

Difference of thrombocyte profile between obesity and central obesity in women

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ABSTRACT

Background: Obesity considered as a low-grade inflammation. Increased body fat has known to trigger inflammation. Platelet profile is a number of platelet-related parameters that can predict inflammation consisting of: platelet count (PLT), Platelet Larger Cell Ratio (P-LCR), Mean Platelet Volume (MPV). Differences in platelet profiles (PLT, P-LCR, MPV) in women with and without central obesity have only been investigated in a few studies.

Objective: To prove differences in platelet profiles in women with and without central obesity.

Materials and Methods: A cross-sectional observational study was conducted on 88 women with and without central obesity in RSND during July-September 2021. Data included age, abdominal circumference, hip circumference, PLT, P-LCR, and MPV. PLT, P-LCR, and MPV were measured using Sysmex XS-500i instrument. Statistical analysis was using Mann-Whitney test.

Results: Mean of women PLT with and without central obesity were $338.72 \pm 71.09 \times 10^3 / \text{uL}$ and $309.09 \pm 44.36 \times 10^3 / \text{uL}$. Difference platelet levels in women with and without central obesity was $p=0.022$. Median MPV of women with and without central obesity were 10.5 (8.5-11.8)fL and 9.7 (8.5-11.6)fL. Difference MPV values in women with and without central obesity was $p=0.000$. Median P-LCR of women with and without central obesity were 28.2 (12.3-44.3)% and 21.5 (15.2-37.1)%, respectively. Difference P-LCR value in women with and without central obesity was $p=0.002$.

Conclusion: Platelet profiles (PLT, MPV, P-LCR) can be used as a marker of chronic low-grade inflammation in women with central obesity.

Keywords : central obesity; MPV; PLT; P-LCR

BACKGROUND

Obesity is still becoming one of major public health problem in the world whose number continues to increase every year. Results of Basic Health Research (Riskesmas) from the Ministry of Health of the Republic of Indonesia in 2018 show that there is an increase in prevalence of obesity. There was a 7 % increase in the prevalence of obesity in the age group over 18 years from 14.8% in 2013 to 21.8% in 2018. This result also conclude that proportion obesity is higher in women than men.¹

Obesity defined by Body Mass Index (BMI) $>25 \text{ kg/m}^2$. Obesity usually divided into 2 types namely Central Obesity and Perifer Obesity. Central obesity is more dangerous than the other type of obesity because central obesity indicates abnormal fat accumulation in the abdominal regions is highly associated with the risk of getting cardiometabolic diseases and their progression to end stage diseases or death.²

Central obesity cannot be defined by BMI only, another anthropometric examination is needed to determine whether someone has a type of central obesity. Waist to hip ratio (WHR) is one of the anthropometric measurements that can be used to determine central obesity. WHR measures the ratio of waist circumference to hip circumference, determining how much fat is stored in the waist, hips, and buttocks. Central obesity defined if the WHR is 0.9 in men and 0.85 in women, and the optimal cutoff value is 0.89 for men and 0.82 for women in Asian populations.³

Obesity is a condition that can trigger low-level inflammation caused by an increase in body fat. Excessive body fat cause adipocyte increased more cytokine pro-inflammatory such as TNF-Alpha, IL-6, and CRP which can be used as inflammatory parameters.⁴ Previous studies have found that the platelet profile plays an important role in a number of diseases whose pathogenesis is strongly influenced by the inflammatory process⁵. Cohort study in 2021 also showed that there is a significant correlation between platelet profile and obesity. Platelet profile can be an alternative inflammatory parameters with the advantage of easier and cheaper examination compared to pro-inflammatory cytokines.⁶

There are several parameters of the platelet profile such as platelet count (PLT), mean platelet volume (MPV), and platelet large cell ratio (P-LCR). MPV can act as a negative or positive acute-phase reactant in a variety of different inflammatory conditions. An increase in MPV is associated with a severe inflammatory condition due to an increase in the number of circulating platelets, while a decrease in MPV is associated with

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a mild inflammatory condition. The P-LCR is an indicator of the number of larger platelets (>12 fL) in the circulation. This parameter can also be used to evaluate platelet activity. The P-LCR value is inversely proportional to the platelet count, and is directly proportional to Platelet Distribution Width (PDW) and MPV. P-LCR will decrease in patients with thrombocytosis and increase in thrombocytopenia .

Cecen S *et al* in their research explained that PLT increases with body weight, fat percentage, fat masses (FM), and fat mass index (FMI). In men, whereas Procalcitonin Test (PCT) did not change in these parameters. PLT in women decreases with age, increases with body weight, body mass index (BMI), fat percentage, FM, fat-free masses (FFM), and FMI while PCT increases with body weight, BMI, fat percentage, FM, FFM, and FMI.⁵ Ali U, *et al* in their research stated that statistically there were differences in the MPV, P-LCR, PCT reference intervals based on gender, whereas in the PDW reference interval there were no significant differences.⁷

Several studies also have emphasized the relationship between obesity-related problems and platelet activation, but few studies have studied differences in platelet profiles in women with and without central obesity. This study was conducted to determine whether there are differences in platelet profiles in women with and without central obesity.

MATERIALS AND METHODS

This study used a cross-sectional observational research method, the study was conducted during July-September 2021 at the Diponegoro National Hospital (RSND) Semarang. This study was cross sectional study with simple random sampling. Total respondent in this study was 87 obese women that divided into 2 groups there is Central Obesity Group and Non Central Obesity Group. Respondent in this study was chosen based on inclusion criterias such as in 20-35 years old having BMI score > 25(kg/m²).⁸ Waist to Hip Ratio (WHR) > 0.85 Central Obesity Group and < 0.85 for Non Central Obesity Group, in healthy condition and willing to participate in this study.⁹ Exclusion criterias were pregnant women, hemolysis specimens, frozen specimens, heart disease, diabetes mellitus, and blood disorders.

$$\text{Body Mass Index (BMI)} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

$$\text{Waist Hip Ratio (WHR)} = \frac{\text{Waist Circumference (cm)}}{\text{Hip Circumference (cm)}}$$

Respondent in this study was taken as much as 3 cc of blood in the EDTA tube, then examined at the RSND outpatient laboratory. Platelet count, PLCR and MPV were measured through a Complete Blood Count (CBC) examination using an automatic hematology analyzer Sysmex XS-500i.

The collected data were analyzed using SPSS software. Normality test of data in this research was conducted by Kolmogorov Smirnov. Data analysis of platelet levels was carried out by independent t-test, while the analysis of MPV and P-LCR values used the Mann Whitney test. The research has been approved by the Ethics Committee of the Diponegoro Medical Faculty Semarang Number 32/EC/KEPK/FK-UNDIP/III/2020.

RESULTS

Total of 88 respondents participated in the study, during data processing there was 1 outlier data, so it was excluded from the study. The final data used 87 samples consisting of 43 samples of the central obesity group and 44 samples of the group without central obesity.

Characteristics of the subjects in the two groups were presented in Table 1. Median of age was older in central obesity group than without central obesity. Median value of WHR in central obese group was 0.9 (0.85-0.98) and 0.79 (0.68-0.84) in the group without central obesity.

Table 1. Characteristics of research subjects

Variable	Central Obesity (n= 43)	Non Central Obesity (n= 44)	p
	Median (min-max)	Median (min-max)	
Age (years) [#]	31 (25-35)	30 (25-35)	0,439 ^M
Weight (Kg) [#]	73,7 (61-138)	69,9 (54-100)	0,080 ^M
Height (cm)	156 (145-167)	157,25 (145-167)	0,704 [†]
BMI (Kg/m ²) [#]	30,83 (24,64-53,08)	29,15 (23,76-42,04)	0,075 ^M
Waist Circumferance (cm) [#]	96 (79-138)	86 (72-112)	0,000 ^{*M}
Hip Circumferance (cm) [#]	108 (90-145)	110 (93-135)	0,195 ^M
WHR [#]	0,9 (0,85-0,98)	0,79 (0,68-0,84)	0,000 ^{*M}

*significant ($p < 0.05$); ^MMann Whitney; [†]independent t-test.

The results of blood examination were platelet count, MPV value, and P-LCR. The difference in platelet profiles between two groups can be seen in Table 2. There was a significant difference in platelets count between two group ($p=0.022$). MPV values in central obesity group had a median of 10.5 (8.5-11.8) fL, and the median among non central obesity group was 9.7 (8.5-11.6) fL. There was a significant difference in MPV values between two groups in this study ($p=0.000$). P-LCR central obesity group had a median of 28.2 (12.3-44.3)%, and the other group was 21.5 (15.2-37.1)%. There was a significant difference in the P-LCR value between two groups ($p=0.002$).

Table 2. Differences in platelet profiles in women with and without central obesity

Variable	Normal Range ¹⁰⁻¹²	Central Obesity (n= 43)		Non Central Obesity (n= 44)		p
		Mean \pm SD	Median (min-max)	Mean \pm SD	Median (min-max)	
PLT ($\times 10^3$ /uL)	150-400	338,72 \pm 71,09	329 (168-458)	309,09 \pm 44,36	301 (219-424)	0,022 ^{*†}
MPV (fL)	7.2-11.2	10,54 \pm 0,86	10,5 (8,5-11,8)	9,82 \pm 0,8	9,7 (8,5-11,6)	0,000 ^{*M}
P-LCR (%)	15-35	28,2 \pm 7,23	28,2(12,3-44,3)	23,4 \pm 6,66	21,5 (15,2-37,1)	0,002 ^{*M}

MPV, mean platelet volume; PLT, platelet/ trombositis; P-LCR, platelet large cell ratio; p: [†]independent t-test; ^MMann Whitney. *significant ($p<0.05$).

DISCUSSION

Obesity is an excessive accumulation of fat due to an imbalance between energy intake and energy expenditure for a long time.³ Obese individuals with high visceral adiposity have increased expression of monocyte-chemotactic protein-1 (MCP-1) and infiltration macrophages in visceral fat compared to subcutaneous fat. Visceral adipose tissue from obese subjects was also found to secrete higher levels of plasminogen activator inhibitor-1 (PAI-1), IL-6, TNF-Alpha, and leptin and lower levels of adiponectin compared to non-obese subjects.

The results of the study by Han S, *et al* said that PLT was positively related to BMI, waist circumference, WHR, and percentage of total fat mass. A similar relationship was found between PCT and body fat. However, there was no significant relationship between MPV, PDW, P-LCR with body fat.¹³ In line with this study, there was a significant difference in PLT in women with and without central obesity ($p = 0.022$) in accordance with Cecen S, *et al* in his study that said PLT, PCT, and PDW is increased with adipose tissue, especially in obese female individuals.⁵ This is because under inflammatory conditions, proinflammatory cytokine IL-6 secreted from adipose tissue increases the maturation of megakaryocyte precursors and may be the cause of increased PLT in obesity.⁵

Obesity causes chronic low-grade inflammation. Chronic low-grade inflammation in obese patients is different from inflammatory conditions in general, because there are no signs or symptoms of inflammation, but it is similar to inflammatory conditions due to activation of inflammatory mediators.¹⁴ Aktas G, *et al* in their study compared MPV as biomarker of inflammation between Diabetes Mellitus (DM) patients with medication and Diabetes Mellitus (DM) patient without medication. This study aims to observed relationship MVP with obesity index, body mass index (BMI) and waist circumference. The result was that MPV, BMI, and waist circumference were significantly higher in patients with uncontrolled DM compared to patients with controlled DM, where waist circumference and BMI were significantly higher in patients with uncontrolled DM.¹⁵ In this study, there were significant differences in MPV values between two groups ($p=0.000$). Central Obesity group having higher median MVP value than Non Central Obesity Group.

MPV is a parameter that inform about platelet size and activation. An increased MPV value indicates the presence of large, newer, denser, and more active platelets.¹⁶ MPV is also a marker of platelet reactivity and acts as an acute-phase reactant. A high MPV is an indicator of high-grade inflammation while a low MPV is an indicator of low-grade inflammation, because obesity is known to be a low-grade inflammation, so the expected MPV value in this study from two groups still categorized in normal range.¹⁷ LCR in women with central obesity where the P-LCR value in women with central obesity has median of 28.2 (12.3-44.3%), while the median in women without central obesity is 21.5 (15.2-37, 1) %.

Result of this study shows that there is significant differences PLT, MVP value between Central obesity group and Non Central Obesity group contradict with result from Alshehri O, *et al* study. This study shows that PLT, MPV and PDW in obese patients were not significantly different compared to non-obese patient.¹⁷

CONCLUSIONS

There are significantly differences platelet profiles (PLT, MPV, P-LCR) in women with and without central obesity. Platelet profiles (PLT, MPV, P-LCR) can be used as a marker of inflammation in women with central obesity.

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