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High sensitive C-reactive protein in adult obese men with and without type II diabetes

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Abstract

C-reactive protein (CRP), an acute phase proteins, is associated with obesity and related diseases. The objective of present study was to determine difference in serum CRP between adult obese men with type II diabetes and healthy obese men. Fasting blood samples were collected in type 2 diabetes men (n = 12) and non diabetes men (n = 12) matched for age and body mass index that participated in present study by accessible sampling. Blood samples used to determine and compare serum CRP, insulin and glucose concentration between two groups. Independent student t test was used for between groups comparison. No significant differences in anthropometrical markers between diabetic and non-diabetic group ($p \geq 0.05$). There were no differences in serum CRP concentrations between diabetic and non diabetic subjects ($p = 0.402$). Fasting glucose ($p < 0.001$) and insulin resistance ($p < 0.001$) were higher in diabetic group than in non diabetic subjects. In conclusion we can say that serum CRP as an inflammatory cytokine does not influence by diabetic state. Indeed, presence of diabetes does not affect serum CRP in obese men. Further studies are needed to clarify possible mechanisms by which diabetes can be affect inflammatory profile.

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Introduction

Diabetes is actually a heterogeneous group of metabolic diseases characterized mainly by higher-than-normal-level increase of blood glucose and lipid and carbohydrate metabolism disorder. In fact, the evidence occurs as a consequence of impaired insulin secretion or impaired sensitivity of target cells in response to blood insulin levels. Nowadays resources suggest increasing prevalence of this disease in developing countries. On the other hand, obesity is also known as one of the major public health problems and adopting strategies for fighting it and preventing its complications or diseases associated with it has been the focus of health researchers (Diabetes Group, 2002). Its incidence and its related diseases such as type-2 diabetes in developed countries and even developing countries are also the main known causes of mortality (Garrow, 1999). However, a review of the literature illustrates that type-2 diabetics, are more susceptible to cardiovascular diseases, atherosclerosis peripheral arteries and cerebral vascular diseases and metabolic disorders and hypertension (Mauvais-Jarvis *et al*., 2000; Bjornholt *et al*., 2000; Bennett, 2004).

The literature states that increase or decrease the secretion of these inflammatory mediators disrupt energy balance and glucose and lipid metabolism the consequences of which are impaired insulin secretion, increased concentration of blood glucose and insulin resistance phenomenon in obese and Type-2 diabetic patients (McMurray *et al*., 2005). C-reactive protein is a kind of proinflammatory cytokine the increased circulatory levels of which are predictable in many inflammatory diseases or metabolic abnormalities. It is synthesized primarily in the liver and is largely regulated by IL-6 (Gillman *et al*., 2000) its plasma concentration can increase up to 1000 times in response to injury or infection (Schultz *et al*., 1990).
Higher levels of this inflammatory cytokine as a predictor of cardiovascular disease are associated with lower levels of adiponectin as an anti-inflammatory cytokine (Engeli *et al*., 2003; Goodarzi *et al*., 2007; Park *et al*., 2010). Also, its significant and direct correlation with glycated hemoglobin (HbA1c) as a predictor of glycemic control in type-2 diabetic patients has previously been reported by some studies (Top *et al*., 2007). On the other hand, some studies suggest the absence of any relationship between HbA1c and inflammatory markers such as CRP (Gustavsson *et al*., 2004) in patients with type 2 diabetes.

Conversely, academic resources report higher levels of CRP in obese individuals compared to those with normal weight (Ouchi *et al*., 2003). Since most diabetic patients are categorized as obese or overweight, it is unclear whether the increased levels CRP in these patients is rooted in the phenomenon of obesity in the population or it is the diabetes phenomenon that affects its secretion or its levels compared with non-diabetics. Hence, this study aims to compare its serum levels between diabetic and non-diabetic obese men.

Method and subjects

This study involved non trained sedentary adult obese men with type 2 diabetes (n = 12) and those without diabetes symptoms (n = 12) matched for age, body weight and body mass index. Participants were non-athletes, non-smokers and non-alcoholics. After the nature of the study was explained in detail, informed consent was obtained from all participants.

None of the subjects used drugs or therapies for obesity. Participants were included if they had not been involved in regular physical activity/diet in the previous 6 months. We also excluded people who had any self reported physician diagnosed chronic disease (arthritis, stroke, hypertension, cancer, heart attack, chronic cough, or bronchitis). Those that were unable to avoid taking drugs for 12 hours before blood sampling were also barred from participating in the study.

Anthropometric measurements of height, weight, percent body fat, and circumference measurements were taken in the physiology laboratory. Body weight and Percentage of body fat was measured by bioelectrical impedance method (Omron Body Fat

Analyzer, Finland) in the morning following a 12-h fast. BMI was calculated as weight (in kilograms) divided by the square of height (in meters). Abdominal circumference and hip circumference were measured in the most condensed part using a non-elastic cloth meter. Hip circumference was measured at the maximum circumference between the iliac crest and the crotch while the participant was standing and was recorded to the nearest 0.1 cm. Abdominal to hip circumference ratio was measured by dividing the abdominal circumference into that of the hip.

For measuring of clinical and biochemical markers, a blood samples were obtained of all participants after a 10 – 12 hours overnight fast. Blood was collected directly from the heart in test tubes containing EDTA, separated by centrifugation, frozen, and stored –80 °C until biochemical analysis was performed. Blood samples used in order to measuring serum CRP, insulin and glucose concentration.

Serum CRP and insulin was determined using ELISA method. Glucose was determined by the oxidase method (Pars Azmoon, Tehran). To estimate insulin resistance, the homeostasis model assessment (HOMA) index was calculated as fasting insulin concentration (μU/ml) × fasting glucose concentration (mmol/l)/22.5.

Statistics

Statistic analysis was done with SPSS 15.0 for Windows. The Kolmogorov-Smirnov test was applied to determine the variables with normal distribution. An Independent sample T-test was used to compare the serum levels of all resistin between asthma and none-asthma subjects. A p-value of less than 0.05 was considered to be statistically significant.

Results

As mentioned above, this study aimed to compare serum CRP between adult obese men with and without type II diabetic. Subject anthropometrical characteristics are summarized in Table 1. Data of Independent T test showed no significant differences in anthropometrical markers between diabetic and non-diabetic group ($p \geq 0.05$).

Table 1. Mean and standard deviation of anthropometrical markers in studied groups.

Variables	Age *(years)*	Weight *(kg)*	Height *(cm)*	BMI *(kg/m²)*	BF *(%)*	AC *(cm)*	HC *(cm)*	WHO
Diabetic	40.3 *(4.1)*	93.2 *(5.4)*	172 *(4.8)*	31.4 *(1.8)*	30.5 *(1.5)*	105 *(7)*	104 *(2.5)*	1.01 *(0.06)*
Non-diabetic	40 *(1.4)*	98.1 *(6.9)*	(176 *(3.5)*	31.8 *(1.9)*	31.7 *(1.9)*	107 *(5.5)*	106 *(5.9)*	1.01 *(0.02)*

BMI, body mass index; BF, Body fat percentage; AC, Abdominal circumference; HC, Hip circumference; WHO, abdominal circumference to Hip circumference ratio.

Table 2 shows the descriptive biochemical features of the study groups. There were no differences in serum CRP concentrations between diabetic and non diabetic subjects ($p = 0.402$). Our results showed that fasting glucose ($p < 0.001$) and insulin resistance ($p < 0.001$) were higher in diabetic group than in non diabetic subjects.

Table 2. Mean and standard deviation of clinical markers in studied groups.

Variables	Glucose *(mg/dl)*	Insulin *(mg/dl)*	C-Reactive Protein *(ng/ml)*	Insulin resistance *(HOMA-IR)*
Diabetic	225 *(67)*	8.28 *(1.6)*	1194 *(398)*	4.34 *(1.03)*
Non-diabetic	100 *(8)*	8.46 *(2.8)*	1673 *(1899)*	2.04 *(0.50)*

Discussion

The prevalence of type 2 diabetes is associated with multiple factors such as obesity and VCD, but the exact mechanisms responsible for its incidence and increased severity are not yet fully understood (Wang *et al.*, 2011). The findings of this study showed no

significant differences in baseline CRP levels between diabetics and non-diabetics, nevertheless, increased plasma levels of this inflammatory cytokine in patients with pre diabetes has been reported in Asian populations (Sabanayagam *et al.*, 2011). The predictive value of this inflammatory hormone for cardiovascular disease in men and women, smokers and non-smokers or people with diabetes and non-diabetic populations has repeatedly been confirmed. In support of the foregoing, some studies suggest that the concentration of CRP in healthy women is an independent and strong risk factor for cardiovascular disease.

In this regard, the findings of a study on a large group of men and women showed that along with age, hypertension and diabetes CRP is considered to be the most important risk factor for cardiovascular disease (Panagiotakos *et al.*, 2008). Similar to other inflammatory cytokines, most previous studies have pointed out that the levels CRP as an inflammatory cytokines increase in response to obesity (Bruun *et al.*, 2003). This in fact signifies the phenomenon of systemic inflammation in obese subjects. On the other hand, researchers report obesity as influential factor in the rising levels of CRP. Levels of CRP were significantly higher in diabetic patients than non-diabetic obese subjects. On the other hand, some relatively recent studies have suggested that certain risk factors such as lipid profile are not very accurate in the diagnosis of cardiovascular disease, while most studies support a close association between inflammatory markers and cardiovascular disease or other chronic diseases (Giffen *et al.*, 2003). Some studies introduce high accuracy measurement of C-reactive protein as a better indicator than lipid profile for diagnosis of cardiovascular disease (Lus, 2003). These studies report a significant increase in this inflammatory cytokine with 2 to 5-fold increased risk of cardiovascular disease.

Despite these statements, the findings of this study imply no significant difference between the serum levels of this inflammatory cytokine in diabetic and non-diabetic obese subjects. These findings somehow indicate that although scientific resources have frequently emphasized higher levels of CRP in obese individuals compared to normal weight individuals, given our findings in which both diabetic and non-diabetic subjects are categorized as obese, it can be concluded that it is obesity that affects CRP levels and compared with obesity, diabetes has a far less important role in secretion or levels of CRP. Furthermore, levels of CRP in diabetic obese subjects tends slightly to increase, but not significantly compared with obese diabetic group which can probably be attributed to the higher weight average (non-significant) in non-diabetic obese group than in diabetic obese group.

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