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Serum high sensitivity C- reactive protein in different grades of obesity

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ABSTRACT

Acute-phase C-reactive protein (CRP) was the sensitive marker for systemic inflammation. There was a strong positive association between base-line CRP concentration and BMI (Body mass index). Elevated serum CRP concentration was used to predict future risk of coronary heart disease. The present study was designed to estimate the serum hs-CRP (High sensitivity C-reactive protein) values in different grades of obesity and to correlate these values to various grades of Obesity and anthropometric parameters. Subjects with raised BMI, WC (Waist circumference) and WHR (Waist hip ratio) had significantly elevated hs-CRP compared to subjects with lower value of variables. There was high positive correlation between hs-CRP levels and BMI(r = 0.853) followed by WC (r = 0.558) and WHR (r = 0.128). Positive correlation was observed between hs-CRP levels and increased obesity grades. Various obesity variables like BMI, WC and WHR were positively correlated with hs-CRP and association of hs-CRP with anthropometric values was stronger for BMI and WC than for WHR.
Key words: hs-CRP, obesity, anthropometric parameters, inflammatory marker.

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INTRODUCTION

Obesity is a state of excess adipose tissue mass. Obesity is the sixth most important risk factor contributing to the overall burden of diseases worldwide [1]. According to Nutrition Foundation of India the prevalence of obesity is 1% for males and 4% for females in the slums while the corresponding figures for the middle socioeconomic class was 32.2% and 50%, respectively [2].

Adipose tissue previously was considered a passive storage depot for fat but is now known to play an active role in metabolism [3, 4]. Among the recently discovered compounds expressed in human adipose tissue is the pro inflammatory cytokine interleukin 6 (IL-6) [5, 6]. IL-6 produced in the adipose tissue of healthy humans is released into the circulation [6, 7]. Adipose tissue is estimated to produce about 25% of the systemic IL-6 in vivo [6]. Because of the inflammatory properties of IL-6, including the stimulation of acute phase protein production in the liver, the release of IL-6 from adipose tissue may induce low-grade systemic inflammation in persons with excess body fat [8, 9]. A sensitive marker for systemic inflammation is the acute-phase C-reactive protein (CRP).Elevated serum CRP concentration was used to predict future risk of coronary heart disease [9].

There was a strong positive association between base-line CRP concentration and BMI [10], and weight loss lowers the CRP value. Raised base-line CRP values were also associated with many features of the insulin resistance or metabolic syndrome [11, 12], up to and including frank diabetes mellitus [13].

The overweight condition and obesity are frequently confirmed by calculating the body mass index (BMI). Higher BMI is collaborated with a higher risk of death by cardiovascular disease [14].The expert panels at the National Institutes of Health (NIH), in recent times, suggested a WC≥88 cm in women and a WC≥102 cm in men with BMI≥25 kg/m2, to identify the increased relative risks for obesity unhealthiness [15].Body mass index (BMI), which relates weight to height, is the most widely used and simple measure of body size, and is frequently used to estimate the prevalence of obesity within a population [16],[17]. A BMI ≥ 25 Kg/m2 is associated with increased morbidity, primarily from DM and CVD, while a BMI >30 Kg/m2 is collaborated with an elevated risk for both unhealthiness and mortality, the latter resulting mainly from diabetes, coronary heart disease, and stroke [18].

BMI does not express the body fat distribution, whereas the intra abdominal deposition of adipose tissue was a major contributor to the development of abnormally high blood pressure, insulin resistance, DM and dyslipidemia [19]. Waist circumference is increasingly being accepted as the best anthropometric indicator of abdominal adiposity and metabolic risk [20-22].

The present study was designed to estimate the serum hs-CRP values in different grades of obesity and to correlate these values to various grades of Obesity and anthropometric parameters.

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MATERIALS AND METHODS

The present study was conducted on the subjects attending to M.G.M Hospital, Kakatiya Medical College, Warangal, for general health check up. Informed consent was taken from the all participants and the study was approved by the Institutional Ethical Committee.

Inclusion criteria

Ages between 20- 50 years of both sexes were included. Participants with BMI 18.5 – 23 kg/m^2 were taken as controls and participants with BMI > 23 kg/m^2 as cases, further the participants were classified into 4 groups based on various grades of obesity as per Asia Pacific Task Force guidelines (23). Group A consists of participants with BMI between 18.5 to 22.9 kg/m^2 (control), Group B 23.0 – 24.9(overweight), Group C 25.0 – 29.9 (obese 1) and Group D >30 kg/m^2(obese2).

Exclusion criteria

Participants with diabetes mellitus /on hypoglycemic agents, Participants with hypertension / on antihypertensive drugs, With history of CHD /angina, on hypolipidemic drugs, Febrile disorders, History of recent infection, acute or Chronic inflammatory condition were excluded from the study.

Body height was measured. Body weight was recorded with the subject clothed. The body mass index was calculated as weight (kg)/height $(m)^2$. Waist circumference was measured at the level of the high point of the iliac crest, and hip circumference was measured at the widest level over the greater trochanters. The waist-to-hip ratio was calculated as waist circumference divided by hip circumference and used as an indicator of abdominal visceral fat.
Hs-CRP levels were measured by using nephelometry, a latex particle-enhanced immunoassay (NA Latex CRP Kit, Dade Behring, Tokyo, Japan). The material has achieved international standardization in the assay of CRP [24].

Statistical analysis

The results were reported as mean± SD. The statistical analysis was done by using the SPSS-version 17 software. The results were evaluated by using the Independent sample ʻtʼ test and the Pearson's correlation coefficient test. Statistical significance was considered at P values <0.05.

RESULTS

In the present study mean age was 42.50 ± 9.8 years. Distribution of hs-CRP values, BMI, WC and WHR among study subjects was shown in table 1. Distribution of hs-CRP values, BMI, WC and WHR among males and females was shown in table 2. There was no significant difference in hs-CRP levels and BMI between males and females, but Waist circumference and

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Waist hip ratio were significantly increased in male subjects when compared to females. Hs-CRP values in different grades of obesity were shown in table 3. It was observed that as the BMI was increasing there was significant increase in hs-CRP levels.

Correlation of hs-CRP values with different grades of obesity was shown in table 4. The hs-CRP levels were positively correlating with the BMI. Correlation of hs-CRP values with anthropometric parameters was shown in table 5. The hs-CRP values were positively correlated with BMI, WC and WHR. Among WC and WHR, WC was more correlating with hs-CRP values.

Table1: Population Characteristics

Parameter	Mean± SD (n=200)
AGE	42.50 ± 9.8
BMI(kg/m2)	25.57 ± 4.07
WC (cms)	93.87 ± 10.45
WHR	0.92 ± 0.07
CRP(mg/L)	3.55 ± 1.88

Table 2: Distribution of hs-CRP and anthropometric parameters among the study subjects.

Sex	Males(n=122)	Female(n=78)	p Value	Significance
hs-CRP(mg/L)	3.33 ± 1.44	3.97 ± 2.18	0.079	NS
BMI(kg/m2)	25.34± 4.47	26.92 ± 5.89	0.132	NS
WC(cms)	91.46 ± 5.96	87.92 ± 6.20	0.005	S
WHR	0.94 ±0.04	0.82 ± 0.04	< 0.001	S

Table 3: hs-CRP values in various grades of Obesity

Grades BMI (kg/m2)	Group A 18.5-22.9 (n =56)	Group B 23.0-24.9 (n =46)	Group C 25.0-29.9 (n =66)	Group D >30 (n =32)
hs-CRP(mg/L)	2.09 ± 0.37	2.78 ± 0.48	3.93 ± 0.89	6.63 ± 1.86

Table 4: Correlation of hs-CRP values in different grades of obesity

Comparison between the groups	r value	P value
Group A and Group B	0.637*	<0.001
Group A and Group C	0.799*	<0.001
Group A and Group D	0.888*	<0.001

*** Correlation is significant at 0.01 level (2 tailed)**

Table 5: Correlation of hs-CRP values with anthropometric parameters (n=200)

Correlation	BMI	WC	WHR
r value	0.853*	0.558*	0.128
p value	<0.001	<0.001	0.205

*** Correlation is significant at 0.01 level (2 tailed)**

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DISCUSSION AND CONCLUSION

Hs-CRP is an easily measured inflammatory biomarker and is released by the liver under the stimulation of cytokines, including interleukin-6, interleukin-1, and tumor necrosis factor-alpha. It has been shown hs-CRP has associations with endothelial dysfunction and insulin resistance syndrome [25]. High-sensitivity C-reactive protein (hs-CRP) levels are closely associated with abdominal obesity, metabolic syndrome, and atherosclerotic cardiovascular disease [26]. Hs-CRP is an inflammatory marker that is markedly correlated with traditional cardiovascular risk factors, including anthropomorphic measures of obesity [27].

In the present study we have observed that the hs-CRP levels were positively correlated with the different grades of obesity. There was significant increase in hs-CRP values with the increase in BMI levels. Among the different anthropometric parameters BMI was having more positive correlation followed by WC and WHR.

The present study results were in accordance with, Lear et al who reported that BMI and waist circumference were strongly correlated with CRP levels in healthy women of Chinese and European descents 18 years or older in Canada, and WHR was only weakly correlated with CRP in both genders[28].

In the present study increase in the hs-CRP levels among the study subjects were positively correlated with increase in BMI, WC and WHR, suggesting that the adipose tissue may induce low-grade systemic inflammation in persons with excess body fat. As WC represents the abdominal adiposity and there was positive correlation between WC and hs-CRP, WC can be used as an anthropometric indicator of abdominal adiposity and metabolic risk.

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