Prevalence and Risk Factors of Oral Cancer Among Saudi Women: A Systematic Review

Hussain Almubarak1, Wafa M Alqahtani2, Shaik M Shamsudeen3, Shaik M Asif4, Jagadish Hosmani5, Usha Balan6, Suraj Arora7, Imran Khalid8

ABSTRACT

Background: Incidence of oral cancer among women has been increasing globally. Consumption of tobacco and alcohol are predominant cause while other factors such as genetics, dietary habits, nature of occupation, and oral hygiene barely determine prevalence of oral cancer among women. Aim of this study was to conduct a systematic review to assess the prevalence and the risk factors of oral cancer among women of Saudi Arabia.

Methods: Search was done with combination of keywords in Google database using English language from 1990 till August 2020 with inclusion criteria includes original research, reviews, and studies focused on the prevalence and risk factors of oral cancer among Saudi Women. Case reports, investigative methods, treatment modalities for oral cancer, and articles that focused on other type of cancers were excluded from the study.

Results: Out of 2,373 articles obtained, nine articles were under final selection after removing duplicates, irrelevant articles for the current topics and after application of inclusion and exclusion criteria. These articles reviewed to identify useful insights about oral cancer among women with special focus on Saudi Arabia.

Conclusion: Observed geographical differentials of oral cancer subject to the development indexes of countries indicate that incidence rate of oral cancer among Saudi women is relatively lower compared to other regions, due to less exposure to cancer-causing risks. Tobacco consumptions particularly smokeless tobacco (Shammah) is the dominant cause among Saudi women, followed by genetic factors. However, a continuous vigilance for oral cancer among women in Saudi Arabia is critically needed for reducing common risks factors of the disease.

Keywords: Alcohol, Oral cancer, Saudi Arabia, Smokeless tobacco, Tobacco, Women.

World Journal of Dentistry (2022): 10.5005/jp-journals-10015-1917

INTRODUCTION

Oral cancer is a malignant epithelial tumor involving oral cavity. It is ranked tenth among cancers globally with an incidence rate of 300,000 cases annually. Incidence of oral cancer is increased in women worldwide due to increase in smoking habit and alcohol consumption equivalent to men. Other risk factors may include diet, hormonal, genetic, and viral such as human papilloma virus infection. In Saudi Arabia, it is the third most common cancer next to Lymphoma and Leukemia. Adults in Saudi Arabia smoke cigarette (15–39.6%) that increases prevalence of oral mucosal precancerous and cancerous lesions followed by Shammah and smokeless tobacco. Shammah is a mixture of powdered tobacco with carbonate of lime, oils, and ash, black pepper, and flavoring substances. The use of Shammah in the Kingdom of Saudi Arabia is most commonly practiced in Jizan province, although it is not limited to this province and studies showed there is a high correlation between the use of Shammah, oral cancer and residency in Jizan province.

The trend of increasing incidence of oral cancer among women could potentially lead serious and life threatening consequences. Gender based studies on various types of cancer have been identified globally, but there are very few studies regarding epidemiology, risk factors, susceptibility, and geographical differentials of oral cancer focused on women.

This Systemic review is conducted to assess the prevalence and associated risk factors of oral cancer in Saudi women.

1,3–5Department of Diagnostic Science & Oral Biology, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia
2Resident Dentist, Ministry of Health, Kingdom of Saudi Arabia
4KMCT Dental College, Calicut, India
7Department of Restorative Dental Sciences, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia
8Department of Oral and Maxillofacial Surgery, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia

Corresponding Author: Hussain Al Mubarak, Department of Diagnostic Science & Oral Biology, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia
E-mail: hualmubarak@kku.edu.sa

How to cite this article: Mubarak HA, Alqahtani WM, Shamsudeen SM, et al. Prevalence and Risk Factors of Oral Cancer Among Saudi Women: A Systematic Review. World J Dent 2022;13(3):289–293.
Source of support: Nil
Conflict of interest: None

MATERIALS AND METHODS

Search Strategy

Electronic database Google Scholar and Pub Med in English language were used for review from the year 1990 till August 2020. Keywords used were “oral cancer,” “squamous cell carcinoma,” “epidemiology,” “risk factors,” “women,” “Saudi Arabia.”
Study Selection

Inclusive Criteria
Articles on original research, reviews, and studies focused on epidemiology, incidence, prevalence, causes, and risk factors of oral cancer among women in Saudi Arabia.

Exclusive Criteria
Case reports, investigative methods, and treatment modalities for oral cancer, articles that focused on other type of cancers were excluded from the study.

Focus question: This systematic review aimed to address the potential focus question based on the following criteria: population (P): women in Saudi Arabia, Study design (S): Reviews and original studies; and outcome (O): Prevalence and risk factors of Oral cancer in Saudi Women.

The focus question was “Is there a higher prevalence and risk factors of Oral cancer seen among Women in Saudi Arabia?”

Ethical Review
The study involves analysis of published articles, the approval of the Medical Ethics Committee is not required. This article does not contain any studies with human participants or animals performed by any of the authors. For this type of study informed consent is not required.

Data Extraction and Data Synthesis
Data extraction includes the author’s name, publication time and the epidemiological data, causative and risk factors regarding oral cancer in Saudi women. The findings were pooled and presented in a narrative table.

Results
Of 2,373 articles obtained (35 from PubMed, 2338 from google scholar), 1,885 articles were eliminated as they were duplicates and irrelevant for the current topics. After applying inclusion and exclusion criteria, the final articles included in the study were nine. Among the nine article, two articles are systematic review, one review, three retrospective studies, two case control studies, and one epidemiological study. The prevalence of oral cancer in Saudi Arabia is higher in the Jizan province. The most common risk factors involved is the Shammah, the smokeless tobacco. The study selection flow is shown in Figure 1. These studies described the epidemiological data, causative and risk factors regarding oral cancer among women in Saudi Arabia, and the findings were summarized and narrated in Table 1.

Discussion
The aim of this study is to assess prevalence and associated risk factors of oral cancer in Saudi women. Prevalence of oral cancer varies widely according to geographical distribution. International Agency for Research on Cancer (IARC) states that Asia and Africa account for highest number (57% and 7.3%, respectively) of cancer-related deaths as they are highly populous and lack in diagnosis and treatment capacities. In a study that seems to corroborate findings states that greatest number of cancer cases (1.7 million) and deaths (1 million) are in East Asia. Unlike Asia, cancer burden is relatively lower in Europe and US where it is 23.4% and 21% cases, respectively. Incident rate of oral cancer in Arab countries including Saudi Arabia was estimated to be approximately 2.13 for every 1,000 people.

The risk of oral cancer was most prevalent among men than women, due to certain differentials in gender-specific factors. Gender disparities were attributed to two factors namely noxious agents that selectively affect men and high defense mechanisms in women, resulting from special hormonal and metabolic characteristics. However, women were the central focus of inquiry because there has been an increasing trend of their vulnerability to the disease. Incident rate of oral cancer among women rose from 966 in 1986 to 2,056 in 2006, due to increased alcohol and tobacco consumption among females in western countries. In a study conducted in Thailand, out of 1,038 oral cancer cases sampled 62% were female while 38% were male. World Health Organization report states that relative risk factors for oral cancer among women consuming tobacco and smoking with alcohol had greatest risk in United States. Smoking tobacco...
Table 1: Articles reviewed in the study

| No. | Article                          | Title                                                                 | Year  | Study design          | Prevalance | Risk factors          | Results                                                                                                                                 |
|-----|----------------------------------|----------------------------------------------------------------------|-------|-----------------------|------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Alshehri BM                      | Trends in the incidence of oral cancer in Saudi Arabia from 1994 to 2015 | 2020  | Descriptive epidemiological study | Jazan highest Hail-lowest | –                     | The age standardization incidence rate (ASR) data revealed that more females than males were diagnosed with oral cancer in Saudi Arabia, at 1.4 for men and 1.6 for women. Incidence of oral cancer for both males and females shows it affects commonly older age groups. |
| 2.  | Basha S, et al.                  | The prevalence of oral cancer in Saudi Arabia–a systematic review     | 2019  | Systematic review      | Jazan highest 32.1–62.4% | Shammah       | The mean age of oral cancer ranged from 48.6-years to 65-years. Male to female percentage varied from 36.6% to 65.3%. Male to female ratio varied from 0.7:1 in Jazan province to 1.2:1 in other regions of KSA. High prevalence of oral cancer among females may be attributed to increased consumption of smokeless tobacco Shammah which in-turn increased the risk of oral cancer. |
| 3.  | Elasbali AM, et al.              | A review on the etiology of oral cancer in Saudi Arabia               | 2018  | Review                 | Jazan      | Cigarette smoking and Shammah | The study from Jazan region of Saudi Arabia, the prevalence of khat usage among university students was found to be 23.1%, mostly among males (38.5%) compared to only 2.1% among females. Tobacco use may be the most evidenced factor for oral cancer in Saudi Arabia. |
| 4.  | Alhazzazi TY, et al.             | Head and neck cancer in Saudi Arabia: a systematic review             | 2016  | Systematic review      | Jazan      | Cigarette smoking and smokeless tobacco Shammah | There are some common risk factors like cigarette smoking, shammah, smokeless tobacco, betel nuts and Khat, among the provinces of Saudi Arabia. |
| 5.  | Quadri MF, et al.                | Oral squamous cell carcinoma and associated risk factors in Jazan, Saudi Arabia: a hospital based case control study | 2015  | Case control studies  | Jazan      | Shammah               | Jazan showed higher number of females suffering from oral cancer when compared to males who use smokeless tobacco–shammah. |
| 6.  | Brown A, et al.                  | The unequal burden related to the risk of oral cancer in the different regions of the Kingdom of Saudi Arabia | 2006  | Retrospective study    | Jazan followed by Najran (Aseer province) | Shammah       | Overall the burden and risk of oral cancer in Saudi Arabia is not large. Oral cancer prevalence is high in the residents of Aseer province. |
| 7.  | Allard WF, et al.                | Smokeless tobacco (shammah) and oral cancer in Saudi Arabia           | 1999  | Case control study     | Jazan 35.4% | Shammah smokeless tobacco | About 35.4% of all referred oral cancer cases in period from 1976 to 1995 were referred from one province--Jazan. |

(continued)
in the form of cigarettes is common type compared to other form of ingestion such as traditional hand rolled flavored cigarettes beedis, water pipes, snuff, smokeless, and reverser cigarette smoking. In high income countries like Australia, Canada, United States, and most countries of Western Europe, women smoke nearly same rate as men. Countries with low human development index have also been found to be highly susceptible to risks factors of cancer such as exposure to alcohol and tobacco. However, in many low-income and middle-income countries, women smoke much less than men. Inadequate diagnosis and lack of effective treatment increases the risk of oral cancer in these countries. Thus, oral cancer prevalence among Saudi women is likely to be lower due to its favorable economic ranking with good infrastructure in diagnosing the condition early.

The prevalence of oral cancer in Saudi Arabia varied from 21.6—68.6%. Jazan region showed highest incidence rate of oral cancer than the northern regions. This can be due to the regional environmental factors and lifestyle habits such as the abuse of Shammah, smokeless tobacco and chewing Khat leaves. Genetic factors are also involved in some regions of Saudi Arabia as they are tribal and consanguineous marriages are also common among them.

According to Shamugham et al., alcohol and tobacco have been found to cause oral cancer among women because simultaneous intake of both agents increases amount of carcinogen, a leading cancer-causing agent in the body. Use of smokeless tobacco, known as shammah and Khat, increases risk of oral cancer among women in Saudi Arabia. Like any other form of tobacco, shammah stimulates release of tumor causing radicals such as acetaldehyde in body and increases the absorption of carcinogen. The negative health effects of smoking and alcohol consumption could lower the body’s immunity and increase poor dietary habits among consumers, and increase the risk of cancer.

Genetic factors may play a vital role in prevalence of oral cancer. According to Elsabi and Ahmed, epigenetic mutations involving DNA have been linked to several types of cancer, including oral cancer. It is also stated that hyper methylation increases risk of cancer by inhibiting tumor-suppressor cells in the body. Taking the evidence into account, it can be stated that genetically driven factors may determine prevalence of oral cancer among men and women, as unfavorable mutations suppress the body’s ability to fight cancer-causing radicals. Presence of certain human infections also increases risk of oral cancer among women such as human papilloma virus, Epstein-Barr virus (EBV), Bacterial and fungal infections. Although there are limited studies on relationship between these infections and oral cancer, they may compromise the body’s immunity and increase the risk for the development of oral tumor.

Additionally, dietary, occupational, and oral hygiene habits could increase women’s vulnerability to oral cancer to a limited extent. High intake of red and processed meat increases risk of oral cancer, while vegetables, fruits, and seafood decrease the chances of oral cancer. Certain occupational subsets increase the levels of exposure to oral cancer. For example, rate of oral cancer is high among doctors, pulp industry workers or those who are consistently exposed to harmful chemicals which may cause unfavorable cell mutations and reduce immunity. Poor dental hygiene was reported to increase prevalence of cancer among both smoking and non-smoking women in Saudi Arabia. Although dietary, profession and dental care related factors may contribute to cancer development, limited statistics have proven their relationship.

This study could establish comparative views about oral cancer prevalence among women which could enhance understanding of extent of research. Analysis will add to existing knowledge on oral cancer and become a reference point for students and researchers to carry similar studies in the future. Information obtained will increase awareness about prevalence of oral cancer by gender, its epidemiological context, and various factors that increase risk among women.

The findings of the current study should be interpreted cautiously. Meta-analysis was not performed because the heterogeneity of studies. The limited number and disparate nature of the studies allowed simple descriptive comparisons only.

**Conclusion**

In conclusion, oral cancer among women is one of the most critical health problems in Saudi Arabia. Tobacco consumption particularly smokeless tobacco (Shammah) is the dominant cause among women, followed by genetic factors. However, other factors such as oral hygiene, dietary patterns, and occupational factors account for a smaller portion of cases among Saudi women. Therefore, mass education on healthy living habits should be consistently conducted to reduce irresponsible tobacco and alcohol consumption. Women should be encouraged to frequently seek medical attention, as this facilitates early diagnosis and timely treatment of the disease.

**Author Contributions**

Writing—original draft preparation, HAM, WM, SMS; Data curation and analysis- SMS, JH. Writing—review and editing, SMA, JH, UB, SA and IK. All authors have read and agreed to the published version of the manuscript.
Prevalence and Risk Factors of Oral Cancer Among Saudi Women

**Institutional Review Board Statement**

Ethical review and approval were waived for this study because this study is a systematic review.

**Informed Consent Statement**

Patient consent was waived because this is a systematic review of published original studies, in each of which patient consent has been obtained.

**References**

1. Zavras AI, Shanmugam P, Shetty D, et al. Oral and pharyngeal cancer in women. Dent Clin North Am 2013;57(2):339–355. DOI: 10.1016/j.dcln.2013.02.001
2. Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68(6):394–424. DOI: 10.3322/caac.21492
3. Al-Jaber A, Al-Nasser L, El-Metwally A. Epidemiology of oral cancer in Arab countries. Saudi Med J 2016;37(3):249–255. DOI: 10.15537/smj.2016.3.11388
4. Kheur SM, Kheur M, Gupta AA. Oral prophylaxis as an adjunct procedure towards prevention and management of oral cancer: rationale and application. Oral Oncol 2014;50(8):e44–e45. DOI: 10.7314/apjcp.2015.16.15.6193
5. Torre LA, Farhad I, Rebecca L, et al. Global cancer in women: burden and trends. Cancer Epidemiol Biomarkers Prev 2014;26(4):444–457. DOI: 10.1158/1055-9965.EPI-16-0858
6. Kruse AL, Marius B, Klaus WG. Oral cancer in men and women: are there differences? Oral Maxillofac Surg 2010;15(1):51–55. DOI: 10.1007/s10006-010-0253-6
7. Suba Z. Gender-related hormonal risk factors for oral cancer. Pathol Oncol Res 2007;13(3):195–202. DOI: 10.1007/BF02893499
8. Patraoovt V, Krittika S, Supot K, et al. Epidemiology of oral and pharyngeal cancers in Khon Kaen, Thailand: a high incidence in females. Asian Pac J Cancer Prev 2011;12(10):2504–2508.
9. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. Oral Oncol 2009;45(4-5):309–316. DOI: 10.1016/j.oraloncology.2008.06.002
10. Turati F, Garavello W, Tramacere I, et al. A meta-analysis of alcohol drinking and oral and pharyngeal cancers. Part 2: results by subsites. Oral Oncol 2010;44(10):720–726. DOI: 10.1016/j.oraloncology.2010.07.010
11. Zavras A, Douglass C, Joshipura K, et al. Smoking and alcohol in the etiology of oral cancer: gender-specific risk profiles in the south of Greece. Oral Oncol 2001;37(1):28–35 DOI: 10.1016/s1368-8375(00)00060-9
12. Alsanosy RM. Smokeless tobacco (Shammah) in Saudi Arabia: a review of its pattern in use, prevalence and potential role in oral cancer. Asian Pac J Cancer Prev 2014;15(16):6477–6483. DOI: 10.7314/apjcp.2014.15.16.6477
13. Basha S, Roshan NM, Yousef Al-Thomali, et al. The prevalence of oral cancer in Saudi Arabia: a systematic review. Ann Med Health Sci Res 2019;9(2):553–557.
14. Shanmugham JR, Athanasios IZ, Bernard AR, et al. Alcohol-folate interactions in the risk of oral cancer in women: a prospective cohort study. Cancer Epidemiol Biomarkers Prev 2010;19(10):2516–2524. DOI: 10.1158/1055-9965.EPI-10-0499
15. Brown A, Ravichandran K, Warnakulasuriya S. The unequal burden related to the risk of oral cancer in the different regions of the Kingdom of Saudi Arabia. Community Dent Health 2006;23(2):101–106.
16. Allard WF, DeVol EB, Te OB. Smokeless tobacco (Shammah) and oral cancer in Saudi Arabia. Community Dent Oral Epidemiol 1999;27(1):398–405. DOI: 10.1111/j.1600-0528.1999.tb02038.x
17. Abdelbaset ME, Ahmed HG. A review on the etiology of oral cancer in Saudi Arabia. Int J Med Res Health Sci 2018;7(6):161–170.
18. Radhakrishnan R, Shamaprasad K, Kapaettu S. DNA hypermethylation as an epigenetic mark for oral cancer diagnosis. J Oral Pathol Med 2011;40(9):665–676. DOI: 10.1111/j.1600-0761.2011.01055.x
19. Rodriguez-Paredes M, Esteller M. Cancer epigenetics reaches mainstream oncology. Nat Med 2011;17:330. DOI: 10.1038/nm.2305
20. Wang L, Ganlyl. The oral microbiome and oral cancer. Clin Lab Med 2014;34(4):711–719. DOI: 10.1016/j.cll.2014.08.004
21. Sritippho T, Pareena C, Anak I. Roles of human papilloma viruses and p16 in oral cancer Asian Pac J Cancer Prev 2015;16(15):6193–6200. DOI: 10.7314/apjcp.2015.16.15.6193
22. Gudry JT, Birdwell CE, Scott RS. Epstein-Barr virus in the pathogenesis of oral cancers. Oral Dis 2018;24(4):497–508. DOI: 10.1111/odi.12656
23. Quadri MF, Alharbi F, Bajonaid AM, et al. Oral squamous cell carcinoma and associated risk factors in Jazan, Saudi Arabia: a hospital based case control study. Asian Pac J Cancer Prev 2015;16(10):4335–4338. DOI: 10.7314/apjcp.2015.16.10.4335
24. Chang JS, Lo HI, Wong TY et al. Investigating the association between oral hygiene and head and neck cancer. Oral Oncol 2013;49(10):1010–1017. DOI: 10.1016/j.oraloncology.2013.07.004
25. Kheur SM, Kheur M, Gupta AA. Oral prophylaxis as an adjunct procedure towards prevention and management of oral cancer: rationale and application. Oral Oncol 2014;50(8):e44–e45. DOI: 10.7314/j.oraloncology.2014.05.001
26. Alshehri BM. Trends in the incidence of oral cancer in Saudi Arabia from 1994 to 2015. World J Surg Oncol 2020;18(1):217. DOI: 10.1186/s12957-020-02019-3
27. Chen F, He B-C, Yan L-J, et al. Influence of oral hygiene and its related to the risk of oral cancer in women who neither smoked nor drank alcohol: a hospital–based, case–control study. Br J Oral Maxillofac Surg 2017;55(3):260–265. DOI: 10.1016/j.bjoms.2016.11.316