Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Connection Amount Type Leukocytes on Student Faculty Medicine of Muslim University of Indonesia Based on Index Mass Body (IMT)

M Syahwal[1], Sri Julyani[2], Andi Alamanda Irwan[3], Irna Diyana Kartika[2], Nesyana Nurmadilla[4]

[1]Study Program Medicine, Faculty Medicine, Muslim University of Indonesia, Makassar City, Indonesia,
[2]Department of Clinical Pathology, Faculty of Medicine, Muslim University of Indonesia, Makassar City, Indonesia,
[3]Parts Knowledge Pharmacology, Faculty of Medicine, Muslim University of Indonesia, Makassar City, Indonesia,
[4] Parts Nutritional Science, Faculty Medicine, Muslim University of Indonesia, Makassar City, Indonesia

Article Info

Keywords:
Leukocytes,
Index Mass Body,
Student Faculty UMI Medicine.

ABSTRACT

Leukocytes play an important role in the body's immune response and can reflect a person's health condition, including the presence of infection or inflammation. In certain conditions, such as obesity, the number of types of leukocytes can change in response to inflammation that occurs in the body. The purpose of this study is to see connection amount type leukocytes with Index Mass Body (BMI) on student Faculty Medicine of Muslim University of Indonesia. Using method study quantitative with design cut cross sectional, with Technique Analysis Univariate and Multivariate. Results study show that, there was no relationship between BMI status and leukocyte count in students of the Faculty of Medicine, Muslim University of Indonesia. Researchers believe that a healthy lifestyle, higher levels of physical activity, and younger age may play a role in preventing significant inflammatory impacts in this population.

Corresponding Author:
Sri Julyani
Faculty Medicine, Indonesian Muslim Universities
Jl. Urip Sumoharjo, Panaikang, Panakkukang District, Makassar City
sri.julyani@umi.ac.id

INTRODUCTION

Leukocytes are part of the immune system, participate in response immune innate and humoral. They circulate in the blood and enhance the inflammatory and cellular response to injury or pathogens. Leukocytosis indicates a condition in which the number of leukocytes (especially neutrophils) is higher than normal, accompanied by a “left shift” or increase in immature cells in the blood. Leukocytosis is usually a sign of an inflammatory response such as infection, but can also occur in parasitic infections or cancers such as leukemia. Neutrophils can also be increased due to other conditions, such as stress. [8]

In obesity, there is excessive expansion of adipocytes which will trigger hypoxia. Hypoxia together with high levels of oxidative stress in adipocytes will then cause death of adipocytes. Dead adipocytes will attract macrophages to the dead adipose tissue to eliminate the dead adipocytes. Macrophages together with adipocytes will produce various types of adipocytokines that trigger a series of chronic inflammatory processes. One of the processes that occurs in inflammation is the infiltration of neutrophils, eosinophils, monocytes, and lymphocytes into adipose tissue. Excessive fat accumulation in adipose tissue causes changes

Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

in substance both in terms of the number and activity of immune cells. Excess fat causes an increase in the number and activity of several immune cells including macrophages, mast cells, neutrophils, T lymphocytes and B lymphocytes but also a decrease in other cells such as eosinophils and T helper 2 (Th2). This imbalance is the basis for local and systemic inflammation related to obesity. The mechanism of infiltration of various immune cells is not yet clearly understood. [9]

Leukocyte count is a method of measuring the distribution/percentage of leukocytes based on their type. Leukocyte count is often times ignored if the examination of the number of leukocytes is normal and there are no hematological abnormalities both clinically and laboratory. However, certain conditions can cause changes in the leukocyte count even though the number of leukocytes is still normal, one of which is in inflammatory conditions. Complete blood count is a cheap and simple laboratory test, and in recent years, the number of leukocytes and platelets, neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), and monocyte-lymphocyte ratio (MLR) have been studied as markers of inflammation in various chronic subclinical diseases. These markers are easy to measure and available (can be calculated from routine complete blood count), cost-effective and reliable, and therefore can be used as an index of the severity of the immune response. [9, 10]

Discussing Body Mass Index (BMI). BMI can be influenced by several factors such as eating habits and lifestyle. The habit of eating unhealthy or unbalanced foods and irregular meal times will affect the nutritional intake received by the body. High nutritional intake that is not accompanied by sufficient energy expenditure will increase the risk of increasing BMI. Likewise, a lifestyle that lacks physical activity will trigger an increase in BMI. Lack of physical activity will cause an imbalance between the amount of energy absorbed and the energy expended. The remaining energy that is not expended will then be converted into body fat which triggers an increase in BMI values.

In previous research (Humaira, DL et al. 2020) "The Relationship between Central Obesity and Leukocyte Type Counts in Adult Men in the University of Lampung Environment" stated that there was a relationship between central obesity and neutrophil, monocyte and lymphocyte type counts in adult men, but there was no relationship in eosinophil and basophil types. [11]

METHOD

This research uses study quantitative with design cut Cross Sectional. Data collection is taken processed on at the same time For analyze existence variable relationship. With Time study implemented on month June 2024, located at the Family Doctor's Clinic (FDC), Tamalanrea District.

Population and sample

Population in This research is Student Faculty Faculty of Medicine, Muslim University of Indonesia, Class of 2021, with research samples that is Students of the Faculty of Medicine, Muslim University of Indonesia. In this study, the sample size was determined using the Roscoe sampling technique.

Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Based on Roscoe's calculations, the sample in this study:

= 10 x (dependent variable + independent variable)
= 10 x (5 + 1)
= 10 x 6
= 60 People

Table 1. Values References Sample

Type Leukocytes	Normal	Tall	Low
Neutrophils	46 – 74 %	> 73%	< 46 %
Lymphocytes	18 – 44 %	> 44%	<18 %
Monocytes	3 – 9 %	> 9%	< 3 %
Eosinophil	0 – 4 %	> 4%	< 0 %
Basophil	0 – 1 %	> 1%	< 0 %

Technique Data Analysis and Collection

a. Analysis Univariate, used to determine the distribution, frequency and percentage of research variables. The variables analyzed among others the proportion Students who experience obesity and counting amount leukocytes sample study.
b. Analysis Bivariate, used For prove hypothesis study that is For know Connection between two variable study that is connection amount type leukocytes with BMI on Student Faculty UMI Medicine. Tests used that is test *Chi-Square* because second variable study is variable categorical No in pairs.

Data processing

After researcher collect data, then changed to in form table and then done data processing with use device statistical software that is on the computer. With Several steps, including :

a. Editing, editing, checking and correcting the results that have been obtained.
b. Coding, Changing data from form sentence become certain codes /symbols to make it more easy analyzed
c. Data entry, inputting data into a computer
d. Cleaning, checking return the data that has been entered

RESULTS AND DISCUSSION

This research was conducted For know connection amount type leukocytes with BMI on student Class of 2021. Based on from the primary data obtained from results laboratory examination at FDC Clinic in 2024

Analysis Univariate

Characteristics Sample

Table 2. Characteristics Sample

Variables	Category	n	%
Gender	Woman	18	40
	Man	27	60
BMI Status	Normal	15	33.3

Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Variables	Category	n	%
Neutrophils	Obesity I	15	33.3
	Obesity II	15	33.3
	Normal	43	95.6
	Tall	0	0
	Low	2	4.4
Lymphocytes	Normal	43	95.6
	Tall	2	4.4
	Low	0	0
Monocytes	Normal	44	97.8
	Tall	1	2.2
	Low	0	0
Eosinophil	Normal	38	84.94
	Tall	7	15.6
	Low	0	0
Basophil	Normal	44	97.8
	Tall	1	2.2
	Low	0	0

Bivariate Analysis

Table 3. Relationship between BMI and Leukocyte Type

	IMT				
	Normal	Obesity 1	Obesity 2	Total	P Value
Neutrophils					
Normal	13	15	15	43	
Low	2	0	0	2	0.123
Lymphocytes					
Normal	13	15	15	43	
Tall	2	0	0	2	0.123
Monocytes					
Normal	14	14	13	41	
Tall	1	1	2	4	0.760
Eosinophil					
Normal	10	15	13	38	
Tall	5	0	2	7	0.040
Basophil					
Normal	14	15	15	44	
Tall	1	0	0	1	0.360

Explanation based on the results of the Bivariate analysis of the Relationship between BMI and Leukocyte Type:

Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

1. The results of the chi-square test showed that there was no significant relationship between Body Mass Index (BMI) and neutrophil levels (p = 0.123). From the data distribution table, it can be seen that normal neutrophils were found in 43 respondents, with a distribution of 13 people (30.2%) having normal BMI, 15 people (34.9%) having obesity level 1, and 15 people (34.9%) having obesity level 2. Meanwhile, low neutrophil levels were found in 2 respondents (100%) who all had normal BMI. There were no respondents with low neutrophil levels in the obesity level 1 or obesity level 2 groups. The total number of respondents was 45 people divided evenly, 15 people (33.3%) in each BMI category.
2. The results of the chi-square test showed that there was no significant relationship between Body Mass Index (BMI) and lymphocyte levels (p = 0.123). From the data distribution, normal lymphocyte levels were found in 43 respondents, with 13 people (30.2%) having normal BMI, 15 people (34.9%) having obesity level 1, and 15 people (34.9%) having obesity level 2. Meanwhile, high lymphocyte levels were found in 2 respondents (100%) who all had normal BMI, with none coming from the obesity level 1 or obesity level 2 group. The total respondents in this study were 45 people, with the same proportion in each BMI category, namely 15 people (33.3%) each.
3. The results of the chi-square test showed that there was no significant relationship between Body Mass Index (BMI) and monocyte levels (p = 0.760). From the data distribution, normal monocyte levels were found in 41 respondents, consisting of 14 people (34.1%) with normal BMI, 14 people (34.1%) with obesity level 1, and 13 people (31.7%) with obesity level 2. Meanwhile, high monocyte levels were found in 4 respondents, with 1 person (25%) having normal BMI, 1 person (25%) having obesity level 1, and 2 people (50%) having obesity level 2. The total number of respondents was 45 people, with an even distribution in each BMI category, namely 15 people (33.3%) each.
4. The results of the chi-square test showed a significant relationship between Body Mass Index (BMI) and eosinophil levels (p = 0.040). From the data distribution, normal eosinophil levels were found in 38 respondents, with 10 people (26.3%) having normal BMI, 15 people (39.5%) having grade 1 obesity, and 13 people (34.2%) having grade 2 obesity. Meanwhile, high eosinophil levels were found in 7 respondents, with a distribution of 5 people (71.4%) having normal BMI and 2 people (28.6%) having grade 2 obesity, while there were no respondents with high eosinophil levels in the grade 1 obesity group. The total number of respondents was 45 people, with the same distribution in each BMI category, namely 15 people (33.3%) each.
5. The results of the chi-square test showed that there was no significant relationship between Body Mass Index (BMI) and basophil levels (p = 0.360). From the data distribution, normal basophil levels were found in 44 respondents, with 14 people (31.8%) having normal BMI, 15 people (34.1%) having obesity level 1, and 15 people (34.1%) having obesity level 2. Meanwhile, high basophil levels were only found in 1 respondent (100%) who had normal BMI, with no respondents with high basophil levels in the obesity level 1 or obesity level 2 groups. The total number of respondents in this

Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

study was 45 people, with the same distribution in each BMI category, namely 15 people (33.3%) each.

Discussion

Based on the results of statistical tests conducted using the Chi-Square Test, no significant relationship was found in the number of Neutrophils, Lymphocytes, Monocytes, and Basophils between different BMI groups. The Chi-Square results for Neutrophils (P = 0.123) and Lymphocytes (P = 0.123) showed that the relationship between BMI groups was not significant. Monocytes (p = 0.760), and Basophils (p = 0.360) also showed similar results. While Eosinophils (p = 0.040) had a significant relationship with BMI.

The absence of a significant relationship indicates that BMI status, whether normal, obesity I, or obesity II, does not have a direct influence on the variation in the number of leukocyte types in the population of medical school students. This finding is contrary to several previous studies that showed a relationship between obesity and changes in the number of leukocytes. [42]

For example, a study by Purdy and Shatzel (2020) showed that obese individuals have an increased number of leukocytes due to the inflammatory process that often occurs in obesity. [43] This increase is caused by increased levels of inflammatory cytokines that stimulate leukocyte production. However, the results of this study indicate that BMI factors do not have a significant impact on leukocyte counts in students who are generally younger and more active.

Several factors may explain these findings. First, the BMI status in this study was in a less extreme range. The majority of participants had a normal BMI or obesity I, which is not high enough to trigger significant inflammatory changes. [44] Previous studies such as those by Rodríguez-Rodríguez et al. (2022) have shown that differences in leukocyte counts are more pronounced in individuals with advanced obesity or those who already suffer from obesity-related comorbidities, such as type 2 diabetes and hypertension. [45] In this population of college students, most of them did not show any diseases that could worsen inflammation, so the impact of BMI status on leukocyte counts was not seen.

Common healthy lifestyle factors in college students may also play a role in moderating the effects of obesity on leukocyte counts. Most college students, despite being obese, tend to have higher levels of physical activity compared to sedentary adults. Research suggests that physical activity can reduce levels of inflammation in the body and, in turn, reduce the number of several types of leukocytes involved in the inflammatory response. [46]

The absence of BMI status on the number of leukocyte types such as neutrophils, monists, and others in this study can be explained by many factors that affect the immune system as a whole. Leukocyte activity is influenced not only by BMI, but also by other factors such as age, level of physical activity, diet, stress, and general health status. [48] In a healthy and young student population, the immune system tends to be more stable so that physiological changes due to BMI may not be visible. Most respondents with high BMI are in the mild obesity category, which usually does not trigger significant systemic inflammation like severe obesity. This condition allows the number of leukocytes to remain within the normal range despite differences in BMI.

Jurnal Eduhealth
Volume 16, Number 01 2025 DOI 10.54209/eduhealth.v16i01
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

The balance of the immune system in young individuals also plays an important role in maintaining stable leukocyte counts. Several previous studies have shown that obesity-related systemic inflammation tends to be more pronounced in individuals with severe obesity or those with comorbidities such as diabetes or hypertension. In this study, the absence of comorbidities may be the main factor explaining the stability of leukocyte counts in all BMI groups. [49] These findings suggest that the effects of obesity on the immune system are more complex and likely depend on the severity of obesity and the presence of additional risk factors.

Changes in the number of leukocytes in the body can be influenced by various factors, both physiological and pathological. In general, an increase in the number of leukocytes (leukocytosis) often occurs in response to infection, inflammation, physical or emotional stress, allergies, or certain immune system disorders. Neutrophils tend to increase in acute bacterial infections, trauma, or chronic stress, while eosinophils often increase in allergic conditions and parasitic infections. On the other hand, lymphocytes increase in viral infections such as mononucleosis or tuberculosis. [50]

A decrease in the number of white blood cells (leukopenia) can occur due to various conditions, such as malnutrition, impaired bone marrow function, autoimmune diseases, or side effects of drugs such as chemotherapy. Neutropenia, or a decrease in neutrophils, is often found in patients with certain viral infections or those undergoing immunosuppressive therapy. Lymphopenia, a decrease in the number of lymphocytes, can occur in immunodeficiency conditions. [50]

In obesity, adipocyte hypertrophy and hyperplasia occur, triggering oxidative stress and tissue hypoxia, which then activates the inflammatory pathway through NF- κB and results in increased production of proinflammatory cytokines. Theoretically, this condition should cause an increase in the number of leukocytes, especially neutrophils and monocytes, in response to these inflammatory signals. [47]

Although BMI status affects many aspects of health, in this case, the relationship between BMI and leukocyte count cannot be clearly concluded because there was no significant difference between BMI groups. In this study, the majority of subjects were young college students who did not have comorbidities, which may explain why the difference in leukocytes was not seen.

This study also showed that BMI status in the less extreme ranges (normal and obesity I) was not sufficient to produce detectable differences in leukocyte counts, either in Neutrophils, Lymphocytes, Monocytes, Eosinophils, or Basophils. This provides evidence that other more complex factors, such as higher levels of inflammation in older individuals, or the presence of comorbidities, may play a greater role in influencing leukocyte counts. Further studies with larger and more diverse samples, and considering other factors such as systemic inflammation levels, diet, and more pronounced comorbidities, are needed to further understand the relationship between BMI status and leukocyte counts.

Based on these findings, it can be concluded that although obesity is known to trigger inflammatory responses, there is no strong evidence to support a relationship between BMI status and leukocyte count in students of the Faculty of Medicine, Muslim University of

Indonesia. These findings suggest that a healthy lifestyle, higher levels of physical activity, and younger age may play a role in preventing significant inflammatory impacts in this population. Further research is needed to explore this relationship in more depth, taking into account other factors that may influence the body's immune response.

CONCLUSION

Based on results research conducted on student faculty umi medical can concluded that, No there is existence meaningful relationship between amount neutrophils, lymphocytes, monocytes, and basophils with index mass body However, there is existence meaningful relationship between amount Eosinophil with index mass body

REFERENCE

Arisandi D, Sugiarti, Wijaya MRF. 2015. Hubungan Indeks Massa Tubuh (IMT) dan Ukuran Lingkar Pinggang dengan Kejadian Hiperkolesterolemia pada Anggota Polisi di Polsek Depok Timur Sleman Yogyakarta. Prosiding Seminar Hasil – Hasil Penelitian dan Pengabdian Masyarakat Stikes Guna Bangsa; 2015; Sleman. Yogyakarta: Fakultas Kesehatan Masyarakat Universitas Ahmad Dahlan. hlm. 5-10

Azis Abdul Zayd. 2021. Hubungan Indeks Massa Tubuh Dengan Spondilolistesis di RSUP DR Mohammad Hoesin Palembang. Fakultas Kedokteran Universitas Sriwijaya, Palembang.

Budiman, B., Hamzah, P. N., & Musa, I. M. (2022). Karakteristik indeks massa tubuh berdasarkan jenis kelamin dan umur pada mahasiswa program profesi dokter Fakultas Kedokteran Universitas Muslim Indonesia. Indonesian Journal of Health, 100–109.

Humaira, D.L, Berwai, N.K, Morfi, W.C. 2020 Hubungan Obesitas Sentral dengan Hitung Jenis Leukosit pada Dewasa lingkungan Universitas Lampung. Fakultas kedokteran, Unversitas Lampung,

Jan, A., & Weir, C. B. 2021. BMI classification percentile and cut off points. StatPearls: Treasure Island, FL, USA, 1–4.

Kementrian Kesehatan Republik Indonesia (Kemenkes RI). 2015 Pedoman Umum Pengendalian Penyakit, Jakarta: Badan Penilitian dan Pengembangan Kesehatan.

Krismawati, E. D. L., N. L. N. Andayani. dan N. Wahyuni. 2019. Hubungan Antara Aktivitas Fisik dengan Indeks Massa Tubuh (IMT) Pada Remaja Usia 16-18 Tahun di SMA Negeri 2 Denpasar.

Misnadiarly. 2017. Obesitas Sebagai Faktor Risiko Beberapa Penyakit. Jakarta :Pustaka Obor Populer.

Mohammad, K. Dan Daisuki, S 2018. Sleep Quality Influences Body Mass Index Of High Scholer, pp. 587-569.

Mraz M, Haluzik M. 2017. The role of adipose tissue immune cells in obesity and low-grade inflammation. Journal of Endocrinology. 222: 113-27.

Musdalifah. 2022. Hubungan Indeks Massa Tubuh dengan Kebugaran Kardiorespirasi Pada Siswa Sekolah Menengah Atas Pondok Pesantren Putri Darul Istiqamah Maros: Fakultas Kedokteran UNHAS. Makassar.

Nowak-Szczepanska, N., Gomula, A., & Koziel, S. 2019. Mid-upper arm circumference and body mass index as different screening tools of nutritional and weight status in Polish schoolchildren across socio-political changes. Scientific Reports, 9(1), 1–7.

Oemati R, et al. 2013 Riskesdas Angka Provinsi Lampung. Jakarta: Lembaga Penerbitan Badan Litbangkes.

Pan S, Yu Z, Ma Y, Liu F, Yang Y, Ma X, et al. 2013. Appropriate Body Mass Index and Waist Circumference Cutoffs for Categorization of Overweight and Central Adiposity Among uighur adults in Xinjiang. PLOS One. 8(11): 1–8.

Retnoningrum Dwi, Hendrianingtyas Meita, Reghita Fitrianita. 2019 Hubungan Lingkar PInggang dan Visceral Fat Dengan Kadar Ferritin Serum Pada Obesitas. Semarang: Jurnal Kedokteran Diponegoro.

Rodríguez-Rodríguez, E., Salas-González, M. D., Ortega, R. M., & López-Sobaler, A. M. (2022). Leukocytes and Neutrophil-Lymphocyte Ratio as Indicators of Insulin Resistance in Overweight/Obese School-Children. *Frontiers in nutrition*, *8*, 811081. https://doi.org/10.3389/fnut.2021.811081

Siburian 2019 Korelasi Lingkar Pinggang Dengan Tekanan Darah Di SMPN 1 Labuhan Deli Tahun 2018, Fakultas Kedokteran.

Singh S, Dulai PS, Zarrinpar A, Ramamoorthy S, Sandborn J, Surgery R, et al. 2017. Obesity in IBD: Epidemiology, Pathogenesis, Disease Course and Treatment Outcomes. HHS Public Access. 14(2):110–21.

Singh S, Dulai PS, Zarrinpar A, Ramamoorthy S, Sandborn J, Surgery R, et al. 2017. Obesity in IBD: Epidemiology, Pathogenesis, Disease Course and Treatment Outcomes. HHS Public Access. 14(2):110–21.

Suciati, T., & Se, H. S. 2019. Body mass index as a parameter of running speed. Bioscientia Medicina: Journal of Biomedicine and Translational Research, 3(2), 1–9.

Tigner A, Ibrahim SA, Murray IV. Histologi, Sel Darah Putih. [Diperbarui 2022 14 November]. Di: StatPearls [Internet]. Pulau Harta Karun (FL): Penerbitan StatPearls; 2024 Januari-. Tersedia dari: https://www-ncbi-nlm-nih gov.translate.goog/books/NBK563148/?_x_tr_sl.

UNICEF.2019 Analisis Lanskap Kelebihan Berat Badan dan Obesitas di Indonesia. 1 ed. Jakarta;

Walya, Genis Ginanjar. 2019. Obesitas Pada Anak. : Bentang Pustaka.

World Health Organization. 2024 (cited 2024 Maret 9) Obesity and Overweight Available from : https://www-who-int.translate.goog/news-room/fact-sheets/detail/obesity-and-overweight?_x_tr_sl=en&_x_tr_tl=id&_x_tr_hl=id&_x_tr_pto=tc.

Yusuf, R. N., & Ibrahim 2019. Jurnal Kesehatan Saintika Meditory Correlation Of Body Mass (BMI) With Cholescterol. Jurnal Kesehatan Saintika Meditory.

Zierle-Ghosh A, Jan A. 2023 Fisiologi, Indeks Massa Tubuh. [Diperbarui 2023 5 November]. Di: StatPearls [Internet]. Pulau Harta Karun (FL): Penerbitan StatPearls; 2024 Januari-. Tersedia dari: https://www-ncbi-nlm-nih-gov.translate.goog/books/NBK535456/?_x_tr_sl=en&_x_tr_tl=id&_x_tr_hl=id&_x_tr_pto=tc