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ORIGINAL ARTICLE

Nutritional risk factors for the development of chronic obstructive pulmonary disease (COPD) in male smokers

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Summary
Background & Aims: The aim of this study was to investigate whether nutritional risk factors, especially black tea consumptions, are inversely associated with the development of chronic obstructive pulmonary disease (COPD) in male smokers.
Methods: Forty male smokers with clinical diagnosis of COPD (Group-I (GI)) and 36 healthy smokers without COPD (Group-II (GII)) were included in this study. We compared the dietary habits and food intakes of the two groups using an adaptation of the Arizona Food Frequency Questionnaire (AFFQ). Question form included a list of 65 food items formed from five main food groups (grain, meat and alternatives, dairy products, vegetables–fruits and fat) and 25 dietary habits. The data were evaluated by binary logistic regression analysis, receiver operating characteristic (ROC) curve, Kolmogorov–Smirnov, Student's *t*, Mann–Whitney, and Chi-square tests.
Results: When both groups compared, black tea consumptions (GI-700 ml; GII-1600 ml (OR: 0.635, $P<0.001$)), vegetable fruits scores (GI-54.30; GII-63.81 (OR: 0.863, $P<0.001$)), regularly breakfast habit (GI-24 patients; GII-36 cases (OR: 0.549, $P<0.001$)) and eating salty (GI-22 patients; GII-5 cases ($P<0.001$)) made significant differences. In ROC curves, the area under the curve of black tea (0.898 (95% CI: 0.819–0.977) and vegetables–fruits (0.833 (95% CI: 0.727–0.938) provided high accuracy to distinguish between COPD group and controls ($P<0.001$).
Conclusions: High intakes of black tea and vegetables–fruits consumptions may be protecting male smokers from developing COPD.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a leading cause of death, estimated by the World Health Organization (WHO) to be the sixth most common cause of death worldwide in 1990 and predicted to rise to third place by 2020.[1] COPD is a prevalent and serious condition and its major risk factor, cigarette smoking, has been identified.[2] However, only a minority of smokers develop clinically relevant disease. Although, the current understanding of a pathogenesis includes an ''abnormal inflammation'' as a response to various noxious agents, its various pathways are not clear. Oxidative stress, inflammation, tissue damage and tissue repair are parts of the complex procedure leading to COPD.[3]

There are some indications from epidemiological studies that dietary factors such as ample consumption of fruit may decrease COPD risk.[4] Several studies, based on the hypothesis that antioxidants in food may protect the lungs against oxidant attack from the free radicals found in cigarette smoke, have found positive associations between low dietary intake of fruit and vegetables and decreased lung function in general populations.[5] The major source of dietary antioxidants is fruits and vegetables. Dietary antioxidants, including tocopherols, ascorbate, and carotenoids as well as antioxidant non-nutritive substances such as flavonoids, which is a polyphenol, may prevent air pollution-induced oxidative stress in lungs. Especially, black tea, one of the most frequently consumed beverages worldwide, is a rich source of antioxidants. In fact, regular black tea consumption may very well be one of the major sources of antioxidant worldwide due to the high concentration of polyphenols in tea combined with the frequent consumption of this beverage,[6] which is a popular beverage in Turkey and hence may be considered an important source of dietary flavonoids among Turks.

Tea contains more than 4000 chemical compounds that may affect the human body in many aspects. Black tea is produced by crouching fresh tea leaves, allowing enzyme-mediated oxidation to occur in a process commonly known as fermentation.[7] Through fermentation, a large percentage of the catechins are converted to oligomeric theaflavins and polymeric thearubigins in black tea. The resulting brewed black tea contains 3–10% catechins, 2–6% theaflavins and $>20\%$ thearubigins.[8] Moreover, it is important to consider that tea beverages often contain a millimolar concentration of caffeine that may affect some properties of the beverage.[9]

The dietary advice for weight-stable COPD patients is generally to eat a healthy diet, which is usually interpreted as a diet according to general dietary recommendations that is, low in fat, high in fiber, containing complex carbohydrates and including large quantities of fruit and vegetables.[10] High intake of fruits and vegetables enhances ventilatory function, thereby reducing risk of COPD.

In this study, we investigated nutritional risk factors for the development of COPD in male smokers and for this purpose, we examined whether intakes with high-level antioxidant such as black tea, vegetables and fruits could play a protective role against COPD in male smokers.

Materials and methods

Forty male patients with COPD defined as forced expiratory volume in 1 s $FEV_{(1)}$/forced vital capacity $FVC<70\%$, and $FEV_{(1)}<80\%$ admitted in a reference university hospital between 2003 and 2004 in the South eastern Anatolia Region of Turkey. Control group included 36 healthy smokers living in the same geographic area were matched with COPD group by sex, age and smoking histories. For selecting individual for control group, a questionnaire that includes only questions about the socio-economic and physical activity of the individuals was applied. The individuals who have the same socio-economic and physical activity with COPD group were accepted to the control group. Each group contained more than 30 subjects to realize statistical parametric tests.[11]

We recruited patients who had symptoms of chronic airflow obstruction and who fulfilled lung function criteria as set out by the National Heart and Lung Institute/Word Health Organization Global Initiative for Chronic Obstructive Lung Diseases guidelines from our outpatient or inpatient clinics.[12]

All patients had postbronchodilator FEV_1/FVC of less than 70% and no substantial improvement in FEV_1 after taking 400 mcg of nebulized salbutamol. We excluded patients if they had a clinical diagnosis of asthma, variability of symptoms not associated with infections, or a history of acute wheeze, breathlessness, or deterioration associated with allergens or older than 65 years, the cases with hypertension and diabetes mellitus. Other exclusion criteria were a history of childhood respiratory disorders, significant bronchiectasis, inflammatory bowel disease, rheumatoid arthritis, and chest well deformity, because of their association with fixed airflow obstruction.