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Correlation of Age, Gender, and Body Mass Index With NLR of Covid-19 Patients

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ABSTRACT
The inflammatory and immunological responses may be used to predict the outcome of COVID-19 patients. The NLR may be used as an indicator of the severity of systemic inflammation in patients with viral pneumonia (NLR). NLR is linked to age-related immunosenescence Sex , and NLR, is a hormonally mediated trait. The prevalence of NLR is higher in people with COVID-19 who are overweight or obese. The researchers wanted to see how factors including age, gender, and BMI affected the NLR of people with COVID-19. This researched used Cross Sectional approach. A sample of 70 respondents with COVID-19 confirmed through RT-PCR examination at Dedy Jaya Hospital Brebes period January-August 2022. Statistical analysis to determine the correlation between variables using Spearman's non-parametric. From 70 samples of COVID-19 patients , the results of the analysis showed that the correlation between NLR and age had ap value = 0.001 with r = 0.558, the correlation between NLR and gender had ap value = 0.001 with r = 0.461 .

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INTRODUCTION

Corona Virus Disease 19 (COVID-19) is a systemic infectious disease caused by a single positive strain virus known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The disease first emerged in Wuhan , China, in late 2019 and quickly spread to countries around the world. World Health The World Health Organization (WHO) officially declared COVID-19 a global pandemic on March 29, 2020. Since then, COVID-19 has caused major impacts in various sectors, including health, economy, and social.

In an effort to understand and treat COVID-19 more effectively, various diagnostic and evaluation methods have been developed. Routine blood tests are one of the supporting tests in diagnostics to evaluate the severity of the disease and predict the possibility of death in COVID-19 patients. This examination includes various hematological parameters that can provide an overview of the condition of the patient's immune system. One of the parameters that is of concern in research related to COVID-19 is Neutrophil Lymphocytes Ratio (NLR).

NLR is the ratio between the number of neutrophils and the number of lymphocytes in the blood which is used as an indicator of systemic inflammation . According to Hernaningsih (2020), NLR is often used to assess the level of inflammation in cases of viral pneumonia , including SARS-CoV-2 infection. This parameter has been shown to have predictive and

prognostic value for viral infections, including COVID-19 (Fathiyah et al. , 2021). An increase in the number of neutrophils and a decrease in the number of lymphocytes are important indicators of changes in the body's immunological function that occur during viral infections.

Several studies have shown that high NLR may be associated with disease severity and poorer prognosis in COVID-19 patients. Increased neutrophils reflect a high inflammatory reaction in the body, while decreased lymphocytes indicate a weakened adaptive immune response. This suggests that the balance between the inflammatory response and the immune system plays an important role in determining disease progression. Therefore, understanding the factors that may affect NLR in COVID-19 patients is crucial.

Individual COVID-19 NLR can be influenced by a number of variables, including patient characteristics such as age, sex, and body mass index (BMI). Age is a factor that has been widely associated with the severity of COVID -19. Older patients tend to have weaker immune systems and higher inflammatory responses compared to younger individuals. Several studies have shown that older patients with COVID-19 have higher NLRs than younger patients, contributing to a greater risk of complications.

In addition to age, gender also plays a role in influencing the severity of COVID-19 and related hematological parameters. Epidemiological studies have shown that men have a higher risk of experiencing serious complications from COVID-19 than women. This is thought to be related to differences in hormones and immune responses between the two sexes. Estrogen in women is known to have a protective effect on the immune system, while men tend to have a higher inflammatory response which can be reflected in higher NLR values.

Body mass index (BMI) is also an important factor that can affect NLR in COVID-19 patients. Obesity is associated with chronic inflammatory conditions that can worsen the immune response to infection. Patients with obesity tend to have higher levels of neutrophils and lower lymphocytes, which can lead to increased NLR. In addition, obesity is also associated with an increased risk of COVID-19 complications, including acute respiratory distress syndrome (ARDS) and multiple organ failure.

Various studies have been conducted to examine the relationship between age, gender, and BMI with the severity of COVID-19. However, studies on the specific correlation between these factors and NLR are still limited. Therefore, this study aims to explore whether age, gender, and BMI have a significant impact on the NLR of COVID-19 patients. By understanding this relationship, it is hoped that deeper insights can be obtained into the pathophysiological mechanisms of COVID-19 and its clinical implications in determining patient treatment and care strategies.

This study has important significance in the medical context, especially in monitoring the condition of COVID-19 patients. If a significant relationship is found between age, gender, and BMI with NLR, then these parameters can be used as additional indicators in assessing patient risk and prognosis. Thus, doctors and medical personnel can more easily identify high-risk patients and provide more appropriate interventions to increase the chances of recovery.

Based on the above rationale, this study will analyze the correlation between age, gender, and BMI on NLR in COVID-19 patients. It is hoped that the results of this study can

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provide a scientific contribution that is useful for the medical world and help in efforts to handle COVID-19 more effectively in the future.

RESEARCH METHODS

This study is an analytical observational study with a cross-sectional approach using secondary data from patient medical records at Dedy Jaya Brebes Hospital. The sampling method used was consecutive sampling , with the number of samples obtained as many as 70 patients, exceeding the minimum number required, which was 63 samples.

The independent variables in this study include age, gender, and Body Mass Index (BMI), while the dependent variable is Neutrophil-to-Lymphocyte Ratio (NLR). NLR values are categorized into two groups, namely high NLR (NLR > 3.17) and normal NLR (≤ 3.17). The inclusion criteria in this study included COVID-19 inpatients at Dedy Jaya Brebes Hospital who were treated during the period January to August 2022, had been confirmed positive for COVID-19 through RT-PCR examination, and had complete medical record data, including patient identity in the form of initials, age, gender, weight, height, and NLR value.

The exclusion criteria in this study were patients who were pregnant. For statistical analysis, non- parametric tests were used. Spearman to determine the relationship between independent variables and NLR. The use of this test was chosen because the data analyzed were not normally distributed and ordinal scale.

This research has obtained ethical approval with ethical number clearance No. 13/KEPK/RSUK/VIII/2023. With the approach used, the results of this study are expected to provide an overview of the factors associated with NLR values in COVID-19 patients, so that they can contribute to the evaluation and clinical management of patients in health facilities .

RESULTS AND DISCUSSION

Analysis Univariate

Table 1. Distribution Frequency , Percentage , Mean and Standard Value Deviation (SD).

	NLR			
Age	Mean	Min	Max	N
Mature young	3.58	1.26	9.5	9
Mature middle	4.20	0.45	8.7	23
Middle age	4.69	0.91	12.2	22
Elderly	5.26	2.1	14.8	12
Gender	Mean	Min	Max	N
Man	4.90	1.62	14.8	37
Woman	3.98	0.91	9.2	33
IMT	Mean	Min	Max	N
Underweight	3.71	1.6	7	8
Normoweight	4.19	0.91	14.8	44
Overweight	4.51	1.62	9.5	17
Obesity level 1	5.28	2	8.7	10
Obesity level 2	3.95	2.6	5.3	2

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Table 1 shows the average age COVID-19 patients in study This is 45.68±13.87. Most of the patient various sex male (52.9%). Patient BMI range from 16 kg/m ^{2} up to 40 kg/m ^{2} with an average of 21.82±3.650 kg/m ^{2}, where majority patient have *a normoweight /normal* BMI (55.7%). The average patient from study This has a high NLR (58.6%), with minimum value of 0.91 and value maximum of 14.80 and an average of 4.45±2.78.

Table 2 . Distribution of mean, minimum and maximum values of age , type gender , and BMI based on the NLR of COVID-19 patients .

Variables	Frequency	Percentage -se	Mean ± SD
Age			
Young Adult	9	12.9%	
Middle Adult	24	31.4%	45.68±13.87
Middle Age	24	37.1%	
Elderly	13	18.6%	
Gender			
Man	37	52.9%	-
Woman	33	47.1%	-
IMT			
BB Less (*Underweight)*	7	10%	
Normal BB (*Normoweight*)	39	55.7%	22,051±3,650
Overweight	14	20.0%	
Obesity level 1	8	11.4%	
Obesity level 2	2	2.9%	
NLR			
Normal	29	41.4%	4.45±2.78
Tall	41	58.6%	

Table 2. shows the NLR of COVID-19 patients based on age in study This is patient category age elderly , In the category type sex obtained patient type sex man has the highest average NLR value of 4.90. In the BMI category, it was found patient with obesity BMI category level 1 has the highest average NLR value by 5.28

Analysis Bivariate

Table 3 Correlation Age , Gender , and BMI with NLR

Variables	N	Correlation *Spearman* (*p*)	*r*
Age	70	0.001	0.558
Gender	70	0.001	0.461
IMT	70	0.003	0.458

Table 3 shows existence correlation between age , type gender , and BMI with NLR in COVID-19 patients , with mark significance of each variable (*p*= <0.005) . *The* coefficient value correlation of each variable show strong connection Enough strong , with direction connection positive indicating the more tall age and BMI, then the more The NLR value of COVID-19 patients is also high .

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Discussion

Correlation age with NLR of COVID-19 patients .

In line with increase age , where patient elderly (>60 years) have trend experience NLR increase . Findings study This consistent with study previously by Liu et al. (2020), who found correlation between aging and NLR. In the study they , 50% of COVID-19 patients with NLR value 3.13 and age ≥50 years experience symptom weight , and 9.1% experienced symptom is . According to another study by (Wang et al. (2020)).

Correlation between age with NLR in COVID-19 patients influenced by 2 factors that is existence condition decline organ function and presence disease comorbidities that result in Condition immunosenesis , namely the state in which the system immunity body experience decline its effectiveness in to fight infection Because effect aging . Condition *immunosenesis* also causes the occurrence decline organ systems such as thymus and *reticuloendothelial organs* . Decline function *reticuloendothelia* l resulting in bias in the differentiation process cell cause hematopoietic . Myeloid progenitor cells will experience increase , and lymphoid progenitor cells will experience decrease . Increase myeloid progenitor cells result in disturbance myeloproliferative , whereas decline lymphoid progenitor cells result in disturbance development B cells and T cells that interfere system immunity adaptive , which plays a role in oppose pathogens , especially virus. (Widya and Andika, 2021).

Disease comorbid and decline the function of the organs is the same impact on immunosenesis . This is due to decline system immunity along increase age and increase risk condition accompanying including COPD, diabetes mellitus , hypertension , and cardiovascular disease kidney chronic (Wisnu et al., 2021). According to study others , 65.4% of individuals with disease accompanying experience increase in NLR (Fathiyah et al., 2021).

Correlation type sex with NLR of COVID-19 patients .

Study This in line with study previously , where patient man have a higher average NLR value tall than patient women . Where the average NLR value of patients was obtained man was 8.05, and the average NLR value of patients Woman is 6.08. This is caused by the influence of hormones , where hormone sexual men , such as androgens , provide effect damage because of hormone the nature press *cell – mediated immunity* which causes the disturbance response immune . (Belice, 2020).

However , the findings study This different with another study found that woman have a higher average NLR value tall than man . This is influenced by factors race and hormones . Estradiol, a component estrogen hormone , can prevent cell apoptosis neutrophils and decrease proliferation lymphocytes in the bone marrow bone back , which results in increase in NLR in women . Aspect racial is other elements that have effect on increasing NLR value in women . According to Wu et al. (2019), every race own different NLR values . Women tend to own higher NLR levels high in Asian race . Information This obtained from another study found that female estrogen levels Asian (Caucasian) race tends to more tall compared to with woman other races , such as race skin white (Caucasian) and African-American races with NLR in COVID-19 patients . (Visvanathan & Yager, 2016). with NLR in COVID-19 patients . According to study by Furuncuolu (2016),

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Correlation of BMI with NLR of COVID-19 patients .

IMT has correlation to NLR, especially in individuals with obesity and *overweight* . This is related with factor immunological , where condition obesity and *overweight* are condition inflammation chronic degrees low , which affects response and function immunity . (Lighter et al., 2020). Accumulation adipose can in a way direct influence macrophage For increase production cytokines inflammation . (Hidayati et al., 2022).

The research above No in line with another study conducted by *Bahadir et al* (2015) report that NLR does not correlated with BMI, and NLR is not good indicator For inflammation in patients obesity and overweight , things This explained that leukocytes and Hs-CRP (*high sensitive C-reactive protein*) are more indicators Good For indicates inflammation in patients obesity and syndrome metabolic which is factor risks that arise in line with overweight or obesity .

CONCLUSION

According to research , average age COVID-19 patient is 45 years old or middle aged , and groups patient with highest NLR value is elderly . Patient NLR value man more big than patient women , and typical COVID-19 patients are male . Maximum NLR score including in category obesity , while the average BMI of COVID-19 patients was 22.51, which is considered normal weight . According to findings research , there is strong and positive relationships between age and NLR, a fairly significant relationship strong between type gender and NLR, and a strong and positive relationship between IMT and NLR.

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