



## Smoking and Diet in Healthy Adults: A Cross-Sectional Study in Tehran, Iran, 2010

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### Abstract

**Background:** Smoking and unhealthy diet are two major risk factors for non-communicable diseases. The aim of this study was to investigate the possible association between these two risk factors amongst healthy adults 30-60 years old in Tehran, Iran.

**Methods:** Overall, 2602 healthy adults 30 to 60 years old in Tehran were studied. The demographic characteristics, anthropometric and smoking status of the participants were questioned. The frequency of consumption of red meat, white meat, fruits and vegetables, dairy products, bread and cereals and fast food were questioned to be daily, weekly, monthly, once every 6 months or yearly and categorized as “healthy” or “unhealthy”.

**Results:** Of the 2602 participants, 974 (37.4%) had smoked more than 100 cigarettes in their life time and continued daily or smoked occasionally. Smokers significantly consumed more fast food and white meat but less fruit and vegetables and dairy product ( $P < 0.0001$ ). Totally, 586 (22.5%) consumed “unhealthy” diet. A positive association between cigarette smoking and unhealthy diet (OR=1.68; 95% CI: 1.40-2.03) were found. After adjusting the analysis for the effect of age, education and gender, the odds ratio of consuming unhealthy diet for the smoker increased to 1.83 (1.50, 2.25) compared with non-smoker.

**Conclusion:** Our study found a noticeable association between cigarette smoking and unhealthy diet. Smoking cessation and changing diet program for smokers is recommended.

**Keywords:** Smoking, Diet, Health, Adult

### Introduction

Causing more than 36 million deaths annually (nearly 63% of global deaths), non-communicable diseases (NCDs) are known to be obvious dangers to mankind and at this time are the main cause of mortality in the world. About 85% of these deaths are related to four main types of NCDs: cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asth-

ma), and diabetes. Nearly 80% (29 million) of these diseases now occur in low- and middle-income countries (1-3). Four lifestyle-related risk factors are believed to be the main underlying causes of NCDs, including tobacco use, unhealthy diet, insufficient physical activity and alcohol overuse. These risk factors mostly affect the low- and middle-income countries and generally the low-income population. (2-5).

Smoking is still a universal leading cause of preventable morbidity and premature mortality, especially in developing countries. There were an estimated 6 million deaths in the world attributable to smoking each year (5.1 million from direct tobacco smoking and 600 000 from exposure to second-hand smoke) (5-7). By the year 2020, smoking and oral tobacco use will increase to 7.5 million, accounting for 10% of all deaths. In 2008, the leading causes of death due to smoking were cardiovascular diseases with 1.69 million deaths, COPD with 0.97 million deaths, and lung cancer with 0.85 million deaths (4, 7).

Unhealthy diet causes adverse effects on tissue/body form and function and clinical outcomes. This affects physical and psychological function and impairs patient's recovery from disease and injury, thereby increases morbidity and mortality. Approximately 16 million (1.0%) DALYs and 1.7 million (2.8%) of deaths worldwide are attributable to low fruit and vegetable consumption. Adequate consumption of fruit and vegetables reduces the risk for cardiovascular diseases, stomach cancer and colorectal cancer (8-10). There is convincing evidence that the consumption of fatty foods, such as fast foods cause obesity and increase the risk of coronary heart disease (11). Smoking cigarette and unhealthy diet are two important and preventable risk factors for NCDs. Several studies have shown that smoking is associated with dietary habits that may lead to higher risk for chronic disease in smokers compared with non-smokers (12-19).

The purpose of this study was to investigate and qualify the possible association between these two risk factors in healthy adults 30-60 years old in Tehran, Iran. The association of smoking and dietary habits has not been quantified in any study yet.

## Materials and Methods

### *Study design*

The data for this study is a part of the Prevalence of Non-communicable Diseases Risk factors (PNDR) project in Tehran, Iran. The PNDR study was conducted by Research Center for Tobacco Prevention and Control and National Re-

search Institute of Tuberculosis and Lung Diseases (NRITLD) in 2010 by general support of Shahid Beheshti University of Medical Sciences, Tehran, Iran. This study focused on smoking habits, physical activity and dietary intake as three major risk factors for non-communicable diseases among healthy adults 30 to 60 years old. Survey data was collected by trained physicians by clinical examination and obtaining medical history.

### *Study participants*

On the basis of information obtained from a pilot study of 100 individuals, a total sample of about 2600 was considered sufficient to achieve all the objectives of the PNDR project in Tehran. The validity and reliability of the study questionnaire which was seized from WHO questionnaires was proven in an expert panel and a pilot study. Briefly, in this study to investigate the relationship between nutrition, daily activity and cigarette smoking 1300 individuals was enough to study a correlation of at least 10% at a confidence level of 95% with a power of 95%. As the sampling scheme in different city regions had a form of cluster sampling a design effect of 2 was applied and therefore the required sample increased to 2600. A sample proportionate to the number of inhabitants was selected in every 22 city regions of Tehran, according to the 2006 census. From map of each 22 regions of Tehran a hypothetical point was randomly selected and by referring to that address and moving to the right and up households the individuals were questioned. The subjects were enrolled to the study if they were healthy, had 30 to 60 years old, had job and normal activity. The definition of a "healthy person" is someone who was disease free one month before the study and was in a normal condition at the time visited as examined by the physician. Individuals who had a disease background and took medicine in the previous month were excluded from the study.

### *Measures*

The participants were all anthropometrically and socioeconomically assessed by trained physicians using a structured questionnaire. Heights and weights were measured using standardized equip-

ment and procedures. Body mass index (BMI) was computed by dividing weight in kilograms by the square of height in meters. To assess socioeconomic status, subjects were classified according to their occupation, education and family size.

Cigarette smoking status was classified into daily smokers and non-smokers by answering the questions: "Have you ever smoked cigarettes? If yes, from what age?" "Have you ever smoked 100 cigarettes?" "What is your current smoking status?" "How much do you smoke daily?". So, the term "smoker" referred to a person who has smoked at least 100 cigarettes so far and will continue in any pattern. EX-smokers were excluded.

Healthy and unhealthy diet

Initially, the frequency of consumption of red meat, white meat, fruits and vegetables, dairy products, bread and cereals and fast food were questioned to be daily, weekly, monthly, once every 6 months or yearly. In order to categorize the diet as "healthy" or "unhealthy", first we scored daily, weekly, monthly, once every 6 months or yearly consumption as 1 to 5 for red meat, white meat, fruits and vegetables, dairy products, and bread and cereals, but from 5 to 1 for the fast food. Then, we added these scores for each participant which ranged from 6 to 23. With this way of scoring, the higher scores could generally show less frequent use of meats, fruits and vegetables, dairy products, bread and cereals or more frequent consumption of fast foods. We computed the 75th percentile of these scores and categorized it and higher scores as the "unhealthy" diet. This enabled us to summarize the quality of diet in two categories to be able to study its association with cigarette smoking.

### **Statistical Analysis**

The demographic characteristics of the study sample are given according to smoking status. The association between demographic characteristics and smoking were examined using Chi-squared test. A T-Student test was applied to examine significant differences of weight, height and BMI in smoker and non-smokers. Logistic regression was performed to evaluate the influence of smoking on diet. The OR and the corresponding 95% con-

fidence intervals are given. To eliminate the effect of confounding factors, the logistic regression analysis was adjusted. The statistically significant criterion was set at ( $P < 0.05$ ). Data was entered and analyzed using SPSS (17.0) and STATA (11.0).

## **Results**

From a total of 2602 participants, 974 (37.4%) had smoked more than 100 cigarettes in their life time, continuing daily or smoking occasionally and 1628 (62.6%) had not.

The demographic characteristics of the participants including gender, age, education, employment status, family size and BMI in each smoking group are presented in Table 1. The prevalence of cigarette smoking was significantly more in higher educated and younger participants ( $P < 0.0001$ ). There was no significant difference in smoking status according to gender, employment status, family size and BMI ( $P > 0.05$ ) (Table 1.)

The frequency of consumption of white meat, red meat, fruits and vegetables, dairy products, bread and cereals and fast food according to the smoking status of the participants are presented in Table 2. As can be seen from the table, there were significant differences in frequency of consumption of white meat ( $P = 0.026$ ), fruit and vegetables ( $P < 0.0001$ ), dairy products ( $P < 0.0001$ ) and consumption of fast food between smoker and non-smokers ( $P < 0.0001$ ).

Smokers significantly consumed more fast food and white meat but less fruit and vegetables and dairy products (Table 2).

Of the participants 586 (22.5%) consumed "unhealthy" diet as defined in the Methods section. The association between having "healthy" or "unhealthy" diet and the gender, age, education, employment status, family size and BMI were investigated, and only with gender was found to be significant ( $P = 0.001$ ). Females were found to consume more unhealthy diet (25.5% vs. 20.1%); data not shown). The results of the logistic regression analysis showed a positive association between cigarette smoking and unhealthy diet (OR=1.68; 95% CI: 1.40-2.03;  $P < 0.0001$ ), Table 3).

**Table 1:** Demographic characteristics of participants according to smoking status (N=2602)

Characteristics	Smoker n (%)	Nonsmoker n(%)	OR (95% CI)	P-value
<b>Gender</b>				
Female	429 (37.0)	732 (63.0)	Referent	
Male	545 (37.8)	896 (62.2)	0.96 (0.82-1.13)	0.648 <sup>a</sup>
<b>Age</b>				
30-40 years	487 (51.4)	460 (48.6)	Referent	
41-50 years	322 (39.6)	491 (60.4)	0.62 (0.51-0.78)	<0.0001 <sup>b</sup>
51-60 years	165 (19.6)	677 (80.4)	0.23 (0.19-0.28)	
<b>Education</b>				
Diploma or less	520 (27.4)	1379 (72.6)	Referent	
Higher education	454 (64.6)	249 (35.4)	4.84 (4.02-5.81)	<0.0001 <sup>a</sup>
<b>Employment Status</b>				
Employed	558 (36.8)	958 (63.2)	Referent	
Unemployed	416 (38.3)	670 (61.7)	1.07 (0.91-1.25)	0.436 <sup>a</sup>
<b>Family size</b>				
≤4	831 (36.9)	1422 (63.1)	Referent	
>4	143 (41.0)	206 (59.0)	1.19 (0.94-1.49)	0.142 <sup>a</sup>
<b>BMI (kg/m<sup>2</sup>)</b>				
<20	3 (30.0)	7 (70.0)	Referent	
20-24.9	816 (37.5)	1358 (62.5)	1.40 (0.36-5.44)	
25-29.9	451 (43.7)	58 (56.3)	1.81 (0.44-7.40)	0.424 <sup>b</sup>
≥30	110 (34.9)	205 (62.1)	1.25 (0.32-4.94)	
<b>Total</b>	974 (37.4)	1628 (62.6)		

a Chi squared test/ b Kruskal-Wallis rank test

**Table 2:** Frequency of consumption of white meat, red meat, bread, fruit, dairy and fast food according to cigarette smoking (N=2602)

Cigarette smoking	Type of food	Daily	Weekly	Monthly	Every 6 months	Yearly	P value*
White meat							
No		159 (9.8)	1180 (72.5)	182 (11.2)	49 (3.0)	58 (3.5)	<b>0.026</b>
Yes		111 (11.4)	722 (74.1)	76 (7.8)	28 (2.9)	37 (3.8)	
Red meat							
No		173 (10.6)	1241 (76.2)	196 (12.1)	18 (1.1)	0 (0)	<b>0.310</b>
Yes		91 (9.4)	748 (76.8)	123 (12.6)	11 (1.1)	1 (0.1)	
Fruit and vegetables							
No		510 (31.3)	958 (58.9)	93 (5.7)	33 (2.0)	34 (2.1)	<b>0.0001</b>
Yes		101 (10.4)	698 (71.7)	97 (10.0)	45 (4.6)	33 (3.4)	
Dairy							
No		207 (12.7)	1180 (72.5)	129 (7.9)	53 (3.3)	59 (3.6)	<b>0.0001</b>
Yes		83 (8.5)	693 (71.2)	131 (13.4)	37 (3.8)	30 (3.1)	
Bread and cereals							
No		170 (10.4)	1234 (75.8)	107 (6.6)	59 (3.6)	58 (3.6)	<b>&gt;0.90</b>
Yes		101 (10.4)	738 (75.8)	73 (7.4)	31 (3.2)	31 (3.2)	
Fast food							
No		132 (8.1)	930 (57.1)	180 (11.1)	224 (13.8)	162 (9.9)	<b>0.0001</b>
Yes		88 (9.0)	729 (74.8)	67 (6.9)	61 (6.3)	29 (3.0)	

\* Mann-Whitney U test

It is also apparent from this table that after adjusting the analysis for the effect of age, education and gender (which were either associated with smoking or diet or both) the odds ratio of con-

suming unhealthy diet for the smoker increased to 1.83 (1.50, 2.25) compared with non-smoker. (Table 3).

**Table 3:** Cigarette smoking status among adults, by diet (N=2602)

	Diet		OR (95% CI)	
	Healthy N (%)	Unhealthy N (%)	Unadjusted	Adjusted*
Smoking status				
Nonsmoker	1318 (65.4)	698 (34.6)	1	1
Smoker	310 (52.9)	276 (42.1)	1.68 (1.40-2.03)	1.83 (1.50-2.25)
Total	1628 (79.6%)	974 (20.4%)		

\*Adjusted for age, sex and education

## Discussion

We found 974 (37.4%) were smoker and 586 (22.5%) consumed “unhealthy” diet. Our study shows that smokers have higher risk of unhealthy diet compared to nonsmokers (OR=1.83; (1.50-2.25)). The analysis showed that smokers consumed more fast food but had lower fruits and vegetables dietary intakes as well as dairy products ( $P<0.05$ ).

The similar patterns of food intake to ours were seen in Prattala and Laaksonen’s study (18). They compared the food habits of Finnish adult smokers, ex-smokers and non-smokers in 1980-1995. Their analysis showed male and female smokers used vegetables and low-fat milk least often. The differences between dietary habits of smoking-based categories persisted after adjusting for socio-demographic factors such as education level, place of residence and marital status.

Smokers had unhealthy nutritional habits, for example in a meta-analysis study, Datlongeville et al. (17) declared that smokers had significantly higher intake of energy, total fat, saturated fats, cholesterol, alcohol and lower intake of fiber, vitamin C, vitamin E, and  $\beta$ -carotene.

There are evidences that smoker consume less fruits, vegetables, cereal and cereal products. For example surveys in Australia (16), England (13), United States (20), Canada (21) and Japan (19) point to these differences between nutritional habits in smokers and non-smokers. It is known that smoking is associated with an increase in oxi-

dative stress (22-24). So having lower intakes of antioxidants such as vitamin C and E, abundant in fruits and vegetables, may aggravate smoking-related risks of cancer and coronary heart disease. This study investigated cigarette smoking behaviors among a sample of Tehran population and its association with the nutrition pattern. This study revealed that the prevalence of cigarette smoking was significantly higher in educated and younger participants.

The findings about the association of smoking with socioeconomically variables are consistent with US National Health Interview Surveys (25). Similar results were also obtained by other studies (26-28). Primarily, the might have been due to the effects of confounding factors; therefore we controlled the possible confounders such as age, education, and gender. Surprisingly after adjusting a stronger association was observed.

In a cross sectional study such as ours, it is not possible to assess the causal relationship between smoking and lower consumption of nutrients that we observed. But the study showed that cigarette smoking and diet were two corresponding factors, affecting each other in a way that creates a vicious cycle. The effects of these two non-communicable risk factors were mentioned in many studies; however, it has not yet been mentioned that these two factors concurrently increase the risk of the related disorders. Evaluation of this status among healthy people was the cardinal point of this study, because the existence of these factors in people with non-communicable diseases was predictable;

besides, screening these risk factors for early detection and taking appropriate measures to eliminate the disease will be helpful for health care programs.

The findings in this study may be subject to two limitations. First, we did not consider some important variables such as race, income, family background and etc in our research. So, it is possible that these factors may affect the findings. Second, using a cross-sectional design does not allow us to determine the temporal relationship between cigarette smoking and diet. However, the large number of participants could compensate this limitation.

## Conclusion

Our study identifies a noticeable association between cigarette smoking and unhealthy diet in healthy adults of Tehran population. So we recommend smoking cessation and changing diet program for smokers.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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