

# Prevalence of smoking and its association with health-related behaviours among Iranian university students: a large-scale study

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## Abstract

**Background:** The prevalence of smoking and contributing factors among Iranian university students has been paid little attention.

**Aims:** The aim of this study was to assess the prevalence of smoking in Iranian university students and its association with health-related behaviours.

**Methods:** This cross-sectional study was carried out on a sample of 82 806 Iranian university students admitted in 2012–2013. Information on demographic characteristics and health-related behaviours, including physical activity, sleep pattern, use of electronic devices and dietary habits, were collected using a standardized questionnaire. Weight and height were measured using a standard protocol and body mass index calculated. Smokers were defined as students who smoked  $\geq 1$  cigarette per week.

**Results:** Smoking was prevalent among 6.0% of university students (males 6.6%, females 5.6%). Moderate physical activity was inversely associated with odds of smoking. A significant positive association was also found between obesity and odds of being a smoker. Higher intake of fruits and dairy products were associated with lower odds of smoking. However, intake of vegetables, fast foods and carbonated beverages was positively associated with smoking. Breakfast consumption was also associated with greater odds of being a smoker.

**Conclusions:** Demographic characteristics and health-related behaviours, including marital status, occupation, economic status, sleep pattern, physical activity, use of electronic devices and dietary intake, were significantly associated with smoking.

Keywords: smoking prevalence, health-related behaviours, university students, Iran

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## Introduction

Smoking is a known risk factor for noncommunicable diseases, including cardiovascular disease (CVD), asthma, COPD, stroke, and cancers (1,2). It imposes a great burden to the health care system and society and is associated with early mortality (3,4). Tobacco is responsible for the 6 million deaths annually worldwide, most in low-income and developing countries (5). Based on the 2010 World Health Organization (WHO) report, the prevalence of current smoking was 7.7% in the United States of America and 11.8% in the Islamic Republic of Iran, which is considered to be high (6).

Many factors, including health-related behaviours, culture, belief, health literacy, and life problems, are involved in encouraging people to smoke (7–9), but health-related behaviours seem to be important. Various studies have investigated lifestyle, dietary habits, and

physical activity are related to smoking (10–12). However, findings are conflicting and limited to western countries. Furthermore, earlier studies have mainly focused on children and adolescents as well as older adults. Hence, youth or university students have been paid less attention. Smoking at a young age might be associated with increased risk of noncommunicable diseases and early death in adulthood (13,14). However, according to WHO predictions, the trend of current tobacco smoking among Iranian adults will be decreased by 2025 (6), so, taking into account the prevalence of smoking at a young age may be essential.

Several studies have shown that stress and psychological distress are the main risk factors for initiation of smoking (15,16). Until now, no study with a large sample size has assessed the relationship between health-related behaviours and smoking among university students in the Middle East countries.

## Methods

### Design

This cross-sectional study was performed within the framework of the Mental and Physical Health Assessment of University Students (MEPHASOUS) project, which was designed by the Counselling and Health Organization of the Ministry of Science and Technology in Tehran in 2012–2013. The purpose of this study was to assess the present health and behavioural issues of Iranian university students. Detailed information about the MEPHASOUS study has been published elsewhere (17).

### Participants

The current study was conducted university students who were newly admitted to governmental universities from 28 provinces in the Islamic Republic of Iran in the academic year 2012–2013. All students were aged  $\geq 18$  years. To gather data, all 151 671 students were invited to the health units of universities using announcements or posters. Data on demographic characteristics, anthropometric measures, medical history, and dietary habits were collected from each student. From those who had been invited, 84 332 agreed to participate in the project and we had complete data for 82 806 students for the final analysis. All participants provided signed informed written consent. The whole project had ethical approval from the Ministry of Science and Technology.

### Questionnaire

A pre-tested questionnaire was used to gather data on demographic characteristics and health-related behaviours (17). The first part of the questionnaire covered demographic characteristics, education, occupation and smoking. To assess economic status, we considered students who had health insurance as “good” economically and those who did not have any type of health insurance as “weak”. From previous research, prevalence of smoking and addiction differs among the Iranian provinces (18). To reflect this difference, we categorized students based on the areas where they were living; high-risk, moderate-risk and low-risk areas, determined according to the prevalence of smoking in each area (18). For example, we considered Isfahan and Yazd, where the prevalence of smoking is low, as low-risk areas.

Another part of the questionnaire was about sleep pattern, with 2 questions: “How is your pattern of sleeping and waking?” and “How many hours do you sleep in a day?” To assess physical activity, we asked: “How often do you exercise for  $\geq 30$  minutes?” Students who answered “rarely” were considered physically inactive. Use of electronic devices was assessed by the question: “In a day, how many hours do you use electronic devices such as computer, cell phone, and notebook?”

### Definition of smoker

Based on smoking status, we had 4 groups of students: non-smokers, those who smoked cigarettes rarely, those who smoked  $< 10$  cigarettes per week and those who

smoked  $\geq 10$  cigarettes per week. Smokers were defined as individuals who smoked one cigarette per week (19).

### Dietary habits

Another part of the questionnaire evaluated dietary intake of certain food groups as well as breakfast eating patterns. The questions were about frequency of consumption of fruits, vegetables, dairy products, fast foods and carbonated beverages. In Iranian culture, fruits are consumed more frequently than the other groups. Therefore, the frequency response categories for fruit consumption were daily compared with vegetables, dairy, fast foods and carbonated beverages which had weekly response categories. Breakfast consumption was assessed by the question: “How many days do you eat breakfast”. Those who consumed breakfast less than 1 day/week were considered breakfast skippers.

### Anthropometric measures

Weight was measured with minimal clothing and without shoes using an analogue scale with a precision of 100 g (20). Height was determined in a standing position without shoes using a tape measure to the nearest 0.5 cm (21,22). Body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in metres. Students were classified into 4 BMI categories according to WHO criteria (23):  $< 18.5$  kg/m<sup>2</sup> (underweight), 18.5–24.9 kg/m<sup>2</sup> (normal), 25.0–29.9 kg/m<sup>2</sup> (overweight) and  $\geq 30.0$  kg/m<sup>2</sup> (obese).

### Statistical analysis

The independent sample *t*-test was used for assessing the continuous variables, including age and BMI, among smokers and non-smokers. In addition, the chi-squared test was applied to assess the distribution of categorical variables among smokers and non-smokers. Binary logistic regression in crude and adjusted models was used to obtain odds ratios (ORs) and related 95% confidence intervals (CIs) for smoking across categories of demographic characteristics and dietary habits. In the first model, age (continuous) and sex (male/female) were controlled. In the second model, additional adjustment was made for all variables except age group and sleep duration. Due to the adjustment for sleep pattern, we did not include sleep duration in the adjusted models. In addition, BMI was included in the second model as a categorical variable.

All statistical analyses were performed using SPSS, version 19.0; *P*-values were considered significant at  $< 0.05$ .

## Results

Demographic characteristics and dietary habits of smokers and non-smokers are presented in Table 1. Compared to the non-smoker students, smokers were more likely to be older, male, married, graduates, physically inactive, breakfast skippers, having an occupation and using electronic devices. Smokers were less likely to live in a dormitory or in high-risk areas, have a regular sleep pattern

**Table 1 Demographic characteristics and dietary habits of smoker and non-smoker Iranian students (n = 82 806), 2012–2013**

Characteristic	Non-smokers		Smokers <sup>a</sup>		P-value
	Mean	SD	Mean	SD	
Age (years)	21.4	4.0	21.8±	4.1	< 0.001
Body mass index (kg/m <sup>2</sup> )	22.5	4.03	22.6±	3.9	0.01
	No.	%	No.	%	
Age (years)					< 0.001
< 20	38 413	49.4	2 247	45.0	
20–< 25	25 095	32.2	1 714	34.3	
25–< 30	10 396	13.4	754	15.1	
≥ 30	3 910	5.0	277	5.5	
Sex					
(female)	42 613	54.8	2 507	50.2	< 0.001
Marital status (married)	7 700	9.9	608	12.2	< 0.001
Residence					
(dormitory)	43 067	56.1	2 281	46.0	< 0.001
Living in a high-risk area <sup>b</sup>	9 893	12.7	128	2.6	< 0.001
Education (graduate) <sup>c</sup>	29 709	38.4	2 239	44.9	< 0.001
Having occupation	6 027	9.4	879	19.0	< 0.001
Economic status (good)	63 483	84.6	2 776	56.3	< 0.001
Physical activity (inactive) <sup>d</sup>	12 170	15.7	1 080	21.8	< 0.001
Sleep pattern (regular)	45 772	59.3	2 956	61.7	0.001
Sleep duration (6–8 hours/day)	54 370	58.4	2 389	48.0	< 0.001
Electronic device use (rarely) <sup>e</sup>	4 561	5.9	605	12.1	< 0.001
Breakfast skipping <sup>f</sup>	3 565	4.6	452	9.1	< 0.001
Dietary intake					
Fruits (> 3 servings/day)	7 847	10.1	525	10.6	< 0.001
Vegetables (1 servings/day)	10 558	13.6	769	15.5	< 0.001
Dairy products (1 servings/day)	19 448	25.0	461	9.3	< 0.001
Fast foods (daily)	755	1.0	192	3.9	< 0.001
Carbonated beverages (daily)	4 528	5.9	608	12.4	< 0.001

SD = standard deviation.

P-value obtained from independent sample t-test or Chi-squared, where appropriate.

<sup>a</sup>Smokers were defined as students who smoked at least one cigarette per week.

<sup>b</sup>Areas in which prevalence of smoking is high.

<sup>c</sup>Students who were in MSc and PhD courses were considered graduate students.

<sup>d</sup>Those who exercised rarely during a week.

<sup>e</sup>Use of computer, cell phone and notebook.

<sup>f</sup>Students who consumed breakfast less than 1 day/week were defined as breakfast skippers.

(such as 6–8 hours/day) or good economic status compared with non-smokers.

In terms of dietary habits, smokers among the students were less likely to consume fruits, vegetables and dairy products, and more likely to consume fast foods and carbonated beverages compared with non-smokers.

Multivariate adjusted ORs for being a smoker across categories of demographic variables are shown in Table 2. Compared with single students, those who were married were more likely to be smokers. This association was significant even after taking potential confounders into account (OR = 1.22, 95% CI: 1.07–1.38). Divorced students had greater odds of smoking than those who were single. However, this association was non-significant in the fully adjusted model. A significant positive association was also found between education and smoking (OR

= 1.31, 95% CI: 1.23–1.38). However, in the fully adjusted model, this association was non-significant. Both before and after considering confounders, students with good economic status had lower odds of being smokers compared with those who were economically weak (OR = 0.27, 95% CI: 0.25–0.29). In addition, students who had a job were more likely to be smokers compared with those without a job. This finding was also seen after adjusting for covariates (OR = 2.42, 95% CI: 2.17–2.69). A significant inverse association was found between physical activity and smoking. This was also seen even after considering age and sex as covariates (OR = 0.79, 95% CI: 0.73–0.85), but in the fully adjusted model this association was non-significant. However, students who practised physical activity 1–2 times/week had 32% lower odds for smoking

**Table 2 Binary logistic regression for smoking among Iranian students (*n* = 82 806) based on demographic characteristics, 2012–2013**

Characteristic	Unadjusted	Adjusted	
	OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)
<b>Marital status</b>			
Single	1.00	1.00	1.00
Married	1.26 (1.15–1.37)	1.20 (1.08–1.32)	1.22 (1.07–1.38)
Divorced	2.99 (1.61–5.56)	2.89 (1.55–5.37)	1.92 (0.79–4.66)
<b>Education</b>			
Undergraduate	1.00	1.00	1.00
Graduate	1.31 (1.23–1.38)	1.37 (1.25–1.49)	1.05 (0.94–1.17)
<b>Occupation</b>			
None	1.00	1.00	1.00
Yes	2.26 (2.09–2.44)	2.54 (2.33–2.77)	2.42 (2.17–2.69)
<b>Economic status</b>			
Weak	1.00	1.00	1.00
Good	0.23 (0.22–0.24)	0.23 (0.22–0.25)	0.27 (0.25–0.29)
<b>Physical activity (times/week)</b>			
Rarely	1.00	1.00	1.00
1–2	0.54 (0.50–0.59)	0.54 (0.50–0.59)	0.68 (0.61–0.75)
≥ 3	0.80 (0.74–0.86)	0.79 (0.73–0.85)	1.00 (0.91–1.11)
<b>Sleep pattern</b>			
Irregular	1.00	1.00	1.00
Regular	1.10 (1.04–1.17)	1.09 (1.03–1.16)	1.13 (1.05–1.23)
<b>Sleep duration (hours/day)</b>			
6–8	1.00	1.00	1.00
< 6	2.73 (2.48–3.01)	2.72 (2.47–2.99)	2.18 (1.91–2.48)
8–10	1.24 (1.16–1.32)	1.27 (1.19–1.35)	1.25 (1.16–1.35)
> 10	3.33 (2.89–3.83)	3.43 (2.98–3.95)	2.36 (1.90–2.93)
<b>Electronic devices use (hours/day)</b>			
Rarely	1.00	1.00	1.00
< 2	0.44 (0.39–0.49)	0.41 (0.37–0.46)	0.39 (0.33–0.45)
2–4	0.41 (0.37–0.45)	0.39 (0.35–0.43)	0.43 (0.37–0.49)
> 4	0.49 (0.44–0.54)	0.48 (0.43–0.53)	0.58 (0.50–0.66)
<b>BMI (kg/m<sup>2</sup>)</b>			
< 18.5	0.98 (0.89–1.07)	1.01 (0.92–1.10)	1.11 (1.00–1.24)
18.5–24.9	1.00	1.00	1.00
25.0–29.9	1.09 (1.01–1.18)	1.05 (0.97–1.13)	1.12 (1.02–1.23)
≥ 30.0	1.03 (0.90–1.18)	1.00 (0.87–1.15)	1.23 (1.04–1.46)

OR = odds ratio; CI = confidence interval; BMI = body mass index.

Model 1: age and sex were adjusted.

Model 2: additionally adjustment was made for all variables mentioned in Table 1 except age group and sleep duration.

compared with those who exercised rarely (OR = 0.68, 95% CI: 0.61–0.75).

Students with a regular sleep pattern had slightly greater odds of being a smoker (OR = 1.10, 95% CI: 1.04–1.17) compared with those with irregular sleep pattern. This finding was also observed even after adjusting for potential confounders (OR = 1.13, 95% CI: 1.05–1.23). Furthermore, in both the crude and adjusted models, students who slept < 6 hours/day (OR = 2.18, 95% CI: 1.91–2.48) or > 8 hours/day (OR = 2.36, 95% CI: 1.90–2.93)

were more likely to be smokers compared with those who slept 6–8 hours/day. There was a significant inverse association between use of electronic devices and odds of being a smoker (OR = 0.49, 95% CI: 0.44–0.54). In the fully adjusted model, students who used electronic devices > 4 hours/day were less likely to be smokers (42%) than those who used electronic devices rarely (OR = 0.58, 95% CI: 0.50–0.66).

Those classed as underweight, overweight and obese were more likely to be smokers compared with normal-

weight students, even after controlling for confounders. These 3 groups had 11%, 12% and 23% greater odds of smoking, respectively, compared with those of normal weight (underweight; OR = 1.11, 95% CI: 1.00–1.24, overweight; OR = 1.12, 95% CI: 1.02–1.23, obese; OR = 1.23, 95% CI: 1.04–1.46).

Multivariate-adjusted ORs for being a smoker across categories of dietary habits are shown on Table 3. Compared with those in the lowest category, students in the highest category for fruit consumption were less likely (55%) to be smokers (OR = 0.45, 95% CI: 0.40–0.52). The association was seen both before and after taking potential confounders into account (OR = 0.78, 95% CI: 0.64–0.96). For vegetable intake we found no significant association with smoking. However, in the fully adjusted model, students in the top category for vegetable consumption had greater odds of being smokers compared with those in the bottom category (OR = 1.36,

95% CI: 1.17–1.57). A significant inverse association was observed between consumption of dairy products and being a smoker. Indeed, after adjusting for potential confounders, students in the highest intake category were less likely (95%) to be smokers compared with those in the lowest category (OR = 0.05, 95% CI: 0.04–0.06).

After controlling for all confounders, we found no significant association between fast food intake and smoking. However, students who consumed fast foods 1 time/week had 67% greater odds of being smokers compared with those who consumed these foods rarely (OR = 1.67, 95% CI: 1.27–2.19). In both the crude and the adjusted models consumption of carbonated beverages was positively associated with being a smoker (OR = 1.59, 95% CI: 1.47–1.73). Those who ate breakfast every day had a lower likelihood (49%) of being smokers (OR = 0.51, 95% CI: 0.46–0.56) compared with students who rarely ate breakfast (< 1 day/week). However, in the fully adjusted

**Table 3 Binary logistic regression for smoking among Iranian students (n = 82 806) based on dietary habits, 2012–2013**

Food	Unadjusted OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)
<b>Fruit (servings/day)</b>			
Rarely	1.00	1.00	1.00
≤ 1	0.52 (0.47–0.59)	0.52 (0.47–0.59)	0.80 (0.67–0.95)
2–3	0.34 (0.30–0.38)	0.34 (0.31–0.38)	0.68 (0.57–0.82)
> 3	0.45 (0.40–0.52)	0.47 (0.41–0.54)	0.78 (0.64–0.96)
<b>Vegetables (servings/week)</b>			
Not weekly	1.00	1.00	1.00
1	0.97 (0.89–1.06)	0.98 (0.90–1.07)	1.25 (1.22–1.40)
2–3	0.83 (0.76–0.91)	0.84 (0.77–0.92)	1.21 (1.07–1.36)
1/day	1.07 (0.96–1.19)	1.10 (0.99–1.22)	1.36 (1.17–1.57)
<b>Dairy products (servings/week)</b>			
Not weekly	1.00	1.00	1.00
1	0.32 (0.30–0.35)	0.32 (0.30–0.35)	0.35 (0.31–0.39)
2–3	0.09 (0.08–0.10)	0.09 (0.08–0.10)	0.08 (0.07–0.09)
1/day	0.06 (0.05–0.07)	0.06 (0.05–0.07)	0.05 (0.04–0.06)
<b>Fast foods (times/week)</b>			
Rarely	1.00	1.00	1.00
1	3.93 (3.32–4.65)	4.08 (3.44–4.83)	1.67 (1.27–2.19)
2–3	1.21 (1.11–1.31)	1.26 (1.16–1.37)	1.06 (0.94–1.18)
Every day	0.85 (0.79–0.91)	0.88 (0.82–0.94)	0.93 (0.86–1.02)
<b>Carbonated beverages (times/week)</b>			
Rarely	1.00	1.00	1.00
1–2	2.66 (2.42–2.92)	2.71 (2.46–2.98)	2.33 (2.03–2.67)
Every day	1.45 (1.36–1.54)	1.46 (1.37–1.55)	1.59 (1.47–1.73)
<b>Breakfast consumption (days/week)</b>			
< 1	1.00	1.00	1.00
1–2	0.41 (0.36–0.47)	0.41 (0.36–0.47)	0.69 (0.58–0.83)
3–4	0.44 (0.39–0.50)	0.44 (0.39–0.49)	0.96 (0.81–1.14)
Every day	0.51 (0.46–0.56)	0.51 (0.46–0.56)	1.33 (1.13–1.56)

OR = odds ratio; CI = confidence interval.

Model 1: age and sex were adjusted.

Model 2: additionally adjustment was made for all variables mentioned in Table 1 except age group and sleep duration.

model, this association was positive: students who consumed breakfast every day were 33% more likely to be smokers compared with those who rarely ate breakfast (OR = 1.33, 95% CI: 1.13–1.56).

## Discussion

In this study, the prevalence of smoking among Iranian students was 6.0%, lower than the mean for Iranian adults (11.8%, 2015 report) (6). However, the prevalence of smoking among female students in the current study (5.6%) was higher than the mean prevalence reported for Iranian women (1.3%).

In a 2008–2009 study in the United States of America among 105 012 university students, 16.8% were cigarette smokers (24). In a large survey in different regions of Europe, the prevalence of tobacco product use ranged from 20% to 35% among individuals aged 15+ years (25). Therefore, it seems that the prevalence of smoking among Iranian university students is lower than in western countries. Cultural and religious beliefs might be the reasons for the lower prevalence of smoking among Iranian students compared with western nations. In addition, based on WHO reports, the prevalence of smoking is decreasing among Iranian youth and adults (6). However, finding the risk factors of smoking helps to develop strategies to hasten this reduction.

We found that marriage was positively associated with smoking. Similarly, Pennanen et al. reported that men living with a spouse were more likely to be smokers compared with single men (26). This finding was also seen in a similar study on Iranian adults (27). An increase in living expenses and responsibilities after marriage can enhance psychological stress and encourage individuals to smoke cigarettes to deal with this stress (28,29). However, we adjusted for economic status on the association between marital status and smoking, and we cannot completely exclude it. We found that students who had a job were more likely to be smokers than those who did not. Azagba et al. reported that having a job and the related stress had a positive and statistically significant impact on smoking intensity (30). In contrast, a study in Germany showed that unemployment was a reason for high prevalence of smoking (31). Overall, it seems that having a job, particularly a high-stress job and unemployment increase the odds of cigarette smoking through increased psychological stress (31,32).

We found that moderate physical activity was inversely associated with smoking. In line with this finding, a previous Iranian study reported that cigarette cessation was easier in physically active smokers than inactive individuals (27). This finding was also reported in a study from Malaysia (33). We found no study indicating a positive or non-significant association between physical activity and smoking. It seems that physical activity alleviates the psychological distress that is associated with smoking (34–36). In addition, physical activity fills the leisure time of students that may otherwise be spent smoking. The lack of a significant association for students

who exercise  $\geq 3$  time/week might be explained by the presence of athletes or students who did professional sports in this group. Previous research has shown a high prevalence of cigarette and tobacco smoking among athletes (37).

Students with a regular sleep pattern were more likely to be smokers compared with those with an irregular pattern. In addition, students who slept  $< 6$  or  $> 8$  hours/day had greater odds of smoking compared with those who slept 6–8 hours/day. In a recent cross-sectional study, insomnia was positively associated with smoking in adults (38). In a 2010 Iranian study, sleeping  $< 6$  or  $> 9$  hours/day was associated with an increased risk of cigarette smoking (27). We found no study that reported a regular sleep pattern was positively associated with smoking. Observed associations between sleep pattern and sleep duration with smoking might be mediated by psychological disorders. Students with these disorders may have regular sleep pattern and longer sleep duration because of the nature of the disease or because of the medication (39,40).

We found that using electronic devices was inversely associated with smoking. Contrary to our finding, previous studies have indicated that addictive internet use was positively associated with smoking (41,42). However, the students who participated in our study were not addicted. It is possible that people who use electronic devices more have more information about smoking harms. Greater use of electronic devices is associated with greater health literacy (43), and this is inversely associated with smoking (44).

In the current study, underweight, overweight and obese students had greater odds of smoking compared with normal-weight students. In a recent cross-sectional study, obese young women were 21.2% more likely to be smokers than those of normal weight (45). In a study on medical students in Saudi Arabia, weight and BMI were higher among smokers than non-smokers (46). In contrast, in an earlier study, weight loss was higher in smokers than non-smokers (47). However, findings from 2 recent Iranian studies showed a significant inverse association between smoking and obesity (48,49). These inconsistent results may be due to differences in the quality of the studies and different populations. For example, in one study, none of confounders were adjusted (48), while in our study, a large number of confounding variables were controlled for.

Similar to the findings of previous research (47), we also found a significant positive association between underweight and smoking. Previous studies have shown a high prevalence of psychological disorders such as depression and anxiety among underweight, overweight and obese individuals (50–52). These disorders are risk factors of smoking. It is important to note that the association between obesity and smoking may be bidirectional, meaning that smoking may contribute to obesity and vice versa. Recently, it has been shown that in smokers leptin concentrations are higher than in non-smokers (53). Nicotine in smokers induces peripheral

leptin resistance through lowering gene expression of leptin receptors (54). Leptin is a key hormone that suppresses appetite and prevents obesity (54). Further studies, particularly those of a prospective nature, are needed to shed light facts on the association between obesity and smoking.

In our study, students who ate breakfast every day were more likely to be smokers than breakfast skippers. In line with our findings, a study on adolescents in China reported that breakfast consumption was more common among smokers than non-smokers (55). In contrast, a study in the United States of America showed that prevalence of smoking was significantly higher in individuals who skipped breakfast than in those who ate breakfast (56). These differences in findings in this regard might be due to a different definition of smokers. In addition, different quality studies and the different statistical methods used to assess the associations may offer other explanations for the discrepancies. The exact mechanism for the association between breakfast consumption and smoking is unclear. Further studies are needed to reveal the effects of breakfast consumption on smoking and mechanisms in this regard.

We found that intake of fruits and dairy products was inversely associated with smoking, while intake of vegetables and carbonated beverages and moderate intake of fast foods were positively associated with smoking. In line with these findings, a Korean cross-sectional study showed that adherence to an unhealthy dietary pattern (low amount of fruits and dairy products; rich in fast foods and carbonated beverages) was more common in smokers (57). This was also reported in a cross-sectional study in Tehran (58). Haibach et al. reported that fruit, but not vegetable, consumption among American adolescents was inversely associated with smoking frequency (59). In a cross-sectional study in China among individuals who consumed tea and sweetened beverages daily, the likelihood of smoking behaviours was lower for those who consumed these beverages less frequently (60). In a study in South Korea, consumption of fruits and dairy products was lower among smokers than non-smokers, and smokers consumed fast foods more often than non-smokers (61). Another Korean study also showed that smokers consumed vegetables less frequently than non-smokers (62). Perhaps the positive association between vegetable consumption and smoking we observed might be an attempt to reduce the harmful effects of cigarette smoking. Overall, the inverse association with smoking for fruits and dairy products and the positive association for fast foods and carbonated beverages may be a result

of greater health literacy: students who choose healthy foods and consume a low amount of unhealthy foods es have greater health literacy. Therefore, greater health literacy is associated with lower odds of being a smoker.

In the current study, we found that participants with good economic status were less likely to be smokers compared with those who were weak economically. In line with our findings, a Malaysian study reported a lower prevalence of smoking among rich individuals compared with poor ones (63). This finding was also seen in a study from Indonesia (64). In addition, it should be noted that economic status, as an important confounder, can affect estimates. In addition to the link with smoking, exposure variable including dietary intakes, education, physical activity, sleep pattern and marital status, can be affected by economic status (65–67). Despite the adjustment for economic status, we cannot exclude the effect of this variable completely because we assessed economic status by only considering health insurance. Furthermore, some associations obtained in the current study might be mediated by economic status. For example, intake of fruits and dairy produce is greater in rich individuals, who smoke cigarette less than poor people (65). In addition, the inverse association between physical activity and smoking might be mediated by economic status: physically active individuals may have better economic status, and consequently lower likelihood of being a smoker, than those who were physically inactive (67).

The most important strength of the current study was the large sample size. As far as know, our study was the first in the Middle East to assess smoking and its association with demographic, anthropometric and health-related behaviours in a large sample size of students. However, some limitations should be considered. The main limitation is the cross-sectional design of our study, which prohibits us inferring causality. Therefore, further prospective studies are needed to confirm our findings. In addition, to assess dietary intake, we used a dietary habits questionnaire. It would be better to use the food frequency questionnaire to assess the long-term dietary intake of students. Furthermore, we had no data on age of starting smoking, years of smoking, number of cigarette per day and patterns of smoking to categorize students as experimenter, current, daily or occasional smoker. Despite controlling for several confounders, we cannot exclude the possible effects of residual confounders such as influence of roommates who smoke, family history of smoking and psychological disorders on the association between different exposure variables and smoking.

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## Prévalence du tabagisme et son association avec les comportements liés à la santé parmi les étudiants iraniens : étude à grande échelle

### Résumé

**Contexte :** La prévalence du tabagisme et les facteurs qui y contribuent parmi les étudiants iraniens n'ont pas fait l'objet d'une grande attention.

**Objectifs :** La présente étude visait à évaluer la prévalence du tabagisme chez les étudiants iraniens et son association avec les comportements liés à la santé.

**Méthodes :** La présente étude transversale a été réalisée dans un échantillon de 82 806 étudiants iraniens admis à l'université en 2012-2013. Des informations sur les caractéristiques démographiques et les comportements liés à la santé, incluant l'activité physique, les habitudes de sommeil, l'utilisation d'appareils électroniques et les habitudes alimentaires ont été recueillies à l'aide d'un questionnaire standardisé. Le poids et la taille ont été mesurés au moyen d'un protocole standard et l'indice de masse corporelle a été calculé. Les fumeurs ont été définis comme ceux qui fumaient une cigarette ou plus par semaine.

**Résultats :** Le tabagisme était prévalent chez 6,0 % des étudiants (hommes : 6,6 % ; femmes : 5,6 %). Une activité physique modérée était inversement associée avec la probabilité de fumer. Une corrélation positive significative a été observée entre l'obésité et la probabilité d'être fumeur. Une plus grande consommation de fruits et de produits laitiers était associée avec une probabilité plus faible de fumer. En revanche, on a noté une corrélation positive entre la consommation de légumes, d'aliments de restauration rapide et de boissons gazeuses et le tabagisme. La prise de petit-déjeuner était également associée à une plus grande probabilité d'être fumeur.

**Conclusions :** Les caractéristiques démographiques et les comportements liés à la santé, incluant la situation matrimoniale, professionnelle et économique, les habitudes de sommeil, l'activité physique, l'utilisation d'appareils électroniques et les apports alimentaires, entretenaient un lien significatif avec le tabagisme.

### انتشار التدخين وارتباطه بالسلوكيات المتعلقة بالصحة بين طلاب الجامعات الإيرانية: دراسة واسعة النطاق

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### الخلاصة

الخلفية: لم يحظ انتشار التدخين والعوامل المساهمة فيه سوى باهتمام ضئيل بين طلاب الجامعات الإيرانية.

الأهداف: هدفت هذه الدراسة إلى تقييم انتشار التدخين بين طلاب الجامعات الإيرانية، وارتباطه بالسلوكيات المتعلقة بالصحة.

طرق البحث: أجريت هذه الدراسة المقطعية على عينة ضمت 82 806 طلاب جامعيين إيرانيين كانوا منتسبين إلى الجامعة في الفترة بين عامي 2012-2013. وجمعت معلومات عن الخصائص السكانية والسلوكيات المتعلقة بالصحة، بما في ذلك النشاط البدني ونمط النوم واستخدام الأجهزة الإلكترونية والعادات الغذائية، باستخدام استبيان موحد. وقيس الوزن والطول باستخدام بروتوكول معياري، وحسب منسب كتلة الجسم. وتم تعريف المدخنين بأنهم الطلاب الذين يدخنون سيجارة واحدة أو أكثر في الأسبوع.

النتائج: كان التدخين منتشرًا بين 6.0٪ من طلاب الجامعات (الذكور 6.6٪، والإناث 5.6٪). وكان هناك ارتباط عكسي بين النشاط البدني المعتدل واحتمالات التدخين. كما وجد ارتباط إيجابي كبير بين السمنة واحتمالات التدخين. وارتبط تناول مقدار أكبر من الفواكه ومنتجات الألبان بانخفاض احتمالات التدخين. غير أن تناول الخضروات والوجبات السريعة والمشروبات الغازية ارتبط ارتباطاً إيجابياً بالتدخين. وارتبط تناول الإفطار أيضاً باحتمالات أكبر للتدخين.

الاستنتاجات: ارتبطت الخصائص السكانية والسلوكيات المتعلقة بالصحة، بما فيها الحالة الزوجية والمهنة والحالة الاقتصادية ونمط النوم والنشاط البدني واستخدام الأجهزة الإلكترونية والمدخول الغذائي، ارتباطاً كبيراً بالتدخين.

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