



## **CORRELATION BETWEEN NEUTROPHIL LYMPHOCYTE RATIO AND LIPID PROFILE IN ADULT PATIENT WITH OBESITY IN PRODIA TANGERANG CLINICAL LABORATORY**

### **HUBUNGAN RASIO NEUTROFIL LIMFOSIT DENGAN PROFIL LIPID PADA PASIEN DEWASA OBESITAS DI LABORATORIUM KLINIK PRODIA TANGERANG**

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#### **Abstract**

Obesity is a condition of abnormal or excessive fat accumulation which can be a risk factor for dyslipidemia. Uncontrolled dyslipidemia can directly cause endothelial dysfunction by increasing the production of free radicals, causing Low Density Lipoprotein (LDL) oxidation and stimulating the release of inflammatory factors that can cause inflammation. Neutrophils and macrophages are the first leucocytes to appear in the early response to inflammation, so the neutrophil-lymphocyte ratio can be useful for evaluating the prognosis of inflammation as an early detector and as a marker of inflammation that can be detected simply and efficiently. This study aims to determine the correlation between Neutrophil-Lymphocyte Ratio (NLR) and Lipid Profile in adult patients with obesity in Prodia Tangerang Clinical laboratory. This study is an analytical study with a cross-sectional approach and used purposive sampling technique. The research sample data was taken from secondary data from patient medical records. The p-value obtained using Rank Spearman correlation from the comparison of neutrophil-lymphocyte ratio with each lipid profile value is total cholesterol (p=0.003), LDL cholesterol (p=0.013), High Density Lipoprotein (HDL) cholesterol (p=0.375) and tryglicerides (p=0.316). This study found a relationship between the neutrophil-lymphocyte ratio with total cholesterol dan LDL cholesterol, but there was no relationship between the neutrophil-lymphocyte ratio with HDL cholesterol and tryglicerides in obese adult patient in Prodia Tangerang Clinical Laboratory.



**Keywords :** Obesity, Neutrophil-Lymphocyte Ratio, Lipid Profile, Dyslipidemia

### Abstrak

Obesitas adalah kondisi penumpukan lemak yang abnormal atau berlebihan yang dapat menjadi faktor risiko untuk dislipidemia. Dislipidemia yang tidak terkontrol dapat secara langsung menyebabkan disfungsi endotelium dengan meningkatkan produksi radikal bebas, yang menyebabkan oksidasi Low Density Lipoprotein (LDL) dan merangsang pelepasan faktor inflamasi yang dapat menyebabkan peradangan. Neutrofil dan makrofag adalah leukosit pertama yang muncul dalam respons awal terhadap peradangan, sehingga rasio neutrofil-limfosit dapat berguna untuk mengevaluasi prognosis peradangan sebagai detektor dini dan sebagai penanda peradangan yang dapat dideteksi dengan cara yang sederhana dan efisien. Penelitian ini bertujuan untuk mengetahui korelasi antara Rasio Neutrofil-Limfosit (NLR) dengan Profil Lipid pada pasien dewasa dengan obesitas di laboratorium Klinik Prodia Tangerang. Penelitian ini merupakan studi analitik dengan pendekatan potong lintang dan menggunakan teknik purposive sampling. Data sampel penelitian diambil dari data sekunder rekam medis pasien. Nilai  $p$  yang diperoleh menggunakan korelasi Rank Spearman dari perbandingan rasio neutrofil-limfosit dengan setiap nilai profil lipid yaitu total kolesterol ( $p=0,003$ ), kolesterol LDL ( $p=0,013$ ), kolesterol High Density Lipoprotein (HDL) ( $p=0,375$ ), dan trigliserida ( $p=0,316$ ). Penelitian ini menemukan adanya hubungan antara rasio neutrofil-limfosit dengan total kolesterol dan kolesterol LDL, namun tidak ditemukan hubungan antara rasio neutrofil-limfosit dengan kolesterol HDL dan trigliserida pada pasien obesitas dewasa di laboratorium Klinik Prodia Tangerang.

**Kata Kunci :** Obesitas, Rasio Neutrofil-Limfosit, Profil Lipid, Dislipidemia

## 1. INTRODUCTION

According to data reported by the World Health Organization in 2022, 43% of adults were overweight and 16% were obese (WHO, 2024). Obesity can occur when the calories consumed through food exceed the body's calorie needs. Obesity can be a risk factor for dyslipidemia, which plays a major role in the pathogenesis of atherosclerosis (Hastuti, 2019).

Uncontrolled dyslipidemia conditions can directly cause endothelial blood vessel dysfunction, resulting in increased free radical production, causing LDL oxidation and stimulating the release of inflammatory factors that can cause inflammation (Kumar et al., 2018). Long-term inflammation will increase the number of neutrophils in the blood because neutrophils will move to the location of inflammation (Raharjo et al., 2020). Neutrophils are known to be involved in the development of atherosclerosis, a chronic, slowly developing disease characterized by the accumulation of large amounts of lipids in the walls of the arteries (Herrero et al., 2022). Chronic inflammation can be determined by measuring levels of inflammatory markers, but in daily practice this is difficult to do due to cost limitations, so the neutrophil lymphocyte ratio (NLR) is expected to be an alternative because of its role in indicating acute, chronic inflammation and adaptive immunity (Arifin et al., 2025). The neutrophil-lymphocyte ratio can be useful for evaluating the prognosis of inflammation as an early detection and as a marker of inflammation that can be detected simply and efficiently (Rinaldi et al., 2021). The neutrophil-lymphocyte ratio can serve as an independent marker of the severity of inflammation, including infection-related inflammation and chronic inflammation. As the severity of infection increases, the neutrophil-lymphocyte ratio also



increases (Buonacera et al., 2022). In cases of chronic inflammation, the duration of the condition affects the ratio; the longer the patient experiences inflammation, the higher the neutrophil-lymphocyte ratio due to ongoing chronic inflammation. Another study reported a relationship between metabolic syndrome and the neutrophil-lymphocyte ratio, where the severity of metabolic syndrome will increase the neutrophil-lymphocyte ratio (Marra et al., 2023). The NLR also correlates with immune system activation due to inflammation and causes an increase in the number of leukocytes and other inflammatory markers (Retnoningrum et al., 2017)

Based on the explanation above, the author is interested in conducting research of the relationship between neutrophil-lymphocyte ratio and lipid profiles in obese adult patients in Prodia Clinical Laboratory Tangerang.

## 2. RESEARCH METHOD

This study employed an analytical design with a cross-sectional approach, conducted from December 2023 to February 2024. The population consisted of obese adult patients who underwent laboratory tests, including complete blood count in hematology, total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels simultaneously. The sample was selected through purposive sampling based on inclusion and exclusion criteria set by the researcher.

The inclusion criteria for the study were: (1) patients categorized as obese adults, specifically late adults aged 26-45 years with a BMI  $\geq 25$ , and (2) patients who underwent a complete hematology examination and lipid profile simultaneously. The exclusion criteria included: (1) patients undergoing radiation therapy or chemotherapy, (2) patients with inflammatory diseases such as immunodeficiency, autoimmune diseases, systemic lupus erythematosus (SLE), and rheumatoid arthritis, (3) patients with viral infections like hepatitis, influenza, measles, or dengue fever, and (4) patients with blood disorders such as leukemia or anemia.

The study focused on two variables: the independent variable, which was the neutrophil-lymphocyte ratio (NLR), and the dependent variables, which included total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels. Data for this research were sourced from secondary data obtained from patient medical records.

The research procedure began with obtaining research permits from the Research Ethics Commission of Wira Medika Bali Health College, with Ethical Clearance Letter No. 279/EI.STIKESWIKA/EC/IV/2024. Afterward, a request for secondary data collection from medical records at the Prodia Tangerang Clinical Laboratory was submitted. The complete blood count, including NLR calculation, was conducted using a hematology analyzer, while the lipid profile was determined through routine chemistry tests using a Roche Cobas C311 automatic chemistry instrument.

The data collected was processed using a computer system and analyzed through correlation analysis with SPSS software version 26.

## 3. RESULTS AND DISCUSSION

### Results

This study was conducted in Prodia Clinical Laboratory. The total sample obtained in this study using Slovin formula with a tolerance limit used by researchers of 5% were 44 samples. The characteristics of respondents based on gender, age and Body Mass Index (BMI) can be seen in Table 1.



Table 1. Characteristics of Respondents based on Gender, Age and BMI

| Category                    | Total | Percentage (%) |
|-----------------------------|-------|----------------|
| <b>Gender</b>               |       |                |
| Men                         | 36    | 81.8           |
| Women                       | 8     | 18.2           |
| <b>Age</b>                  |       |                |
| 26-35 years                 | 13    | 29.5           |
| 36-45 years                 | 31    | 70.5           |
| <b>BMI</b>                  |       |                |
| Obesity I (25.0-29.9)       | 31    | 70.5           |
| Obesity II (30.0-39.9)      | 12    | 27.2           |
| Obesity III ( $\geq 40.0$ ) | 1     | 2.3            |

Based on Table 1, it can be seen that the subjects in this study consisted of 36 men (81.8%) and 8 women (18.2%). The respondents were also divided by age where the majority had an age range in the late adult category (36-45 years) for about 70.5% and the rest were in the age range of early adult category (26-35 years) for about 29.5%. Meanwhile, the respondents were categorized in the obesity I as much as 70.5%, followed by obesity II as much as 27.2% and obesity III as much as 2.3%. In this study, a correlation test was conducted to determine the relationship between the neutrophil-lymphocyte ratio and total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides. The relationship between the neutrophil-lymphocyte ratio and total cholesterol yielded a p-value of 0.003 ( $p < 0.05$ ), as shown in Table 2.

Table 2. Correlation between NLR with Total Cholesterol

| Variable          | P value | Coefficient correlation |
|-------------------|---------|-------------------------|
| NLR               | 0.003   | 0.442                   |
| Total Cholesterol |         |                         |

The relationship between the neutrophil-lymphocyte ratio and LDL cholesterol yielded a p-value of 0.013 ( $p < 0.05$ ), as shown in Table 3.

Table 3. Correlation between NLR with LDL Cholesterol

| Variable          | P value | Coefficient correlation |
|-------------------|---------|-------------------------|
| NLR               | 0.013   | 0.371                   |
| Total Cholesterol |         |                         |

The relationship between the neutrophil-lymphocyte ratio and HDL cholesterol yielded a p-value of 0.375 ( $p < 0.05$ ), as shown in Table 4.

Table 4. Correlation between NLR with HDL Cholesterol

| Variable          | P value | Coefficient correlation |
|-------------------|---------|-------------------------|
| NLR               | 0.375   | -0.137                  |
| Total Cholesterol |         |                         |

The relationship between the neutrophil-lymphocyte ratio and triglycerides yielded a p-value of 0.316 ( $p < 0.05$ ), as shown in Table 5.



Table 5. Correlation between NLR with Triglycerides

| Variable          | P value | Coefficient correlation |
|-------------------|---------|-------------------------|
| NLR               | 0.316   | -0.155                  |
| Total Cholesterol |         |                         |

## Discussion of Results

Research results based on respondent characteristics showed that 81.8% of obese respondents were male. This is consistent with a literature review by Muscogiur, G (2023), which states that men are more likely to be obese than women due to differences in body composition, adipose tissue distribution, and metabolism, all of which are highly dependent on different hormonal backgrounds.

Based on age characteristics, the study found that 70.5% of respondents aged 36-45 years, categorized as late adulthood, experienced obesity, compared to respondents aged 25-35 years, categorized as early adulthood. This is in line with research conducted by Septiyanti & Seniwati (2020), which stated that more respondents experienced obesity in the age range of 40-59 (51%) compared to 20-39 age range.

The results of the correlation analysis showed a significant relationship between the neutrophil-lymphocyte ratio to total cholesterol and LDL cholesterol. In obesity, there is an increase in lipid levels in blood plasma, where prolonged exposure to endogenous agents, namely chronically elevated plasma lipid components, will cause LDL oxidation. Oxidized LDL will stimulate the release of inflammatory factors that can cause inflammation. Chronic inflammation is a continuous body response to persistent stimuli characterized by tissue damage. Inflammatory cells can be found in all phases of atheromatous plaque formation and are closely related to the development of atherosclerosis. This causes endothelial dysfunction and increases leukocyte adhesion to blood vessel walls. This is consistent with research results that show a fairly strong relationship between the neutrophil-lymphocyte ratio to total cholesterol and LDL cholesterol. LDL cholesterol are correlated with total cholesterol, because LDL cholesterol are the type of lipoprotein with the highest cholesterol content and are the end result of the hydrolysis of Very Low Density Lipoprotein (VLDL) carried out by lipase 13.

The results of the correlation analysis showed that there was no significant relationship between the neutrophil-lymphocyte ratio with HDL cholesterol and triglycerides because in this study the majority of respondents were at an average age of early adults, for about 39 years, where the possibility that occurred was that they did not have long-term complications from obesity, and there was no adequate information regarding the length of time the respondents had been obese, as well as the consumption of routine lipid-lowering drugs so that the chronic inflammatory process which should be a result of dyslipidemia could not be analyzed.

In fat metabolism, fat deposits in the liver are metabolized into triglycerides and cholesterol esters. VLDL triglycerides are broken down into free fatty acids through the action of the enzymes lipoprotein lipase (LPL) and hepatic lipase (HL). VLDL lipoproteins are converted into IDL (intermediate-density lipoproteins), which contain only apo-B and apo-E. LDL receptors in the liver can take up IDL lipoproteins. IDL lipoproteins with normal apoE are broken down by LPL and HL to form LDL. LDL lipoproteins are the lipoproteins with the highest cholesterol content and are the end product of VLDL hydrolysis triggered by lipase 13. The end product of endogenous fat metabolism is LDL lipoprotein, so this study found a relationship between neutrophil-lymphocytes ratio to total cholesterol and LDL cholesterol,



but there was no relationship between neutrophil-lymphocytes ratio to HDL cholesterol and triglycerides.

This study still has several limitations, including the use of secondary data in the form of medical records of patients who came for examination, so it cannot accurately determine the patient's previous history and the amount of data obtained is small, so it is less diverse and less able to describe the condition of obesity due to less diverse data variations so that some lipid profile parameters do not show any correlation with the neutrophil-lymphocyte ratio. The condition of obesity and dyslipidemia is a chronic disease, meaning it requires a long process time, so this study cannot yet identify factors that may influence it, such as the length of time the patient has experienced obesity, information on the use of routine lipid-lowering drugs consumed by patients that can affect the results of the examination. This study also only describes data obtained in the period December 2023 - February 2024, so the data obtained in this population cannot yet describe and conduct a more indepth analysis.

#### 4. CONCLUSION

This study found a relationship between the neutrophil-lymphocyte ratio with total cholesterol dan LDL cholesterol, but there was no relationship between the neutrophil-lymphocyte ratio with HDL cholesterol and tryglicerides in obese adult patient in Prodia Tangerang Clinical Laboratory.

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