ORIGINAL ARTICLE

Frequency of oral cancers among cancers in Sudanese patients (2009-2016)

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ABSTRACT:

Background: Cancer is the second leading cause of death worldwide. Following malaria and viral pneumonia, the cancer in Sudan was the third leading cause of death in 2000. Controversial conclusions have been reported regarding the frequency of oral cancer in Sudan. Therefore, updated information of the frequency of oral cancer and patterns is needed continuously. **Design**: Descriptive cross sectional multicenter hospital-based epidemiological study. The data were gathered from the major histopathology labs and RICK in Khartoum state between 2009 and 2106. Data were collected from the records included name, age, gender, year, type of cancer, and site of cancer. **Objectives**: To determine the relative frequency of oral cancer among total body cancers. To identify the most common types of oral cancers, and to investigate the distribution of oral cancer in relation to age, gender, year, and site. **Results**: The total body cancers were 55571 cases, out of these there were 1857 oral cancers accounting for 3.34% of all cancers. Oral cancer was the seventh in males and the eighth in females. Squamous cell carcinoma was the most common type accounting for 73.3%, followed by mucoepidermoid carcinoma 4.8%, adenoid cystic carcinoma 4%, osteosarcoma 2.4%, and verrucous carcinoma 2.4%. Male to female distribution was 1.45:1. The most common site affected by oral cancer was the overlapping areas especially the lower gigivolabial and lower gingivobuccal 29.8%, followed by tongue 19.6%, lower lip 18%, mandible 16.8%, and palate 16%. **Conclusion**: This study showed that the oral cavity cancer was among the top ten body cancers in Sudanese population. Program of prevention and early detection of oral cancer is needed in Sudan, and further studies should be conducted to investigate the possible causal and risk factors associated with oral cancers. **Keywords:** Cancer, Oral cancer, Multicenter, Epidemiology, Frequency, Sudan.

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INTRODUCTION

Cancer is a complex genetic disease caused mainly by environmental factors that mutate genes encoding, leading to abnormal cell behavior causes expansive masses of aberrant cells that destroy the surrounding normal tissue, and spread to vital organ, and finally death. The cancer causing agents can be found in food, water, air, chemicals, and sun light. Ninety percent of cancers are epithelial cancer because the epithelial cells covers the skin, line the respiratory and alimentary tracts (1).

Head and neck cancer (HNC) is a significant health problem for the affected persons. Most patients with HNCs are of low socioeconomic status, smokers, tobacco chewer, and alcohol abuser. Genetic changes should be consider in development of HNC from premalignant lesions therefore testing of genetic alteration may help in identification of patients of high risk to develop cancers (2).

Cancers of the oral cavity are the malignant tumors that affect the gingivae, alveolar ridge, tongue, floor of the mouth, buccal mucosa, hard and soft palate, and the uvula and other unspecific regions of the oral cavity (3). At least 90% of all oral malignancies are squamous cell carcinomas (4-6). The anatomical site of Oral Squamous Cell Carcinoma (OSCC) influences the tumor evolution and outcome because the vascular and lymphatic networks vary between different anatomic sites. Hence, there is higher metastatic disease rate for OSCC at the base of the tongue rather than oral tongue (7), and higher mortality rate in patients with tongue carcinoma than those who develop lip carcinoma (8).

Following malaria and viral pneumonia, the cancer in Sudan was considered the third leading cause to death in 2000. Between the years 1967-1984 nasopharyngeal carcinoma and Non-Hodgkin's lymphoma (NHL) were the most common malignant tumors in Sudanese males, while between the years 1985-2004 the Chronic myeloid leukemia (CML) became the predominant cancer followed by NHL. In Sudanese females the cervical cancer was the first common cancer followed by ovarian cancer between the years 1967-1984. However, the breast

cancer was the predominant cancer followed by cervical cancer between the years 1985-2004 (9). Some environmental risk factors may be considered for cancer in Sudan such as: infection, pesticides, and other sources of pollution (10).

Oral cancer in Sudan accounts for 12.6% of all cancers recorded in the Sudan Cancer Registry between the periods 1970 and 1985. Other data obtained from Radio Isotope Center in Khartoum (RICK) at the same period included 8.1% malignant oral neoplasms of all cancers, out of these cancers, 76% were Squamous cell carcinoma, 9.4%neoplasms of salivary glands, 0.82% neoplasms of odontogenic origin, 13.7% neoplasms of non-squamous and non-odontogenic origin (11). The squamous cell carcinoma strongly related to snuff dipping and tobacco chewing. At the site of snuff dipping there were clinically and histologically developed lesion (10). There is a Lack of baseline data regarding the frequency of oral cancers among cancers in Sudanese patients during the period (2009-2016). Determining the trend of oral malignancies throughout a period of time will be helpful in taking actions regarding the management and treatment of these tumors. No previous oral cancers epidemiological study collected data from a wide range of laboratories during this period. The aim of this study, therefore, was to establish another baseline record for oral cancers in Sudan. This record is helpful to identify the frequency of oral cancers among the total body cancers in the Sudanese cancer patients, to study the distribution of oral cancers in relation to age, gender, and site, and to determine the common types of oral cancers in the Sudanese population.

MATERIALS AND METHODS
This study was a descriptive cross-sectional epidemiological retrospective study. The target population were cancer patients attended all major histopathology labs and RICK in Khartoum state, Sudan during the period 2009 - 2016. All records of cancer patients diagnosed in those labs at that period were collected and checked. Recurrent and metastatic cancers records were excluded. Unfilled and/or uncompleted records were also excluded. Name, age, gender, year, type of tumor, and location of the tumor were extracted for the records. Sites of the tumors were coded according to the international code of diagnosis ICD-10 Version: 2016 (Appendix I). For data analysis, descriptive statistics in terms of central tendency, frequency, and charts were used in data analysis. Distribution of the tumors and sites of tumors according age groups, gender, and years was performed. The data were entered and analyzed using M. Excel 2010 and SPSS version 22.

RESULTS
Frequency of total body cancers
The total number of primary malignant neoplasms of the body screened through the period of the study (8 years; between 2009 and 2016) in Khartoum state was 55571 cases. Out of these, 1857 were primary malignant neoplasms of the oral region accounting for 3.34 % of all body malignant neoplasms, and ranking in the ninth position. The total number of the top 10 body cancers for both sexes was 34033 cases. Breast cancer was the number one followed by leukemia while, oral cavity cancer was number nine and the last one in top 10 was liver cancer (Fig. 1). More details for frequency of the top 10 body cancers for each gender are presented in Table 1. There was a gradually increasing in the number of all cancers from 2009 to 2013, with the peak prevalence of cancers in 2013. The trend slightly decreased in 2014, then increased in 2015 and 2016. The mean age of the total body cancers was a 51.25±19.35 year ranging from less than one year to 110 years. Age group ≥ 65 years was the most age group affected by cancers, followed by age group 45 - 54 years. The least age group affected by cancers was 15 - 24 years. Females were affected by cancers more than males. The total cancers of females were 30318 (54.65 %), while the total cancers of males were 25253 (45.44 %). Female to male ratio was 1.2:1 (Table 2).

Frequency of oral cancers (OC)
The total number of OC reports were 1857. Out of these only 1563 reports were found with complete details. Therefore, the detailed analysis of OC was performed only on 1563 cases. There were 33 types of OC found in this study started with the most common type which was squamous cell carcinoma accounted for 1145 (73.3 %) cases, and finished by the least common type which was malignant ameloblastoma accounted for only 1 (0.1 %) case. There were 26 sites with OC. The most common site infected with cancers was C14.8 (overlapping or contiguous area especially lower gingivolabial, and lower gingivobuccal areas) accounted for 270 (17.3 %) cases while, the least site infected was C46.3 (Kaposi sarcoma of lymph node) accounted for 1 (0.1 %) case. Three hundred and ten cases (19.8 %) were in 2016, followed by 298 (19.1 %) oral cancers in 2015 and the least prevalence of OC were in 2011 accounted for only 46 cases (2.9 %). Apart from the decreased peak in 2011, there was an obvious increase of the prevalence of OC from 2009 to 2016. Out of 1563 OC there were 924 (59.1 %) cases in males and 639 (40.9 %) cases were in females. The male to female ratio was 1.45:1. The most age group affected by oral cancers was ≥ 65 years, and the least age group affected was < 15 years. There was a gradually increase in the prevalence of OC with the increasing of age.

Frequency of top 5 types of OC:
The total number of the top 5 types of OC was 1358 accounting for 87 % of all oral cancer types. Squamous cell carcinoma (SCC) was found to be number one accounting for 1145 (84.3 %) cases, followed by mucoepidermoid carcinoma accounted for 75 (5.5 %) cases, adenoid cystic carcinoma accounted for 63 (4.6 %), osteosarcoma accounted for 38 (2.8 %) cases, and verrucous carcinoma which accounted for only 37 (2.7 %) cases.

The total number of the top 5 types of OC was 1358, out of these 807 (59.4 %) cases were in males, and 551(40.6 %) cases were in females. The male to female ratio was 1.46:1 (Table 3). Out of 1145 cases of SCC, there were 699 (61 %) cases in males and 446 (39 %) cases in females. There were 35 (46.7 %) mucoepidermoid carcinomas in males and 40 (53.3 %) cases in females, while adenoid cystic carcinoma was found in 35 (55.6 %) cases of males, and 28 (44.4 %) cases of females. However, osteosarcoma were 27 (71 %) cases in females and only 11 (29 %) cases in males. And last, Verrucous carcinomas were 27 (73%) cases in males and 10 (27 %) cases in females.

The most age group affected by the top 5 types of OC was ≥ 65 years while, the least age group affected was < 15 years. Similar to the total OC, there was an increasing of the prevalence of the top 5 types of OC with the increasing of age. The prevalence of SCC decreased gradually to the age group < 15 years, and the most age group affected by SCC was ≥ 65 years. Mucoepidermoid carcinoma affected mostly the age groups 55-64, 45-54, and 35-44 years. Adenoid cystic carcinoma affected the age groups ≥ 65, 55-64, and 45-54 years more than the other age groups, while osteosarcoma mostly affected the age group 35-44 years. However, most cases of verrucous carcinoma were found in the age group ≥ 65 years, and were not found in the age groups 25-34, 15 - 24, and < 15 years (Table 3).

SCC was mostly found in the overlapping areas (C14.8), followed by tongue (C02), and the least site found affected with SCC was the upper vestibule (C06.1U). The most affected site with mucoepidermoid carcinoma was C06.0 (buccal mucosa), followed by C05 (palate) while adenoid cystic carcinoma was found frequently in C05 (palate), followed by C07 (parotid gland). Osteosarcoma, however, was most frequent in the mandible (C41.1), followed by maxilla (C41.0). The last type of the top 5, verrucous carcinoma, mostly affected the overlapping areas (C14.8), followed by lower lip (C00.1) (Table 4).

Frequency of top 5 sites of OC:
There were 905 cases recorded for the top 5 sites. The most affected site with tumors was C14.8 (overlapping area, especially lower gingivolabial and lower gingivobuccal) which accounted for 270 (29.8 %) cases, followed by C02 (tongue) accounting 177 (19.6 %) cases. The least site affected with tumors was C05 (palate) which accounted for 145 (16 %) cases.

The total number of cases of the top 5 sites was 905 cases. Of these, 565 (62.4 %) cases were in males, and 340 (37.6 %) cases were in females. Male to female ratio was 1.7:1. Among male patients the most frequent affected site was C14.8, followed by C00.1, C02, C41.1, and C05. However, in females the most frequent affected site was C02, followed by C14.8, C05, C41.1, and C00.1. It can be noticed that tongue and palate (C02 and C05) were more affected with cancers in females than in males (Table 5).

In general, the most age group affected was ≥ 65 years, and the least age group affected was < 15 years. With increasing age all the top 5 sites were affected more with cancers. All sites, except tongue, were found to be more affected with cancers among the age group ≥ 65 years and least affected among the age group < 15 years. Tongue was mostly affected among the age group 45-54 years, followed by the age group ≥ 65 years, and the least age group was < 15 years (Table 5).

As shown in Table 6, the overlapping areas (C14.8) were affected by 8 tumors only, the most frequent tumor was SCC (230 cases), followed by verrucous carcinoma (29 cases). Tongue (C02) was affected by 7 tumors only, the most frequent one was SCC (164 cases), followed by adenoid cystic carcinoma (4 cases). The lower lip (C00.1) was affected by 4 tumors only, the first one was SCC (156 cases), followed by verrucous carcinoma (5 cases). Mandible and palate (C41.1 and C05) were affected by more types than the other sites with SCC as the most frequent tumor.
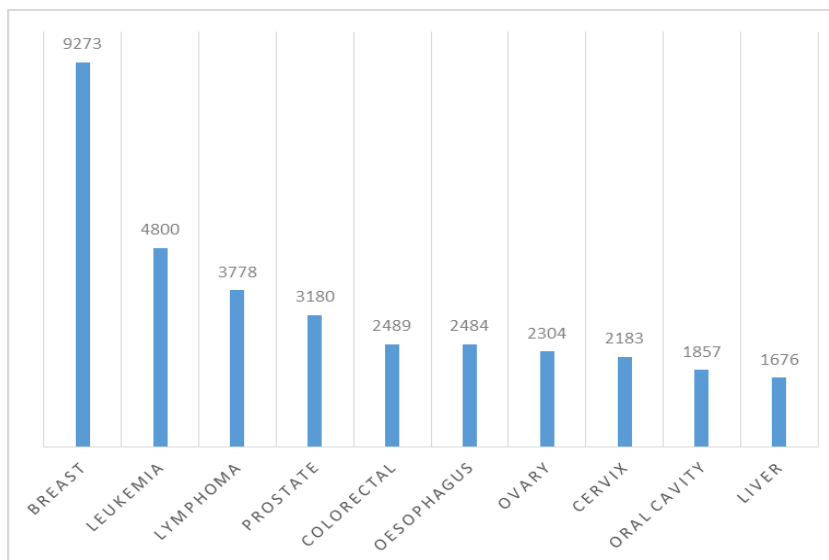
Figure 1: Frequency of top 10 body cancers

Table 1: Distribution of top 10 body cancers in relation to gender

Male		Female	
Prostate	3180	Breast	8897
Leukemia	2789	Ovary	2304
Lymphoma	2377	Cervix	2183
Colorectal	1460	Leukemia	2011
Liver	1168	Oesophagus	1438
Nasopharynx	1110	Lymphoma	1410
Oral cavity	1085	Colorectal	1029
Oesophagus	1046	Oral cavity	772
Lung	862	Brain	585
Brain	715	Nasopharynx	531

Table 2: Distribution of oral cancers in relation to year, gender, and age groups

Year	Frequency	Percent
2009	70	4.5
2010	133	8.5
2011	46	2.9
2012	208	13.3
2013	211	13.5
2014	287	18.4
2015	298	19.1
2016	310	19.8
Gender		
Male	924	59.1
Female	639	40.9
Age group		
< 15 yrs	33	2.1
15 - 24 yrs	55	3.5
25 - 34 yrs	95	6.1
35 - 44 yrs	181	11.6
45 - 54 yrs	308	19.7
55 -64 yrs	372	23.8
≥ 65 yrs	519	33.2

Table 3: Distribution of top 5 oral cancer types in relation to age groups and gender

	Oral cancer type					
	Adenoid Cystic CA	Mucoepidermoid CA	Osteosarcoma	Squamous Cell CA	Verrucous CA	Total
Age group						
> 15 yrs	0	2	4	6	0	12
15 - 24 yrs	2	6	6	23	0	37
25 - 34 yrs	10	12	6	42	0	70
35 - 44 yrs	6	15	9	123	4	157
45 - 54 yrs	14	14	8	238	5	279
55 -64 yrs	13	15	3	296	11	338
≥ 65 yrs	18	11	2	417	17	465
Gender						
Male	35	35	11	699	27	807
Female	28	40	27	446	10	551

Table 4: Distribution of top 5 oral cancer types in relation to sites

	Oral cancer type				
	Adenoid Cystic CA	Mucoepidermoid CA	Osteosarcoma	Squamous Cell CA	Verrucous CA
C00.0	0	0	0	8	0
C00.1	1	0	0	156	5
C00.6	0	0	0	22	1
C02	4	3	0	164	0
C03.0	0	0	1	53	0
C03.1	0	1	0	114	0
C03.2	0	0	0	1	0
C03.3	0	0	0	1	0
C04	2	1	0	28	0
C05	28	16	0	71	1
C06.0	4	19	0	77	1
C06.1L	0	0	0	20	0
C06.1U	0	0	0	1	0
C06.2	0	3	0	26	0
C07	6	9	0	13	0
C08.0	5	8	0	3	0
C08.1	1	0	0	1	0
C14.8	2	2	0	230	29
C31.0	5	2	0	19	0
C41.0	3	3	18	25	0
C41.1	1	8	19	87	0
C44.31	0	0	0	0	0
C44.32	0	0	0	25	0
C44.39	1	0	0	0	0
C46.3	0	0	0	0	0
C83.79	0	0	0	0	0
C85.91	0	0	0	0	0
C85.99	0	0	0	0	0

Table 5: Distribution of top 5 oral cancer sites in relation to age groups and gender

	Oral cancer site					
	C00.1	C02	C05	C14.8	C41.1	Total
Age group						
> 15 yrs	2	4	1	0	6	13
15 - 24 yrs	4	7	4	3	11	29
25 - 34 yrs	3	16	17	6	10	52
35 - 44 yrs	15	28	11	16	17	87
45 - 54 yrs	43	45	33	38	28	187
55 -64 yrs	38	35	32	88	38	231
≥ 65 yrs	58	42	47	119	40	306
Gender						
Male	132	88	72	195	78	565
Female	31	89	73	75	72	340

Table 6: Distribution of top 5 oral cancer sites in relation to oral cancer type

	Oral cancer site				
	C00.1	C02	C05	C14.8	C41.1
Acinic Cell CA	0	1	1	1	0
Adenocarcinoma	0	1	4	2	0
Adenoid Cystic CA	1	4	28	2	1
Ameloblastic CA	0	0	0	0	12
Basal Cell CA	0	0	0	0	0
Basaloid Squamous CA	0	0	0	0	0
Burkitt's Lymphoma	0	0	0	0	0
CA ex pleomorphic Adenoma	0	0	1	0	0
CA in Situ	0	2	0	0	0
Chondrosarcoma	0	0	0	0	6
Clear Cell CA	0	0	2	0	0
Clear Cell Odontogenic CA	0	0	0	0	2
Ewing's Sarcoma	0	0	0	0	1
Fibrosarcoma	0	2	1	0	2
Hodgkin Lymphoma	0	0	0	0	0
Kaposi Sarcoma	0	0	2	0	0
Liposarcoma	0	0	0	0	0
Lymphoma	0	0	0	0	0
Malignant Ameloblastoma	0	0	0	0	1
Malignant Fibrous Histocytoma	0	0	0	1	1
Melanoma	0	0	5	3	0
Mucoepidermoid CA	0	3	16	2	8
Multiple Myeloma	0	0	0	0	2
Myoepithelial CA	0	0	3	0	0
None Hodgkin Lymphoma	0	0	0	0	0
Odontogenic CA	0	0	0	0	3
Osteosarcoma	0	0	0	0	19
Plasmacytoma	0	0	0	0	1
Pleomorphous Low Grade Adenocarcinoma	0	0	9	0	0
Rhabdomyosarcoma	1	0	0	0	4
Salivary Duct CA	0	0	1	0	0
Squamous Cell CA	156	164	71	230	87
Verrucous CA	5	0	1	29	0

DISCUSSION

Frequency of total body cancers

In the current study there were 55571 cases of body cancers distributed between the years 2009 and 2016, with average of 6946 cases in each year. This number seems to be large in comparison with some previous studies conducted in Sudan. Elhassan N (12) performed a hospital-based survey of five years between 2004 and 2008 in Khartoum state and found a total of 10680 cases while another broader survey conducted by Sudan Cancer Registry (SCR) of five years between 2009 and 2013 (13) among all Sudanese states and found a total of 43102 cases. An earlier study was conducted by Idris et al (11) between the year 1970 and 1985, the data were extracted from Sudan Cancer registry and found 14922 cases of total body malignancies. These differences in the total number might relate to the period of the collected data and/or the differences in the trend of tumor incidence.

The top 10 body cancers found in this study were breast cancer, followed by leukemia, and the last one was liver cancer. The oral cancer (OC) was number nine in both sexes. The result of the top 10 is approximately similar to the result of the Sudan Cancer Registry report between 2009 and 2013 (13), where the top 10 started with breast cancer, followed by leukemia, and the last one was other cancers. The OC, however, was not reported within the top 10 in the result of the SCR (13). There might be an increase of OC after the year 2013. On the other hand, another study conducted by Saeed et al (14) where data collected from Sudan Cancer Registry between 2009 and 2010 and included only Khartoum residents revealed that the OC was number six among the top 10 body cancers in

both sexes. Even though the study of Saeed et al (14) conducted in the same period of SCR report (13) the OC was reported in a different rank, This might be related to increase occurrence of OC among Khartoum residents comparing to the other Sudanese states. In a global survey conducted in 2008 by Feraly et al (15), the top 10 body cancers in both sexes started with lung cancer, followed by breast cancer, and non-Hodgkin lymphomas (NHL) was number 10. The OC was out of the top 10 and ranked number 15. Leukemia and lymphoma in the present study ranked in the second and third cancers whereas the OC was number nine. This means an increase in the prevalence of these cancers among Sudanese population.

Gender differences in the frequency of top 10 total body cancers
The presence of gender-specific organs (prostate, ovary, and cervix) among both genders will result in different occurrence of cancers. This means some cancers will affect one gender and not the other. Therefore, the top 10 total body cancers will be obviously different among both genders. The top 10 total body cancers in males started with prostate cancer, followed by leukemia, and number 10 was brain cancer. The OC in males was number seven. Whereas, the top 10 total body cancers in females started with breast cancer, followed by ovary, and number 10 was nasopharynx cancer. The OC in females was number eight. The first five cancers of both genders were also reported by SCR 2013 (13). The OC cancer was not included in the top ten of the SCR 2013 (13) report in Sudanese males and females separately while, in this study the OC was number seven among Sudanese males and number eight in Sudanese females. This may be due to increase occurrence of OC after 2013 and/or this study was only limited to Khartoum state. The OC was also not included within the top 10 total body cancers in a previous study conducted among Sudanese males and females between the periods from 1985 to 2004 by Hamad(9). However, the OC was number 5 among Sudanese males and number 4 among Sudanese females between the periods from 1967 to 1984 in the same study by Hamad(9).

In a study conducted by Parkin et al. (16), leukemia and lymphoma were not reported in the first ranks among the most common cancers in African males. However, breast and cervix cancers were in the first ranks among the most common cancers in African females. In the same study, the OC was also not reported among the most common in males and females. This might be due to increase prevalence of Kaposi sarcoma among Africans related to HIV disease in some African countries.

Frequency of oral cancers
In this study frequency of OC was 3.34 % of all total body cancers and ranking number nine of the top 10 total body cancers. While Hickey et al. in 1959 (17) reported a frequency of 9.8 % of all total body cancers, Malik et al. in 1976 (18) revealed a frequency of 5.5 % of the oral cancers, and Mukhtar et al. in 1986 (19) revealed oral cancer frequency of 5.3%. The prevalence of oral cancer was high in these previous studies, may that was because

the less of oral primary care and early diagnosis of oral cancers in these periods of times. In a recent study conducted by Elhassan N (12) in 2008, the oral cancer frequency was 9.4 %. This difference in results might be due to the differences in total reports gathered and/or the included periods of times.

Compared to other countries the frequency of OC in this study is less than the frequency of OC in India which reached to 30 % (20) and was attributed to tobacco and betel quid chewing. Oral and pharynx cancers in the United States (US) ranked number eight (4 %) of all body cancers among US males%, However, the oral cancer was not among top 10 total body cancers in US females (21). In Myanmar (22), it was reported that the OC ranked at the 10th position in females with a frequency of 2.2 % while, in males it was at the 6th position with a frequency of 5.3. In present study the frequency of oral cancer among Sudanese males was 5.13%, and 3.65% in females. Globally, oral cancer is considered to be at the 8th to 14th most common cancers accounting for 3 % of all cancers (23).

Trends of oral cancers
In the current study there were 1857 oral cancers. Out of these, only 1563 oral cancers were with complete details and included in the analysis. These cancers distributed between the years 2009 and 2016 with average of 195 oral cancers in each year. There was gradual increasing of the oral cancers frequency started in 2012 to 2016. The peak prevalence of oral cancers was in 2016 with 310 cases, followed by 298 cases in 2015, then 287 in 2014, 211 cases in 2013, and 208 cases in 2012. In 2011 there was an obvious decrease of the oral cancers prevalence. The explanation for this decrease is the lacking of data with complete details. In Sudan, Mosalleum et al. (24) reported gradual increase in the prevalence of oral cancer between 2004 and 2008 while, Osman et al. (25) showed that the prevalence of oral cancer in 2006 was more than the prevalence in 2007. Although these two studies were conducted in the same hospital, there were different reports of results which might relate to the inclusion and exclusion criteria of the study samples. Elhassan N (12), however, reported inconstant frequency of the OC prevalence during the period from 2004 to 2008. The author explained this result by the lack of data in the decreased years. In Myanmar, Oo et al (22)reported more or less upward frequency of the OC in 6 years period from 2002 to 2007. Upward frequencies in oral cancer have also been reported among different studies (26-28).

Types of oral cancers
In the current study there were 33 types of oral cancers, started with the most common type which was Squamous cell carcinoma (SCC) of 73.3 %, followed by salivary gland cancers of 13 % of all oral cancers, and sarcomas of 5.3 % of all cancers. This results is in agreement with that by Idris et al. (11), Abuidris et al. (29), and Elhassan N (12) which were reported among Sudanese population. That also as those reported by Ariyoshi et al.(30) in Japan and Shinde et al. in India (31).

Oral SCC has been reported to be more than 90 % of all oral cancers (3, 32, 33) while, in the current study oral SCC accounted for 73.3 %. This might be due to the increase of prevalence of salivary gland cancers in Sudanese population. However, this result is the same as that of Osman et al. (25), who reported 73.6 % of oral SCC, and approximately closed to the result of Idris et al. (11), who reported 76 % of oral SCC, in Sudan. This frequency of oral SCC is higher than the result of Ibrahim et al. (34) in Egypt, which revealed a frequency of 62.8 % of SCC in the oropharynx cancers. It is also higher than that reported by Elhassan N (12)in Sudan which showed a frequency of 62.7 % of oral SCC.

The top five types of oral cancers in the current study were Squamous Cell Carcinoma (SCC), followed by Mucoepidermoid Carcinoma (MEC), Adenoid Cystic Carcinoma (ACC), Osteosarcoma (OS), and Verrucous Carcinoma (VC). There is a slight difference between this result and that of Osman et al. (25) which revealed VC was the second after SCC, and the ACC was the third, while MEC was number five. This study result also differs from the result of Elhassan N (12) which showed that the SCC was the first, followed by ACC, then VC, MEC, and the fifth one was CA antrum. In India, shinde et al. (31) publicized the most common types of oral cancers were SCC, followed by Acinic Cell Carcinoma, and VC. Also in Iraq, Mussedi et al. (35) showed that the most common types of oral cancers were SCC, followed by ACC, and Basal Cell Carcinoma. Another result presented by Ariyoshi et al. (30) in Japan revealed that the most common types of oral cancers were SCC, followed by ACC, and MEC.

Mucoepidermoid carcinoma is the most common salivary gland cancers in USA (4, 36, 37). In the present study the most common salivary gland cancers was also MEC, followed by ACC. This result, however, is not consistent with other studies conducted in Sudan (Idriss et al) (11), Elhassan N (12), and (Osman et al) (25) which revealed that the ACC was the most common salivary gland cancers. Also, Tian et al. (38) in china and Lima et al. (39) in Brazil reported that ACC was the most common type of salivary gland cancers.

Sites of oral cancers

In the current study there were 26 sites of oral cancers. The significant increase of C14.8 which include more than one site may reflect the late presentation of most patients after the tumor reaches a very large size due to ignorance, poverty, and lack of awareness, in addition to the long travel distance which is considered as a contributory factor to the late presentation of patients seeking medical treatment (10, 24, 25). This result is consistent with the result of Mosalleum E (24), where the overlapping areas were the most common sites, followed by tongue, and then the lower lip. The increase prevalence of lower gingivolabial and lower gingivobuccal cancers may be explained as the toombak is mainly placed in the labial and buccal sulcus, and males affected twice more than females due to the habit of toombak dipping is more common in males.

In many studies, it has been reported that tongue is the most common site affected by oral cancers (22, 23, 30, 31, 34, 35, 40-42). However, in this study tongue was the most common site affected by oral cancer among Sudanese females only. This may because toombak dipping (placed in gingivolabial and gingivobuccal sulcus) in males is a very common habit which is considered as a predisposing factor of oral cancer.

The third most common site affected by oral cancers in both sexes was C00.1 (lower lip). It stood at the second most common site affected by oral cancers in males with 132 cases, while it was the 5th with only 31 cases in females (males to females ratio was 4.3:1). This may be attributed to the outdoor occupation and more sunlight exposure in males more than females. This result is similar to the result of Hogan et al. (43) in Australia, and Ibrahim et al. (34) in Egypt, but is not consistent with some previous studies in Sudan which revealed that the lower lip cancer was number four (24), and number seven (25).

Gender in relation to oral cancers

In the current study the total oral cancers analyzed were 1563 cases. Of these, 924 (59.1 %) were in males, and 639 (40.9 %) were in females. The male to female ratio was 1.45:1. In some previous studies in Sudan, Mosalleum et al. (24) revealed similar male to female ratio which was 1.44:1, Idriss et al. (11) presented male to female ratio of 1.4:1, Osman et al. (24) displayed male to female ratio of 1.5:1, and Elhassan N. (12) showed a ratio of 1.4:1. In Egypt, Ibrahim et al. (34) showed male to female ratio of 1.4:1, and in Japan, Ariyoshi et al. (30) revealed male to female ratio of 1.45:1. All these studies are consistent with the current result in gender distribution. The difference found between males and females may be related to the fact that more men are implicated in the high risk habits (like toombak dipping) than women.

There was a noticeable difference in gender distribution among the different types of oral cancers. The SCC was more frequent in males than in females, and the male to female ratio of SCC was 1.56:1. This result is comparable to the result of Mosalleum et al. (24) in Sudan which revealed male to female ratio of 1.67:1, and the result of Elhassan N. (12) who reported the male to female ratio of 1.4:1. In India, Mahajan et al. (44) revealed male to female ratio of 1.5:1, the authors related this result because more men involve in high risk habits. Other studies in India revealed high frequency of oral SCC in males than in females (2.6:1 and 3.2:1) (45, 46). All these studies showed a male predominance of oral SCC and this may due to men are more associated with high risk habits than women. The different results reported form India may reflect the difference of male to female ratio even within the same geographic area.

The total salivary gland cancers were 204 cases. Of these, 138 cases were found within the top five types of oral cancers distributed as MEC: 75 cases and ACC: 63 cases. Females were more affected than males by MEC, and the male to female ratio was 1:1.14. A similar result was reported by Elhassan N. (12) in Sudan which revealed

male to female ratio of MEC 1:1.3. In china Tian et al. (38) showed male to female ratio of MEC 1:1.25. Another study in United States of America also presented female predilection of MEC with male to female ratio 1:1.38 (36).

Osteosarcoma was number four of the top five types of oral cancer with a total of 38 cases distributed as 11 cases in males and 27 cases in females. The male to female ratio was 1:2.5. The predominance of female in osteosarcoma was also revealed by Bennet et al. (47) in United Kingdom where male to female ratio was 1:1.27. Mirabello et al. (48) stated that the incidence of osteosarcoma in middle age and elderly Black patients is slightly higher in females. In Sudan, however, Mosalleum et al. (24) reported male to female ratio of 1.14:1. Also, in China Wang et al. (49) showed slight male predominance where male to female ratio was 1.32:1.

Age in relation to oral cancers
The age distribution of all oral cancers (OC) during the eight years revealed a gradual increase in the number of OC with the increase of age in both sexes. The most age group affected by OC was ≥ 65 years, and the least age group affected was ˂ 15 years. These results are consistent with the results of many previous studies in Sudan (11, 12, 24, 25), and the global epidemiology data (50). Oral SCC in the current study was most frequent in age group ≥ 65 years, followed by age group 55-64 years, and then age group 45-54 years. About 87 % of oral SCCs were in patients older than 45 years. In Sudan, Mosalleum et al. (24) revealed increase prevalence of OSCC after age 40 years. Osman et al. (25), also in Sudan, showed that the prevalence of oral SCC after 50 years was 85.9 % and was significantly more than in younger age groups. In Brazil, 97 % of oral SSCs were in patients older than 40 years (51). In India, 93 % of oral SCCs were in patients older than 40 years (45). In Mexico, 88.3 % of oral SCCs were also in patients older than 40 years (52), and in Jamaica 85.4 % of oral SCCs were in patients older than 50 years (53). This high occurrence of oral SCC among this specific ages may be due to the probability of developing oral SCC increase with the period of exposure to risk factors, and increasing age adds the further dimension of age-related mutagenic and epigenetic changes (44).

Mucoepidermoid carcinoma (MEC) was the most common salivary gland cancer, and was most frequent in age groups 35-44, 45-54, and 55-64 years. This result is consistent with the result of Elhassan N. (12) in Sudan which revealed that MEC was mostly between 30-60 years. Tian et al. (38) in China also reported that the median age of MEC was 47 years. In Brazil, Lima et al. (39) showed that the most MEC were diagnosed between fourth to seventh decades. In United States of America, Auclair et al. (36) revealed that the peak prevalence of MEC was in the fifth decade followed by sixth decade.

Osteosarcoma was most common in age group 35-44 years, followed by age group 45-54 years. Similar result was reported in the United Kingdom by Bennet et al. (47), where the peak prevalence of gnathic osteosarcoma was between 31-40 years, followed by 41-50 years. Also

in china, Wang et al. (49) reported that the mean age of jaws osteosarcomas was 37.8 years and the peak prevalence of jaws osteosarcoma was between 31-40 years, followed by 41-50. These results may reveal that the occurrence of osteosarcoma of the jaws is more frequent in the middle age.

CONCLUSION
The following conclusions can be drawn from this study:
- During the period of this study 2009-2016 there was a trend of increase of total body cancers.
- In Sudanese population oral cancer are within the top 10 most common cancers.
- Oral SCC is the most frequent type of oral cancers, followed by salivary glands cancers, and then the sarcomas.
- The overlapping areas, especially lower gingivolabial and lower gingivobuccal, are the most affected sites, followed by tongue, and then the lower lip.
- There was slight predominance of male in the occurrence of oral cancers except in MEC and osteosarcoma where females were more affected than males.
- There was gradual increase of oral cancers with the increase of age. Elderly patients were more affected with oral SCC while, MEC and osteosarcoma were more frequent in the middle ages.

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Appendix I:

International Code of Diagnosis (ICD-2016)

C00.0: Upper lip.
C00.1: Lower lip.
C02: Tongue
C03.0: Upper gum includes alveolar ridge mucosa.
C03.1: Lower gum includes alveolar ridge mucosa.
C04: Floor of the mouth.
C05: Palate.
CO6.0: Buccal mucosa (cheek mucosa).
C06.1: Vestibule; 1-C06.1U (Upper vestibule), 2-C06.1L (Lower vestibule).
C06.2: Retromolar area.
C06.9: Minor salivary gland.
C07: Parotid gland.
C08: Salivary duct and unspecified major salivary gland.
C08.0: Submandibular gland.
C08.1: Sublingual gland.
C09: Tonsil.
C10: Oropharynx.
C11: Nasopharynx.
C13: Hypopharynx.
C14.8: Primary malignant neoplasm of two or more contiguous sites of lips, oral cavity, and pharynx. (Overlapping sites).
C41.0: Maxilla, Orbital bone.
C41.1: Mandible.
C43: Melanoma of the skin.
C44.3: Other and unspecified malignant neoplasm of skin of other and specified parts of the face.
C44.31: Basal cell carcinoma of skin of other and unspecified parts of face.
C44.32: Squamous cell carcinoma of other and unspecified parts of face.
C44.39: Other specified malignant neoplasm of skin of other and unspecified parts of face.
C44.4: Other and unspecified malignant neoplasm of skin of scalp and neck.
C44.41: Basal cell carcinoma of skin of scalp and neck.
C44.42: Squamous cell carcinoma of skin of scalp and neck.
C44.49: Other specified malignant neoplasm of skin of scalp and neck.
C30.0: Malignant neoplasm of nasal cavity.
C31.0: Maxillary sinus.
C81.4: Hodgken's lymphoma of unspecified site.
C81.91: Hodgken's lymphoma of lymph nodes of head, face, neck.
C81.99: Hodgken's lymphoma of extranodal and solid organ sites.
C85.9: Non-hodgken's lymphoma of unspecified site.
C58.91: Non-hodgken's lymphoma nodes of head, face, neck.
C85.99: Non-hodgken's lymphoma of extranodal and solid organ sites.
C95.9: Unspecified leukemia.
C91.9: Lymphoid leukemia.
C92.9: Myeloid leukemia.
C46.0: Kaposi sarcoma of the skin.
C46.1: Kaposi sarcoma of soft tissue.
C46.2: Kaposi sarcoma of palate.
C46.3: Kaposi sarcoma of lymph node.
C46.7: Kaposi sarcoma of oral cavity.
C83.71: Burkitt's lymphoma of the lymph nodes of head face, and neck.
C83.79: Burkitt's lymphoma of extranodal and solid organ sites.