Original Article

Blood Flow Rate, Dialysis Adequacy, Quality of Life among Hemodialysis Patients in Medan: A Cross-Sectional Analysis

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ABSTRACT

OBJECTIVE: To analyze the relationship between blood flow rate (Qb), hemodialysis adequacy (Kt/V and Urea Reduction Ratio [URR]), and quality of life in patients undergoing maintenance hemodialysis in Medan, Indonesia.

METHODOLOGY: This study used Pearson's correlation analysis, involving 82 hemodialysis patients selected via total sampling and conducted from May to October 2024. Data were collected through observation of hemodialysis parameters (Qb, Kt/V, URR) and the Kidney Disease Quality of Life-36 (KDQOL-36) questionnaire. Validity was assessed using the Pearson product-moment correlation, and reliability was assessed using Cronbach's alpha. Data were analyzed using descriptive statistics and the chi-square test.

RESULTS: The majority of patients (45%) underwent hemodialysis for less than 12 months. 56% had normal Qb values, 54% had inadequate URR values, 85% had insufficient Kt/V values, and 63% had a good quality of life. Cross-tabulation analysis of QoL with Qb, URR, and Kt/V values in the good quality of life category indicated that clinical adequacy parameters were not absolute predictors of patient well-being.

CONCLUSION: This study demonstrates a significant positive relationship between blood flow rate (Qb), hemodialysis adequacy (Kt/V and URR), and the quality of life of patients undergoing maintenance hemodialysis. Patients who achieved higher blood flow and adequate dialysis clearance reported markedly better well-being. These findings highlight that optimizing dialysis adequacy parameters is not only a clinical target but also a vital nursing responsibility for improving patients' physical, emotional, and social quality of life.

KEYWORDS: Blood Flow Rate; Hemodialysis; Life Style; Qualiti of Life; Ureum

INTRODUCTION

Chronic renal failure is characterized by a gradual decline in kidney function over months to years, typically resulting from severe and irreversible renal damage.[1] Degenerative disorders linked to the rising prevalence of chronic renal failure include diabetes mellitus, hypertension, coronary artery disease, and several others. Beyond degenerative conditions, factors such as unhealthy lifestyles, cultural influences, and shifts in socioeconomic status also contribute to the increasing incidence of chronic kidney disease.[2] The Indonesian Health Survey showed that the prevalence of chronic kidney disease diagnosed by doctors in Indonesia was 0.22% of the population, equivalent to 638,000 people. The prevalence of chronic kidney disease diagnosed by doctors in individuals aged 15 years and older was 638,178 cases. The prevalence of chronic kidney disease in North Sumatra was recorded at 0.17% of a population of 33,884[23]. The two primary methods of treating chronic kidney failure are kidney transplantation and dialysis, which require lifelong care.[3]

Hemodialysis is a renal replacement therapy for individuals with chronic kidney failure, performed through blood filtration using a dialysis machine. The procedure is typically performed two to three times per week, lasting about 4 to 5 hours per session, to eliminate waste products and maintain fluid balance.[4] Quality of life refers to a condition in which individuals experience satisfaction and fulfillment in their daily living. It encompasses various aspects, including physical, psychological, and spiritual well-being. When a person maintains good health in these domains, they are more likely to achieve life satisfaction.[5] Hemodialysis patients experience a lower quality of life than those treated with a kidney transplant, which can occur because hemodialysis patients have to go to the hospital for hemodialysis repeatedly.[6]

Quality of life plays a vital role in influencing both mortality and morbidity among CKD patients receiving hemodialysis. One factor that significantly contributes to this is hemodialysis adequacy, which helps determine the overall quality of life in these patients.[7]

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The effectiveness of hemodialysis depends on the fulfilment of hemodialysis volume according to patient needs. Evaluation of the success of hemodialysis dosing in patients can be seen from the level of hemodialysis adequacy achieved.[8]

Hemodialysis adequacy refers to the extent to which the prescribed dialysis dose is delivered during treatment. The effectiveness of the process can be assessed in two main ways. The first is to calculate the Urea Reduction Ratio (URR), which represents the proportion of urea removed from the blood and is determined by comparing pre- and post-dialysis urea levels. The second is by measuring Kt/V, a parameter that evaluates dialysis efficiency by relating urea clearance and treatment duration to the volume of distribution of urea in the patient's body fluids.[8]

Research reported by (Somji et al., 2020) shows that the achievement of adherence for HD 2 times a week with a Kt / V target of 1.8 is only 14% of patients who reach the Kt / V target, and for the URR target 80%, only 10% of patients reach the URR target.[9] This shows that there are still many dialysis doses that are not sufficient to achieve hemodialysis adequacy. If the dose is insufficient, there will be an accumulation of metabolized substances in the body that have the potential for toxicity and show signs and symptoms in all organ systems of HD patients.

One critical determinant of dialysis adequacy is the blood flow rate. Blood flow rate (Qb) is the velocity at which blood is delivered through the vascular access, measured in millilitres per minute (ml/min).[10] Qb is one of the crucial factors affecting clearance; the higher the blood flow velocity, the more blood will be processed during hemodialysis.[5] The patient's condition varies greatly, resulting in different QB (Quick of Blood) settings for each patient. Differences in each patient's blood setting will yield different blood values. The existence of various quick of blood values will affect the achievement of hemodialysis adequacy; the accomplishment of hemodialysis adequacy will also affect the quality of life of hemodialysis patients.

METHODOLOGY

Study Design

This research is quantitative and uses the Pearson correlation analysis method. The study population was patients with chronic kidney disease undergoing hemodialysis at a category C hospital in Medan. Data collection began from May to October 2024. The study sample used a total of 82 respondents.

Population and Sample

The study population consisted of 135 hemodialysis patients. The sample size was determined using the Slovin formula with a significance level (α) of 0.05 and a margin of error (e) of 0.05. A purposive sampling technique was used to obtain a sample of 82 patients. The inclusion criteria were no complications, hemodialysis for less than a year, and regular hemodialysis twice a week.

Instrument

Data collection included observation and questionnaires. The demographic questionnaire collected data on age, gender, education, marital status, occupation, and duration of hemodialysis. Observational data were collected using an observation sheet consisting of a complete blood count (CBC), a hemodialysis adequacy sheet including Kt/V and URR, and a Kidney Disease sheet. Quality of life assessment uses the Quality of Life Questionnaire (KDQOL-36). The validity of the KDQOL-36 was assessed using the Pearson product-moment correlation, with r values ranging from 0.70 to 0.82 for all questions (valid). Reliability was assessed using Cronbach's alpha (0.73). The questionnaire consists of 36 questions and is divided into five subscales: physical component summary, mental component summary, burden of kidney disease, symptoms and problems of kidney disease, and effects of kidney disease. The KDQOL-36 consists of 12 favourable and 24 unfavourable questions, each with a different score. Questions number (4, 5, 6, 7) have answer scores (1= 0, 2= 100), questions number (2, 3) have answer scores (1= 0, 2 = 50, 3= 100), questions number (12, 13, 14, 15, 16) have answer scores (1= 0, 2= 25, 3= 50, 4= 75, 5= 100), questions number (1, 8, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 36) have answer scores (1= 100, 2= 75, 3= 50, 4=25, 5= 0), questions number (11) has answer scores (1= 0, 2= 20, 3= 40, 4= 60, 5= 80, 6= 100), question number (9,10) has an answer score (1= 100, 2= 80, 3= 60, 4= 40, 5= 20, 6= 0). The total score is divided into poor patient quality of life (0-24), moderate (25-60), good (61-83), very good (84-99), and excellent (100).

The questionnaire was completed while the respondents were undergoing hemodialysis. Before completing the questionnaire, respondents were informed about the purpose, benefits, and disadvantages, and they could refuse if they felt uncomfortable during data collection. Minors were asked for parental consent and assistance. Respondents were asked to sign an informed consent form, and the researcher maintained the confidentiality of patient data. The respondents filled out the questionnaire themselves. If the respondents were unable to write, the researcher would read the questions and the respondents would select the answer items.

Data Analysis

This study used univariate and bivariate analyses in SPSS version 20. Univariate analysis describes the frequency distribution of age, gender, education, marital status, employment status and duration of hemodialysis. Bivariate analysis was conducted to examine the relationships between Quick of Blood, Urea Reduction Ratio, and Hemodialysis Adequacy with quality of life using the Chi-Square test.

Ethical Statement

This research complied with research ethics standards

and protected the rights of respondents. This study was approved by the Faculty of Nursing's Health Research Ethics Committee on May 8, 2021 (no: 152/ UN5.2.3.1/PPM/SPP-TALENTA USU 2021). All respondents provided written consent. The researcher maintained the confidentiality of the data and information provided.

RESULTS

Characteristics of Respondent

The study results describe the frequency distributions of demographic characteristics and the percentages of each variable, namely the description of blood quickness, hemodialysis adequacy, and the quality of life of hemodialysis patients. The results of the frequency distribution analysis of respondents (**Table I**) showed that the majority of respondents were aged > 46-65 years 42(51%), men 44(54%), with a high school education 35 (43%), married status 70 (85%), and duration of HD <12 months 37(45%).

Table I: Characteristics of respondents (n=82)

Characteristics	f	%
Age	17-25 years old	2(2.4)
	26-35 years old	8(9.7)
	36-45 years old	11(13.4)
	46-55 years old	21(25.7)
	56-65 years old	21(25.7)
Mean: 53.7	> 65 years old	19(23.1)
Gender	Male	44(53.6)
	Female	38(46.4)
Last Education	Elementary school	6(7.4)
	Junior high school	9(10.8)
	Senior high school	35(42.8)
	College	32(39.0)
Marital Status	Married	70(85.4)
	Widower/Widow	2(2.4)
	Unmarried	10(12.2)
Employment Status	Work	29(35.4)
	Not Working	53(64.6)
Undergoing HD	Less than 12 Months	37(45.2)
	1-3 years	22(26.8)
	> 3 years	23(28.0)

The results of data analysis in **Table II** show that more than half of the patients (56%) had normal Qb and good category (33%), with a mean Qb value of 218.78 ml/minute and a minimum-maximum range of 150-260 ml/m2. The average value indicates that most patients underwent hemodialysis with blood flow rates within the optimal range, as defined by clinical guidelines (200–300 mL/minute). This supports the efficiency of the blood cleansing process during therapy. The patient's URR values were in the range of 45.1–86.4%, with an average of 75.1 ± 9.14%. The adequacy classification of (54%) patients had inadequate URR (<65%), while (46%) had adequate URR values (≥65%). This indicates that almost half of the respondents had not achieved optimal urea clearance levels. The Kt/V values ranged from 1.0 to 2.0, with an average of 1.59 ± 0.23. Based on dialysis adequacy criteria, 15% of patients achieved Kt/V (≥ 1.2 or adequate category), while 85% of patients were still in the inadequate category (Kt/V < 1.2). These results indicate that most patients received an adequate dialysis dose to achieve clearance of toxic substances, as defined by international standards. The quality of life of hemodialysis patients, the majority of whom have a good quality of life, is assessed by 52 respondents (63%).

Table II: Quick of Blood, Urea Reduction Ratio, and Adekuasi Hemodialysis (n=82)

Variable	f	%
Quick blood		
Not Good	9	10.9
Normal	46	56.2
Good	27	32.9
URR		
Adequate	38	46.3
Inadequate	44	53.7
Kt/V		
Adequate	12	14.6
Inadequate	70	85.4
Quality of Life		
Moderate	23	28.1
Good	52	63.4
Very Good	7	8.5

	Minimum-Maximum	Mean	SD
Qb	150-260	218.78	27.76
URR	45.1-86.4	75.1	9.14
Kt/V	1.0-2.0	1.59	0.23

The analysis showed a significant relationship between blood flow velocity (Qb), hemodialysis adequacy (Kt/V and URR), and patient quality of life ($p < 0.05$). The relationship between Qb and Quality of Life showed that respondents with normal to good blood flow (61% and 65%) could improve their quality of life better than patients with low blood flow. The relationship between URR and Quality of Life showed that respondents with adequate URR (≥65%) had a higher quality of life than patients with low URR. This means that the better the dialysis machine's ability to clean urea from the blood, the better the patient's physical condition and the comfort of life. The relationship between Kt/V and Quality of Life showed that an adequate Kt/V value (≥1.2) was associated with a better quality of life. Patients who received a standard dialysis dose felt healthier and stronger and reported a more stable emotional state.

Table III: Relationship between Blood Flow rate (Qb), Hemodialysis adequacy (Kt/V and URR) and Quality of life (n=82)

Variable	KDQOL n(%)			Pv
	Very Good	Good	Moderate	
Quick blood				
Not Good	1 (14%)	5(72%)	1(14%)	0.004
Normal	4(9%)	27(61%)	13 (30%)	
Good	2(6%)	20(65%)	9(29%)	
URR				
Adequate	2(5%)	24 (63%)	12 (32%)	0.008
Inadequate	5(11%)	28 (64%)	11 (25%)	
Kt/V				
Adequate	1(5%)	13(59%)	8(36%)	0.015
Inadequate	6(10%)	39(65%)	15(25%)	

DISCUSSION

The results of this study indicate a significant positive relationship between blood flow rate (Qb), hemodialysis adequacy (Kt/V and URR), and patients' quality of life. These findings are consistent with KDIGO guidelines, which emphasize that maintaining adequate dialysis dose and optimal blood flow contributes to better treatment outcomes and quality of life. Therefore, achieving target values of Qb > 200 mL/min, URR ≥ 65%, and Kt/V ≥ 1.2 should remain a clinical priority to optimize patient well-being[24].

Based on the results of the study, the majority of respondents' Quick of Blood (QB) values were normal, with 46(56%) respondents having an average Quick of Blood (QB) value of 218.78 ml/min. This study is in line with research conducted by **Jia et al**.[11] which reported that the average blood flow rate (QB) in hemodialysis patients ranged from 272 to 333 mL/min, indicating that most patients received treatment within the clinically normal range. This study is also in accordance with **Yamamoto et al.**[12], who reported that 51% of patients undergo hemodialysis with blood flow rates ranging from 200 to 249 ml/min. This range is commonly applied in clinical practice and considered appropriate, as an increase in blood flow within the same treatment duration is associated with improvements in dialysis adequacy.

The effectiveness of achieving and maintaining optimal blood flow, however, does not rely solely on the machine setting but is influenced by a variety of patient-related and clinical factors. These include adequate nutritional status that supports vascular and hematologic stability, the presence of stable blood pressure during treatment, the absence of anemia which ensures sufficient oxygen transport and circulation, and the maintenance of normal fluid balance to prevent intradialytic complications. In addition, proper regulation of calcium and phosphate metabolism contributes to vascular health. In contrast, the condition and function of vascular access, whether an arteriovenous fistula or a catheter, along with the performance of the extracorporeal circuit, are essential for maintaining effective blood flow. Collectively, these factors determine the extent to which blood flow can be optimized to improve hemodialysis adequacy. This is supported by research **Ai et al.**[13] found that the higher the blood flow rate (Qb), the more blood is processed during hemodialysis therapy, thereby improving adequacy of dialysis. This is also supported by the results of research conducted by **Kaban et al.**[14], which found a significant relationship between the speed of blood flow and hemodialysis adequacy in patients receiving therapy in the hemodialysis room.

The respondents in this study were mainly adults aged 46–65, male, married, with more than half having a high school education and being unemployed. These demographic and socioeconomic characteristics differ from those of similar studies in developed countries, where patients tend to have higher levels of education and better access to healthcare resources. The combination of limited income, dependence on family support, and long-term fatigue from treatment may impact patient adherence to hemodialysis schedules and their overall perception of quality of life. The mean blood flow rate (218.78 mL/min) in this study falls within the moderate adequacy range commonly used in Indonesian dialysis centres, which differs from the higher Qb target (≥250 mL/min) applied in Western clinical settings. These contextual differences suggest that technological and systemic factors, such as the condition of vascular access, staff-to-patient ratio, and machine maintenance standards, may influence patient outcomes in developing countries.

Despite varying characteristics and resource constraints, optimizing dialysis parameters to maintain adequate Qb and URR can still significantly improve patients' perceived quality of life. These findings emphasize the role of nursing interventions in ongoing monitoring, patient motivation, and individualized education to address sociodemographic barriers that affect treatment adequacy.

The Canadian Association of Nephrology Nurses and Technologists states that the determination of blood flow rate (QB) or blood pump speed is adjusted according to the patient's level of comfort and the lumen size of the catheter or needle[15]. If the patient tolerates and feels comfortable at a QB of 180–200 mL/min, this setting is maintained unless clinical symptoms such as nausea, vomiting, cramps, fatigue, or hypothermia occur.

Kaban et al. also stated that the regulation of the patient's quick of blood does not have to be based on the patient's weight, but what nurses need to pay attention to is the patency of the vascular access.[14] The accuracy of adequate vascular access can drain blood optimally with no infection or redness of the vascular access (AV), no drop in blood pressure during the dialysis process and a strong drill/thrill (when pressing the vascular access, there is a strong blood flow or pulsation). Adequate blood flow velocity occurs because the patient is compliant with hemodialysis therapy, adheres to the doctor's diet

recommendations, and maintains patency of the vascular access. Nurses need strong skills and knowledge in hemodialysis management. The regulation of blood pressure during hemodialysis is critical and must be done accurately, tailored to each patient's needs. This aims to ensure that dialysis adequacy targets are optimally achieved.

Based on the study results, hemodialysis adequacy, as measured by Kt/V, is mostly inadequate; 60 (73.2%) respondents report inadequate Kt/V, and only 22(26.8%) report achieving hemodialysis adequacy. This is in line with research by **Hamidi et al.**[16], which found that before intervention, only 21.9% of patients achieved adequate Kt/V. In comparison, 78.1% were inadequate, indicating that most hemodialysis patients failed to meet adequacy targets. This study is also in accordance with Jia et al., who found that only 14% reached the Kt/V target of 1.8.[11] The hemodialysis adequacy value of each sample is not all the same because several factors affect hemodialysis adequacy, one of which is intradialysis time and dialysis duration.

According to **Ahmed et al.** [17] the longer the hemodialysis, the higher the hemodialysis adequacy. This is because the longer hemodialysis, more blood and fluid volume hemodialysis machine filters out a lot of blood and fluid so that the volume of blood and fluid takes longer to separate from the blood. This results in of higher filtered urea value and is followed by an increase in the hemodialysis adequacy value.

This is in line with the results of Somji et al. [9] who state that in Indonesia, hemodialysis adequacy can be achieved with a total hemodialysis dose of 10-15 hours per week. Patients who undergo hemodialysis 2 times/week are given a Kt/V target of 1.8. The results of this study indicate that only 26.8% of respondents can achieve adequacy with a Kt/V of 1.8 with an average hemodialysis adequacy of 1.59.

The hemodialysis undertaken by the research respondents was 2 times/week, with the length of time for each session lasting 4 to 5 hours. This indicates that it was sufficient for the recommended ideal time; however, some respondents did not reach the Kt/V target.[9] This is because many other factors can affect hemodialysis adequacy values, such as dialyzer surface area, type of vascular access, hematocrit levels, blood flow velocity (Qb), dializer, dose of heparinization, ultrafiltration, and Body Mass Index (BMI). The Qb factor and vascular access also play essential roles in achieving hemodialysis adequacy. Cimino/AV Shunt provides optimal access to improve the smoothness of blood flow (Qb), thereby optimizing urea clearance[12].

Based on the results of the study, the adequacy of hemodialysis using URR is inadequate among 44 respondents (53.7%) and 38 respondents (46.3%). This is in line with the results of **Yamamoto et al.** [12], which state that the target achievement of URR adequacy is achieved in 10% of patients. The average hemodialysis adequacy URR of respondents was 75.51%. This also has not reached the URR target set by **Somji et al.**[9], at 80%. According to **Alshraifeen et al.** [18], age factor, gender factor, dialysis patient diet factor (potassium value), hematocrit level factor, anticougulant dose factor, body mass index factor, dialysis frequency factor, length of dialysis session, and blood flow velocity factor (Quick of Blood) affect dialysis adequacy URR) in dialysis patients. The URR is assessed by blood urea analysis before and after dialysis; the URR value is closely related to factors that filter urea maximally, so that the post-dialysis urea value will be lower. Alshraifeen et al., also stated that the blood flow velocity factor (Quick of Blood) is the dominant factor affecting dialysis adequacy (Kt/V and URR) in dialysis patients[18].

also stated that the relationship between quick of blood and hemodialysis adequacy is that an increase in the value of quick of blood can help increase the URR, thereby achieving hemodialysis adequacy of the patient. However, not only is the quickness of blood value a factor in increasing URR, but nurses must also pay attention to the length of hemodialysis time, the quality of the dialysis machine, and the speed of dialysis. Plus, cooperation between nurses and patients to ensure optimal therapy discipline and dialysis adequacy.

It is emphasized that measuring urea levels is vital for assessing therapy in patients with end-stage renal failure. Urea is a byproduct of protein catabolism that is processed in the liver; when it accumulates in excess, it can lead to uremia, a toxic condition. The development of uremic syndrome marks the onset of systemic deterioration in patients with terminal kidney failure[8]. The results of urea after hemodialysis, which remain high, will cause several problems, such as malnutrition, which can lower Hb levels, increased susceptibility to infection, and a weakened immune system[3].

Based on the results of the frequency distribution analysis of the description of the quality of life of hemodialysis patients, the majority of the quality of life is good, with as many as 52 respondents (64.4%). This is also in line with the results of research conducted by **Nurdiana et al**. [19], which found that the majority of respondents had a good quality of life, with 56 respondents (80%). The quality of life of patients with chronic renal failure is very good or good. Patients who undergo hemodialysis therapy for an extended period feel the positive impact of therapy on their bodies and experience fewer symptoms related to routine therapy. This relates to the process of adaptation and acceptance of conditions. This is in line with research by **Rammang et al.**[20], which found that patients who undergo hemodialysis for longer periods tend to have a better quality of life because it makes them more aware of the importance of following a hemodialysis regimen, allowing them to benefit from treatment.

Patients who have been on hemodialysis for more than 12 months often report better quality of life, likely

because they've had time to adapt to their condition and the treatment routine.[21] Over time, they also perceive symptom relief from dialysis, which helps them resume daily activities. In contrast, individuals within their first year of hemodialysis frequently describe poorer quality of life, reflecting ongoing adjustment to lifelong therapy. Therefore, it is essential to have support and motivation from various parties to help kidney failure patients improve their quality of life. Patients who think positively while undergoing hemodialysis will ease the burden and improve their quality of life.[22] This is in line with research conducted by Alshraifeen et al. that family support can improve the quality of life of chronic renal failure patients undergoing hemodialysis therapy because the family is the first person, as well as the first helper, for patients in facing various difficulties[18].

This study has limitations, namely, the design used only examined the correlation between hemodialysis adequacy and patient quality of life. A quasi-experimental design is recommended to assess adequacy based on changes in laboratory results. The sample size was relatively small, and the observation period was short. Future research is recommended to examine the causal relationships among blood flow velocity, hemodialysis adequacy, and quality of life using longitudinal or interventional designs. Studies with larger sample sizes and involving multiple hemodialysis centres across various regions of Indonesia are needed to generalize the results. Further research is required to assess the psychosocial, cultural, and economic factors that influence patient adherence to therapy. Future research is also expected to evaluate the effectiveness of nursing interventions, such as patient education, self-management programs, and vascular access monitoring, in improving dialysis adequacy and overall patient quality of life.

CONCLUSION

The results of this study indicate a significant relationship between blood flow velocity (Qb), hemodialysis adequacy (Kt/V and Urea Reduction Ratio [URR]), and quality of life in patients undergoing regular hemodialysis ($p < 0.05$). Patients with higher blood flow velocities and dialysis adequacy values that meet the standards ($Kt/V \geq 1.2$ and $URR \geq 65\%$) have a better quality of life compared to patients who do not achieve the target. This confirms that the effectiveness of hemodialysis, as reflected by blood flow parameters and dialysis adequacy, plays a significant role in improving the physical, psychological, and social well-being of hemodialysis patients. The findings of this study emphasize the vital role of nurses in ensuring optimal hemodialysis adequacy. Nurses play an active role in monitoring vascular access function, maintaining stable blood flow during the procedure, and providing ongoing education to patients regarding adherence to therapy schedules, fluid restrictions, and dietary adherence. Effective collaboration between nurses, the medical team, and patients is necessary to achieve dialysis adequacy targets and improve patients' overall quality of life.

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AUTHOR CONTRIBUTION

Siregar CT: Data collection, research report writing.
Siregar RY: Data collection, research report writing, verified the analytical techniques
Tarigan M: Data collection, research report writing, verified the analytical techniques
Sitepu NF: Data collection, research report writing, verified the analytical techniques
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Bukit EK: Data collection, research report writing, contributed to ethical documentation, social-cultural and manuscript refinement.
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