the aging population reflects the higher average life expectancy, which possesses an impact on the emergence of degenerative non-communicable diseases. Promotive effort through an exercise program (tai-chi exercise and cognitive stimulation) is required for the elderly to enhance their physical and mental health. This study aims to determine an overview of the exercise program's effectiveness on the health status of the elderly in nursing homes. The research method administered Quasi experiment with a control group design. The sample was the elderly who live in nursing homes. This study employed simple random sampling with a total sample of 116 people in 2 provinces: DKI Jakarta and South Sumatra Province. The statistical test utilized a t-test and multiple linear regression test. The results revealed that there was a difference in the average value of the health status of the elderly before and after the exercise programs in the intervention group (p-value = 0.001), there was a difference in the average value of the health status of the elderly between the intervention group and the control group after the exercise intervention program (p-value = 0.001), there was a relationship between the length of stay in the orphanage on the health status of the elderly. Recommendation: the resulting exercise program can be employed as complementary therapies replicated more extensively in various health care settings.

Keywords: Tai Chi Exercise, Cognitive Stimulation, Health Status, Elderly.

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1. INTRODUCTION

The elderly population continues to increase globally. Recently, the population of 11 member countries of the WHO (World Health Organization) in the Southeast Asia region aged over 60 years and over amounted to 142 million. The two largest ASEAN countries are Singapore, 9%, and Thailand, 7%. Indonesia is estimated to possess an increasing elderly population higher than other countries in Asia and globally after 2050. The results of the 2010 population census explained that Indonesia is lately encompassed in the top 5 countries with the largest number of elderly in the world (Kementerian Kesehatan Republik Indonesia, 2019).

The aging population structure reflects an increasing average life expectancy of the population in Indonesia. The high life expectancy is one of the success indicators in achieving national development, particularly in the health sector (Kementerian Kesehatan Republik Indonesia, 2016). The increasing life expectancy is performed by improving health status through enhancing nutrition, sanitation, health services, education, and economic progress. However, with the growing age, physiological functions decrease due to the aging process or are affected by the illness suffered by the elderly such as heart disease, diabetes mellitus, stroke, rheumatism, and injury (Kementerian Kesehatan Republik Indonesia, 2018).

Government efforts to empower and improve the welfare of the elderly are conducted in an integrated manner across programs and sectors.These efforts are intended to maintain the healthy living, independency, and productivity of the elderly (Kementerian Kesehatan Republik Indonesia, 2014). Efforts developed to support these policies encompass promotive and preventive efforts, which are essential to reducing morbidity in the elderly. Health promotion is a health advocacy process to improve clients' support, professionals, and the public for positive health practices and to uphold the elderly change their lifestyle to move towards an optimal state of health (Allender, et al., 2014). Health promotion is performed to support the empowerment of the elderly in enhancing their healthy lifestyle. One form of health promotion is an exercise program for the elderly to improve physical fitness and mental health. Hence, tai chi and cognitive stimulation are exercise programs as complementary therapies in nursing which are suitable to be practiced by the elderly.

Complementary therapy is a treatment technique to improve healing through connectivity between the body-mind-spirit of each individual (Lindquist, et al., 2014). Complementary therapies in nursing are utilized as techniques/interventions assisting nurses in integrating the physical, mental, emotional, and spiritual dimensions of nursing. The optimal aging process involves a healthy mind, body, and spirit that can maintain the elderly′s independence, community involvement, and quality of life (Hallisy, 2019). Accordingly, Tai chi is a suitable exercise for the elderly as a mind-body exercise that affects physical, mental, and social health.

Tai chi exercise starts with meditation movements to calm the mind and then light movements to improve blood circulation. Then, a full concentration was performed on the abdominal area just below the navel, which is the center of gravity. After that, it was conducted the formation of Tai chi movements in which each movement with deep breathing (Sutanto, J., 2015). Tai chi can enhance the health status of the elderly, as illustrated by the research finding (Raman, et al., 2013), that tai-chi significantly enhances sleep quality in healthy adults and patients with chronic health problems,

improves health, including physical appearance, decreases pain, and produces psychological well-being. This study is also corroborated by research conducted by (Kong, et al., 2016) revealing that tai chi performed within five weeks could reduce chronic pain because of osteoarthritis. Research result by (Yogisutanti, et al., 2018) discovered that there was an effect of Tai chi exercise on the flexibility and muscle strength of the extremities in the elderly. Movement exercises through Tai chi gymnastics increase muscle strength and flexibility of the extremities in the elderly by training the muscles and movements. Thus, the elderly can be physically prepared, and daily activities can be performed productively. Tai chi can uphold the total score of the elderly's quality of life, including general health status, vitality, and mental health. (Pereira, et al., 2017).

The elderly require a regular exercise program to improve their physical and mental health to remain healthy, independent, and productive. The study aims to identify an overview of the effect of the tai chi exercise program and cognitive stimulation on improving the health status of the elderly.

2. RESEARCH METHOD

This study employed a quasi-experimental pre-posttest design with a control group design. The population was elderly living in nursing homes. Meanwhile, the sample was elderly with inclusion criteria: aged 60 years and over, living in nursing homes, not resting, not experiencing visual and hearing impairments, willing to be respondents, and able to read and write. The sampling strategy used simple random sampling. The sample size was 120 people (60 intervention groups and 60 control groups). In the implementation of the study, the sample excluded four people due to their declining health conditions, so that the number of samples became 116 people. This research was conducted in DKI Jakarta in 2 nursing homes (1 nursing home for the intervention group and one nursing home for the control group) and in South Sumatra Province, which utilized two nursing homes. The nursing home was chosen to understand that it would be used as a practice site for the students. All respondents have explained the study and given their informed agreement to participate by signing the informed consent form. Univariate, bivariate, and multivariate analyses were utilized to analyze the data. The dependent and independent t-tests and the Multiple Linear Regression Test were utilized in the statistical analysis. The researcher acquired authorization to research the Province Health Office DKI Jakarta and ethical clearance from the Ethics Committee of Health Polytechnic Jakarta II of the Ministry of Health No. LB.02.01/KE/L/167/2016 before beginning the study.

The exercise program (Tai Chi Gymnastics and Cognitive Stimulation) were performed for the elderly through the following stages: 1) Performing tai chi exercises beginning with meditation to calm the mind through breathing regulation, then warming up with light movements and continuing with various movements of the hands and feet at a slow speed, which is completed in groups by the elderly; and 2) Applying cognitive stimulation through reality orientation therapy, memory therapy, and puzzle games. The exercise program, which is a combination of tai chi exercise and cognitive stimulation, was applied through the following activities: 1) Conducting training for nurses in nursing homes by the researcher on the exercise programs for the elderly (training is conducted in 1 day); 2) Training the elderly to involve in tai chi exercises and cognitive stimulation two times a week for eight weeks in which the activities were performed eight times with guidance and eight times independently by utilizing a monitoring book;

The frequency of exercise which was two times a week is based on the results of previous research and follows the schedule of gymnastics activities at nursing homes. Thus, it is easier to integrate the exercise program into routine gymnastics activities at the nursing homes:3) Evaluating the exercise program by assessing the health status and cognitive function of the elderly before and after the intervention (Zhang, et al., 2012).

The instrument used to assess the health of the elderly was a modified version of the Short-Form Health Survey (SF-12) developed by researchers. Researchers have utilized this device in past studies (Riasmini, et.al., 2019). The SF-12 is a 12-item questionnaire with a Likert scale of 1 to 5. The physical component summary (PCS) and mental component summary (MCS) values were utilized to calculate the SF-12 scale of 1-60. A higher score meant the client's physical and mental health was in better shape. The support of health workers was examined using a modified questionnaire from the MOS social support survey, which consisted of 20 items with a 0-3 Likert scale and measured changed emotional, reward, informational, and instrumental support.

3. RESULTS AND DISCUSSION

Table 1. Respondents characteristic scores based on age, length of stay in nursing homes and support from health workers.

Variable	Group	N	Mean	Median	SD	Min-Max
Age	Intervention	57	70,70	70	9,805	60-88
	Control	59	69,51	68	6,678	60-78
Length of stay in the nursing homes	Intervention	57	44,80	36	55,367	1-319
	Control	59	36,17	28	28,534	2-120
Health Worker Support	Intervention	57	33,72	30	12,588	0-73
	Control	59	30,56	31	9,511	3-46

Results of the The analysis revealed the average age of the elderly in the two groups was almost the same (around 70 years), while the youngest age was 60 years and the oldest was 88 years. The length of stay in the nursing home between the intervention and control groups was almost similar: between 3-4 years. The support of health workers was almost the same in both groups: around 30. After being categorized, it was discovered that the support of health workers for the elderly was half adequate, and the other half was inadequate.

Table 2. Distribution Characteristics of Respondents by Sex, Marital Status, and Education.

Variable	Intervention Group		Control Group		Total	
	N	%	N	%	N	%
Sex						
Men	28	49,1	28	47,5	56	47,83
Women	29	50,9	31	52,5	60	52,17
Marital status						
Married	7	12,3	1	1,7	8	6,95
Widowed/Separated	44	77,2	51	86,4	95	82,60
Single	6	10,5	7	7	13	10,45
Education						
Primary School	49	86	51	86,4	100	86,20
Secondary School	8	14	8	13,6	16	13,8

The results analysis of the characteristics presented that most respondents were women, with widowed/separated, marital status, and primary school of education.

Table 3. Analysis of Elderly Health Status Before and After Intervention Exercise Program.

Variable	Group	Mean	SD	95% CI	t	*p-value**
Health Status	Intervention Group					
	Before	40,28	6,155	(-5,050) – (-1,933)	-4,487	0,001
	After	43,77	5,477			
	Difference	3,49	0,678			
	Control Group					
	Before	39,08	4,790	(-0,401) – (1,181)	0,987	0,328
	After	38,69	4,352			
	Difference	0,39	0,438			

**Dependent t-test*

The analysis results presented a significant difference in the health status of the elderly in the intervention group before and after the exercise program intervention (p-value = 0.001), with an average difference of 3.49. Meanwhile, in the control group, there was no significant difference in the cognitive function of the elderly (p-value = 0.328)(Table 3).

The study results illustrate that the average health status of the elderly was still good because the elderly were still able to perform activities. However, nearly all of the senior people in this study had health issues such as knee pain, sleep problems, high blood pressure, and urine problems. The reduction of body cells causes health difficulties in the elderly, resulting in a decrease in body function and endurance and a rise in disease risk factors. Malnutrition, balance issues, and abrupt bewilderment are common health problems in the elderly. In addition, hypertension, hearing and vision issues, dementia, osteoporosis, hypertension, and other degenerative disorders are all common in the elderly. This is in conformity with the study's findings Bestari & Wati, 2016, which found that there was a relationship between the number of chronic diseases they had on the anxiety of the elderly with chronic diseases, (p = 0.004). The elderly who possess more than one chronic disease have a three times greater risk of feeling anxious. Multiple chronic diseases can affect the ability of the elderly to function independently so that it possesses an impact on the low quality of life of the elderly.

Promotive and preventive efforts are essential factors that must be performed to reduce morbidity in the elderly. Furthermore, there must be effective coordination between the associated programs within the Ministry of Health and professional organizations to improve the health of the elderly. Promotive efforts through exercise programs, combining tai chi and cognitive stimulation, are expected to overcome various problems experienced by the elderly due to the aging process. Hallisy, 2019, stated that the optimal aging process involves a healthy mind, body, and spirit. Mobility is a key to maintaining independence, community involvement, and quality of life. Tai chi is a mind-body exercise that affects physical, mental, and social health.

The results of this study indicate a significant difference in the health status of the elderly in the intervention group before and after being provided the exercise program intervention of 3.49 points. Meanwhile, in the control group, there was no significant difference. There was even a decrease in the average value.

There was no significant change in the health status of the elderly in the control group. It is possible that this is due to the elderly's previous health issues, such as joint pain, hypertension, and other issues. Despite taking part in sporting activities that were consistently carried out in nursing homes, the elderly were unable to enhance their health. Even the average value of the elderly's health status dropped by 0.39 points. This demonstrated that tai chi exercise plays a significant effect on improving the health of the elderly. As a result, it is hoped that health staff in nursing homes will be able to continue tai chi exercise programs that are already part of the orphanage's regular sports activities. The involvement of health workers in the nursing home during the intervention and the assistance of tai chi exercise videos helped them implement these activities as a promotive effort for the elderly. The support of health workers and families needs to be increased to help the elderly perform regular exercise programs, thereby increasing the motivation of the elderly to conduct activities and reduce loneliness. It was in accordance with the results of the study (Kang, et al., 2018) which presented a significant effect between social support with physical activity and quality of life and that can reduce loneliness. Supported by research results (Keswara, 2017), it was found that there was a relationship between social interaction and loneliness. Good social interaction reduces loneliness experienced by the elderly. Exercise programs performed with fellow elderly with the support of health workers can increase interaction and provide feelings of pleasure because they can communicate with each other and share experiences.

Table 4. Analysis of the Health Status of the Elderly After Exercise Program Intervention.

Variable	Group	N	Mean	SD	95% CI	F	*p- value*
Health Status	Intervention	57	43,77	5,477	3,252 – 6,902	2,846	0,001
	Control	59	38,69	4,352			

**Independent t-test*

The analysis results presented a difference in the health status of the elderly between the intervention group and the control group after the exercise program intervention with a p-value = 0.001 (Table 4)**.**

The study results also discovered the differences in the health status of the elderly between the intervention group and the control group after the exercise program intervention. It proved that the health status of the elderly was better because they followed the exercise program regularly, which was twice a week for eight weeks. These differences presented that tai chi exercises and cognitive stimulation were periodically beneficial for the elderly. Supported by research results Djawa et al., 2017, it was revealed that there was a relationship between the activities of the elderly and the health status of the elderly. The elderly who are independent, able to meet their daily needs, are not dependent on their family members. Similar to the results of qualitative research Baga, et al., 2017, it is illustrated that physical activity performed by the elderly has a relationship with physical well-being in which they were still able to perform activities independently without assistive devices. Moreover, the elderly are motivated to stay healthy and feel fit and excited frequently.

Based on interviews with the elderly, information was obtained that the pain in the knees was reduced. The elderly were more able to hold back urination because, in tai chi, there was also a Kegel exercise. The elderly also stated that they slept more soundly. Research results corroborate these results (Raman, et al., 2013), that tai-chi

significantly improves sleep quality for healthy adults and patients with chronic health problems and enhances physical appearance, pain reduction, and psychological well-being. In accordance with the research results Hall, et al., 2017, it is discovered that tai chi effectively reduces pain and disability in patients with musculoskeletal disorders. Accordingly, research results by Yan et al., 2013, unveiled that Tai chi conducted for 12 weeks could reduce pain and improve physical function in the elderly with arthritis.

The results of the blood pressure examination discovered that the average blood pressure of the elderly who possessed hypertension decreased after regular tai chi exercises. Corroborated by research results (Guan, et al., 2020), it is stated that tai chi performed routinely for 12 weeks could lower systolic and diastolic blood pressure. Tai chi is a healthy physical activity that can help avoid essential hypertension and other chronic disorders. In addition, the elderly who practiced tai chi regularly felt more excited about engaging in events at the orphanage and felt healthier and more vital to move and satisfy their daily demands, according to the results of interviews. This conforms with the study's findings (Yogisutanti, et al., 2018). Tai Chi was proven to affect the elderly's flexibility and muscle strength in the extremities. By exercising the muscles and movement in the elderly, movement activities such as Tai Chi gymnastics can develop muscle strength and flexibility of the extremities, allowing the elderly to be physically trained. This allows the elderly to be more productive in their regular duties. Hosseini, et al., 2018, described that Tai chi effectively improves balance and the fear of falling risk and is considered a practical and valuable method for fall prevention in the elderly in the community.

Table 5. Effect of Elderly Characteristics on Health Status.

Variable	B	St. Error	Beta	t	*p-value**
Health Status					
Length of stay in the nursing home	0.044	0.022	0.263	1.982	0.053
Constant	33.092	2.971		11.140	0.000

**Uji Regresi Linier Ganda*

Based on the multivariate multiple linear regression test results, it was revealed that only one independent variable (length of stay in the orphanage) possessed an effect on the dependent variable of the elderly health status with p-value = 0.053(Table 5). It indicates that in addition to the exercise program, there was a variable length of stay in the orphanage that contributes to the health status of the elderly.

The findings revealed that, in addition to the influence of the exercise program, the length of stay in the nursing home impacted the elderly's health. In both the intervention and control groups, the average length of stay in a nursing home was roughly 3-4 years, with the longest staying up to 26 years. According to the findings of interviews with orphanage nurses, the elderly who had lived at the orphanage and were self-sufficient at the time of entrance increasingly developed health difficulties as they grew older. There were senior adults whose health had deteriorated due to chronic conditions, including one of the respondents who dropped out due to their deteriorating condition and was hospitalized, preventing them from continuing the study. It was by the results of the study Kelly, et al., 2010, which stated discovered that length of stay was significantly associated with sex, marital status, and chronic disease conditions experienced by the elderly. The elderly who have lived in the nursing home experienced worthless blamed themselves, and felt abandoned by their family members (Moniung, et

al., 2015). The elderly also frequently experience loneliness due to the lack of interaction from family members. It is similar to the results of the study (Keswara, 2017). It was uncovered that around 58.1% of the elderly experienced loneliness in the nursing home, and it was discovered that there was a significant relationship between social interaction and loneliness. Therefore, tai chi exercise program and cognitive stimulation performed in groups were expected to increase interaction between the elderly so that the physical and mental health status of the elderly increases.

4. CONCLUSION

The exercise program (Tai Chi Gymnastics and Cognitive Stimulation) has been proven to improve the health status of the elderly effectively. As a result, it is envisaged that this training program can be used as one of the modalities and complementary therapies in nursing that can be developed for the elderly in the community and the post-care recovery phase, rather than just in nursing facilities. Nurses can use this training program as a guide to constructing various interventions for empowering the elderly in their communities.

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Hemodialysis Duration with Levels of Hemoglobin, Hematocrit, Serum Iron and Total Iron Binding Capacity on Chronic Kidney Disease

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Abstract

The correlation of the length of time undergoing hemodialysis with the levels of hemoglobin, hematocrit, serum iron and total iron binding capacity in patients with chronic kidney disease at RSUD Prof. Dr. W. Z. Johannes Kupang. People with chronic kidney disease who are performing Hemodialysis suffer from anemia. Blood loss during the hemodialysis process is affected by frequent blood sampling for laboratory tests. To diagnose the occurrence of iron deficiency, anemia laboratory tests such as complete blood, serum iron (SI), TIBC, transferrin saturation, and serum ferritin can be conducted. The objective of this study is to determine the correlation between the length of undergoing Hemodialysis with the levels of Hemoglobin, Hematocrit, Serum Iron, and Total Iron Binding Capacity (TIBC) in patients with chronic kidney disease in RSUD Prof. Dr.W. Z Johannes Kupang. This study employed an anon-reactive research design or unobtrusive research based on secondary data derived from medical record records at RSUD Prof. Dr.W. Johannes in August - September 2019 on 92 hemodialysis patients who met the inclusion criteria. The collected data were calculated with the SPSS application, while the correlation analysis between variables was performed by administering a linear regression analysis test. Ninety-two (92) respondents were obtained by employing the purposive sampling technique. The majority of patients with chronic kidney disease undergoing Hemodialysis were men (57.6%) with ages 39 - 59 years (63.0%), and the majority of patients undergoing Hemodialysis in patients with chronic kidney failure (CKD) were <12 months (41.3%). It was discovered that there was no relationship between the length of Hemodialysis with hemoglobin, hematocrit, serum iron, and total iron-binding capacity levels in patients with chronic kidney disease (CKD).

Keywords: Hemodialysis, Anemia, Hemoglobin, Hematocrit Serum Iron, Chronic Kidney Disease.

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1. INTRODUCTION

Kidneys are vital organs in humans that possess a tremendous essential role in the body's metabolism. If there is a disturbance in kidney function caused by chronic disease, it affects the function of other organs in the body. Chronic Kidney Failure (CKD) is a non-communicable disease (NCD) that has become a global public health issue due to increased prevalence and incidence of kidney failure, poor prognoses, and high expenses. According to the World Health Organization (WHO), chronic kidney disease, with an annual mortality rate of 850.000 individuals, contributes to the world's disease burden (World Health Organization, 2003). The prevalence of CKD rises in tandem with the aging population and the rise in the frequency of hypertension and diabetes mellitus (Kementerian Kesehatan Republik Indonesia, 2018). Chronic kidney disease (CKD) is a global health problem whose prevalence has increased. The state of fluid overload is often a systemic complication of CKD patients undergoing hemodialysis (HD) therapy. One of the clinical parameters of fluid overload in HD patients is ascites (Yusman, et al, 2020).

Chronic Kidney Disease is a non-communicable disease affecting the kidney organ, in which the kidney organ suffers from severe damage due to the decreased glomerular filtration rate (Permatasari, 2019). Basic Health Research data in 2018 reported that the prevalence of the Indonesian population suffering from kidney failure reaches 3.8%, and the province of East Nusa Tenggara attains 2% suffering from chronic kidney failure (Kementerian Kesehatan Republik Indonesia, 2018).

Chronic kidney failure or end-stage renal disease (ESRD) is a progressive and irreversible renal function disorder in which the ability of the body fails to maintain metabolism, fluid, and electrolyte balance, causing uremia (Simatupang, 2019). Chronic kidney disease can be caused by various conditions such as vascular disease, chronic glomerular disease, chronic infections, hypertension, diabetes, obstruction processes, and others. The kidneys can be translated for the treatment, or dialysis/hemodialysis can be used. Hemodialysis, frequently known as dialysis, is a kidney replacement therapy that cleans metabolic residue from the blood. It is most commonly used in patients with chronic kidney failure to extend and improve their quality of life. Low blood pressure, sepsis signs such as high fever and disorientation, muscular cramps, sleeplessness, and bone and joint pain are all side effects of hemodialysis (Permatasari, 2019).

Hemodialysis is a method of transferring dissolved compounds with products remaining in the body. Residual compounds collected in patients with CKD were obtained attractively by administering a semipermeable membrane passive diffusion method. The transfer of substances or compounds remaining in metabolic products works by following a decrease in the concentration gradient in the circulation into the dialysate (Aisara, et al., 2018). One method of managing chronic kidney disease is hemodialysis. Hemodialysis therapy takes a long time, has complications, and requires patient compliance. This will give the patient physiological and psychological stressors, affecting the patient's quality of life (Fitriani et al., 2020). Hemodialysis has developed as replacement therapy for renal function. Correctly understanding the patient's condition and providing the necessary care is at the core of patient care. Furthermore, optimal care of patients with the end-stage renal disease requires a thorough understanding of the different treatment options related to dialysis. In comparison, dialysis patterns may differ from country to country depending on national health policies (Kim & Kawanishi, 2018).

The highest increase in the number of patients with chronic kidney failure undergoing hemodialysis occurred in the 45–64-year age group, patients actively undergoing hemodialysis. Patients with chronic kidney failure who are performinghemodialysis suffer from anemia. Blood loss during the hemodialysis process is affected by frequent blood collection for laboratory and other examinations, characterized by a decrease in transferrin saturation and reduced ferritin levels. Laboratory tests such as Complete Blood, Serum Iron (SI), Total Iron Binding Capacity (TIBC), transferrin saturation, and serum ferritin are performed to diagnose iron-deficiency anemia. Chronic kidney failure, also understood as CKD or chronic kidney disease, is characterized by a significant decrease in kidney function, which is frequently up to less than 20% of the normal GFR value, over a long period, usually >3 months. Chronic kidney disease lasts without symptoms for years with increasing uremia and accompanying symptoms when the GFR has dropped to below 60 mL/min. The causes of chronic kidney failure are all in the form of long-term chronic disease (Indri, 2020).

According to Rachmanto, 2018, hemodialysis is a therapy that is performed to replace the work function of the kidneys by utilizing a tool specifically designed to treat symptoms and signs due to low levels of GFR patient's quality of life. In simple terms, hemodialysis is interpreted as a method of washing blood by removing excess waste or harmful compounds through a semipermeable membrane conducted to replace kidney function that is not functioning properly. Hemodialysis cleans and replaces the work that healthy kidneys are supposed to function. Hemodialysis should be conducted for the rest of the life of patients with decreased renal function until the patient receives a kidney transplant. If the transplant is not successful, hemodialysis can be performed again..

Wahyuni, et al., 's research 2018 study, there was a significant relationship between hemodialysis duration and quality of life in patients with chronic kidney disease, while Permatasari in 2019, study revealed no link between hemodialysis length and hemoglobin, hematocrit, or serum iron levels in patients with chronic kidney failure. The study on the length of hemodialysis with hemoglobin (Hb), hematocrit (Ht), serum iron (SI), and Total Iron Binding Capacity (TIBC) levels in kidney failure patients in Prof. Dr. WZ. Hospital Johannes Kupang, Indonesia, considers anemia's influence on kidney failure patients receiving hemodialysis.

2. RESEARCH METHOD

This study employeddescriptive analysis with frequency distribution tables of the patients' characteristics with chronic kidney failure undergoing hemodialysis in the form of age, sex, level of education and employment. This research is non-reactive research based on secondary data, in which the secondary data comes from medical records in RSUD Prof. Dr. W. Z. Johannes Kupang. This study was conducted on 92 patients undergoing hemodialysis in the hemodialysis unit of RSUD Prof. Dr. W. Z. Johannes Kupang General Hospital in August-September 2019. Moreover, this study was performed in patients with chronic kidney failure who underwent hemodialysis by looking at the results of their medical records which objective is to identify the correlation between length of time undergoing hemodialysis with hemoglobin, hematocrit, serum iron, and total iron-binding capacity in patients with chronic kidney failure.

The research data obtained were assessed by the SPSS application, while the correlation analysis between variables and data analysis results are presented in narration and frequency distribution tables. Results revealed significant when $p<0.05$. This research has also received research ethics permit from the Faculty of Medicine, University of Nusa Cendana with no. 45/UN15.16/KEPK/2019.

3. RESULTS AND DISCUSSION

Table 1. Characteristics of Respondents by Age.

Age	Frequency	Percent
18 – 38 Year	9	9.8
39 – 59 Year	58	63.0
60 – 80 Year	25	27.2
Total	92	100.0

Based on Table 1, it is displayed that the age of chronic kidney failure patients undergoing hemodialysis is mainly in the age group 39-59 years as many as 58 respondents (63.0%). Chronic kidney failure is a non-communicable disease affecting the kidney organ, in which the kidney organ suffers from severe damage due to a decreased glomerular filtration rate.

Based on research by Dharmawan, et al. in 2018, it was stated that patients undergoing hemodialysis were more common in the elderly or older than 40 years who often took hypertension drugs. Djami, et al.'s research in 2018 also stated that hypertension complications can affect various organs such as the heart (ischemic heart disease, left ventricular hypertrophy, heart failure), brain (stroke), kidneys (kidney failure), eyes (retinopathy) as well as peripheral arteries (intermittent claudication). The damage to these organs depends on the patient's high blood pressure and how long the high blood pressure is uncontrolled and untreated.

Table 2. Characteristics of Respondents by Gender.

Gender	Frequency	Percent
Male	53	57.6
Female	39	42.4
Total	92	100.0

Based on Table 2, the sex of chronic renal failure patients undergoing hemodialysis is the most male sex with 53 respondents (57.6%), and the least is the female sex with the number of 39 respondents (42.4%). Basic Health Research data in 2013 which shows that CKD patients are more common in men than women (Kementerian Kesehatan Republik Indonesia, 2013). These results were the same as Winalda's research in 2018 showed that the most extensive distribution of respondents according to gender was male by 52 people (52.0%).

Table 3. Characteristics of Respondents by Education Level.

Education Level	Frequency	Percent
Primary School	9	9.8
Junior High School	15	16.3
Senior High School	41	44.6
Diploma	4	4.3
Bachelor	23	25.0
Total	92	100.0

Based on Table 3, it is presented that the level of education of chronic kidney failure patients undergoing hemodialysis is mostly the level of high school education with a number of 41 respondents (44.6%), and for the least educational level is Diploma and 4 respondents (4.3%).

Table 4. Characteristics of Respondents Based on Employment Status.

Employment	Frequency	Percent
An Worker	38	41.3
Entrepreneur	26	28.3
Civil Servant	27	29.3
Army	1	1.1
Total	92	100.0

Based on Table 4, the occupational status of chronic kidney failure patients undergoing hemodialysis is largely not working with 38 respondents (41.3%). The occupational status of chronic kidney failure patients undergoing hemodialysis is the least with Indonesian Armies with only 1 respondent (1.1%).

Table 5. Duration of Hemodialysis.

Duration of Hemodialisis	Frequency	Percent
< 12 Month	38	41.3
12 – 24 Month	34	37.0
≥ 24 Month	20	21.7
Total	92	100.0

Based on Table 5 the length of time to undergo hemodialysis in patients with chronic kidney failure is the most <12 months with 38 respondents (41.3%).

Table 6. Hemoglobin levels.

Hemoglobin	Frequency	Percent
Low	92	100.0
Normal	0	0.0
High	0	0.0
Total	92	100.0

Based on Table 6, it can be concluded that the overall hemoglobin level in patients with chronic kidney failure is decreased by a total of 92 respondents (100%). The 92 respondents who suffered from chronic kidney failure and were undergoing hemodialysis as a whole had a hemoglobin level <13 g / dl (100.0%).

The research results by Agustina, et al. (2019) showed a significant difference between pre and post hemodialysis Hb levels in chronic kidney disease patients, where post hemodialysis Hb levels were lower than pre hemodialysis Hb levels. This is because a small amount of blood is usually left in the dialyzer. This can be a source of iron deficiency over time, leading to anemia.

Table 7. Hematocrit levels.

Hematocrit	Frequency	Percent
Low	91	98.9
Normal	1	1.1
High	0	0.0
Total	92	100.0

Based on Table 7, it can be concluded that overall hematocrit levels in patients with chronic kidney failure are decreased by 91 respondents (98.9%). It was found that the incidence of anemia in patients with chronic kidney disease was 98.5%, with an average Hb level of 7.3 g/dl and an average glomerular filtration rate of 8.81 ml/minute/1.73 m^2. From the Pearson correlation test results, it was found that there was a relationship between the incidence of anemia and chronic kidney disease (Hidayat, et al., 2016).

Table 8. Serum Iron levels.

Serum Iron	Frequency	Percent
Low	25	27.2
Normal	56	60.8
High	11	12.0
Total	92	100.0

Based on Table 8, it can be concluded that most Serum Iron (SI) levels in chronic kidney raga sufferers are normal, with 56 respondents (60.8%). Of the 92 respondents who suffered from chronic kidney failure and were undergoing hemodialysis, as many as 25 respondents (27.2%) had serum iron <65 ug / dL. Absolute Iron Deficiency Anemia (IDA) is one of the complications in patients undergoing hemodialysis, with an incidence of 76.4%. If this condition is not treated properly, it can impair heart function and increase mortality. The incidence of this case is between 30−45%. Determining iron status in hemodialysis patients using serum ferritin and transferrin saturation did not significantly change the value of the initial state of iron deficiency (Rachmiwatie, et al., 2018).

Table 9. Total Iron Binding Capacity (TIBC).

Total Iron Binding Capacity (TIBC)	Frequency	Percent
Low	14	15.2
Normal	62	67.4
High	16	17.4
Total	92	100.0

Based on Table 9, it can be concluded that the majority of the Total Iron Binding Capacity (TIBC) in chronic renal disease sufferers is normal, with 62 respondents (67.4%). This study found levels of Total Iron Binding Capacity (TIBC) decreased by 14 respondents (15.2%), and as many as 16 respondents (17.4%) had high SI levels/increased. Serum transferrin estimated by measurement of total iron-binding capacity is one of the energy and protein malnutrition markers. On chronic kidney disease, anemia often occurs due to anemia deficiency. TIBC is indirectly from iron stores from transferrin (Pradipta, et al., 2018).

Table 10. Correlation of the Duration of Hemodialysis with the Levels of Hemoglobin, Hematocrit, Serum Iron and Total Iron Binding Capacity (TIBC) in Chronic Kidney Disease Patients (CKD).

Levels	*p-value*
Hemoglobin	0.682
Hematocrit	0.147
Serum Iron (SI)	0.561
Total Iron Binding Capacity (TIBC)	0.606

Based on table 10, it can be identified the results of the correlation spearmen test of the relationship between the length of undergoing hemodialysis with hemoglobin and hematocrit levels in patients with chronic kidney failure undergoing hemodialysis obtained Sig. in hemoglobin of 0.682 (>0.05) and Sig. in hematocrit of 0.147 (>0.05). Thus, it is identified that there is no relationship between the length of undergoing hemodialysis with hemoglobin and hematocrit levels in patients with chronic kidney failure. Sig value in Serum Iron value is 0.561 (>0.05), and Sig value in Total Iron Binding Capacity is 0.606 (>0.05). It can be indicated that there is no relationship between the length of undergoing hemodialysis with Serum Iron levels and Total Iron Binding Capacity levels in patients with chronic kidney failure.

4. CONCLUSION

In general, patients with chronic kidney failure on hemodialysis are 39-59 years old, male, high school educated, and unemployed. Patients with chronic kidney failure who receive hemodialysis at the RSUD Prof. W. Z Johannes Kupang General Hospital have a maximum of one-year stay. The majority of chronic kidney failure patients on hemodialysis have low hematocrit and low hemoglobin levels. Most hemodialysis patients with chronic kidney failure possess normal Serum Iron and Total Iron Binding Capacity levels. In patients with chronic kidney disease, there is no link between the length of time spent on hemodialysis and hemoglobin, hematocrit, serum iron, or total iron-binding capacity in patients with chronic kidney failure.

Further research needs to be conducted by comparing the levels of hemoglobin, hematocrit, serum iron, and total iron-binding capacity before and after hemodialysis in patients with chronic kidney failure. Moreover, caution must be considered to ensure the length of data undergoing hemodialysis to eliminate bias..

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