Prevalence of cigarette smoking among college students in Iran: An updated systematic review and meta-analysis of observational studies

Mahmoud Khodadost1,2, Khadije Maajani3, Alireza Noroozi4,5, Seyed Abbas Motevalian6,2, Morteza Naserbakht7, Fatemeh Sarvi8, Roohollah Seddigh6, Leila Jamshidi9, Samira Yavari9, Malihe Khoramdad2, Ebrahim Ghodusi9, Ahmad Hajebi*6

Received: 17 Jul 2019 Published: 8 Dec 2020

Abstract

Background: Cigarette smoking is known as a gateway drug for illicit drug use in youth. The objective of this study is to assess the prevalence of cigarette smoking in the college students in Iran.

Methods: We searched electronic databases including Scopus, Medline/PubMed, Google Scholar and Web of Science, and national databases such as Magiran, Scientific Information Database, Iranmedex, Medlib, Irandoc, and IranPsych from 1946 to 21st July 2018 without any language restriction using a proper search strategy. We used a random effect model to calculate the pooled prevalence of cigarette smoking in college students in Iran. Chi-square test and I² index were used to evaluate the heterogeneity between the studies. We used the meta-regression and subgroup analysis to assess the potential source of heterogeneity. Stata software, version 11 (StataCorp, TX) was used for all statistical analysis.

Results: We included 60 eligible articles in our study. The pooled prevalence of cigarette smoking at least once in the lifetime was 19% (95%CI: 17-22). The I² index indicated considerable between-study heterogeneity (I²=98%, p<0.001). The pooled prevalence of cigarette smoking at least once in the lifetime in males and females was 28% (95% CI: 23-34) and 9% (95% CI: 6-13), respectively. In multivariable meta-regression, a significant association was shown between the year of study (β=-13.1, p=0.011) and sampling method (β=-12.8 p=0.017) and daily use in the last month.

Conclusions: Increasing prevalence of smoking among Iranian university students is an important health priority. Increasing preventive and health education programs are recommended.

Keywords: University students, Smoking, Tobacco, Meta-analysis

Conflicts of Interest: None declared

Funding: The Substance Abuse Prevention and Treatment Office (SAPTO), Ministry of Health and Medical Education (MoHME) of Iran

*This work has been published under CC BY-NC-SA 1.0 license.

Copyright© Iran University of Medical Sciences

Cite this article as: Khodadost M, Maajani K, Noroozi A, Motevalian SA, Naserbakht M, Sarvi F, Seddigh R, Jamshidi L, Yavari S, Khoramdad M, Ghodusi E, Hajebi A. Prevalence of cigarette smoking among college students in Iran: An updated systematic review and meta-analysis of observational studies. Med J Islam Repub Iran. 2020 (8 Dec);34:165. https://doi.org/10.47176/mjiri.34.165

↑What is “already known” in this topic: Cigarette smoking was known as gateway drug in vulnerable populations, especially in college students. There is no consensus about the recent trends and prevalence rate of cigarette smoking in Iranian university students. Therefore, the estimate of the pooled prevalence of Cigarette smoking is important.

→What this article adds: The pooled prevalence of cigarette smoking in college students was 19%. Increasing prevalence of smoking among Iranian university students is an important health priority. These results could be good bases to help evidence-based policymaking for the health sector policymakers.
Prevalence of smoking among college students in Iran

Introduction

Cigarette smoking is known as a serious public health problem and an important cause of preventable morbidity and mortality in the world (1). According to the global burden of disease study in 2010, cigarette smoking is the second leading cause of death globally (2) and has adverse health effects such as coronary heart disease (CHD), stroke, serious cancers including lung, larynx, esophagus, pancreas, liver, cervix, bladder, mouth, etc. (3). It is estimated 1.3 billion people smoke worldwide and WHO estimated that over 6 million people die annually due to cigarette smoking (WHO 2002). According to the WHO estimates in 2010, the prevalence of smoking in the Iranian population was about 12%. Recent national surveys from 2005 to 2011 in adults between 15-64 years in Iran indicated that cigarette smoking use is decreasing (4). The national survey reported that the current use of cigarette smoking in men was from 24.1% in 2005 to 20.8% in 2011 and in women were from 4.3% in 2005 to 0.9% in 2011. Also, daily use of cigarette smoking in men was from 20.9% in 2005 to 19.2% in 2011 and for women was from 2.9% in 2005 to 0.6% in 2011. The prevalence of smoking in college students of some neighborhood counties was reported 11% to 30% (5-7). The Prevalence rate of Cigarette smoking in the general population in Iran was reported 11.9% in 2007. Also the prevalence of cigarette smoking among Iranian youth was increasing 1). Various studies conducted in Iran reported the prevalence of cigarette smoking in college students from 9.8% to 18.48% (8-10). Thus, because there is no consensus about the recent prevalence rate of cigarette smoking in Iranian university students and because of notable increased in the prevalence rate of cigarette smoking among university student in Iran, we aimed to calculate the prevalence rate of cigarette smoking in college students by meta-analysis.

Methods

We used a universal systematic review through various national and international electronic databases to identify studies that report the prevalence of smoking among university students in Iran. In this article, we used a preferred item for reporting systematic review and meta-analysis (PRISMA) guidelines to present the results.

Search strategy

We conducted an initial search from 1946 to July 21, 2018, in various international (CINAHL, Medline/PubMed, EMBASE, PsychnFO and Web of Science), regional (IMEMR), and national (Magiran, Scientific Information Database, Iranmedex, Medlib, Irandoc, and IranPsych) databases. The PICO of systematic review and meta-analysis was used to retrieve and screen the related studies. We used various combinations of related keywords to specify the geographic location (i.e., country and province names), target population (e.g., university students) and type of substance (e.g., tobacco, smoking, cigarette smoking). We did not limit searches by language.

For national databases, both English and Farsi key terms were used. We used the EndNote X7 software to screen the citations based on inclusion and exclusion criteria from various online databases and additional documents retrieved through other sources. We also searched the key journals in the field of substance use and mental health and assessed the reference section of retrieved studies or national reports documents to identify the related citations.

Eligibility criteria

The following eligibility criteria were used to screen the retrieved studies.

1. All observational studies that reporting data on the prevalence of cigarette smoking, including cohort studies, cross-sectional studies, case-control studies and the related regional and national surveys were included.

2. We included studies that report data on smoking use through self-rated questionnaires or interviews among university students.

3. We limited our geographic scope to studies conducted within Iran.

4. For the study population, we included studies conducted among university students at the time of the study.

5. All scientific document types such as original articles, national reports, and surveys were included.

Exclusion criteria

1. We excluded documents not reporting epidemiologic data and also not reporting original data.

2. We excluded the review articles, systematic reviews, meta-analyses, case reports, case-series studies and qualitative studies.

3. Studies with a sample size less than 100 were considered to be underpowered and also prone to a wider range of biases and thus were also excluded.

4. Studies conducted among Iranian college students residing outside of Iran.

5. We excluded studies in the general population, high school students, and other age and gender-specific groups that did not include university students. We did not set any limits on study implementation or publication year.

Study selection and quality assessment

We screened studies in a stepwise fashion. Two authors (KM & MK) reviewed the studies by title, abstract and full text independently, based on eligibility criteria. Documents with disagreement were reconsidered by the two reviewers, and a third coauthor (AN) was evaluated the papers if needed. We used strengthening the reporting of observational studies in epidemiology (STROBE) checklist to investigate the risk of bias and the quality of each eligible study. The studies were categorized into three groups; studies receiving more than 80 percent of the total score were considered as high quality, 60-79% of the total scores as intermediate quality and 30-59% of the total score were classified as low quality. Two authors (KH, M and M.KH) were conducting the quality assessment of included papers. The agreement among two reviewers was calculated using weighted Kappa (86%).

http://mjiri.iums.ac.ir
Med J Islam Repub Iran. 2020 (8 Dec); 34:165.
**Data extraction**

MK & KM extracted data from the retrieved studies and discussed disagreements with the third coauthor (AN) as indicated. We used the structured sheets in Microsoft Excel® to extract the data including (1) authors, (2) publication year, (3) publication type, (4) site/s of study, (5) study implementation year, (6) type of study, (7) sampling method, (8) study population and sample size, (9) data gathering method, (10) language (Farsi, English), (11) Study scale (city, province, sub-national, national), (12) number of recruitment sites, (13) gender distribution, (14) age characteristics, (15) key socioeconomic indicators, (16) type of university, (17) major of university student, (18) prevalence of smoking.

**Statistical analysis**

We used the Q test at 5% significant level and $I^2$ index to investigate the statistical heterogeneity; according to the result of these tests we used a random effect model to calculated summary pooled prevalence of cigarette use and 95% confidence intervals, weighted by the inverse of the variance. We used the binomial distribution to calculate the standard error in each study. We illustrated data in the form of forest plots for the above sub-populations wherever such data was available. We used the Metaprop command in Stata to conduct the meta-analysis.

Meta-regression analysis was used based on sample size, year of the study and sampling methods to investigate the potential source of heterogeneity. We did not assess the publication bias because the pooled prevalence is a positive number as a proportion effect size and if we saw asymmetry in the funnel plot, it is not due to the publication bias. To perform the statistical analysis, we used Stata-11 (StataCorp, College Station, TX, USA).

**Results**

**Descriptive Statistics**

In the electronic database searching, the total number of 1917 publications was enrolled, and 4 studies were identified by the other sources. In the final step, 60 documents were enrolled in the meta-analysis based on the screening process by applying inclusion and exclusion criteria (Fig. 1). Table 1 reports the studies characteristics enrolled in the systematic review and meta-analysis.

---

**Fig. 1.** The PRISMA flow diagram of different phases involved in searching and for relevant publications

http://mjiri.iums.ac.ir

*Med J Islam Repub Iran.* 2020 (8 Dec); 34.165.
### Table 1. The characteristic of studies were enrolled in the systematic review and meta-analysis

| Study ID | First author | Year of study | Study location | Age in years (Mean) | Sampling methods | Sample size (n) | Response rate (%) | Daily Last week | Last month | Last year | Lifetime |
|----------|--------------|---------------|----------------|--------------------|------------------|----------------|------------------|-----------------|-------------|-----------|----------|
| W1       | Afrashteh S & et al 2016 Bushehr 22.1 Random sampling 977 100 _  _  _  10 |
| W2       | Ahmadabadi S & et al 2015 Tehran 21.7 Multistage random sampling 1173 100 _  _  _  13.9 30.6 |
| W3       | Ahmad J & et al 2000 Shiraz 23.23 Random Cluster Sampling 501 90.22 36.1 _ _ _ 54.9 |
| W4       | Ahmad J & et al 2000 Shiraz 20.69 Census 400 100 _  _  _  10.8 25.3 |
| W5       | Ahmad J & et al 2001 Shiraz 20.5 Random sampling 184 100 _ _ _ _ 34.8 |
| W6       | Akbari Zard khaneh S & et al 2011 Survey * Stratified random sampling 8352 90.0 _ _ _ _ 18.78 |
| W7       | Allahverdipour H & et al 2011 Tehran 22.09 Random Cluster sampling 2128 86.1 15.6 |
| W8       | Amin-Esmaeil M & et al 2006 Tehran 20.4 Census 1761 96.8 10.2 3.4 4.8 8.2 12.5 16.9 |
| W9       | Amin-Esmaeil M & et al 2007 Tehran 20.2 Census 1736 96.1 4 5.2 7.8 13.2 17.6 |
| W10      | Babaei Heydarabadi A & et al 2013 Tehran Random sampling 604 100 30.7 |
| W11      | Bahreinian A & et al 2001 Tehran 22 Random Cluster Sampling 566 100 3.3 9.01 |
| W12      | Dehghani KH & et al 2009 Yazd 22 Random sampling 534 100 _ _ _ _ 14.4 |
| W13      | Eslami A & et al 2013 Isfahan 23.02 Random sampling 264 91.29 _ _ _ _ 21.2 |
| W14      | Fajani S & et al 2013 Isfahan Stratified random sampling 1801 83.95 32.8 33.79 |
| W15      | Ghanizadeh A & et al 1999 Shiraz 22.35 Random sampling 220 96.82 _ _ _ _ 52.38 |
| W16      | Goreishi A & et al 2010 Zanjir 21.3 Stratified random sampling 1340 89.5 _ _ 3.08 _ 16 |
| W17      | Heydari T & et al 2013 Jahrom 21.15 Random sampling 1149 100 _ _ _ _ 17 |
| W18      | Jalilian F & et al 2012 Kerman 22.68 Random sampling 385 82.08 _ _ _ _ 14.5 |
| W19      | Kabir K & et al 2014 Kerman 22.4 Random Cluster sampling 1959 94 _ _ _ _ 15.48 |
| W20      | Kiaransari A & et al 2010 Ardabil 25.54 Random sampling 330 94.85 _ _ _ _ 13.1 |
| W21      | Majidpour A & et al 2004 Ardabil – Census 1106 100 _ _ _ _ 13.9 |
| W22      | Mardani H & et al 2010 Bandar Abbas 25.54 Stratified random sampling 350 88.57 _ _ _ _ 15.48 |
| W23      | Moayedi F & et al 2015 Hormozgan 22.7 Random sampling 350 97.7 _ _ _ _ 21.8 |
| W24      | Mohtasham Amir Z & et al 2005 Astara 24.2 Stratified random sampling 1380 88.84 17.69 19.6 _ 21.8 |
| W25      | Mohtasham Amir Z & et al 2005 Guilan 22.2 Multistage random sampling 3958 93.48 16.02 _ 19.5 _ 20.4 |
| W26      | Moniropr N & et al 2013 Karaj, Takestan 22.55 Stratified random sampling 1053 100 _ _ _ _ 20.4 |
| W27      | Mortazavi GH & et al 2007 Tehran 22.4 Multistage random sampling 1000 87.00 _ _ _ _ 31.5 |
| W28      | Mozafarzade M & et al 2014 Tehran 24.2 Random sampling 422 100 _ _ _ _ 26.3 |
| W29      | Nakhcheh N & et al 2009 Kerman 21.2 ± 2.1 Random sampling 1677 96 _ _ _ _ 31 |
| W30      | Refahi A & et al 2012 Zahedan Random Cluster sampling 1014 98.9 _ _ _ _ 11.7 22% |

* Survey includes 5 universities from Iran: Tehran University, Isfahan University of Technology, Shahid Bahonar University of Kerman, Razi University of Kermansheh, and Ferdowsi University of Mashhad.

* Tehran, Guilan, Mazandaran, Golestan, Khorasan-shomali, Khorasan razavi, Khorasan Jonobi, Sistan and Baluchestan, Kerman, Hormozgan, Boshahr, Khoojestan, Fars, Esfahan, Markazi, Qome, Semnan, Yazad, Qazvin, Lorestan, Chaharmahal and Bakhtiar, Kohgiluyeh Boyer, Kurdistan, Qomansheh, Ilam, Hamadan, Western Azerbaijan, East Azerbaijan, Ardabil, Zanjan university.

* Survey includes 5 universities from whole of Iran: Tehran university, Isfahan University of Technology, Shahid Bahonar University of Kerman, Razi University of Kermansheh, Ferdowsi University of Mashhad.

* Please refer to the appendix I for details of studies included to the systematic review and meta-analysis.
| Study ID | First author | Year of study | Study location | Age in years (Mean) | Sampling methods | Sample size (n) | Response rate (%) | Daily | Last week | Last month | Last year | Lifetime |
|----------|--------------|---------------|----------------|---------------------|------------------|----------------|-------------------|-------|-----------|------------|-----------|----------|
| W31      | Rezahosseini O & et al | 2008          | Rafsanjan       | 21.35               | Random sampling   | 1260           | 100               | –     | –         | –          | –         | 12.6     |
| W32      | Rezakhani Moghadam H & et al | 2012          | Tehran          | 22.92               | Stratified random sampling | 977            | 100               | –     | –         | –          | –         | 22.76    |
| W33      | Roohafza H & et al | 2007          | Isfahan & Kashan | –                   | Random sampling   | 812            | 100               | –     | –         | –          | –         | 9.48     |
| W34      | Safiri S & et al | 2015          | Tabriz          | –                   | Stratified random sampling | 1730          | 97.3              | –     | –         | –          | 12.4      | –        |
| W35      | Sahraian A & et al | 2008          | Shiraz          | –                   | Random sampling   | 971            | 100               | –     | –         | –          | 5.9       | –        |
| W36      | Sargolzayi M & et al | 2001          | Mashhad         | 25.28               | Census            | 1126           | 83.45             | 5.08  | –         | –          | –         | 3.9      |
| W37      | Shafiie N & et al | 2011          | Bam             | 21.56               | Random sampling   | 760            | 100               | –     | –         | –          | –         | 5.7      |
| W38      | Shojaa M & et al | 2010          | Golestan        | 22.1                | Census            | 699            | 80                | –     | –         | –          | –         | 83.5     |
| W39      | Sohrabi F & et al | 2006          | Survey a        | 21.03               | Random Cluster Sampling | 8375          | 99.98             | –     | –         | 10.3       | 14        | 20       |
| W40      | Taheri E & et al | 2008          | Mashhad         | –                   | Census            | 1100           | 85                | 9.8   | 3         | –          | –         | –        |
| W41      | Talaei A & et al | 2008          | Torbat jaam     | 18-24               | Census            | 843            | 100               | –     | –         | –          | –         | 19.2     |
| W42      | Taremian F & et al | 2006          | Tehran          | –                   | Random sampling   | 2997           | 100               | –     | –         | 11.6       | 15.7      | 24.2     |
| W43      | Taremian F & et al | 2011          | Tehran          | –                   | Random Cluster Sampling | 4000          | 89.55             | –     | –         | –          | –         | 18       |
| W44      | Tarrahi MJ & et al | 2015          | Lorestan        | 19.6                | Random sampling   | 1131           | 95.8              | 0.8   | –         | –          | –         | 18       |
| W45      | Valipour M & et al | 2009          | Lorestan        | Range: 19-27        | Census            | 100            | 100               | –     | –         | –          | –         | 21       |
| W46      | Yaghoubi H & et al | 2011          | Survey b        | –                   | Stratified random sampling | 7330          | 95.12             | –     | 9.2       | 12.4       | 20.4      | –        |
| W47      | Yekkehfallah L & et al | 2009          | Qazvin          | –                   | Random Cluster Sampling | 200            | 100               | –     | –         | –          | –         | 1.5      |
| W48      | Zahedi R & et al | 2016          | Kerman          | 20.5                | multistage non-random sampling | 1730          | 83.6              | –     | –         | 15.2       | –         | –        |
| W49      | Zarrabi H & et al | 2006          | Gilan           | 22.12               | Random sampling   | 845            | 97.87             | –     | –         | 9.6        | –         | 25.8     |

a Survey includes 5 universities from Iran: Tehran University, Isfahan University of Technology, Shahid Bahonar University of Kerman, Razi University of Kermansheh, and Ferdowsi University of Mashhad.

b Tehran, Guilan, Mazandaran, Golestan, Khorasan shomali, Khorasan razavi, Khorasan Jonobi, Sistan and Balouchestan, Kerman, Hormozgan, Boshehr, Khozestan, Fars, Esfahan, Markazi, Qome, Semnan, Yazad. Qazvin, Lorestan, Chaharmahal and Bakhhtiari, Kohgiluyeh Boyer, Kurdistan, Kermansheh, Ilam, Hamedan, Western Azerbaijan, East Azerbaijan, Ardabil, Zanjan university.

c survey includes 5 universities from whole of Iran: Tehran university, Isfahan University of Technology, Shahid Bahonar University of Kerman, Razi University of Kermansheh, Ferdowsi University of Mashhad

d Please refer to the appendix 1 for details of studies included to the systematic review and meta-analysis
A total sample size of 81610 college students in mixed-gender was included from 60 studies. Also, 34 studies reported prevalence in male (n = 33514) and 26 in female (n = 46307), respectively.

The highest prevalence of lifetime smoking (at least once in a lifetime) in mixed-gender studies was reported in Shojaa et al. study in Golestan province that was equal to 83.5% (11) and the lowest prevalence was 1.5% in Qazvin (12). The highest prevalence of lifetime smoking in males was 70.2% in the Ahmadi et al. study from Shiraz (13); In females, it was 31.7% in the Yaghoubi et al. study (14). The lowest prevalence of lifetime smoking in males and females were 2.38% and 0.86% in Qazvin (12) (Yekkehfallah et al.), respectively. The average age of males (reported in 32 studies) and females (reported in 26 studies) were 22.35 and 21.2 years, respectively. The mean age of mixed samples was 21.7 years that reported in 58 studies.

**Heterogeneity**

According to the result of the chi-square test and I² index, there was a substantial between-study heterogeneity; they report the prevalence of cigarette smoking in at least once in a lifetime (I²=98.65%, p<0.001), at least once in the last year (I²=98.58, p<0.001), at least once in the last month (I²=98.92%, p<0.001) and daily use in the last month (I²=98.8%, p<0.001). Consequently, the random effect model was used in this study.

**Subgroup Analysis**

Based on the random effect model, the pooled prevalence of cigarette smoking at least once in a lifetime in college students was 19% (95% CI: 17-22) (Table 2). Also, the pooled prevalence of cigarette smoking at least once in a lifetime in males and females was 28% (95% CI: 23-34) and 9% (95% CI: 6-13), respectively (Table 2). The pooled prevalence of cigarette smoking at least once in the last year in college students was 11% (95%CI: 9-3), also in males and females were 18% (95%CI: 16-21) and 7% (95%CI: 5-8) respectively (Table 2).

Also, the pooled prevalence of cigarette smoking at least once use in last month in both gender and male and female subgroups was 10% (95% CI: 7-12), 20% (95% CI: 15-26) and 5% (95% CI: 3- 8), respectively (Table 2). The pooled prevalence of cigarette smoking daily use in last month in both gender and male and female subgroups was 6 (95% CI: 4-10), 12% (95% CI: 2-28) and 2% (95% CI: 0-6), respectively (Table 2).

Moreover, the pooled estimate prevalence of lifetime cigarette smoking by sampling methods, in random sampling, random cluster sampling, census, and stratified random sampling were 25.63% (95% CI: 19.62-31.64), 20.05% (95% CI: 11.30-28.80), 17.60% (95% CI: 8.75-26.44) and 20.10% (95% CI: 18.70-21.51), respectively.

| Subgroup                   | No. of Included studies | Pooled Prevalence (Random Effect) | 95% CI       | I²   | P value for I² |
|----------------------------|-------------------------|----------------------------------|--------------|------|----------------|
| At least once in the Life time | 44                      | 0.19                             | 0.17-0.22    | 98.65| <0.001         |
| Male                       | 22                      | 0.28                             | 0.23-0.34    | 98.58| <0.001         |
| Female                     | 20                      | 0.09                             | 0.06-0.13    | 98.72| <0.001         |
| At least once in the Last year | 10                      | 0.11                             | 0.09-0.13    | 91.52| <0.001         |
| Male                       | 4                       | 0.18                             | 0.16-0.21    | 79.30| <0.001         |
| Female                     | 4                       | 0.07                             | 0.05-0.08    | 73.95| 0.015          |
| At least once in the Last month | 20                     | 0.10                             | 0.07-0.12    | 98.63| <0.001         |
| Male                       | 12                      | 0.20                             | 0.15-0.26    | 97.73| <0.001         |
| Female                     | 12                      | 0.05                             | 0.03-0.08    | 98.00| <0.001         |
| Daily use in the Last month | 15                      | 0.06                             | 0.04-0.10    | 98.87| <0.001         |
| Male                       | 5                       | 0.12                             | 0.02-0.28    | 98.82| <0.001         |
| Female                     | 4                       | 0.02                             | 0.01-0.06    | 95.49| <0.001         |

- **Table 2.** The result of pooled prevalence of smoking in related subgroups in college students of Iran

- **Table 3.** Evaluation of effect of every included study on the pooled prevalence of cigarette smoking using sensitivity analysis

a. EF: effect size; the upper and lower limit of effect size (pooled prevalence) in post-sensitivity analysis after omitting each study

b. Please refer to the appendix 1 for details of studies included to the systematic review and meta-analysis
The prevalence of smoking in the total sample, men and women is 11.75%, 22.9 and 0.6, respectively (15). In the previous meta-analysis of smoking use in college students of Iran in 2013, the pooled prevalence was reported 11.6% in mixed-gender and 19.5% and 2.2% in male and female college students; it shows the significant increase in both genders in comparison with the results of this study (16). Moreover, various studies in Iran reported the prevalence of smoking in 15-64 years old population from 9.7% to 13.9% in both genders, 19% to 24% in males and 0.3 to 0.9 % in females (3, 17). Therefore, the prevalence of daily use in the last month in university students is consistent with the general population in Iran, but is higher than youth (15-34 years old) that reported 8.3% (3). This difference has variant causes; several studies indicated that some factors such as having smoking friends, stress, being far from family and entertainment, living alone, curiosity and seeking pleasure, an extended course of education, despair from coming career and use as a fun and enjoyment (18, 19). Smoking was significantly higher among students living away from their families than those living with families (20). In the contrary, some factors such as friends, parental supervision, and personal expenditure by them and extracurricular activities like sports are reported as protective factors (21).

Smoking prevalence in adolescents and students as a key and influential population in comparison with university students is so important. In a systematic review study, the prevalence of lifetime tobacco use including cigarettes, pipe and hookah among high school students in both gender, men and women were 21%, 30.9% and 14%, respectively (22). On the other hand, the pooled estimates for meta-analysis of cigarette smoking (not mention to duration) in Iranian adolescents (14-19 years old) were 16.8% (21). A meta-analysis of smoking status in Iranian male adolescents found almost one-third of male adolescents (34.2%) have experienced smoking; this means lifetime prevalence. These results showed lifetime prevalence in high school students correspond to university students. Therefore, it is concluded that maybe the onset of smoking in university student was in the school (23). Smoking is a behavior that generally begins in adolescence. Most of the smokers begin smoking in secondary school. Moreo-

| Prevalence                          | Univariable Model | Multivariable Model |
|-------------------------------------|-------------------|---------------------|
|                                    | β | SE   | p* | β | SE  | p |
| At least once in the Life time      | -4.3 | 4.2 | 0.329 | -4.5 | 4.4 | 0.532 |
| Sample size                        | 0.7 | 0.7 | 0.17 | 0.7 | 0.7 | 0.716 |
| Year of study                       | 0.9 | 0.9 | 0.34 | 1.1 | 1.1 | 0.842 |
| Sampling method                     | 13.2 | 7.5 | 0.173 | 16.06 | 8.5 | 0.124 |
| Year of study                       | 1.7 | 1.7 | 0.754 | 1.7 | 8.5 | 0.885 |
| Sampling method                     | -2.83 | 5.4 | 0.692 | -4.05 | 8.5 | 0.628 |
| At least once in the Last year      | 2.8 | 2.8 | 0.543 | 2.4 | 4.6 | 0.618 |
| Sample size                        | -0.6 | 0.6 | 0.815 | -3.3 | 3.9 | 0.456 |
| Year of study                       | -4.9 | 4.9 | 0.163 | -6.3 | 3.9 | 0.186 |
| Sampling method                     | -3.04 | 4.6 | 0.511 | -2.5 | 3.7 | 0.586 |
| Daily use in the last month         | -4.9 | 4.8 | 0.382 | -13.1 | 4.7 | 0.011 |
| Sample size                        | -6.08 | 4.5 | 0.237 | -12.8 | 4.6 | 0.017 |

* Studies with sample size ≥1,000 versus <1,000 as reference.
* Random sampling, multistage random sampling, stratified random sampling, random cluster sampling vs. census as reference.
* p-value < 0.05 considered significant

http://mjiri.iums.ac.ir
Med J Islam Repub Iran. 2020 (8 Dec); 34:165.
ver, about 60% of smokers in Iran have smoked before the age of 18 years (7).

Much research has been conducted to confirm smoking among university students across the country. The survey of international comparison of tobacco smoking from 23 countries indicated that the prevalence of current smoking was 6% to 44.5% (24). In the other study, smoking in European university students from 13 countries, the prevalence of current smoking in both gender, male and female was 33.9%, 35% and 33% (24). In addition, there was a wide range variety of smoking prevalence among college students of Eastern Mediterranean region countries and some Arabic countries. Prevalence of cigarette smoking among male Kuwait university students reported 42.2% smoked daily a mean of 31 cigarettes per day (25) in Jordan; current smoking was 16.5% (26) in Syria was 20.75% (20) and in KSA and Lebanon (5) were 24% and 18.9%, respectively. In Saudi Arabia, the prevalence of cigarette smoking among female college students was reported 13.3% and among college departments, the highest prevalence was in the respiratory care department by 25% (27) that is much higher than in Iran (28). The prevalence of smoking in university students in Iran is lower than more countries in the world and lower than their counterparts in Arabic and neighboring countries. Maybe that means an alarm, this result show cigarette smoking shift to other products such as water pipe or other substance, because the water pipe is so acceptable and adaptable with Iranian culture and environment. The prospective study conducted in college students in the United States indicated that current hookah use in the past 30 days predicts cigarette smoking progression among college smokers (27).

We also found that the prevalence of cigarette smoking in males was considerably more than that of females. This pattern was according to the results of all studies in Iran and other countries in the university student and other populations. The result of assessing the gender-related responses to smoking cessation indicated that women worried more about smoking-related illnesses than men (26). The results of our study subject to some limitations due to existing high heterogeneity in all study subgroups pooled prevalence. Consequently, the result of this meta-analysis should be used and interpreted with consideration of these limitations. One possible cause for heterogeneity could be the variety of questionnaires used in included studies. Most of the included studies in the meta-analysis failed to follow and report the standard questionnaire with acceptable validity and reliability for measuring substance and smoking use. Another cause may be the high variety of smoking prevalence in the provinces of Iran that may be another source of heterogeneity.

Conclusion

This meta-analysis showed that the pooled prevalence of cigarette smoking among female and male college students of Iran is lower than in other countries but high in comparison with its prevalence in the general population who are aged 15-34 years in Iran. In comparison with other countries may be a shift in use of other products such as water pipe. The most common risk factors are having smoker friends and lack of family support. However, as the society has high expectations of this group, even low smoking prevalence in this group is not acceptable. Therefore, providing a comprehensive program with high efficiency, which covers all aspects of life, is essential. Implementation of prevention programs such as ‘life skills training program’, “peer education” and “social marketing”, in addition to predicting a way of assessment and monitoring of prevalence smoking and other substance in university students are suggested.

Conflict of Interests

The authors declare that they have no competing interests.

References

1. Mohammadpoor Asl A, Fakhari A, Rostami F, PouraFkary N. Cigarette smoking among Iranian adolescents. Iran J Psychiatry Behav Sci. 2007;1(1):30-5.
2. WHO. Global Burden of Disease Study 2010: WHO; 2012 [cited 2016 5/30/2016]. Available from: http://ash.org/global-burden-of-disease-study-2010/
3. Ardeshiri MJ, Moosazadeh M, Masouleh MF, Masouleh MF, Kiani A, Fakhri M. Prevalence of smoking in 15-64 years old population of north of Iran: meta-analysis of the results of non-communicable diseases risk factors surveillance system. Acta Med Iran. 2013;51(7):494-500.
4. Rezaei F, Noroozi A, Armoon B, Farhoudian A, Massah O, Sharifi H, et al. Social determinants and hepatitis C among people who inject drugs in Kermanshah, Iran: Socioeconomic status, homelessness, and sufficient syringe coverage. J Subst Use. 2017;22(5):474-8.
5. Tamim H, Terro A, Kassem H, Ghazi A, Khamis FA, Hay MMA, et al. Tobacco use by university students, Lebanon, 2001. Addiction. 2003;98(7):933-9.
6. Haddad LG, Malak MZ. Smoking habits and attitudes towards smoking among university students in Jordan. Int J Nurs Stud. 2002;39(6):793-802.
7. Al-Nefisah OS, Al-Ghanem SM. The prevalence of smoking among male students of Majmaah University, J Taibah Univ Med Sci. 2016;11(2):175-178.
8. Taheri E, Ghorbani A, Salehi M, Sadeghnia HR. Cigarette smoking behavior and the related factors among the students of mashhad university of medical sciences in iran. Iran Red Crescent Med J 2015;17(1):1-6.
9. Ahmadi J, Khalili H, Jooyhar R, Namazi N, Aghaee P. Cigarette smoking among Iranian medical students, resident physicians and attending physicians. Eur J Med Res. 2001;6(9):406-8.
10. Alizade H, Sharifi H, Naderi Z, Ghanbarpour R, Bamorovat M, Aflatoonian MR. High Frequency of Diarrheagenic Escherichia coli in HIV-Infected Patients and Patients with Thalassemia in Kerman, Iran. J Int Assoc Provid AIDS Care. 2017;16(4):353-8.
11. Shojaa M, Qorbani M, Jouybari LM, Sanagoo A, Mohebi R, Bamyar R, et al. Prevalence of smoking among the students resided at dormitories in Golestan university of medical sciences, Iran. Bangladesh J Medical Sci. 2014;13(4):460-5.
12. Yekkehfallah L, Momeni A, Torkashvand A, Jahani Hashemi H. Factors Associated with Ecstasy Use in Students of Qazvin University of Medical Sciences. Hayat. 2009;15(2):73-80.
13. Ahmadi J, Yazdanfar F. Current substance abuse among Iranian university students. Addict Disord Their Treat. 2002;1(2):61-4.
14. Yaghubi H, Taremian F, Peyravi H, Zafar M. Drug use Prevalence among College Students of Ministry of Science, Research and Technology, Iran (2012). Research on Addiction. 2015;8(32):9-36.
15. Moosazadeh M. Meta-analysis of prevalence of smoking in 15-64-year-old population of west of Iran. Int J Prev Med. 2013;1(1):1108-14.
16. Haghdoost AA, Moosazadeh M. The prevalence of cigarette smoking among students of Iran’s universities: A systematic review and meta-analysis. J Res Med Sci. 2013;18(8):717-25.

http://mjiri.iums.ac.ir

Med J Islam Repub Iran. 2020 (8 Dec); 34.165.
17. Moosazadeh M, Salami F, Movahedian M, Amiri MM, Afshari M. Prevalence of smoking in northwest Iran: a meta-analysis. Electron Physician. 2014;6(1):734-40.
18. Majidpur A, Hamidzadeh Y, Abasgholizade N, Salehy E. Prevalence and Causes of Tendency to Cigarette Smoking among Students in Ardabil University of Medical Sciences. J Ardabil Univ Med Sci. 2005;5(3):266-70.
19. Nazemi S, Chaman R, Davardust N. Prevalence and Reasons of Inclination towards Smoking among University Students. Knowl Health. 2012;7(3):107-11.
20. Al-Kubaisy W, Abdullah NN, Al-Nuaimy H, Kahn SM, Halawany G, Kurdy S. Factors Associated with Smoking Behaviour among University Students in Syria. Procedia Soc Behav Sci. 2012;38:59-65.
21. Ansari-Moghaddam A, Rahshani F, Shahrahi-Sanavi F, Mohammadi M, Miri-Bonjar M, Bakshani N-M. Prevalence and patterns of tobacco, alcohol, and drug use among Iranian adolescents: A meta-analysis of 58 studies. Child Youth Serv Rev. 2016;60:68-79.
22. Rahimi Movaghar A, Hefazi M, Amin Esmaeili M, Sahimi Izadian E, Yusefi Nuraei R. smoking life time prevalence in high school student: A systematic review. Payesh. 2012;11(3):337-49.
23. Nazarzadeh M, Bidel Z, Ayubi E, Bahrami A, Jafari F, Mohammadpoorasl A, et al. Smoking status in Iranian male adolescents: A cross-sectional study and a meta-analysis. Addict Behav. 2013;38(6):2214-8.
24. Steptoe A, Wardle J, Cui W, Bellisle F, Zotti A-M, Baranyai R, et al. Trends in smoking, diet, physical exercise, and attitudes toward health in European university students from 13 countries, 1990–2000. Prev Med. 2002;35(2):97-104.
25. Alansari B. Prevalence of cigarette smoking among male Kuwait University undergraduate students. Psychol Rep. 2005;96(3 suppl):1009-10.
26. Kofahi MM, Haddad LG. Perceptions of lung cancer and smoking among college students in Jordan. J Transcult Nurs. 2005;16(3):245-54.
27. Doran N, Godfrey KM, Myers MG. Hookah use predicts cigarette smoking progression among college smokers. Nicotine Tob Res. 2015;17(11):1347-53.
28. Ansari K, Farooqi FA. Comparison and prevalence of smoking among Saudi females from different Departments of the College of Applied Medical Sciences in Dammam. Int J Health Sci. 2017;11(5):56-62.