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THE CORRELATION BETWEEN LIPID PROFILES WITH LENGTH OF STAY AND CLINICAL OUTCOMES OF ISCHEMIC STROKE PATIENTS AT PROF. Dr. I GOESTI NGOERAH GDE NGOERAH GENERAL HOSPITAL

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ABSTRACT

Ischemic stroke is a neurological condition due to the blockage of cerebral arteries or veins, leading to disrupted blood flow and oxygen supply to the brain. One of the causes of ischemic stroke is abnormalities in lipid profile levels. This study aims to determine the correlation between lipid profiles with the length of stay and clinical outcomes in patients with ischemic stroke. This study is cross-sectional research using secondary data from ischemic stroke patients admitted to Prof. Dr. I Goesti Ngoerah Gde Ngoerah General Hospital between January 1, 2021, and January 31, 2023, who meet the inclusion and exclusion criteria. Out of 215 study subjects included in this research, 137 (63.7%) were male, and 78 were female. Additionally, 192 (89.3%) were aged ≥ 45 years, and 23 (10.7%) were <45 years. Spearman's analysis showed a weak negative correlation between the length of stay and total cholesterol levels (r = 0.174, p = 0.010), LDL (r = 0.152, p = 0.026), and HDL (r = 0.141, p = 0.039), but no significant correlation was found with triglyceride levels (r = 0.020, p = 0.767). The results of this study also indicated a correlation between clinical outcomes and total cholesterol (p = 0.029) and LDL (p = 0.039), but not with triglyceride levels (p = 0.090) and HDL (p = 0.115). However, further research with a cohort method is needed to establish a direct correlation between lipid profiles with length of stay and clinical outcomes in ischemic stroke patients.

Keywords : Ischemic Stroke., Length of Stay., Outcome

INTRODUCTION

Several non-communicable diseases, such as stroke and cardiovascular disease, are currently experienced by many people.[1,2] Stroke itself has become the second most common cause of death and the third most common cause of disability in the world, especially in those of productive age and the elderly, so stroke is still a concern for the world community.[3] The incidence of stroke (including ischemic and hemorrhagic stroke) affects approximately 13.7 million people globally per year and causes 5.5 million deaths per year.[4,5] Riskesdas data in 2018 recorded that the prevalence of stroke in Bali reached 10.7%.[6]

In general, strokes can be hemorrhagic strokes and non-hemorrhagic strokes. According to the American Heart Association/American Stroke Association, ischemic stroke or non-hemorrhagic stroke is a neurological dysfunction caused by cerebral, focal retinal, or spinal infarction. According to the cause, ischemic stroke can include thrombosis stroke, embolic stroke, and systemic hypoperfusion or hypoperfusion stroke.[4] Meanwhile, hemorrhagic stroke can occur due to bleeding into the brain due to a ruptured blood vessel. Hemorrhagic strokes that occur can include intracerebral hemorrhage and subarachnoid hemorrhage.[7] Of all stroke incidents, almost two-thirds are ischemic strokes.[8] Ischemic strokes occur around 70-85% of the total stroke events.[4,9] Globally, there are more than 7.6 million new ischemic strokes recorded every year, with an estimated more than 77 million people alive today having experienced an ischemic stroke.[10]

Ischemic stroke occurs acutely with the influence of several risk factors that trigger the high incidence and clinical outcomes of ischemic stroke. These factors include modifiable risk factors and non-modifiable risk factors. One of these factors is lipid fraction abnormalities in the form of an increase in Low-Density Lipoprotein Cholesterol (LDL-C), triglycerides, total cholesterol, and a decrease in high cholesterol. High-Density Lipoprotein Cholesterol (HDL-C).[11,12] High levels of LDL, triglycerides, and total cholesterol can damage the blood vessels as they cause blockage and narrowing. This condition can worsen if there is a decrease in HDL, which is crucial in clearing deposits or plaque caused by total cholesterol, triglycerides, and LDL. Research has shown that stroke patients with low HDL levels tend to have worse severity and prognosis. In addition, high LDL levels can increase the risk of ischemic stroke and affect the outcomes after a stroke. The risk of stroke will increase by around 25% with an increase in total cholesterol levels of 1mmol/L or the equivalent of 38.7 mg/dL. This condition is inversely proportional to the

condition where there is an increase in HDL levels of 1 mmol/L will reduce the risk of stroke by up to 47%..[12]

Several studies have also discussed the relationship between lipid profile abnormalities and length of stay and clinical outcomes in ischemic stroke patients. According to a study by Saputri & Maulina (2018), the length of stay for ischemic stroke patients varies based on the description of the lipid fraction, including total cholesterol, triglycerides, LDL, and HDL. The study found a correlation between HDL, LDL, and total cholesterol with the length of stay, whereas triglycerides do not have a significant effect. The results of the study suggest that high LDL and total cholesterol levels and low HDL levels result in longer lengths of stay for ischemic stroke patients.[12] Research from Septianto (2020) states that during an episode of ischemic stroke, HDL levels have prognostic value regarding length of treatment, recurrent ischemic stroke, severe neurological dysfunction, and mortality.[13]

The purpose of this study is to identify and analyze the correlation between lipid profiles, length of stay (hospitalization), and clinical outcomes for individuals with ischemic stroke. The result of this study is anticipated to offer deeper insight to predict the prognosis and mitigate the complications of the patient with ischemic stroke.

MATERIAL AND METHOD

This study is an analytical observational research conducted with a cross-sectional approach and has been ethically approved [2023.01.1.0102] by the Research Ethics Commission Unit, Faculty of Medicine, Udayana University. The data was collected between January 1st, 2021, and January 31st, 2023. Ischemic stroke patient data will be filtered with inclusion criteria recorded by the medical record installation section of Central General Hospital Prof. Dr.

The inclusion criteria included patients who had been hospitalized at Prof. Ngoerah Gde Ngoerah General Hospital for their first ischemic stroke attack, age ≥18 years and ≤80 years, complete medical record data with laboratory examination results of blood lipid profile and clinical examination results of the patient starting from the time of treatment, ischemic stroke is the patient's main diagnosis. The exclusion criteria included patients who are hospitalized when there is a recurrent ischemic stroke or a history of previous strokes, patients with dyslipidemia without an ischemic stroke, patients are sent home not based on the doctor's indication but at the request of the patient and family or the patient is forced to go home, the patient is discharged from the hospital in a dead condition.

Samples were collected from eligible patients using purposive sampling, where patients who met the criteria were included sequentially with a total of 215 patients involved in this study. The collected data was analyzed using Statistical Package for the Social Science (SPSS) software for Windows version 26. The normality of the data was assessed using the Kolmogorov-Smirnov test, where it is considered to follow a normal distribution if the p-value is >0.05. The correlation analysis between lipid profile and length of stay was conducted using the Spearman correlation test (with a significance level of $\alpha = 0.05$). The correlation analysis between lipid profile and clinical outcome was conducted using the chi-square test.

RESULTS

The data collected comes from medical records of ischemic stroke patients hospitalized at Prof. Dr. I Goesti Ngoerah Gde Ngoerah General Hospital between January 1, 2021 and January 31, 2023. The characteristic data was analyzed using univariate analysis and presented in **Table 1**.

Table 1. Characteristics of Ischemic Stroke Patients

Variable	n (%)	Tahun		
		2021	2022	2023
Sex				
Male	137 (63.7)	57 (26.5)	75 (34.9)	5 (2.3)
Female	78 (36.3)	31 (14.4)	42 (19.5)	5 (2.3)
Age				
< 45 years	23 (10.7)	9 (4.2)	14 (6.5)	0 (0.0)
≥ 45 years	192 (89.3)	79 (36.7)	103 (47.9)	10 (4.7)
Length of Stay				
< 7 days	159 (74.0)	57 (26.5)	95 (44.2)	7 (3.3)
≥ 7 days	56 (26.0)	31 (14.4)	22 (10.2)	3 (1.4)
Total Cholesterol (mg/dL)				
Low (< 200)	140 (65.1)	60 (27.9)	72 (33.5)	8 (3.7)
High (≥ 200)	75	28	45	2

	(34.9)	(13.0)	(20.9)	(0.9)
Triglyceride (mg/dL)				
Low (< 150)	156 (72.6)	58 (27.0)	90 (41.9)	8 (3.7)
High (≥ 150)	59 (27.4)	30 (13.9)	27 (12.6)	2 (0.9)
LDL (mg/dL)				
Low (< 100)	58 (27.0)	27 (12.6)	25 (11.6)	6 (2.8)
High (≥ 100)	157 (73.0)	61 (28.4)	92 (42.8)	4 (1.8)
HDL (mg/dL)				
Low (< 40)	133 (61.9)	58 (27.0)	70 (32.6)	5 (2.3)
High (≥ 40)	82 (38.1)	30 (13.9)	47 (21.9)	5 (2.3)
Clinical Outcome				
without impaired physical function	66 (30.7)	30 (14.0)	34 (15.8)	2 (0.9)
with impaired physical function	149 (69.3)	58 (27.0)	83 (38.6)	8 (3.7)

Table 1 shows that out of these patients, 137 (63.7%) were male, and 78 (36.3%) were female. The age distribution of these patients revealed that 192 (89.3%) were above 45 years old, while only 23 (10.7%) were under 45 years old. The number of ischemic stroke patients who underwent hospitalization for less than seven days was 159 people (74%), while ischemic stroke patients who underwent hospitalization for seven days or more were 56 people (26%). This study found that 66 patients (30.7%) had improved clinical outcomes without impaired physical function after hospitalization, while 149 patients (69.3%) had improved clinical outcomes but with physical function impairments. Physical function impairments include hemiparesis (flaccid or spastic), paresis (cranial nerves VII or XII), hemiplegia, plegia, hemihypesthesis, aphasia, and several other physical impairments.

Table 2. Distribution of Lipid Profiles in Ischemic Stroke Patients

Lipid Profile (mg/dL)	Mean ± SD
Total cholesterol	182.52 ± 47.22
Triglyceride	125.68 ± 51.90
LDL	128.61 ± 43.87
HDL	58.31 ± 8.54

Based on **Table 2**, the data illustrates that the average total cholesterol level of patients was 182.52 ± 47.22 mg/dL, triglyceride level was 125.68 ± 51.90 mg/dL, LDL level was 128.61 ± 43.87 md/dL, and HDL level was 58.31 ± 8.54 mg/dL.

Table 3. Normality Test of Ischemic Stroke Patient Data

Variable	*Kolmogorov-Smirnov**	P*
Total cholesterol	0.055	0.200
Triglyceride	0.040	0.200
LDL	0.048	0.200
HDL	0.045	0.200
Length of stay	0.248	<0.001

Note: *Based on Kolmogorov-Smirnov Test

Table 3 presents the results of the normality test conducted on the data of ischemic stroke patients used in this study. The test results indicated that the significance value (p-value) for total cholesterol levels of 0.200 ($p > 0.05$), triglycerides 0.200 ($p > 0.05$), LDL 0.200 ($p > 0.05$), HDL 0.200 ($p > 0.05$) which implies that the data follows a

normal distribution. On the other hand, the length of stay had a p-value < 0.001 (p < 0.05), meaning that it does not follow a normal distribution.

Table 4. Correlation Test of Lipid Profile withLength of Treatment for Ischemic Stroke Patients

Variable	r_s*	P*
Total cholesterol	-0.174	0.010
Triglyceride	-0.020	0.767
LDL	-0.152	0.026
HDL	-0.141	0.039

Note: *Based on Spearman's Correlation Test

Based on the statistical tests performed on the lipid profiles of ischemic stroke patients, as listed in **Table 4**, there is a significant correlation between total cholesterol levels, LDL levels, and HDL levels with the length of stay in the hospital. The p-values of these correlations are >0.05, so the null hypothesis (H0) is rejected. On the other hand, the statistical test results for the correlation between triglyceride levels and length of stay in the hospital has a p-value of 0.767 (p>0.05), which means that the null hypothesis (H0) is accepted, indicating that there is no significant correlation between triglyceride levels and length of stay for ischemic stroke patients. The strength of the correlation between lipid profile and length of care in this study was weak.

Table 5. Correlation Test of Lipid Profile with Clinical Outcomes of Ischemic Stroke Patients

Lipid Profile (mg/dL)	without impaired physical function	with impaired physical function	Total	P value
	n (%)	n (%)	n (%)	
TC				
Low (<200)	50 (23.3)	90 (41.9)	140 (65.2)	0.029
High (≥200)	16 (7.4)	59 (27.4)	75 (34.8)	
TG				
Low (<150)	53 (24.7)	103 (47.9)	156 (72.6)	0.090
High (≥150)	13 (6.0)	46 (21.4)	59 (27.4)	
LDL				
Low (<100)	24 (11.2)	34 (15.8)	58 (27.0)	0.039
High (≥100)	42 (19.5)	115 (53.5	157 (73.0)	
HDL				
Low (<40)	46 (21.4)	87 (40.5)	133 (61.9)	0.115
High (≥40)	20 (9.3)	62 (28.8)	82 (38.1)	

Note: *Based on Chi-Square test, TC = Total Cholesterol, TG = Triglyceride

Table 5 shows the results of the statistical tests. The analysis reveals that the total cholesterol and LDL have a p-value <0.05, with significance values of 0.029 and 0.039, respectively. It means that H0 is rejected, and there is a significant relationship between total cholesterol levels and LDL levels in clinical outcomes in ischemic stroke patients. On the other hand, the triglyceride levels and HDL levels have a p-value>0.05, with significance values of 0.090 and 0.115, respectively. Therefore, H0 is accepted, implying that there is no significant relationship between triglyceride levels and HDL levels in the clinical outcomes of ischemic stroke patients in this study.

DISCUSSION

This study found that ischemic stroke was more common in men than in women, with 137 male subjects (63.7%) and 78 female subjects (36.3%). These results are consistent with a previous study by Saputri & Maulina (2018), which also reported a higher incidence of stroke in men (63.3% men and 36.7% women out of 98 patients).[12] Another study by Ayudia & Imran

(2023) also found more male patients than female patients.[14] Sex steroid hormones, especially estrogen, have an impact on biological processes that explain gender-based variations in the occurrence of ischemic stroke. Endogenous estrogen functions as a neuroprotective agent and provides natural protection for women. Estradiol's primary function is to promote blood flow and dilatation, whereas testosterone has the opposite effect. Apart from its effects on blood vessels, estrogen also has a significant anti-inflammatory function that is influenced by anti-oxidant and anti-apoptotic properties.[12] The incidence of ischemic stroke in men is high in some adults. However, it's important to note that the incidence of ischemic stroke in middle-aged women also increases due to the secondary impact of menopause and the decline in sex hormones. After menopause, the risk of ischemic stroke doubles compared to before menopause.[15]

Most of the ischemic stroke patients who were subjects in this study were aged ≥ 45 years, namely 192 people (89.3%) with a mean of 58.31 ± 11.25 years. The results of these age characteristics are almost the same as several studies, such as those conducted by Saputri & Maulina (2018), namely that the average age of ischemic stroke patients in BLUD RSU Cut Meutia, North Aceh Regency is 59.50 years.[12] Research by Nawaz et al. (2019) reported that there were 233 (60.5%) ischemic stroke patients aged 50 – 60 years, while there were 152 (39.5%) patients aged 15 – 49 years.[16] As a person ages, changes occur in the structure and function of both micro and macro circulation. These changes are related to the mediation of endothelial dysfunction, which causes neuroinflammation, impaired cerebral autoregulation, leading to microvascular injury, and neurovascular disorders, causing decreased cortical function. Therefore, aging is associated with changes in intracranial and extracranial cerebral arteries that play a role in the risk of ischemic stroke.[17] Ischemic strokes can occur in younger individuals, but they are less frequent when compared to older people. Numerous risk factors, including inheritance, congenital conditions, comorbidities, lifestyle choices, and other factors, can impact the pathogenesis of ischemic stroke in young individuals.[18]

Based on the data in this study, a correlation was sought between the lipid profile and length of stay and clinical outcomes of ischemic stroke patients, especially those undergoing inpatient treatment at Prof. Dr. I Goesti Ngoerah Gde Ngoerah General Hospital in the period 1 January 2021 – 31 January 2023. Based on the statistical test results, it was discovered that there is a significant correlation between total cholesterol levels and the length of stay for ischemic stroke patients. This was indicated by the significance value (p-value) of 0.010 ($p < 0.05$) which means that the null hypothesis (H0) was rejected. These findings are consistent with the results of Saputri & Maulina's (2018) research which also states that there is a significant relationship between total cholesterol levels and the length of treatment, with a significance value (p-value) of 0.001 ($p < 0.01$).[12] The statistical test revealed a weak negative correlation which means lower total cholesterol levels are associated with longer patient stays in the hospital, while higher levels of cholesterol are associated with shorter stays. These findings differ from those of various other studies, which suggest that a rise in total cholesterol and a decrease in HDL levels can impede the post-stroke recovery process, affect the severity of the disease, patient clinical outcomes, and also increase the incidence of death due to ischemic stroke.[19,20] Furthermore, based on the results of statistical tests in this study, the correlation between total cholesterol and clinical outcomes of ischemic stroke patients obtained a significance value (p-value) of 0.029 ($p < 0.05$), which means that the null hypothesis (H0) was rejected so that there was a significant correlation between total cholesterol levels and clinical outcomes of ischemic stroke patients after undergoing inpatient. Total cholesterol levels including LDL, HDL, and triglycerides, are a predictor of clinical outcomes for ischemic stroke patients. High cholesterol levels contribute to the development of atherosclerosis, which in turn leads to ischemic stroke.[21,22] The severity of cerebral blood vessel blockage in ischemic stroke patients increases with higher total cholesterol levels, leading to continuous hypoxia and brain tissue death.[23] However, research from Wang et al. (2017) also stated that low total cholesterol levels also influence on poor prognosis and increased mortality rates.[23] Cholesterol is crucial in the body's metabolism, so low total cholesterol levels indicate malnutrition or inflammation related to poor quality of life and functional status after stroke. Cholesterol also plays a role in the integrity of blood vessels and preventing ruptures, so adequate total cholesterol levels are needed. Therefore, high total cholesterol levels pose a risk for vascular problems, whereas low total cholesterol levels contribute to poor clinical outcomes in ischemic stroke patients.[19,23] The healing process, length of treatment, and clinical outcomes of ischemic stroke patients can be complex and influenced by various factors, including genetics, therapy, pathophysiology, and sociodemographic. It is essential to monitor these factors as they can alter and affect the patient's overall health.[24]

According to the research findings, there is no significant relationship between the levels of triglycerides and the length of stay or clinical outcomes for ischemic stroke patients after hospitalization. The p-value for the correlation between triglycerides and length of stay was 0.767 ($p > 0.05$), which means that the null hypothesis (H0) is accepted. According to Saputri & Maulina's (2018) research, there was also no statistically significant relationship between triglycerides and length of treatment ($p>0.01$, significance value=0.096).[12] For the relationship between triglyceride levels and clinical outcomes, the p-value was 0.090 ($p > 0.05$), and the null hypothesis was accepted, indicating no significant relationship. Triglyceride levels did not show a significant correlation with either length of stay or clinical outcomes in ischemic stroke patients. This could be due to the limited sample size or uncontrolled variables in this study, such as the patient's diet, the likelihood of malnutrition, fasting before lipid profile measurements, or obesity. Nutrition and the body's metabolic functions have an impact on triglyceride levels. Triglyceride levels might rise as a result of unhealthy lifestyle choices such as excessive alcohol consumption, lack of physical activity, overeating, and other unhealthy lifestyles.[19] Studies examining the association between triglyceride levels and the severity and incidence of ischemic stroke indicate that triglyceride levels play a significant part in the development of atherosclerosis and the depletion of cerebral blood vessel reserve capacity.[19,25,26] Triglycerides undergo hydrolysis and are then absorbed into the plasma in two distinct forms including intestine absorption as chylomicrons and liver-formed Very Low-Density Lipoprotein (VLDL) absorption. Insulin resistance-induced high triglyceride levels may affect blood glucose metabolism and lead to dyslipidemia. Consequently, triglycerides are associated with insulin resistance and metabolic syndrome, which will generate

pro-inflammatory cytokines and pro-thrombotic reactions that induce atherosclerosis. This illness will raise the death rate for those who have an ischemic stroke and exacerbate the brain damage that results from the stroke.[19,26,27] However, triglycerides also have a role as a source of energy reserves, so low triglyceride levels can be an indicator of malnutrition in ischemic stroke patients. Malnutrition after acute ischemic stroke represents a poor prognosis and risk of mortality in ischemic stroke. In addition, triglyceride is a protective factor against lipotoxicity produced by saturated fatty acids and vascular endothelial integrity.[23,28] Therefore, both low and high triglyceride levels are associated with poor clinical outcomes after acute ischemic stroke.[28]

The study showed that there is a significant correlation between LDL levels and the length of stay for ischemic stroke patients, with a p-value of 0.026 ($p < 0.05$). That means the null hypothesis (H0) was rejected. Similar results were found in the research by Saputri & Maulina (2018) with a p-value of 0.006 ($p < 0.01$), and Ayudia & Imran (2023) also obtained the same results with a p-value of 0.042. These studies show a significant correlation between LDL cholesterol levels and length of stay.[12,14] The study found a weak negative correlation between LDL levels and the length of stay in ischemic stroke patients. That implies lower LDL levels can result in longer treatment times, while higher LDL levels can lead to shorter treatment times. These findings differ from those of previous studies that suggested low LDL levels were beneficial as they reduced the risk of coronary heart disease, stroke severity, and patient mortality rates. However, research has also shown that extremely low LDL levels can result in side effects such as hemorrhagic stroke, dementia, depression, hematuria, and cancer.[29] The statistical test results have shown that there is a significant correlation between LDL levels and the clinical outcomes of hospitalized ischemic stroke patients . The obtained significance value (p-value) was 0.039 ($p < 0.05$), which means that H0 was rejected. The association of LDL with the incidence of ischemic stroke begins with the tendency of LDL to stick to the walls of blood vessels and form plaque that triggers atherosclerosis, which can cause the narrowing of blood vessels and obstruct blood flow to the brain.[30] The tendency of low-density lipoprotein (LDL) to adhere to blood vessel walls and form plaque, which promotes atherosclerosis (a condition that can restrict blood arteries and obstruct blood flow to the brain), is the first step in the relationship between LDL and the incidence of ischemic stroke. Elevated low-density lipoprotein (LDL) levels can harm the endothelium of blood vessels, promoting the growth and creation of fatty streaks that trigger the onset of atherosclerosis.[29] Atherosclerotic plaques are difficult to reverse and can cause impaired vasoregulation, leading to worse patient outcomes.[12] It is crucial to pay attention so that the treatment strategy for each individual may be adjusted to these characteristics since there are various aspects in each individual that have a significant impact on clinical outcomes and the healing process.[24]

HDL and patient length of stay in this study showed a significance value (p-value) of 0.039 ($p < 0.05$), which means that H0 was rejected so there was a significant correlation between HDL levels and length of stay for ischemic stroke patients. The results of this study are in line with the results obtained by Saputri & Maulina (2018) research that states that HDL and length of treatment have a significant relationship with a significance value (p-value) of 0.004 ($p < 0.01$).[12] The results of the study indicated that there is a weak negative correlation between HDL levels and the length of stay for ischemic stroke patients. So, it means patients with lower HDL levels tend to have prolonged stays, while those with higher HDL levels tend to have shorter stays. Low levels of HDL can increase the risk of ischemic stroke during an acute stroke, which can hinder the recovery process and raise the mortality rate.[12] It is because low levels of HDL can worsen atherosclerosis and promote inflammation.[13] HDL is a lipoprotein that acts as a vacuum cleaner to clean excess fat deposits.[30] HDL causes reverse cholesterol transport, a mechanism for cleaning and transporting cholesterol from the peripheral tissues of blood vessels back to the liver and excreted through the bile ducts.[13] In this study, the relationship between HDL and patient clinical outcomes had a significance value (p value) of 0.115 ($p > 0.05$), which means that H0 was accepted so that there was no significant relationship between HDL levels and clinical outcomes for ischemic stroke patients after undergoing hospitalization. This result differs from research from Varela et al. (2020) that shows impaired anti-inflammatory and antioxidant capacity of HDL associated with poor outcomes in ischemic stroke patients.[31] HDL function can change in several situations according to the pathophysiology that accompanies it, such as acute phase responses, obesity conditions, and chronic inflammatory diseases. So clinical outcome of each patient can also be influenced by these things.[32]

CONCLUSION AND SUGGESTION

In conclusion, there was a weak negative correlation between the length of stay in ischemic stroke patients and total cholesterol, LDL, and HDL levels, but not triglycerides. After hospitalization, there is a significant correlation between total cholesterol and LDL levels and clinical outcomes of ischemic stroke patients. However, no significant correlation was found between triglycerides and HDL with clinical outcomes of ischemic stroke patients. Further research is needed to determine other variables that correlate with the length of stay and clinical outcomes of ischemic stroke patients, such as comorbid (comorbid) diseases, obesity conditions, and patient living habits that can influence the incidence and severity of ischemic stroke.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

ETHICAL ASPECT

This research has received ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Udayana University, No. 227/UN14.2.2.VII.14/LT/2023.

REFERENCES

1. Simarmata OS, Lolong DB, Pangaribuan L, Sulistiyowati N, Sulistiowati E. Penyebab Kematian di Kabupaten Gianyar Tahun 2010-2012. Bul Penelit Kesehat. 2018 Oct 23;46(2):77–86.
2. Khariri, Andriani L. The predominance of non-communicable diseases and unhealthy eating patterns.

PROS SEM NAS MASY BIODIV INDON [Internet]. 2020 Jun;6(1):649–52. Available from: https://www.who.int/healthinfo/global_burden_disease/en/
3. Adam MF, Hutahaean YO, Siagian LRD. Gambaran Profil lipid dan Rasio Lipid pada Pasien Stroke Iskemik Berulang di RSUD Abdul Wahab Sjahranie Samarinda. J Ked Mulawarman. 2020;7(2):1–10.
4. Campbell BCV, De Silva DA, Macleod MR, Coutts SB, Schwamm LH, Davis SM, et al. Ischaemic stroke. Nat Rev Dis Prim. 2019 Dec 1;5(1).
5. Johnson CO, Nguyen M, Roth GA, Nichols E, Alam T, Abate D, et al. Global, regional, and national burden of stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Neurol. 2019 May 1;18(5):439–58.
6. Kemenkes RI. Laporan Nasional Riskesdas 2018. 2018.
7. Unnithan AKA, Das JM, Mehta P. Hemorrhagic Stroke. StatPearls; 2022. 1–17 p.
8. Prasetyo E, Garini AS. Prevalensi Dislipidemia pada Pasien Stroke Iskemik Berulang Rawat Jalan dan atau Rawat Inap di Rumah Sakit Pusat Otak Nasional Periode 2015 – Juni 2017. Maj Kesehat Pharmamedika. 2018;10(1):031.
9. Ary G, Kamajaya P, Lestari AAW, Yasa IWS. Hubungan Antara Profil Lipid dan Hipertensi pada Penderita Stroke Iskemik Di RSUP Sanglah Denpasar Tahun 2014. E-Jurnal Med Udayana [Internet]. 2016;5(11):2. Available from: https://ojs.unud.ac.id/index.php/eum/article/view/30457
10. WSO. World Stroke Organization (WSO): Global Stroke Fact Sheet 2022 [Internet]. 2022. Available from: http://ghdx.healthdata.org/gbd-results-tool
11. Hui C, Tadi P, Patti L. Ischemic Stroke. StatPearls; 2022. 1–20 p.
12. Saputri AI, Maulina M. Hubungan Profil Lipid dengan Lama Rawatan Pasien Stroke Iskemik di Badan Layanan Umum Daerah Rumah Sakit Umum Cut Meutia Kabupaten Aceh Utara. J Kedokt dan Kesehat Malikussaleh. 2018 Feb;91–102.
13. Septianto R. Nilai Prognostik Kolesterol High Density Lipoprotein pada Kejadian Stroke Iskemik. JIMKI. 2020;8(1):77–82.
14. Ayudia P, Imran Y. Kadar Kolesterol Ldl Sebagai Prediktor Lama Perawatan Pada Pasien Stroke Iskemik Akut. J Penelit Dan Karya Ilm Lemb Penelit Univ Trisakti. 2023;8(2):310–20.
15. Roy-O'Reilly M, McCullough LD. Age and sex are critical factors in ischemic stroke pathology. Endocrinology. 2018;159(8):3120–31.
16. Nawaz B, Eide GE, Fromm A, Øygarden H, Sand KM, Thomassen L, et al. Young ischaemic stroke incidence and demographic characteristics – The Norwegian stroke in the young study – A three-generation research program. Eur Stroke J. 2019;4(4):347–54.
17. Yousufuddin M, Young N. Aging ang Stroke. Aging (Albany NY). 2019;11(9):2542–4.
18. George MG. Risk Factors for Ischemic Stroke in Younger Adults: A Focused Update. Stroke. 2020;51(3):729–35.
19. Santoso BR, Gaghauna EEM, Raihana R. Trygliceride and Total Cholesterol level as the predictor of mortality in stroke patient: Literature Review. J Heal. 2023;10(1):009–18.
20. Yuziani Y. Korelasi Rasio Kolesterol Total Terhadap HDL dengan Prediksi Outcome Stroke Iskemik Akut. Qanun Med - Med J Fac Med Muhammadiyah Surabaya. 2018;2(01):59–71.
21. Yi SW, Shin DH, Kim H, Yi JJ, Ohrr H. Total cholesterol and stroke mortality in middle-aged and elderly adults: A prospective cohort study. Atherosclerosis [Internet]. 2018;270:211–7. Available from: https://doi.org/10.1016/j.atherosclerosis.2017.12.003
22. Siregar FA, Makmur T, Utara US, Islam U, Utara S. Metabolisme lipid dalam tubuh. 2020;1(2).
23. Wang IK, Liu CH, Yen TH, Jeng JS, Hsu SP, Chen CH, et al. Cholesterol Levels Are Associated with 30-day Mortality from Ischemic Stroke in Dialysis Patients. J Stroke Cerebrovasc Dis. 2017;26(6):1349–56.
24. Alawieh A, Zhao J, Feng W. Factors affecting post-stroke motor recovery: Implications on neurotherapy after brain injury. Behav Brain Res. 2018;340:94–101.
25. Lee MJ, Park JT, Han SH, Kim YL, Kim YS, Yang CW, et al. The atherogenic index of plasma and the risk of mortality in incident dialysis patients: Results from a nationwide prospective cohort in Korea. PLoS One. 2017;12(5):1–15.
26. Zhang A, Yao Y, Xue Z, Guo X, Dou J, Lv Y, et al. A Study on the Factors Influencing Triglyceride Levels among Adults in Northeast China. Sci Rep [Internet]. 2018;8(1):1–8. Available from: http://dx.doi.org/10.1038/s41598-018-24230-4
27. Laufs U, Parhofer KG, Ginsberg HN, Hegele RA. Clinical review on triglycerides. Eur Heart J. 2020;41(1):99–109.
28. Deng Q, Li S, Zhang H, Wang H, Gu Z, Zuo L, et al. Association of serum lipids with clinical outcome in acute ischaemic stroke: A systematic review and meta-analysis. J Clin Neurosci [Internet]. 2019;59:236–44. Available from: https://doi.org/10.1016/j.jocn.2018.09.003
29. Bandyopadhyay D, Qureshi A, Ghosh S, Ashish K, Heise LR, Hajra A, et al. Safety and Efficacy of Extremely Low LDL-Cholesterol Levels and Its Prospects in Hyperlipidemia Management. J Lipids. 2018;2018:1–8.
30. Maulina M, Rahayu MS, Yuziani. Profil Lipid sebagai Prediktor Outcome Stroke Iskemik. UNIMAL PRESS; 2017. 1–23 p.

31. Varela LM, Meseguer E, Lapergue B, Couret D, Amarenco P, Meilhac O. Changes in high-density lipoproteins related to outcomes in patients with acute stroke. J Clin Med. 2020;9(7):1–15.

32. Damayanthi D, Krishnamoorthy S, Sylaja PN, Gopala S. Increased high-density lipoprotein-oxidanindex in ischemic stroke patients. Biomed Reports. 2022;17(5):1–6.