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Comparison of serum C reactive protein in middle-aged smoker and non-smokers males

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Abstract

The objective of present study was to compare serum C Reactive Protein (CRP) between smoker and none-smoker men. For this purpose, venous blood samples were collected after a overnight fast in order to measuring serum CRP in eighteen middle-aged non-trained males and eighteen none-smoker males matched for age (42.8 ± 8.3 years of old) and BMI (30.63 ± 3.3 kg/m2) participated in this study by accidentally samples. Independent sample T-test was used to compare the serum levels of CRP between two groups. Serum level of CRP was significantly higher in smoker group when compared with non-smoker subjects (median 2131 ± 211 Vs 1670 ± 313 ng/dl; P value = 0.021). Based on this data, we can point to the presence of systemic inflammation in smokers that is also associated with airway inflammation in these subjects probably.

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Introduction

While the prevalence of tobacco use has declined among men in some high-income countries, it is still increasing among young people and women (Crofton *et al.,* 1989). It is generally accepted that Smoking is one of the major lifestyle factors influencing the health of human beings and Life-term use of that is well known to have a higher prevalence of common diseases such as such as COPD and cancer, particularly lung cancer and cancers of the larynx and tongue (Boyle, 1997). Data from a recent observational study indicate that circulating level of inflammatory cytokines is increased in presence of obesity or some chronic diseases (Eizadi[a] *et al.,* 2011; Eizadi[b] *et al.,* 2011). Recent evidence has shown changes in levels of inflammatory mediators not only in the lungs but also in the circulation of healthy smokers.

Common conditions caused by smoking can be affecting some circulating cytokines. Inflammatory cells secrete some inflammatory mediators in response to cigarette smoke, first of all, acute-phase proteins (APPs) and cytokines (Dilyara *et al.,* 1999). Accumulating evidence indicates that the increase of pro-inflammatory cytokines participates in the genesis of insulin resistance, since it can interfere in the insulin signaling (Marreiro *et al.,* 2004; Stienstra *et al.,* 2007; Fernández-Real *et al.,* 2003). Several studies have shown increased levels of TNF-α and IL-6 in smokers (Bermudez *et al.,* 2002; Helmersson *et al.,* 2005). Some study have also reported increased white blood cell in smoker than non-smokers (Wannamethee *et al.,* 2005; Yarnell *et al.,* 2000; Frohlich *et al.,* 2003; Woodward *et al.,* 1999).

Among inflammatory cytokines, C Reactive Protein (CRP) is associated with risk for cardiovascular diseases (Danesh *et al.,* 2000; Ridker *et al.,* 1998). C-reactive protein is an acute phase plasma protein, produced in response to general inflammatory episodes within the body (Black *et al.,* 2004; Pepys *et al.,* 2003). CRP is secreted primarily by the liver cells, but can also be expressed by adipocytes and cultured coronary artery smooth muscle cells (Ouchi *et al.,* 2003; Calabro *et al.,* 2005). This inflammatory cytokine may be easily and sensitively measured in a variety of clinical situations to monitor disease progression (Casas *et al.,* 2008). In another study it was found that CRP might be not only a biomarker of different cardiovascular diseases but may have direct effects on the pathogenesis of atherosclerosis and endothelial dysfunction (Szmitko *et al.,* 2003). The current study is designed to examine whether serum CRP is affect by cigarette smoking in healthy middle-aged males.

Materials and methods

The purpose of this study was to compare serum CRP between healthy middle-aged smoker men (n=18) and non-smoker men (n=18) matched for age (42.8 ± 8.3 year), height (175.6 ± 6.7 cm) and BMI (30.63 ± 3.3 kg/m2) that participated in this study by accidentally samples. The study protocol was approved by the ethics committee of exercise physiology of Islamic Azad University of Iran. Each participant received written and verbal explanations about the nature of the study before signing an informed consent form.

Participants were included if they had not been involved in regular physical activity/diet in the previous 6 months. Subjects of two groups were reported to be non-athletes. Inclusion criteria to study for smoker group were smoking history of At least 10 cigarettes a day for 3 years ago. Neither the smoker nor non-smoker had ongoing cardiovascular disease, infections, renal diseases, hepatic disorders, use of alcohol, and use of nonselective β blockers and presence of malignancy. Subjects were asked to avoid doing any heavy physical activity for 48 hours before blood sampling.

All anthropometric measurements were made by the same trained general physician and under the supervision of the same pediatrician. Weight and height of the participants were measured by the same person when the participant had thin clothes on and was wearing no shoes. Height was measured on standing while the shoulders were tangent with the wall. Body fat percentage was measured by body composition monitor (BF508-Omron made in Finland) with a precision error of less than 100 g.

BMI was calculated using the formula body weight/height2 in terms of kg/m².

All participants were asked to attend Lab between the hours of 8 to 9 am after an overnight fast. Blood samples were obtained in order to measuring serum CRP of each subject in two groups. Serum CRP was determined by ELISA method (Diagnostics Biochem Canada Inc. High sensitivity C - reactive protein (Hs-CRP)). The Intra- assay coefficient of variation and sensitivity of the method were 5% and 10 ng/mL, respectively.

Statistical analysis

Normal distribution of data was analyzed by the Kolmogorov-Smirnov normality test. Statistic analysis was done with SPSS 15.0 for Windows. Independent t-test was used to compare the means of variables between asthma and non-asthma groups. A p-value of less than 0.05 was considered to be statistically significant.

Results

Anthropometric and metabolic characteristics of the study participants in the smoker and non-smoker groups are shown in Table 1. All values are given as mean and standard deviation

Table 1. Mean and standard deviation of anthropometric and metabolic characteristics of studied subjects.

Variables	Non-smokers	Smokers
Age (year)	42.8 ± 8.3	41.8 ± 4.8
Height (cm)	175.6 ± 6.7	174.9 ± 6.5
Weight (kg)	93.8 ± 3.8	95.4 ± 4.5
Abdominal circumference (cm)	106.3 ± 5.6	108.7 ± 7.6
Hip circumference (cm)	105.2 ± 6.6	107.6 ± 7.8
Body mass index (kg/m²)	30.63 ± 3.3	31.51 ± 4.2
Body Fat (%)	30.94 ± 4.3	31.33 ± 3.4
CRP (ng/ml)	1670 ± 313	2231 ± 211
White blood cell	6767 ± 655	7343 ± 611

There were no differences in the age and anthropometrical markers such as body weight, body mass index, body fat percentage and abdominal circumference between the two groups ($p \leq 0.05$). Serum CRP levels in smoker men showed were significantly higher than those in non-smoker group ($p = 0.021$). Also, we have observed that in smokers the WBC was significantly higher than in non-smoker subjects ($p = 0.034$).

Discussion and conclusion

The dependent t-test statistical findings in this study, showed a significant difference in baseline CRP as an inflammatory cytokine between smoker and nonsmoker subjects. In other words, smoking men possess higher levels of CRP than non-smoking men. Since both smokers and nonsmokers were similar in weight and body fat percentage, higher levels of this inflammatory cytokine in smokers than in non-smoker men can somehow be attributed to long-term consumption of tobacco in this group.

It is known that nitrogen oxides and other oxidants from cigarette or tobacco smoking increase inflammation in the respiratory pathways (Valença *et al.,* 2009) leading to increased mucus secretion and increased sensitivity of them to allergens which is eventually associated with the eosinophil count and the secretion of inflammatory mediators from the respiratory tract and other tissues of the body (Ronchetti *et al.,* 1990). Inflammatory markers, such as CRP and TNF-a, play a central role in the

regulation of inflammatory responses and although the structure of CRP is independent of immunoglobulins it shares many biological activities with immunoglobulins. For example, CRP contributes to production of inflammation increasing cytokine (Du *et al.,* 2000). Therefore its measurement is used as a marker of inflammation and necroses of tissues (Merghani *et al.,* 2012). It is known that male smokers who are constantly using tobacco or cigarette have higher baseline CRP levels than non-smokers and this is indicative of augmented inflammatory processes in these individuals (Merghani *et al.,* 2012). However, similar to the findings of this study, some previous studies have also reported insignificant increases of CRP Plasma in smokers compared with non-smokers (Helmersson *et al.,* 2005; Boshtam *et al.,* 2006). It is not clear whether these conflicting results are due to differences in genetic, environmental factors or changes associated with CRP half-life (Merghani *et al.,* 2012) or it has roots in other interfering factors.

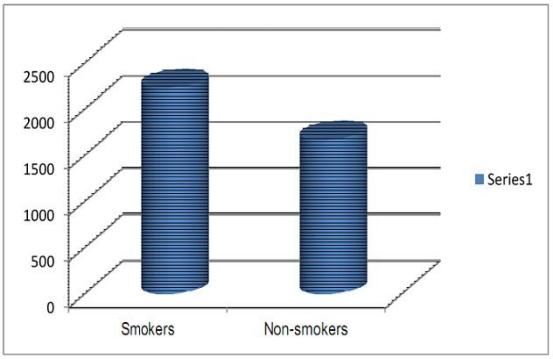

Fig. 1. The diagram shows fasting serum level of CRP in smoker and non-smoker groups. Compare columns in the chart states higher serum CRP in smokers than non-smokes men.

On the other hand, according to the findings that CRP levels would increase in response to overall body inflammation (Black *et al.,* 2004; Pepys *et al.,* 2003) and as well as being secreted by the respiratory tract, adipose tissue and coronary artery smooth muscle cells (Ouchi *et al.,* 2003), most of it is secreted by the liver hepatocytes (Tonstad *et al.,* 2009) it is likely that in addition to affecting its secretion by respiratory tract smooth muscles, the inflammation caused by cigarette smoking also augments secretion of inflammatory cytokines from these tissues by affecting other tissues such as the liver hepatocytes or adipose tissue.

In recent years, confirming the findings of this study, a large volume of studies have measured CRP levels in smokers because of the possible association between smoking and incidence of inflammatory pathways (Yanbaeva *et al.,* 2007). It has also been suggested that increased IL-6 and Il-1B in response to inflammation of lungs would increase expression of CRP (Van Eeden *et al.,* 2005). In a study on a group of British men it was found that CRP levels in men increased from 1.13 milligrams per liter in nonsmokers to 1.87, 2.32 and 2.50 mg daily, accordingly in those who smoked 1-14, 15-24 and more than 25 cigarettes (Lowe *et al.,* 2001). Although in another study on the Japanese, no significant correlation was observed between serum CRP and the number of cigarettes smoked per day (Ohsawa *et al.,* 2005). Also CRP levels in children exposed to secondhand smoke have been reported to be higher than those who were not exposed to tobacco smoke (Wilkinson *et al.,* 2007).

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