

Prevalence of Dental Caries among Adult Patients in Bungoma County, Kenya

Caren M. Sumba, Donald A. Kokonya, and Bernard Wesonga

ABSTRACT

Globally, dental caries has affected nearly 100% of adult teeth. Dental caries is caused when microbial biofilm converts free sugar contained in such foods and drinks into acid which corrodes the tooth structure. In Kenya, the prevalence is 34%. This high prevalence has led to the negative impact associated with the disease. Therefore, this study's main aim was to determine the prevalence of dental caries among adult patients in Bungoma County, Kenya. This study was conducted in Bungoma County and adopted a cross-sectional design. The target population was adult dental patients and the key informants were the dentist and dental technologist. Participants were selected using multistage sampling techniques. The sample size of 347 dental patients was arrived at using Cochran's formula. Data were collected using the WHO-modified assessment questionnaire. WHO DMFT index checklist was also used. Data were analysed using descriptive and inferential statistics with the aid of the Statistical Package for Social Sciences 25.0. Data were presented using tables and figures. Logistic regression was used to determine the direction of the association at the significance level set at 0.05. Thematic analysis was used to analyse qualitative data. The researcher observed the ethical principles applicable to the study. The prevalence of dental caries among adult patients was 43.7% with a mean total DMFT index of 3.249 which signifies a moderate distribution among the adult population. Kimilili sub-county hospital had a moderate mean DMFT index of 4.47 and Webuye County hospital had a low mean DMFT index of 1.585. Dental caries was more prevalent in youths aged between 18 years to 35 years (60.1%). Moreover, the female gender has more dental caries prevalence at 57.4% as compared to male patients. The prevalence of dental caries is more prone among the rural (56.8%) as compared to the urban (43.2%). According to incomes, individuals who earn more than Ksh. 23,750 have a higher prevalence of 65.6% than those who earn less than Ksh. 23,750 (34.4%). Dental caries is more prominent in the lower jaw. Those who do not brush their teeth were 4 times more likely to develop dental caries as compared to those who practise good oral hygiene practices (OR =3.0). Those who consume sugary foods and drinks frequently (OR: 2.4) and those who smoke tobacco (OR: 2.0) were times more likely to develop dental caries compared to those who did not consume sugary foods and smoke tobacco. **Conclusion:** The prevalence of dental caries among adults is moderate with the prevalence being higher in youths, female, low-income earners (< ksh.23,750) and rural dwellers. In terms of the jaws, the lower jaw is more susceptible to caries attack compared to the upper jaw and also the posterior teeth (premolar and molars) are more susceptible to caries compared to the upper jaw. **Recommendation:** There is a need to conduct a community-based campaign even through Chiefs' Barazas on the importance of proper oral hygiene practices in Bungoma County.

Keywords: Bungoma, Caries, DMFT, Prevalence, Tooth Decay.

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I. INTRODUCTION

The global burden of dental caries is nearly 100% among adults [1]. Dental caries is the most prevalent mouth disease, which is caused by multiple factors i.e., the tooth structure, oral microbiota (Streptococci and Lactobacilli bacteria), and dietary carbohydrates [2],[3],[4]. The prevalence of dental caries is between 60 and 90% worldwide [5]. Dental caries manifests themselves through the existence of a hole in the hard tissue of teeth which becomes brown or black [6]. The caries is painless until the hole becomes bigger and reaches

the highly innervated pulp cavity [7]. When caries is left untreated, it gets deeper and becomes painful when exposed to changes in stimuli [8]. Inflammation occurs in the mouth, and the infection causes tissue death in the pulp chamber. Carbohydrates are generally cariogenic as they contain primarily sucrose [4]. Tobacco smoking is common in developing countries and is a threat to current and future world health [9]. Gender-wise, male are twice users of cigarettes as compared to female [10] and smoking or chewing tobacco has a 25% chance of developing oral diseases [11].

The morphology of the posterior teeth has cusps and pits

that are good sites for food packing [12]. The most frequent site for attacks is the 1st and 2nd permanent molars [13]. Individual tooth surface has different susceptibilities, pits and fissures on the occlusal surface are more susceptible than the smooth labial and lingual [14]. Dental caries prevalence also varies according to the position and morphology of teeth [15]. The likelihood of a tooth surface getting caries depends on the time during the 1st post-eruptive year when caries is low but rise rapidly over the years [16]. The structure of a tooth is important because some surfaces are more susceptible to caries attacks than others [17]. The posterior teeth have a higher prevalence of caries than the anterior teeth [18]. Therefore, dental caries is borne from personal behaviours [19]. Tobacco smoking, poor oral hygiene and consumption of a sugary diet increase the prevalence of dental caries [20]. About 80% of those who do not clean their teeth have cavities in more than one tooth [21]. People with poor oral hygiene are six times more at risk of contracting caries [22][23]. Therefore, the prevalence of dental caries is higher in rural than in urban [24][1] the older people have higher prevalence rates than younger people [9][11].

In African countries, there is variation in the prevalence of dental caries in relation to population and socioeconomic status. The occurrence of caries differs in countries, population groups, age, gender, residence, socioeconomic status and oral hygiene practices in sub-Saharan Africa [16]. The prevalence of tooth cavities is affected by age, gender, diets, lifestyle choices such as tobacco smoking and oral hygiene practices [1]. According to several studies, the prevalence rates were that in Tanzania at 40.2% [25], in South Africa at 42% [26], in Sudan at 52.4% [27], in Nigeria 24.1%, in Kenya 34.3% and in Sudan 30.5% [28] and in Ethiopia 41% [29]. The prevalence of dental caries increases with age [30][31]. Moreover, females exhibit a higher prevalence rate than males [32]. In East Africa, the accumulative prevalence stands at 45.7% [33].

The Kenya Oral Health National Survey of 2015 [34] revealed that the prevalence of dental caries was 34.3%. Prevalence of caries among adults living in rural arid areas was 40% [28]. Dental caries is an oral disease associated with lifestyle factors such as tobacco smoking, oral hygiene practices and dietary patterns [35]. People experience reduced oral health-related quality of life as a result of suffering from dental caries [36]. There is a vast difference in the accessibility of dental health care in urban and rural populations in Kenya that triggers increased dental caries among its adult population [37]. Notwithstanding the tobacco smoking rate in Kenya is approximately 90%. There was no previous study conducted on dental caries and its associated factors among adults in Bungoma County.

II. PROBLEM STATEMENT

In 2015, the Kenya National Oral Health Survey Report indicated that the prevalence of dental caries among adults was 34.3% [34]. Among the adults residing in arid areas, the prevalence was 40% [28]. Therefore, patients with dental cavities suffer from one or all of the social and economic effects associated with the disease [38]. Although the national oral health survey was carried out in Kenya, there has been scanty data on the current and future trends of dental caries [34] yet caries is the most prevalent oral disease affecting nearly 100% of adults [1]. In Bungoma County, the prevalence of dental caries is unknown. Thus, there was a need to investigate the prevalence of dental caries and the

associated factors among adult patients in Bungoma County. It is in accordance with this backdrop that this study was carried out to determine the prevalence of dental caries and associated factors among adult patients in Bungoma County, Kenya.

III. CONCEPTUAL FRAMEWORK

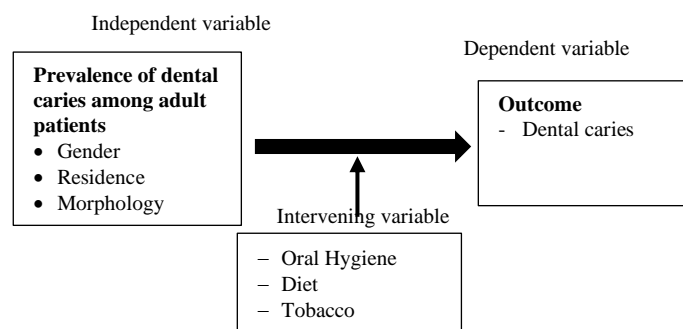


Fig 1. Conceptual framework

IV. MATERIALS AND METHODS

Bungoma County was an area of interest due to the limited oral health studies in the County [34]. In addition, the principal investigator is a dental health practitioner and thus was bequeathed the necessary expertise to determine the prevalence of dental caries and its associated factors in Bungoma County. This study was conducted at two major hospitals in Bungoma County, which are the main dental referral centres in Bungoma County - Kimilili Sub County Hospital and Webuye County Referral Hospital. These hospitals receive increasing numbers of dental carious patients and thus represent the dental caries condition in Bungoma County. The staple food for the people in Bungoma is mostly carbohydrates (Ugali). A cross-sectional design was used with both quantitative and qualitative techniques of data collection. This study design was used so as to provide a snapshot of dental caries and the associated factors among the adult population at the time of the study. The study population comprised adult patients in Bungoma County. Numerous studies had focused on adolescents and children neglecting the adult population yet the adults too, bore the burden of dental caries [39]. The target population was 700 adult patients who have been visiting the hospitals monthly.

According to departmental attendance, Kimilili Sub County Hospital received 20 patients and Webuye County Referral received an average of 15 patients daily. Convenience sampling was used to select Bungoma County as the study area because of scanty data on dental caries among adult patients. Purposive sampling was used to select only patients who were aged at least 18 [40]. Secondly, simple random sampling was used to select the 347 participants. Proportionate probability was used to sample the hospitals - Kimilili Sub County Hospital had 200 patients and Webuye County Hospital had 147 patients recruited. Data were collected by interview using the modified WHO oral health assessment form for adults (questionnaire), key informant interview guides and WHO modified DMFT Index checklist (clinical examination). These tools were used to collect data on the prevalence of dental caries and the associated factors in Bungoma County. The pre-coded questionnaires were serialized during the time of entry and data was entered into Statistical Package for Social Sciences

SPSS Version 25 for analysis. Data cleanliness was done by running all frequencies, identifying missing records and filling in details. The data were cross-checked for errors and descriptive analysis was done for basic variables that described the respondents to show the total number of responses and frequency of distributions. Analytically, correlation and regression were used. Data was presented in frequency tables and figures.

Approval to conduct this study was given by Masinde Muliro University of Science and Technology – the Directorate of Postgraduate Studies (DPS). Thereafter, the principal investigator applied for written permission from the County Government of Bungoma where the study was conducted and further permission was sought from the National Commission of Science, Technology and Innovation (NACOSTI). Specifically, the principal investigator adhered to the four pillars of medical ethics namely: Autonomy, Non-maleficence and Justice.

V. RESULTS

A. Prevalence of dental caries

The prevalence of dental caries among adult patients in Bungoma County was 43.7% a representative of active caries. Figure 2 presents the findings on the prevalence of dental caries in patients.

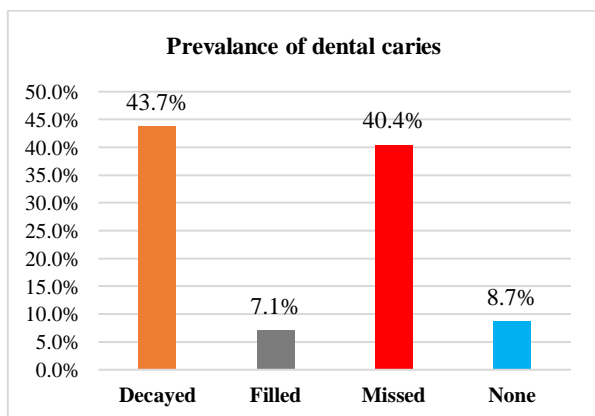


Fig. 2. Prevalence of dental caries among adults in Bungoma County hospitals

Key Informant on the prevalence of Dental caries

“...the prevalence of dental caries is high compared to other oral diseases like gum diseases and most patients visiting the clinic have caries.”

B. Determination of the Mean DMFT index (Decay, Missing, Filled Teeth)

From the data acquired from the surveyed hospitals, there was a total sum of 646 decayed teeth, 86 filled teeth and 395 missing teeth. Thus, the total DMFT was 1,127 from all the dental patients selected for this study.

The Mean DMFT was thus calculated from the total DMFT (1,127) divided by the total sampled and surveyed dental patients ($n=347$):

$$\text{Mean DMFT} = \frac{\text{Total DMFT}}{n}$$

Key
D - Decay
M - Missed
F - Filled
n – Sample size

$$\text{Mean DMFT} = \frac{1127}{347} = 3.249$$

For Kimilili Sub County Hospital was:

$$\text{Mean DMFT} = \frac{894}{200} = 4.47$$

For Webuye County Hospital was:

$$\text{Mean DMFT} = \frac{233}{147} = 1.585$$

According to the WHO of 1986 under the quantification for the DMFT index, 2.7 – 4.4 mean index signifies moderate dental cavities.

C. Prevalence of dental caries according to age, gender, place of residence, formal income (monthly salary) and hospitals.

The prevalence of dental caries in relation to the demographic characteristics of the patients was determined (age, gender, residence, and monthly income). The findings show that dental caries is more prevalent in youths aged between 18 years to 35 years (60.1%). Moreover, the female gender has more dental caries prevalence at 57.4% as compared to male patients. The prevalence of dental caries is more prone among the rural (56.8%) as compared to the urban (43.2%). According to incomes, individuals who earn more than Ksh. 23,750 have a higher prevalence of 65.6% than those who earn less than Ksh. 23,750 (34.4%). The findings were presented in Table III.

TABLE III: PREVALENCE OF DENTAL CARIES ACCORDING TO AGE, GENDER, PLACE OF RESIDENCE, FORMAL INCOME (MONTHLY SALARY) AND HOSPITALS

Prevalence of dental caries by demographic characteristics	Prevalence
Age	
<= 35 years	60.1%
> 35 years	39.9%
Gender	
Male	42.6%
Female	57.4%
Residence	
Rural	56.8%
Urban	43.2%
Formal income levels (Monthly salary)	
≤ Ksh. 23,750	34.4%
> Ksh. 23,750	65.6%
Hospital	
Webuye County	45.8%
Kimilili Sub-County	54.2%

Results presented in proportions (%); $n = 347$.

The opinion of the key informant observed that:

“... Well, the youths consume a lot of refined sugars and carbohydrate-rich foods. This has promoted a

conductive environment for mouth bacteria to thrive and exacerbate decay.”

D. Prevalence of dental caries according to the tooth structure and position.

To determine the prevalence of dental caries, it was important to understand the sections of the jaws whether the upper, the lower jaw or both jaws that were more prone to dental caries. From, Figure 3 shows that 63.3% of the participants had dental caries on the lower jaw, 26.3% had dental caries on the upper jaw and 10.4% of the participants had dental caries on both jaws.

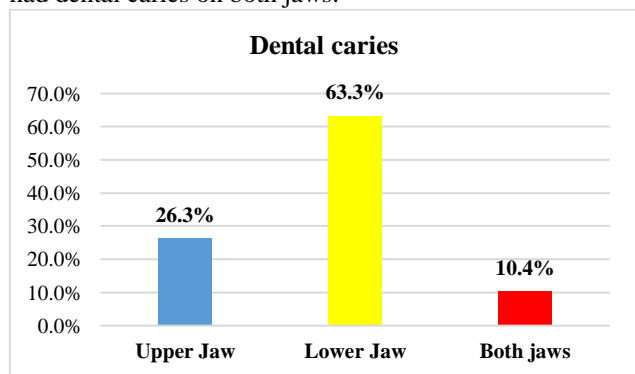


Figure 3: Position of the decayed teeth

Key informants stated that:

“...Dental caries is more prevalent in the lower jaw because the lower jaw is used for grinding food hence food stays longer in the lower teeth with poor oral hygiene dental caries sets in.”

Moreover, the researcher sought to examine the prevalence of dental caries on the upper jaws and lower jaws separately. It was established in Table IV stated that only 54.4% (n=50) of the participants had dental caries on the upper jaw while the majority (94%, n=240) had dental caries on the lower jaw. Furthermore, collectively the posterior section of both jaws had the highest dental caries of 83.6% (n=290) and the anterior section had only 16.4% (n=57) of the teeth with dental caries. From the examination of the anterior section of the mouth, the upper jaw is more (45.6%, n=42) exposed to dental caries as compared to the lower jaw (6%, n=15). The posterior section of the mouth shows that the prevalence of dental caries is mostly felt in the lower jaw and the upper jaw is the least affected.

TABLE IV: PREVALENCE OF DENTAL CARIES – UPPER JAW AND LOWER JAW

Dental caries	Frequency (raw %)		Total
	Anterior	Posterior	
Upper Jaw	42 (45.6%)	50 (54.4%)	92 (100%)
Lower Jaw	15 (6%)	240 (94%)	255 (100%)
Total	57 (16.4%)	290 (83.6%)	347 (100%)

The result is presented in frequency (n) and raw proportions (%); N=347

The opinion of key informants pertaining to the anterior teeth and posterior teeth with prevalent caries. It was stated that:

“... Posterior teeth have cusps and fissures therefore they are hard to remove the food remains. Meticulous cleaning is required. But most people do not give attention to cleaning the posterior teeth due to time and lack of skills with regard to posterior teeth cleaning. Due to their

morphology, well, the longer the food particles reside the higher chances for the carious outcome.”

E. Relationship between dental caries and behavioural factors

The prevalence of dental caries was also determined in relation to behavioural factors which were oral hygiene, a sugary diet and tobacco smoking. The study findings revealed that those who do not brush their teeth were 4 times more likely to develop dental caries compared to those who practise good oral hygiene practices (OR =3.0). Those who consume sugary foods and drinks frequently (OR: 2.4) and those who smoke tobacco (OR: 2.0) were times more likely to develop dental caries compared to those who did not consume sugary foods and smoke tobacco.

The key informant on dental caries and behavioural factors stated that:

“...Dental caries is associated with behavioural factors such as oral hygiene practices, consumption of sugary foods and tobacco smoking.”

Another key informant stated that:

“...Those who rarely observe oral hygiene are most likely to develop caries compared to those who do.”

VI. DISCUSSION

A. Prevalence of dental caries on adult patients

The mean total DMFT of 3.249 indicates that the data from the two hospitals may be used to generalise the dental caries status in Bungoma County as moderate. Moreover, in Kimilili sub-county hospital had the highest mean DMFT index of 4.47 and Webuye County hospital had the lowest mean DMFT index of 1.585. This could be, according to the results on place of residence where the rural population were mostly affected by dental caries as compared to the urban population. It is worth noting that Kimilili sub-county hospital its population is largely rural as compared to Webuye County hospital. This study has posited that there is a relationship between the demographic characteristics of adult dental patients and dental caries. At least 12.6% of the dental patients interviewed were affected by demographic factors. It is thus imperative to address the demographic disparities that are brought about by the place of residence as well as the education level that increase dental caries prevalence.

As per the study findings, it was revealed that dental caries was most prevalent in the lower posterior jaw. This could be because the lower posterior jaw holds the food for a longer time as compared to the upper posterior jaw whose teeth are made to only crush the food. Moreover, the researcher acknowledges the morphology of the posterior teeth which have pits and fissures. Food particles in most instances stay and are hidden for a longer time in those pits and fissures. This study agrees with Birungi [16] and Lussi et al [17] that the role of the posterior teeth is food grinding because of the morphology of cusps and pits, the food tends to stay there for

a longer time. Notwithstanding the inadequacies in cleaning the posterior teeth, therefore, they are the most exposed teeth to the dental cavity. This study is in line with the previous studies [13][14][23] where the tooth structure differs and as such the posterior teeth structure has pits and fissures on the occlusal surface is more susceptible to dental caries attacks than the anterior teeth. This study showed that the posterior attacks were dominant at the molars whose results concur with the findings by Innes et al. [13].

The prevalence of dental caries in the anterior teeth was fairly low as compared to the posterior teeth. The primary role of the anterior teeth is the tearing of food. Moreover, the morphology of the anterior teeth mitigates the high occurrence of cavities. However, among the anterior teeth, teeth from the upper jaw are more exposed to dental caries as compared to the lower jaw. This could be supported by the fact that the upper jaw anterior teeth are mainly for tearing food as compared to the lower jaw teeth. Besides, most people give little attention to the upper anterior thus contributing to increased risks of dental caries.

B. Evidence of dental caries prevalence

Teeth decay was the most prevalent (2 out of 5) which meant that out of a hundred people, forty-four were not taking care of their oral hygiene. Poor oral hygiene practices are a global determinant of dental caries. This could be the main reason as to why there were high dental caries from decayed teeth among the patients surveyed. The prevalence of missing teeth with cavities was 100 (2 out of 5). This was corroborated by the findings from the observation checklist where 1 out of 2 patients had carious teeth and 1 out of 4 had missing teeth due to caries. Filled teeth prevalence was at 1 out of 20 and the plastic denture was at 1 out of 50, which could signify the lack of financial resources among dental caries patients to pay for teeth filling (temporary or permanent). From the evidence, it was established that tooth decay had a higher prevalence as compared to other conditions such as missed teeth. From the interviews with dental professionals, it was stated that tooth decay was influenced by poor oral hygiene habits and consumption of carbohydrates and sugary foodstuff. Therefore, the prevalence of dental caries could be propelled by associated factors such as poor oral hygiene habits, tobacco smoking and poor diet habits. On the same note, the missing teeth indicate socio-economic incapacities to seek dental services in time to cushion against loss of teeth.

C. Prevalence of dental according to sociodemographic characteristics

Age, gender, place of residence, formal income (monthly income) and hospital dental caries prevalence was established. It was stated that the prevalence of dental caries among patients aged thirty-five and less was 3 out of 5. This meant that the youthful patients were affected by dental caries as compared to the older ones studied. According to the World Health Organisation [5], the prevalence of tooth decay was approximately 100% among adults above eighteen years. Moreover, WHO [5] findings differ from this study in that globally older people had a higher prevalence of dental caries as compared to young people. This could be because the old population globally can seek dental health services.

Moreover, they had consumed sweetened food and drinks and carbohydrates for a longer time thus with their poor oral hygiene were at a higher risk of dental caries than the younger generation. Simangwa et al. [30] had similar findings that concur with this study's finding where the dental caries prevalence among the youth was sixty per cent.

According to the gender of the participants, it was established that among the female patients' the prevalence of dental caries was 3 out of 5 and male partners were 2 out of 5. This could be because the hormonal imbalances among women have largely contributed to the increased prevalence of dental caries in females. Women have a habit of frequent snacking especially during gestation periods such as sweetened food staff. Moreover, Cheng et al. [32] concur with this study that female participants exhibited a higher prevalence rate than their male counterparts. Female dental patients have a higher prevalence of dental caries because of reasons of pregnancy because of physiological changes such as saliva flow rate, puberty and menstruation increasing their chances for dental caries [22].

Dental caries was established to be more prevalent in rural (3 out of 5) settings as compared to urban (2 out of 5) settings. Therefore, this could mean that the rural population are far from health facilities that could provide dental caries services. Moreover, Gethece [34] support this study's finding that the rural population were inaccessible to dental clinics thus increasing the prevalence of dental caries. In Addition, the local clinics in the rural setting could have had a shortage or lack of dental health professionals. Simangwa [30] noted that in the rural setting, there was a shortage of dental professionals.

Prevalence in Kimilili sub-county hospital was 1 out of 2 and Webuye was at 2 out of 5. This could be because Kimilili sub-county hospital is the headquarter of dental care in Bungoma County. Besides, Kimilili sub-county hospital has a larger catchment area thus making it have more patients who attend dental care services.

D. Relationship between dental caries and behavioural factors

The researcher investigated oral hygiene, tobacco smoking and diet as associated factors to dental caries prevalence. Of the dental caries prevalence among adult people, poor oral hygiene such as infrequent tooth brushing to liberate the teeth from food particles and sugary food particles led to a higher prevalence of dental caries in this study. In this study about half of the dental patients brushed their teeth with a proper toothbrush and toothpaste. Oral hygiene is a common and simple habit that mitigates dental cavities. However, it is an area that is much neglected as dental health patients did not properly adhere to dental hygiene practices. It was clearly, established that good oral hygiene helped mitigation against dental cavities as noted by Chen et al. [41]. In this study, it is revealed that the increased prevalence of dental cavities was due to poor oral hygiene habits such as inadequate brushing. Inadequacy in teeth brushing creates an environment in the mouth where bacteria find their residence, which produces acid that corrodes the teeth leading to teeth cavities. Poor oral hygiene increased the probability of dental caries an opinion shared by Perez and Lalloo [22].

It was discovered that the dental patients interviewed were consuming carbohydrates rich food on a daily and weekly basis. Besides, a significant number were using sugary beverages. These food types are sugar-based and therefore provide a conducive environment for mouth bacteria growth and development in the mouth thus leading to higher risks of dental caries. In this case, dental caries is propagated by a lack of or poor oral hygiene habits. It is known that sweetened foods and drinks are determinants of dental caries globally [42]. Mouth bacteria thrive on sugary remains and carbohydrate food staff that they break down and form acids that corrode teeth enamel. It was established from this study that the participants consumed carbohydrates and sweetened food and drinks. This, it could mean to be the reason for increased dental caries in Bungoma County. Therefore, advocating for proper and frequent oral hygiene – tooth brushing – will reduce dental caries in Bungoma County. This could be related to the study by Soltani et al. [43] and Bogale et al. [44], that when sweetened foodstuffs, drinks and carbohydrates are minimised the risk of dental caries.

This study posited that smoking cigarettes also contribute to dental caries, especially for those individuals with poor oral hygiene habits. Besides, cigarettes produce tar which may stick to the teeth and cause discolouring. Without proper dental hygiene chewed and smoked cigarettes tend to get stuck in the teeth. This is also informed by the study by Komar et al. [45], which established a significant association between tobacco smoking and dental caries prevalence, which was 1.32 times more likely to cause dental caries in smokers as compared to non-smokers. Moreover, Sandeep et al. [46] had similar findings to this study that cigarette smoking increased the prevalence of dental caries rate.

VII. CONCLUSION

The prevalence of dental caries among adults is moderate with the prevalence being higher in youths, female, low-income earners (< ksh.23,750) and rural dwellers. In terms of the jaws, the lower jaw is more susceptible to caries attack compared to the upper jaw and also the posterior teeth (premolar and molars) are more susceptible to caries compared to the upper jaw. When comparing the association of dental caries and behavioural factors, dental caries is more prominent in those with poor oral hygiene practices, those that frequently consume sugary foods and those that smoke tobacco. The burden is however the most on those that have poor oral hygiene practises.

VIII. RECOMMENDATION

This study determined that the prevalence of teeth decay is a result of poor or lack of proper hygiene practices. Therefore, it is important to conduct a community-based campaign even through Chiefs' Barazas on the importance of proper oral hygiene practices in Bungoma County. It will be vital for carious patients to always brush their teeth with toothpaste to rid the cavities of the sweetened food or drinks and food rich in carbohydrates to mitigate against dental caries. Train the community members on proper brushing techniques in order to effectively control food remaining and subsequent caries at the posterior teeth.

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