CORRELATION BETWEEN HIGH SENSITIVITY C-REACTIVE PROTEIN AND LIPIDS IN OBESITY AMONG INDIANS

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ABSTRACT: BACKGROUND: Obesity has increased in prevalence to an epidemic proportion. The causes of which are many. There is also increase in the incidence of cardiovascular events in parallel with it. Central obesity (Visceral adiposity) is a key regulator of inflammation. Dyslipidemia is major risk factor for ischemic heart disease. Atherosclerosis, an inflammatory condition is a precursor for cardiovascular disease. High sensitivity C reactive protein, a major marker of systemic inflammation is increased in Ischemic heart disease as evidenced by various studies. In this study we looked at correlation between high sensitivity C-reactive protein and lipid parameters. **OBJECTIVE:** To correlate between high sensitivity C- reactive protein (hsCRP) and lipid profile in obese and non-obese Indians. **MATERIALS AND METHODS:** Eighty-eight participants were enrolled for the study after inclusion and exclusion criteria were met. History and physical examination was done including blood pressure. BMI was calculated and below 23kg/m² was considered normal. Routine blood investigations were done. HDL, LDL, Triglycerides, total Cholesterol and hsCRP were measured using standardized methods. Participants with BMI of <23 kg/m² were categorized as cases and those with BMI>23kg/m² as cases. **RESULTS:** Out of 88 participants 34 were female and 54 were men. Twenty-six females and 39 men were obese among the participants. Obese females with low HDL and all obese participants had higher statistically significant mean CRP of 5.94±2.97mg/L and 4.78±2.59 mg/L respectively. All other parameters had insignificant correlation. **CONCLUSION:** HsCRP correlates with triglycerides in obese individuals. HsCRP correlates with obesity.

KEYWORDS: hsCRP, obese, lipid profile.

INTRODUCTION: The prevalence of obesity has reached an epidemic proportion in India and the world across. The causes of which are many and unknown. There is also an increase in the incidence of ischemic heart disease in parallel with other metabolic disorders. Recent studies implicate adipose tissue, particularly visceral adiposity (Central obesity) as a key regulator of inflammation¹. Earlier adipose tissue was thought as a site of energy storage and in the form of triglycerides. Now it is considered as an endocrine organ. Many inflammatory cytokines and adipokines are produced from the adipocytes especially from visceral fat. The reason for association between abdominal obesity and metabolic syndrome is not clear. But one theory is that visceral adipose tissue has higher lipolysis which results in elevated portal non-esterified fatty acids that increase hepatic very low density lipoprotein production, increase hepatic glucose production and thus leading to insulin free fatty acids in the plasma.²

This leads to dyslipidemia which is a major risk factor for ischemic heart disease. Atherosclerosis – an inflammatory state is the main pathophysiologic mechanism involved in these cardio-vascular events. C- reactive protein is an important marker of vascular inflammation and predictor of atherosclerosis.³ Cytokines especially Interleukin (IL-6) and Adipokines released from visceral fat increase the synthesis and release of C-reactive protein from the liver. Indians have

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higher body fat percentage even at lower body mass index and high waist hip ratio at lower waist circumference.⁴ Also Indians have sarcopenia with high fat composition. This increased visceral adiposity leads to increased incidence of cardiovascular and metabolic events among Indians.⁵

OBJECTIVES: To correlate between high sensitivity C- reactive protein (hsCRP) and lipid profile in obese and non-obese Indians.

MATERIALS AND METHODS: This case control study was conducted at a tertiary hospital in Karnataka. Hospital ethical committee approved the study. Eighty eight participants were enrolled. Informed consent was taken.

Inclusion Criteria: Age between 20-60 years. Participants with BMI more than 18.5

Exclusion Criteria: Subjects having signs and symptoms of Ischemic heart disease(IHD), recent infection and inflammation, trauma, diabetes mellitus, hypertension or on OAD/antihypertensive/ any other medication, smoker.

Detailed history was taken. Complete haemogram was done including complete urine analysis, Blood urea, serum creatinine, Fasting blood sugar (FBS), postprandial blood sugar (PPBS), Serum electrolytes. ECG was done. 8 hours of fasting blood sample was drawn for lipid profile. Was considered normal or high based on Asia pacific task force guidelines for various lipid parameters. Anthropometric values like BMI, waist circumference, hip circumference and waist hip ratio were taken. Participants with BMI between 18.5-23Kg/m² was taken as control and those with BMI>23 Kg/m² as cases. Blood samples were drawn from the antecubital vein with participant seated and with minimal tourniquet use. Specimens were collected in siliconized vacuum glass tubes containing a 1/10 volume of 3.8 percent trisodium citrate for blood glucose, and no additives for lipids. Total cholesterol (TC) and triglycerides levels were measured by using an enzymatic method. High density lipoprotein was measured by using phosphotungstate precipitation method. hsCRP levels were measured by using nephelometry, a latex particle-enhanced turbidometric immunoassay (NA Latex CRP Kit, Dade Behring, Tokyo, Japan). The material has achieved international standardization in the assay of CRP. The function of the assay was found to be satisfactory. The assay is sensitive enough to detect 0.5 mg/liter of CRP. Undetectable CRP values were recorded as 0.015 mg/liter. T test was calculated. Data obtained was analyzed using graph pad software.

RESULTS: The demographic profile of cases and controls is shown in table no. 1. Eighty-eight participants were enrolled for the study. They were matched for the age, systolic blood pressure, diastolic blood pressure, fasting blood sugar and postprandial blood sugar. The mean CRP was high in participants with BMI>23 kg/m².

The Asia pacific task force has set separate guidelines for the South-east Asians⁶. We correlated hsCRP to lipid parameters based on the recommended cut off values for each parameter. For HDL the cut off values are set separately for male and females. For females cut off value of HDL is 40mg/ dl and for men it is 50 mg /dl. Among controls females with HDL>40 mg/dl (n=4) had a high mean CRP (3.00±1.49mg/L) compared to mean CRP (2.42±1.07mg/L) in those with HDL<40mg/dl (n=4). This increase was statistically insignificant (p>0.05, t=0.6324.). Among cases females with HDL >40mg/dl (n=15) had a lower mean CRP (3.16±0.16 mg/L) compared to mean CRP (5.94±2.97mg/L)

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in those with HDL<40mg/dl (n=11). This difference was statistically very significant ($p<0.01$, $t=3.0211$).

For men cut off value for HDL was taken as 50 mg/dl. In controls men with HDL < 50 mg/dl (n=15) had a mean CRP of 2.24 ± 0.85 mg/L. and none had HDL>50mg/dl. Among cases men with HDL<50mg/dl (n=37) had a lower mean CRP (3.55 ± 1.31 mg/L) compared to mean CRP (3.60 ± 0.70 mg/L) in those with HDL>50mg/dl (n=2). This difference was statistically insignificant ($p>0.05$, $t=0.053$). This could be because less number of men had HDL>50mg/dl.

The cut off value of LDL is < 100mg/dl as per Asia pacific task force guidelines. Controls with LDL<100mg/dl (n= 7) had a higher mean CRP (2.89 ± 1.15 mg/L) compared to mean CRP (2.19 ± 0.39 mg/L) in those with LDL>100mg/dl (n =16). This difference was statistically significant ($p<0.05$, $t= 2.2131$). Cases with LDL < 100mg/dl (n =16) had higher mean CRP (4.40 ± 2.54 mg/L) compared to mean CRP (3.92 ± 1.85 mg/L) in those with LDL>100mg/dl (n =49) with p value >0.05 and $t=0.8189$.

Similarly we took 150 mg/dl as a cutoff value for triglycerides as recommended. In both controls and cases, the mean CRP was higher in those with TG > 150 mg/dl compared to CRP in those with TG <150mg/dl as shown in table 2. This increase in CRP was statistically significant in cases. Indicating that obese individuals with high triglycerides, are having very high inflammation.

Cut off value of total cholesterol (TC) was taken as 200mg /dl. Cases and controls were divided as those having TC<200mg/dl and >200mg/dl. Controls with TC<200 mg/dl (n=17) had a mean CRP of 2.36 ± 0.59 mg/L and those with TC>200mg/dl (n=6) had mean CRP of 2.51 ± 0.59 mg/L. This increase in CRP among controls was statistically insignificant ($p>0.05$, $t=0.5354$). Similarly cases with TC<200mg/dl (n=43) had mean CRP of 3.97 ± 2.07 mg/L and those with TC>200mg/dl (n=22) had mean CRP of 4.16 ± 1.97 mg/L with $p>0.05$. In cases also the increase in CRP was statistically insignificant ($p>0.05$, $t=3558$).

DISCUSSION: The present study was done by excluding all the possible known causes where CRP may be elevated. We included participants who are obese and with no other co-morbidities like diabetes, ischemic heart disease and hypertension. Participants were divided into cases and controls based on BMI. Participants with BMI less than 23kg/m^2 were taken as controls and those with BMI more than 23kg/m^2 were taken as cases. Asia pacific task force has set cutoff value for various lipid parameters. Based on these guidelines mean CRP was analyzed separately in various lipid parameters. There was no significant correlation between HDL and hsCRP in both men and women with normal BMI. Obese females with low HDL had significantly elevated CRP. Implying that females with low HDL are prone for atherosclerosis. Females with low HDL require proper lifestyle modification to prevent cardio-vascular complication at the earliest. In the present study we found that only high TG level was significantly associated with elevated CRP in obese participants. Elevated plasma CRP has been reported among subjects with high TG and low HDL. This is similar the other studies.^{7,8} It could be because of relative homogeneity of our sample of healthy participants covering a wide range of body fatness. There was no correlation between Cholesterol, LDL and CRP. Non-obese participants with LDL less than 100mg/dl had significantly elevated CRP. We couldn't come to any conclusion for this. But several studies that are done had no consistent association between various plasma lipoprotein variables and hs-CRP. Larger studies are required. Some studies done had no association between CRP and lipoproteins⁹ whereas others have shown association between HDL, TG and CRP.^{8,10}

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CONCLUSION: Hypertriglyceridemia is associated with elevated C reactive protein whereas there is no correlation with other lipid parameters. Obese individuals with hypertriglyceridemia are prone for atherosclerosis. Individuals with obesity especially females should be screened for lipid profile as early as possible and treated, to prevent morbidity and mortality.

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Parameters	Mean $\pm$ SD n=88	BMI <23 mg/dl Mean $\pm$ SD n =23	BMI >23 mg/dl Mean $\pm$ SD n =65
Age	41.67 $\pm$ 9.09	40.47 $\pm$ 8.62	42.09 $\pm$ 9.28
Females/Males	34 / 54	8/14	26/39
SBP (mm Hg)	120.90 $\pm$ 7.73	121.82 $\pm$ 7.20	120.58 $\pm$ 7.93
DBP(mm Hg)	77.54 $\pm$ 6.94	79.95 $\pm$ 8.22	77.75 $\pm$ 6.49
BMI(kg/m ²)	25.77 $\pm$ 4.11	21.19 $\pm$ 1.30	27.39 $\pm$ 3.49
WC (cms)	93.93 $\pm$ 10.42	83.82 $\pm$ 9.64	97.50 $\pm$ 8.12
WHR	0.92 $\pm$ 0.06	0.85 $\pm$ 0.05	0.94 $\pm$ 0.05
FBS(mg/dl)	88.73 $\pm$ 9.52	88.91 $\pm$ 10.37	88.67 $\pm$ 9.29
PPBS(mg/dl)	116.14 $\pm$ 16.11	111.21 $\pm$ 16.53	117.89 $\pm$ 15.71
CRP(mg/L)	3.61 $\pm$ 1.95	2.40 $\pm$ 1.00	4.04 $\pm$ 2.03
HDL(mg/dl)	37.36 $\pm$ 9.78	35.30 $\pm$ 9.83	38.09 $\pm$ 9.74
LDL(mg/dl)	121.15 $\pm$ 35.86	114.95 $\pm$ 23.92	123.35 $\pm$ 39.15
TG(mg/dl)	139 $\pm$ 59.88	109.21 $\pm$ 37.69	149.53 $\pm$ 62.8
CH(mg/dl)	184.79 $\pm$ 0.53	172.95 $\pm$ 39.54	188.98 $\pm$ 32.32

Table 1: Population Character

TG mg/dl		<150	>150	t / p value
BMI< 23 Kg/ M2	CRP mg/L	2.37 $\pm$ 1.07	2.53 $\pm$ 0.61	t =0.2860 p >0.05
	n =	19	4	
BMI > 23 Kg/M2	CRP mg/L	3.60 $\pm$ 1.40	4.78 $\pm$ 2.59	t =2.3890 p <0.05
	n =	41	24	

Table 2

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