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Analysis of Neutrophil-to-Lymphocyte Ratio between Obese and Non-Obese Women

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ABSTRACT: Obesity is one of the largest global challenges for public health. Obesity is more prevalent in women than men. They also have a higher body fat percentage than men. Accumulation of fat cells in the adipose tissue causes stress and adiposity malfunction that leads to inflammation. Neutrophils are the first immune cells that infiltrate the adipose tissue. The neutrophil-to-lymphocyte ratio is a simple and cost-effective inflammatory marker. This study is quantitative with a cross-sectional design conducted on 70 subjects. The results showed the age of obese vs non-obese women (30.26 ± 8.58 vs 28.66 ± 8.72, p = 0.554), waist circumference (88.48 ± 4.23 vs 74.51 ± 3.50, p = 0.000), WBC level (6.49 ± 0.56 vs 6.25 ± 0.39, p = 0.002), neutrophil level (65.16 ± 3.73 vs 62.76 ± 6.13, p = 0.030), lymphocytes level (28.10 ± 3.40 vs 33.89 ± 5.38, p = 0.000), and NLR level (2.31 ± 0.34 vs 1.85 ± 0.39, p = 0.020).

This study found a significantly higher NLR level in obese women compared to non-obese women.

Keywords: Obesity, Women, NLR

I. INTRODUCTION

The prevalence of obesity has increased within the last decade. Body Mass Index (BMI) is one of the indicators of overweight and obesity by dividing weight in kilograms by height in meters squared. (kg/m^2).[1,2]

The prevalence of obesity has increased throughout the world within the last 50 years, causing an epidemic, and does not show any signs of declining within a short time. Obesity is most prevalent in younger individuals. Obesity in children aged 2 to 17 years old has increased by 17.4% between 2013 and 2014. Thirty-nine percent of adults aged 18 years and above were overweight, while 13% were obese.[1,3]

Obesity is classified into central and peripheral. In central obesity, fats fill the abdominal area (abdominal obesity), where fats accumulate in the central part of the body and the abdominal cavity (mesenteric and visceral). Peripheral obesity has fats accumulate in the hip and thigh areas. Central obesity has more risk for diseases related to metabolic syndrome, type 2 diabetes mellitus, and cardiovascular diseases. Fat accumulation in men is in the upper body part (body and abdomen), while in women, visceral fats are usually found in the lower part of the body, which are the hip and thighs. Total body fat distribution in men comprises ≥ 25%, while

in women comprises ≥ 35%.Central obesity has increased twice in postmenopausal women compared to premenopausal women.[2,4]

Fat accumulates due to an imbalance between energy intake and expenditure. Obesity is associated with mild chronic inflammation, which is proven by an increase in the levels of various inflammatory markers, including C-reactive protein (CRP), tumor necrosis factor (TNF)-α, interleukin 6 (IL6), and interleukin 8 (IL8). Systemic inflammation can be measured by various biochemical and hematological markers. The local inflammatory condition of the visceral adipose tissue is marked by the infiltration of monocytes/macrophages and various lymphocyte subtypes. Therefore, the white blood cell (WBC) level and its subtypes reflect an inflammatory status without infection. Currently, NLR is included as an inflammatory marker reflecting the balance between innate immune response (neutrophil) and adaptive (lymphocytes) measured from the ratio of ANL and ALC, which is easy and cost-effective. A previous study showed that the increase in NLR was associated with an increased concentration of various proinflammatory cytokines that can damage cellular DNA. This neutrophil-to-lymphocyte ratio is also a strong inflammatory indicator that has been studied in various inflammations and neoplastic diseases, including metabolic syndrome, colorectal cancer, hepato cellular carcinoma, and others. Neutrophils can migrate into the systemic myocardial tissue before other inflammatory cells, causing destructive changes by stimulating enzyme release, oxygen free radicals, and neutrophils.[5,6]

Neutrophils and lymphocytes are the first line of defense from infection and hold a primary role in inflammation. The neutrophil-to-lymphocyte ratio (NLR) is the ratio between absolute neutrophil and lymphocyte levels, a new inflammatory marker used as a prognostic for various diseases.[7]

Obesity, mostly found in women, is a chronic inflammatory condition measurable by a simple NLR marker. Therefore, the authors are interested in conducting this study.

II. MATERIALS AND METHODS

This study used a quantitative approach with a cross-sectional design. It was conducted from September-November 2022. The population was adult women aged 18-45 years old. Seventy samples fulfilled the inclusion criteria, i.e., obese women aged 18-45 years old, willing to participate in the study by filling out and signing an informed consent. The exclusion criteria were diabetes mellitus, cardiovascular disease, malignancy, infectious disease, hypertension, icteric, lipemic, or hemolyzed serum samples.

III. RESULTS

Table 3.1 Sample characteristics of obese and non-obese women

Variable	Obese (n=35) Mean ±SD	Non obese (n=35) Mean ±SD	*p-value*
Age	30,26±8,58	28,66±8,72	0,554
Hip circumference (cm)	88,48±4,23	74,51±3,50	0,000
WBC (10^3/ul)	6.49±0.56	6.25±0.29	0,002
Neutrofil (%)	65,16±3,73	62,76±6,13	0,030
lymphocyte (%)	28,10±3,40	33,89±5,38	0,000
NLR	2,31±0,34	1,85±0,39	0,020

The table above stated 35 samples of obese women and 35 samples of non-obese women. Mann-Whitney test indicated the age (30.26 ± 8.58 vs 28.66 ± 8.72, p = > 0.554), hip circumference (88.48 ± 4.23 vs 74.51 ± 3.50, p = 0.000), WBC level (6.49 ± 0.56 vs 6.25 ± 0.29, p = 0.002), neutrophil level (65.16 ± 3.73 vs 62.76 ± 6.13, p = 0.030), lymphocyte level (28.10 ± 3.40 vs 33.89 ± 5.38, p = 0.000), and NLR level of obese vs non-obese women (2.31 ± 0.34 vs 1.85 ± 0.39, p = 0.020).

IV. DISCUSSION

This study suggested a significant correlation between NLR levels in obese and non-obese women (p-value = 0.020). This was in line with Rodriguez, who in 2020 stated that the increase in NLR level is proportional to the increase in WHR level. Aydin in 2015 found that NLR level was significantly higher in the obese group compared to the healthy control. Obesity is a chronic inflammatory disease characterized by changes in adipokine production and increased levels of inflammatory cytokines.[5,6,7]

Obese individuals undergo molecular and cellular changes that affect systemic metabolism. First, increased free fatty acid (FFA) in the whole body along with glycerol release from adipocytes. Second, the production of proinflammatory cytokines in the adipose tissue.[7] The underlying mechanism of mild chronic inflammation in obesity has not been fully understood. Several studies showed that various stages of adiposity (overweight, obesity, and severe obesity) cause the accumulation of myeloid cells, including macrophages and neutrophils. Obesity can change the hematopoietic cellular compartment structure which can cause increased progenitors of granulocytes and macrophages.[8,9]

Fat cell accumulation in the adipose tissue led to stress and adiposity malfunction, which will induce the inflammatory process. Furthermore, the most abundant innate immune cells in the blood, neutrophils, will infiltrate the adipose tissue. Neutrophils will be activated and release inflammatory factors that recruit macrophages and other immune cells. These cells will induce cytokine and chemokine production, which will cause systemic inflammation.[10]

This study has several limitations due to the cross-sectional approach, thus could not obtain a causal conclusion. The study did not conduct examinations to rule out some diseases as confounding factors. Diseases were identified only through questionnaires, history taking, and routine laboratory tests.

V. CONCLUSION AND SUGGESTION

The results conclude that:

1. NLR level is higher in obese women compared to non-obese women.
2. There is a significant correlation between NLR levelsin obese and non-obese women.

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