

# Elevated Serum C - Reactive Protein Level in Obese Pregnant Women

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## ABSTRACT

**OBJECTIVE:** To find out association of serum C - reactive protein (CRP) with obesity as an inflammatory marker in obese pregnant women as compared to non-obese pregnant women.

**METHODS:** This comparative observational study was carried out in the Department of Biochemistry, Peoples Medical College for Girls Nawabshah, during the period of January 2010 to December 2010. A total of eighty pregnant women of age range 20 – 40 years in their 3<sup>rd</sup> trimester were recruited in the study. Of these forty were obese and forty non-obese women. Non-obese pregnant women were grouped as control group. Serum C-reactive protein was measured by ELISA method. Data analysis including independent t-test and correlation analysis was carried out. P value up to 0.05 was considered significant.

**RESULTS:** Serum C - reactive protein concentrations were significantly higher ( $P < 0.001$ ) in obese pregnant women as compared to control group ( $9.1 \pm 0.12$  mg /L vs  $4.3 \pm 0.16$  mg /L), which indicate ongoing low grade systemic inflammation at more advanced level in obese pregnant women.

**CONCLUSION:** In pregnant women, higher BMI is associated with higher C-reactive protein concentration. These findings highlight a state of low grade systemic inflammation in obese pregnant women. Measures should be taken to control profound weight increase during pregnancy to avoid complications during or after pregnancy.

**KEY WORDS:** C-reactive protein, inflammation marker, obesity, BMI, gestational age, ELISA.

## INTRODUCTION

C-reactive protein (CRP) is so named because it can precipitate the C-polysaccharide of streptococcus pneumococcus<sup>1</sup>. It is a normal plasma protein, whose concentration rises dramatically in cytokine mediated response to most forms of tissue injury, infection and inflammation. Its physiological role is to bind phosphocholine expressed on the surface of dead or dying cells in order to activate complement system via the C1q complex, which is due to its pro-inflammatory and pro-coagulant effect.<sup>2,3</sup> It was first acute-phase protein to be described and is an exquisitely sensitive systemic marker of inflammation and tissue damage.<sup>4</sup> Raised CRP levels are correlated with several cardiovascular risk factors such as obesity, diabetes mellitus, smoking, and hypertension<sup>5,6</sup>. CRP as an inflammatory marker is produced and released by the liver under the stimulation and transcriptional control<sup>7</sup> of factors released by adipocytes, such as cytokines tumor necrosis factor-alpha (TNF- $\alpha$ ) and interleukin-6<sup>8</sup>. Interleukin 6 (IL-6), a major pro-inflammatory cytokine, is produced in a variety of tissues, including activated leukocytes, adipocytes and endothelial cells<sup>6</sup>. Several studies revealed that in humans the expansion of adipose tissues seen in the obesity result in more blood vessels and more connective tissue fibroblast and especially more macrophages. There is an enhancement

in the secretion of some interleukins and inflammatory cytokines in adipose tissue of obese which produce inflammation.

Adipose tissue is a reservoir for excess calories which are stored as triglycerides<sup>9</sup>. Excessive deposition of triglycerides in adipose tissue is strongly associated with raised circulating CRP level, as adipose tissue is considered a source of subclinical inflammation<sup>10,11</sup>. Elevated CRP level is also associated with weight gain during late second and early third trimesters of pregnancy<sup>5</sup>.

C-reactive protein is found a sensitive marker for low grade systemic inflammation. Elevated C-reactive protein concentration predict future risk of ischemic heart disease and ischemic cerebrovascular disease.<sup>12,13</sup> Maternal concentrations of CRP have been studied as an aid to diagnosed subclinical infection<sup>14</sup>. The present study was designed to find out any association of serum C - reactive protein with obesity in pregnant women.

## SUBJECTS AND METHODS

This comparative observational study was carried out in the Department of Biochemistry, Peoples Medical College for Girls Nawabshah, during the period January 2010 to December 2010. Eighty pregnant women of age range 20 – 40 years, in their 3<sup>rd</sup> trimester were selected for the study with the collaboration of Depart-

ment of Gynecology and Obstetric, Peoples Medical College Hospital Nawabshah. Subjects were divided into two groups according to presence or absence of obesity: group A, normal weight pregnant women and group B, obese pregnant women. For comparative analysis, group A was considered as control (normal weight pregnant women), having same age range, height, weight, BMI and gestational age. Women who gave history of conditions like malignancy disorders, acute or chronic liver disease, or other acute inflammatory conditions were excluded from the study. Also patients of diabetes mellitus and cardiovascular disease were excluded from the study.

By accessing peripheral vein, 5 ml of venous blood was drawn with the help of disposable syringe under all aseptic measures and transferred to a gel centrifuge tube. After clotting, blood was centrifuged to obtain serum. The serum is then transferred to clean and dry plastic cups which were properly covered and stored at  $-50^{\circ}\text{C}$  till analyzed. Before analyzing serum was thawed and allowed to attain room temperature. Weight and height of all subjects were measured in kilograms and centimeters respectively, using weighing machine with high scale (MIC health scale machine, Made in China). For body mass index calculations, height in centimeters was converted to meters. Body mass index was calculated by applying following formula:

$$\text{Body mass index} = \frac{\text{Weight in kilogram}}{(\text{Height in meter})^2}$$

Serum C - reactive protein was estimated by ELISA (enzyme linked immunosorbant assay) method (Biosource, USA) using QM Lab (Germany) analyzer. Data analysis including independent t-test and correlation analysis were carried out by SPSS version 10.0 for windows. Independent sample t-test was used to analyze the numeric variables like age and C - reactive protein level. Pearson's correlation co-efficient (r) values were calculated to find out the correlation between C - reactive protein and BMI.

## RESULTS

The results of present study showed increase in the level of serum C-reactive protein (CRP) in proportion to increase in body mass index (BMI). The mean values for weight and BMI in obese pregnant women as against the non-obese pregnant women were highly significantly ( $P < 0.001$ ) different, while mean values for age, height and gestational age were non-significant (**Table I**). The mean value for C-reactive protein was statistically highly significant ( $P < 0.001$ ) in obese pregnant women as compared to control group (**Table II**). However, BMI showed statistically significant ( $P < 0.001$ ) positive correlation with serum C-reactive protein in obese pregnant women (group B) as compared to con-

trol group (**Table III**). The raised CRP level in obese pregnant women warrant need of appropriate management of obesity during pregnancy.

**TABLE I: COMPARISON OF BIOPHYSICAL PARAMETERS**

Parameter	Group A Non- Obese pregnant women (n=40)	Group B Obese pregnant women (n=40)	P-Value
Age (years)	22.3 $\pm$ 0.29	22.4 $\pm$ 0.26	0.405
Height (m)	1.49 $\pm$ 0.01	1.50 $\pm$ 0.02	0.62
Weight (Kg)	57.8 $\pm$ 0.40	75.3 $\pm$ 0.41	0.001
BMI (kg/m <sup>2</sup> )	24.2 $\pm$ 0.11	31.40 $\pm$ 0.15	0.001
Gestational Age	31.1 $\pm$ 0.16	31.1 $\pm$ 0.16	1.00

Individual values are expressed as mean  $\pm$  SD

**TABLE II: COMPARISON OF C - REACTIVE PROTEIN LEVELS**

Parameter	Group A (n=40)	Group B (n=40)	P-Value
C-Reactive Protein	4.3 $\pm$ 0.16	9.1 $\pm$ 0.12	0.001

Individual values are expressed as mean  $\pm$  SD  
9.1  $\pm$  0.12 mg /L vs 4.3  $\pm$  0.16 mg /L

**TABLE III: CORRELATION COEFFICIENT BETWEEN SERUM C-REACTIVE PROTEIN AND BMI**

Parameter	Group A	Group B	P-Value
Serum CRP versus BMI	0.38	0.91	0.001

## DISCUSSION

C-reactive protein (CRP) is studied as an inflammatory marker<sup>7</sup>. It was originally discovered by Tillet and Francis in 1930<sup>1</sup>. It is also a marker of cardiovascular disease risk<sup>15</sup>. Rota et al<sup>3</sup>, Deghan et al<sup>8</sup> and Fain et al<sup>9</sup> reported positive association of BMI with serum CRP level. We also noticed highly positive correlation ( $P < 0.001$ ) of BMI with serum CRP level. Increase of BMI was positively associated with serum CRP level in obese pregnant women.

In present study, we observed that maternal serum CRP level was significantly higher in obese pregnant women in 3rd trimester of pregnancy as compared to non-obese pregnant women. However the correlation can be confounded by other diseases<sup>16,17</sup>. Therefore other inflammatory factors that can affect plasma CRP

concentration must be excluded.

In our study, a higher prevalence of low grade systemic inflammation was observed in obese pregnant women as compared with non-obese pregnant women ( $p= 0.001$ ) indicated by higher CRP level. This finding of our study is almost identical with the finding of Verhaeghe et al,<sup>18</sup> who reported that plasma C – reactive protein concentration in gravidas, measured at 24-29 weeks of gestational age is strongly related to body mass index. In the study of Visser et al,<sup>19</sup> it was found that the higher body mass index was associated with higher C-reactive protein concentration. Their results highlight the state of low grade systemic inflammation in over weight and obese persons. Our study results are in agreement with that study.

Rexrode et al<sup>20</sup> suggested body mass index as the strongest predictor of elevated inflammatory markers. His study showed high association of BMI with inflammatory markers. Women with highest BMI were having more than twelve fold increased risk of having elevated CRP level. Our results are in total agreement with this study. Elevated levels of CRP measured during pregnancy have been linked to adverse outcomes such as preeclampsia and intrauterine growth retardation.<sup>14</sup> Different modalities are adopted to see the effect of medicines like statin to lower CRP level in subjects without hyperlipidemia and having increased CRP level, but safety of medicines during pregnancy is not established<sup>21,22</sup>.

## CONCLUSION

The results of present study showed that BMI is strongly positively correlated with C - reactive protein level in obese pregnant women. It indicates a state of low grade systemic inflammation in obese pregnant women. Therefore high CRP level in obese pregnant women highlight the need of proper management during pregnancy from early days, especially focusing on weight control, as increased CRP level is also indicator of other complications like ischemic heart disease, which may be a complication of obesity. Multicenter studies are needed to establish the risk and to provoke awareness of developing complications in obese pregnant women.

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