Original Article

Prevalence of dental caries and associated risk factors among adult outpatients attending Gakoma district hospital, Rwanda

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ABSTRACT

Introduction: Dental caries and other oral health conditions are public health challenges worldwide. The World health organization reports the burden of oral diseases to be less in developing countries including Africa and higher in the developed world. Despite health sector improvement in Rwanda, dental caries has remained among the leading causes of consultation at all levels of the health care delivery pyramid with high numbers in rural communities. The prevalence of dental caries experienced in Rwanda is found to be 64.9% but few studies have been conducted assessing the predisposing risk factors, especially in adults. The objectives of the study included the determination of dental caries prevalence and associated risk factors among adult outpatients who attended Gakoma district hospital in Gisagara district of Rwanda from November 2016 to January 2017. **Methods:** Hospital-based cross-sectional study using quantitative methods with a sample size of 281participants aged 18 and above systematically selected randomly without repetition from patients' registry at reception picking every tenth among patients who attended Gakoma district hospital's outpatient department during the study period. The sample size calculation used Yamane's 1967 formula. Ethical approval was issued by the school of health sciences of Mount Kenya University and informed consents were signed by participants with the right to withdraw at any time without prior justifications. Data collection instruments included a self-administered close-ended questionnaire with questions on sociodemographic characteristics, eating and drinking habits, oral hygiene practices, and smoking habits; and a data sheet to extract data from patients' files after a physical dental examination of study participants. The study collected information on risk factors for dental caries development that included age, gender, oral hygiene practice, alcohol consumption, sugary snacks, and beverages consumption, and tobacco use. Data were analyzed using a statistical package of social sciences at a 95% confidence interval. **Results:** The prevalence of dental caries is 71.5% among patients attending the outpatient department and predisposing risk factors were found to be old age, gender, poor oral hygiene, consumption of sugary snacks and beverages. Alcohol was also found to contribute to dental caries development, but no statistical significance was found. **Conclusions:** The prevalence of dental caries was found to be high in the study population and the multifactorial risk factors associated with its development were found to be poor oral hygiene, frequent consumption of sugary snacks and beverages, gender, and old age. The study recommended further studies to explore these multifactorial risk factors on a larger scale.

Key words: *dental caries, risk factors, Gakoma district Hospital.*

The importance of teeth hygiene seems less known by a portion of the general population mainly in rural areas with the influence of their education level and other socioeconomic factors. The oral cavity plays an important role in physiological processes, including digestion, respiration, and speech and it is a key indicator of overall health, wellbeing, and quality of life [1]. The World Health Organization defines oral health as a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum disease, tooth decay, tooth loss), and other diseases and disorders that may limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing [2]. The Global Burden of Disease Study 2016 estimated that oral diseases

affected 50% of the world's population (3.58 billion people) with dental caries in permanent teeth being the most prevalent condition assessed [3]. The disease causes tooth decay leading to teeth loss in addition to local, psychological, systemic, and social complications. Some risk factors are known for specific chronic diseases including diet, hygiene, tobacco use, alcohol, and risky behaviors causing casualties and impairments. Some of the food listed to be cariogenic include sugar and chocolate, confectionery, cakes and biscuits, jams and jellies, ice cream, fruit syrup, sugared soft drinks, and flavored /sweetened milk, pastries, fruit pies, puddings, and sugared breakfast cereals [4]

Approximately 99% of human fluoride is found in bones and teeth and high-water fluoride concentrations produce skeletal and dental fluorosis. Optimal amounts of fluoride prevent dental caries, and since the 1950's WHO adopted water fluoridation as a public health strategy to increase fluoride from 0.7 to 1.2mg F-/L depending on both conditions and the amount of water consumed per day in the region [5]. The Potential of Hydrogen (PH) is a significant aspect that influences dentin erosion. Acidic beverages are responsible for more permeability of dentin, and they include lemon juice (187.83%), orange juice (148.33%), vinegar (147.16%), Cola drink (139.83%) and white wine (184%) [6]. The combination of Smoking and other factors such as old age, poor oral hygiene practices, food choices, and fewer dental visits predispose to higher caries. Oral smokeless tobacco (ST), or tobacco chewing is a significant contributor to the increased occurrence of dental caries [7].

Tobacco use is estimated to be responsible for more than nine in ten oral cavity cancer cases and is linked with exacerbated periodontal diseases, and poor oral hygiene leading to premature tooth extraction [8]. Any form of tobacco use alters the host immunity level making it unable to challenge bacteria on dental plaque providing favorable environment for bacteria in the mouth. The byproducts of smoking inhibit the mechanism that restricts the growth of pathogenic bacteria in the oral cavity [9]; and smokers have a decreased level of hygiene compared to non-smokers [10]. A significant dental caries causal relationship exists between eating habits and choices like fatty foods, sugars-containing foods or fermentable carbohydrates, nutrition status, and dental health. [11].

Dental erosion results from both food and beverages containing acidic ingredients and these are widely available and include Coca-Cola and orange juice due mainly to phosphoric acid which is a common constituent in these drinks for its preservative property [12] [13] Occurrence of dental diseases within a population change according to age, gender, race, socio-economic class, race, geospatial location, eating choices and individual oral hygiene practices.

Psychotropics promote dental caries development due to their affection for the consumer's behavior. Some classes of pharmaceutical formulations facilitate dental caries development as the effect of the active pharmaceutical ingredient (drugs causing dry mouth like antimuscarinics) or additives in the compounding (high sugar content). The list also comprises drugs that reduce the buccal pH like inhaled powders and drugs that cause demineralization such as tetracyclines [14]. The current fast-changing lifestyles with more consumption of sugar, inadequate hygiene, and lack of both fluoride and calcium negatively impact oral hygiene all over the world [15].

In Rwanda, the recent oral health survey conducted in 15 randomly selected sites in both rural and urban zones with 2097 participants revealed that 64.9% had caries experience and their greater portion (70.6 %) never consulted health facilities [16]. However, 19.4% of all outpatients received at Butaro district hospital in 2012; regardless of their age range, had oral health complaints as a major concern and among them, 80% were diagnosed to have dental caries where more than 95% underwent dental extraction [17]. In children, a basic package of oral care composed of oral urgent treatment, affordable fluoride toothpaste and atraumatic restorative treatment was proven to be effective in reducing dental caries, gums bleeding, and mouth pain [18]After comparison, people in rural areas are more affected than those ones in urban areas; and frequent consumption of Sugar-Sweetened Beverages and foods is highly related to dental caries development and eating choices are their major factors [5]. This study aims to determine the prevalence of dental caries and associated risk factors among adult outpatients attending Gakoma district hospital from November 2016 to January 2017.

MATERIALS AND METHODS

It was a hospital-based cross-sectional research design using quantitative methods to assess the prevalence of dental caries and associated risks factors among adult consulting outpatient departments during the study period. The Gakoma district hospital is in Gisagara district

Southern province of Rwanda. The data collection was done using a structured questionnaire during a physical dental examination.

Ethical and hospital administrative procedures were considered before having access to patients. This study was ethically cleared by Mount Kenya University through the approving committee of the School of Health Sciences. It also got a permission letter from the administrative authorities of Gakoma district hospital. The dignity, privacy, and confidentiality of the patient information were our first concerns. In the study, the patients' names have not been used instead the code has been assigned to every participant. The results of the study will only be used in improving and protecting the health of the population. It used systematic random sampling technique without repetition and the sample size calculation for this study used Yamane1967 formula

Where $n=N/1+N(e)^2$, e=0.05

Hence, n=N/ (N.e2) +1= 949/ (949X0.00025) +1=281

n=281

After coding, rating, ranking, and categorizing the collected data, the data entry and data analysis using Statistical Package for Social Sciences version software.

RESULTS

The prevalence of dental caries has been found to be 71.5% as shown in Table 2 with a 95% confidence interval lying between 70.84% and 72.27%.

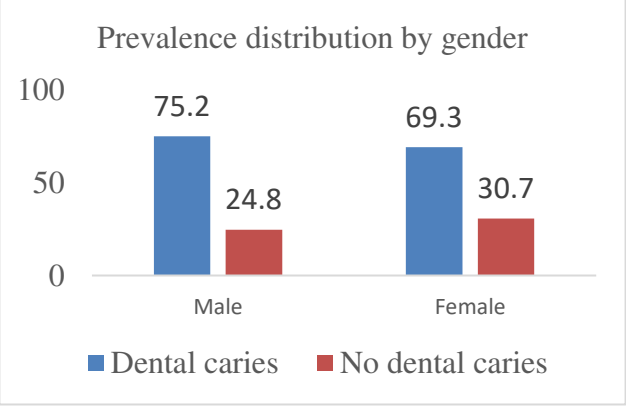

Figure 1: Prevalence of dental caries by gender

Despite the results presented above, only 3.6% of the respondents were found to be free from any oral health conditions. The prevalence was found to be higher in males than females with 75.2% and 69.3% respectively.

However, this difference in dental caries prevalence by gender is greatly related to poor healthcare-seeking behavior among males compared to females. By considering the age group, dental carries were more prevalent among elders with 92.7% in the age group of 51 to 65 years, compared to 78.8% in 36 to 50 years and 73.3% in elders over 65 years. Contributing factors could include the difference in eating habits and lifestyle in general.

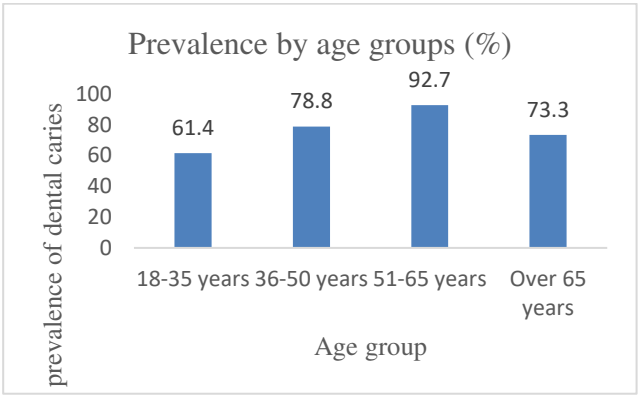

Figure 1: Prevalence of dental caries by age groups

As shown in Table 3, a high prevalence of dental caries was observed among the population with poor oral hygiene where 42.3% use wooden sticks to clean their teeth and 65.5% occasionally clean their teeth. Besides this, 6.3% declared never cleaning their teeth and only 19% followed the recommended standard frequency of tooth brushing at least twice daily using a toothbrush and fluoride-containing paste. This is a serious socio-cultural risk factor for developing not only dental caries, but also other oral conditions related to poor oral hygiene. Considering the toothpaste content in fluoride and its beneficial impact on oral health status, we obviously notice a challenge in population behaviors towards oral hygiene for general oral health protection.

The level of soft drinks and sugary snacks (sugary food and beverages) consumption were found to be risk factors in dental caries development among this population where 61.9% and 55.5% frequently consume soft drinks and sugary snacks respectively. Furthermore, regular consumption of soft drinks and sugary snacks is 24.6% and 28.1% respectively. Among respondents, 13.2% and 14.9% declared neither consumes soft drinks nor sugary snacks and this is an advantage to this population with poor oral

hygiene. The consumption of soft drinks increases the risk of developing dental affections including dental caries by the contribution of sugars to the proliferation and development of bacteria and other micro-organisms. Culturally, the consumption of sugary diets and drinks is relatively low in elders than in young people.

Participants were exposed to frequent alcohol consumption where 5.7% reported drinking every day while 38.1% drink several times during a week. Excessive alcohol consumption is not only among the common oral health risk factors but also harmful to the general health and a risk factor for other non-communicable diseases including liver impairment and progressive brain damage. Exposure to both excessive alcohol consumption and poor oral hygiene intensifies the risk of developing oral health conditions including dental caries. 69.8% of participants are Roman Catholic Church believers which explains the high number of people drinking alcohol. However, due to the low economic income of the population, they consume traditionally brewed banana or sorghum beers which do not have known alcohol concentrations for us to compare with international recommendations on the quantity of alcohol.

Among respondents, tobacco users were 4.3% which constitutes a lesser exposure rate compared to other risk factors highlighted above. Generally, the respondents are prone to developing oral health conditions mainly through exposure to different factors exacerbated by poor oral hygiene, alcohol and soft drinks consumption, and sugary snacks.

Testing the association of risk factors and dental caries development tested by using chi-square has found a significant association between poor oral hygiene frequency and the use of wooden sticks associated with dental caries development (P = 0.000). A strong association was also found between frequent sugary snacks and beverages consumption and the development of dental caries among this population (P = 0.000). Gender was also found to have a significant association with dental caries development (P= 0.000) where being male is riskier than being female. This is mainly due to the poor healthcare-seeking behavior of males among the population.

Age was found to be positively associated with dental caries development (P=0.000) and this can be easily noticed through the prevalence that is higher in elders than in young ages. Frequent alcohol consumption was found to be significantly associated with the development of dental caries (P=0.000). However, recent studies have not concluded its association with dental caries development despite its ability to favor bacteria multiplication and proliferation in the mouth.

No significant association has been found to be between tobacco use and the development of dental caries (P = 0.115) despite its provision of a favorable environment for the development of mouth bacteria like p. gingivitis and p. intermedia among others.

The logistic regression at a 95% confidence interval found that males were 3.75 times more likely to develop dental caries compared to females (OR = 3.75, 95% CI:[1.85-7.58], P=0.000). Apart from gender, age was also associated with dental caries development where having less than 50 years of age attributes 3.362 greater risks of developing the disease (OR = 3.362, 95% CI: [1.452-7.785], P=0.001). The frequency of oral hygiene is also associated with dental caries development to the extent that not brushing teeth were 9.536 times more likely to develop dental caries compared to those who were brushing at least once daily (OR = 9.536, 95% CI: [4.518-20.128], P=0.000). Similarly, cleaning teeth using a wooden stick was about 2 times more likely to develop dental caries compared to those who used brush and toothpaste regularly (OR = 1.84, 95% CI: [1.21-3.43], P=0.012). The extent to which people consume sugary snacks and beverages were associated with dental caries, where those who frequently consumed sugary snacks and beverages were 4.5 times more likely to develop the disease than those who did not (OR = 4.5, 95% CI: [1.68-5.34], P=0.005). The frequency of alcohol consumption has also contributed to the risk of getting dental caries diseases although the association was not statistically significant (OR = 1.795, 95% CI: [0.146-3.079], P=0.08).

DISCUSSION

The prevalence of dental caries was found to be 72.25% among adult outpatients attending Gakoma district hospital. Although hospital-based, this result is comparable to findings from the national oral health survey conducted in Rwanda in which two-thirds of the study participants reported having caries experience, and a community-based cross-sectional study conducted in Uganda among adults in four districts Arua, Mbale, Kampala, and Mbarara which found the prevalence to be 62.5%.

Dental caries experience was reported to be 64.9% among the general population in Rwanda which correlates the current prevalence of 71.5% in this hospital-based research recruiting already exposed people. However, it is less than 80% prevalence found among elders in a rural area of Kenya comparable to Gisagara district with less access to dental care among 15 to 65 years; and 83.7% prevalence among HIV patients in a hospital-based study conducted in Uganda. Contrally, it is higher compared to 22.6% prevalence among adult patients attending a tertiary dental institution although the difference could be linked with the level healthcare package where only complicated cases are expected.

Males are more affected than females although the level of consultation is inversely less in males than females as confirmed by a study in Butaro district hospital assessing the management of dental caries in rural northern Rwanda among patients aged over 21 years [17]. It is comparable to findings from a cross-sectional hospital-based study in Ethiopia which found the prevalence in adult outpatients to be 78,2%. The prevalence was found to be more concentrated in elders where the prevalence is 92.7% in the age group of 51 to 65 years, and 73.3% in elders over 65 years, which is comparable to findings from the national oral health survey which was found to be 82% among people aged 40 and above. It can also relate to the 80% prevalence found among elders of rural areas in Kenya.

Poor oral hygiene is found to be associated with the development of dental caries among our study population which correlates with findings from the meta-analysis research in east African countries which found poor oral hygiene to be an independent factor for the development of dental caries and other oral diseases. They also correlate with a school-based cross-sectional study conducted in Tanzania which reported dental caries to be related to irregular use of toothpaste and a school-based cross-sectional study conducted in Ethiopia which found dental caries to be related to poor oral hygiene especially the use of small sticks of wood.

It revealed the significant association between frequent sugary snacks and beverages consumption and the development of dental caries among the studied population which correlates with findings from a school-based cross-sectional study conducted in Tanzania which reported dental caries to be related to the high frequency of sugary snacks and soft drinks consumption and this is mainly due to the ability of sugars to favor the development and proliferation of micro-organisms.

Association between gender and development of dental caries; although not in line with other findings; showed females to be riskier than males in developing dental caries. the explanation is linked to earlier eruption of teeth in girls, longer exposure of girls' teeth to the cariogenic oral environment, easier access to food supplies, and frequent snacking during food preparation. No association established between tobacco use and dental caries development in contradiction to findings from a longitudinal study in Sweden which found significant contribution of tobacco use to the development of dental caries with a p-value of 0.0001.

In this case report we have discussed the use of direct drill technique for flapless implant placement. This approach is novel and requires less time consumption. It also leads to lower patient morbidity.

CONCLUSION

The prevalence of dental caries among adult outpatients attending Gakoma district hospital has been found to be 71.5% and the prevalent risk factors contributing to dental caries development among this population were found to be poor oral hygiene such as the use of wooden sticks for teeth cleaning, frequent consumption of sugary snacks and beverages, alcohol consumption, age, and gender. This prevalence is high, and their predisposing factors could be reversible through the adoption of appropriate oral hygiene and healthy eating habits. Poor oral hygiene has been found to be the most frequent risk factor for dental caries and its combination with other factors increases the likelihood of developing dental caries. Dental health conditions are multi-factorial diseases with the possibility for prevention and control to reverse the tendency of their burden. Strategies would include community-based, learning institutions and family-based approaches to raise community awareness and behavior change. Policymakers and primary healthcare providers are to make comprehensive primary and secondary prevention and control programs regarding dental affections and oral health promotion in general.

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