ORIGINAL ARTICLE

COMPARISON OF TOTAL SERUM ANTIOXIDANT CAPACITY BETWEEN MALE SMOKERS AND NONSMOKERS

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Background: Smoking is characterized by the production of increased free radicals and oxidative stress. The objective of this study was to compare total antioxidant capacity between adult male smokers and nonsmokers. **Methods:** A total of 74 male subjects were involved in this study. Thirty-six of them were nonsmokers and another 38 of were smokers. Age of the smokers and nonsmokers were ranged between 30 and 45. Venous blood was collected from subjects after an overnight fast between 8:00 AM and 9:00 am. Blood samples were used for evaluation of serum total antioxidant capacity. **Results:** Data showed that total antioxidant capacity was significantly higher in smoker than non-smoker subject (p<0.05). There was no a significant correlation between the number of cigarettes smoked and the total antioxidant capacity (r= -0.137, p=0.673). **Conclusion:** Smoking reduces total antioxidant capacity which may put the smokers at risk of developing many oxidative stress related disorders.

Keywords: Free radicals, Antioxidant capacity, Smoking

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INTRODUCTION

Free radicals, atoms or molecules with one or more unpaired electrons, are highly reactive and mainly responsible for causing damage to molecules, such as proteins, carbohydrates, lipids and DNA.[1,2]

Various exogenous factors, such as radiation and smoking cause the production of free radicals, inducing an imbalance between free radicals and antioxidant protection mechanisms. This imbalance which is called oxidative stress leads to enhanced low density lipoprotein (LDL) oxidation.[3] Smoking accounts for 17–30% of all morbidity from cardiovascular diseases and is considered to be a preventable cause.[4] Cigarette smoke is rich in Reactive Oxygen and Nitrogen Species (ROS and RNS), such as nitrogen, alkoxyl and peroxyl radicals. These can cause the production of other free radicals, which, in turn, initiate lipid peroxidation on the LDL particle and cause endothelial cell dysfunction.[5,6]

In the view of the fact that many people are hooked to smoking, regardless of age and gender, this study was undertaken to compare the level of Total Antioxidant capacity (TAC) of smokers and nonsmokers.

PARTICIPANTS AND METHODS

A cross sectional comparative study, conducted at Sreevalsam Institute of Medical Sciences, Edappal, Malappuram, Kerala, India after getting institutional approval. A total of 74 male participants who gave written informed consent were involved in this study through convenience sampling. Thirty-six of them were nonsmokers and another 38 were smokers. Age of all the participants ranged between 30 to 45 years. All participants were non-athletes and non-alcoholics and had not participated in regular exercise/diet programs for the preceding 6 months. Inclusion criteria for smoker group were smoking history of at least 10 cigarettes a day for 5 years. Those with type II diabetes, respiratory and cardiovascular diseases, cancer, kidney dysfunction and other chronic diseases were excluded.

A diet survey form was provided to the participants. Blood was collected at Sreevalsam Institute of Medical Sciences-Edappal during April–July 2014. The blood was kept overnight before centrifugation to get serum. Centrifugation was done at 1250 rpm for 5 minutes at room temperature. Serum samples were stored at -70 degree centigrade until required for use. TAC was measured by two methods using the total ferric reducing ability of serum assay established by Benzie and Strain in1999.[7] In ferric reducing assay, ferric to ferrous ion reduction at low pH causes a colored ferrous-tripyridyltriazone complex to form. TAC is obtained by comparing the absorbance change at 593nm in test reaction mixtures with those containing ferrous iron in known concentration.

All the data collected were analyzed using the t-test in SPSS-15 for differences in TAC of two mean values between nonsmokers and smokers. Pearson correlation coefficient was used for analysis of correlation between the number of smoked cigarettes and TAC, and p<0.05 was considered as significant.

RESULTS

Total of 36 smokers and 38 nonsmokers were evaluated for TAC with a mean age of 35.7±5.8 and 34.0±4.4 years respectively. Demographic details of Smokers and nonsmokers are listed in Table-1. All

participants of two groups matched for age and anthropometrical markers as shown in table 1.

In this study, trend of lower serum TAC in smokers compared with that of nonsmokers was established and this difference in TAC between both groups was statistically significant as shown in table 2. There was no a significant correlation between the number of cigarettes smoked and the TAC (r= -0.137, *p*=0.673).

Table-1: Demographic profile of smokers and nonsmokers

Physiological Variables		Smoking Volunteers	Nonsmoking Volunteers	*p*
Mean age (years)±SD		35.7±5.8	34.0±4.4	>0.05
Mean BMI (kg/m^2)		22.4±4.1	23.1±3.7	>0.05
Heart Rate (beats/min)		84.6±9.3	76.4±5.8	>0.05
BP (mmHg)	SBP	128.8±10.8	121.1±13.8	>0.05
	DBP	77.1±8.6	72.7±10.4	<0.05

SBP= Systolic blood pressure, DBP= Diastolic blood pressure

Table-2: Comparison of TAC between smokers and nonsmokers

	TAC (mmol/l) Mean±SE	*p*
Smokers	0.409±0.014	<0.05*
Non-Smokers	0.591±0.034	

*Significant

DISCUSSION

According to the findings of this study, male smokers had lower levels of total antioxidant capacity. These findings relatively support the devastating effects of cigarette smoking on antioxidant defense system, as well as the progress of oxidative stress in the presence of cigarette smoking.

Hence it can be concluded that reduced antioxidant capacity in cigarette smokers is associated with increased production of oxidants and free radicals. In a study conducted by Ranjbar *et al* lipid peroxidation levels in smokers were more than in nonsmokers.[8] In their study, total antioxidant capacity of plasma and plasma thiols were lower in smokers compared with smokers. The reduced thiols and total antioxidant capacity of plasma suggest that smokers, had an increased production of free radicals, which correspond with the results of present study. Block *et al* in a study, demonstrated that the amount of lipid peroxidation and F2-isoprostanes were increased significantly in smokers compared with nonsmokers.[9]

Improvement in antioxidant capacity is facilitated through regular exercise, good nutrition, and more importantly the use of antioxidant supplements, which under different conditions, show different immediate or chronic response based on biochemical and bio-molecular regulatory mechanisms. These systems are weakened under some conditions. In other words, some internal or external stimuli contribute to decreased antioxidant capacity and consequently to increased production of oxidants or free radicals, based on the stimulation degree. For example, the devastating impacts of smoking, especially cigarette as the most common tobacco product, on the antioxidant system have been frequently investigated and it has been shown that a single puff of cigarette contains more than 1014 free radicals and a complex mixture of 4700 chemical compounds.[10]

Chronic exposure to cigarette smoke affects hematological indexes and oxidative stress biomarkers negatively. This might mean decreased antioxidant protection and increased risk for cardiovascular diseases in smokers. One limitation of the present study is the small sample size due to the availability of less number of volunteers. Similar study with larger sample size is to be conducted so that the results can be generalized on to the population. Such results need to be publicized in simple language for the information of masses with the hope that some fraction may think about quitting smoking. This would be a step forward towards developing a healthy society free of smoking.

CONCLUSOIN

Smoking reduces total antioxidant capacity which may put the smokers at risk of developing many oxidative stress related disorders.

CONFLICT OF INTEREST

No conflict of interest is declared by the authors.

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