

Relation between BMI, Total Leukocyte count and C Reactive Protein in Preeclampsia

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ABSTRACT

Aim: To check the correlation of Body Mass Index (BMI) with Total Leukocyte count (TLC) and C Reactive Protein (CRP) levels in preeclamptic and normotensive pregnant women.

Methods: It was a comparative cross sectional study with 120 participants divided into two groups with 60 diagnosed cases of preeclampsia and 60 healthy pregnant women with normal blood pressure. The samples were collected in the third trimester of pregnancy. All the participants were in the range of 20-40 years of age and had a BMI within 18-25kg/m².

Results: TLC and BMI were significantly high in the preeclamptic group (p value <0.001). BMI correlated positively with both systolic and diastolic blood pressure (p value <0.05). A positive correlation at a significant p value of <0.05 was observed between BMI and CRP levels. Moreover, BMI correlated with TLC at a statistically significant level (p value <0.05).

Conclusion: The study concludes that BMI is related to CRP levels as well as TLC in pregnancies complicated with PE. High BMI in the preeclamptic group highlights the role of adipose tissue as a source of systemic inflammation. In addition to placental dysfunction adipose tissue might contribute to the systemic inflammation due to superfluous production of inflammatory mediators.

Keywords: BMI, C reactive protein, leukocyte count

INTRODUCTION

Preeclampsia (PE) is a complex complication of pregnancy characterized by hypertension and proteinuria commencing at >20 weeks of gestation¹. The pathogenesis of this disorder is multifactorial with contribution of a number of risk factors e.g. history of PE, diabetes, null parity, twin pregnancy, fetal sex, chronic hypertension, high Body Mass Index (BMI) etc².

Whatever the cause, generalized maternal systemic inflammation remains the hallmark of PE³ and release of proinflammatory cytokines results in endothelial injury along with activation of neutrophils and coagulation⁴. High BMI and excessive adiposity have been linked with PE and increase in maternal weight has been related with progressive risk of the disorder⁵. Similar to PE, widespread systemic inflammation has been reported in obesity⁶. C reactive protein (CRP) is a marker of inflammation and elevated levels have been reported in PE as well as obesity^{7,8}.

Moreover, a positive correlation has been reported between BMI and Total leukocyte count (TLC).⁹ The aim of this study was to check the relation of BMI with TLC and CRP levels in PE.

METHODS AND MATERIALS

This cross sectional observational study was conducted in the Department of Physiology at Shaikh Zayed Medical Complex, Lahore. Study population comprised of 120 patients divided into two groups with 60 normotensive and 60 preeclamptic women. All the participants were in the third gestational period and the age was between 20-40 years. Women with history of smoking, diabetes mellitus, renal disorders, inflammatory disease of bowel, hypertension, cardiovascular illness (e.g., ischemic heart disease) and symptomatic infections (bacterial and viral) were excluded. The study was approved by the Ethical Review Board and all the participants signed written consent. Blood pressure and BMI were recorded. Aseptic measures were used to collect 3cc blood. TLC was calculated by automated hemoanalyzer. C reactive protein levels were estimated by commercial ELISA-based kits (manufactured by Bio check Inc. Foster city). Data were entered and analyzed by using SPSS version 20.0.

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RESULTS

The clinical characteristics of the participants have been reported earlier along with CRP levels.⁸ Total leukocyte count and BMI were higher in the preeclamptic group as were the CRP levels (p value <0.001). BMI correlated positively with both systolic and diastolic blood pressure (SBP, DBP) as shown in Fig. 1 and 2 respectively. A positive correlation at a significant p value of <0.05 was observed between BMI and CRP levels (Fig. 3). Moreover, BMI correlated with TLC at a statistically significant level (p value <0.05) as shown in Fig. 4.

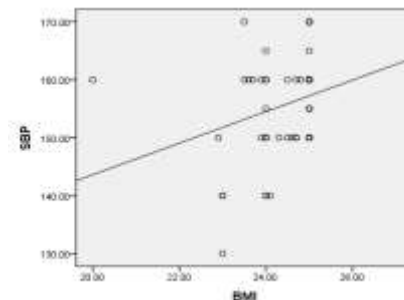


Figure 1: Correlation of BMI with SBP, $p = 0.31$, $p < 0.05$. (Spearman's rank correlation test showing positive correlation between BMI and SBP). Body Mass Index (BMI), Systolic Blood Pressure (SBP)

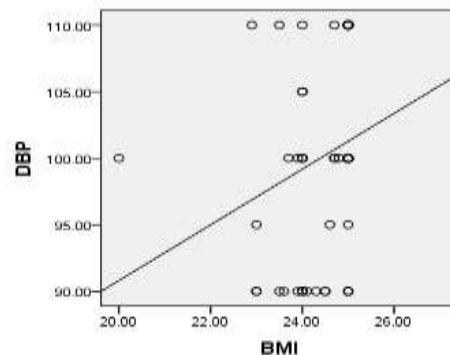


Figure 2: Correlation of BMI with DBP, $p = 0.35$, $p < 0.01$. (Spearman's rank correlation test showing positive correlation between BMI and DBP). Body Mass Index (BMI), Diastolic Blood Pressure (DBP)

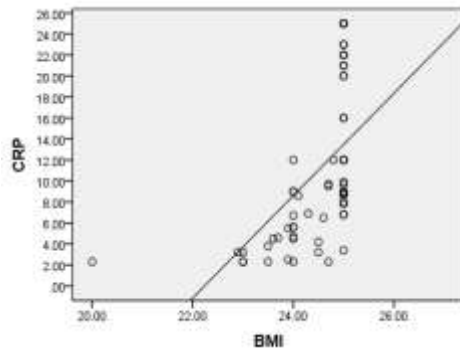


Figure 3: Correlation of BMI with CRP, $\rho = 0.75$, $p < 0.001$. (Spearman's rank correlation test showing positive correlation between BMI and CRP). Body Mass Index (BMI), C Reactive Protein (CRP)

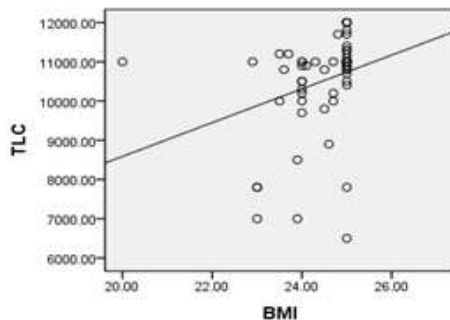


Figure 4: Correlation of BMI with TLC, $\rho = 0.43$, $p < 0.001$. (Spearman's rank correlation test showing positive correlation between BMI and CRP). Body Mass Index (BMI), Total Leukocyte Count (TLC)

DISCUSSION

In the current study, BMI was significantly higher in the preeclamptic group ($p < 0.00$) and the results are consistent with the previous study that reported higher incidence of PE in overweight women¹⁰. The findings are further augmented by another study where a strong significant association was observed between maternal BMI and PE¹¹. Obesity has been linked with low level of subclinical inflammation because of increased production of proinflammatory cytokines. Excessive adipose tissue contributes to the higher production of these cytokines^{12,13}. Generalized inflammation is a hallmark of both these conditions i.e. obesity and PE. High BMI and excess gain of weight during pregnancy are associated with maternal systemic inflammation and insulin resistance and have been proposed to contribute to endothelial dysfunction, proteinuria, multi-organ damage, and high morbidity and mortality of mothers. Increased fat stores produce excessive acute phase reactants as reflected by high circulating CRP levels¹⁴. Similarly, higher CRP levels have been reported in diagnosed cases of PE⁸ as well as in early pregnancy in patients who later develop PE. This association of high levels of CRP in early gestation with development of PE attenuates when adjusted for BMI¹⁵. The current study supports these results as we found positive correlation between BMI and CRP levels. CRP along with other inflammatory mediators alters endothelial function with resultant widespread vascular dysfunction. Elevated CRP levels in obese patients have been reported to predict high risk of cardiovascular morbidity and mortality¹⁴. The future risk of cardiovascular disease and associated mortality is also increased in later life in preeclamptic cases¹⁶.

Low grade systemic inflammation in PE has been proposed to be associated with overweight and linked to the altered endothelial function. This state of low degree of inflammation precedes the clinical presentation of the disease as supported by the high levels of CRP and leukocytes in the first trimester of gestation in preeclamptic pregnancies¹⁷. The high leukocyte count contributes as an extra placental source to the excessive circulating proinflammatory cytokines in PE¹⁸. Higher WBC count has been associated with obesity. White

blood cells infiltrate the adipose tissue and along with the adipocytes produce enormous amount of inflammatory markers contributing to the state of chronic inflammation⁹. The current study has reported high TLC count in the preeclamptic pregnant women and these high levels show a strong positive correlation with maternal BMI. The results are in accordance with the previous studies^{9,19}. Although the participants of the current study were not obese, there was a significant difference with a higher value in the preeclamptic group. It is important to note that a BMI equal to and higher than 23 is classified as overweight for South Asians²⁰. The current study highlights the correlation of BMI with the inflammatory marker CRP as well as leukocyte count in pregnancies complicated with preeclampsia. Placental dysfunction is the hallmark of PE, but adipose tissue might contribute to the pathogenesis of the disease by excessive production of inflammatory mediators.

CONCLUSION

The study concludes that BMI is related to CRP levels as well as TLC in pregnancies complicated with PE. High BMI in the preeclamptic group highlights the role of adipose tissue as a source of systemic inflammation. In addition to placental dysfunction adipose tissue might contribute to the systemic inflammation due to superfluous production of inflammatory mediators.

Conflict of interest: Nil

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