Relation of High Sensitive C – Reactive Protein with Metabolic Syndrome and Its Components in South Indian Obese Individuals Data from A Cross Sectional Study.

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Abstract
Background: High sensitivity C-reactive protein (hsCRP), a marker of systemic inflammation and a predictor of type 2 diabetes and cardiovascular disease. Low grade inflammation has been hypothesized to be involved in the pathogenesis of metabolic syndrome.We estimated the level of hsCRP in obese people with and without the metabolic syndrome and also assessed the relation of hsCRP with different components of metabolic syndrome (MetS).
Methods: A cross sectional study was designed among 90 obese individuals who have attended obesity clinic in a tertiary care centre in Kerala. Anthropometric measurements such as height, weight, body mass index (BMI), and waist to hip ratio (WHR) were recorded. HsCRP, Lipid profile and fasting plasma glucose level were estimated. MetS was diagnosed using International Diabetic Federation (IDF) criteria and the study population was grouped as those with and without MetS.
Results: Mean hsCRP level was significantly higher in individuals with MetS (2.56mg/L) compared to those without MetS (1.56mg/L). Serum hsCRP level shows statistically significant positive correlation with waist circumference(r-0.238, p-0.024), BMI (r-0.279, p-0.008) and systolic blood pressure (r-0.246, p-0.019). Thirteen of the 55 with MetS have hsCRP level of more than 3 mg/L.
Conclusion: The present study provides evidence that hsCRP levels are elevated in MetS subjects.
Keywords: high sensitive C-reactive protein, metabolic syndrome, Obesity

I. Introduction

Metabolic syndrome (MetS) is a common metabolic disorder that results from increasing prevalence of obesity. The pathophysiology seems to be associated with insulin resistance with increased levels of free fatty acids. It is estimated that people with MetS have increased risk of developing cardiovascular disease and diabetes compared to those without MetS. [1]

Low grade inflammation has been hypothesized to be involved in the pathogenesis of MetS. High sensitivity C - reactive protein (hsCRP) is considered as one of the important biomarker of inflammation and is associated with increased risk of cardiovascular disease and diabetes. [2]In Indian scenario, few studies have evaluated the importance of hsCRP in individuals with MetS.The present study was carried out to assess the relationship between hsCRP with different components of MetS in obese south Indian population who attended the obesity clinic attached to a tertiary care teaching hospital.

II. Materials And Methods

A cross sectional study was conducted among 90 obese individuals at the department of Clinical Biochemistry, Govt.Medical College, Trivandrum. Study subjects were selected from the obesity clinic attached to Physical Medicine Department from July 2010 to December 2010.MetS was diagnosed using IDF criteria.

After taking informed consent; height, weight, waist circumference, hip girth and blood pressure was taken from each subjects. Waist to hip ratio (WHR) and BMI was calculated from these measurements. The study was approved by institutional ethics committee. Fasting venous blood samples are collected for estimating the hsCRP level, fasting plasma glucose and lipid profile. hsCRP assay was done by ERBA turbidimetry immunoassay kit on a fully automated EM200 analyser. Estimation of FPG (fasting plasma glucose) was done by glucose oxidase - peroxidase based method. Lipid profile which includes total cholesterol (TC), high density lipoprotein cholesterol (HDL-C) and serum triglycerides (TG) was analyzed by enzymatic methods using ERBACHEM5 analyser. Low density lipoprotein cholesterol (LDL-C) was estimated by using the Friedewald equation. [3]Reference range for hsCRP for cardiovascular risk stratification includes low risk, moderate risk and high risk ie <1mg/L,1-3mg/L,>3mg/L respectively.[4]

Statistical analysis was done with Epi info version 7. Student t test was used to find out the difference between components of MetS in MetS positive and MetS negative population. Results were expressed as Mean ± SD.Chi-square test was used to compare proportions. Pearson correlation analysis was performed to find the relationship between hsCRP and components of MetS.P-value <0.05 was considered significant.

III. Results

Out of the 90 obese subjects, 55(61.1) was diagnosed to have MetS based on IDF criteria. Mean age of the study subject was 31.79±5.59 years (For those with MetS-32.4±5.47 year and for those without -30.83±5.72 years).56.7% (51) of the subjects were males. Mean BMI and WHR was 30.54 ±5.08 Kg/m^2 and0.94 ±0.04 respectively.

The clinical and biochemical profiles of the study subjects are shown in Table 1.serum hsCRP level was significantly increased in individuals with MetS compared to those without MetS(p-value-<0.001).Mean BMI,waist circumference, blood pressure, fasting plasma glucose and triglyceride level was also significantly increased in individuals with MetS (Table.1)

Table 2 depicts the Pearson correlation analysis of the hsCRP with other variables. Serum hsCRP level shows statistically significant positive correlation with waist circumference(r-0.238, p-0.024), BMI (r-0.279, p-0.008) and systolic blood pressure (r-0.246, p-0.019).

Table 3 shows distribution of levels of hsCRP among the study subjects. Number subjects with higher level of hsCRP was seen in individuals with MetS than those without. Thirteen of the 55 with MetS have hsCRP level of more than 3 mg/L.There was no statistically significant difference between sex and hsCRP level(Table.4)

IV. Discussion

Mean hsCRP level was significantly higher in individuals with MetS (2.56mg/L) compared to those without MetS (1.56mg/L).This finding is in concordance with several studies. [5, 6]The mechanisms by which hsCRP reflect the risk for MetS are not completely understood. Previous data suggests that there is a strong link between obesity and elevated hsCRP. [7]Adipose tissue is known to secrete cytokines that stimulates hsCRP production from liver and also adipose tissue itself secrete hsCRP and thereby raises the hsCRP levels.[8]Genetic polymorphism could explains the individual variability observed in the hsCRP level among those with and without MetS.[9]

We observed positive correlation between hsCRP levels with BMI, waist circumference and systolic blood pressure. Similar findings were noted in previous studies. [5, 6, 10]No statistically significant correlation was noted for other components of MetS. Several studies have assessed the relation between hsCRP and different components of MetS.In Univariate analysis most of them showed significant association with components of MetS.Studies that assessed independent association by adjusting other MetS components, mostly reported that central obesity as the major determinant of elevated hsCRP in individuals with MetS. [11, 12]

In conclusion the findings in this study highlights the role of inflammation as measured by hsCRP in the pathogenesis of development of MetS and its future complications.One of the limitation of the study is that, it is a cross sectional study and cannot explains the causal role hsCRP for the development of Mets. So prospective studies are needed to understand the independent relationship between hsCRP and MetS and its interaction with MetS components.

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[13]. Variable	[14]. [15]. MetS (+) Mean (SD)	[16]. [17]. MetS (-) Mean (SD)	[18]. p-Value
[19]. Age (Years)	[20]. 32.4(5.47)	[21]. 30.83(5.72)	[22]. 0.20
[23]. Weight (Kg)	[24]. 84.12(11.14)	[25]. 81.18(9.08)	[26]. 0.19
[27]. Height (cm)	[28]. 163.87(9.64)	[29]. 167.91(11.57)	[30]. 0.08
[31]. BMI (Kg/m²)	[32]. 31.54(5.68)	[33]. 28.98(3.50)	[34]. 0.02
[35]. Waist (cm)	[36]. 102.31(10.57)	[37]. 96.54(8.51)	[38]. 0.01
[39]. Hip (cm)	[40]. 107.02(10.09)	[41]. 102.09(7.64)	[42]. 0.02
[43]. Waist Hip Ratio	[44]. 0.95(0.04)	[45]. 0.94(0.04)	[46]. 0.29
[47]. Systolic BP (mmHg)	[48]. 129.60(13.32)	[49]. 119.89(10.33)	[50]. <0.001
[51]. Diastolic BP (mmHg)	[52]. 83.84(6.58)	[53]. 79.54(5.38)	[54]. <0.001
[55]. Fasting Blood Sugar (mg/dl)	[56]. 96.04(13.54)	[57]. 85.80(12.67)	[58]. <0.001
[59]. Total Cholesterol (mg/dl)	[60]. 196.2(29.0)	[61]. 182.06(20.23)	[62]. 0.01
[63]. Triglyceride (mg/dl)	[64]. 160.71(44.85)	[65]. 120.11(24.76)	[66]. <0.001
[67]. High Density Lipoprotein (mg/dl)	[68]. 40.73(8.30)	[69]. 43.54(9.0)	[70]. 0.13
[71]. Low Density Lipoprotein (mg/dl)	[72]. 123.11(27.08)	[73]. 114.49(20.97)	[74]. 0.11
[75]. hsCRP (mg/L)	[76]. 2.56(0.93)	[77]. 1.56(0.45)	[78]. <0.001

Tables- Table.1 Characteristics of the study population
[MetS (+)-Metabolic syndrome present, MetS (-)-Metabolic syndrome absent, SD- SD-standard deviation, p-value <0.05 –statistically significant, BMI-Body Mass Index, hsCRP-high sensitivity C-reactive protein]

Variable	Correlation Coefficient(r)	p-Value
Age	0.129	0.224
Weight	0.282	0.007
Height	-0.080	0.456
BMI	0.279	0.008
Waist	0.238	0.024
Hip	0.223	0.034
Systolic BP	0.246	0.019
Diastolic BP	0.195	0.065
Fasting Blood Sugar	0.090	0.397
Total Cholesterol	0.154	0.148
Triglyceride	0.123	0.246
High Density Lipoprotein	-0.170	0.109
Low Density Lipoprotein	0.179	0.091

Table.2 Correlation between hsCRP and other anthropometric and biochemical parameters
[BP-blood pressure,p-value <0.05 –statistically significant,hsCRP-high sensitivity C-reactive protein]

Table.3 Distribution of serum hsCRP level in the study population

	Study Population (n=90)	MetS (+) (n=55)	MetS (-) (n=55)	p-value
	N (%)	N (%)	N (%)	
hsCRP Level(mg/L)				0.006
<1	03	01(1.9)	02(5.7)	
1-3	74	41(74.5)	33(94.3)	
>3	13	13(23.6)	0	

[MetS (+)-Metabolic syndrome present, MetS (-)-Metabolic syndrome absent,hsCRP-high sensitivity C-reactive protein]

Table.4 Comparison of mean of metabolic syndrome components with hsCRP Level

	hsCRP Level (mg/L)		
	≤3	>3	p-Value
Waist circumference	99.56(9.49)	103.08(13.61)	0.251
Systolic BP	124.78(11.92)	132.0(17.92)	0.065
Diastolic BP	81.9(6.11)	83.77(8.35)	0.336
Fasting Blood Sugar	91.95(14.21)	92.69(13.66)	0.861
Triglyceride	145.43(42.93)	146.15(46.94)	0.956
HDL-c	42.11(8.74)	39.54(8.01)	0.306

[hsCRP-high sensitivity C-reactive protein]