

Evaluation of total antioxidant power of plasma in biomass smoke exposed COPD patients

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Abstract

The present study was carried out to analyse the total antioxidant power of plasma in biomass smoke exposed COPD patients and matched controls. A total of 48 biomass smoke exposed COPD patients and 29 matched controls were assessed. FRAP (ferric reducing ability of plasma) assay was used to measure the total antioxidant ability of plasma. The mean age of COPD patients was 56.062 ± 1.754 years and that of control subjects 56.793 ± 2.751 years. Markedly significant difference ($p < 0.001$) was observed in the mean FRAP value of biomass smoke exposed COPD patients (361.900 ± 9.056) as compared to controls (727.210 ± 12.976). Mean value of FRAP in vegetarians and alcohol consuming biomass smoke exposed COPD patients showed no significant difference ($p > 0.05$) as compared to the non-vegetarians and abstainers.

Keywords: COPD, Plasma, FRAP, biomass smoke

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by slow progressive and largely irreversible airway inflammation and obstruction in expiratory airflow [1]. Cigarette smoking is the most dangerous risk factor for COPD [3]. The use of biomass fuel, such as wood, dried animal dung for cooking, also increases the risk of COPD by three to four times [4-5]. Approximately 3 billion people worldwide use biomass fuel for heating and cooking purpose [6]. Burning of biomass fuel can

produce a broad range of gaseous pollutants, including formaldehyde, carbon monoxide, hydrocyanic acid, ammonia, nitrogen oxides and sulfur, and volatile organic compounds, such as benzene and polycyclic aromatic hydrocarbons (PAH) [7-8]. The pollutants present with high PAH content, are act as powerful oxidative stress inducers [9-10]. It is considered that reactive oxygen species (ROS) is the major cause of cell and tissue damage associated with many chronic inflammatory lung diseases, including COPD [11-12].

Under normal conditions, blood and lungs are adequately protected by various intracellular and extracellular antioxidants against the deleterious effect of the reactive oxidants [13]. Ferric reducing ability of plasma (FRAP) assay is a novel method for assessing antioxidant power of plasma. The principle of FRAP assay is based on the reduction of the ferric ions to produce ferrous ions, which form a blue colored complex with tripyridyl triazine (TPTZ) at low pH. The present study was carried out to analyse the antioxidant ability of plasma with the help of FRAP assay in biomass smoke exposed COPD patients and matched controls.

MATERIALS AND METHODS

Subjects

A total of 77 subjects were studied out of which 49 were biomass smoke exposed COPD patients and 28 controls matched with respect to age, lifestyle and socioeconomic status. All the patients were diagnosed by a registered medical practitioner, using clinical history, physical examination and spirometry test. The study was performed in Human Genetics Laboratory, Department of Zoology, Kurukshetra University, during the period March-August, 2016. A detailed questionnaire was filled by COPD patients and controls to collect details regarding their sex, age, alcohol drinking habit and biomass smoke exposure. Ethical clearance was obtained from Institutional Ethics Committee, Kurukshetra University, Kurukshetra (No.IEC/14/371) dated-October 1, 2014 for the present study. An informed consent was taken from each subject prior to blood sampling.

Sample collection and laboratory analysis

Blood samples were taken by a registered medical practitioner from the vein of the subjects and were taken to the laboratory in K₂ EDTA coated vials (Becton Dickinson) and centrifuged at 2500 rpm. Analysis was carried out within 12 hours. FRAP assay was used to measured the total antioxidant power of plasma [14]. 100 µL of plasma was mixed with 300 µL distilled water and 3 mL of working FRAP reagent, freshly prepared by adding 10:1:1 ratio of 300 mmol/L acetate buffer, 10 mmol/L 2,

4, 6-tripyridyl-S-triazine (HIMEDIA) in 40 mmol/L HCl and 20 mmol/L $\text{FeCl}_3 \times 6\text{H}_2\text{O}$ (HIMEDIA). Ascorbic acid was taken as standard. Absorbance was measured at 593 nm at zero minute after vortexing. After that, samples were placed in a water bath at 37 °C and absorbance was taken after 4 minutes.

RESULTS

The general characteristics of the subjects are given in the Table 1. The average age of COPD patients was 56.062 ± 1.754 years and that of control subjects 56.793 ± 2.751 years. Markedly significant difference ($p > 0.001$) was observed in the mean FRAP value of biomass smoke exposed COPD patients 361.900 ± 9.056 as compared to controls 727.210 ± 12.976 Figure 1. Mean FRAP value of vegetarian COPD patients (368.270 ± 10.369) showed no significant difference when compared with non-vegetarian COPD patients (347.870 ± 17.888). Total antioxidant value of plasma was lower in alcohol consuming COPD patients (340.620 ± 17.595) as compared to the abstainers (369.800 ± 10.398).

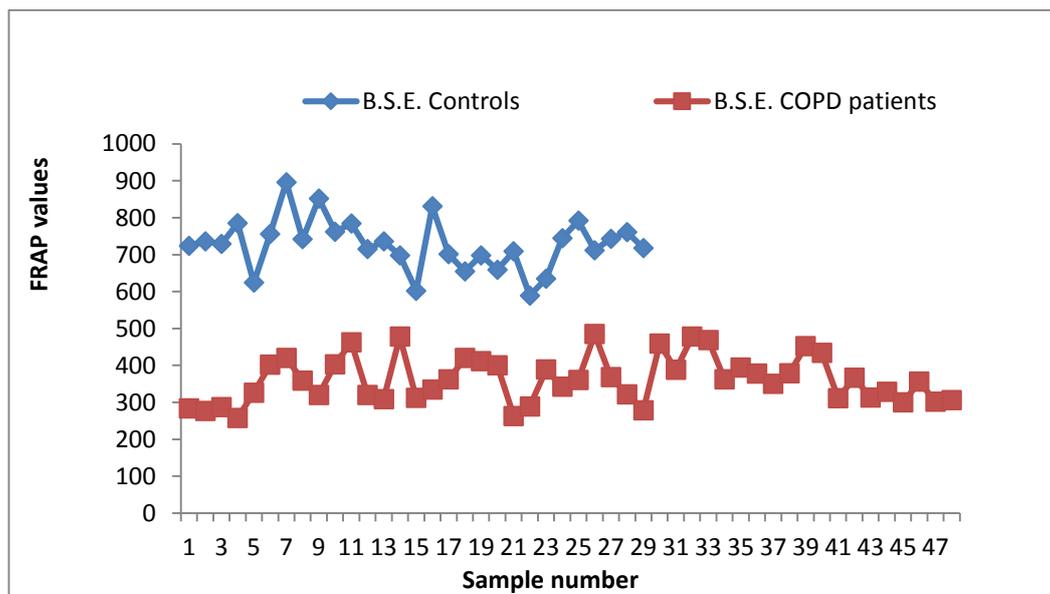
Statistical analysis

Statistical analysis was performed with software SPSS version 16 and the results were evaluated by Student's t test.

Table I. General and clinical characteristics of the subjects.

Characteristics	Controls (B.S. Exposed)	COPD patients (B.S. Exposed)
N	29	48
Age (years)	56.793 ± 2.751	56.062 ± 1.754
Sex (Male/Female)	09/20	15/33
Alcohol consumers/Abstainers	09/20	13/35
Vegetarians/Non-vegetarians	18/11	33/15
FRAP values ($\mu\text{mol/L}$)	727.210 ± 12.976	$361.900 \pm 9.056^*$

*Significant ($p < 0.001$), unpaired Student's t-test. B.S.-Biomass Smoke



B.S.E.-Biomass Smoke Exposed

Figure 1. Ferric reducing antioxidant power of plasma ($\mu\text{mol/ml}$) in COPD patients and controls.

DISCUSSION & CONCLUSION

In recent years, in rural areas, the role of biomass fuels in the pathogenesis of COPD has received increasing attention. Approximately 50% of the world's population and 90% of homes in rural areas burn biomass as their main source of energy in the home, for cooking or heating [15-16]. Various recent studies have investigated the role of reactive oxygen species in the production of the inflammatory response in peripheral and central airways of the COPD patients [17-18]. In the present study we have observed a decrease level of total antioxidant ability of plasma in biomass smoke exposed COPD patients as compared to controls. Earlier, Gani *et al.* (2000) [19] observed the effect of biomass smoke exposure in Turkish women and reported a decrease in the antioxidant enzyme activity. Sezer *et al.* (2006) [20] studied the combined effect of both cigarette smoke and biomass smoke exposure on rabbits and reported a decrease level of antioxidant with exposure to biomass smoke. Mondal *et al.* (2010) [21] observed significantly reduced level of total antioxidant among the subjects who were exposed to biomass smoke.

In conclusion the present study proposed that biomass smoke exposed COPD patients have significantly lower level of antioxidant in plasma as compared to the biomass smoke exposed controls. We have also observed slight decrease level of antioxidant in non-vegetarian and alcohol consuming COPD patients as compared to vegetarian and abstainers in controls.

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