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High Sensitivity C Reactive Protein: A Surrogate Marker Appalling the Impact of Inflammation in Obese Young Adults

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Abstract

Introduction: Obesity is primarily considered to be a disorder of energy balance, and it has recently been suggested that some forms of obesity are associated with chronic low-grade inflammation. Obesity is a chronic, multifactorial and complex disease which poses a major public health issue increasing the risk of non - communicable diseases like, Type -2-DM, Cardiovascular disease, Hypertension etc. **Aim:** The present study aims to emphasize the burden of obesity in inflammation by associating with elevated levels of hs CRP in adults. **Materials and Method:** The study was a Hospital based cross sectional study including 30 obese individuals in the age group of 17-30 years,(15 males and 15 females)with BMI > 30 were included. Other systemic diseases were excluded. Assessment was done by Weight, Height, BMI by Quetelet index and measurement of hs CRP by Immunoturbidometer. The results were tabulated and analysed. **Results:** Total of 30 obese subjects were included of which 15 were males and 15 were Females. In obese subjects hs-CRP was elevated significantly. The level of hs-CRP was proportionally elevated in relation to BMI in obese subjects. **Conclusion:** Elevated hs-CRP levels in obese individuals indicates a proinflammatory state. This further concludes a risk for metabolic and cardiovascular manifestations in obese individuals.

Key words: *BMI, hs CRP.*

Introduction

Obesity is defined as a state of being overweight with excess body fat resulting in a significant impairment of health of a person. The most widely used method to gauge obesity is BMI which is [weight kg / height (m^2)]. So BMI of 30 is the most commonly used threshold for obesity in both men and women.[1] Approximately 55 % of adults in the united States are overweight, and nearly 22 % of adults are obese.[2]

Genes that predispose to obesity in humans and animals have already been identified - the faulty gene -FTO, indicating the importance of genetic factor in the development of this disorder[3] and currently regarded as a proinflammatory state. Recent research has shown that the number as well as the size of adipocytes in obese people is more than people with normal body weight. Weight loss in an obese adult can reduce the size but not the number of adipocytes.[4]

CRP a trace protein is synthesized by the liver[7] with a medium concentration of 1 mg/L[5] increasing 1000 fold in diseases. Hence, it is an acute phase protein which gets elevated during episodes of acute-inflammation or infection.[6] The physiologic role of CRP is to bind to phosphocholine expressed on the surface of dead or dying cell (and some types of bacteria) in order to activate the complement system via the C1Q complex as an immunologic defense mechanism[8] and considered as an novel biomarker, since it measures even low levels of CRP in human serum or plasma.[9]

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The adipokine imbalance characterizing obesity, including low levels of adiponectin, high levels of leptin, inflammatory mediators (IL-6 and TNF-α) and antifibrinolytic factors (PAI-1) may induce oxidative stress and endothelial dysfunction- initial steps of atherogenesis.[10]Many studies have suggested that higher BMI is associated with higher CRP concentrations indicating a state of low – grade inflammation. Elevated CRP levels were present in 27.6% women and 6.7 % men of US adult population in obese persons with BMI > 30.[11]Only a few studies have been done based on the impact of hs CRP (High Sensitivity C – reactive protein) prevalence in obesity.

Due to the paucity of information for correlation between BMI and hs CRP in Indian settings, the present study was undertaken. Elevated hs-CRP levels in young obese individuals is an indication of an existing pro-inflammatory state in them, which might lead to complications in future. Thus the present study aimed to correlate the concentration of hs-CRP in obese individuals and create awareness regarding risk factors.

Aim: : The present study aims to emphasize the burden of obesity in inflammation by associating with elevated levels of hs CRP in adults.

Materials and Method

Study was conducted at Sri Manakula Vinayagar Medical College and Hospital, Madagadipet , Puducherry between the period October 2012 to August 2013 after getting approved from the Institutional Research Council and Ethical committee. The subjects included into the study were selected after obtaining informed consent on the basis of fulfillment of inclusion criteria whilst excluding exclusion criteria. The study was a cross sectional study. 30 obese individuals such as Staff, Students, Persons attending medicine OPD (15 males and 15 females) in the age group of 17-30 years with BMI > 30 constituted the study population. other systemic diseases like diabetes,hypertension,hyperlipidemia were excluded.

Procedures:

Body Mass Index :

For the assessment of obesity, height and weight measurements were taken on each subject, and using Quetelet index, the value of BMI was calculated for each subject.

BMI=weight (kg) / height (m) ^{2}

Classification of BMI:

Underweight : 18.5

Normal weight: 18.5-24.9

Overweight : 25-29.9

Obesity :

Class 1 : 30-34

Class 2 :35-39.9

Class 3: ≥40

Height and Weight was measured using standard apparatus.

High Sensitivity C-Reactive Protein:[12] Immunoturbidometer (Beacon) : Version 3.81.[12]

Principle:[12]

The analyzer is designed on the basis of Lambert-Beer Law. The hs- CRP Turbilatex test is a quantitative turbidimetric test for the measurement of low levels of CRP in human serum or plasma. Latex particles coated with specific anti-human CRP were agglutinated when mixed with samples containing CRP.

reference values :

Below 3 mg/ L is considered as normal.

Procedure:

2 ml of blood was taken in a test tube and left undisturbed for half an hour for complete clot formation. The sample was then centrifuged at 3000 rpm to separate the serum from the clot. After centrifugation, the serum was stored at 20° C in Ependorf tubes till the analysis for hs-CRP was conducted. Serum hs-CRP levels were measured by turbidimetry method, using commercial kit (Beacon Diagnostics Pvt Ltd, India). hsCRP kit : Code no -T05, Pack size - 32 ml. Statistical analysis: At 95 % CI, 80% Power, minimum sample needed is 30.[18]The values of mean ± SD for the obese subjects to evaluate hs CRP levels are 1.710 ± 0.3434 and 2.450 ± 0.5130 respectively. The data collected was entered in Microsoft Excel and analyzed using SPSS software package Version 19. Pearson correlation was used to analyse the hs CRP thresholds with BMI of obese individuals.

Results: Total of 30 obese individuals were selected for the study of which 15 were males and remaining 15 were females categorised by calculating their BMI. The results were tabulated and analysed.

Table 1: Age and gender distribution in obese subjects.

Age (years)	Females n (%)	Males n (%)	Total n (%)
20-24	6 (40%)	7 (47%)	13 (43.3%)
25-27	3 (20%)	4 (27%)	7 (23.3%)
28-30	6 (40%)	4 (27%)	10 (33.3%)

Among these individuals 43.3% were between the age 20-24 yrs, 23.3% were between 25-27 yrs of age and 33.3% were between the age 28-30 yrs.

Table 2: BMI and gender distribution in study subjects.

BMI	Females n (%)	Males n (%)
30-34.9	9 (60%)	9 (60%)
35-39	5 (33.3%)	6 (40%)
≥ 40	1 (7%)	0 (0%)

Among the 30 obese individuals (15 Females and 15 Males) whose BMI was categorized as Class I 30 to 34.9 Kg/ m^2, Class II 35 to 39.9 Kg/ m^2, Class III ≥ 40 Kg/ m^2 respectively. Among them 60% of both males and females had BMI of Class I, 40% males and 33.3% females had BMI of Class II and 7% of females and none of the males had BMI of Class III which showed no significant association between BMI and gender distribution in obese individuals.

Table 3: Association between hs CRP and gender in subjects.

Reported hs CRP (mg/L)	Females n(%)	Males n (%)
< 3	3 (20%)	6 (40%)
≤ 3	12 (80%)	9 (60%)
Total	15 (100%)	15 (100%)

On the basis of gender, all the individuals included in this study were divided in two groups and were screened for the hs CRP levels. Total of 15 females and 15 males were screened and found that 80% females showed elevated hs CRP, as compared to 60% of males. The gender specificity was assessed for their association with hsCRP levels and no statistical significant association was reported (chi square 1.67 with a p value of > 0.5 NS).

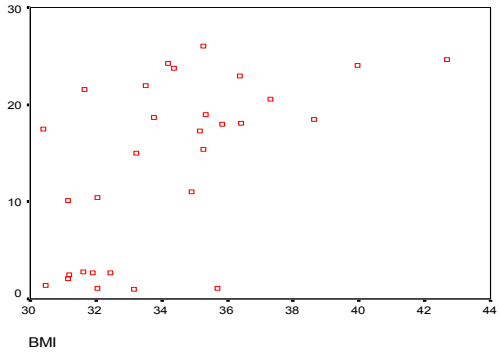

Figure 1: Scatter plot to show relation between BMI and hs CRP in study subjects.

A total of 30 individuals were screened for the strength of association of obesity with high sensitivity CRP. Based on the BMI calculation they were categorized as obese subjects which showed that, there was a significant relationship between BMI and levels of hsCRP, Pearson correlation coefficient r = 0.59, P = 0.01.Obesity was associated with high values of hsCRP.

All the individuals included in this study were also interviewed for the risk factors i.e. hypertension, hyperlipidemia, diabetes mellitus, drug intake, alcohol and smoking and found that these conditions did not illustrate any relation with obesity and levels of hs CRP.

Discussion

Obesity is a long term disease having many serious consequences on the health of a person.[2] It is a state of excess adipose tissue mass and the most widely used method to calculate obesity is BMI.[1] Recently it has also been described as a pro inflammatory state which is involved in the pathophysiology of many diseases. The main aim of the present study was to explore the association between the body mass index and hsCRP level among the obese individuals.

Total of 30 obese individuals were selected for the study of which 15 were males and remaining 15 were

females categorised by calculating their BMI. Among these individuals 43.3% were between the age 20-24 yrs, 23.3% were between 25-27 yrs of age and 33.3% were between the age 28-30 yrs. Among the 30 obese (15 males and 15 females) individuals who were subjected to relative BMI by using Quetelet index, no statistical significant difference in BMI was observed among males and females. The similar observation was made by other studies determined by Deepa M[14] and her colleagues and Desigamani Kanniyappan[15] and his colleagues.

The high sensitivity C- reactive protein is considered as the marker of inflammation inside the body. In this cross sectional study all obese individuals were analysed for the level of hsCRP and BMI and found that hsCRP was significantly elevated among the obese individuals,but there was no significant elevation in any specific gender in accordance with obesity. Our results, together with the evidence of previous studies by Visser M et al[16], Hussain S D[17], Preethi B L[18], Chieh Lin C et al[19], Shilpa B A et al[20], Rogowski O et al[21] indicates the overweightness and obesity as a risk factor for one's own health.

In recent reports obesity has linked with development of fatty liver diseases.[22] In obesity there is increased secretion of IL - 6 which activates the hepatic pathways to release the large amount of acute-phase proteins CRP in circulation.[23] The older experimental studies and cross-sectional studies have showed that CRP along with IL - 6 are contributing in the development of hyperglycemic, insulin resistance and Type 2 - DM.[24]CRP a liver derived pentraxin, recently has emerged as one of the most promising biomarker for future cardiovascular events and peripheral vascular diseases in the obese individuals.[25]

The link between obesity and inflammation is based on two basic theories. According to first theory, obesity - induced inflammation has been considered as a protective mechanism, which stops the body from losing activity or fitness by storing the fat in tissues and organs by anabolic process. Second theory suggest that inflammation as an catabolic process which break down the organs and tissue to control the body weight within the normal limits.[26]

Conclusion

Higher the BMI, the levels of hs CRP increases, suggesting that obesity represents a major risk factor and constitutes a serious threat to the current and future health of all population on earth, in which inflammation acts as a major driver in the pathogenesis of obesity.

The present study advocated strongly to encourage people for healthy dietary patterns, regular assessment of BMI and biochemical parameters.

Conflict of Interest: Due to paucity of information regarding obesity,hence this study is aimed to create awareness among young obese adults to prevent individuals from metabolic syndrome and other high risk complications related to obesity.

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Ethical Clearance: Obtained from Pondycherry University, Pondy.

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