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Review Article

Smoking among High School Students in Iran: A Meta-Analysis Study

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Abstract

Objective: Cigarette smoking is an important and preventable risk factor, especially for adolescents and high school students. This issue has become one of the challenges for health system. Thus, the present study aimed to investigate the prevalence of smoking among Iranian high school students.
Method: This systematic review and meta-analysis study was done by searching PubMed, Scopus, Web Science (WOS), Science Direct, SID, and Google Scholar using the following keywords: “student” and “smoking” from 2000 to March 2018. After initial and critical appraisal, data were entered into a checklist and analyzed by a comprehensive meta-analysis software.
Results: The prevalence of smoking was 7.9% by combining the results of 49 articles. Males and females had 10.6% and 4.5% smoking prevalence, respectively. The overall prevalence of smoking was higher in northern areas in Iran (22.4%). Males in the northern (22.4%) and females in western regions (5.3%) were more smokers. There was a significant relationship between the prevalence of smoking with the year of publication, sample size, and age ($P < 0.001$).
Conclusion: In this study, Students' tendency to smoke was different in various regions of Iran, and had a high rate (7.9%). This figure indicates the necessity for planning some coherent educational programs for the public.

Key words: *Cigarette; Iran; Meta-Analysis; Prevalence; Students; Systematic Review*

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Smoking, one of the most important health threats, kills millions of people annually. As reported in 2016, there were more than 7 000 000 victims of tobacco-related illnesses (1). It is estimated about 80% of deaths will be related to smoking and tobacco in 2030, and the current trend of death is continuing (2, 3). Worldwide, 1852 billion dollars are the annual cost for smoking (4), and more than 150 billion dollars are spent for health-related problems due to smoking (5). In Iran, approximately 1740 million dollars is spent on smoking each year (6), and 5.220 billion dollars is dedicated to cure tobacco side effects in the health system (6).

The prevalence of smoking among adolescents is increasing (7). The negative effects of smoking on health have fully been documented, however, adolescents and young adults perform other high-risk behaviors that accompany smoking, causing excessive risks (8, 9). Smoking is coupled with bowel disorder, chronic obstructive pulmonary disease, cardiovascular malfunction, cancer risk, and increasing in severity of respiratory illnesses (10-14). It accounts for 71%, 42%, and 10% of lung cancer, chronic respiratory diseases, and cardiovascular disease, respectively (15). Students constitute a crucial part of the population (16), thus, smoking among this group has attracted more attention from the World Health Organization (WHO) (17).

Adult smokers commonly start smoking when younger than 18 years, a critical period for preventing smoking (18). There are various findings on the prevalence and factors of smoking among Iranian students. Roohafza et al (2018) in Isfahan, Iran, showed that the prevalence of smoking was 17.5% and the common factors were depression, attitude toward smoking acceptance, and risky behaviors (19). In another study by Karimi et al (2018) in Tabriz, Iran, the prevalence of smoking among boys and girls was 22.6% and 17.2%, respectively, and age, living with parents, smoking friends and family members, risk-taking behaviors, self-harm, attitudes, and positive thinking about smoking were significant factors correlated with smoking (20). In another study by Nosrat Abadi et al (2017), the prevalence of smoking among students was 33.4%, and an inverse correlation between smoking and emotional appraisal and mindfulness was found (21).

The age of smoking is considered as one of the most important determinants of dependence on tobacco and the possibility of not-quitting smoking, which maintains the risk of unintended health outcomes. Those who start smoking during adolescence are among more heavy smokers during adulthood, thus, they have the highest mortality rate due to smoking. Therefore, the best time to take the necessary measures and implement preventive strategies for smoking is in adolescence period and even before that.

With regard to increasing the prevalence of cigarette smoking among high school students (19-21), as the significant portion of the population, it is suggested that the rate of cigarette smoking be taken into account. Because of the diversity of the studies in Iran, this study was conducted to determine the prevalence of smoking among Iranian high school students.

Materials and Methods

In this systematic review and meta-analysis, the prevalence of smoking in high school students of Iran was investigated. The research question was designed based on the PEO, which is as follows: What is the prevalence of smoking among Iranian students?

Search Strategy

In this study, the articles published from 1998 to March 2018 were investigated. Two researchers (M.N, Ar.A independently searched PubMed, Scopus, Web of Science (WOS), Science Direct, SID, and Google Scholar using the keywords of “cigarette", "tobacco", "students" and "Iran" (both in English and Persian). The search strategy was (((cigarette smoking [Title Abstract]) OR tobacco [Title Abstract]) AND student [Title Abstract]) AND Iran [Affiliation])) Inclusion criteria were descriptive, descriptive-analytical, experimental and modeling studies, and availability of full-text. Case studies, duplicate studies, simple review studies, and unclear method papers were excluded.

Paper Selection and Data Extraction

During the initial evaluation, the title and abstract of the studies were independently assessed by 2 researchers (M.N., A.R.A.), and those that met the inclusion criteria were critically evaluated. If there was any discrepancy, the paper referred to the third researcher (A.A.). The data were entered into a researcher-made checklist, which included (1) study title, (2) first author name, (3) year of publication, (4) date of review, (5) sample size, (7) research tools (8), cigarette prevalence rate (8), and mean age of the sample (SD).

Quality of articles was checked based on the items of STROBE checklist, which is a 22-items checklist that evaluates how the title, summary, methods, results, discussion, and source of study funding are provided. Studies with a score of less than 16 are considered undesirable. If the score is 16 out of 22 points, it is considered to have a good quality (22).

Statistical Analysis

Since the main indicator in this study was prevalence, its variance was calculated through binomial distribution with 95% confidence level. The weighted mean was used to combine the prevalence of different studies. Each study was weighted according to its variance. Given the great differences in prevalence rates across studies (heterogeneity of studies) and the significance of the heterogeneity index, the random effects model was used in the meta-analysis. To analyze data, the comprehensive meta-analysis software (CMA) was used.

Results

In this study, 548 articles were identified. After excluding the duplicates, 240 articles underwent initial evaluation. Of them, 69 were critically appraised, and eventually 49 papers were eligible for data extraction and analysis (Figure 1). A total of 19 studies whose full-text were not available, or whose full text did not mention smoking were excluded.

The results of the Eager test showed that publication bias of the studies was significant (P = 0.002; Z = 2.825). This value is also visible in the funnel plot (Figure 2). Most studies were of medium to high quality. According to the STROBE checklist, 38 of these studies were desirable and 11 were undesirable. The quality of the selected articles is presented in Table 1.

The mean and standard deviation of age was 15.00 ± 1.00 years. The overall sample size was 179 697, with lowest and highest related to Alaeikharayem et al (2010) (23) with 112 people, and Kelishadi et al (2013) (24) study with 13 846 individuals.

According to the random model and statisticsI^2, the overall prevalence of smoking was 7.9% (Q=10270.84, I^2=99.026) (0.068-0.093: 95% confidence interval) (Figure 3), and in males and females was 10.6% (Q=2738.25, I^2=98.466) (0.148-0.155: 95% confidence interval) and 4.5% (Q=1063.54, I^2=98.379) (0.088-0.095: 95% confidence interval), respectively (P < 0.000). The lowest and highest prevalence was found in Mojahed et al (2003) (25), with 4% and Pirdehghan et al (2014) (26), with 38.2%.

The highest and lowest overall smoking prevalence was related to Gilan (28.2%) and Zahedan (1.6%). These rates belonged to males were taken in Yazd (35.2%) and south Khorasan (3.9%), and smoking in females were respectively more prominen in Karaj and Sistan and Baluchestan provinces (Figure 4).

The results of the meta-regression test indicated with increasing mean age (Q = 9364.58; P < 0.001), and year of study (Q = 10270.84; P < 0.001), the prevalence of cigarette smoking was increased, however, this rate reduced with increasing the sample size (Q = 10270.84; P < 0.001).

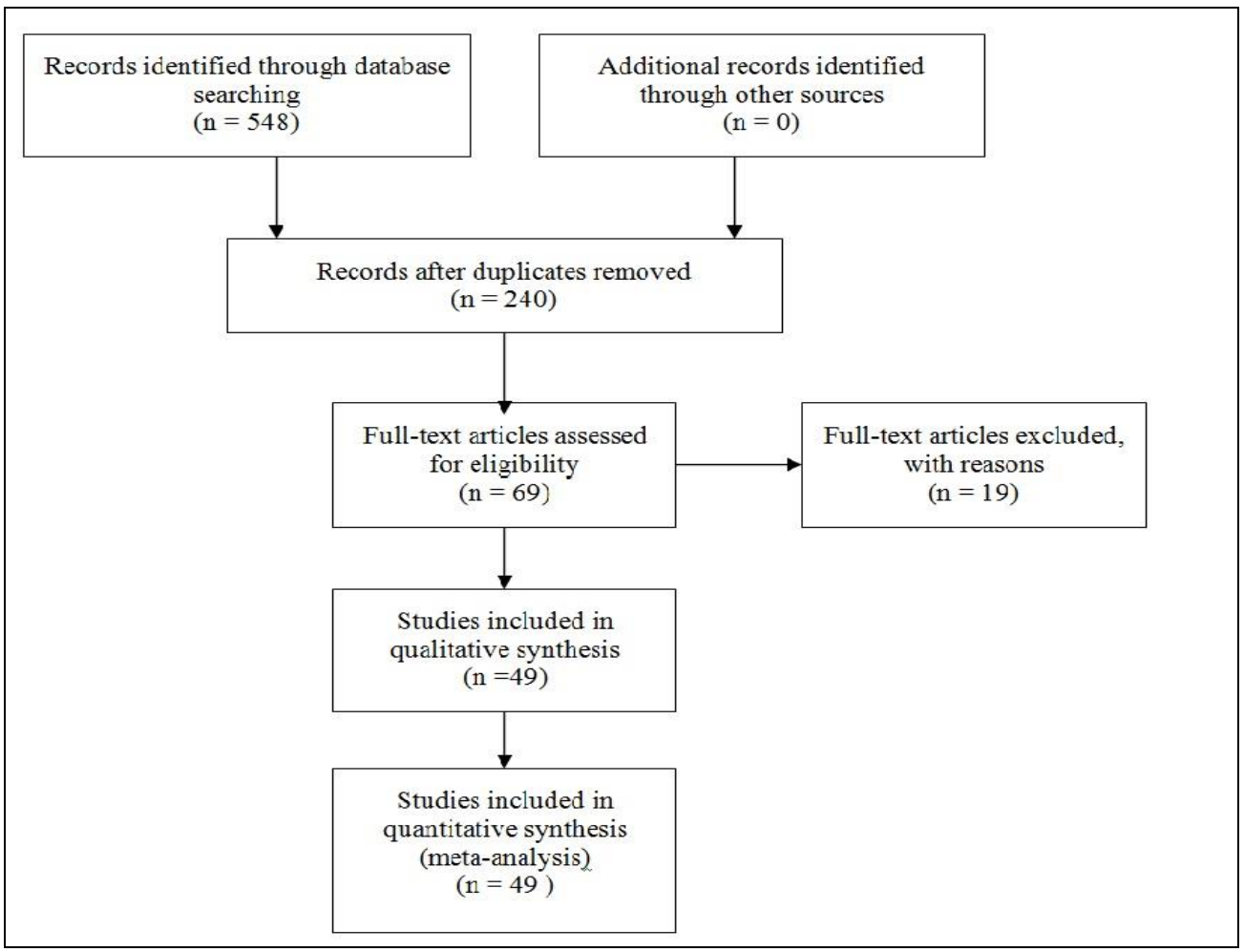

Figure 1. Flow Chart of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and Number of Studies

Table 1. The Characteristics of the Articles Entered into the Meta-Analysis

	Study name	Publication Years	Location of study	The mean age	sample size			prevalence			scope quality
					total	male	female	total	male	female	
1	Ahmadi (44)	2000	Shiraz	16	397	197	200	8.3	15.2	1.5	desirable
2	Ahmadi (45)	2001	Shiraz	13.6	470	470		17.5	175		desirable
3	Alaeikharayem (46)	2010	Karaj	16.50	477	143	112	24.8	31.2	19.2	desirable
4	Alizadeh-Charandabi (46)	2014	Kurdistan	16.00	1524	762	762	9.5	13.1	6.4	desirable
5	Anbarlouei (47)	2017	Tabriz	15.49	1321	584	798	3.5	6.9	0.07	desirable
6	Ataeiasl (9)	2017	Tabriz	15.50	1131	565	566	5.9	10.6		desirable
7	Ayatollahi (48)	2002	Shiraz	16	1132	1132		2.5	2.5		desirable
8	bidel (49)	2013	Ilam	16.20	1000	1000		10.1	10.1		desirable
9	Chaman (15)	2011	Shahroud	16.50	450	450		7.1	7.1		desirable
10	Farshidi (50)	2016	BandarAbbas	16.40	422	422		15.2	15.2		undesirable
11	Gavidel (51)	2008	Nazarabad	17.30	400	400		2.3	2.3		desirable
12	Habibi (52)	2011	Tehran	17.50	4591	2093	2498	8.4	12.1	5.3	desirable
13	Habibi (53)	2011	Tehran	16.30	698			33.5			desirable
14	Heydari (54)	2003	Tehran	16.70	1095	712	383	5	6	2	desirable
15	Heydari (55)	2002	Tehran		1095	712	383	29	31	26	desirable
16	Jamshidi (56)	2016	Ahwaz	16.50	810	400	410	5.4	8.5	3.6	undesirable
17	Karimi (57)	2014	Shiraz	16.11	900	900		19.7	19.7	-	desirable
18	Karimi (20)	2018	Tabriz	15.70	4907	2115	2792	28.7	22.6	17.2	undesirable
19	Karimy (58)	2012	Tehran	16.50	365	365		15.1	15.1		desirable
20	Kelishadi (59)	2004	All acountry	12.10	11966	5928	6038	14.3	18.5	10.1	undesirable
21	Kelishadi (24)	2013	All acountry	12.50	13486	6848	6640	2.6	3.5	1.7	desirable
22	Khajehdaluee (60)	2011	Sarakhs	16.50	943	63	312	1.9	24	13.8	desirable
23	Meysamie (61)	2014	Tehran	16.00	2877	1556	1321	4.4	7	1.4	undesirable
24	Moeini (62)	2010	Hamedan	15.70	1161	587	574	10.2	13.4	6.8	desirable
25	Moghimbeigi (63)	2000	Northwest	17.00	1745	809	936	10.2	12.3	4.9	desirable

26	Mohammadi (64)	2013	Babsler	15.30	450	450		17.2	17.2		undesirable
27	Mohammadi (65)	2015	Kurdistan	13.20	470	470		4.7	4.7		desirable
28	Mohammadpooras (66)	2010	Tabriz	15.70	4903			4.8			undesirable
29	Mohammadpoorasl (67)	2011	Tabriz	15.70	5197			7.1			undesirable
30	Mohtashem amiri (68)	2003	Gilan		1400	1400		28.2	28.2		desirable
31	Mojahed (69)	2003	Zahedan	15.90	500	200	259	1.2	2.3	0.4	undesirable
32	Namakin (70)	2005	Birjand	16.30	1233			3.9	3.9		desirable
33	Nazarzadeh (71)	2011	Zanjan	17.20	1100	112		23.4	23.4		undesirable
34	Nazarzadeh (72)	2013	Zanjan	17.20	1064	762		10.8	10.8		desirable
35	Nosratabadi (21)	2017	Isfahan	16.08	350	698		34.4	34.4		desirable
36	Pasharavesh (73)	2004	Kermanshah	16.36	3150	566	3150	15		15	desirable
37	Pirdehghan (26)	2014	Yazd	17.6	730	464	266	31.1	38.2	18.8	desirable
38	Pirdehghan (74)	2012	Yazd	16.2	450	273	187	23.5	31.8	12.8	desirable
39	Poureslami (75)	2000	Tehran	14	5934		3028	2.4	3.8	1	desirable
40	Rahmanian (76)	2007	Jahrom		1145			10.1			desirable
41	Rakhshani (77)	2010	Zahedan	15.90	380			2.1	2.1		desirable
42	Ramezankhani (78)	2008	Tehran	14.70	4532	2498	2162	1.9	2.7	1	desirable
43	Ramezankhani (79)	2008	Tehran	14.69	4533			25.5			desirable
44	Rezaei (80)	2014	Jahrom	15.70	630	383	615	2.7	3.8	۱٫۶	desirable
45	Roohafza (81)	2015	Isfahan	15.30	5408	381	2704	11.6	20	0.4	desirable
46	Roohafza (19)	2018	Isfahan		5500	410	2250	17.5	8.6	2.6	desirable
47	Sarraf-Zadegan (82)	2004	Isfahan		836		404	2.5	2.7	2.2	undesirable
48	Javadzade (83)	2011	Isfahan	17.20	382	2792	382	7.2		7.2	desirable
49	Ziaaddini (84)	2002	Kerman		860		514	9.7	10.1	9.7	desirable

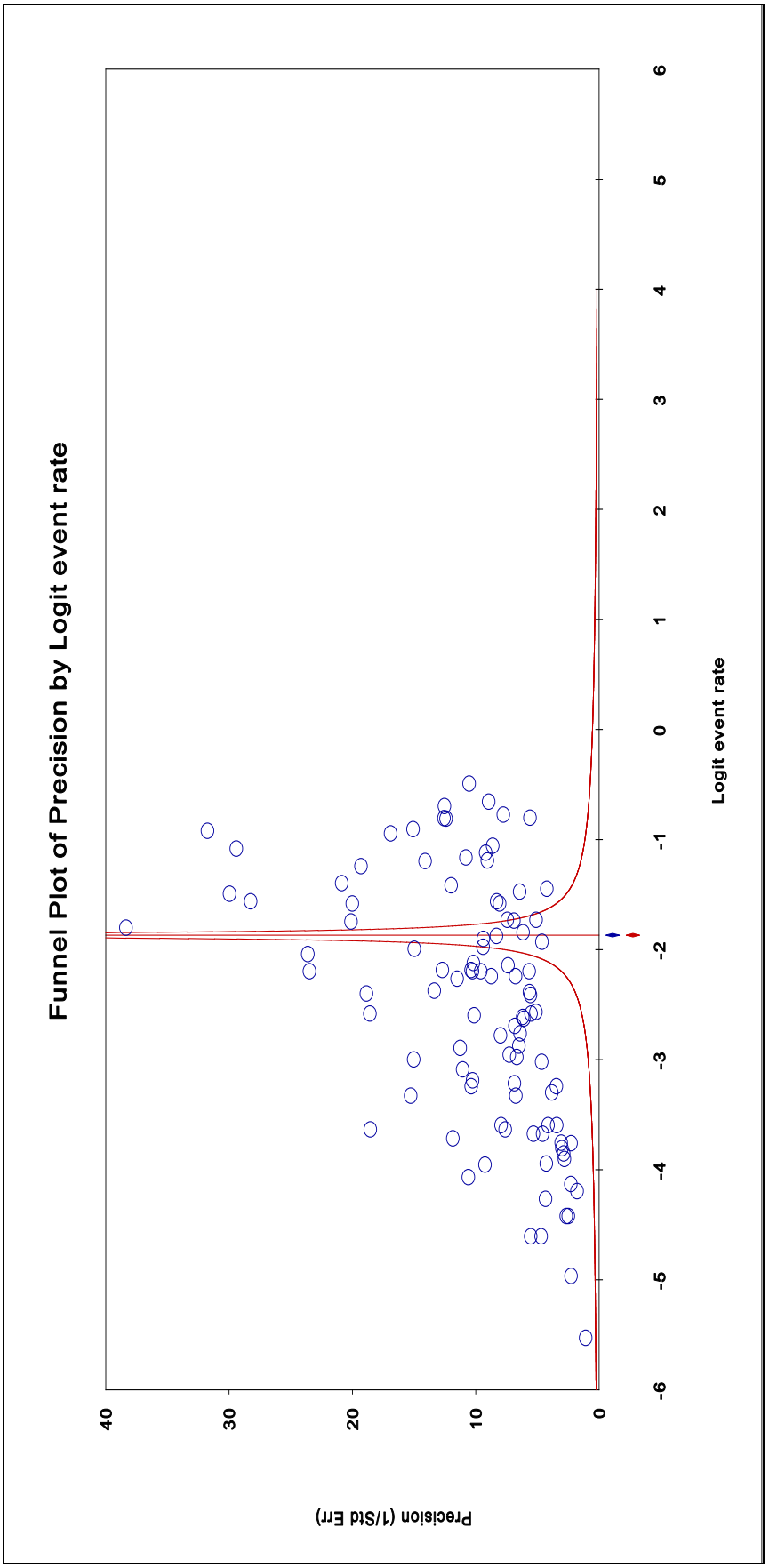

Figure 2.The Funnel Plot for Bias of Published Articles

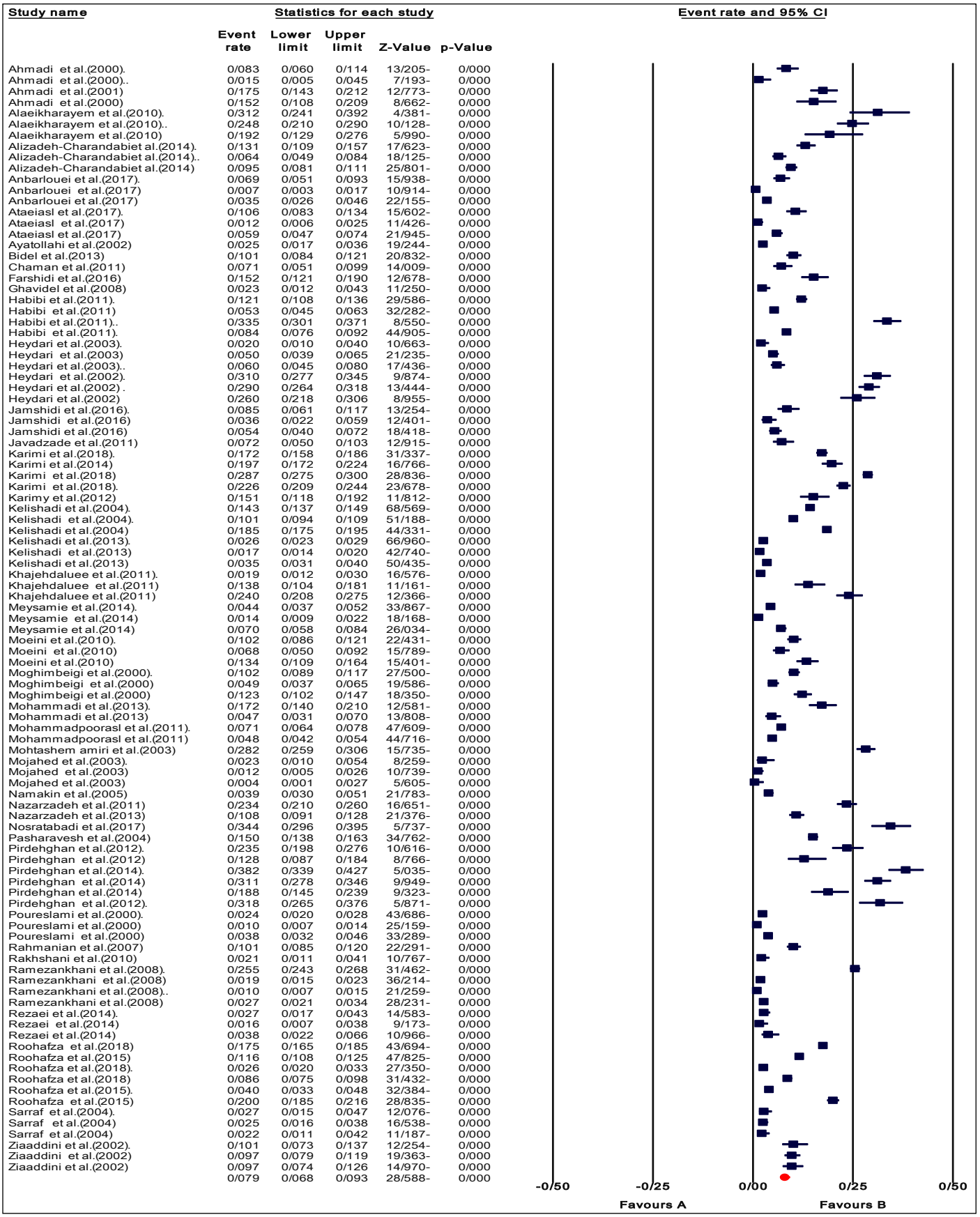

Figure 3.The Overall Prevalence of Smoking of High School Students in Iran

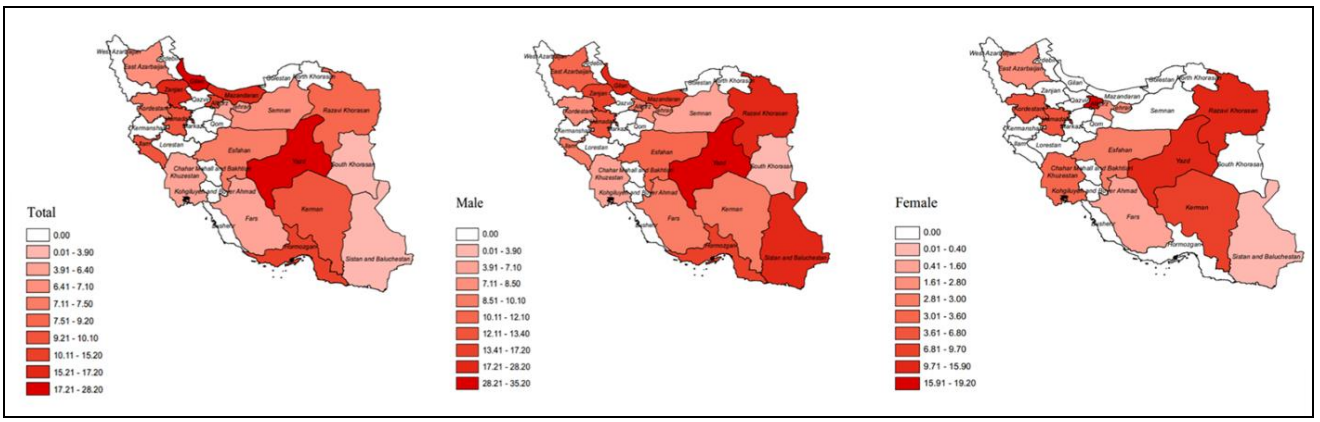

Figure 4. The Overall Male and Female Prevalence of Smoking of High School Students in Different Cities of Iran

Discussion

This study is the third meta-analysis and systematic review of the prevalence of cigarette smoking on Iranian students after Rahimi Moaghar et al (2012) (27) and Ismaili et al (2007) (28) studies. We conducted this study because of the large number of new studies.

In this study, the prevalence of smoking among Iranian high school students was 7.9%. This rate was 21% and 15.7% in Rahimi Moaghar et al (2012) and Ismaili et al (2007), respectively (27,28), indicating a lower incidence in the present study. The reasons for this difference can be explained by the results of new published studies. Another study conducted in 35 European countries (2003) on 16-year-old students showed that the prevalence of lifelong smoking among students was between 50% and 80% (29). Other studies in Cyprus and China reported the prevalence of smoking was 48% and 38% to 58% (30-31). Also, the results of this study showed that students aged 16 to18 years old had the highest rate (10.6%) of smoking. In other countries, the rate in this age range was 16.1% to 18.9% (32-34). In comparison with other studies (29-34), our results demonstrate a lower prevalence of smoking. It seems that with regard to the reducing of the population rate in Iran during recent years by decreasing birth rates, family supervision has improved on children. This would accompany with less smoking and other risky behaviors among high school students, which demanded more studies .

The prevalence of smoking among males was 10.6%. This rate was 30.9% in another study in Iran (27). However, Mehrabi et al (2004) showed that the prevalence of cigarette smoking was 7.1% in men aged 15 to 24 years in Iran (35). Other studies in different nations reported this rate as 2.1% to 31.4% (36-39). The smoking has raised to the maximum level in developed and developing countries, however, it is declining slowly overtime (40). Our study also showed that the incidence of smoking among students has reduced during the 2 recent decades, which could be associated with Iran's Health Ministry planning according to the warnings and concerns of the WHO regarding global increase of smoking (3). In this respect, families as the main pillar of the society could enhance their intimate relationship with children, change their attitudes towards smoking, and use effective management means to reduce adolescent smoking (41). Furthermore, it is most important for schools and the community to have a comprehensive preventive program for smoking among students (42).

Our results represented that the prevalence of cigarette smoking was 4.5% in female students. Mehrabi et al (2005) showed the prevalence of smoking in females aged 15 to 64 and 15 to 24 years was 0.9% and 0.3%, respectively (35), which is lower than our study. Studies in other countries show that female students in Malaysia, Norway, Poland, and Enggland had the prevalence of 2.4%, 0.6%, 9.6% and 7%, respectively (36-38), indicating almost higher prevalence of smoking among Iranian female students compared to their peers. In developed countries, the prevalence of smoking among women is decreasing, and the trend is steadily increasing in developing nations (40). Because of the cultural and social reasons and constrains, it seems that the actual prevalence of cigarette smoking among Iranian female students is higher than the results of the present study. It is believed that the prevalence of smoking in Iranian female students in the last 2 decades has had a declining trend, which shows the correct and coherent planning in this area (3). However, despite the WHO recommendations, smoking rates among Iranian female students are high, but industrialized nations have done a great deal to reduce and prevent cigarette smoking and have successfully implemented programs aimed at improving students' awareness and changing their attitudes and behaviors regarding smoking (43). Given the high prevalence of cigarette smoking by Iranian students, it is needed to implement policies by the government to reduce tobacco use, adopt appropriate and applicable strategies such as advertising, warning videos, enhance cognitive skills, and improve lifestyle (42).

Limitation

Due to the different variations in the prevalence of nicotine use at different times and places, one of the limitations of this study was to present the prevalence of smoking as mean/median. Another limitation of this study was the limitation of Iranian databases that could not combine different keywords. Another limitation of our study is that we specifically looked at the prevalence of smoking, not other tobacco products.

Conclusion

In this study, the prevalence of cigarette smoking was different in various regions of Iran and the overall prevalence was 7.9%, and the prevalence was higher among male students. Given the importance of smoking prevalence among students and the lack of attention to this issue in most Iranian schools, planning for strict preventive measures is highly recommended.

Acknowledgment

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Conflict of Interest

The authors declare that they had no financial and nonfinancial competing interests.

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