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Insomnia Among Covid-19 Patients During Isolation Treatment in Inpatient Room of Indonesian Health Care Facilities

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ABSTRACT

Insomnia was a problem of Covid-19 patients often moaned because the physical and psychological condition of patients are weak. This study aims to analyze the association between respondent's characteristics, social factors, and medication adherence with insomnia when Covid-19 survivor become isolated patients. This study used a descriptive and analytical cross-sectional design. The study was conducted in August 2021. The population of this study was all Covid-19 survivors. The sample of this study was part of Covid-19 survivors with a total number of 191. Data were collected by an online questionnaire via google form and analyzed by chi-square test. Almost all respondents (83.77%) were female, and most of the respondents (73.30%) worked as health workers. The age mean of the respondents was 31.51 (SD 8.82, min=18, max=60). Insomnia was experienced by almost half of the respondents (41.36%). There was no association between sex (OR = 1.92, 95% CI 0.89-4.17; *p*=0.113), type of work (OR = 1.11, 95% CI 0.58-2.11; *p*=0.868), medication adherence (OR = 0.47, 95% CI 0.05-4.56; *p*=0.644), and motivation (*p*=0.269) with insomnia. There was an association between optimism (*p*=0.043) and discrimination (OR=4.19, 95% CI 1.86-9.43, *p*=0.001) with insomnia. Insomnia was experienced by almost half of isolated patients in inpatient rooms of Indonesian health care facilities. Factors associated with insomnia were optimism and discrimination. Treatment for Covid-19 patients should pay attention to their physical care and give psychological care.

INTRODUCTION

In almost two years, the world has been busy with cases of mysterious pneumonia infection originated from one of the most populated cities in Central China. By identifying genetic sequences, it was found that SARS-CoV-2 caused the infection.[1,2] The massive increase in infections to various world regions underlies the determination of Covid-19 pandemic status in March 2021 by WHO.[3]

The Covid-19 pandemic impact was diverse and complex in all sectors of life. The most significant sector affected is the health sector. The increasing number of patient visits at health care facilities caused the augmentative workloads on health workers, the unpreparedness of health care facilities in dealing with the pandemic because it occurs quickly and in a short time, and the lack of logistics for patient care were some of the pandemic impacts felt by the management of health services.

Meanwhile, if it was observed in public health, the perceived effect was the increasing number of disease incidences, getting serious attention.[4] SARS-CoV-2 infection not only caused problems in physical health but also affected the mental health of patients.[5] Cases of Covid-19 infection in Indonesia experienced a significant increase in the middle 2021.

Since the initial discovery of Covid-19 infection cases in March 2020, the graph of the highest increase was shown in the interval from July to August 2021, with cumulative confirmed cases reaching 30,000-50,000 people per day.[6] Health surveys in Indonesia showed that during the Covid-19 pandemic, there was an increase in mental health disorders characterized by high rates of stress, anxiety, depression, and obsessive-compulsive disorder (OCD).[7,8]

Insomnia was one of the problems that Covid-19 patients often moan about.[5] Representation of mental health disorders could be seen in patients with moans of sleeping difficulty.[9] Weak physical conditions caused insomnia in Covid-19 patients. Insomnia was more influenced by psychological conditions when the virus infected the patient.

The rise of news in the mass media about Covid-19, the high number of infections, the increasing number of deaths due to Covid-19, the patient's fear of its condition when infected with the virus, the lack of motivation from those closest people, discrimination from the surrounding environment, and the impact of Covid-19 therapy were factors that caused poor sleep quality in patients.[10,11] Insomnia would cause patients to stay in the hospital for a long time because it inhibits the production of hormones that help the patient's healing.[12]

Insomnia would cause long duration of treatment, so it reduced mental health and caused a high burden on health service management.[10] Therefore, an analysis of insomnia was needed to help patients and the health care management facilities to take further action to prevent its severity. This study aims to analyze the association between respondent characteristics, social factors, and medication adherence with insomnia when survivor Covid-19 becomes isolated patients.

MATERIAL AND METHOD

This study used a descriptive and analytic cross-sectional design. The study was conducted in August 2021. The study population was all Covid-19 patients who had been declared to get cured (Covid-19 survivors) and were discharged from the hospital with a minimum limit of July 1, 2021, until the study took place. The research sample was part of Covid-19 survivors in considering the inclusion and exclusion criteria.

The calculation of sample size refers to the Lemeshow with an infinite population (P = 11%,[13] d = 0.05, = 95%) and obtained 191 samples. Sampling was done by simple random sampling technique. The inclusion criteria included having been an isolated patient in a public hospital, private hospital, or a Covid-19 specific field hospital for more than 24 hours. Exclusion criteria included had been long Covid symptoms which made them difficult to communicate and did not remember their physical and psychological conditions while at isolation treatment.

Research variables included insomnia, medication adherence, optimism, discrimination, and motivation. Insomnia was defined as a sleep disorder experienced by Covid-19 patients with less than 7 hours of sleep per day. Medication adherence was defined as the patient's routine of taking drugs given by health workers. Optimism was defined as the patient's confidence to

recover from Covid-19 and carry out normal activities. Discrimination was defined as the patient's feeling of being ostracized or shunned by the people around them. Motivation was defined as the patient's support from the closest people in the family and friendship.

Data collection by an online questionnaire via google form, which had previously been tested for validity and reliability with an r > 0.361 and Cronbach's Alpha 0.731. The questionnaire consisted of five questions related to insomnia, five questions related to medication adherence, five questions related to optimism, five questions related to discrimination, and five questions related to motivation. The scoring was done on a dichotomous scale.

Categorization of each variable was given by calculating the maximum and minimum values. Insomnia categories were divided into insomnia (score: 8-10) and no insomnia (score: 5-7). Medication adherence categories were divided into obedient (score: 8-10) and no obedient (score: 5-7). Optimism categories were divided into optimism (score: 8-10) and not optimism (score: 5-7). Discrimination categories were divided into experienced discrimination (score: 8-10) and not experienced discrimination (score: 5-7). Motivation categories were divided into get motivated (score: 8-10) and not get motivated (score: 5-7).

Data were analyzed by Chi-Square test through SPSS 22. This research has received ethical approval from the Ethics Committee of Public Health Faculty, Universitas Airlangga with the ethical number 50/EA/PK/2021.

RESULTS

Characteristics of respondents showed that almost all respondents (83.77%) were female, and most of the respondents (73.30%) worked as health workers. The mean respondent's age was 31.51 (SD 8.82, min: 18, max: 60). Characteristics were grouped by sex, age, and type of work. Characteristics of respondents are presented in Table 1.

Almost half of the respondents (41.36%) experienced insomnia. A total of 2.09% of respondents did not obey taking medication, 3.14% of respondents were not optimistic, 17.28% of respondents experienced discrimination, and 1.57% of respondents did not get motivation from family or close relatives. Insomnia, medication adherence, optimism, discrimination, and motivation are presented in Table 2.

The association between sex and insomnia was statistically no significant (OR=1.92, 95% CI 0.89-4.17; *p*=0.113). However, the cross-tabulation analysis showed that females experienced insomnia more than males. The association between type of work and insomnia was statistically no significant (OR=1.11, 95% CI 0.58-2.11; *p*=0.868). However, the cross-tabulation analysis showed that health workers experienced insomnia more than non-health workers. The association between medication adherence and insomnia was statistically no significant (OR=0.47, 95% CI 0.05-4.56; *p*=0.644). However, the cross-tabulation analysis showed that patients who obeyed taking medication experienced insomnia more than patients who did not obey taking medication (Table 3).

Through the Fisher Exact test, it was found that optimism was significantly associated with insomnia (*p*=0.043). Respondents who experienced discrimination had 4.19 times the risk of experienced insomnia than respondents who did not experience discrimination and this association was statistically significant (OR=4.19, 95% CI 1.86-9.43, *p*=0.001). Through Fisher Exact test, it is known that motivation was not significantly associated with insomnia (*p*=0.269). Through cross-tabulation analysis, it is known that all respondents who had motivation also experienced insomnia (Table 3).

Table 1. Characteristics of Respondents

Characteristics	n=191	%
Sex		
Male	31	16.23
Female	160	83.77
Type of Work		
Health Worker	140	73.30
Non-Health Worker	51	26.70
Age (Years)		
Min		18
Max		60
Mean		31.51
SD		8.82

Source: Primary Data, 2021

Table 2. Distribution of Insomnia, Medication Adherence, Optimism, Discrimination, and Motivation

Measurement Component	n=191	%
Insomnia		
Experienced	79	41.36
Not Experienced	112	58.64
Medication Adherence		
Obey	187	97.91
Not Obey	4	2.09
Optimism		
Optimistic	185	96.86
Not Optimistic	6	3.14
Discrimination		
Experienced	33	17.28
Not Experienced	158	82.72
Motivation		
Get Motivated	188	98.43
Not Get Motivated	3	1.57

Source: Primary Data, 2021

DISCUSSION

Insomnia was a predictor that can assess a person's mental health. Insomnia in Covid-19 patients was higher than in general care patients. Insomnia symptoms were found immediately after the patient entered the hospital treatment room. This study showed that almost half of the respondents (41.36%) experienced insomnia. The frequency of Covid-19 patients with insomnia increased to 36.36% in the first two days after treatment. Up to the seventh day of treatment, an increase of 69.23% of Covid-19 patients with insomnia was found.[14] Insomnia in Covid-19 patients was more influenced by their social conditions, such as restrictions on movement, discrimination, fear of losing their job, and lack of motivation.[15,16]

Sex had an essential role in determining a person's psychological reaction to pandemic. The study results stated that although there was no significant association between sex and insomnia, insomnia was more experienced by female respondents. Guadagni in his research, stated that females had a higher sense of worry, anxiety, and stress levels than males when infected with Covid-19.[16] It was because females often feel alone during isolation treatment. There was news about the high mortality rate that triggers anxiety, perceptions about the difficulty of Covid-19 treatment, and perceptions of discrimination obtained from the surrounding environment after knowing their status as a Covid-19 survivor.[16]

Table 3. Factor Associated with Insomnia in Covid-19 Patient

Variable	Insomnia				Total		*p-value*	OR	CI	
	Experienced		Not Experienced						Lower	Upper
	n = 79	%	n = 112	%	n = 191	%				
Sex										
Male	17	8.90	14	7.33	31	100	0.113	1.92	0.89	4.17
Female	62	32.46	98	51.31	160	100				
Type of Work										
Health Worker	57	29.84	83	43.46	140	100	0.868	1.11	0.58	2.11
Non-Health Worker	22	11.52	29	15.18	51	100				
Medication Adherence										
Obey	78	40.84	109	57.07	187	100	0.644	0.47	0.05	4.56
Not Obey	1	0.52	3	1.57	4	100				
Optimism										
Optimistic	79	41.36	106	55.50	185	100	0.043	-	-	-
Not Optimistic	0	0.00	6	3.14	6	100				
Discrimination										
Experienced	23	12.04	10	5.24	33	100	0.001	4.19	1.86	9.43
Not Experienced	56	29.32	102	53.40	158	100				
Motivation										
Get Motivated	79	41.36	109	57.07	188	100	0.269	-	-	-
Not Get Motivated	0	0.00	3	1.57	3	100				

Source: Primary Data, 2021

Having Analyzed from the sex difference, females were a vulnerable group for mental health disorders. Females tend to be more sensitive to negative stimuli obtained from the surrounding environment, marked by an increase in Galvanic Skin Response (GVA) and changes in heart rate. Women's high level of sensitivity to negative stimuli was prone to cause excessive emotions, so it impacted mental health problems.[17,18]

Insomnia was found to have a high prevalence in health workers.[19,20] The association test showed no significant association between insomnia and type of work. The cross-tabulation showed that all respondents who experienced insomnia, health workers experienced more insomnia. The study showed that health workers belong to the nurse group were more prone to experience insomnia because they were at the forefront of patients service. Insomnia could be caused by excessive searching for news about the pandemic through personal cellphones and inflicted nightmares so that the sleeping time was only 6 hours per day.[21] Recommended hours of adequate sleep for adults was not less than 7 hours per day.[22] In addition, to worry about their condition, insomnia in health workers was also caused by feelings of anxiety if their family were infected, and other people's response after knowing their status as a Covid-19 survivor.[21,23]

Patient treatment was a medical effort made to relieve symptoms, cure, stop, and prevent severe infection so they can go back to normal activities.[24] The association test showed no significant association between medication adherence and insomnia. Analyzed from the cross-tabulation analysis, it could be seen that almost all patients who experienced insomnia adhere to medication. This condition should be a serious concern because even though the patient had received medical treatment and followed the recommendations for routine care, the patient still had insomnia. Sleeping was a human biological need. Lack of sleeping can worsen health conditions after being infected with SARS-CoV-2, reduce well-being, and affect safety.[25]

Sleep quality was closely associated with one's feelings of optimism. When a person experiences a depressive mood, symptoms of anxiety and stress would occur, which would cause a pessimistic attitude to do daily activities and cause insomnia.[26] The results showed a significant association between an optimistic and insomnia. Cross tabulation shows that although most of optimistic respondents did not experience insomnia, it needs to be a concern because not a few respondents who have an optimistic attitude also experienced insomnia. This condition might happen because Thinking something over would eliminate drowsiness and experienced insomnia.[27] Someone who experienced insomnia also tends to face an optimism bias. That means that every decision seems advantageous even though it will significantly lose. As exemplified by gamblers who have less sleep duration, they will continue to spend money with the assumption of winning when in reality, they have spent much money.[28]

Discrimination was one of the factors that could also affect insomnia in Covid-19 patients. The results showed a significant association between discrimination and insomnia. Respondents who experienced discrimination had 4.19 times risk of experienced insomnia than respondents who did not experience discrimination. Cross-tabulation analysis showed that most of the respondents who were not discriminated also experienced insomnia.

There were still 56 respondents who did not receive discrimination but experienced insomnia. Discrimination was defined as unequal treatment obtained by a person due to differences in social conditions in society.[29] Even though Covid-19 patients have recovered from the infection, they feel that they got a lot of discrimination in their daily lives from the work environment, education environment, and social environment in society.[30] Discrimination could cause patients to experience mental health disorders characterized by insomnia, anxiety, and isolation from the social environment.[30] The worse impact was shown by some people who experienced symptoms of Covid-19 feeling better if they hide their condition for fear of being discriminated against by the surrounding environment.[31]

Motivation was an essential factor to reduce mental health disorders during the Covid-19 pandemic. The motivation was a determining factor for a person's decision-making.[32] Motivation could encourage Covid-19 patients to take various ways to achieve recovery, such as following treatment procedures from health care

facilities, one of them was adequate sleep duration. The results showed no significant association between motivation and insomnia. Through cross-tabulation analysis, it could be seen that although respondents were motivated, they still experienced insomnia. These conditions may be due to the excessive motivation of the respondents. Insomnia could have occurred when the human brain is too active to think due to depression, so eliminating drowsiness and making it difficult to sleep.[33]

CONCLUSION AND RECOMMENDATION

Insomnia was experienced by almost half of isolated patients in inpatient rooms of Indonesian health care facilities. Factors associated with insomnia were optimism and discrimination. Insomnia was more experienced by females. Insomnia was more experienced by health workers.

People who adhere to medication still experienced insomnia. People who were optimistic about recovering from Covid-19 infection still experienced insomnia. People who did not receive discrimination still experienced insomnia. Motivated people still experienced insomnia. Based on these conclusions, we recommend that treatment for Covid-19 patients does not only focus on their physical care but also gives psychological care.

The limitations of this study are the study only analyzes the association between variables so that the response and variable predictors are not known. The results of cross-tabulation showed that there are still cells with zero value, further research should increase the sample size and conduct an experimental study to assess psychological care on Covid-19 patients and its impact on sleep disorders and other mental health problems.

AUTHOR CONTRIBUTIONS

Tamara Nur Budiarti contributed at performed the analysis and writing the paper. Arina Dery Puspitasari and Alfian Nur Rosyid contributed to designing the analysis, writing the paper, and supervising the study. Diah Indriani and Soenarnatalina Melaniani contributed at performed the analysis. Fatimatuz Zahra Oviary Satryo, Lily Aina, Nanda Ardianto, Melinda Putri, Amelia Rachman, and Fauzul Meiliani contributed to collecting the data and writing the paper.

CONFLICTS OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this article.

REFERENCES

1. Chen Y, Liu Q, Guo D. Emerging coronaviruses: Genome Structure, Replication, and Pathogenesis. *Journal of Medical Virology*. 2020;92:418–423.

2. Maldonado LL, Bertelli AM, Kamenetzky L. Molecular Features Similarities Between SARS-CoV-2, SARS, MERS and Key Human Genes Could Favour the Viral Infections and Trigger Collateral Effects. *Scientific Reports*. 2021;11(1):4108.

3. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomedica*. 2020;91:157–160.

4. Haleem A, Javaid M, Vaishya R. Effects of COVID-19 Pandemic in Daily Life. *Current Medicine Research and Practice*. 2020;10(2):78-79.

5. Tony AA, Tony EA, Ali SB, Ezzeldin AM, Mahmoud AA. COVID-19-Associated Sleep Disorders: A Case Report. *Neurobiological of Sleep and Circadian Rhythm*. 2020;9:100057.

6. COVID-19 Handling Acceleration Task Force. Mapping Distribution COVID-19. [Internet]. 2021.

7. Ifdil I, Fadli RP, Suranata K, Zola N, Ardi Z. Online Mental Health Services in Indonesia During the COVID-19 Outbreak. *Asian Journal of Psychiatry*. 2020;51:102153.

8. Martina, Hapsari D, Ramdhoni R. Mental Health Situation During COVID-19 Pandemic in Indonesia. *International Journal of Community Medicine and Public Health*. 2020;7(11):4278–4282.

9. ter Heege FM, Mijnster T, van Veen MM, Pijnenborg GHM, de Jong PJ, Boersma GJ, et al. The Clinical Relevance of Early Identification and Treatment of Sleep Disor-

ders in Mental Health Care: Protocol of a Randomized Control Trial. *BMC Psychiatry*. 2020;20(1):1–10.

10. Akıncı T, Başar HM. Relationship Between Sleep Quality and the Psychological Status of Patients Hospitalised with COVID-19. *Sleep Medicine*. 2021;80:167–170.

11. Bhat S, Chokroverty S. Sleep Disorders and COVID-19. *Sleep Medicine*. 2022;91:253-261.

12. Zhang J, Xu D, Xie B, Zhang Y, Huang H, Liu H, et al. Poor-Sleep is Associated with Slow Recovery from Lymphopenia and an Increased Need for ICU Care in Hospitalized Patients with COVID-19: A Retrospective Cohort Study. *Brain, Behavior, and Immunity*. 2020;88:50–58.

13. Goldstein CA, Rizvydeen M, Conroy DA, O'Brien LM, Gupta G, Somers EC, et al. The Prevalence and Impact of Pre-Existing Sleep Disorder Diagnoses and Objective Sleep Parameters in Patients Hospitalized for COVID-19. *Journal of Clinical Sleep Medicine*. 2021;17(5):1039–1050.

14. Liguori C, Pierantozzi M, Spanetta M, Sarmati L, Cesta N, Iannetta M, et al. Subjective Neurological Symptoms Frequently Occur in Patients with SARS-CoV2 Infection. *Brain, Behavior, and Immunity*. 2020;88:11-16.

15. Lin YN, Liu ZR, Li SQ, Li CX, Zhang L, Li N, et al. Burden of Sleep Disturbance During COVID-19 Pandemic: A Systematic Review. *Nature and Science of Sleep*. 2021;13:933–966.

16. Guadagni V, Umilta' A, Iaria G. Sleep Quality, Empathy, and Mood During the Isolation Period of the COVID-19 Pandemic in the Canadian Population: Females and Women Suffered the Most. *Frontiers Global Women's Health*. 2020;1(585938):1-10.

17. Tibubos AN, Otten D, Ernst M, Beutel ME. A Systematic Review on Sex and Gender Sensitive Research in Public Mental Health During the First Wave of the COVID-19 Crisis. *Frontiers in Psychiatry*. 2021;12(712492):1-17.

18. Otten D, Tibubos AN, Schomerus G, Brähler E, Binder H, Kruse J, et al. Similarities and Differences of Mental Health in Women and Men: A Systematic Review of Findings in Three Large German Cohorts. *Frontiers in Public Health*. 2021;9(553071):1-15.

19. Velavan TP, Meyer CG. The COVID-19 Epidemic. *Tropical Medicine and International Health*. 2020;25(3):278–280.

20. Salari N, Khazaie H, Hosseinian-Far A, Ghasemi H, Mohammadi M, Shohaimi S, et al. The Prevalence of Sleep Disturbances Among Physicians and Nurses Facing the COVID-19 Patients: A Systematic Review and Meta-Analysis. *Global Health*. 2020;16(1):1–14.

21. Stewart NH, Koza A, Dhaon S, Shoushtari C, Martinez M, Arora VM. Sleep Disturbances in Frontline Health Care Workers During the COVID-19 Pandemic: Social Media Survey Study. *Journal of Medical Internet Research*. 2021;23(5):e27331 .

22. Chaput JP, Dutil C, Sampasa-Kanyinga H. Sleeping Hours: What is the Ideal Number and How Does Age Impact This?. *Nature and Science of Sleep*. 2018;10:421-430.

23. Trockel MT, Menon NK, Rowe SG, Stewart MT, Smith R, Lu M, et al. Assessment of Physician Sleep and Wellness, Burnout, and Clinically Significant Medical Errors. *JAMA Network Open*. 2020;3(12):1-13.

24. NCIRD. Treatments Your Healthcare Provider Might Recommend if You Are Sick. 2022.

25. Ramar K, Malhotra RK, Carden KA, Martin JL, Abbasi-Feinberg F, Aurora RN, et al. Sleep is Essential to Health: an American Academy of Sleep Medicine Position Statement. *Journal of Clinical Sleep Medicine*. 2021;17(10):2115–2119.

26. Kocevska D, Blanken TF, Van Someren EJW, Rösler L. Sleep Quality During the COVID-19 Pandemic: Not One Size Fits All. *Sleep Medicine*. 2020;76:86-88.

27. Ramadhani R. Relationship Between Optimism and Social Support with Coping Stress in Nursing Students Who Are Completing Thesis at Stikes Muhammadiyah Samarinda. Stikes Muhammadiyah Samarinda; 2014.

28. Bottemanne H, Morlaàs O, Fossati P, Schmidt L. Does the Coronavirus Epidemic Take Advantage of Human Optimism Bias?. *Frontiers in Psychology*. 2020;11(2001):1-5.

29. Gulliford M. Discrimination and Public Health. *Lancet Public Health*. 2019;4(4):173–174.

30. Liu R, Nicholas S, Leng A, Qian D, Maitland E, Wang J. The Influencing Factors of Discrimination Against Recovered Coronavirus Disease 2019 (COVID-19) Patients in China: a National Study. *Human Vaccines & Immunotherapeutics*. 2021;18(1):1–9.

31. Tehrani H. Mental Health Stigma Related to Novel Coronavirus Disease (COVID-19) in Elderly. *Geriatrics & Gerontology International*. 2020;20(8):796–797.

32. Kou Murayama. The Science of Motivation [Internet]. Psychological Science Agenda. 2018. Available from: https://www.apa.org/science/about/psa/2018/06/motivation.

33. Institut of Medicine (US) Committee on Sleep Medicine and Research. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Washington (DC): National Academies Press (US); 2006.

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The Utilization of Lactation Rooms by Health Workers in Medan City

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ABSTRACT

Exclusive breastfeeding for infants with working mothers still becomes a significant problem. The provision of on-site lactation rooms has not substantially impacted the utilization of lactation rooms. This study analyzes the factors that influence the utilization of breastfeeding rooms by health workers in all public health centers in Medan City. This study is a quantitative study using a cross-sectional design. The study involved 78 health workers who breastfed children under two years old. The determination of the sample used the total sampling technique. The results show knowledge (0.000), attitudes (0.002), practice (0.008), support from health workers (0.000), the availability of lactation rooms (0.000), and formula feeding (0.000) affect the utilization of breastfeeding rooms. The regression test results show that knowledge is the most influential factor in the utilization of the lactation room. Respondents with good knowledge have 9.477 times more opportunities to use the lactation room than respondents with poor knowledge. It can be concluded that the use of lactation rooms is influenced by factors such as knowledge, attitudes, practice, support from health workers, availability of lactation rooms, and formula feeding. It is recommended for local governments to provide adequate and comfortable facilities at each institution's offices to increase the utilization of breastfeeding rooms. The provision of a comfortable lactation room has implications for the mother's willingness to use the lactation room. However, it becomes difficult to realize without the support of colleagues.

INTRODUCTION

Breastfeeding the baby exclusively until six-month old is recommended by WHO. Although a lot of literature references recommend the benefits that babies get if they are exclusively breastfed, the prevalence and duration of exclusive breastfeeding are lower than the recommendations for breastfeeding for the first six months in many countries.[1] Rate of Exclusive Breastfeeding (EBF) up to 6 months in most low- and middle-income countries is far below the standard.[2,3]

In Indonesia, there is only 1 in 2 infants under six months are exclusively breastfed, and only slightly more than 5% of children are still breastfed at 23 months. This means that almost half of all Indonesian children do not receive the nutrition they need during the first two years. More than 40% of infants are introduced to complementary foods too early, i.e., before they reach the age of 6 months and the food which provided does not meet the nutritional needs of infants.[4] Indonesian Basic Health Research (Riset Kesehatan Dasar) results in 2018 show the proportion of exclusive breastfeeding patterns for infants aged 0-5 months is 37.3%. This percentage is still far from the target set by WHO which is 50%. The proportion of breastfeeding patterns for infants aged 0-5 months in 2018, in North Sumatra province reached 48%, those who gave exclusive breastfeeding was in the last 24 hours only consuming breast milk and not consuming food or beverage during the period.[5]

Most women spend a lot of time working after the first year of birth, so they are distant from their children.[6,7] Friendly Lactation rooms in workplaces are indispensable for working mothers. This particular room allows female employees to work productively but does not forget the activity of pumping their breast milk to be given to their babies at home. Thus, breastfeeding is not interrupted even though the mother goes to work every day. The most common reasons why mothers stop breastfeeding are work demands, limited time and distance.[8] Several studies have shown that providing a lactation room contributes to improved performance, reduced absenteeism and commitment.[3,9]

Many factors are related to the practice of breastfeeding can be viewed from various perspectives and classified according to individual and social roles. Studies have shown that high intensity of work, uncomfortable and hygienic lactation rooms in the workplace, and social conditions cause low breastfeeding practices for working mothers.[10,11] Knowledge and attitudes also contribute to improve breastfeeding practices, but they need support from their husbands and coworkers as well as adequate working conditions for mothers.[12] The formula feeding practice can also inhibit exclusive breastfeeding for working women.[6] The discomfort and embarrassment in expressing breast milk at work lead many women to give formula milk or stop breastfeeding altogether.[13] In this study, the researchers focused on the population group of women working in health care institutions such as health center and hospital because there are still few study results for this population. Previous studies in Indonesia have primarily focused on women working in the industrial, agricultural, and informal sectors.[14–17]

In Indonesia, the provision of lactation room (rooms for breastfeeding babies, expressing breast milk storing expressed breast milk, and breastfeeding counseling) is regulated in Minister of Health Regulation No. 15 of 2013 concerning Procedures to Provide Special Facilities for Breastfeeding and Expressing Mother's Milk. The provision of this lactation room protects mothers in providing exclusive breastfeeding and fulfilling children's rights to get exclusive breastfeeding.

Among the 41 primary healthcares in Medan City, 9 primary healthcares do not provide a lactation room for their employees. The long-lasting COVID-19 pandemic has caused the lactation room to change its function into a storage area for goods for preventing COVID-19. Even in some primary healthcares, there is no longer a lactation room. This condition makes employees feel disturbed and uncomfortable to practice breastfeeding. This study intends to examine matters related to the usage of lactation rooms in primary healthcare. The study results will contribute to a better understanding for employers and supervisors about barriers to working mothers to breastfeed so that they can implement a policy of providing a friendly and comfortable lactation room.

MATERIAL AND METHOD

This research is quantitative research using a cross-sectional design. It analyzes the factors that influence the utilization of lactation rooms by health workers in all primary healthcare services in Medan City. This research was conducted from November 2020 to January 2021. This study involved 78 health workers with children under two years old including those who breastfeed or express breast milk at the office. The determination of the sample used the total sampling technique.

Data were collected using a validated questionnaire. Researchers also used a checklist in data collection. The data was collected in the form of respondents' characteristics, knowledge, attitudes, practice, support from health workers, availability of lactation room, use of formula milk and utilization of lactation room. In measuring the variables of knowledge, mother's practice, and support from health workers, subjects were given a questionnaire consisting of 5 statements on each variable. The number of respondents' answer scores were categorized into three categories which are good (76-100), moderate (56-75), and poor (0-55). In the attitude questionnaire, respondents were given five statements. If the respondent's answer score is > 50, it is categorized as positive, while a score of 50 is categorized as negative.

The researchers would use the Chi-square statistical test to analyze the collected data, provided that there was no expected value less than 5. If the Chi-square test conditions are not met, an alternative test is used, namely the Fisher's Exact Test. The tested variables are said to have a significant relation if the p-value is less than 0.05. Furthermore, the researchers conducted a logistic regression test with predictive modeling. The interaction test was carried out on variables that were suspected to have interaction in substance. If the p-value is less than 0.05, there is an interaction between the independent variables and vice versa. If there is interaction, then the final modeling used is multivariate model with interaction. If there is no interaction, the final model used is a multivariate model without interaction.

RESULTS

The calculation of the frequency distribution among 78 respondents showed that the majority have diploma education (70.51%), and aged between 20 and 45 years (66.67%). Most respondents have sufficient knowledge (44.87%) and have a positive attitude (70.51%). In the practice parameters, the majority are in a good category (39.74%), while most respondents stated that the support they received is good (44.87%). Respondents said that the availability of a lactation room is still inadequate (88.46%), and respondents also stated that they gave formula milk to their babies. Finally, 62.82% said that they used the lactation room.

Table 1. The Demographic Characteristics of Female Health Workers Using Lactation Rooms

Characteristics	n = 78	%
Education		
Diploma	55	70.51
Bachelor	23	29.49
Age (Years)		
< 20	2	2.56
20 - 45	52	66.67
> 45	24	30.77
Knowledge		
Poor	11	14.10
Moderate	35	44.87
Good	32	41.03
Attitude		
Negative	23	29.49
Positive	55	70.51
Practice		
Poor	19	24.36
Moderate	28	35.90
Good	31	39.74
Health Worker Support		
Poor	21	26.92
Moderate	22	2821
Good	35	44.87
Availability of Lactation Room		
Available	69	88.46
Not available	9	11.54
Formula-Feeding		
Yes	20	25.64
No	58	74.36
Utilization of Lactation Room		
Used	49	62.82
Not used	29	37.18

Source: Primary Data, 2021

Table 2 shows that the results of the Chi-square test on knowledge with the use of a lactation room shows a significant effect (*p*=0.000). Likewise, the test results between attitudes and the use of the lactation room show a significant relation (0.002). The statistical test on the parameters of the mother's practice with the use of the lactation room obtains a *p-value* = 0.008, meaning that there is an effect of the mother's practice with the use of the lactation room. Likewise, the support obtained by the mother also correlates significantly with the utilization of the lactation room (0.000).

The results in Table 2, shows statistical tests on the variable availability of lactation room and utilization of lactation room show a positive correlation (0.003), meaning that there is an influence between the two variables. Respondents who stated the availability of a lactation room have 3.450 times more chance to use a lactation room. Formula feeding also affects the utilization of the lactation room (0.000).

A logistic regression test was performed as a follow-up to the Chi-square test. All variables were eligible to be analyzed using logistic regression. Among the six independent variables tested, there are still variables with a significant value above 0.25 which is the availability of lactation room and formula feeding. Only variables with a value of < 0.25 can be included in stage two of logistic regression test (knowledge, attitudes, practice of mothers, and support of health workers).

The results on the second stage of the logistic regression test show that respondents with good knowledge have 9,477 times more opportunities to use the lactation room than respondents with poor knowledge. Because B is positive, knowledge positively influences health of workers. utilization of the breastfeeding corner (B=2.273). Then, respondents who have a positive attitude are 5.934 times more likely to use the lactation room than those who have negative attitude. Because B is positive, the attitude positively influences the utilization of the lactation room (B = 1.781) (Table 3).

Table 2. The Association Between Utilization of Lactation Room and Predictors Among Health Workers

Variable	Utilization of Lactation Room				*p*
	Not used		Used		
	n = 29	%	n = 49	%	
Knowledge					
Poor	9	11.54	2	2.56	0.000
Moderate	18	23.08	17	21.79	
Good	2	2.56	30	38.46	
Attitude					
Negative	15	19.23	8	10.26	0.002
Positive	14	17.95	41	52.56	
Practice					
Poor	12	15.38	7	8.97	0.008
Moderate	11	14.10	17	21.79	
Good	6	7.69	25	32.05	
Health Worker Support					
Poor	16	20.51	5	6.41	0.000
Moderate	9	11.54	13	16.67	
Good	4	5.13	31	39.74	
Availability of Lactation Room					
Available	20	25.64	49	62.82	0.000
Not available	9	11.54	0	0	
Formula-Feeding					
Yes	20	25.64	0	0	0.000
No	9	11.54	49	62.82	

Source: Primary Data, 2021

Respondents who have good practice have 6.324 times more opportunities to use the lactation room than respondents who have poor practice. Because B is positive, the mother's practice positively affects the utilization of the lactation room (B=2.273). Furthermore, respondents who received good support from health workers are 9.705 times more likely to use the breastfeeding corner than respondents who did not receive support from health workers. Because B has a positive value, the support of health workers positively influences the utilization of the lactation room (B=2.273). It can be concluded that knowledge is the most dominant variable influencing the utilization of the lactation room. This can be seen from the logistic regression equation which shows the regression coefficient value of 2.969.

DISCUSSION

This study provides holistic information about the aspects affecting breastfeeding health workers in utilizing the lactation rooms. The lactation room is beneficial for breastfeeding mothers who are working. The existence of a lactation room will help mothers to express breast milk so that even though they have to work, mothers can still provide breast milk to their babies. Expressed breast milk can be stored temporarily in the refrigerator or freezer. Lactation rooms in the workplace can provide comfort and privacy for mothers, reducing stress and impacting the quantity of breast milk expressed.

Referring to KAP theory in this study, three variables (Knowledge, Attitudes, and Practice) affect the utilization of lactation rooms. The better mother's KAP score, the more likely she uses the breastfeeding room at work. The literature shows that many women mistakenly think they cannot breastfeed if they plan to return to work after giving birth. They also do not know that breastfeeding can be done in the workplace.[18] Studies in Ghana and Jakarta reported that working mothers with good knowledge are more likely to breastfeed their babies exclusively.[19,20] The study by Jara-Palacios et al. showed that primigravida mothers are more at risk of exclusive breastfeeding for less than six months due to lack of experience and knowledge about the benefits of exclusive breastfeeding.[21] Information held by mothers about the benefits of exclusive breastfeeding and government's regulations on breastfeeding practices in the workplace encourage mothers to provide exclusive breastfeeding.[22] Furthermore, a study in Surakarta reported that the knowledge, experience, and motivation of working mothers affect the mother's perception on the availability of lactation corner facilities.[23]

A strong attitude is owned by working mothers to continue to breastfeed well when working by utilizing the lactation room.[12] Studies in Kenya show that working mothers have a good attitude towards achieving exclusive breastfeeding through breastfeeding.[24] Practice is an activity carried out by mothers through the decision making for the successful implementation of exclusive breastfeeding. A person's practice of behaving is the main determinant of the individual's behavior. Mothers who want to give breast milk will tend to use the lactation room.[25,26]

In line with the previous studies, support from health workers also affects the utilization of lactation rooms. Professional health workers can be a supporting factor for mothers in breastfeeding. Female health workers are part of working mothers who usually marry and have children naturally. Thus, breastfeeding is an integral part of the process. However, the fact is poor because health workers themselves have a lower percentage of success in breastfeeding their babies.[27] The support of health workers is necessary for the physical and psychological aspects of the mother during breastfeeding. The better support of health workers for breastfeeding mothers, the better mothers will give breast milk to their children.[28] The support of health workers is expected to be able in realizing the process of mutual development of love and affection between mothers and their children. Therefore, mothers can exclusively breastfeed with the support of other health workers by using the lactation room. The lack of encouragement from health workers makes people not get information or encouragement about the benefits of breastfeeding.[29] The wrong explanation comes from the health workers who recommend replacing breast milk with formula milk.[30] Health workers who assist mothers in childbirth and provide postnatal guidance to mothers affect maternal compliance in exclusive breastfeeding.[31]

Table 3. The Factors Related to the Use of Lactation Room by Multivariate Logistic Regression

Variable	B	df	Sig	Exp. (B)
Stage 1				
Knowledge	4.661	1	.067	105.696
Attitude	4.896	1	.059	133.759
Practice	2.365	1	.117	10.639
Health worker support	5.421	1	.045	226.077
Availability of breastfeeding room	19.445	1	.999	2.784
Formula-feeding	-24.449	1	.997	.000
Constant	-45.233	1	.998	.000
Stage 2				
Knowledge	2.969	1	.001	19.477
Attitude	1.781	1	.054	5.934
Practice	1.844	1	.002	6.324
Health worker support	2.273	1	.002	9.705
Constant	-17.183	1	.000	.000

Source: Primary Data, 2021

The results of studies obtained from the field indicate that there is an influence of the availability of lactation rooms and the use of lactation rooms. The literature shows that the unavailability of lactation facilities in the workplace is associated with a decrease in breastfeeding initiation of mothers who return to work.[32] The lactation room is one of the government's programs to increase exclusive breastfeeding and support high maternal mobility. Article 30 of the Indonesian Government Regulation Number 33 of 2012 states that workplace administrators and organizers of public facilities must provide special facilities for breastfeeding and expressing breast milk following the company's capacity. Public facilities are required to provide lactation booths in health service facilities, hotels and inns, recreation areas, land transportation terminals, train stations, airports, seaports, shopping centers, sports buildings, refugee shelter locations, and other public facilities.

An ideal lactation room is equipped with breastfeeding and expressing milk facilities used for breastfeeding babies, expressing breast milk, storing expressed breast milk, and breastfeeding counseling. Every workplace and public places should provide facilities and infrastructure for lactation room following minimum standards and as needed. The purpose of providing a lactation room is to protect mothers in exclusive breastfeeding, fulfill children's rights to exclusive breastfeeding, and increase the role and support of families, communities, and government for exclusive breastfeeding.

Mothers who work outside the home need support from their workplace. It is stated in the Regulation of the Minister of Health of the Republic of Indonesia Number 15 of 2013 concerning the Provision of Special Facilities for Breastfeeding and Expressing Breast Milk: the workplace provides opportunities for mothers to work indoor and outdoor to breastfeed and express breast milk at work.[33] The provision of opportunities for mothers who work indoor and outdoor, as referred to in the Permenkes above provides a lactation room according to standards that meet health requirements. Still, under the same regulation of the Minister of Health, the lactation room in every office must have a person in charge who can act as a breastfeeding counselor. The person in charge is appointed by the workplace administrator. In the case of a lactation room that does not have a breastfeeding counselor, the workplace administrator can work closely with health service facilities or coordinate with the provincial, district, or city health offices to provide breastfeeding counseling training. The type and number of health and non-health workers as trained personnel in breastfeeding are adjusted to the needs and types of services provided in the lactation room.

In this study, there is an effect between formula milk and the utilization of the lactation room. Formula feeding can inhibit exclusive breastfeeding. Giving formula milk to newborns shows a lack of knowledge of mothers about exclusive breastfeeding and the dangers of giving formula milk to babies. Sadly, formula feeding is given when the baby is born. The main reason is that the milk has not come out, and the baby still has trouble at suckling. They are worried that the baby will cry if left alone. Working mothers have reasons to give formula milk instead of breast milk.[34,35]

The place of giving birth influences exclusive breastfeeding for babies because it is the starting

point for mothers to choose whether to continue to exclusively breastfeed their babies or formula feeding given by health or non-health workers. Even though there is an international code of ethics regarding breast milk substitutes (formula milk), the marketing of formula milk is getting more intense. It seriously disrupts the success of exclusive breastfeeding programs. Perpetrators of violations of the international code of ethics are now shifting from baby food companies to health workers and health care facilities. Hospitals or maternity hospitals distribute formula milk products as gifts for mothers after giving birth. In addition, some health workers subtly encourage mothers not to provide breast milk but formula milk to their babies.[36–38]

Formula feeding as prelacteal is adjusted in private practice of midwives and maternity homes. The main reason is that milk has not come out, and the baby still has difficulty at suckling, so the baby will cry if left alone. Usually, the midwife will advise on formula feeding first. In fact, formula milk is made by midwives or nurses themselves. They even provide a bottle sterilizer. This will negatively influence the mother's beliefs. The mother will think that formula milk is the most effective medicine to stop the baby's crying. The mother's lack of confidence in producing a lot of breast milk encourages mothers to give bottle-feeding. Children who do not use bottle with pacifier are more likely to be exclusively breastfed.[39,40]

CONCLUSION AND RECOMMENDATION

This study concludes that knowledge (0.000), attitude (0.002), practice (0.008), support from health workers (0.000), availability of lactation room (0.000), and formula feeding (0.000) affect the utilization of lactation room. The regression test results show that knowledge is the most influential factor in the utilization of the lactation room. Respondents with good knowledge have 9.477 times more opportunities to use the lactation room than respondents with poor knowledge. To increase the utilization of lactation rooms, local governments should provide adequate and comfortable facilities at each institution's offices. The provision of a comfortable lactation room has implications for the mother's willingness to use the lactation room. It becomes difficult to realize without the support of colleagues.

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AUTHOR CONTRIBUTIONS

YSN, CNG, SLRN carried out the experiment. YSN, MS, PM verified the analytical methods and contributed to interpret the results. YSN, CNG, PM took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis, and manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Awoke S, Mulatu B. Determinants of Exclusive Breastfeeding Practice Among Mothers in Sheka Zone, Southwest Ethiopia: A Cross-Sectional Study. *Public Health in Practice* [Internet]. 2021;2:100–108. Available from: https://www.sciencedirect.com/science/article/pii/S2666535221000331.
2. Olufunlayo TF, Roberts AA, MacArthur C, Thomas N, Odeyemi KA, Price M, et al. Improving Exclusive Breastfeeding in Low And Middle-Income Countries: A Systematic Review. *Maternal & Child Nutrition*. 20195(3):12788.
3. Rollins NC, Bhandari N, Hajeebhoy N, Horton S, Lutter CK, Martines JC, et al. Why Invest, and What It Will Take to Improve Breastfeeding Practices?. T*he Lancet* [Internet]. 2016;387(10017):491–504. Available from: https://doi.org/10.1016/S0140-6736(15)01044-2.
4. World Health Organization. World Breastfeeding Week: UNICEF and WHO Call on Government and Stakeholders to Support All Breastfeeding Mothers in Indonesia During COVID-19 Pandemic [Internet]. World Health Organization; 2020 Available

from:https://www.who.int/indonesia/news/detail/03-08-2020-pekan-menyusui-dunia-unicef-dan-who-menyerukan-pemerintah-dan-pemangku-kepentingan-agar-mendukung-semua-ibu-menyusui-di-indonesia-selama-covid-19.

5. Kemenkes RI. Riset Kesehatan Dasar 2018. Jakarta: Kementrian Kesehatan RI; 2018.
6. Febrianingtyas Y, Februhartanty J, Hadihardjono DN. Workplace Support and Exclusive Breastfeeding Practice: A Qualitative Study in Jakarta, Indonesia. *Malaysian Journal of Nutrition*. 2019;25(1):129–142.
7. Thomas CL, Murphy LD, Mills MJ, Zhang J, Fisher GG, Clancy RL. Employee Lactation: A Review and Recommendations For Research, Practice, and Policy. *Human Resource Management Review*. [Internet]. 2021;100848. Available from: https://www.sciencedirect.com/science/article/pii/S1053482221000279.
8. Mcfadden A, Siebelt L, Marshall J, Gavine A, Girard L-C, Symon A, et al. Counselling Interventions to Enable Women to Initiate and Continue Breastfeeding: A Systematic Review and Meta-Analysis. *International Breastfeeding Journal*. 2019;14(42):1-19.
9. Dai W, Deng X, Li L, Qiu J, Mao B, Shao Y, et al. An Observational Study on Ca Supplementation and Dietary Intake During Pregnancy on Low Birth Weight and Small for Gestational Age. *Public Health Nutrition*. 2020(1);1–10.
10. Chen J, Xin T, Gaoshan J, Li Q, Zou K, Tan S, et al. The Association Between Work Related Factors and Breastfeeding Practices Among Chinese Working Mothers: A Mixed-Method Approach. *International Breastfeeding Journal*. [Internet]. 2019;14(1):28. Available from: https://doi.org/10.1186/s13006-019-0223-z.
11. Horwood C, Surie A, Haskins L, Luthuli S, Hinton R, Chowdhury A, et al. Attitudes and Perceptions About Breastfeeding Among Female and Male Informal Workers in India and South Africa. *BMC Public Health*. 2020;20(1):1–12.
12. Gebrekidan K, Plummer V, Fooladi E, Hall H. Attitudes and Experiences of employed Women When Combining Exclusive Breastfeeding and Work: A Qualitative Study Among Office Workers in Northern Ethiopia. *Maternal & Child Nutrition*. 2021; 14(4):13190.
13. Russell S, Smith D, Birtel M, Hart K, Golding S. The Role of Emotions and Injunctive Norms in Breastfeeding: A Systematic Review and Meta-Analysis. *Health Psychology Review*. 2022; 16(2): 257-279.
14. Hutabarat SMD, Dalimunthe SNIS. Pengaturan Penyediaan Ruang ASI Bagi Pekerja Perempuan pada Perusahaan. *ADIL: Jurnal Hukum*. 2017;8(2):210–229.
15. Mahdang PA, Ahmad ZF. Pengaruh Sikap, Pengetahuan, dan Fasilitas Perusahaan terhadap Pemberian ASI Ekslusif oleh Pekerja Wanita. *Madu Jurnal Kesehatan*. 2021;10(2):26–33.
16. Wijaya PS, Soesanto SS. Kajian Implementasi Kebijakan Ruang Laktasi di Sektor Pemerintah dan Swasta. *Unnes Journal of Public Health*. 2017;6(3):196-202.
17. Hardi MW, Yuliana T, Purbasari AAD. Faktor–Faktor yang Berhubungan dengan Pemanfaatan Ruang Laktasi pada Ibu Menyusui yang Bekerja di Kementerian Keuangan. *Jurnal Kesehatan Masyarakat STIKES Cendekia Utama Kudus*. 2019;7(1):129–143.
18. DeMaria AL, Wierenga M, Kelly K, Smith S, Bohning A, Bauman T, et al. Ecological Factors Affecting Infant at Work Policies and Programs in University Settings. *Journal of Occupational Health*. 2021;63(1):1–12.
19. Rapingah S, Muhani N, Besral, Yuniar P. Determinants of Exclusive Breastfeeding Practices of Female Healthcare Workers in Jakarta, Indonesia. *Kesmas*. 2021;16(1):59–65.
20. Abekah-Nkrumah G, Antwi MY, Nkrumah J, Gbagbo FY. Examining Working Mothers' Experience of Exclusive Breastfeeding in Ghana. *International Breastfeeding Journal*. 2020;15(56):1-10.
21. Mudaharimbi EP. Efikasi Diri Ibu Primigravida yang Bekerja dalam Keberhasilan Memberikan ASI. *Jurnal*

Promkes : The Indonesian Journal of Health Promotion and Health Education. 2021;9(1):27–34.

22. Kemenkes RI. Surat Menteri Kesehatan No. 872/Menkes/XI/2006 Mengenai Kriteria dan Fasilitas Ruang Menyusu. Jakarta: Kementerian Kesehatan RI; 2006.
23. Rachmawati A, Werdani KE, Kusumawati Y. Persepsi Ibu Pekerja Terhadap Pentingnya Ketersediaan Pojok Laktasi di Lingkungan Universitas Muhammadiyah Surakarta. [Thesis]. Surakarta: Universitas Muhammadiyah Surakarta; 2016. Available from: http://eprints.ums.ac.id/46840/.
24. Edemba PW, Irimu G, Musoke R. Knowledge Attitudes and Practice of Breastmilk Expression and Storage Among Working Mothers With Infants Under Six Months of Age in Kenya. *International Breastfeeding Journal*. 2022;17(33):1-8.
25. Radzyminski S, Callister LC. Mother's Beliefs, Attitudes, and Decision Making Related to Infant Feeding Choices. *The Journal of Perinatal Education*. 2016;25(1):18–28.
26. Tsai S-Y. Shift-Work and Breastfeeding For Women Returning to Work in A Manufacturing Workplace in Taiwan. *International Breastfeeding Journal*. 2022;17(27):1-9.
27. Susiloningtyas I, Ratnawati D. Faktor-Faktor yang Mempengaruhi Pemanfaatan Ruang Laktasi di Puskesmas Gunung Pati Semarang. *Jurnal Kebidanan*. 2017;9(01): 59-67.
28. Gavine A, MacGillivray S, Renfrew MJ, Siebelt L, Haggi H, McFadden A. Education and Training of Healthcare Staff in the Knowledge, Attitudes and Skills Needed to Work Effectively with Breastfeeding Women: a Systematic Review. *International Breastfeeding Journal*. 2017;12(6): 1-10.
29. Dun-Dery EJ, Laar AK. Exclusive Breastfeeding Among City-Dwelling Professional Working Mothers in Ghana. *International Breastfeeding Journal*. 2016;11(23):1-9.
30. Haryono R, Setianingsih S. *Manfaat ASI Eksklusif untuk Buah Hati Anda*. Yogyakarta: Gosyen Publising; 2014.
31. Huang P, Ren J, Liu Y, Luo B, Zhao X. Factors Affecting Breastfeeding Adherence among Chinese Mothers: A Multicenter Study. *Medicine*. 2017;96(38):1-6.
32. Basrowi RW, Sastroasmoro S, Sulistomo AW, Bardosono S, Hendarto A, Soemarko DS, et al. Challenges and Supports of Breastfeeding at Workplace in Indonesia. *Pediatric Gastroenterology, Hepatology & Nutrition*. 2018;21(4):248–256.
33. Kemenkes RI. Peraturan Menteri Kesehatan Nomor 15 Tahun 2013 Tentang Cara Penyediaan Fasilitas Khusus Menyusui dan atau Memerah ASI. Jakarta: Kementerian Kesehatan RI; 2013.
34. Umugwaneza M, Havemann-Nel L, Vorster HH, Wentzel-Viljoen E. Factors Influencing Complementary Feeding Practices in Rural and Semi-Urban Rwanda: A Qualitative Study. *Journal of Nutritional Science*. 2021;10(45):1-8.
35. Al-Katufi BA, Al-Shikh MH, Al-Hamad RF, Al-Hajri A, Al-Hejji A. Barriers in Continuing Exclusive Breastfeeding Among Working Mothers in Primary Health Care in The Ministry of Health in Al-Ahsa Region, Saudi Arabia. *Journal Family Medicine and Primary Care*.2020;9(2): 957-972.
36. Pereira-Kotze C, Jeffery B, Badham J, Swart EC, du Plessis L, Goga A, et al. Conflicts of Interest are Harming Maternal and Child Health: Time For Scientific Journals to End Relationships with Manufacturers of Breast-Milk Substitutes. *BMJ Global Health*. 2022;7(2):008002.
37. Hernández-Cordero S, Vilar-Compte M, Castañeda-Márquez AC, Rollins N, Kingston G, Pérez-Escamilla R. Exposure To Marketing of Breastmilk Substitutes in Mexican Women: Sources And Scope. *International Breastfeeding Journal*. 2022;17(16):1-11.
38. Temple Newhook J, Newhook LA, Midodzi WK, Murphy Goodridge J, Burrage L, Gill N, et al. Determinants of Nonmedically Indicated In-Hospital Supplementation of Infants Whose Birthing Parents Intended to Exclusively Breastfeed. *Journal of Human Lactation*. [Internet]. 2017;33(2):278–284. Available from: https://doi.org/10.1177/

0890334417695204.

39. Suryani D, Simbolon D, Elly N, Pratiwi BA, Yandrizal Y. Determinants Failure of Exclusive Breast Feeding on Health in the City Bengkulu. *Kemas: Jurnal Kesehatan Masyarakat*. 2017;12(2):304–312.
40. Widyastutik O, Trisnawati E. Determinan Kegagalan ASI Eksklusif pada Komunitas Madura. *Jurnal IKESMA*. 2018;14(2):12134.

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The Relation between Rainfall and Larval Density of Dengue Hemorrhagic Fever with Spatial Modeling

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) is a disease transmitted by the aedes aegypti mosquito. This study aims to determine the relationship between rainfall and larval density which consist of House Index (HI), Container Index (CI), Breteau Index (BI), and Larval Free Rate (LFR) on the incidence of dengue hemorrhagic fever using GIS modeling. The research method is quantitative with a spatial approach and Univariate and Bivariate analysis. The study population was all cases of DHF in all working areas of Lahat District Health Center, Lahat Regency in 2016-2019. The results of the statistical correlation test showed that there was a correlation between rainfall and the incidence of DHF with a value (p=0.003), while larval density showed a correlation between HI and the DHF incidence (p-*value*=0.007), CI (p-*value*=0.007), BI (p-*value*=0.007). ABJ (p-*value*=0.012). Spatially, it was found that the incidence of dengue fever was high in the working regions of Public Health Center with high HI (≥5%), low CI (<10%), low BI (<50%), and low larvae-free rate (<95%). It can be concluded that there is a relation among rainfall, HI, CI, and BI on the incidence of DHF in Lahat Regency in 2016-2019 and spatially shows the high incidence of DHF in high HI (≥5%) and low LFR (<95%). It is recommended that the Lahat Regency Office used climate information from the BMKG in planning a program to eradicate DHF and eradicate mosquito nests during the rainy season in Lahat District.

INTRODUCTION

Diseases that transmitted through various media are called infectious diseases. One of the infectious diseases that still become global health problem in the world is Dengue Hemorrhagic Fever (DHF). The spread of this disease is caused by a virus, namely the Flaviviradae family transmitted by the bite of Aedes mosquitoes, namely *Aedes aegypti* and *Aedes albopictus* infected with dengue virus which transmitted to humans.[1]

DHF cases that occurred in Indonesia in 2017 with a total of 68,047 cases (IR 26.12/100,000 population and CFR 0.72%) experienced a significant decrease compared to 2016 about 204,171 cases (IR 78.85/100,000 population and CFR 0.78%). In 2018 there were 53,975 cases (IR 20.01/100,000 population and CFR 0.65%) and in 2019 there were 13,683 cases (IR 5.08/100,000 population and CFR 0.94%). In 2016 the highest dengue cases were in three provinces, namely West Java, East Java and Central Java. Meanwhile, the lowest number of cases was North Maluku Province.[2]

Dengue fever is still a problem for people in several regencies in South Sumatra, including in Lahat regency. Lahat Regency consists of 24 subdistricts covering 360 villages, 17 sub-districts and has 33 health centers located in the region of Lahat Regency Health Office.[3] One of the subdistricts that has the highest number of dengue cases in the last four years is Lahat District.

DHF cases in Lahat District showed a fairl fluctuating morbidity rate (IR) from the last four years which is in 2016, there are about 109 cases of DHF with an IR of 103.03 per 100,000 population, it decreased to 62 cases of DHF with an IR of 57.90 per 100,000 population in 2017, it decreased again to 31 cases of DHF with an IR of 28.95 per 100,000 population in 2018 and it increased again to 41 cases of DHF with an IR of 42.40 per 100,000 population in 2019. The DHF mortality rate (CFR) in 2016 was 4 cases of death, there were 2 cases of death in 2017 and there were no deaths in 2018 and 2019.[3]

Several factors that influence the spread of dengue cases are the host, agent and environment consisting of geographical conditions (weather and climate), one of which is rainfall, because high rainfall can also affect the population density of adult female mosquitoes to breed.[4] Besides that, other causes that can affect the spread of DHF are the larval density, this is because the higher the density of larvae in an area, the risk of transmission of dengue disease also increases.[5] To determine the density of larvae, several indexes are used, including the House Index (HI), Container Index (CI), Breteau Index (BI) and Larva Free Rate (LFR).

The existence of spatial analysis can help to analyze the dissemination of risk factors transmitted by Mosquitoes which carry disease or vectors and can control the development of dengue disease that requires special and quick handling. The specific source of information regarding an event that occurs in a certain area with a period is by using the spatial analysis function.[5]

The spatial analysis of the incidence of DHF in Lahat District is unknown, so that with this research it is possible to know the spatial analysis of the incidence of DHF to be seen from the larval density. Therefore, this research was carried out to find out whether there is a relation between rainfall and larval density in terms of the House Index (HI), Container Index (CI), Breteau Index (BI) and Larva-Free Rate (LFR) (Flat Free Rate) on the incidence of disease. DHF with geographic information system modeling in Lahat District, Lahat Regency in 2016-2019.

MATERIAL AND METHOD

The type of research used is quantitative research with a spatial approach. This study took secondary data from the Lahat Regency Health Office, each working region of the Public Health Center in Lahat Regency and Sultan Mahmud Badaruddin II Climatology Station Class II Palembang. The tools used in data collection in this study are monthly and annual reports that have been collected from several related agencies and using a checklist table to review secondary data documents. Several methods were carried out by surveying people's home to find out the presence of mosquito larvae assisted by using additional lighting devices, namely flashlights. The population in this study were all cases of DHF in all working areas of the Public Health Center in Lahat District.

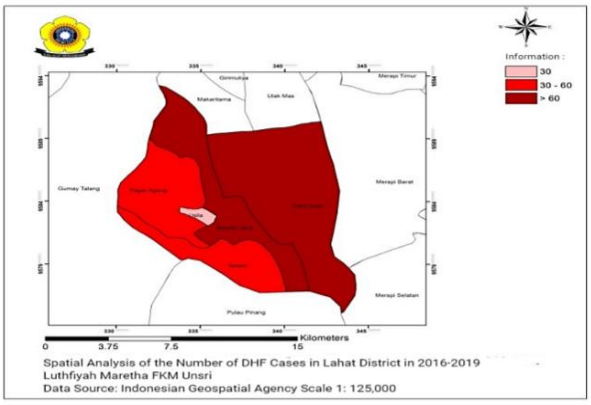
The sample of this research is the sum of

all population in Lahat District which consists of five working areas of Public Health Center namely Bandar Jaya, Pagar Agung, Perumnas, Selawi and Usila from 2016 to 2019. The data analysis technique in this study is univariate and bivariate analysis using SPSS software and spatial analysis using GIS software support. This study meets the requirements of the applicable code of ethics with the number 344/UN9.1.10/ KKE/220 Faculty of Public Health Sriwijaya University.

RESULTS

The DHF morbidity rate in Lahat District decreased from 2016 to 2018, namely in 2016 from 103.03 per 100,000 population to 28.95 per 100,000 population in 2018. Then it increased 68.3% from the previous year of 42, 4 per 100,000 population in 2019. The following is a map of the distribution of dengue cases from 2016 to 2019 in Lahat District (Figure 1).

Based on the figure 1 below, it shows that there are two public health center working areas that have the highest number of DHF cases from 2016 to 2019 namely Bandar Jaya Health Center and Perumnas work areas with 75 cases and 68 cases. While the highest case values after Bandar Jaya Health Center and Perumnas work areas were Pagar Agung Health Center Work area with 49 cases and Selawi with 30 cases. The lowest distributioUsila Health Center with 21 cases.

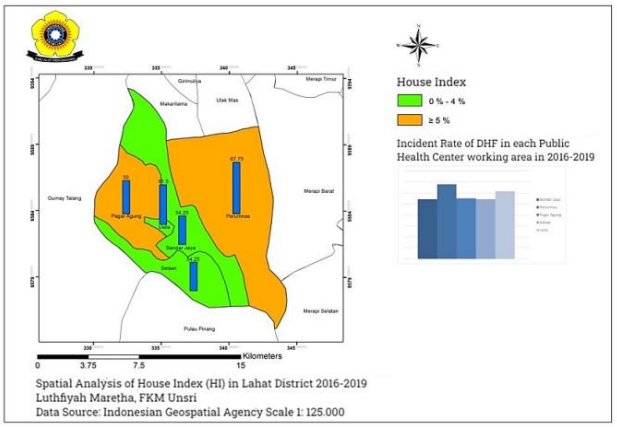


Source: Secondary Data of the Lahat Regency Health Office, 2016-2019

Figure 1. Distribution of DHF Cases in Lahat District in 2016-2019

Spatially (Figure 2), it can be seen that the distribution of HI with the category of high risk of transmission in the period 2016 to 2019 is more commonly found in the work areas of the Perumnas and Pagar Agung Health Centers with an IR of DHF > 49 per 100,000 population. The following is a map of the distribution of HI to the incidence of DHF from 2016 to 2019 in Lahat District. The results of statistical analysis (Table 1) it is known that there is a relationship between HI and the incidence of dengue hemorrhagic fever with a *p-value* = 0.007<0.05 and an *p-value* 0.007 of 0.583 which means the strength of the correlation is moderate, a positive value means that the higher HI value, the higher incidence of cases. DHF in Lahat Regency from 2016 to 2019.

Spatially (Figure 3) the distribution of CI in the period 2016 to 2019 only found 2 working areas of the public health center with a high transmission category in Lahat District, namely Pagar Agung Health Center working area in 2017 and Perumnas Health Center working area in 2016 and 2019 with IR DHF > 49 per year. 100,000 inhabitants.



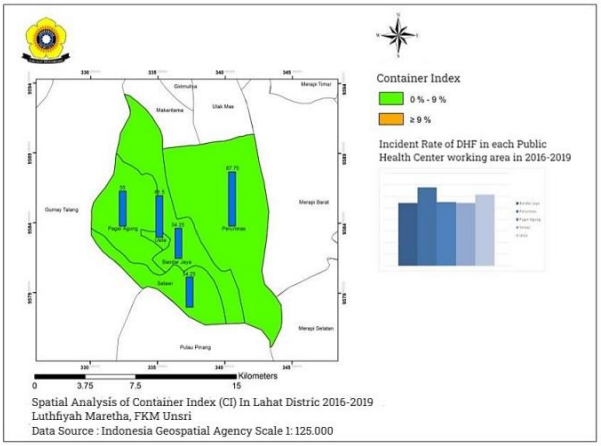
Source: Secondary Data of the Lahat Regency Health Office, 2016-2019

Figure 2. House Index (HI) Spatial Map of DHF Incidence 2016-2019 in Lahat District

The following is a map of the distribution of CI in the incidence of DHF from 2016 to 2019 in Lahat District. Statistical results (Table 1) it is known that there is a CI relationship (*p-value* = 0.007<0.05; r = 0.583) to the incidence of dengue hemorrhagic fever with moderate correlation strength, a positive value means that the higher CI value, the higher incidence of dengue cases in Lahat District 2016 to 2019.

Spatially (Figure 4) the distribution of BI in the period 2016 to 2019 did not find any Work areas in public health center with a high transmission category in Lahat District with an IR of DHF > 49 per 100,000 population. The following is a map of BI's distribution of DHF incidence from 2016 to 2019 in Lahat District. Statistical results (table 1) it is known that there is a relation between BI (*p-value* = 0.012<0.05; r = 0.548) to the incidence of dengue hemorrhagic fever with a moderate correlation of strength value, a positive value means the higher BI value, the higher incidence of dengue cases in the district. Look at the years 2016 to 2019.

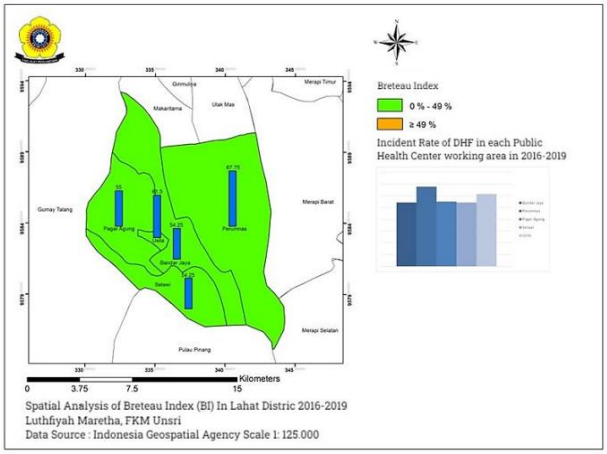
Spatially (Figure 5), the low distribution of LFR in the period 2016 to 2019 was mostly found in the work areas of the Pagar Agung, Selawi and Perumnas Health Centers. Figure 5 shows that IR > 49 per 100,000 population. The following is a map of the distribution of LFR for the incidence of DHF from 2016 to 2019 in Lahat District. Statistical results (Table 1) shows that there is no relation between LFR (p-value = 0.218 > 0.05) and the incidence of dengue hemorrhagic fever in Lahat District in 2016-2019.



Source: Secondary Data of the Lahat Regency Health Office, 2016-2019

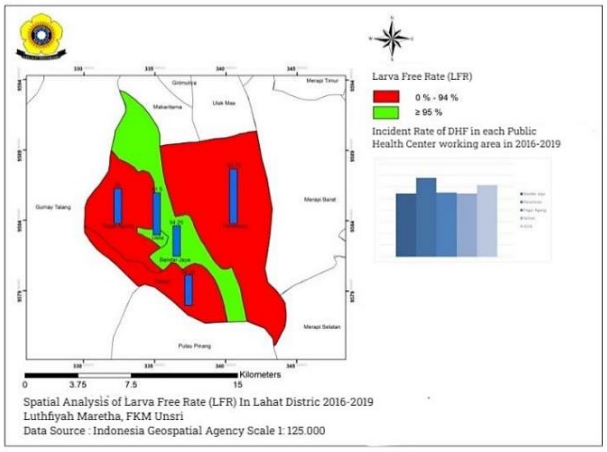
Figure 3. Container Index (CI) Spatial Map of DHF Incidence 2016-2019 in Lahat District

Table 1. above shows the result of the bivariate analysis in the rainfall, HI, CI, LFR variabel with the Dengue Hemorrhagic Fever.



Source: Secondary Data of the Lahat Regency Health Office, 2016-2019

Figure 4. Breteau Index (BI) Spatial Map of DHF Incidence 2016-2019 in Lahat District



Source: Secondary Data of the Lahat Regency Health Office, 2016-2019

Figure 5. Larva Free Rate (LFR) Spatial Map of DHF Incidence 2016-2019 in Lahat District

Table 1. Results of Analysis of the Relation among Rainfall, HI, CI, BI and LFR on the Incidence of Dengue Hemorrhagic Fever in Lahat District 2016-2019

Variable	Dengue Hemorrhagic Fever		
	n	*p-value*	r
Rainfall Years 2016-2019	48	0,003	0,417
HI Years 2016-2019	20	0,007	0,583
CI Years 2016-2019	20	0,007	0,583
BI Years 2016-2019	20	0,012	0,548
LFR Years 2016-2019	20	0,218	-0,288

Source: Secondary Data of the Lahat Regency Health Office, 2016-2019

DISCUSSION

An increase or decrease in the number of dengue fever from year to year has something to do with rapid urban population growth, population mobility followed by improved transportation facilities and infrastructure but not paying attention to strong vector population control.[8]

The high or low number of dengue cases is supported by several factors, including densely populated urban areas while Lahat District is an urban center area in Lahat Regency. The peak of dengue cases in Lahat District from January to December 2016-2019 shows that there were 38 cases in February 2016, there were 18 cases in 2017, there were 6 cases in 2018 there were 6 cases in 2018. there were about 14 cases in December 2019.

The heavy rainfall in Lahat District from 2016 to 2019 fluctuated for a month so that this supported the increase in the number of vectors of the Aedes aegypti mosquito and the potential for the transmission of dengue fever in the rainy season was also high. Besides that, it can also be affected by small rainfall and for a long time so that it can add mosquito breeding places and increase their population. Babita's study in India area shows that larvae are more often found in breeding places inside the house in the rainy season, larvae are found often in breeding places outside the house and natural breeding places.[9]

Rainfall can affect the increase in dengue cases, which is followed by an increase in air temperature and humidity, thereby increasing the breeding ground for the *Aedes aegypti* mosquito. This happens because the more breeding places the *Aedes aegypti* mosquito will also lay its eggs. The ideal temperature for transmission of dengue disease is 21.6°C – 32.9°C with humidity ranging from 79%.

High rainfall will increase the number of natural mosquito breeding places outside such as cans, used bottles, leaves that can accommodate rainwater.[10] The same thing was obtained from Lahdji's study which showed that there was a relationship between rainfall and the number of dengue cases in Semarang City for the 2006-2015 period.[11]

The House Index (HI) is the number of houses that are positive for larvae in the water reservoir from all the houses examined. According to WHO, high-risk area if an area has HI value 5%, while at low-risk if the HI value is < 5%.[1]

The relation between HI and the incidence of DHF is caused by the behavior of people who rarely drain the bath tub, do not cover the water reservoir, pay less attention to the clean environment around the house so that there is still garbage such as used bottles and cans, broken glass and pieces of bamboo so that it can trigger transmission. and the breeding of eggs into adult mosquitoes and eventually mosquitoes become vectors of dengue. This research is in line with Indriyani's research which states that there is a significant relation between HI and the incidence of DHF in Jepara District, Jepara Regency.[12]

Spatially, the distribution of CI was found in the working regions of public health center with CI in the category of low-risk of transmission. Meanwhile, the distribution of CI with the category of high transmission was only found in 2 work areas of public health center, namely the work regions of Pagar Agung Health Center in 2017 and the work area of Perumnas Health Center in 2016 and 2019. One of the causes of the high CI value in the work area of Perumnas Health Center and Pagar agung Health Center work regions where the community has an open container condition, so that it is easier for mosquitoes to enter and breed in water reservoirs. This situation is the same as water reservoirs that are not closed properly or not tightly. In such circumstances, mosquitoes prefer water reservoirs that are not closed properly because it makes the water reservoir darker and moister, so that mosquitoes will grow better.

In addition, the container with larvae shows the existence of larvae that have the potential to transmit dengue. The larvae found in the container indicated that the gravid female mosquito laid eggs in the container. Pregnant female signifies success in mating with male mosquito. Ae. aegypti at a time, capable of laying about 100-400 eggs and placed in the water container wall.[13] This is because the use of containers such as buckets as water reservoirs can be a protective factor against the presence of

mosquito larvae.[14]

Breteau Index (BI) is a calculation to find out the water storage containers inside and outside the house that were found to be positive for *Aedes aegypti* mosquito larvae from the house got inspected. According to WHO, the standard value for BI is 50%.[1]

Based on the results of the survey conducted by jumantik officers, it was found that the BI value in the working regions of the Lahat District Health Center had more than 1 larvae positive container in 1 house that was inspected. This means that the number of containers that have larvae is classified as varied, such as bathtubs, flower vases, used cans, barrels and so on. The results of this study are in line with Riandi's research which shows that there is a relationship between BI and the incidence of dengue hemorrhagic fever cases in Tawang District, Tasikmalaya City.[13]

Spatially the distribution of BI in 2016-2019 in Lahat District shows a high morbidity rate of dengue cases (> 49 per 100,000 population) mostly found in public health center working areas with BI with a low-risk category of transmission and no BI value with a high-risk of transmission in the area. Public health center work in Lahat District in 2016-2019. The low value of BI in all public health center working areas, is due to water storage/containers such as inside and outside houses found in people's home that have a low BI category. The Larva Free Rate (LFR) is an illustration of the density of the *Aedes aegypti* mosquito vector in an area. The parameter or indicator of the success of PSN DHF is if the LFR is 95% so it is hoped that the transmission of DHF can be prevented or controlled.

Several factors that influence the high value of LFR are to get a larva-free number, researchers use secondary data obtained from the public health center, so the need for validity of LFR data regarding larvae examinations has been carried out in accordance with the procedure. The research is in line with Yuliawati's research which shows that there is no correlation between the LFR and the incidence of dengue hemorrhagic fever in 2018 in Rowosari Health Center working area.[15]

Spatially, the distribution of larva-free numbers (LFR) in Lahat District in 2016-2019 shows that high DHF case morbidity rates (> 49 per 100,000 population) are mostly found in public health center working areas with low LFR (many larvae are found). Meanwhile, the low distribution of LFR in 2016-2019 was found in the work areas of Pagar Agung, Perumnas and Selawi Health Centers. The average LFR value for 2016-2019 is 89.3% below the national indicator of 95%.

The low value of LFR in the working area of Pagar Agung, Perumnas and Selawi Public Health Centers is due to the lack of community participation in eradicating mosquito nests (EMN) which is caused because people think that PSN is only carried out by larvae monitors from the public health center only. In addition, many people have asked for suggestions for fogging to anticipate dengue transmission, even though fogging is only able to kill adult mosquitoes, while larvae that breed in puddles can still grow into adult mosquitoes.

Until now vaccines and drugs for the DHF virus have not been found, so one of the main and most effective strategies to control DHF is to take preventive parameters by breaking the chain of transmission through the PSN-DHF movement. According to the Technical Instructions from the Ministry of Health, LFRs are obtained during Periodic Lartic Checks (PLC) which are carried out periodically at least once every 3 months by each public health center, especially in endemic villages/ward in breeding places for *Aedes aegypti* mosquitoes in 100 samples of houses/buildings randomly selected and repeated for each inspection cycle.[16]

CONCLUSION AND RECOMMENDATION

The conclusion in this research is there is a relation between rainfall, House Index (HI), Container Index (CI) and Breteau Index (BI) and there is no relation between LFR and DHF incidence in Lahat District in 2016-2019. While spatially, it was found that the high incidence of DHF was found in the working regions of the public health center with high HI (≥ 5%), low CI (< 10%), low BI (< 50%) and low larva free rate (< 95%). Suggestions for the Lahat District Health Office require that every public health center area in Lahat Regency, not only Lahat District, is to have a spatial picture of the distribution of DHF in their respective regions and it is hoped that the community, especially in

the work area of Pagar Agung, Perumnas and Selawi Health Centers, should be able carry out independently and routinely in mosquito nest eradication activities (PSN) which are by doing 3M Plus and paying more attention to containers or puddles around the house.

AUTHOR CONTRIBUTIONS

Rahmatillah Razak and Achmad Fickry compiled and designed experiments, Luthfiyah Maretha collected data, Luthfiyah Maretha and Rahmatillah Razak analyzed data and compiled manuscripts.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. WHO. Comprehensive Guidelines For Prevention and Control of Dengue and Dengue Haemorrhagic Fever: Revised and Expanded Edition. New Delhi: WHO, Regional Office for South East Asia. 2011.
2. Kemenkes RI. InfoDatin Demam Berdarah Dengue 2017. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018. [Internet]. Available from: http://www. pusdatin kemkes go id/download php. 2017.
3. BPS Kabupaten Lahat. Kabupaten Lahat Dalam Angka 2021. Kabupaten Lahat: Badan Pusat Statistik; 2021. [Internet]. Available from: https://lahatkab.bps.go.id/.
4. Mangguang MD, Sari NP. Analisis Kasus DBD Berdasarkan Unsur Iklim dan Kepadatan Penduduk Melalui Pendekatan GIS di Tanah Datar. *Jurnal Kesehatan Masyarakat Andalas*. 2017;10(2):166-171.
5. Widjajanti WW, Ayuningrum FD. Kepadatan Jentik Vektor Demam Berdarah Dengue di Daerah Endemis di Indonesia (Sumatera Selatan, Jawa Tengah, Sulawesi Tengah Dan Papua). *Indonesian Journal of Health Ecology*. 2017;16(1):1-9.
6. Maharani, N.E, Rohsulina P. Pengaruh House Index dan Maya Index Terhadap Kejadian Demam Berdarah Dengue di Kecamatan Grogol Kabupaten Sukoharjo Menggunakan Geographic Information System (GIS). *Jurnal Ilmu Kesehatan Masyarakat*. 2018;14(2):135-143.
7. Kemenkes RI. Infodatin Demam Berdarah Dengue 2017. Jakarta: Kementerian Kesehatan; 2018. [Internet]. Available from: http://pusdatin. kemkes. go.id/download. php.
8. Bisht B, Kumari R, Nagpal BN, Singh H, Kumar S. Influence of Environmental Factors on Dengue Fever in Delhi*. International Journal of Mosquito Research*. 2019;6(2):11-18.
9. Xiang, J., Hansen A., Liu, Q., Liu, X., Tong, M. X., Sun, Y., Cameron, S., Hanson-Easey, S., Han, G.-S . & Williams, C. Association between Dengue Fever Incidence and Meteorologic al Factors in Guangzhou, China, 2005-2014. *Environmental Research*.2017;(153):17-26.
10. Fitriana BR, Yudhastuti R. Hubungan Faktor Suhu dengan Kasus Demam Berdarah Dengue (DBD) di Kecamatan Sawahan Surabaya. *The Indonesian Journal of Public Health*. 2018;13(1):83-94.
11. Lahdji A, Putra BB. Hubungan Curah Hujan, Suhu, Kelembaban dengan Kasus Demam Berdarah Dengue di Kota Semarang. *MEDIKA*. 2017;8(1).
12. Indriyani Z, Rahardjo M, Setiani O. Hubungan Faktor Lingkungan dengan Persebaran Kejadian Demam Berdarah Dengue (DBD) di Kecamatan Jepara Kabupaten Jepara. *Jurnal Kesehatan Masyarakat*. 2017;3(3):842-850.
13. Riandi MU, Hadi UK, Soviana S. Karakteristik Habitat dan Keberadaan Larva Aedes Spp. Pada Wilayah Kasus Demam Berdarah Dengue Tertinggi dan Terendah di Kota Tasikmalaya. *ASPIRATOR-Journal of Vector-Borne Disease Studies*. 2017;9(1):43-50.
14. Restuti, C.T., Wahyuningsih, N.E & Hapsari, H. Hubungan Container Index dengan Kejadian Demam Berdarah Dengue di Semarang. *Jurnal Kesehatan Masyarakat*. 2017;9:43-50.
15. Yuliawati S, Saripudin A, Martini M, Saraswati LD, Hestiningsih R. Environmental Factors and Vector Density Analysis of Dengue Haemorrhagic Fever in Rowosari Health Center, Semarang. *European Journal of Molecular & Clinical Medicine*. 2021;7(10):2370-2377.
16. Prasetyowati A. Kajian Epidemiologi Keja-

dian Demam Berdarah Dengue di Wilayah Kerja Puskesmas Rowosari Kota Semarang. *Jurnal Manajemen Informasi dan Administrasi Kesehatan (JMIAK)*. 2019;2(2).

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Analysis of Stunting Phenomenon in Sragen Regency During The COVID-19 Pandemic from Economic Perspective

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ABSTRACT

The COVID-19 pandemic has hit all countries in the world including Indonesia. To prevent the spread of the virus, the PSBB and PPKM policies have been implemented and these policies have crippled economic activities which have an economy impact and food security. The purpose of this study was to analyze the effect of economic and food security during the COVID-19 pandemic on toddler stunting status including 1) knowing the relation of economy on food security, 2) knowing the effect of economic and food security. on toddler stunting. This research is an observational study with a cross-sectional design. The data in this study were data on children under five years old years old, family economic status, and family food security status. The population of this study was toddlers aged 0-5 in Sragen Regency in 2020. The sampling technique is cluster sampling. Data analysis used the Spearman correlation technique and binary logistic regression. The results of the study are 1) Economic status is related to food security (r = 0.637, *p-value* = 0.000), 2) Economic status affects stunting of children under five years old years old (B = 1.460; *p-value* = 0.006; OR = 4,307), 3) Food security affects the stunting of children under five years old years old (B = 5.028; *p-value* = 0.000; OR=152,660). Economic and food security affect toddler stunting in Sragen Regency during the COVID-19 pandemic. The incidence of stunting is still common in Indonesia, further research can be carried out to analyze other factors that influence stunting according to the conditions of the toddler area.

INTRODUCTION

Corona Virus Disease 19 (COVID-19) has spread to more than 122 countries including Indonesia. To deal with this problem, the government has implemented policies namely substantive policy (prevention) while focusing on Policy for economic growth.[1]

The pandemic caused by Corona virus does not only threaten public health but also social condition and economic growth In particular, the economy of the underprivileged which supported by daily income is really affected.[2,3,4] This has resulted in a sluggish economic condition of the community.

Currently, in addition to face the COVID-19 pandemic, the Indonesian government also still solve the stunting problem which is feared to be even worse due to Covid-19. The COVID-19 pandemic makes it possible for the number of stunting children (chronic malnutrition) in Indonesia to increase. It is predicted that the Stunting Reduction target until 14 will be difficult to achieve, considering that the integrated healthcare center known as Posyandu is no longer operating and health workers at the public health center (*Puskesmas*) are also not immune from the impact of COVID-19. In Indonesia, the policy on restricting social activities also impacts access to consumption, nutrition services, and routine health services for children.[5]

Before the pandemic occurred, Indonesia had already faced Malnutrition Problem, it was recorded that Indonesia was in the third position with the highest prevalence of stunting in the Southeast Asia Area. UNICEF predicts that there will be an increase in stunting children considering that many households in Indonesia have lost their economic income. The results of the Indonesian Toddler Nutrition Status Survey (*Survei Status Gizi Balita Indonesia*) in 2019 have shown that the prevalence of stunting has reached 27.67 percent. This means that for every ten children, 3 of them are stunted. This figure is also still above the World Health Organization (WHO) requirement, which is 20 percent.[6]

Several factors that influence the incidence of stunting under five years old years old are economic factors and food security.[7,8] Family economic status is the ability of family to fulfill the financial needs of all family members.[9] Food security is measured from the economic aspect based on food expenditure and measured from the nutritional aspect based on the fulfillment of adequate food consumption in energy units.[10]

The percentage of stunting in the Sragen Regency based on data from the Sragen District Health Office in 2020 has actually decreased which is in 2019 by 12.65% to 8.15% in 2020. However, based on the top 20 stunting data, there are several villages in the Sragen Regency that still have a percentage above 20, exceeding the availability of the WHO and expectations of the Indonesian government which targets the stunting rate to be below 14. Based on the description above, this study analyzes the influence of family economic status and food security status on the incidence of stunting under five years old in the Sragen Regency during the COVID-19 pandemic.

MATERIAL AND METHOD

This research is an observational study with a cross-sectional design. The research was conducted in Sragen Regency between April-August 2021. The population in this study was 56,034 toddlers aged 0-5 years recorded in the work area of the public health center in Sragen Regency. The sample size determination was calculated using the WHO sample size application and the minimum sample was 382. Samples were taken in 5 villages located in 3 sub-districts. The five villages are Pengkol Village and Kecik Village located in Tanon District, Geneng Village and Jeruk Village located in Miri District, and Jetak Village located in Sidoharjo District. The sampling technique is cluster random sampling.

The data used in this study are data of children under five years old, family economic status and family food security. The Data of toddlers are used to determine Stunting status of toddlers which is calculated using the WHO Anthro application. Data for toddlers includes gender, age, weight, height, arm circumference, and head circumference. The tools used to measure body weight are toddler scales and digital scales. Meanwhile, the measuring tools used to measure height are infant ruler, height meter, and measuring tape. The criteria for classifying stunted toddlers are if the height below -2 SD from the Z score based on the TB/U or BB/U index. Family economic data and food security status were obtained by giving questionnaires to parents of children under five years old. Before the ques-

tionnaire was given to respondents as a research sample, it is necessary to test the validity and reliability of the question items in the questionnaire. The validity and reliability test of the questionnaire was conducted on 30 respondents. The results are presented in Table 1. Based on the test results, all questions in the questionnaire are valid (the correlation test value is significant or *p-value* < 0,05) and reliable or valid (Conbrach Alpha test > 0.7). After obtaining the validity and reliability test, the questionnaire was given to 400 respondents. from the 400 questionnaires given to the respondents, only 387 were filled out completely. Therefore, for further data analysis, 387 data were used. Data were analyzed using Spearman correlation and binary logistic regression techniques. The results of the binary logistic regression test were said to be significant if the *p-value* < 0.05. This research has received permission from the Ethics Committee of Politeknik Indonusa Surakarta Number 0671/ DIII/INDO/VIII/2021.

RESULTS

The data from the results of research that have been carried out are summarized and shown in Table 2. Based on the summary data, it can be seen that the incidence of under-five stunting occurs mostly at the moderate level of education of the father (83.80%), the mother's education level is low (62.20%), the father's occupation private employees (37.80%), mother status is employed (85.10%), family income around 1.5 million – 3 million (48.60%), number of family members more than 4 (73%), low monthly food expenditure (78.40%), less food variety (91.90%), less food supply (100%), low family economy (60.880%), and low family food security (95.90%).

Table 1. Results of the Validity and Reliability of Questionnaire

Questionnaire	Validity Test Results		Reliability Test Results
	r	*p-value*	
Family Economic Status			
Father's Education	0.786	0.000	
Mother's Education	0.742	0.000	
Father's Occupation	0.788	0.000	0.702
Mother Status	0.524	0.003	
Family Income	0.871	0.000	
Number of Family Members	0.395	0.031	
Family Food Security			
Family Food Expenses	0.698	0.000	
Food Variety	0.900	0.000	0.735
Family Food Reserves	0.917	0.000	

Source: Primary Data, 2021

Furthermore, the Spearman correlation test was conducted between family economic status and family food security status with stunting status of children under five years old to determine the relation between these variables. The results of Spearman correlation test are presented in Table 3. The results of the Spearman correlation test showed that the family economic status and family food security status correlates with the stunting status of children under five years old (r = 0,543 and *p-value* = 0.005; r = 0,701 and 0,000). Family economic status also shows a correlation with family food security status (r = 0,637 and *p-value* = 0,000.

As these variables show a significant correlation with the status of stunted toddlers, these can be included in a binary logistic regression test to determine their effect on stunted toddlers. The results of the binary logistic regression test are presented in Table 4.

DISCUSSION

Based on the results of the Spearman correlation test shows that economic status is related to food security. Economic status has an important factor in the status of food security. This study's family economic statuswas based on the father's education, mother's education, father's occupation, mother's status, family income, and the number of families. Education, occupation, family income, number of families are variables that determine family food security.[11]

Economic hardship and low income affect household accessibility to food and thus affect daily eating patterns. A high economic status will ensure that the purchasing power of food is also high so that there are sufficient food reserves in the family. During the COVID-19 pandemic to ensure food security, the Indonesian government assisted families with low economic status. Through the *BLT (Bantuan Langsung Tunai)*,

Raskin (Beras Miskin), *PKH (Program Keluarga Harapan)*, MSME assistance, pre-employment, *BSU (Bantuan Subsidi Upah)* programs. It is expected to overcome food insecurity so that food security is maintained.

Tabel 2. The Results of The Respondents' Questionnaire Regarding Father and Mother's Education, Father's and Mother's Occupation, Family's Income, The Number of Family Members, Food Expenditure, Food Variety, Food Supply, Family Economic Status, and Family Food Security Status

Variable	Stunting Status of Toddlers			
	Stunted		Not Stunted	
	n = 74	%	n = 313	%
Father's Education				
Low (Primary to Secondary School)	12	16.2	10	3.2
Middle (High School)	62	83.8	256	81.8
High (Diploma – Bachelor)	0	0	47	15
Mother's Education				
Low (Primary to Secondary School)	46	62.2	16	5
Middle (High School)	28	37.8	267	85
High (Diploma – Bachelor)	0	0	30	10
Father's Occupation				
Unemployed	4	5.4	0	0
Laborer	25	33.8	9	2.9
Farmer/Breeder/Business	9	12.2	85	27.2
Private Employees	28	37.8	49	15.7
Police/Soldier	4	5.4	77	24.6
Teacher	4	5.4	63	20.2
Public Employees	0	0	7	2.2
Teacher	0	0	5	1.6
Civil Servant	0	0	18	5.8
Mother's Occupation				
Employed	63	85.1	90	28.8
Unemployed	11	14.9	223	71.2
Family's Income/Month				
< 1,5 million	35	47.3	9	2.9
1,5 million – 3 million	36	48.6	80	25.6
3 million – 5 million	3	4.1	184	58.8
5 million – 7 million	0	0	30	9.6
> 7 million	0	0	10	3.2
The Number of Family Members				
> 4	20	27	74	23.6
≤ 4	54	73	239	76.4
Food Expenditure/Month				
< 1 million (Less)	58	78.4	11	3.5
1-3 million (Moderate)	16	21.6	218	69.7
> 3 million (Large)	0	0	84	26.8
Food Variety				
Less	68	91.9	18	5.8
Medium	6	8.1	114	36.4
Many	0	0	181	57.8
Food Supply				
Less	74	100	146	46.6
Adequate	0	0	121	38.7
Many	0	0	46	14.7
Family Economic Status				
Low	45	60.8	13	4.2
Middle	29	39.2	248	79.2
High	0	0	52	16.6
Family Food Security Status				
Low	71	95.9	19	6.1
Middle	3	4.1	225	71.9
High	0	0	69	22

Source: Primary Data, 2021

The binary logistic regression test results showed that the family's economic status affected the stunting status of children under five years old (*p-value* < 0.05). The odds ratio is 4.307. This means that families with high family economic status will increase the number of children under five years old who are not stunted 4,307 times. This means that a high family economic status can prevent stunting in children under five years old.

The results of this study are the same as the results of previous studies. Income and education affect the incidence of stunting in children under five years old in Kualu Tambang Village, Kampar,[8] and the incidence of stunting in children under five years old in Teluk Betung subdistrict, Bandar Lampung City.[12]

The status of family food security also affects the stunting status of children under five years old (*p-value* < 0.05). The odds ratio is 152,660. This means that families with highfood security status will increase the number of children under five years old who are not stunted by 152,660 times. It can be interpreted that a high food security status can prevent stunting under five years old.

The results of research that have been carried out show good results. Food security will result in food insecurity and this will result in stunting for children.[13] Food security is also related to the incidence of stunting under five years old in Teluk Betung sub-district, Bandar Lampung City.[12] Food security is also associated with events in Rwanda.[7] Food security can help reduce child malnutrition that affects stunting in the iLembe district of South Africa's KwaZulu-Natal province.[14]

The incidence of stunting under five years old in this study mostly occurred in families with low economic status about 60.80% and medium economic status about 39.20%. There are no children under five years old who experience stunting for high economic status. High family economic status can fulfill family needs, especially family nutrition. During the COVID-19 pandemic, many family economies were disrupted, especially if the family's livelihood depended on the daily income, such as pedicab drivers, traders and day laborers. In addition, many industrial workers during the COVID-19 pandemic have been laid off.

This affects the decline of family income.[15] Loss of household income creates a high risk for a spike in malnutrition and micronutrient deficiencies between toddlers and children.[16] If this condition occurs continuously, it will decrease family income, which can cause stunting underfives to increase.[12] Because the family does not longer pay attention to the nutritional needs of the family.

The most important thing is that the family's food needs are fulfilled according to their purchasing power. This means that economic status factors can affect the occurrence of stunting in children under five years old. This incident also occurred in Bangladesh where children under 24 months were stunted due to economic factors.[17] Economic factors based on wealth index are also associated with stunting in Ethiopia.[18]

Good family food security will provide sufficient family food needs. In this study, the incidence of stunting in children under five years old mostly occurred in low family food security status 95.90%, and food security status for middle families was 3.10%. Meanwhile, families with high food security status do not have children under five years old who experience stunting.

Table 3. The Results of Spearman Correlation Test

Variable	Family Food Security	Toddler Stunting Status
Family Economic Status	r = 0.637 *p-value* = 0.000	r = 0.543 *p-value* = 0.000
Family Food Security Status		r = 0.701 *p-value* = 0.000

Source: Primary Data, 2021

Table 4. The Results of Binary Logistics Regression Test

Variable	B	*p-value*	OR	95% CI	
				Lower	Upper
Family Economic Status	1.460	0.006	4.307	1.517	12.227
Family Food Security Status	5.028	0.000	152.660	42.476	548.668
Constants	-8.608	0.000	0.000		

Source: Primary Data, 2021

Toddlers who did not experience stunting in this study were mostly in families with medium food security status about 71.90%, and high food security status about 22.00%. Only a small proportion of children under five years old about 6.10% are in families with low food security who do not experience stunting. Toddlers in families with high food security status will influence the fulfillment of energy and good nutritional intake.

A balanced and varied composition of nutritious food, both quality and quantity will support the growth and development of toddlers So that toddlers will avoid stunting. During the COVID-19 pandemic and the implementation of *PPKM (Pemberlakuan Pembatasan Kegiatan Masyarakat)*, it can result uneven distribution of food. The existence of an unequal distribution of food can cause food prices to rise due to reduced food supplies create food insecurity.[16,19]

The high demand for food that is not matched by a large food supply also makes food prices expensive so the purchasing power goes down. This can lead to a decrease in the quality and quantity of family nutritional intake.

The decrease in nutritional intake that occurs in toddlers can interfere with the growth and development of toddlers and make toddlers stunted. This means that family food security is a factor that can cause toddlers to experience stunting.[14,12] To improve food security during the COVID-19 pandemic, it can be done through financial and nutritional assistance programs.[19,20]

CONCLUSION AND RECOMMENDATION

During the COVID-19 pandemic, family economic status and family food security status affected the incidence of stunting. Toddlers will experience stunting if the family's economic status is low and food security is low. So that toddlers do not experience stunting, it is necessary to have assistance from various parties to help families with low economic status. So that families with low economic status can still fulfill the family's food needs and can provide nutritious food for toddlers. Based on the results of the study, the incidence of stunting under five years old was found in families with low economic status and low family food security, it was also found in families with low maternal education and mothers who did not work. Therefore, it is necessary to empower mothers who do not work to do farming techniques by utilizing the land around the house. This program can not only maintain family food security, it can also increase the family's economic income. Counseling on nutrition for toddlers also needs to be done considering that many mothers have low education.

There are many factors that influence the occurrence of stunting in toddlers, for further research, a more in-depth analysis can be carried out on the factors that influence the occurrence of stunting based on the condition of the area where the toddlers are located. Because the factors in each region that influence the occurrence of stunting can be different. By knowing the factors that can cause stunting in detail, it is hoped that it can help to prevent and reduce the incidence of stunting in toddlers.

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AUTHOR CONTRIBUTIONS

This study's contributions are as follows: author 1 composes and designs research and makes research articles. Author 2 takes care of legal licensing. Authors 1 and 2 collected data and analyzed the data.

CONFLICTS OF INTEREST

The author declares there is no conflict of interest. This study is only to find out whether economic conditions and food security during the COVID-19 pandemic affect the incidence of stunting in toddlers.

REFERENCES

1. Djalante R, Lassa J, Setiamarga D, Sudjatma A, Indrawan M. Review and Analysis of Current Responses to COVID-19 in Indonesia: Period of January to March 2020. *Progress in Disaster Scencei*. 2020;6:1-9.
2. Putri RK, Sari RI, Wahyuningsih R, Meikhati E. Efek Pandemi Covid-10: Dampak Lonjakan Angka PHK Terhadap Penurunan

Perekonomian di Indonesia. *Jurnal Bisnis Manajemen dan Akuntansi (BISMAK)*. 2020;1(1):50-55.

3. Pratap Singh R, Kataria R, Ul Haq MF. Letter to the Editor in Response to: COVID-19 Pandemic and Challenges for Socio-economic Issues, Healthcare and National Programs in India (Gopalan and Misra). *Diabetes & Metabolic Syndrome: Clinical Research Reviews*. 2020;14(5):841-842.
4. Nasution DAD, Erlina E, Muda I. Dampak Pandemi COVID-19 Terhadap Perekonomian Indonesia. *Jurnal Benefita*. 2020;5(2):212-224.
5. Has DFS, Ariestiningsih ES, Mukarromah I. Pemberdayaan Kader Posyandu dalam Program Pencegahan Stunting pada Balita di Masa Pandemi Covid-19. *Indonesian Journal of Community Dedication in Health (IJCDH)*. 2021;1(2):7-14.
6. Teja M. Stunting Balita Indonesia dan Penanggulangannya. *Pusat Penelitian Badan Keahlian DPR RI*. 2019;XI(22):13-18.
7. Weatherspoon DD, Miller S, Ngabitsinze JC, Weatherspoon LJ, Oehmke JF. Stunting, Food Security, Markets and Food Policy in Rwanda. *BMC Public Health*. 2019;19(1):1-13.
8. Wahyuni D, Fitrayuna R. Pengaruh Sosial Ekonomi dengan Kejadian Stunting pada Balita di Desa Kualu Tambang Kampar. *PREPOTIF Jurnal Kesehatan Masyarakat*. 2020;4(1):20-26.
9. Sumardi, Mulyanto dan Dieter H. *Kemiskinan dan Kebutuhan Pokok*. Jakarta: CV. Rajawali; 2005.
10. Saliem HP, Arianingsih E. Perubahan Konsumsi dan Pengeluaran Rumah Tangga di Perdesaan: Analisis Data SUSENAS 1999-2005. 2008;(70):1-17.
11. Njeri A. Socio-Economic Factors Affecting Food Security Among the Elderly. a Critical Literature Review. *Journal of Food Science*. 2021;2(1):51-64.
12. Wardani DWSR, Wulandari M, Suharmanto S. Hubungan Faktor Sosial Ekonomi dan Ketahanan Pangan terhadap Kejadian Stunting pada Balita. *Jurnal Kesehatan Poltekkes Tanjungkarang*. 2020;11(2):287-293.
13. Widiyanto A, Atmojo JT, Darmayanti AT. Pengaruh Faktor Kerawanan Pangan dan Lingkungan Terhadap Stunting. *INTEREST : Jurnal Ilmu Kesehatan*. 2018;8(1):61-66.
14. Drysdale RE, Bob U, Moshabela M. Coping Through a Drought: The Association Between Child Nutritional Status and Household Food Insecurity in the District of Ilembe, South Africa. *Public Health Nutrition*. 2021;24(5):1052-1065.
15. Peter Garlans Sina. Ekonomi Rumah Tangga di Era Pandemi Covid-19. *Journal of Management*. 2020;12(2):239-244.
16. UNICEF. COVID-19 and Children in Indonesia: An Agenda for Action to Address Socio-Economic Challenges. Jakarta: United Nations Children's Fund;2020;(May). Available from: https://www.unicef.org/indonesia/sites/unicef.org.indonesia/files/2020-05/COVID-19-and-Children-in-Indonesia-2020_0.pdf.
17. Rahman T, Chakrabarty S, Rakib M, Afrin S, Saltmarsh S, Winn S. Factors Associated with Stunting and Wasting in Children Under 2 Years in Bangladesh. *Heliyon*. 2020;6(9):1-7.
18. Ayelign A, Zerfu T. Household, Dietary and Healthcare Factors Predicting Childhood Stunting in Ethiopia. *Heliyon*. 2021;7(4):1-8
19. Picchioni F, Goulao LF, Roberfroid D. The Impact of COVID-19 on Diet Quality, Food Security and Nutrition in Low and Middle Income Countries: A Systematic Review of the Evidence. *Clinical Nutrition*. 2021:1-10
20. Reimold AE, Grummon AH, Taillie LS, Brewer NT, Rimm EB, Hall MG. Barriers and Facilitators To Achieving Food Security During the COVID-19 Pandemic. *Preventive Medicine Reports*. 2021;23:1-18.

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Monitoring Kidney Function Through the Use of Candesartan, Telmisartan or Valsartan Antihypertensive Therapy towards Patients CKD

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ABSTRACT

Chronic Kidney Disease (CKD) lower kidney function caused by an irreversible reduction in normal nephron function. Globally, CKD contributes to the cause of death. Activation of the Renin-Angiotensin-Aldosterone system is involved in the pathogenesis. ARBs have a cardiorenal protective effect. The purpose of this study was to determine the changes in kidney function with the use of Candesartan, Telmisartan or Valsartan antihypertensive therapies in CKD patients. This research method was a prospective observational cohort study looking at changes in kidney function (BUN and Serum Creatinine) at 1 and 6 months of using Antihypertensive Drugs Valsartan, Telmisartan, and Candesartan and tested by statistical analysis. The number of samples in this study was 72 patients which are 24 patients (Candesartan), 27 patients (Telmisartan), and 21 patients (Valsartan). The results showed that the Candesartan group experienced a decrease in average BUN of 0.13±0.85 mg/dl and serum creatinine of 0.004±0.09 mg/dl with independent t-test p=0.479 (p>0.05), Serum Creatinine p= 0.809 (p>0.05). The Telmisartan group experienced a decrease in average BUN of 4.74±5.16 mg/dl and serum creatinine of 0.33±0.20 mg/dl with Wilcoxon BUN test results p=0.000 (p<0.05), Serum Creatinine p=0.000 (p<0.05). In contrast, in the valsartan group, there was no change. So, it can be said that telmisartan has the highest effectiveness in kidney function (BUN and Serum Creatinine).

INTRODUCTION

Hypertension is a health problem because of the extensive prevalence rate so that an assessment of the use of antihypertensive drugs is needed because it is a potent killer disease in this world.[1] Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC), hypertension is defined as blood pressure 140/90 mmHg. Blood pressure above normal that is not handled properly will cause more severe complications, one of them is kidney disease.[1,2] Chronic Kidney Disease (CKD) is kidney damage that causes the kidney to be unable to remove toxins and waste products from the blood, which is characterized by the presence of protein in the urine and a decrease in the Glomerular Filtration Rate (GFR) that lasts for more than three months.[3] According to the Kidney Disease Outcomes Quality Initiative, stage V CKD damage kidney tissue or decreased GFR less than 15 mL/min/1.73 m2 for more than three months and undergoing hemodialysis (HD).[3] According to Riskesdas (2018), the prevalence of chronic kidney failure (now called CKD) in Indonesia to the patients aged fifteen years and over Indonesia, which was recorded based on the number of cases diagnosed by doctors about 0.2%.[4]

There is a strong relation between chronic kidney disease and high blood pressure, which can cause or worsen the other's conditions. High blood pressure will cause pressure in the kidney to increase, resulting in damage to the nephrons (increased interglomerular pressure) which can cause proteinuria (presence of protein in the urine). Blood pressure control is the cornerstone of the patient care with CKD and relevant throughout all stages of CKD regardless of the underlying cause.[5] So that blood pressure control is an essential aspect in the management of all forms of kidney disease.[6]

Antihypertensive drugs have a route of elimination through the kidneys. In conditions of renal failure, antihypertensive drugs can cause accumulation in the kidneys to worsen the renal prognosis. Therefore, special attention and action are needed, especially selecting antihypertensive drugs that are comfortable for the kidneys.[7] The treatment regimen recommended by the Eighth Joint National Committee and the Guidelines for Clinical Care Ambulatory, as the initial treatment option for chronic kidney disease with hypertension, is an antihypertensive Angiotensin-Converting Enzyme Inhibitor (ACEI) or Angiotensin Receptor Blockers (ARB) with the target blood pressure being achieved. 140/90mmHg. Efficient lowering of blood pressure can avoid vasoconstriction of blood vessels and reduce morbidity and mortality. Rational use of drugs, either alone or in combination, can lower blood pressure.[8] The use of ACEIs and ARBs as first-line drugs to treat hypertension and the treatment of disorders of cardiovascular system are numerous. Besides being effective as an antihypertensive, this drug also has another function as a renoprotector, to protect the kidney.[9]

Antihypertensive ARBs are widely used because they act as angiotensin II receptor antagonists by blocking the angiotensin II receptor type 1 (AT1) which mediates the effects of angiotensin II vasoconstriction, aldosterone release, antidiuretic hormone release and constriction of efferent arterioles from the glomerulus. ARBs have deficient side effects compared to other antihypertensive drugs. Research has shown that ARBs have cardiorenal protection. Losartan, candesartan, irbesartan, valsartan, telmisartan, olmesartan, and eprosartan have been approved for the treatment of hypertension. Antagonistic effect on Angiotensin II, this drug relaxes smoothly, causes vasodilation, increases salt and water excretion and reduces plasma volume.[10]

Based on the previous study reporting on the Irbesartan Diabetic Nephropathy Trial (IDNT) in hypertensive patients with diabetic nephropathy, their besartan group had a 37% lower risk than amlodipine for increasing serum creatinine (p<0.001) and 33% lower than the placebo group (p=0.003). Progression of end-stage renal disease was lower than Inberstand, amlodipine and placebo but did not reach statistical significance (p=0.07).[11] Another study also stated that in the study of Reduction of Microalbuminuria With Valsartan towards Patients With Type 2 Diabetes Mellitus, compared the anti-proteinuric effects of valsartan and amlodipine in patients with type 2 diabetes and microalbuminuria with blood pressure of 135/85 mmHg. The urinary albumin excretion rate in 24 weeks with valsartan 80 mg/day was 56% compared with 92% from baseline with amlodipine 5 mg/day (p<0.001). In addition, more patients returned to normal

buminuria with valsartan than with amlodipine (29.9% versus 14.5%, respectively; $p<0.001$).[12] Based on the description that has been explained, this study was conducted to determine the monitoring of changes in kidney function in the use of antihypertensive therapy candesartan, telmisartan and valsartan towards patients with chronic kidney disease.

MATERIAL AND METHOD

This type of study is a retrospective observational cohort by looking at changes in kidney function (BUN and Serum Creatinine) in the first month and sixth month 6 following the use of Antihypertensive Drugs Valsartan, Telmisartan and Candesartan in hypertensive patients with chronic kidney disease. Sampling was carried out using a non-probability sampling technique by means of Consecutive Selection.

Inclusion Criteria: Outpatients diagnosed with hypertension with CKD complications without hemodialysis aged 18 years at the Outpatient Polyclinic of Haji General Hospital Surabaya received antihypertensive therapy with Valsartan, Telmisartan, or Candesartan monotherapy who underwent laboratory tests of kidney function (BUN and serum creatinine). The data obtained from this study were 72 patients who met the inclusion criteria, consisting of 24 patients on candesartan therapy, 27 patients on telmisartan therapy, and 21 patients on valsartan therapy. Independent variable Valsartan, Telmisartan, and Candesartan. The Dependent variable is the Effectiveness of kidney function (BUN and Serum Creatinine).

Data analysis was performed using the SPSS statistical program. with the normality test before performing statistical tests. The form of research data in the form of intervals. For normality test using Shapiro Wilk and homogeneity test using Levene test. If it is customary to use an independent t-test, if not standard/inhomogeneous, use the Wilcoxon test. To test the comparison of the effectiveness of kidney function (BUN and Serum Creatinine) and the three antihypertensive drugs, the Kruskal-Wallis test was used. Prior to this research, the ethics committee test was conducted at the Ethics Committee Institute of the University of Surabaya, and it was declared ethically worthy without an ethics permit certificate 154/KE/I/2021.

RESULTS

The data obtained from the study were 72 patients who met the inclusion criteria consisted of 24 patients on candesartan therapy, 27 patients on telmisartan therapy, and 21 patients on valsartan therapy. From the observed data, the results of the patient characteristics are as follows:

Demographic Data of Research Subjects

The demographic data of the subjects in this study were observed in terms of several characteristics, including age, gender, BMI, and the degree of CKD stage. Demographic data of research subjects are presented in more detail in table 1.

From table 1, patient characteristics can be seen in terms of age classification, it is known that the highest frequency of patients diagnosed with hypertension with chronic kidney disease who were treated with antihypertensive Angiotensin Receptor Blockers (ARBs), Valsartan, Telmisartan, or Candesartan aged 56-65 years were 21 patients (29.17%). In bivariate analysis, *p-value*=0.561(> 0.05) which means that there is no significant relation between age and ARB therapy in the Candesartan, Telmisartan, and Valsartan groups given.

Based on the patient characteristics in terms of gender characteristics, it can be seen that there were 38 patients (52.78%) male and 34 patients (47.22%) female from 72 patients diagnosed with hypertension with chronic kidney disease who were treated with antihypertensive ARBs Valsartan, Telmisartan or Candesartan. In the bivariate analysis, the *p-value*=0.923(> 0.05) means that there is no significant relation between gender and the ARB therapy given to the Candesartan, Telmisartan, and Valsartan groups.

Based on the characteristics of research data in terms of Body Mass Index (BMI) can be seen from Table 1 shows that most of the normal BMI category about 42 patients (58.33%) of 72 patients diagnosed with hypertension with chronic kidney disease who were treated with antihypertensives ARBs. Valsartan, Telmisartan or Candesartan in bivariate analysis, *p-value* =0.108(> 0.05) which means that there is no significant relation between BMI and ARB therapy in the Candesartan, Telmisartan, and Valsartan

groups given.

Based on the characteristics in terms of the stage of CKD, patients diagnosed with hypertension with chronic kidney disease who were treated with antihypertensives ARBs who received Valsartan Therapy were dominated by 19 patients (90.48%), Telmisartan Therapy in the stage IV about 15 patients (55.55%) and Candesartan Therapy in the stage II about 14 patients (58.33%) with bivariate analysis obtained, *p-value*=0.000 (<0.05) which means that there is relation between the level of CKD stage and the therapy given.

From the analysis data on the use of antihypertensive Angiotensin Receptor Blockers (ARBs) on the effectiveness of kidney function, in Table 2 and 3, the results of these measurements showed that patients who used candesartan therapy, BUN, and initial serum creatinine obtained patients who used candesartan therapy with an average decrease in initial BUN of 15±2.74 mg/dl, Serum Creatinine 0.94±0.20 mg/dl after 6 months of therapy there was a change in kidney function to BUN 15.19±2.58 mg/dl, Serum Creatinine 0.94±0.17 mg/dl (Table 3) so that the average BUN decreased by 0.13±0.85 mg/dl and Serum Creatinine of 0.004±0.09 mg/dl (Table 2). The results of independent t-test on BUN levels were *p-value*=0.479(*p*>0.05), Serum Creatinine, *p-value*=0.809 (*p*>0.05). So, it can be concluded that after 6 months of therapy there was no difference in the effect of decreasing kidney function (BUN and Serum Creatinine) in hypertensive patients with chronic kidney disease who were treated with Candesartan.

Table 2. Average Decline in Kidney Function (BUN and Serum Creatinine) on the Use of Antihypertensive Therapy Angiotensin Receptor Blockers

Kidney Function	ARB Therapy		
	Candesartan	Telmisartan	Valsartan
BUN	0.13±0.85	4.74±5.16	0±0
Serum Creatinine (Cr)	0.004±0.09	0.33±0.20	0±0

Source: Primary Data, 2021

Table 1. Characteristics of Patients Diagnosed with Hypertension with Chronic Kidney Disease Who Were Treated with Antihypertensive ARB

Patient Characteritics	ARB Therapy			Total	*p-value*
	Candesartan	Telmisartan	Valsartan		
	n (%)	n (%)	n (%)	n = 72 (%)	
Age (Years)					
26- 35	5 (20.83)	2 (7.41)	0 (0)	7 (9.72)	0.561
36-45	5 (20.83)	5 (18.52)	5 (23.81)	15 (20.83)	
46-55	4 (16.67)	5 (18.52)	6 (28.57)	15 (20.83)	
56-65	6 (25)	9 (33.33)	6 (28.57)	21 (29.17)	
66-75	4 (16.67)	6 (22.22)	4 (19.05)	14 (19.44)	
Gender					
Male	12 (50.00)	15(55.55)	11 (5238)	38 (52.78)	0.923
Female	12 (50.00)	12 (44.45)	10 (47.62)	34 (47.22)	
Body Mass Index					
Thin	0 (0)	1 (2.20)	0 (0)	1 (1.38)	0.108
Normale	11 (45.83)	21 (77.78)	10 (47.62)	42 (58.33)	
Obesity	12 (50)	4 (14.82)	9 (42.86)	25 (34.72)	
Obesitas	1 (4.17)	1 (2.20)	2 (9.52)	4 (5.55)	
Stage degree CKD					
St. I	9 (37.50)	0 (0)	0 (0)	9 (12.50)	0.000
St. II	14 (58.33)	0 (0)	19 (90.48)	33 (45.83)	
St. IIIA	1 (4.17)	4 (14.82)	2 (9.52)	7 (9.72)	
St. IIIB	0 (0)	8 (29.63)	0 (0)	8 (11.11)	
St. IV	0 (0)	15 (55.55)	0 (0)	15 (20.83)	

Source: Primary Data, 2021

In patients receiving telmisartan therapy, the results of BUN and initial Serum Creatinine measurements were 34.07±10.59 mg/dl; Serum Creatinine 2.32±0.67 mg/dl after 6 months of therapy there was a change in kidney function to BUN 29.33±7.46 mg/dl, Serum Creatinine 1.99±0.64 so that the average BUN decreased by 4.74±5.16 mg/dl and Serum Creatinine by 0.33±0.20 mg/dl with Wilcoxon test results on BUN levels, *p-value*=0.000 (p<0.05), Serum Creatinine, *p-value*=0.000 (p<0.05), so it can be concluded that after 6 months of therapy there was a difference in the effect of decreasing kidney function (BUN and serum creatinine) in hypertensive patients with chronic kidney disease who were treated with Telmisartan.

DISCUSSION

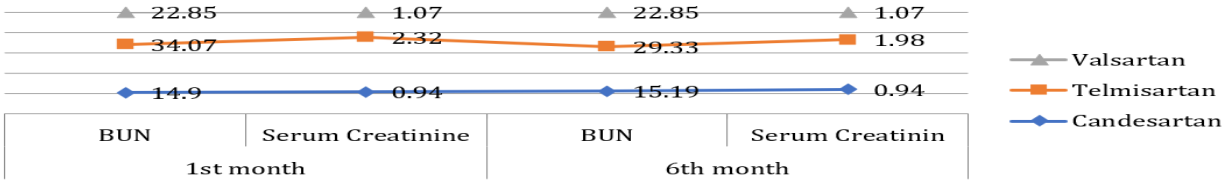
Patient characteristics can be seen in terms of age classification, it is known that the highest frequency of patients diagnosed with hypertension with chronic kidney disease who were treated with Antihypertensive Angiotensin Receptor Blockers (ARBs), Valsartan, Telmisartan, or Candesartan aged 56-65 years were 21 patients (29.17%). In bivariate analysis, *p-value*= 0.561 which means that there is no significant relation between age and ARB therapy in the Candesartan, Telmisartan, and Valsartan groups given. This is in line with research conducted by Udayani in 2017 in Bali.[13] Renal function will change with age. After 40 years, there will be a progressive decrease in the glomerular filtration rate until 70 years, approximately 50% of normal. With aging, the kidneys lose their ability to respond to acute fluid and electrolyte changes. About 50% of patients who develop CKD during hospitalization for medical or surgical problems are over 60 years old.[14]

Based on the patient characteristics in terms of gender characteristics, it can be seen that there were 38 patients (52.78%) male and 34 patients (47.22%) female from 72 patients diagnosed with hypertension with chronic kidney disease who were treated with antihypertensive ARBs Valsartan, Telmisartan or Candesartan. In the bivariate analysis, the *p-value*=0.923 means that there is no significant relation between gender and the ARB therapy given to the Candesartan, Telmisartan, and Valsartan groups. This means that male and female respondents have the same opportunity to receive the two combination therapies.[15,16] Basically, from some literature, it is explained that CKD patients are not influenced by gender, men and women have the same risk for suffering from CKD. According to the researchers in this study, there were more male respondents because it was caused by the lifestyle of male respondents who like to smoke and drink coffee, wherefrom interviews with respondents generally CKD was initiated by hypertension and some others suffered from a stroke, where the disease can lead to stroke. Caused by smoking and caffeine consumption. Prolonged hypertension can be a risk factor for CKD.[17]

Table 3. Mean Kidney Function (BUN and Serum Creatinine) Before and After the Use of Antihypertensive Therapy Angiotensin Receptor Blockers (ARBs) Treated with the Antihypertensive ARBs Valsartan, Telmisartan or Candesartan

Kidney Function	ARB Therapy								
	Candesartan			Telmisartan			Valsartan		
	Pre	Post	*p-value*	Pre	Post	*p-value*	Pre	Post	*p-value*
BUN	15 ± 2.74	15.19 ± 2.58	0.479	34.07 ± 10.59	29.33 ± 7.46	0.000	22.86 ± 1.35	22.86 ± 1.350	No Change
Serum Creatinine (Cr)	0.94 ± 0.20	0.94 ± 0.17	0.809	2.32 ± 0.67	1.99 ± 0.64	0.000	1.07 ± 0.23	1.07 ± 0.23	No Change

Source: Primary Data, 2021



Source: Primary Data, 2021

Figure 1. Mean Renal Function (BUN and Serum Creatinine) in Hypertensive Patients with CKD Treated with the Antihypertensive ARBs Valsartan, Telmisartan or Candesartan

Body Mass Index (BMI) can describe the level of adiposity or fat accumulation in a person's body. Excess fat in the body can cause health risks.[18,19] Based on the characteristics of research data in terms of BMI can be seen from Table 1 shows that most of the normal BMI category about 42 patients (58.33%) of 72 patients diagnosed with hypertension with chronic kidney disease who were treated with Antihypertensives ARBs. Valsartan, Telmisartan or Candesartan, in bivariate analysis, *p-value*=0.108 which means that there is no significant relation between BMI and ARB therapy in the Candesartan, Telmisartan, and Valsartan groups given. An increased BMI has been shown to increase the risk of developing pre-existing kidney disease, including diabetes and hypertension. Obese patients with chronic kidney disease have a higher rate of decreased glomerular filtration rate and Build End-Stage of Renal Disease (ESRD) more rapidly. an increase in BMI is an independent risk factor for the development of ESRD in obese individuals compared with normal weight.[20] Obesity is associated with an increased risk of developing chronic kidney disease. Renal plasma flow, renin–angiotensin–aldosterone system activity, and intraglomerular pressure are each increased in obesity and can cause kidney damage. Obesity also increases the risk of diabetes and hypertension, which are the most common causes of kidney disease.[21]

Based on the characteristics in terms of the stage of CKD, patients diagnosed with hypertension with chronic kidney disease who were treated with antihypertensives ARBs received Valsartan Therapy were dominated by 19 patients (90.48%), Telmisartan Therapy at stage IV about 15 patients (55.55%) and Candesartan Therapy at stage II about 14 patients (58.33%) with bivariate analysis obtained, *p-value* = 0.000 which means that there is a relationship between the level of CKD stage and the therapy given. Antihypertensives of the ARB working group by blocking the AT1 receptor, causing vasodilation, increasing Na + and fluids (reducing plasma volume), reducing vascular hypertrophy. Apart from blocking AT1, ARBs do not decrease the concentration of angiotensin II in the blood if more AT2 is stimulated by angiotensin II, which causes vasodilation and antiproliferative action.[7]

Analysis of the Use of Antihypertensives Angiotensin Receptor Blockers (ARBs) on the Effectiveness of Kidney Function

CKD is associated with increased activity of the RAAS. Reduced blood flow in the peritubular capillaries downstream from the sclerosis of glomeruli. As a result, the glomeruli in this Hypersecretion area of renin, thereby increasing circulating levels of angiotensin II. Angiotensin II has a direct vasoconstrictor effect, which increases systemic vascular resistance and blood pressure. Because there are fewer functioning glomeruli in CKD, each remaining glomerulus must increase the Glomerular Filtration Rate (GFR), increasing systemic arterial pressure helping to increase perfusion pressure and GFR.[10]

Antihypertensives of the ARB class is widely used because they can act as angiotensin II receptor antagonists by blocking the angiotensin II type 1 (AT1) receptor which mediates the effects of angiotensin II which are known in human, namely: vasoconstriction, aldosterone release, release of antidiuretic hormone and constriction of efferent arterioles from the glomerulus. ARBs have the lowest side effects compared to other antihypertensive drugs.

From the analysis data on the use of Antihypertensive Angiotensin Receptor Blockers (ARBs) on the effectiveness of kidney function, in Tables 2 and 3, the results of these measurements showed that patients who used Candesartan Therapy, BUN, and initial Serum Creatinine obtained patients used Candesartan Therapy with an average decrease in initial BUN of 15 ±2.74 mg/dl, serum creatinine 0.94±0.20 mg/dl after 6 months of therapy there was a change in kidney function to BUN 15.19±2.58 mg/dl, serum creatinine 0.94±0.17 mg/dl so that the average BUN decreased by 0.13± 0.85 mg/dl and serum creatinine of 0.004±0.09 mg/dl. The results of independent t-test on BUN levels were, *p-value*=0.479, serum creatinine *p-value*=0.809. So, it can be concluded that after 6 months of therapy there was no difference in the effect of decreasing kidney function (BUN and serum creatinine) in hypertensive patients with chronic kidney disease who were treated with candesartan.

The results of independent t-test on BUN lev-

els were, *p-value*=0.479, serum creatinine, *p-value*=0.80. So, it can be concluded that after 6 months of therapy there was no difference in the effect of decreasing kidney function (BUN and serum creatinine) in hypertensive patients with chronic kidney disease who were treated with candesartan.

In patients who received telmisartan therapy, the results of BUN and initial serum creatinine measurements were 34.07±10.59 mg/dl; serum creatinine 2.32±0.67 mg/dl after 6 months of therapy there was a change in kidney function to BUN 29.33±7.46 mg/dl, serum creatinine 1.99±0.64 so that the average BUN decreased by 4.74±5.16 mg/dl and serum creatinine by 0.33±0.20 mg/dl with Wilcoxon test results on BUN levels, *p-value*=0.000, serum creatinine *p-value*=0.000, so it can be concluded that after 6 months of therapy there was a difference in the effect of decreasing kidney function (BUN and serum creatinine) in hypertensive patients with chronic kidney disease who were treated with telmisartan.

Meanwhile, in patients using Valsartan Therapy, the results of the initial and final BUN and serum creatinine measurements did not change, so it can be concluded that there was no difference in the effect of decreasing kidney function (BUN and serum creatinine) in hypertensive patients with chronic kidney disease who were treated with Valsartan.

So, it can be concluded that of the three antihypertensive drugs of the Angiotensin Receptor Blocker (ARB), Valsartan, Telmisartan or Candesartan which have effectiveness in kidney function (BUN and serum creatinine) the best in outpatients with a diagnosis of hypertension with chronic kidney disease is telmisartan. Telmisartan is an angiotensin II receptor antagonist (ARB) used in the management of hypertension. Telmisartan is given orally. After giving a dose, the peak effect of lowering blood pressure is achieved within 3 hours and lasts for 24 hours. The maximum blood pressure-lowering effect occurs about 4 to 8 weeks after starting therapy.[22]

Telmisartan is rapidly absorbed from the gastrointestinal tract. Oral bioavailability is dose-dependent, about 42% after a 40 mg dose and 58% after 160 mg. Peak plasma concentrations of telmisartan is reached about 0.5 to 1 hour after an oral dose. Telmisartan is bound to plasma proteins more than 99.5%. Telmisartan has a long elimination half-life of 24 hours and a total clearance of more than 800 ml/min.[23] The choice of ARB therapy cannot be separated from various pharmacological considerations, including pharmaceutical, pharmacokinetic, and pharmacodynamic profiles.

The physicochemical properties of ARBs underlie differences in oral bioavailability, affinity, degree of dissociation, and even other effects that are not mediated by AT1 receptor binding. The tetrazole group in telmisartan is replaced by a carboxyl group, increasing lipophilicity and bioavailability compared to Candesartan. Telmisartan is 4′ - {[4 – Methyl – 6 - (1-methyl – 2 - benznidazole) – 2 – propyl – 1 bensimidazolyl] methyl} – 2 - biphenyl carboxylic acid with the empirical formula C33H30N4O2.[24] Telmisartan was the most lipophilic with a log *p-value* (partition coefficient) of 6.66; followed by Candesartan with a partition coefficient (logP) of 4.02 and valsartan with a partition coefficient of 3.68. Only the lipophilic of the circulating active drug is relevant for tissue penetration after the drug is absorbed. Lipophilicity of the active molecule is essential for distribution in the body.[25]

A recent meta-analysis of 20 randomized controlled trials of telmisartan performed primarily in diabetic patients concluded that telmisartan therapy may be effective in easing proteinuria or preventing its development. Telmisartan caused statistically significant reductions in percent change in urinary albumin/protein excretion and urinary albumin/protein to creatinine to telmisartan ratio relative to ARBs, AFIs, and other therapies by 20, 14, and 40%.[24] Other studies have also suggested that ARBs have renoprotection and this effect of telmisartan appears to be stronger than Losartan, Candesartan, or Olmesartan in the early stage of DN patients.[25]

There are also studies that show the results that creatinine is significantly reduced by 18% from baseline (p<0.05). On the use of telmisartan 40 mg once daily for 12 months and the reduction was significantly greater than in the amlodipine group (p<0.05).[22] So, in this study showed that telmisartan is effective in the progression of kidney function (BUN and Serum Creatinine) in

CKD patients. Based on the results of the study, the impact of public health, especially in health services, is to provide information to medical personnel about the effectiveness of using anti-hypertensive drugs so that they can improve the quality of services to the community and prevent disease progression.

CONCLUSION AND RECOMMENDATION

Therefore, it can be concluded that of the three antihypertensive drugs, the Angiotensin Receptor Blocker (ARB), Valsartan, Telmisartan, or Candesartan have the best kidney function effectiveness (BUN and Serum Creatinine) in outpatients with a diagnosis of hypertension with chronic kidney disease is telmisartan. The results of this study can provide information to health services in achieving the effectiveness of antihypertensive therapy in the progression of CKD patients.

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AUTHOR CONTRIBUTIONS

From the research process until the writing of this article, all authors played a role in this research. The correspondent author plays a role in compiling and designing research, the second author acts as a data analyzer, and 3rd author, 4th author, acts as data collection in the field.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Guirguis-Blake JM, Evans C V., Webber EM, Coppola EL, Perdue LA, Weyrich MS. Screening for Hypertension in Adults: Updated Evidence Report and Systematic Review for the US Preventive Services Task ForceGuirguis-Blake, Janelle M., et al. Screening for Hypertension in Adults: Updated Evidence Report and Systematic Review for the US. *JAMA - Journal of American Medical Association*. 2021;325(16):1657–1669.
2. Whelton PK, Carey RM, Aronow WS, Ovbiagele B, Casey DE, Smith SC, et al. 2017 Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults A Report of the American College of Cardiology/American Heart Association T. *American College of Cardiology Foundation and the American Heart Association*. 2017.
3. Jadoul M, Martin P. KDIGO 2018 Prevention, Evaluation and Treatment of Hepatitis C in Chronic Kidney Disease. *Kidney International Supplements*. 2018;8(3):91-165. [Internet]. Available from: https://kdigo.org/wp-content/uploads/2017/02/KDIGO-2018-Hep-C-GL.pdf
4. Kemenkes RI. Protokol Riset Kesehatan Dasar 2018. Jakarta: Kementerian Kesehatan Republik Indonesia; 2018.
5. Ku E, Lee BJ, Wei J, Weir MR. Hypertension in CKD: Core Curriculum 2019. *American Journal of Kidney Diseases*. 2019;74(1):120–131.
6. Tuot DS, Grubbs V. Chronic Kidney Disease Care in the US Safety Net. *Advances in Chronic Kidney Disease*. 2015;22(1):66–73.
7. Wang K, Hu J, Luo T, Wang Y, Yang S, Qing H, et al. Effects of Angiotensin-Converting Enzyme Inhibitors and Angiotensin II Receptor Blockers on All-Cause Mortality and Renal Outcomes in Patients with Diabetes and Albuminuria: a Systematic Review and Meta-Analysis. *Kidney and Blood Pressure Research*. 2018;43(3):768–779.
8. Chung EYM, Strippoli GFM. Aldosterone Antagonists in Addition to Renin Angiotensin System Antagonists for Preventing the Progression of CKD: Editorial Summary of a Cochrane Review. *American Journal of Kidney Diseases*. 2021;77(5):810–812.
9. Zhao M, Wang R, Yu Y, Chang M, Ma S, Zhang H, et al. Efficacy and Safety of Angiotensin-Converting Enzyme Inhibitor in Combination with Angiotensin-Receptor Blocker in Chronic Kidney Disease Based on Dose: A Systematic Review and Meta-Analysis. *Frontiers in Pharmacology*. 2021;12(6).

10. Kim-Mitsuyama S, Soejima H, Yasuda O, Node K, Jinnouchi H, Yamamoto E, et al. Cardiovascular and Renal Protective Role of Angiotensin Blockade in Hypertension with Advanced CKD: A Subgroup Analysis of ATTEMPT-CVD Randomized Trial. *Scientific Reports*. 2018;8(1):1–12.
11. Benjamin D. Granta, Chelsey A. Smithb, Philip E. Castlec, d, Michael E. Scheurere and RR-K. Trends in Antihypertensive Medication Monotherapy and Combination Use Among US Adults, NHANES 2005–2016. *Physiology & Behavior*. 2017;176(5):139–148.
12. Judge PK, Haynes R, Herrington WG, Storey BC, Staplin N, Bethel A, et al. Randomized Multicentre Pilot Study of Sacubitril/Valsartan Versus Irbesartan In Patients with Chronic Kidney Disease: United Kingdom Heart And Renal Protection (HARP)-III—Rationale, Trial Design and Baseline Data. *Nephrology Dialysis Transplantation*. 2016;32(12).
13. Udayani NNW, Riastini NW, Putra IMAS. Perbedaan Efektivitas Penggunaan Obat Amlodipin Tunggal dengan Kombinasi Amlodipin dan Lisinopril pada Pasien Hipertensi Rawat Inap di Rs 'X' Tabanan Tahun 2017. *Jurnal Ilmiah Medicamento*. 2018;4(02):128-133.
14. Corsonello A, Fabbietti P, Formiga F, Moreno-Gonzalez R, Tap L, Mattace-Raso F, et al. Chronic Kidney Disease in the Context of Multimorbidity Patterns: The Role of Physical Performance. *BMC Geriatrics*. 2020;20(1):1–12.
15. Dewi IK, Aminuddin M, Zulkarnain BS. Analysis Of Change In Nt-Probnp After Angiotensin Receptor Blocker (ARB) Therapy in Patient with Heart Failure. *Folia Medica Indonesia*. 2017;52(4):305.
16. Fandinata SS, Purnamayanti A, Utami PR, Surabaya AF, Farmasi PS, Farmasi F, et al. Efektivitas dan Keamanan Terapi Natrium Diklofenak dan Piroksikam pada Pasien Osteoarthritis di Puskesmas Kota Surabaya. *Jurnal Ilmiah Manuntung*. 2020;6(2):306–311.
17. Putri NRIAT, Rekawati E, Wati DNK. Relationship of Age, Gender, Hypertension History, and Vulnerability Perception With Physical Exercise Compliance in Elderly. *Enfermeria Clinica*. 2019;29:541–545.
18. Puspitasari DR, Setyabudi MT, Rohmani A. Hubungan Usia, Graviditas dan Indeks Massa Tubuh dengan Kejadian Hipertensi dalam Kehamilan. *Jurnal Kedokteran Muhammadiyah*. 2013;2(01)29-33:
19. Fandinata SS, Ernawati I. The Effects of Self Reminder Card to the Successful Treatment of Blood Pressure of Hypertension Patients in Community Health Centers in Surabaya. *STRADA: Jurnal Ilmiah Kesehatan*. 2020;9(2):831–839.
20. Benjamin Chun-Kit Tong. Associations Between Weight Loss, Kidney Function Decline, and Risk of ESRD in the Chronic Kidney Disease in Children (CKiD) Cohort Study. *Physiology & Behavior*. 2017;176(5):139–148.
21. Amanda D, Martini S. The Relationship between Demographical Characteristic and Central Obesity with Hypertension. *Jurnal Berkala Epidemiologi*. 2018;6(1):43.
22. Agrawal A, Kamila S, Reddy S, Lilly J, Mariyala MS. Effect of Telmisartan on Kidney Function in Patients with Chronic Kidney Disease: An Observational Study. *Journal of Drug Assessment*. 2016;5(1):24–28.
23. Bhava BS S, Subrahmanyam B S, Reddy Ch A, D A, K H, K S, et al. Efficacy of Telmisartan and Enalapril in Patients with Diabetic Nephropathy. *Advances in Obesity, Weight Management & Control*. 2019;9(2):53–57.
24. Burnier M, Lin S, Ruilope L, Bader G, Durg S, Brunel P. Effect of Angiotensin Receptor Blockers on Blood Pressure and Renal Function in Patients with Concomitant Hypertension and Chronic Kidney Disease: A Systematic Review And Meta-Analysis. *Blood Pressure*. 2019;29(6):358-354.
25. Khan MY, Pandit S, Abdulkutty J, Navasundi G, Hazra PK, Phadke U, et al. Effectiveness of Telmisartan on Blood Pressure Control in Hypertensive Patients in India: A Real-World Retrospective Study from Electronic Medical Records. *Cardiology and Therapy*. 2021;10(1):255–569.