Prevalence of cigarette and waterpipe smoking and associated cancer incidence among adults in the Middle East

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Abstract

Background: Smoking is an important risk factor for various diseases, especially cancer.

Aims: To estimate the prevalence of cigarette and waterpipe smoking and its association with cancer incidence in Middle Eastern countries.

Methods: We searched Medline, Google Scholar, and PubMed for original articles published between 2000 and 2020 using a combination of the terms smoking, cigarettes, waterpipe, hookah, tobacco, prevalence, Middle East, and the names of countries in the Middle East. Data were analysed using STATA version 14. We performed a random-effect meta-analysis to obtain pooled smoking prevalence estimates with 95% CI and used the I^2 statistic to assess heterogeneity between studies. We conducted subgroup analyses by sex, country, residence, and age to explore the sources of heterogeneity, and used visual examination of the funnel plot and Egger's test to identify publication bias.

Results: We included 90 articles in this meta-analysis. The pooled prevalence of current cigarette and waterpipe smoking in Middle East countries was 17.41% and 6.92%, respectively. The prevalence of current cigarette and waterpipe smoking among men was significantly higher than among women. In the past decade, the prevalence of cigarette smoking decreased by 7.21% but the prevalence of waterpipe smoking increased by 7.80%. The highest population attributable risk was shown for oesophageal (35.0%), lung (30.50%), and gastric (8.20%) cancers.

Conclusion: Cigarette smoking is still a public health problem especially among adult men in the Middle East. About 30% of oesophageal and lung cancers in this region were attributed to cigarette smoking. The increasing trend in waterpipe smoking during the last decade is of concern. Prevention programmes are needed as a top priority for health interventions.

Keywords: waterpipe, cigarette, tobacco, smoking, Middle East, cancer

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Introduction

Tobacco use is the cause of many preventable diseases and premature death worldwide (*1*). WHO estimates that smoking-related mortality in developed countries will decrease by 9% between 2002 and 2030, while in developing countries, it will double (*2*). Previous studies have shown that smoking and hookah use are associated with various diseases, such as lung cancer, oral cancer, cardiovascular disease, and respiratory disease (*3*). Regular use of tobacco can expose a person to high levels of nicotine and cause dependence (*4*, *5*).

The high prevalence of tobacco use is of concern in Middle East countries, especially among secondary school and university students, and it has been increasing in the last 20 years (*6*, *7*). Smoking prevalence is reported to be higher among men than among women (*8*).

WHO has highlighted measures to reduce tobacco use by 25% by 2025, but the goal may be undermined by the increase in prevalence in different environments (*9*). In the last 20 years, waterpipe smoking has become more common than cigarette smoking among young people and is part of a new global epidemic of tobacco use (*10*). The main factors driving waterpipe use are low cost and availability (*11*). Many people believe that waterpipe smoking is less dangerous than cigarettes and use it in social gatherings (*12*).

The aimsof this meta-analysis were: (1) to estimate the prevalence of cigarette and waterpipe smoking among adults in Middle East countries, and (2) to investigate the population risk of common cancers attributed to cigarette and waterpipe smoking in Middle East countries.

Methods

Search strategy

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to perform this systematic review and meta-analysis (*13*). We searched for relevant English-language articles from 2000 to 2020 in PubMed, Google Scholar, and Medline. The search strategy used a combination of terms: smoking, cigarettes, waterpipe, hookah, tobacco, prevalence, Middle East, and the names of countries in the Middle East.

Selection criteria

Inclusion criteria were: (1) cross-sectional studies published from 2000 to 2020; (2) assessment of the prevalence of current, daily, occasional, and regular waterpipe and cigarette smoking among adults; and (3) reports on prevalence of waterpipe and cigarette smoking different from other forms of smoking. Exclusion criteria were: (1) studies that were not published in English; (2) studies with specific target populations, such as high school students, university students, or pregnant women; (3) studies with no measure of prevalence or data to calculate 95% confidence intervals (CIs); and (4) mixed reports of the prevalence of any tobacco use (cigarettes, water pipe, and smokeless tobacco). We also excluded abstracts for which we could not identify the full text after contacting the corresponding author.

Study selection and data extraction

Two researchers independently screened the titles and abstracts of articles to identify eligible articles. We then assessed the full text of the studies and extracted data using an Excel form. The extracted data included: names of authors; year of publication; study setting (country and location); sampling (age, method, number in population, and sex); and prevalence of cigarette and waterpipe smoking and its 95% CIs. The current smoker category included always, sometimes, occasional, daily, and regular smokers.

Statistical analysis

We performed a random-effect meta-analysis to obtain pooled smoking prevalence estimates with 95% CIs. The I^2 statistic was used to assess heterogeneity between studies. To explore the sources of heterogeneity, we conducted subgroup analyses by sex, country, residence, and age. Visual examination of the funnel plot and Egger's test was performed to identify publication bias. All analyses were conducted using STATA-14 statistical software (Stata Corp., College Station, TX, USA). We calculated population attributable risks for common types of cancer, such as gastric, lung, ovarian, bladder, colorectal, oesophageal, liver, and kidney cancers, related to smoking in Middle East countries among males and females, using the formula: PAR = P (RR – 1) / P (RR – 1) + 1. The relative risk (RR) of cancer caused by smoking was obtained from a previously published meta-analysis, and prevalence (P) was estimated from studies identified in this meta-analysis. RR and 95% CI for gastric, lung, ovarian, bladder, colorectal, oesophageal, liver, and kidney cancers were 1.53 (1.42–1.65), 3.59 (3.25–3.96), 1.05 (0.95–1.16), 1.22 (1.06–1.4), 1.14 (1.10–1.18), 4.18 (3.42–5.12), 1.51 (1.37–1.67), and 1.39 (1.28–1.51), respectively (*14–21*).

Quality assessment

Loney et al. provided a tool for critical assessment of prevalence studies, which was used to assess the quality of the included studies (*22*). This instrument included 8 criteria: methodology (1, design; 2, sampling frame; 3, sample size; 4, outcome measures; 5, measurement; 6, response rate); interpretation of results (7, prevalence with CIs and detailed subgroup analysis); and applicability of results (8, are the study subjects and setting similar to those of interest?). The studies received 1 point for each criterion that was met. High-quality studies were rated 7 or 8, medium-quality studies 4–6, and low-quality studies 0–3.

Ethical considerations

The Ethics Committee of Zahedan University of Medical Sciences approved this study (IR.ZAUMS.REC.1401.214).

Results

We identified 1091 articles from the database search; 442 were duplicates, and 372 were excluded because of unrelated titles and after reading the abstract. We assessed the full text of 277 articles, and 187 were excluded for the following reasons: no cross-sectional study, did not measure prevalence rate, insufficient information, focus on specific populations, reports of prevalence of any tobacco use, and absence of full text. Finally, 90 articles were eligible for inclusion in the meta-analysis. Figure 1 shows the flowchart of the study selection. Most of the studies were conducted in the Islamic Republic of Iran (n = 33), Jordan (n = 12), and Saudi Arabia (n = 9). Overall, 744 960 participants aged ≥ 15 years were included in the meta-analysis. The sample size for the studies ranged from 46 to 170 430.

Quality assessment

Fifteen studies were categorized as high-quality, 63 as moderate quality, and 12 as low quality. The low-quality studies had the highest pooled prevalence of current cigarette smokers (19.29%, 13.83–26.91%), followed by the moderate-quality studies (18.89%, 15.77–22.63%), and high-quality studies (12.44%, 7.03–22.0%). We found no indication of heterogeneity among the studies (P = 0.37).

Publication bias

The funnel plot revealed a little asymmetry (Figure 2). The P value for Egger's test was 0.98, implying no publication bias.

Prevalence of current cigarette and waterpipe smoking

The overall pooled prevalence of current cigarette and waterpipe smoking among adults in 17 Middle East countries was 17.41% (95% CI: 13.76–22.03) and 6.92% (95% CI: 3.70–12.93), respectively (Figure 3 and Table 1). The highest prevalence of current cigarette smoking was seen in Iraq (32.0%, 95% CI: 20.20–50.69) and Cyprus (31.40%, 95% CI: 25.86–38.13). The lowest prevalence was in Bahrain (2.60%, 95% CI: 0.70–6.60) and Qatar (8.86%, 95% CI: 6.28–12.48) ($P < 0.001$, I^2 = 93.2%). The highest prevalence for waterpipe smoking was in Iraq (25.0%, 95% CI: 19.10–31.60) and Palestine (20.90%, 95% CI: 17.40–24.70). The lowest prevalence was in Oman (1.10%, 95% CI: 0.60–1.90) and Syrian Arab Republic (1.30%, 95% CI: 0.90–

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart of study selection proces

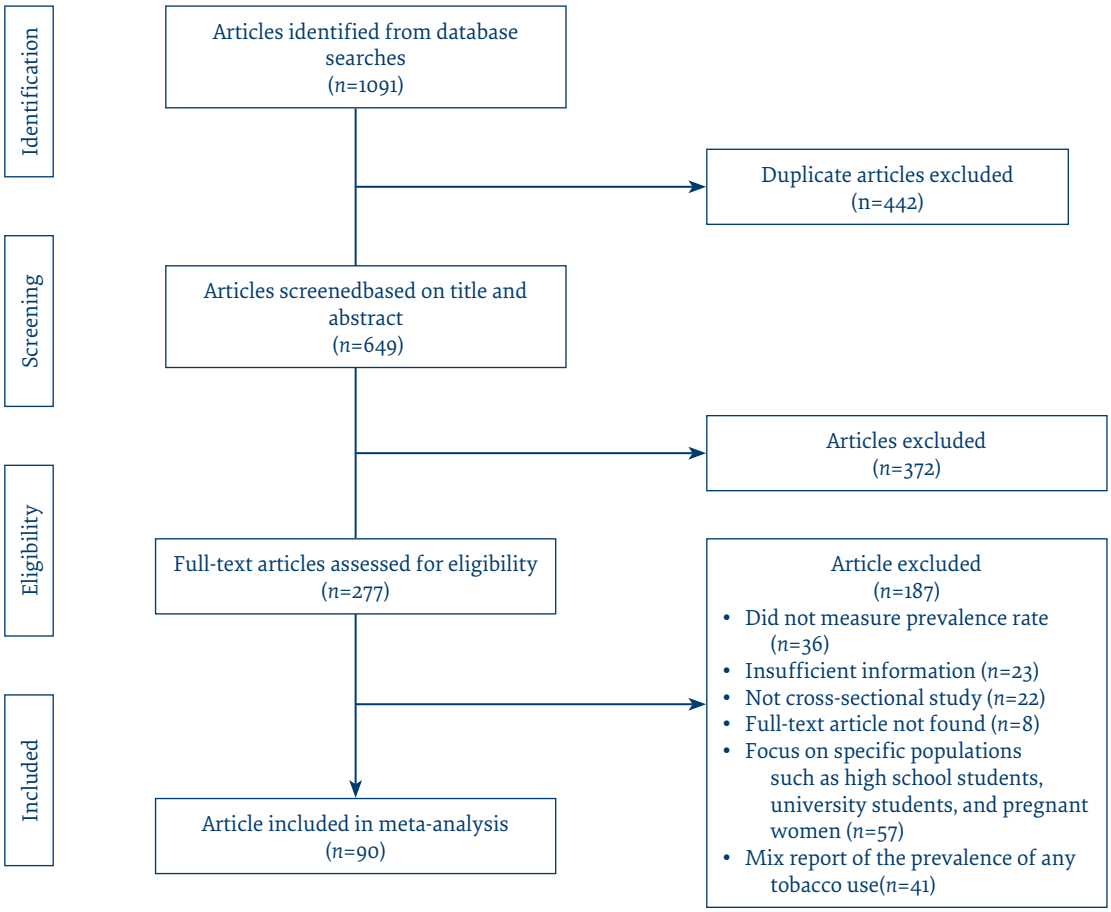
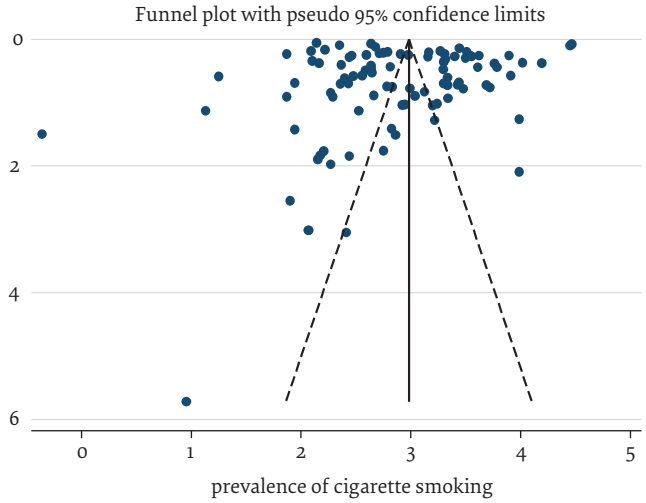


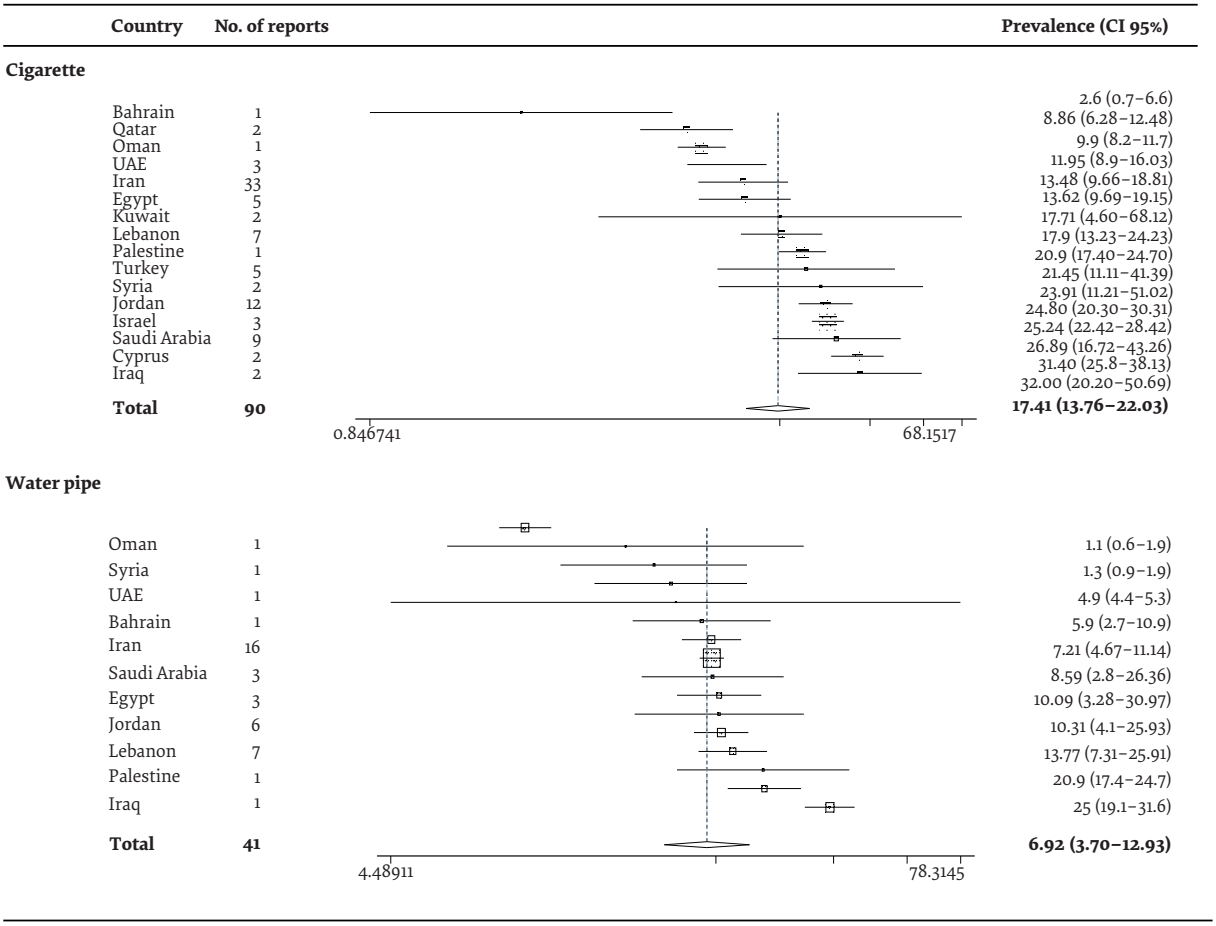
Figure 2 Funnel plot to check for publication bias



1.90).There was some heterogeneity among the studies ($P < 0.001$, $I^2 = 96.7\%$).

According to sex, 24.86% of men and 4.09% of women smoked cigarettes and 9.55% of men and 5.05% of women smoked waterpipes (Table 1). Therefore, the prevalence of current cigarette and waterpipe smoking in men ($P < 0.001$,$I^2 = 99.2\%$) was significantly higher than in women ($P = 0.03$, $I^2 = 77.3\%$). The prevalence of current cigarette smoking was highest among the age groups 30–39 (16.92%) and 40–49 (14.66%) years, and lowest among the age groups 18–29 (12.98%) and ≥ 60 (8.84%) years, but the difference was not significant ($P = 0.28$). In contrast, waterpipe smoking was most prevalent in the age groups 18–29 (4.0%) and 30–39 (3.60%) years, and least prevalent in the age groups 50–59 (0.76%) and ≥ 60 (0.84%) years ($P < 0.001$, $I^2 = 88.7\%$). The rural population had a higher

Figure 3 Overall prevalence of current smoking in Middle East countries



prevalence of cigarette smoking and a lower prevalence of waterpipe smoking than the urban population had, but these differences were not significant (P = 0.91, P = 0.66). The prevalence of cigarette smoking decreased from 22.25% (95% CI: 17.48–28.33) during 2008–2011 to 15.04% (95% CI: 11.20–20.21) during 2016–2020. The prevalence of waterpipe smoking increased from 6.03% (95% CI: 3.96–9.17) ($P < 0.001$, I^2 = 83.9%) to 13.83% (95% CI: 9.68–19.76) (P= 0.002, I^2 =80.9%) during the same period of time.

Table 2 shows the population attributable risk of smoking for common types of cancer. The highest risk overall was for oesophageal cancer (35.0%), followed by lung (30.50%) and gastric (8.26%) cancers, and in both men and women. Because of the higher prevalence of smoking in men, the cancer burden associated with smoking was higher among men than among women.

Discussion

This meta-analysis shows that, between 2000 and 2020, ~20% of adults in the Middle East were cigarette smokers and ~7% were waterpipe users. The study demonstrates that waterpipe and cigarette smoking was more popular in Iraq, Cyprus, and Palestine. In comparison, the lowest prevalence of waterpipe and cigarette smoking was in Oman and Bahrain. Socioeconomic status and differences in customs and cultures may explain these differences in prevalence.

In this study, the prevalence of cigarette and waterpipe smoking was significantly higher among men than among women. This pattern was similar to other studies, including in Europe (*8*, *23*), which may have been due to the social acceptance of men's smoking habits. Another study confirmed that men smoke more than women do, regardless of age group (school children, university students, and adults) (*24*). In previous studies, smoking habits were related to various factors such as age, sex, and level of education (*25*), and prevalence was higher among people of lower socioeconomic status (*26*).

The prevalence of cigarette smoking among rural populations was higher than among urban populations, but this difference was not significant. Our results show that the prevalence of cigarette smoking increased among those aged 18–29 to 50–59 years, which is consistent with other related studies (*27–29*). In our study, most cigarette smokers were in the age groups of 30–39 (16.92%) and 40–49 (14.66%) years, and the prevalence was lower among people aged ≥ 60 years. This decrease in cigarette smoking could have resulted from attributable diseases and mortality and a better understanding of the dangers

Table 1 Prevalence of current smoking in Middle East countries

Variables	No. of studies (population)	Cigarette smoking		Test for heterogeneity	Waterpipe smoking		Test for heterogeneity
		NR	Prevalence (95% CI)	*P*	NR	Prevalence (95% CI)	*P*
Country				< 0.001			< 0.001
Saudi Arabia	9 (37998)	9	26.89 (16.72–43.26)		3	8.59 (2.80–26.36)	
Oman	1 (1191)	1	9.9 (8. 2–11.7)		1	1.1 (0. 6- 1.9)	
Syria	2 (3523)	2	23.91 (11.21–51.02)		1	1.3 (0.9–1.9)	
Türkiye	5 (19713)	5	21.45 (11.11–41.39)		_	_	
Palestine	1 (502)	1	20.9 (17.4–24.7)		1	20.9 (17.4–24.7)	
Lebanon	7 (12782)	6	17.90 (13.23–24.23)		7	13.77 (7.31–25.91)	
United Arab Emirates	3 (180195)	3	11.95 (8.90–16.03)		1	4.9 (4.4–5.3)	
Kuwait	2 (6479)	2	17.71 (4.60–68.12)		_	_	
Cyprus	2 (3532)	2	31.40 (25.86–38.13)		_	_	
Israel	3 (12688)	3	25.24 (22.42–28.42)		_	_	
Iraq	2 (500)	2	32.0 (20.20–50.69)		1	25.0 (19.1–31.6)	
Bahrain	1 (152)	1	2.6 (0.7 - 6.6)		1	5.9 (2.7 - 10.9)	
Jordan	12 (8619)	12	24.80 (20.30–30.31)		6	10.31 (4.10–25.93)	
Egypt	5 (36990)	5	13.62 (9.69–19.15)		3	10.09(3.28–30.97)	
Islamic Republic of Iran	33 (419837)	30	13.48 (9.66- 18.81)		16	7.21 (4.67–11.14)	
Qatar	2 (259)	2	8.86 (6.28–12.48)		_	_	
Total (Middle East)	90 (744960)		17.41 (13.76–22.03)		41	6.92 (3.70–12.93)	
sex				< 0.001			0.03
Female	58 (180208)	58	4.09 (3.19–5.25)		25	5.05 (3.08–8.29)	
Male	66 (252025)	66	24.86 (21.57–28.65)		29	9.55 (6.80–13.40)	
Residency				0.91			0.66
Urban	6 (74723)	6	12.98 (8.82–19.08)		2	6.40 (0.79–51.87)	
Rural	6 (53983)	6	13.45 (8.09–22.36)		2	3.99 (3.00–5.29)	
Year of publication				< 0.001			0.002
2000-2003	1(3859)	1	8.8 (5.8–11.9)		_	_	
2004-2007	8 (5727)	8	14.90 (9.29–23.90)		1	11.3 (9.1–13.8)	
2008-2011	14 (96437)	14	22.25 (17.48–28.33)		8	6.03 (3.96–9.17)	
2012-2015	29(264411)	28	20.44 (15.39–27.16)		16	6.18 (3.95 -9.65)	
2016-2020	38(374928)	35	15.04 (11.20–20.21)		16	13.83 (9.68–19.76)	
Age group, yr				0.28			< 0.001
18-29	7 (215325)	7	12.98 (8.00–21.05)		1	4.00 (2.8 –5.4)	
30-39	7 (215325)	7	16.92 (9.12–31.37)		1	3.6 (2.4–5.0)	
40-49	8 (220515)	8	14.66 (9.06–23.70)		2	0.95 (0.33–2.70)	
50-59	5 (212447)	5	13.21 (9.32–18.72)		2	0.76 (0.44–1.32)	
≥ 60	5 (212447)	5	8.84 (6.19–12.61)		2	0.84 (0.31–2.27)	

CI = confidence interval; NR = number of reports.

of smoking, as well as health literacy among the older age group.

The highest prevalence of waterpipe smoking was among the 18–29 and 30–39 years age groups. Other studies also showed that the prevalence of waterpipe smoking among young people has increased (*30*). This may have been because of the spread of waterpipe smoking as a recreational activity and a lack of awareness or understanding of the health risks among the younger age groups (*31*). There is a misconception that waterpipe smoking is less harmful than cigarette smoking and this has led to its social acceptance (*32*). Also, according to our results, the prevalence of waterpipe smoking has increased in the last decade and the prevalence of cigarette smoking has decreased. Other studies have shown that tobacco use has been declining in recent years and the use of alternative tobacco products including e-cigarettes and waterpipes has increased (*33*).

Table 2 **Population attributable risk of smoking for common types of cancer**

Type of cancer	Sex/population attributable risk		Total (Middle East)
	Male	Female	
Oesophageal	43.2 (33.6–53.5)	11.28 (6.7–17.0)	35 (23.9–47.5)
Ovarian	1.2 (1.06–4.28)	0.19 (0.14–0.83)	0.86 (0.68–3.40)
Lung	39.1 (32.6–45.8)	9.3 (6.3–12.8)	30.5 (22.6–39.4)
Gastric	13.1 (8.2–15.6)	2.07 (1.2–3.1)	8.26 (5.17- 12.5)
Kidney	8.8 (5.6–12.4)	1.5 (0.83 –2.4))	6.2 (3.5–10)
Colorectal	3.3 (2.1–4.8)	0.55 (0.2–0.8)	2.3 (1.2–3.8)
Bladder	5.1 (1.2–10.2)	0.87 (0.17–1.9)	4.6 (0.77–8.08)
Liver	10.9 (7.2–15.7)	1.9 (1.0 - 3.2)	7.9 (4.5–12.8)

Smoking increases the risk of some types of cancer, including gastric, lung, and kidney cancers (*34*, *35*). Accordingly, this study demonstrated that 35% of esophageal cancer, 30% of lung cancer, and 8% of gastric cancer in Middle East countries was attributed to cigarette smoking. Because of the higher prevalence of smoking among men, the burden of smoking-related cancers was also higher among men than among women.

There were a few limitations to this study that should be addressed before interpreting the findings. First, we used the results from self-reporting studies on cigarette and waterpipe smoking, and the categories reported differed (e.g. current, ever, daily, occasional, and regular). Second, the numbers of studies varied between countries. Third, the study populations differed in age distribution, sociodemographic characteristics, workplace and occupation, which may have caused differences in cigarette and waterpipe smoking prevalence. Fourth, the attributable risk was calculated using unadjusted relative risk, even though there were potential confounders, such as blood pressure, diabetes, and socioeconomic status, that could have affected the relationship between smoking and cancer.

Conclusion

This meta-analysis shows that the prevalence of cigarette smoking was high among adults, especially men, in Middle East countries. The increasing trend in the prevalence of waterpipe smoking in the Middle East in the last decade and among young people is worrying, just as the high percentage of esophageal, lung, and gastric cancers due to smoking. Therefore, there is a need to prioritize comprehensive tobacco use control programmes in the region to reduce the harm caused by tobacco.

Funding: None.

Conflict of interest: None declared.

Prévalence du tabagisme par cigarette et par pipe à eau et incidence du cancer associée chez les adultes au Moyen-Orient

Résumé

Contexte : Le tabagisme est un facteur de risque important pour différentes maladies, notamment le cancer.

Objectif : Estimer la prévalence du tabagisme par cigarette et par pipe à eau et son lien avec l'incidence du cancer dans les pays du Moyen-Orient.

Méthodes : Nous avons effectué des recherches sur Medline, Google Scholar et PubMed afin de trouver des articles originaux publiés entre 2000 et 2020 en utilisant une combinaison des termes tabagisme, cigarettes, pipe à eau, houka, tabac, prévalence, Moyen-Orient, ainsi que le nom des pays du Moyen-Orient. Les données ont été analysées à l'aide du logiciel STATA, version 14. Nous avons effectué une méta-analyse à effet aléatoire pour obtenir des estimations de la prévalence globale du tabagisme avec un IC à 95 % et avons utilisé la statistique I^2 pour évaluer l'hétérogénéité entre les études. Nous avons réalisé des analyses de sous-groupes par sexe, pays, résidence et âge pour explorer les sources d'hétérogénéité, et avons utilisé l'examen visuel du graphique en entonnoir et le test d'Egger pour identifier les biais de publication.

Résultats : Nous avons inclus 90 articles dans cette méta-analyse. La prévalence globale du tabagisme par cigarette et par pipe à eau dans les pays du Moyen-Orient au moment de l'étude était respectivement de 17,41 % et 6,92 %. La prévalence du tabagisme par cigarette et par pipe à eau au moment de l'étude était significativement plus élevée chez les hommes que chez les femmes. Au cours de la dernière décennie, la prévalence du tabagisme par cigarette a diminué de 7,21 %, mais celle du tabagisme par pipe à eau a augmenté de 7,80 %. Le risque attribuable à la population le plus élevé a été observé pour les cancers de l'œsophage (35,0 %), du poumon (30,50 %) et de l'estomac (8,20 %).

Conclusion : Le tabagisme par cigarette demeure un problème de santé publique, en particulier chez les hommes adultes au Moyen-Orient. Environ 30 % des cancers de l'œsophage et du poumon dans cette région ont été attribués à la consommation de cigarettes. La tendance à la hausse du tabagisme par pipe à eau au cours de la dernière décennie est préoccupante. Les programmes de prévention constituent une priorité majeure pour les interventions sanitaires.

معدل انتشار تدخين السجائر والنرجيلة (الشيشة) والإصابات ذات الصلة بالسرطان بين البالغين في الشرق الأوسط

شيوا كارگر، على رضا انصارى مقدم

الخلاصة

الخلفية: التدخين عامل خطر شديد التأثير والأهمية في أمراض مختلفة، خاصة السرطان.

الأهداف: تقدير معدل انتشار تدخين السجائر والنرجيلة (الشيشة) وارتباطه بالإصابة بالسرطان في بلدان الشرق الأوسط.

طرق البحث: بحثنا في نظام استرجاع المعلومات البيليوغرافية الطبية والبيولوجية (قاعدة بيانات مدلاين) وجوجل سكولر، وقاعدة البيانات الطبية Pubmed عن المقالات الأصلية المنشورة بين عامَي 2000 و2020 باستخدام مزيج من مصطلحات التدخين، والسجائر، والنرجيلة، والشيشة، والتبغ، ومعدل الانتشار، والشرق الأوسط، وأسماء بلدان الشرق الأوسط. وحُللت البيانات باستخدام الإصدار 14 من برنامج STATA. وأجرينا تحليلاً تلويًّا عشوائي التأثير للحصول على تقديرات مجمعة لانتشار التدخين بفاصل ثقة 95٪، واستخدمنا إحصائية I^2 لتقييم التباين بين الدراسات. وأجرينا تحليلات للمجموعات الفرعية حسب الجنس والبلد والإقامة والعمر لاستكشاف مصادر التباين، واستخدمنا الفحص البصري لمخطط القمع واختبار إيغر لتحديد تحيز النشر.

النتائج: أدرجنا 90 مقالاً في هذا التحليل التلوي. وبلغ معدل الانتشار المجمع الحالي لتدخين السجائر والنرجيلة (الشيشة) في بلدان الشرق الأوسط 17.41٪ و6.92٪ على التوالي. وتبين أن معدّل الانتشار الحالي لتدخين السجائر والنرجيلة (الشيشة) بين الرجال أعلى بكثير منه بين النساء. وعلى مستوى العقد الماضي، انخفض معدل انتشار تدخين السجائر بنسبة 7.21٪، بينما ارتفع معدل انتشار تدخين الشيشة بنسبة 7.80٪. وأظهرت الدراسة أن أعلى المخاطر يمكن عزوها إلى الإصابة بسرطانات المريء (35.0٪) والرئة (30.50٪) والمعدة (8.20٪).

الاستنتاجات: لا يزال تدخين السجائر مشكلةً صحيةً عامةً خاصة بين الرجال البالغين في الشرق الأوسط. ويُعزى نحو 30٪ من سرطانات المريء والرئة في هذه المنطقة إلى تدخين السجائر. والاتجاه المتزايد لتدخين النرجيلة (الشيشة) خلال العقد الماضي أمر مثير للقلق. وثمة حاجة إلى برامج الوقاية بوصفها أولوية قصوى للتدخلات الصحية.

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