

# Evaluation of Neutrophil/Lymphocyte, Lymphocyte/Monocyte and Lymphocyte/Platelet Ratios in Healthy Volunteers

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Original Article

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## ABSTRACT

**Objective:** The aim of this study was to investigate the differences in neutrophil / lymphocyte, lymphocyte / monocyte, lymphocyte / platelet values between groups in different gender and age groups.

**Method:** This study is a retrospective study. In January 2024, patients aged 18-60 years who applied to the family medicine outpatient clinic of Mengücek Gazi Training and Research Hospital and who did not have a known chronic disease were included in the study. In the study, Neutrophil, Lymphocyte, Monocyte, LDL, HDL, glucose, HBA1C, white blood cell (WBC), Platelet (PLT) results were examined.

**Results:** A total of 165 subjects, 89.7% (n=148) male and 10.3% (n=17) female, were included in the study. The mean age of the participants was 38.96±10.63 years. The LDL value of the participants was 119.33±33, the HDL value was 44.52±8.48, the WBC value was 7.76±1.96, and the PLT value was 245±58.6. Participants' glucose values ranged from 72 to 319 and HBA1C levels ranged from 4.6 to 7.9. When the neutrophil/lymphocyte, lymphocyte/monocyte, lymphocyte/platelet ratios of the participants were evaluated, lymphocyte/platelet p=0.009 was found to be statistically significant.

**Conclusion:** There are many studies evaluating lymphocyte/platelet, neutrophil/lymphocyte, lymphocyte/monocyte ratios and investigating their relationship with different diseases in the literature. However, due to the fact that whole blood parameters vary according to age, the differences between measurement methods affect the measurement results, and the differences between societies also have an effect, studies in the healthy human population for men and women in different age groups are very limited. It is important to conduct more studies in healthy human populations to examine the parameters that vary with age and to determine the reference intervals for our population.

**Keywords:** Lymphocyte, monocyte, neutrophil, lymphocyte/monocyte ratio, lymphocyte/platelet ratio, neutrophil/lymphocyte ratio

## INTRODUCTION

Neutrophils, lymphocytes, monocytes and platelets are important components of our body's immune system and hematological functions. These cells play critical roles in fighting infection, regulating inflammatory responses, and maintaining the overall health of the body. Leukocytes, which make up the innate immune system, defend the organism against diseases and harmful factors. Leukocytes, granulocytes and lymphocytes form cell groups. Granulocytes; neutrophils, eosinophils, basophils, mast cells, dendritic cells, monocyte-macrophages and phagocytes.

Granulocytes recognize pathogens such as bacteria and viruses and neutralize them by taking them into the cell. While granulocytes are classified within the "innate" immune system because they are active; Lymphocytes, on the other hand, are classified within the "adaptive immune system" because they first recognize the target molecule and require customized synthesis for the target (1).

An increase in the number of neutrophils in blood tests is called "neutrophilia", and a decrease in the number is called "neutropenia". The presence of a systemic infection or systemic inflammatory response increases the number of neutrophils in the blood (2).

Lymphocytes are produced in the bone marrow. Unlike granulocytes, they become active after undergoing a maturation process. B lymphocytes mature in the lymphoid tissue and T lymphocytes mature in the thymus (3). The neutrophil/lymphocyte ratio is calculated using the neutrophil and lymphocyte values in the whole blood test. Neutrophil/lymphocyte is an indicator of subclinical inflammation. In some studies, it has been concluded that it can be used to calculate morbidity and mortality in neutrophil/lymphocyte surgical procedures and to predict the prognosis in some cancer types (4-6). Lymphocyte/monocyte ratio is also an indicator of inflammation, and recent studies have shown that it can be used to determine prognosis in some cancer types and to follow up rheumatologic diseases (7, 8). The lymphocyte/platelet ratio shows changes in platelet and lymphocyte counts due to acute inflammatory and prothrombotic conditions. Studies have shown the importance of changes in lymphocyte/platelet ratio in assessing the severity of systemic inflammation and predicting infections and other comorbidities in inflammatory rheumatic diseases (8).

In this study, the test results of individuals who applied to Erzincan Binali Yıldırım University Mengücek Gazi Training and Research Hospital Family Medicine Outpatient Clinic, who did not have a known chronic disease and who underwent a whole blood test were examined. The aim of the study was to investigate the differences between neutrophil/lymphocyte, lymphocyte/monocyte and lymphocyte/platelet ratios in different gender and age groups.

## MATERIALS AND METHODS

This study is a retrospective study. In January 2024, patients aged 18-60 years who applied to the family medicine outpatient clinic of Mengücek Gazi Training and Research Hospital and who did not have a known chronic disease were included in the study.

In the study, Neutrophil, Lymphocyte, Monocyte, LDL, HDL, glucose, HBA1C, white blood cell (WBC), Platelet (PLT) results were examined. Complete blood count was measured using the Sysmex XN-1000 Haematology System (Sysmex Corporation, Kobe, Japan) and biochemical parameters were analyzed spectrophotometrically using the Beckman Coulter Olympus AU2700 Plus Chemistry Analyzer (Beckman Coulter, Tokyo, Japan).

## Ethics

Since this study was designed as a retrospective study, ethics committee approval was not obtained. However, during the conduct of the study, the ethical principles of the Declaration of Helsinki were meticulously followed. The confidentiality of the data and the anonymity of the participants are protected. All data in the study were analyzed with patient privacy in mind, and no data that could reveal the identity of individuals was used. Due to the nature of the study, no intervention was made, and only existing patient records were reviewed retrospectively. In this regard, maximum attention has been paid to meeting ethical standards in scientific research.

## Statistical analysis

Data analysis was performed in IBM SPSS 25.0 (SPSS Inc., Chicago, IL, USA) package program. Descriptive statistics were given with mean  $\pm$  standard deviation, median (min – max) for quantitative data, and frequency (%) for categorical variables. The conformity of the data to the normal distribution was evaluated by Shapiro Wilks test.

The significance of the difference between the two groups in terms of median values was examined with the Mann Whitney U test and the Pearson Chi-Square test for nominal variables. Pearson correlation analysis was used to evaluate the relationship between continuous variables. Statistical significance level was taken as  $p < 0.05$ .

## RESULTS

A total of 165 subjects, 89.7% (n=148) male and 10.3% (n=17) female, were included in the study. The mean age of the participants was  $38.96 \pm 10.63$  years.

**Table 1.** Demographic and Clinical Characteristics of Participants

Variables	Mean $\pm$ Std. Dev.	S.E (Min-Max)
Age	38.96 $\pm$ 10.63	
Glucose		72-319
Hba1c		4.6-7.9
LDL	119.33 $\pm$ 33	
HDL	44.52 $\pm$ 8.48	
WBC	7.76 $\pm$ 1.96	
Platelet	245.16 $\pm$ 58.6	
Lymphocyte #	2.46 $\pm$ 0.7	
Lymphocyte %	32.22 $\pm$ 7.24	
Monocyte #	0.59 $\pm$ 0.15	
Monocyte %		4.1-13.6
Neutrophil #		1.29-9.47
Neutrophil %		37.9-78.2

The LDL value of the participants was 119.33±33, the HDL value was 44.52±8.48, the WBC value was 7.76±1.96, and the PLT value was 245±58.6. Participants' glucose values ranged from 72 to 319 and HBA1C levels ranged from 4.6 to 7.9. The demographic and clinical characteristics of the participants are given in Table 1.

When the neutrophil/lymphocyte, lymphocyte/monocyte, lymphocyte/platelet ratios of the participants were evaluated, lymphocyte/platelet p=0.009 was found to be statistically significant (Table 2).

**Table 2.** Comparison of Lymphocyte/Monocyte, Lymphocyte/Platelet, and Neutrophil/Lymphocyte Ratios by Gender

	Gender	N	Mean	Std. Deviation	Std. Error Mean	p
Lymphocyte/Monocyte	Men	148	4.2212	1.14359	.09400	.135
	Women	17	4.7192	1.42859	.34648	
Lymphocyte/Platelet	Men	148	1.0754	.39925	.03282	<b>.009</b>
	Women	17	.8450	.28992	.07031	
Neutrophil/Lymphocyte	Men	148	1.9365	.81003	.06658	.793
	Women	17	1.9343	.67851	.16456	

Correlation analysis was applied to understand the relationship between the parameters examined. As a result of the statistics; a significant correlation was found between age and HBA1C and LDL,

neutrophil/lymphocyte and lymphocyte/monocyte, lymphocyte/platelet ratios, LDL and HBA1C, WBC and neutrophil/lymphocyte, lymphocyte/platelet ratios (Table 3).

**Table 3.** Correlation Matrix of Hematological and Biochemical Parameters

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Lymph/Mono	r	1.000															
2.Lymph/Platelet	r	.416**	1.000														
3.Neu/Lymph	r	-.515**	-.459**	1.000													
4.Glucose	r	.083	.099	-.079	1.000												
5.Hba1c	r	.052	.000	-.058	.261*	1.000											
6.LDL	r	.222*	.140	-.037	.053	.524**	1.000										
7.HDL	r	.059	-.143	-.075	-.070	-.025	.298**	1.000									
8.WBC	r	.009	.320**	.304**	.013	.036	.166	-.110	1.000								
9.Platelet	r	.079	-.468**	.007	.029	.079	.034	.131	.290**	1.000							
10.Lymphocyte #	r	.504**	.677**	-.497**	.094	.102	.233**	.010	.604**	.257**	1.000						
11.Lymphocyte %	r	.598**	.472**	-.983**	.092	.041	.047	.077	-.285**	.007	.523**	1.000					
12.Monocyte #	r	-.414**	.314**	-.009	.000	.042	.023	-.017	.635**	.172*	.522**	-.044	1.000				
13.Monocyte %	r	-.542**	.050	-.347**	-.011	-.027	-.163	.013	-.309**	-.151	-.058	.259**	.479**	1.000			
14.Neutrophil #	r	-.158*	.074	.637**	.001	-.008	.114	-.138	.909**	.236**	.274**	-.603**	.456**	-.427**	1.000		
15. Neutrophil %	r	-.385**	-.426**	.968**	-.074	-.049	-.016	-.082	.337**	.044	-.434**	-.928**	-.073	-.462**	.668**	1.000	
16.Age	r	-.080	-.095	.121	.164*	.405**	.372**	-.008	-.009	-.021	-.166*	-.133	-.096	-.051	.032	.086	1.000

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

## DISCUSSION

Our study aimed to investigate the usability of neutrophil/lymphocyte, lymphocyte/monocyte, lymphocyte/platelet ratios in follow-up in patients admitted to the family medicine outpatient clinic without chronic disease. When the findings of the study were examined, the lymphocyte/platelet ratio was found to be significant; Neutrophil/lymphocyte, lymphocyte/monocyte ratios were found to be statistically insignificant.

The neutrophil/lymphocyte ratio has been prominent in several studies as a common indicator of systemic inflammation. This rate has been defined as an effective indicator in the prognosis of sepsis, cardiovascular diseases and some solid tumors (9, 10). However, the fact that this ratio did not give a significant result in our study may be a result of the variation in the healthy population or the limited number of participants. Furthermore, this finding suggests that the neutrophil/lymphocyte ratio in healthy individuals may only show significant changes during specific inflammatory processes.

Lymphocyte/monocyte ratio is a recommended parameter in cancer prognosis and monitoring rheumatologic diseases (11, 12). However, in our study, no significant results were obtained regarding the lymphocyte/monocyte ratio. This suggests that the lymphocyte/monocyte ratio is more important in significant inflammatory or pathological conditions and that this ratio may be a limited indicator in healthy individuals.

The lymphocyte/platelet ratio has been linked to inflammatory processes such as rheumatologic diseases and cancer (3, 13, 14). In our study, this rate was found to be statistically significant, supporting that this parameter may be a sensitive indicator of inflammatory processes. It is thought that the lymphocyte/platelet ratio can be used as a valuable tool in the assessment of inflammation and early detection of rheumatologic conditions, especially in healthy individuals.

## Limitations

Although individuals with known chronic diseases were excluded in this study, there is a possibility that individuals with diseases that have not yet been diagnosed may be included in the study population. This may affect the results of neutrophil/lymphocyte, lymphocyte/monocyte, and lymphocyte/platelet ratios, which are evaluated specifically in relation to inflammatory conditions. In addition, due to the retrospective design of the study, the data

obtained are based only on existing patient records, and more comprehensive prospective studies are needed. The limited number of participants and the fact that it was carried out only in a single center also limited the generalizability of the findings. In the future, it will be possible to overcome these limitations with studies to be carried out in larger populations and different centers.

## CONCLUSION

There are many studies in the literature in which lymphocyte/platelet, neutrophil/lymphocyte, lymphocyte/monocyte ratios are evaluated and their relationship with different diseases is investigated. However, due to the fact that whole blood parameters vary according to age, the differences between measurement methods also affect the measurement results, and the differences between societies also have an effect, there are very limited studies in the healthy human population for male and female sex in different age groups. It is important to conduct more studies in the healthy human population and to examine the parameters that vary according to age and to determine the reference ranges for our society. It is thought that it will be more beneficial in the follow-up of inflammatory diseases and the prognosis of cancer and sepsis when reference intervals are established for our society with large studies to be carried out in the healthy population.

## DECLARATIONS

**Author contributions:** OKC and GY performed the research. OKC designed the research study. OKC, GY contributed essential reagents or tools. GY analysed the data. OKC wrote the paper.

**Conflicts of interest:** There is no conflict of interest between the authors or family members of the authors. The authors do not have any consultancy, expertise, working conditions, shareholding, or similar situations that may lead to potential conflicts of interest in any company.

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