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Original Article

Level of C-reactive Protein in Obese and Overweight Individuals at Indira Gandhi Institute of Medical Sciences: A Tertiary Care Center of Bihar

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Abstract

Introduction: Human adipose tissue releases interleukin-6 which is a pro-inflammatory cytokine that causes low-grade systemic inflammation. Acute-phase C-reactive protein (CRP) is a sensitive marker for systemic inflammation. Low-grade systemic inflammation in overweight and obese can be measured by serum CRP level.

Objective: The objective of this study was to find out the prevalence of raised serum CRP level among the obese and overweight person.

Materials and Methods: Overweight and obese persons were screened for raised CRP (≥3.0 mg/L) after excluding comorbidity.

Results: The prevalence of raised CRP among obese and overweight is 23%, the female has higher prevalence of 25.45% as compared to male 20%. The prevalence among overweight and obese participants is 18.88% and 60%, respectively.

Conclusions: The finding suggest a higher prevalence of low-grade systemic inflammation in obese as compared to an overweight person.

Key words: Body mass index, C-reactive protein, Low-grade systemic inflammation, Obesity, Overweight, Prevalence

INTRODUCTION

C-reactive protein (CRP) is an annular, pentameric protein found in plasma, whose level rise in response to inflammation. CRP was discovered by Tillett and Francis in 1930. Its physiological role is to bind to lysophosphatidylcholine expressed on the surface of dead or dying cells (and some types of bacteria) to activate the complement system promoting phagocytosis by macrophages, which clears necrotic and apoptotic cells and bacteria. Thus, CRP is thought to act as a surveillance molecule for altered self and certain pathogens. This recognition provides early defense and leads to a pro-inflammatory signal and activation of the humoral, adaptive immune system. It is an acute-phase protein of hepatic origin that increases following interleukin-6 (IL-6) secretion by macrophages and T cells. The CRP is a sensitive marker of inflammation.[1] Plasma CRP levels are low in healthy individuals without any illness.

The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended. For adults, the World Health Organization (WHO) defines that overweight is body mass index (BMI) between 25 and <30 kg/m^2, and obesity is a BMI 30 kg/m^2 or higher. Worldwide, obesity has nearly tripled for 1975. In 2016, more than 1.9 billion adults were overweight. Of these, over 650 million were obese. About 39% of adults aged 18 years and over were overweight in 2016, and 13% were obese.[2]

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Adipose tissue has always been considered a passive storage depot for fat, but it is also known to play an active role in metabolism by producing the pro-inflammatory cytokines and IL6.[3-5] As IL6 has inflammatory properties as well as stimulation of acute-phase protein production in the liver, the release of IL6 from adipose tissue may induce low-grade systemic inflammation in person with excess body fat.[6-8] Moreover, the accumulation of free fatty acids in obesity activates pro-inflammatory serine kinase cascades, which, in turn, promotes adipose tissue to release IL6 that triggers hepatocytes to synthesize and secret CRP.[9,10]

Since inflammation is believed to have a role in the pathogenesis of cardiovascular events, elevated concentrations of CRP are found in patients with acute coronary syndromes. The acute phase reaction is associated with elevated levels of fibrinogen, a strong risk factor for coronary heart disease (CHD), with autocrine and paracrine activation of monocytes by IL-6 in the vessel wall contributing to the deposition of fibrinogen. The acute-phase response is associated with increased blood viscosity, platelet number, and activity. Thus, there is the role of CRP and IL6 in the pathogenesis of CHD.[11] Measurement of CRP has been proposed as a method to improve the prediction of the risk of these events.[12]

Obesity is commonly cited as a risk factor for the development of CHD. Epidemiologic studies tend to support this contention, particularly those focusing on patients with central obesity.[13]

Objective of Study

The objective of this was to know the prevalence of raised serum CRP level in an overweight and obese person.

MATERIALS AND METHODS

After approval of the study protocol from the ethical committee of the institute Indira Gandhi Institute of Medical Sciences (IGIMS), this cross-sectional and observational study (prevalence study) included 100 obese and overweight participants of more than 18 years of age from outpatients department of general medicine IGIMS. Those obese or overweight having associated inflammatory condition, infectious disease, and other comorbidities which are known to influence CRP were excluded from the study. Height and body weight were measured using standardized procedures. BMI was calculated as weight in kilogram divided by the square of height in meter. The WHO definition was used to define overweight (BMI, 25–29.9 kg/m^2) and obesity (BMI ≥30 kg/m^2), and serum CRP was measured in all participants. Level ≥3.0 mg/L was labeled as raised. Interpretation of raised CRP was done depending on serum level. Level between 3.0 and 10.0 mg/L is minor elevation, >10–100.0 mg/L is moderate elevation, and more than 100.0 mg/L is marked elevation. Finally, data were statistically analyzed to determine the prevalence of raised serum CRP among obese and overweight.

RESULTS

Among 100 participants 45 were male, and 55 were female. Among males 41 were overweight and four were obese, female group 49 were overweight, and six were obese. Sixteen participants were in the age group 18–40 years, 56 were in the age group 41–60, and the number of participants ≥61 years of age is 28 [Table 1].

Elevated CRP level was present in 20% of men, and 25.45% of women and overall prevalence of raised CRP in study participants is 23%. The prevalence of moderately raised CRP level (≥10–100 mg/L) in men and women is 4.44% and 5.45%, respectively, whereas minor elevation of CRP (3–10 mg/L) is present in 15.55% of men and 20% of women. None of the participants have marked elevation (>100 mg/L) of CRP. Overall 18% of participants have minor elevation and 5% have a moderate elevation of CRP.

The prevalence of raised CRP among overweight (BMI-25–29.9 kg/m^2) men and women is 17.07% and 20.4%, respectively, whereas the prevalence of raised CRP among obese (BMI- ≥30 kg/m^2) men and women is 50% and 66.66%, respectively. The prevalence among overweight and obese participants is 18.88% and 60%, respectively [Table 2].

The prevalence of raised CRP among 18–40 years of age group is 3%, and among 41–60 years is 16%. Older participants (≥61 years) have a prevalence of 4% [Table 3].

DISCUSSION

Earlier studies have reported a high prevalence of raised CRP in obese and overweight, but in these studies, the high prevalence may have been confounded by inflammatory or infectious disease. We carefully excluded infectious or inflammatory disease and other factors in study participant which is known to influence serum CRP level. In our study, the prevalence of raised CRP in obese

Table 1: Characteristics of the study participants

Variables	Number (men)	Number (women)
Sample size number (*n*-100)	45	55
Age group in years		
18–40	7	9
41–60	26	30
≥61	12	16
Body mass index (kg/m^2)		
25–29.9 (over weight)	41	49
≥30 (obese)	4	6

Table 2: Prevalence of elevated C-reactive protein by BMI category

BMI level of CRP	Overweight men (*n*-41) (%)	Obese men (*n*-4) (%)	Overweight women (*n*-49) (%)	Obese women (*n*-6) (%)
Minor elevation (*n*-18)	(*n*-6) 14.63	(*n*-1) 25	(*n*-8) 16.32	(*n*-3) 50
Moderate elevation (*n*-5)	(*n*-1) 2.43	(*n*-1) 25	(*n*-2) 4.08	(*n*-1) 16.66
Marked elevation (*n*-0)	(*n*-0)	(*n*-0)	(*n*-0)	(*n*-0)

Table 3: Prevalence of elevated C-reactive protein by age and sex category

BMI level of CRP	18–40 (men) (*n*-7)	18–40 (women) (*n*-9)	41–60 (men) (*n*-26)	41–60 (women) (*n*-30)	≥61 (men) (*n*-12)	≥61 (women) (*n*-16)
Minor elevation (*n*-18)	(*n*-2) 28.57%	(*n*-1) 11.11%	(*n*-5) 19.23%	(*n*-8) 26.66%	(*n*-0)	(*n*-2) 12.5%
Moderate elevation (*n*-5)	(*n*-0)	(*n*-0)	(*n*-1) 3.84%	(*n*-2) 6.66%	(*n*-1) 8.33%	(*n*-1) 6.25%
Marked (*n*-0)	(*n*-0)	(*n*-0)	(*n*-0)	(*n*-0)	(*n*-0)	(*n*-0)

and overweight is 23%, which is comparable to a study done by Visser *et al*.[14]

Our data showing a high prevalence of raised CRP in women compared with men (20% vs. 25.45%), it could be due to the fact that at a similar BMI, women have more body fat than men.[15]

The prevalence of raised CRP among obese is more than 3 times higher (60%) than overweight participants (18.88%). A similar observation was found in a study by Visser *et al*.[14] Again, this could be due to difference in the amount of body fat in overweight and obese.

Raised CRP among obese and overweight was also investigated after stratification by age group (young = 18–40 and middle-aged = 41–60; old = ≥61) and of the level of CRP (minor elevation, moderate elevation, and marked elevation), in our study, the prevalence of minor elevation is common in young and middle-age participant as compared to older people, whereas moderate elevation was more common in the older participant. None of the participants have marked the elevation of CRP.

Our result, along with the evidence of earlier studies, has important implication for the cardiovascular risk in an overweight and obese person.

CONCLUSIONS

Higher BMI is associated with a high prevalence of raised CRP which suggests that a high prevalence of a state of low-grade systemic inflammation is present in an overweight and obese person.

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