The prevalence of cigarette smoking among students of Iran's universities: A systematic review and meta-analysis

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Background: Studentship period is a time when most behavioral traits are being created and fixed; this is a special time when students may start smoking. Thus in the present research, prevalence of smoking in university students in Iran has been evaluated. **Materials and Methods:** Having extensively explored Iranian and International databases (SID, Iranmedex, Magiran, Medlib, Irandoc, Pubmed, Google Scholar, and WHO) with broad keywords, we looked for relevant papers about the frequency of cigarette smoking among students in Iranian universities in recent years. We recruited only those primary papers with required information and acceptable methodology by reviewing their titles, abstracts, and full-texts. The main data about the prevalence of smoking, age and sex distribution of subjects, sample size, date, and location of studies were extracted from the full-text of eligible papers. **Results:** A total of 22 valid articles were selected. Among the findings of these studies, the lowest and highest prevalence of smoking among male students was 13.4 and 39.9, respectively, while it was 0.7 and 25.5%, respectively, among female students. Meta-analysis results reveals that smoking frequency among male and female students in Iran's universities is 19.8% (17.7-21.9) and 2.2% (1.4-3.02), respectively. **Conclusion:** The variation of smoking in students in different universities shows that the tendency of smoking varies in different locations. Furthermore, compatible with the prevalence of smoking in the general population in Iran, female students smoke much less than male students.

Key words: Cigarette, Iran, meta-analysis, systematic review, students

INTRODUCTION

Smoking is considered as an important risk factor contributing to global burden of diseases specially in chronic noncommunicable diseases such as cardiovascular and respiratory diseases, cancers, and stroke and is the most common preventable cause of mortality in the world.[1-3] According to estimations of the World Health Organization (WHO), mortality, which results from smoking, will decrease by 9% between 2002 and 2030 in the developed countries, while it will double in the developing countries.[4] Similarly, another estimation of WHO in the 1990s, indicated that 3 million people die of smoking annually; 2 million in the developed countries and 1 million in the developing countries. It is, however, predicted that it will increase by 10 million deaths in 2020-2030; 3 million in the developed countries and 7 million in the developing countries. According to this report, a person dies due to smoking in every 10 seconds and this will increase to one death in every 3 seconds in 30-40 year's time.[5]

Smoking is a behavior that generally starts in adolescence. About 80% of smokers have smoked before the age of 18 years, however, according to an Iranian study, this figure is 60% in Iran.[6,7]

Student period is a time when most behavioral traits are being created and established;[8] this is a special time when students may start smoking and this socio-cultural problem (e.g., peer pressure) threatens the health of young people.[7-9]

Various studies have reported the prevalence of smoking among university students of Iran at the considerable amount of 10%.[10-13] According to Ministry of Health, only 10.7% of people aged 15-24 (age group of most of university students) were smokers in 1990, while it was 17.1% in 2000.[10] Hasanzade et al. (in Mashhad) showed that 10.9% of students (15.45% males and 1.9% females) are smokers; it was 13% in the Zohoor's study (in Kerman), and 30.8% in the Teraghghijah study (in Iran).[9-11] The mentioned studies show that prevalence

of smoking among different groups of the society including students is increasing and starting age of smoking is decreasing.

Since students constitute a considerable part of the society and since number of students are increasing in universities, smoking must be carefully considered in this group; thus, determining prevalence of smoking in this group is essential for planning and selecting suitable intervention strategies. Systematic review and meta-analysis as one of the study methods with valid results is precious for policy making and decision making.

We found out in our literature review that several studies, with various sample size, had reported smoking among university students in Iran; if results of these studies are taken into consideration, valuable information will be extracted. Accordingly, in this study we aimed to estimate prevalence of smoking among university students of Iran, applying systematic review and meta-analysis approach and taking into account heterogeneity issues.

MATERIALS AND METHODS

The present research is a systematic review and meta-analysis of prevalence of smoking among university students of Iran.

Search strategy

In this research, studies published electronically between April 2001 and September 2011, articles published in domestic and foreign journals as well as those available in Persian data bases of SID (www.sid.ir), Iranmedex (www.iranmedex.com), Magiran (www.magiran.com), Medlib (www.medlib.ir), Irandoc (www.irandoc.ac.ir), and English database of Pubmed, Google Scholar, and WHO site were used. In this search, Persian and English keywords and probable combination of main and important words were searched. The search had been done with the keywords of cigarette, smoking, tobacco, nicotine, Iran/Iranian and with names of provinces and conjunctions "and/or". The Persian keywords were equivalent to their English counterparts and all probable combinations were considered. This search was carried out in October 2011. Also, reference list of published studies was evaluated to increase sensitivity and to select more studies. Search evaluation was done randomly by an independent researcher and it was confirmed that no studies were excluded.

Studies selection

Entire text or summary of all searched articles, documents, and reports were extracted. After reviewing and studying titles of documents, the repeated items were excluded; then, texts of articles were carefully studied by researchers and the related articles were selected and irrelevant ones were excluded.

Quality evaluation

Having determined the related studies in terms of titles and contents, a checklist, which was used in previous study,[14] was applied to evaluate the quality of documents; objective of every research, study method, sample size, sampling method, data collection tool, variables evaluation status, studied target group, and analysis status were examined using 12 questions (one score for each question).

According to this checklist, maximum score is 12 and minimum acceptable score is 8.[14] Finally, the articles, which obtained the minimum score and more, were selected and the related information was extracted and analyzed.

Studies inclusion criteria

All Persian and English studies that obtained the necessary score and which determined smoking prevalence among university students of Iran were included.

Studies exclusion criteria

After reviewing and examining the articles or abstract of articles and after recognizing disagreements, the following studies were excluded:
a. Studies that have exclusively evaluated the relationship between smoking in students and some factors and have not examined prevalence of smoking,
b. Studies that have not applied random sampling approach,
c. Papers that have not obtained the minimum score of 8,
d. Papers, documents, and reports that were published before 2001, and
e. Studies that have been carried out qualitatively.

Data extraction

Data was extracted by researchers in terms of article title, first author, study year, total sample size, sample size according to gender, research method, research place, total prevalence of smoking, prevalence of smoking in terms of gender, starting age of smoking, beginning of smoking at university, smoking criterion, and average age of smokers. Data was entered in Excel spreadsheet.

Analysis

Standard error of prevalence rate of smoking in every study was calculated based on binomial distribution formula. Finally, heterogeneity index was determined using Q test and I^2 index. According to heterogeneity results with meta command in meta-analysis, random effect model was used to estimate smoking rate among all the students, as male and female students as well. In order to minimize the random variation of estimations of studies, we used

Bayesian adjusted estimation in the forest plots. Finally, effects of variables, which were determined as probable sources of heterogeneity in the study, were examined using meta-regression method. Point estimation of prevalence of smoking with confidence interval of 95% was calculated in forest plots; in this plot, square size represents weight of every study, which had positive association with the sample size and lines in both sides of it represent confidence interval of 95% of the reported prevalence, and the diamond below the graph shows the pooled average. Also, we conducted sensitivity analysis to estimate the effect of each individual study in the pooled prevalence estimation.

Analysis was carried out using Stata ver11 (Stata Corporation, College Station, TX, USA).

RESULTS

Thirty-eight studies were entered for text appraisal,[7-11,15-47] of which 22[7-11,15-31] qualified articles were finally selected [Figure 1, Table 1]. Surprisingly 19 studies have not explained the meaning of "being a smoker" in their methodology. A total of 14 articles have been mainly carried out among students of Medical Science Universities and 63.6% of these studies were carried out after 2007. Overall sample size of all 22 articles was 23,027 persons. Four studies only focused on male students and the remaining 18 focused on both the genders. A total of 10,837 males and 11,196 females were entered in this meta-analysis. A total of 19 studies reported smoking in males and 15 studies reported smoking in females. Seven studies reported that the average

age of participants was 21.5 years. Eight studies reported that the average age of students who started smoking was 18.1 years. Of only two papers, which studied the time when the students started smoking, one study reported that 43.5% started smoking after entering university, while the other study reported it as 50%.

Among studies that entered this meta-analysis, the highest smoking level was found in a study carried out by Mortazavi in 2009 on 870 students (31.5%). The lowest rate, however, was found in a study carried out by Shojaei in 2008 on 538 students (6.2%) [Table 1].

The highest smoking rate in males was 39.9% reported (of all 870 participants in both genders and in all universities of Birjand in 2009) by Mortazavi and the lowest rate was 13.4% reported (of all 941 participants in both sexes and in Tehran University of Medical Science in 2010) by Fayazbakhsh [Table 1].

Moreover, among the studies entered to this research, the highest and lowest prevalence of smoking among female students of Iran was 25.5% (Mortazavi's study with 870 sample size in both sexes and in all the universities of Birjand in 2009) and 0.7% (Ahmadi's study with sample size of 532 students in both sexes and in Shiraz University in 2002), respectively [Table 1].

Results of heterogeneity evaluation of studies revealed that [Table 1] heterogeneity is high among studies. Overall estimation of smoking among students in Iran's universities
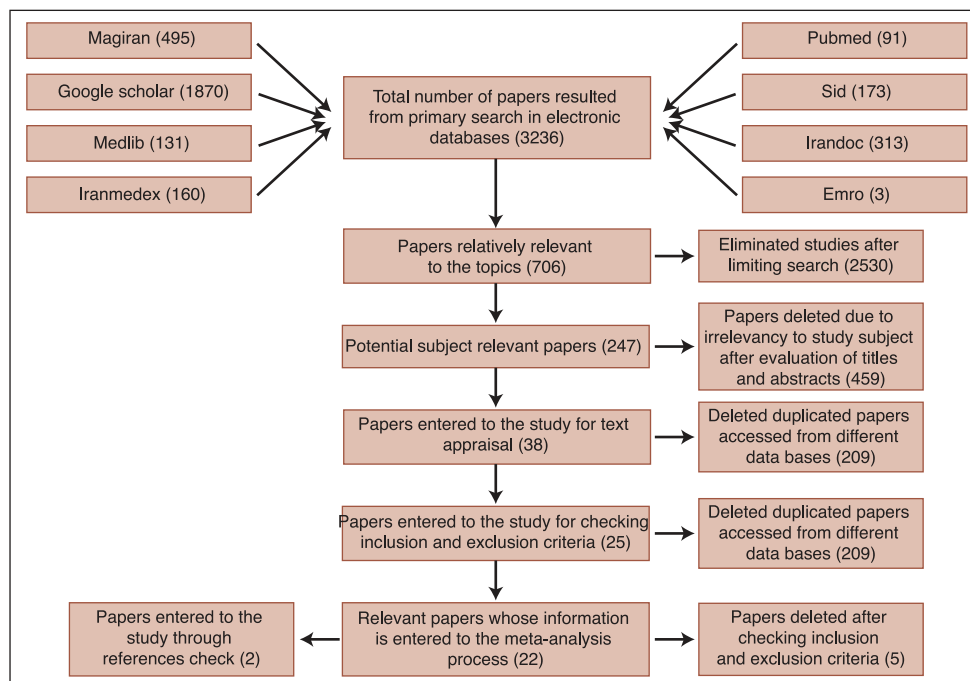

Figure 1: Papers search and review flowchart

**Table 1: Description of the studies included in the meta-analysis**

ID	First author	Publication year	Study population	Location of study	Smoking definition used	Score quality	Sample size			Prevalence		
							Total	Male	Female	Total (%)	Male (%)	Female (%)
1	Nazary[16]	2010	Medical sciences	Semnan	Every-day and occasional smokers	8	320	320	–	14.4	14.4	–
2	Shoja[15]	2010	Medical sciences	Gorgan	At least smoke 100 cigarette	9	538	176	362	6.2	17.3	0.8
3	Majidpoor[8]	2006	Medical sciences	Ardabil	Indeterminate	9	1106	326	780	7.4	22	1.2
4	Abedini[17]	2008	Medical sciences	Bandarabbas	Indeterminate	8	200	75	125	9	20	2.4
5	Roohafza[18]	2011	Medical sciences	Isfahan	Indeterminate	9	812	361	451	9.5	18.3	2.5
6	Taremeyan[19]	2008	All types	Tehran	Indeterminate	9	2997	1133	1864	11.2	–	–
7	Heyderi[7]	2008	All types	Tehran	At least smoke 100 cigarette	8	1271	1271	–	16.9	16.9	–
8	Divsalar[20]	2008	All types	Kerman	Indeterminate	10	1677	755	922	11	21.5	2.4
9	Dehghani[21]	2010	Medical sciences	Yazd	Indeterminate	8	534	×	×	14.4	–	–
10	Ramzani[22]	2010	All types	Kerman	Indeterminate	8	460	×	×	12.1	–	–
11	Seyam[23]	2005	All types	Rasht	Indeterminate	8	800	800	–	24.13	24.13	–
12	Teraghghyja[11]	2010	All types	Overall	Indeterminate	10	4483	1784	2699	15.3	15.9	15
13	Divsalar[24]	2010	Medical sciences	Kerman	Indeterminate	10	1065	244	821	8.3	30.7	1.7
14	Fayaz-Bakhsh[25]	2010	Medical sciences	Tehran	Indeterminate	10	941	456	485	6.99	13.38	1.24
15	Hashemi[27]	2001	Medical sciences	Yasoj	Indeterminate	8	206	206	–	18.4	18.4	–
16	Mortazavi[31]	2009	All types	Birjand	Indeterminate	8	870	361	509	31.5	39.9	25.5
17	Hasanzadeh[9]	2002	Medical sciences	Mashhad	Indeterminate	10	1086	718	368	10.9	15.45	1.9
18	Zohoor[10]	2002	All types	Kerman	Indeterminate	9	993	492	501	13.4	21.7	5.2
19	Mohtashamiry[30]	2006	Medical sciences	Rasht	Indeterminate	8	531	266	265	16.6	26	7.1
20	Shamsipoor[26]	2010	Medical sciences	Tabriz	Indeterminate	9	539	246	293	8.9	18	1.4
21	Ahmadi[28]	2002	Medical sciences	Shiraz	Indeterminate	9	532	261	271	8.7	16.8	0.69
22	Masjedi[29]	2003	Medical sciences	Tehran	Indeterminate	9	1066	586	480	16.3	25.6	5
Total	Pooled estimate	–	–	–	–	–	23027	10837	11196	13.8 (11.2-16.3)	20.9 (18.3-23.6)	3.7 (2.3-5.1)
	Heterogeneity test	Chi-square (Q)	–	–	–	–	–	–	–	768.6 (P=0.0001)	156.5 (P=0.0001)	212.3 (P=0.0001)
		I-Square	–	–	–	–	–	–	–	97.3	89.1	93.9
Total (after removal of the outlier data)	Pooled estimate	–	–	–	–	–	21357	9343	6124	11.6 (10.1-13.1)	19.8 (17.7-21.9)	2.2 (1.4-3.02)
	Heterogeneity test	Chi-square (Q)	–	–	–	–	–	–	–	239.3 (P=0.0001)	76.8 (P=0.0001)	56.7 (P=0.0001)
		I-Square	–	–	–	–	–	–	–	92.1	82.1	78.8

is 11.6% (CI = 0.1-13.1) according to the random effect model. Baysian analysis indicated that the adjusted prevalence of smoking in primary studies were between 0.95% and 4% for female students, between 14.21% and 26.8% for male students, and between 6.7% and 15.7% for all the students [Figures 2-4].
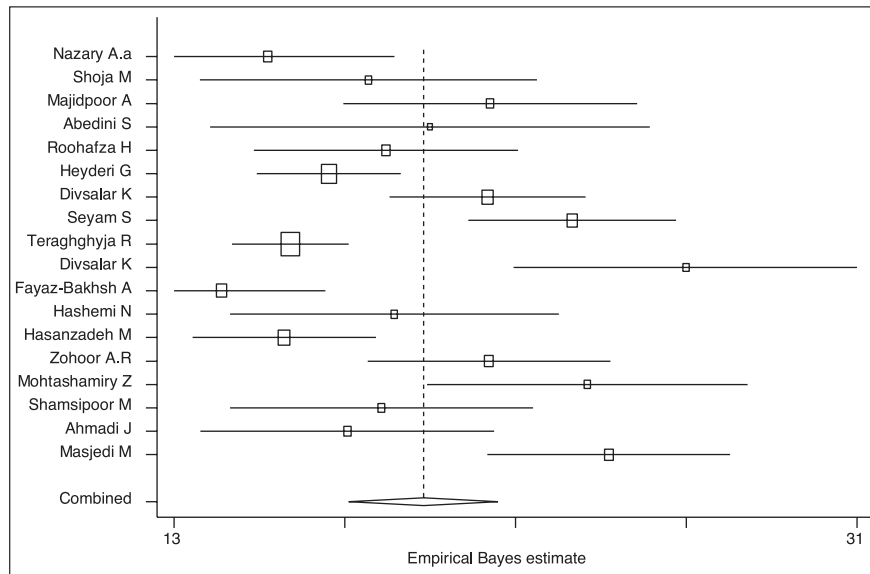
Figure 2: Distribution of the adjusted prevalence of smoking among men in each study and overall. This chart shows that the range in prevalence of smoking among male students of college in each study is 14.21-26.8% after removal outlier data, pooled estimate: 19.8% (17.7-21.9), I²=82.1%
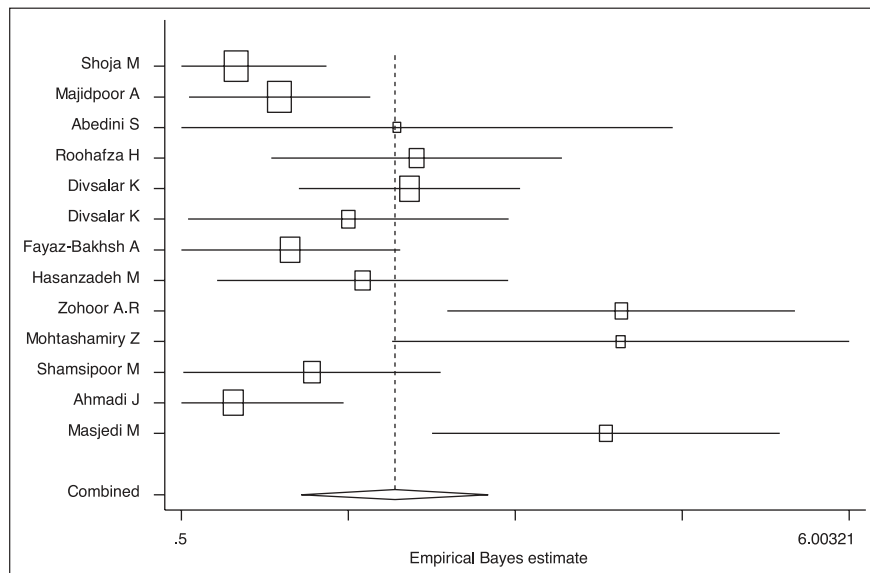
Figure 3: Distribution of the adjusted prevalence of smoking in females in each study and pooled. This chart shows that the range in prevalence of smoking among female students of college in each study is 0.95-4% after removal outlier data, pooled estimate: 2.2 (1.4-3.02), I²=78.8%

In addition, frequency of smoking among the male and female students of Iran is 19.5% (17.4%-21.6%) and 2.2% (1.4%-3.02%), respectively.

Sensitivity analysis indicated that elimination of any individual studies did not change the pooled prevalence estimation significantly (coefficient = 2.4, P = 0.5). To examine factors contributing to heterogeneity, variables of average age and date of publication of the study entered in the meta-regression model as the factors causing heterogeneity; none of them could justify heterogeneity among the mentioned studies [Table 2]. Among the studies, which were entered in this meta-analysis, prevalence of

smoking reported among both genders in Mortazavi's study was much more than other studies that was carried out in medical sciences universities, public nonmedical science universities, and Azad universities of Birjand, prevalence of consuming some narcotics (cigarette, alcohol, opium, and cannabis) was examined simultaneously.

DISCUSSION

Smoking in male students was 8.9 times more than that in female students and it seems that changes in the recent years has had no significant effect on smoking prevalence in this group.
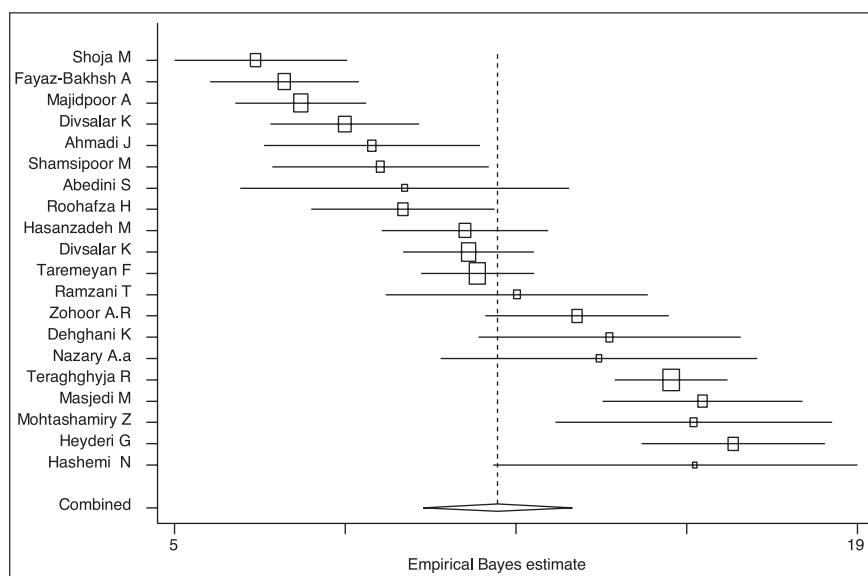
Figure 4: Distribution of the adjusted prevalence of smoking in students of college in each study and pooled. This chart shows that the range in prevalence of smoking among students of college in each study is 6.7-15.7% after removal outlier data, pooled estimate: 11.6(10.1-13.1), I²=92.1%

Table 2: Result of assessment source of heterogeneity with Meta regression

Predictors	Male		Female		Total	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Mean age	-4.6	0.05	0.7	0.3	1.9	0.1
Publication date	0.1	o.8	0.1	0.8	0.2	0.9

According to the Iranian's study of noncommunicable diseases risk factors,[13] prevalence of smoking in men aged 15-64 is 21.7% and in men aged 15-24 it is 7.1%; thus, prevalence of smoking among male students is 12.5% (2.8 times) more than that of their counterparts in the general population.

In studies carried out by Mortazavi,[31] Taraghijah,[11] and Taromian,[19] smoking prevalence was 39.9, 30.8%, and 24%, respectively; results of these three studies was higher (20.3%, 19.2%, and 12.4%, respectively) than the results of the present meta-analysis estimation. The lowest prevalence of smoking in male students among studies entered to meta-analysis was 13.4%, which is 6.2% less than the overall prevalence of smoking in male students as estimated in this meta-analysis.[48] A study on frequency of smoking among university students of 23 countries reported that frequency of smoking varies from 14% in Thailand to 47% in Portugal;[49] this shows that the prevalence of smoking in male students in Iran is closer to the developing countries. In addition, epidemiologic studies have shown a considerable variety regarding prevalence of smoking among student population of various Arabic and eastern Mediterranean countries.[50-58] In these studies, prevalence of smoking in male students of Syria[57] and Jordan[58] was 15.8% and 56.9%, respectively. Ramakrishna et al.[59] reported that prevalence of smoking among male medical students in India was 12.4%.

Since the ratio of female student's population to male is high, examining smoking prevalence in girls separately can reveal more important facts. In the study of risk factors of noncommunicable diseases in Iran,[13] it was shown that smoking in women aged 15-64 was 0.9% and it was 0.3% in women aged 15-24. Thus, prevalence of smoking among female students is 1.3% (2.4 times) more than that in women aged 15-64 and 1.9% (7.3 times) more than that in women aged 15-24. This figure is remarkable considering the number of female students. Smoking prevalence in female students in universities of Thailand, Spain, Syria, Jordan, and India was 2, 46, 3.3, 11.4, and 0.8%, respectively.[49,57-59] Therefore, smoking prevalence in female students of Iran is more than that in their mentioned counterparts. Meanwhile, it seems that the real prevalence of smoking among female students in Iran is higher than the estimated figures because of under reporting and concealment.

Moreover, results of this research show that a lot of studies have been carried out in the field of cigarette epidemiology in recent years. This subject is a turning point for the related organizations and researchers to work in this field; social environment permits them, to some extent, to publish their information in this field. However, most universities of Iran have not paid attention to this subject yet and there is still no information in this field; it makes the conditions more complicated and increases the expenses spent to prevent

this problem. In addition, findings reveal that medical sciences universities have paid higher and more attention to this issue but no significant difference can be found in prevalence level of smoking among female and male students of medical and other universities.

CONCLUSION

Generally, this meta-analysis showed that prevalence of smoking among female and male students of Iran is high in comparison with findings of the mentioned studies especially compared with its prevalence in the general population who are aged 15-24 years. The reasons of this difference are varied and noteworthy. In a study, smoking in students was attributed to factors like stress reduction, life problems, peer pressure, social acceptance, smoking history in family, and parents' low knowledge.[58] Another study, showed that a group of young people start smoking to have transient happiness, to reduce their weakness or due to lack of self-confidence and lack of personality growth; but unfortunately, they get addicted.[15] In addition, effect of friends and people who are a little older than them can be considered as another factor. Since the person wants to be accepted in a group, he is forced to obey the rules determined by the group.[15] Living place, marital status, gender, religion, lack of family support, having friends who smoke, being native or nonnative, and academic progress were among the most important factors reported as the causes of students smoking cigarette and hookah in a study.[11] Generally, among various effective factors mentioned in various studies,[10-13,15,60] the most common factors are having friends who smoke and dormitory life. As students enter university, they start a new life away from their families in a new and unknown environment, and this new period can play an important role in their smoking. Students constitute a huge number of knowledgeable people in the society and will be in charge of future duties in the society. Society and people have high expectations of this educated group and consider them as suitable patterns and models. Moreover, following university students, adolescents choose their lives. Thus, providing a systematic and comprehensive program with high efficiency and applicability, which covers all aspects of student life especially mental, emotional, and social factors, is essential. Moreover, to remove the information shortages mentioned above, it is recommended that a regional sentinel center should be established to perform such studies in order to be used in planning.

Limitations

High variety of data collection instruments, and subsequently, variation in reporting different variables were most important limitations of the present meta-analysis. These made us not to access sufficient data on some of variables.

In addition, the probability of not having access to a part of the studies due to social and political considerations and due to publication bias was another limitation of this meta-analysis.

ACKNOWLEDGMENT

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