

Smoking and Physical Activity in Healthy Adults: A Cross-Sectional Study in Tehran

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Received: 26 May 2015

Accepted: 23 August 2015

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INTRODUCTION

Smoking is still a universal leading cause of preventable morbidity and premature mortality, especially in low- and middle-income countries (1-3). It is responsible for about 6 million tobacco-related deaths annually, accounting for 10% of all deaths (4). About half of all life-long smokers will die prematurely, losing on average about 10 years of life. Smoking as a direct cause of cardiovascular, cancer and respiratory diseases (5-7) imposes an immense burden on the health care system (8, 9).

Background: Smoking and physical inactivity are two major risk factors for non-communicable diseases (NCDs). Not only these factors have a causal effect on NCDs, but they can also affect each other. This study aimed to assess the relationship between these factors as well as their effect on NCDs.

Materials and Methods: A total of 2,602 healthy adults aged 30-60 years participated in this survey in 2010. Data on demographic characteristics, medical history, smoking status, physical activity and anthropometric measures including weight and height were collected and analyzed. The effect of smoking on physical activity was evaluated by logistic regression adjusting for potential confounders.

Results: Among demographic characteristics, only age ($P<0.001$) and educational level ($P<0.001$) had a significant association with smoking status. Compared with nonsmokers, smokers had an odds ratio of 4.88 (95% CI, 3.34-7.13) for having unsatisfactory physical activity.

Conclusion: The present study showed that cigarette smoking negatively affects the quality of physical activity.

Key words: Harm reduction; Health services; Smoking; Global health; Physical activity

On the other hand, research has shown a significant negative dose-response relationship between physical activity and risk of coronary heart disease (10). A cohort study on US female nurses found that physical activity, including moderate-intensity exercise such as walking, is associated with substantial reduction in risk of stroke (11). In addition, it seems that physical activity helps to protect against depression (12). In addition, several recent epidemiologic studies have shown that smoking can affect some behavioral risk factors for chronic diseases such as

physical activity and diet (13, 14). In a recent review, more than half of studies showed an inverse association between cigarette use and physical activity in adults (15).

Although the exclusive and simultaneous effects of cigarette smoking and physical activity on non-communicable diseases have been evaluated in various studies (16, 17), only a few have assessed the association between these risk factors (18-20).

Thus, in this study we aimed to investigate the relationship between smoking and level of physical activity, two major risk factors for non-communicable diseases, amongst healthy adults aged 30 to 60 years in Tehran, Iran.

MATERIALS AND METHODS

Study design

The current study is part of a larger study on the Prevalence of Non-communicable Diseases Risk factors (PNDR) conducted by the Research Center for Tobacco Prevention and Control and National Research Institute of Tuberculosis and Lung Diseases (NRITLD) in 2010. The Shahid Beheshti University of Medical Sciences supported this project. Approved by the Research Ethics Committee, the PNDR study was designed to focus on three major risk factors for non-communicable diseases including smoking habits, physical inactivity and dietary intake in healthy adults aged 30 to 60 years. A structured questionnaire was used to peruse these elements whose validity and reliability were proven in our previous study by an expert panel and through a pilot study (21). Trained physicians filled out the questionnaires by collecting survey data via clinical examination and taking medical history of the subjects. In this study, the term "smoker" was referred to a person who had smoked at least 100 cigarettes so far and would continue in any way. EX-smokers were not enrolled. The definition of a "healthy person" was someone who did not mention the history of any diseases in the month prior to the study and was in a normal condition at the time examined by the physician.

Study sample

In order to determine the sample size, we performed a pilot study including 100 healthy adults aged 30 to 60 years. A total sample of approximately 2,600 subjects was considered sufficient to achieve the objectives of the study. According to Tehran population in 2006, a sample, proportional to population in all 22 different districts of Tehran was randomly selected using cluster sampling scheme. Healthy subjects aged 30 to 60 years who were willing to participate in the study were included. Prior to enrollment, informed consent was obtained from each subject.

Demographics and anthropometric data

Socioeconomic status and anthropometric measures for each subject were assessed by trained physicians using a structured questionnaire. To assess socioeconomic status, subjects were categorized by their response to the questions regarding their occupation, education and family size.

Heights and weights were measured using standardized equipment and procedures. Weight was measured with patients wearing light clothes with barefoot, using a HealthOMeter digital scale with an accuracy of 500 grams. Height was measured via a HealthOMeter digital height rod with the subject standing upright against the wall, with straight knees and the back of the feet, buttocks, shoulders and head touching the wall with an accuracy of 1 centimeter (22). Body mass index (BMI) was computed by dividing weight in kilograms by the square of height in meters [i.e. weight (kg)/ height (m²)].

Behaviors

As stated, the term "smoker" referred to a person who had smoked at least 100 cigarettes so far and was going to continue on a daily basis or occasionally.

Physical activity was assessed by asking the subjects about the amount of time spent in each position during a day, including sleeping, lying down, sitting, standing, walking and running. The percentage of each activity was computed by dividing the corresponding spent time by 24

hours. The mentioned positions were categorized into two groups of "active" and "inactive". Sleeping, lying down and sitting were designated as "inactive" and standing, walking and running were put into "active" group. The corresponding percentage scores were summed for active and inactive positions. Then, each of the active and inactive positions was divided into two different categories: "less than or equal to mean" and "more than mean" of the computed sum of percentages. This classification has been previously used in some other studies as well (23-25). Finally, the physical activity was classified into two categories of "appropriate" and "inappropriate" according to the mentioned classification.

For each participant, the physical activity was classified as "appropriate" if the active position was higher than the mean and the inactive position was lower than the mean. The combination of other categories was classified as "inappropriate" (Figure 1).

		Active position	
		>mean	≤mean
Inactive position	>mean	Inappropriate	Inappropriate
	≤mean	Appropriate	Inappropriate

Figure 1. Appropriateness of physical activity according to active and inactive positions

Statistical analysis

Data were entered into SPSS (17.0) and analyzed using STATA (11.0). The demographic characteristics of the study sample are presented according to their smoking status. Regarding the large sample size of this study, data were considered as being normally distributed. The association between demographic characteristics and smoking was examined via Chi-square test. Student's t-test was applied to examine significant differences of weight,

height and BMI between smokers and non-smokers. Logistic regression was performed to evaluate the effect of smoking on appropriateness of physical activity. The OR and the corresponding 95% confidence intervals are given. Multiple logistic regression analysis was used to eliminate the effect of confounding factors. The statistically significant criterion was set at $P \leq 0.05$.

RESULTS

Sample characteristics

In total, 1,441 respondents (55.4%) were males and 1,161 (44.6%) were females. The mean age was 44.7 (± 9.1) years, and the age range was 30 to 60 years. As the majority of the participants, 947 subjects (36.4%) were 30 to 40 years old, 1,421 (54.6%) had high school diploma and 1,516 (58.3%) were employed. The mean (\pm SD) weight, height and BMI values of subjects were 68.7 (± 11.2) kg, 165.2 (± 8.1) cm and 25.1 (± 3.4) kg/m², respectively as illustrated in Table 1.

Characteristics of adults who smoked cigarettes

As shown in Table 1, 974 individuals (37.4%) were considered as smokers according to the afore-mentioned definition. These subjects reported smoking an average of 9.7 (± 7.6) cigarettes per day. Prevalence of cigarette smoking was not significantly different between males and females ($P = 0.648$). The percentage of smokers significantly decreased by age but increased by the level of education ($P < 0.001$). No significant differences were found in prevalence of smoking regarding the subjects' occupation, BMI or family size ($P \geq 0.142$; Table 1).

Status of being in various positions

In order to assess the daily activity of the participants, they were asked about the hours they spent in each position per day. The mean figures were found to be 9.0 hours for sleeping, 1.7 for lying down, 6.3 for sitting, 2.8 for standing, 3.2 for walking and 1.1 hours for running. The recorded figures were divided by 24 to calculate the percentage of a day each subject spent in a specific position. The calculated percentages for different activities are presented in Table 2. In general, Table 2 is more

weighted in the right upper side (i.e. sleeping) and the left lower side (i.e. running) as expected for a healthy individual in this age range. The mean (\pm SD) percentage of hours/day spent in sleeping, lying down, sitting, standing, walking and running positions was 37.4 (\pm 9.4), 7.0 (\pm 5.8), 26.1 (\pm 11.3), 11.7 (\pm 8.6), 13.2 (\pm 6.7) and 4.7 (\pm 5.1), respectively. As shown in Table 2, the participants spent most of their time sleeping and sitting which were considered inactive positions.

The mean hours spent in active and inactive positions was found to be 7 and 17 hours, respectively. The mean (\pm SD) percentage of hours/day spent in inactive positions was 70.8% (\pm 13.9) while it was 29.2% (\pm 13.9) for active

positions. We classified a person as having appropriate physical activity if sum of their inactive positions' scores (percentage) was less than the mean and their active positions' score was more than the computed mean (as explained in the methods section and shown in Figure 1). We found that 1,437 (55.2%) participants had appropriate and 1,165 (44.8%) had inappropriate physical activity (Table 3).

Inappropriate physical activity was found to be significantly ($P \leq 0.001$) associated with the female gender (57.4% vs. 34.6%), younger ages (30-40 years of age; 74.0% vs. 28.0%), unemployment (48.5% vs. 42.1%) and university education (95.7% vs. 25.9%; data not shown).

Table 1. Demographic characteristics of participants according to smoking status (N=2,602)

Characteristics		Smoker N(%)	Nonsmoker N(%)	Total N(%)	
Gender	Male	545 (37.8%)	896 (62.2%)	1441 (55.4%)	0.648
	Female	429 (37.0%)	732 (63.0%)	1161 (44.6%)	
Age	30-40 years	487 (51.4%)	460 (48.6%)	947 (36.4%)	<0.001
	41-50 years	322 (39.6%)	491 (60.4%)	813 (31.2%)	
	51-60 years	165 (19.6%)	677 (80.4%)	842 (32.4%)	
Education	School education	0 (0.0%)	478 (100.0%)	478 (18.4%)	<0.001
	High school diploma	520 (36.6%)	901 (63.4%)	1421 (54.6%)	
	Higher education	454 (64.6%)	249 (35.4%)	703 (27.0%)	
Employment Status	Employed	558 (36.8%)	958 (63.2%)	1516 (58.3%)	0.436
	Unemployed	416 (38.3%)	670 (61.7%)	1086 (41.7%)	
Family size >4		143 (41.0%)	206 (59.0%)	349 (13.4%)	0.142
Total		974 (37.4%)	1628 (62.6%)	2602 (100%)	
		Mean (\pmSD)			
Weight (kg)		68.7 (\pm 11.0)	68.7 (\pm 11.3)	68.7 (\pm 11.2)	0.902
Height (cm)		165.2 (\pm 8.3)	165.1 (\pm 7.9)	165.2 (\pm 8.1)	0.738
BMI (kg/m ²)		25.1 (\pm 3.4)	25.1 (\pm 3.5)	25.1 (\pm 3.4)	0.735

Table 2. Distribution of physical activities of participants per day; 2010 (N=2602)

Activity		Percentage of a day spent for each activity												
		0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%
Sleeping	N	-	-	-	1	156	236	439	462	675	199	197	237	-
	%	-	-	-	0.04	6	9.07	16.87	17.76	25.94	7.65	7.25	9.11	-
Lying	N	467	1211	513	325	12	47	17	10	-	-	-	-	-
	%	17.95	46.54	19.72	12.49	0.46	1.81	0.65	0.38	-	-	-	-	-
Sitting	N	-	-	227	547	504	323	100	31	844	8	9	-	9
	%	-	-	8.72	21.02	19.37	12.41	3.84	1.19	32.44	0.31	0.35	-	0.35
Standing	N	448	445	525	657	271	20	236	-	-	-	-	-	-
	%	17.22	17.10	20.18	25.25	10.42	0.77	9.07	-	-	-	-	-	-
Walking	N	-	698	614	492	515	283	-	-	-	-	-	-	-
	%	-	26.83	23.60	18.91	19.79	10.88	-	-	-	-	-	-	-
Running	N	1028	1117	70	383	4	-	-	-	-	-	-	-	-
	%	39.51	42.93	2.69	14.72	0.15	-	-	-	-	-	-	-	-

Table 3. Cigarette smoking status among adults, by appropriateness of activity

Smoking status	Activity		OR (95% CI)	
	Appropriate N (%)	Inappropriate N (%)	Unadjusted	Adjusted*
Nonsmoker	1156 (71.0%)	472 (29.0%)	1	1
Smoker	281 (28.9%)	693 (71.1%)	6.04 (5.06-7.20)	4.88 (3.34-7.13)

*Adjusted for age, sex, employment status, education and BMI

Smoking and physical activity

The effect of cigarette smoking on appropriateness of daily activity was investigated using logistic regression analysis and adjusting the results for the effect of confounders.

As illustrated in Table 3, 693 smoker subjects (71.1%) and 472 (29%) nonsmokers were classified as having inappropriate daily activity. The odds ratio of having inappropriate daily activity for smokers was 4.9 (3.4-7.2) in comparison with nonsmokers, after adjusting for the effect of variables significantly associated either with smoking and/or appropriateness of daily activities including gender, age, occupation, education and BMI.

DISCUSSION

This study showed that cigarette smoking had a close relationship with physical inactivity and smokers tended to exercise less, compared to non-smokers. The exclusive effects of these two non-communicable risk factors have been mentioned in many studies (6, 7, 11, 12); however, only a few have simultaneously evaluated both (18-20). For example, Azagba and Sharaf demonstrated that physical inactivity was associated with smoking in old adults (OR=1.52)(20). Audrain-McGovern also showed that physical activity reduced the likelihood of smoking by adolescents (19). Evaluation of these risk factors among healthy people was the cardinal point of this study since people with non-communicable diseases are expected to be affected by them. Moreover, detecting these risk factors before the presentation of disease in healthy population and taking preventive measures to eliminate them are of great importance in health care programs (26, 27).

Our study assessed cigarette smoking behavior among a diverse sample of Tehran population and the association

of cigarette smoking with a range of physical activities. Cigarette smoking rate in our sample population was not similar to the reports from Tehran population in 2009 (37.4% vs. 28.05%) and was found to be considerably higher (28). The reason might be the fact that we only included healthy adults aged 30-60 years, an age group that has been reported to comprise the majority of Iranian smoker population (29). This might have led to a higher smoking prevalence in our sample population.

In the current study, smoking was not associated with gender, employment status or weight, based on BMI. The findings on relationship of smoking, age and education are consistent with those of the US National Health Interview Surveys (30). We found an association between smoking and educational level in our study, which is in contrary to the results of other studies. In our study, the relationship observed between smoking and educational level was direct while other surveys reported an inverse association (30, 31). Moreover, no relationship with weight was found in our study while other surveys reported higher rates of smoking among overweight subjects (31).

In the current study, we found inappropriate positions or physical activity to be more common among smokers. Some studies prior to ours reported weak or no significant relationship between physical activity and smoking (32). In line with previous studies, there is evidence that smokers spend significantly less time on sports, leisure and aerobic activities compared to nonsmokers (14). A large cross-sectional survey in Germany indicates that smokers with a high degree of nicotine dependence are engaged in lower levels of physical activity (33). Young adult smokers valued pursuing regular exercise as a strategy for reducing the risk of developing tobacco-related diseases (34).

Another study classified female gender, lower educational level and smoking as variables associated with insufficient levels of physical activity in leisure settings while female gender, higher educational level and not smoking were associated with insufficient levels of physical activity in occupational settings (35).

One of the strengths of this study was the large and diverse sample of adults, which allowed us to assess the effect of modification by demographic status (i.e. gender, age, BMI, educational level and occupational status). Other positive aspects included the range of physical activity evaluated within this sample and creating a new method for assessing the relationship between smoking and physical activity.

The findings of this study are subject to at least two limitations. First, we did not include some important variables such as race, income, family history, underlying diseases, etc. in our research. Thus, it is also possible that these factors affect the trends described in this report. Second, using a cross-sectional design did not allow us to determine the temporal relationship between cigarette smoking and physical activity. We hope that large number of participants could compensate for this limitation to some extent.

In conclusion, our study identifies a strong, negative and independent relationship between cigarette smoking and physical activity in a representative sample of Tehran population. We also found a strong association between cigarette smoking and some demographic characteristics.

Because of the strong association between smoking and several well-established risk factors for morbidity and mortality, confronting the smoking epidemic is an urgent priority (36). Our findings suggest that encouraging people to spend most of their time in appropriate positions and promoting exercise may be an important mechanism by which we can prevent smoking habits among Tehran population.

Acknowledgements

The authors gratefully acknowledge Tobacco Prevention and Control Research Center and National

Research Institute of Tuberculosis and Lung Diseases (NRITLD) for collecting the data. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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