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Review

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Abstract

Background: Cigarette smoking is a shared risk factor for a variety of health conditions.

Aims: To estimate the prevalence of cigarette smoking among Iranian adolescents and young adults.

Methods: In this systematic review and meta-analysis, we searched PubMed, Web of Science, Embase, Scopus and domestic databases from January 2001 to December 2018. Cross-sectional studies that reported the prevalence of cigarette smoking among high school students, university students or general population aged 14–30 years were eligible. Data on prevalence of smoking, age and gender of subjects, sample size, date, and location of studies were extracted by 2 independent reviewers.

Results: We included 99 studies in the analysis. For high school students, the pooled life-time prevalence of cigarette smoking was 13% in girls and 23% in boys. For university students, the life-time prevalence was 11% in women and 33% in men. The pooled prevalence of current and regular smoking among high school boys was 9% and 5%, respectively, compared with 3% and 1% in girls. The pooled prevalence of current and regular smoking among male university students was 22% and 11%, respectively, compared with 5% and 1% among female students. The prevalence of current smoking among the general population aged 15–24 years was 3.3–13.9%. The prevalence of regular smoking among this population was 1.0–10.2%.

Conclusion: Cigarette smoking is notable among Iranian young adults especially boys and university students. Our findings call for reinforcement of tobacco prevention and control policies across Iranian schools and universities.

Keywords: cigarette smoking, adolescents, young adults, prevalence, Islamic Republic of Iran

Citation: Aryaie M; Sharifi H; Khorrami Z; Ardalan G; Rajaei L; Heydari G; et al. Prevalence of cigarette smoking in Iranian adolescents and young adults: a systematic review and meta-analysis. East Mediterr Health J. 2021;27(6):612–628. https://doi.org/10.26719/emhj.21.018

Received: 27/11/19; accepted 23/06/20

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Introduction

Cigarette smoking is one of the most important causes of death and disability worldwide. The World Health Organization (WHO) has estimated that tobacco causes about 8 million deaths annually worldwide (1). Smoking imposes a heavy economic burden globally, especially in developing countries. The diseases attributed to smoking accounted for around 6% of global health expenditure in 2012 (2). In the WHO Eastern Mediterranean Region, the

age-standardized prevalence of smoking in men aged > 15 years is estimated to be around 40% (3).

Cigarette smoking usually begins at an early age of adolescence. The early onset of smoking is associated with early incidence of noncommunicable diseases (4) as well as infectious diseases (5). Furthermore, tobacco dependence is more severe in people who start smoking at younger ages, and quitting smoking is more difficult in this group (6–8). The prevalence of adolescent and young adult smoking varies in different regions of the world. In the United States of America (USA), 16% of young adults aged 18–24 years (9) and 12.5% of adolescents smoked cigarettes at least once a month (10). A recent estimate indicates that around 10% of adolescents aged 12–15 years in low- and middle-income countries smoke cigarettes (11). In the Islamic Republic of Iran, the prevalence of monthly smoking among high school students varies from 2.7% to 20% (12–16).

Policy-making requires that we take into account the public health importance of cigarette smoking, and provide timely and comprehensive information on current status of cigarette smoking among adolescents and young adults. In this systematic review, we provided a nationwide estimate of current, regular and life-time cigarette smoking among Iranian adolescents and young adults aged 18–30 years. Furthermore, we reported the gender-specific prevalence of smoking in various subgroups including high school and university students as well as the general population.

Methods

Study design

This systematic review was conducted according to the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) guidelines. We used the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) for detailing the identification and selection of studies for inclusion in the review.

Study selection

Studies were eligible for inclusion if they were cross-sectional; conducted among adolescents aged 14–18 years or young adults aged 18–30 years; and published in either English or Farsi languages. Studies were excluded if they used nonrandom sampling; the sample size was not clearly declared; the prevalence was not reported or could not be calculated from the data; and the prevalence was reported based on the level of nicotine.

Search strategy

We searched PubMed, Web of Science, Embase and Scopus to identify English-language articles. To capture Farsi-language articles, databases of SID, Iran Medex, MagIran, Medlib and IranDoc were searched. The search was restricted to January 2001 to December 2018. The searches were adapted for each database, using combinations of the following keywords: (1) prevalence OR epidemiology OR frequency OR cigarette smoking OR occurrence OR incidence OR survey; (2) tobacco smoking OR cigar smoking OR smoking OR smoking behave* OR smoking habit*; and (3) Iran OR Persia*

Article screening

Two independent reviewers (MA and ZKh) carefully scanned the titles, abstracts and keywords of each article for their relevancy and eligibility. Any disagreements between the reviewers were resolved by further investigation and discussion among the authors. If the information in the title or abstract was insufficient, the full text was reviewed.

Data extraction

The following information was extracted from each eligible article by 2 independent reviewers, and if there was any discrepancy between the reviewers, the decision was based on negotiation with the third reviewer. The extracted data included: study location and setting, publication year, participants' characteristics (gender and age), sampling source (high school, university, or general population), sample size, reported prevalence of cigarette smoking and its confidence intervals (CIs) by type (life-time vs current and regular).

Definitions

Life-time smoking was defined as whether a person had ever smoked cigarettes in their life-time. Cigarette smoking during the previous month was considered as current smoking. Regular smoking was defined as smoking ≥ 1 cigarette every day or every other day during the previous month. We categorized the prevalence of smoking by level of education, gender, and type of smoking. Furthermore, to increase the generalization of the results, we estimated the prevalence based on the time of the study and type of city. As the prevalence of smoking may vary by time, we estimated the pooled prevalence in 2001–2010 and 2011–2018. We categorized cities based on their population: small cities with the population **Quality assessment**

The quality of studies was examined by two authors (ZKh and MA) based on the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist for cross-sectional studies.

Statistical analysis

The pooled prevalence was calculated using the metaprop command in Stata version 14. The standard error of prevalence, , for each study was calculated based on the binomial distribution formula. The heterogeneity of studies was evaluated using I2 statistics. For I2 > 50%, which depicted heterogeneity between studies, the random effects model was used to estimate the pooled measures and 95% CIs. A forest plot was used to display the results of the meta-analysis. A funnel plot of log odds versus study size was constructed (17).

Results

Literature search

Our search identified 3456 articles, and 1477 of them were excluded because they were duplicates. Title/abstract screening of the remaining 1979 articles resulted in the selection of 475. Further screening of full-text articles led to the inclusion of 99 eligible articles in the meta-analysis.

Forty-six studies were conducted in high school students and included 51 943 girls and 74 476 boys. The number of studies on male, female and both genders was 17, 1 and 28, respectively. Twenty-four studies reported current smoking and 33 the lifetime prevalence of cigarette smoking. Daily or regular smoking was reported in 22 studies (12–14,18–60). Thirty-seven studies were conducted among university students; 4 among men and 33 among both genders. There were 37 169 female and 25 647 male students. Twenty-eight studies reported the current prevalence and 13 the life-time prevalence of smoking. Daily or regular smoking was reported in 10 studies (16,61–96). Finally, 16 studies were conducted in the general population; 1 among women and 15 among both genders. These studies recruited 29 676 women and 36 587 men. The current and life-time prevalence of smoking was reported in 7 and 1 studies, respectively. Regular smoking was reported in 13 studies (97–112).

Meta-analysis of smoking prevalence

High school students

The characteristics of the studies included in the systematic review and meta-analysis of cigarette smoking prevalence in Iranian high school students are presented in Table 1 . The pooled prevalence (95% CI) of life-time smoking was 13% (10–16%) in girls (Figure 1A) and 23% (20–26%) in boys (Figure 1D). The overall (combining both genders) pooled prevalence of life-time smoking was 18% (14–23%) (Figure 2A). The pooled prevalence of current smoking was 3% (2–4%) among girls (Figure 1B) and 9% (7-11) among boys (Figure 1E). The overall pooled prevalence of current smoking was 7% (5–8%) (

Figure 2B
). The pooled prevalence of regular smoking was 1% (0–1%) in girls (Figure 1C) and 5% (4–7%) in boys (
Figure 1F
). The overall pooled prevalence of regular smoking was 3% (2–4) (
Figure 2C
). The pooled prevalence of current smoking in both genders was higher in 2011–2018 than in 2001–2010 (4% vs 3% among girls and 10% vs 9% among boys) (
Figure 3B
and 3E). However, the pooled prevalence of life-time smoking was lower in 2011–2018 than in 2001–2010 (10% vs 17% among girls and 23% vs 25% among boys) (Figure 3A and 3D). For regular smoking, there was a decrease in smoking prevalence within the more recent period among girls (0.0% vs 1%) but an increase among boys (6% vs 5%) (Figure 3C and 3F). Furthermore, the pooled prevalence of all types of smoking in both genders was higher in large cities than in small cities (Figure 4, see Appendix online).

University students

The characteristics of the studies included in the systematic review and meta-analysis of cigarette smoking prevalence in Iranian university students are presented in Table 2 . The pooled life-time prevalence of smoking was 11% (7–14%) in women (Figure 5A, see Appendix online) and 33% (23–44%) in men (Figure 5D, see Appendix online). The overall pooled prevalence of life-time smoking was 18% (12–24%) (Figure 2D). The pooled prevalence of current smoking was 5% (3–6%) in women (Figure 5B, see Appendix online) and 22% (16–28%) in men (Figure 5E, see Appendix online). The overall pooled prevalence of current smoking was 12% (10–15%) (Figure 2E). The pooled prevalence of regular smoking was 1% (1–2%) in women (Figure 5C, see Appendix online) and 11% (7–15%) in men (Figure 5F, see Appendix online). The overall pooled prevalence of regular smoking was 5% (3–7%) (Figure 2F). The pooled prevalence of current smoking in both genders was higher in 2011–2018 than in 2001–2010 (2% vs 1% among women and 24% vs 20% among men) (Figure 6B and 6D, see Appendix online). However, the pooled prevalence of life-time smoking was lower within the more recent period than in the previous years. This increase was greater among men (10% vs 13% among women and 29% vs 49% among men) (Figure 6A and 6C, see Appendix online). We did not perform the subgroups analysis for regular smoking because of the insufficient number of studies. The pooled prevalence of all types of smoking in both genders was higher in large cities than in small cities (Figure 7, see Appendix online). The only exception was a higher prevalence of current smoking among men in small cities than in large cities (Figure 7E, see Appendix online).

General population

The studies on smoking prevalence in the general population were heterogeneous (Table 3 , see Appendix online); therefore, we could not estimate the pooled prevalence. The prevalence of current smoking among the age group 15–24 years was reported to be 3.3–13.9%. The

prevalence of regular smoking among this age group varied from 1.0% to 10.2%. The asymmetry in the funnel plots was indicative of some degree of publication bias (Figures 8 and 9, see Appendix online).

Discussion

The current systematic review and meta-analysis indicated that the prevalence of cigarette smoking was high among Iranian adolescents and young adults. The pattern of smoking differed among different age groups. The prevalence of smoking among male university students was markedly higher than among male high school students, whereas in female students, the difference between the 2 groups was negligible. In both age groups, male students had a higher prevalence of smoking than female students had. Furthermore, the prevalence of smoking was higher in large cities compared to small cities. Around 25% of Iranian male high school students experienced smoking during their life time. The prevalence of current and regular smoking was 9% and 5%, respectively, among male high school students. In male university students, a third had experienced life-time smoking; more than 20% of students were current smokers and 10% were regular smokers. Around 13% of female high school students and 11% of university students had ever smoked cigarettes. The prevalence of current smoking in female university students was only 2% more than among high school students (5% vs 3%), and regular smoking in both age groups was similar (1%).

According to the findings of a nationwide approach to surveillance (STEPS) survey in the Islamic Republic of Iran in 2016, the prevalence of current smoking among adults aged 18–24 years was estimated to be 14% for men and 2% for women. In the current study, we showed that among university students, 22% of men and 5% of women currently smoked cigarettes. Comparison of our findings with those of the STEPS survey indicate that the prevalence of current smoking among university students is higher than in the general population. Furthermore, a meta-analysis in the Islamic Republic of Iran in 2013 indicated that 19.8% of male and 2.2% of female university students smoked cigarettes (113). However, the main drawback of that meta-analysis is the lack of a clear definition for smoking, which limits any comparison. The prevalence of current smoking in young adults varies in different regions of the world. For instance, in Western Cape, South Africa, the prevalence for men and women was 22% and 14.8%, respectively (114). According to the 2013 National Health Interview Survey in the USA, the prevalence of current cigarette smoking in men and women aged 18–25 years was approximately 22% and 15%, respectively (115). Furthermore, in the Eastern Mediterranean Region, the prevalence of current cigarette smoking in university students was 11% in Pakistan (116), 18% in Palestine (32.8% in men vs 3.6% in women) (117) and 24.7% in the Syrian Arab Republic (39.82% in men vs 5.54% in women) (118). The global estimates in health profession students showed that the prevalence of smoking varies by region. The highest prevalence was reported in Europe, where the prevalence in men ranged from 36% among nursing students to 55.8% among pharmacy students. In the Eastern Mediterranean Region, the prevalence varied from 3% to 6% in women and 20% to 28% in men (119). Compared with these national reports, in our study, the prevalence of smoking among Iranian students, especially women, seems to

be lower than in European countries, but similar to most Eastern Mediterranean countries. One explanation for the lower prevalence of cigarette smoking in the Eastern Mediterranean Region, including the Islamic Republic of Iran, may be the increasing tendency of young adults to try other types of tobacco, mainly water pipe smoking. In the Islamic Republic of Iran, the prevalence of life-time and current water-pipe smoking among students was 42% and 19%, respectively (120). Lack of awareness of the negative effects of water-pipe smoking and lower stigma toward its use are factors that explain this pattern (121).

In male high school students, the prevalence of current cigarette smoking was lower than among university students (9% vs 22%). However, for girls and women, the prevalence was similar among high school and university students (3% vs 5%). A meta-analysis of 12–15-year-old adolescents of 68 low- and middle-income countries indicated that 13.3% of boys and 6% of girls currently smoked cigarettes (11). The highest prevalence for boys was for the Western Pacific Region (17.5%) followed by the Eastern Mediterranean Region (13.3%), whereas for girls, the highest prevalence was reported in the Western Pacific Region (10.0%) and Region of the Americas (8.7%). The corresponding prevalence in the Eastern Mediterranean Region for girls was estimated at 3.8%, which was close to our estimate (11), while the prevalence of current smoking among Iranian high school boys (9%) seems to be lower than the overall estimate in the Eastern Mediterranean Region (13.3%).

We showed that in both age groups, male students smoked cigarettes more than female students smoked. The sex ratio varied from 2 (for life-time smoking in high school) to 11 (for regular smoking among university students). Global estimates indicate that men smoke 5 times as much as women smoke (124). A variety of national studies have confirmed the higher prevalence of smoking in Iranian men (122, 123). The lower prevalence of cigarette smoking among women may be due to greater stigma that exists toward smoking among women.

We found that the prevalence of smoking was higher in large cities compared to small cities. Despite a slight increase in prevalence of smoking within more recent years, the prevalence of life-time smoking decreased. This decrease may have been due to several factors including increasing awareness of young people about tobacco hazards, tendency to use other drugs, including hookah, and success of tobacco control programmes. In the Islamic Republic of Iran, it is culturally inappropriate for girls to smoke (124). Around 15% of the 80 million Iranian population is aged 15–24 years and half of them are men. Among > 2 million high school students and ~4 million university students, more than half are male (125,126). Extrapolating our results to these populations reflects the alarming rate of cigarette smoking among Iranian adolescents. A growing body of evidence indicates that smoking initiation at lower ages is strongly related to subsequent smoking behaviour, including regular and heavy smoking in adulthood, which highlights the importance of early interventions for smoking prevention (127). According to the World Health Organization report on the national tobacco control programme,

the Islamic Republic of Iran has performed well compared to other countries in the Eastern Mediterranean Region in many aspects of smoking control (including monitoring and smoke-free policies, smoking cessation programmes, health warnings on cigarette packages, and mass media and advertising bans for tobacco use). However, more action is needed in the field of taxation and affordability of tobacco, especially in large cities (128,129). The nature of the tobacco epidemic requires a comprehensive prevention and intervention plan focusing on the community as well as schools. A variety of strategies should be reinforced to reduce the prevalence and health effects of cigarette smoking in adolescents. Existing laws to restrict access to tobacco products by banning sales to minors should be reinforced. Effective and comprehensive educational programmes on the health risks of tobacco consumption and exposure to tobacco smoke should be established in schools and universities. Additionally, tobacco cessation facilities should be extended to all areas. Involvement of nongovernmental organizations and parents in tobacco control programmes as well as licensing the distribution of tobacco products in order to decrease availability are other strategies that should be strengthened by policy-makers.

Our findings should be interpreted by taking into consideration the limitations of the study. There were high variability and heterogeneity among studies regarding the sampling method, study instruments and reporting of variables. For example, despite the use of random sampling in all recruited studies, the variations in the sampling approach among studies were indicative of possible selection bias. Similarly, the different instruments used in the studies were suggestive of some degree of information bias. While definitions regarding life-time smoking were consistent among the included studies, there was some degree of heterogeneity regarding the definition of current and regular smoking. For example, in most studies, an exact definition of current smoking was not used, but in a small number of studies, it was measured objectively. Therefore, our results should be interpreted with caution. Furthermore, due to the lack of comprehensive databases, we did not have access to grey literature. Nevertheless, this review is important as it provides a comprehensive picture regarding the prevalence of smoking among Iranian young people that could serve as the foundation for policy-makers to develop and implement effective smoking prevention and intervention programmes.

Conclusion

Cigarette smoking is notable among Iranian young adults in a way that boys and university students are affected more. Prevention programmes in high schools and universities should focus on information, education and communication, and current policies on tobacco control should be reinforced.

Funding: None.

Competing interests: None declared.

Prévalence du tabagisme par cigarettes chez les adolescents et les jeunes adultes iraniens : revue systématique et méta-analyse

Résumé

Contexte : Le tabagisme par cigarettes est un facteur de risque partagé pour un grand nombre de maladies.

Objectifs : Estimer la prévalence du tabagisme chez les adolescents et les jeunes adultes iraniens.

Méthodes : Dans la présente revue systématique et méta-analyse, nous avons effectué des recherches dans PubMed, Web of Science, Embase, Scopus et des bases de données nationales de janvier 2001 à décembre 2018. Les études transversales rapportant la prévalence du tabagisme par cigarettes chez les lycéens, les étudiants ou dans la population générale âgée de 14 à 30 ans étaient éligibles. Des données sur la prévalence du tabagisme, l'âge et le sexe des sujets, la taille de l'échantillon, la date et le lieu des études ont été extraites par deux analystes indépendants.

Résultat : Nous avons inclus 99 études dans notre analyse. Pour les lycéens, la prévalence globale vie entière du tabagisme était de 13 % chez les filles et de 23 % chez les garçons. Pour les étudiants universitaires, la prévalence vie entière était de 11 % chez les filles et de 33 % chez les garçons. La prévalence cumulée du tabagisme actuel et régulier chez les garçons du secondaire était de 9 % et 5 %, respectivement, contre 3 % et 1 % chez les filles. La prévalence cumulée du tabagisme actuel et régulier chez les étudiants universitaires de sexe masculin était de 22 % et 11 %, respectivement, contre 5 % et 1 % chez les étudiantes. La prévalence du tabagisme actuel dans la population générale âgée de 15 à 24 ans était comprise entre 3,3 % et 13,9 %, La prévalence du tabagisme régulier au sein de cette population était de 1,0 % à 10,2 %.

Conclusion : Le tabagisme par cigarettes est très répandu parmi les jeunes adultes iraniens, en particulier les garçons et les étudiants. Nos conclusions appellent au renforcement des politiques de prévention et de lutte antitabac dans l'ensemble des écoles et des universités iraniennes.

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من تعاطي التبغ ومكافحته في جميع المدارس والجامعات الإيرانية .

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