(RESEARCH ARTICLE)

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Oral health assessment of urban and rural dwellers in Bafia-Cameroon

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Abstract

Background: The public health problems associated with oral health are a serious burden on countries around the world. Those problems are acute in developing countries which are hit by non-communicable chronic diseases, including oral diseases.

Objectives: The purpose of this study is to assess the oral health of individuals from both urban and rural areas in Bafia, Cameroon.

Materials and Methods: A commnunity and descriptive cross-sectional survey with probability sampling was used in this study. 2,840 individuals, aged 5 years and older, were selected, using a two-staged simple random sampling technique. The study was based on a structured questionnaire completed by the participants, and on a clinical examination performed by the dentists. Statistical methods included bivariate analyses.

Results: Among the 2,759 participants who successfully completed the survey, 53.4% were males and 46.6% were females. Majority of the participants i.e., 52.4 % belonged to 17 years and more vs 47.6 % who belonged to 05-17 years age group. Of the total individuals examined, 50.4% had a poor oral health level, of which 42.9% urban dwellers and 57% rural dwellers.

Conclusion: There is a significant need for increased public awareness and regular surveillance of oral hygiene practices, as well as the complications associated with poor oral hygiene. In addition, development of guidelines, public health awareness programmess and dental community educational programmes are urgently needed.

Keywords: Oral health; Buccodental hygiene; Dental public health; Bafia-Cameroon

1. Introduction

Like the concept of health, that of oral health is an elusive one because numerous definitions are associated with it [1] [2]. Despite this complexity, oral health is considered as "a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, and tooth loss" [3]. Accordingly, oral health is related to the overall health of individuals. However, oral and general health status depends on a dynamic interplay of several factors, including the individual's personal attributes, behaviors, and perceptions. Despite great improvements in the oral health of population, global problems still persist [4]. According to FDI world dental federation [5], oral diseases affect nearly 3.5 billion people worldwide, and it is estimated that 2.3 billion people suffer from tooth decay (dental caries) of permanent teeth, whereas severe gum (periodontal) disease, which result in tooth loss, affects 10%

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of the world population. In the industrialized countries, oral cancer, which includes cancers of the lip and oropharynx, is one of the 10 most common cancers, with an estimated 300-700 thousand new cases every year [6]. A significant increase in the burden of oral-health related diseases has been observed recently in developing countries, particularly in Sub-Saharan Africa. This increase is largely the result of poor awareness concerning the importance of oral health and best practices towards achieving good oral hygiene. Contributing factors to this burden include but are not limited to: increased sugar consumption, inadequate oral hygiene practices and a high prevalence of smoking. All these factors are known to have considerable influence on the development of the most common oral diseases, such as dental caries, periodontal diseases, oral precancerous lesions and cancer. Although those oral diseases represent a significant burden on the quality of life and healthcare economics of sub-Saharan Africa countries, restorative and preventive dental care have not been given nearly enough attention. Some studies have been performed to assess oral health of dwellers worldwide, but data on oral health of dwellers living in urban and rural in semi-urban settings in sub-Saharan Africa is still lacking. Given the fact that, prevention of dental diseases is critical to preserving not only oral health but also to maintaining general well-being, this study this study is interested in assessing the health status of the oral cavity of individuals aged 05 years and older; this is the purpose of developing a prevention program at the community level.

2. Material and methods

2.1. Study area

This study focuses on the city of Bafia, which is located in Cameroon slightly above the Equator, between 4°40'00''-4°47'00'' latitude North and 11°07'30''- 11°17'30'' longitude East. It is a semi-urban setting located about 120 km from Yaoundé the national capital, at 1,100 and 1,300 m above sea level, and over the southern Cameroonian plateau in the Mbam-and-Inoubou department, over an area of approximately 1,300 km^2. The setting hosts nearly 69,270 inhabitants, and urban dwellers comprise 55% of the total population. Bafia is essentially an administrative city. Economic activities are dominated by agriculture, hunting, fishing, and other informal activities such as catering and small retail trade.

2.2. Study design, target population, and sampling

An observational and descriptive cross-sectional design study was conducted. Though a community-level study, the survey targeted only individuals aged 5 years and above. The sampling size was determined using the following formula:

$$n = \frac{z^2 \times p(1-p) \times f \times k}{r \times e^2}$$

n: size of the sample;
e: sought precision;
f: average household size;
k: non-response rate;
r: proportion of households with health conditions;
z: value of the normal distribution for the desired confidence level 1-α; p: expected coverage or prevalence rate

From this, a size of 2,840 individuals was determined. The study being a cross-community one, participants were selected based on a stratified cluster random sampling, involving the 50 enumeration areas defined by the Census national agency (2011). The first cluster consisted of rural areas comprising 8 enumerated areas whereas the second cluster consisted of urban areas comprising 42 enumerated areas. Regarding the cluster variable, the rural areas had relatively few inhabitants and hence a much lower proportional weight compared with the urban areas. Therefore, the sample was disproportionately stratified by cluster using a post-sample weighting factor, to ensure a low error rate on the overall performance. Community results included a weighting coefficient applied to inhabitants of each of the clusters, in order to cancel out the influence of their different population sizes. The final sample was made up of 2,217 participants from the urban areas and 623 participants from the rural areas. Thus, this sample was considered as representative of the whole Bafia population of five years of age and more.

2.3. Data collection and survey tool

Data were collected from a questionnaire and a clinical oral examination. With regard to the questionnaire, we resorted to a standardized questionnaire adapted from the WHO Oral Health Surveys manual, which provides guidelines for assessing oral health status of a population [7]. With the aim to answer the research question, the questionnaire was composed of items pertaining to sociodemographic information, extraoral conditions, dentition status (crown, root), periodontal status, loss of attachment, enamel fluorosis, dental erosion, dental trauma, oral mucosal lesions. The questionnaire was administered face-to-face to all participants by trained teams consisting of ten graduate students in

epidemiology. Prior to the data collection, questions were pre-tested among comparable groups in order to assess reliability and validity. Tests of reliability of answer were carried out in each cluster from a sub-sample of participants whose same questionnaires were given five days after completion of the initial questionnaire, and validity rate of at least 80% was considered. The clinical oral examination was conducted by two dentists, who performed examinations visually with prepackaged sterilized instruments (plane mouth mirrors, metallic periodontal probes) and equipment (rubber gloves, mask, and gauze pads, plastic containers) according to WHO specifications. The number of teeth with carious lesions at D3 level according to the Eckstrand classification, teeth with fillings and missing teeth were recorded [8]. The DMFT Index was calculated according to the World Health Organization criteria. For dentate subjects, the Simplified Oral Hygiene Index (OHI-S) as described by Greene and Vermillion [9] was applied with its two components (debris and calculus index). The modified gingival index (MGI) was used to assess periodontal status ranging from 0 = no inflammation to 4 = severe inflammation.

2.4. Data management

Data were processed and analyzed using Social Sciences (SPSS-PC+) for Windows as described by Maroco [10]. Bivariate and multivariate analyses of the data on oral health knowledge, attitudes and practices were based on frequency distributions. The Chi^2 test was used in the statistical evaluation of the bivariate frequency distributions. All tests were applied at a significance level of 5%. An "oral health status score" was calculated by adding the total number of items answered correctly in the Oral Health Assessment Tool (OHAT) proposed by Chalmers et al. [11]. Thus, oral health status scores ranged from 0 to 16, with higher scores indicating poor oral health.

2.5. Ethical considerations

The study was approved by the *Institutional Research Ethics Board for Human Health* of the School of Health Science (Catholic University of Central Africa). The informed written consent of each individual was taken prior to recording oral health, and confidentiality of responses was assured. In addition, permission to examine population groups was obtained from the relevant local authority.

3. Results

3.1. Demographic Details

Table 1 Sociodemographic characteristics of the respondents

Variables	Urban (n=2158)		Rural (n=601)	
Gender	Frequency	%	Frequency	%
Male	1035	48.0	438	72.9
Female	1123	52.0	163	27.1
Age group				
[05-17]	1131	52.4	183	30.5
]17-75]	1027	47.6	418	69.5
Education level				
No Education	445	20.6	164	27.3
Primary level	647	30.0	287	47.7
Secondary level	903	41.8	139	23.2
University level	163	07.6	11	01.8
socio-professional status				
Unemployed/Retired	118	05.5	98	16.3
Civil servants	93	04.3	16	02.6
Self-employed professionals	216	10.0	10	01.7
Informal activities	1523	70.6	171	28.4
Farmer/hunter	208	09.6	306	51.0

A total of 2,840 individuals were selected to participate to this study. However, 2,759 completed the questionnaires, yielding a response rate of 97.1%. The breakdown of the population by gender is well balanced (53.4% males vs 46.6% females), that is a sex ratio of 1.1. Majority of the participants i.e. 52.4 % belonged to 17 years and more vs 47.6 % who belonged to 05-17 years age group. The level of education varied among the respondents with majority of them (77.9%) having attended school vs 22.1% who never went to school. Table 1 also indicates that what ever the residency context (rural or urban), most of the participants are involved in informal activities (61.4%), and 18.6% in agricultural and hunting activities.

3.2. Oral health-related practices

Table 2 Distribution of participants' habits and practices regarding oral hygiene according to group age and area of residence in Bafia

Variables	Youths (5-17 years)		Adults (+18 years)		P value
	Urban	Rural	Urban	Rural	
Frequency of tooth cleaning †					0.113
Seldom or no cleaning at all	45 (04.0%)	89 (48.6%)	127 (12.4%)	241 (57.6%)	
Once daily	1039(26.8)	79 (43.2%)	729 (71.0%)	128(30.7%)	
At least twice daily	47 (04.2%)	15 (08.2%)	171 (16.6%)	49 (11.7%)	
Reasons for tooth cleaning/brushing†					0.003
Clean/bright teeth	929 (82.1%	97 (53.0%)	602 (58.6%)	287 (68.7%)	
Bleeding gums prevention	84 (07.5%)	20 (10.9%)	111 (10.8%)	52 (12.4%)	
Oral diseases prevention	118 (10.4%)	66 (36.1%)	314 (30.6%)	79 (18.9%)	
Tooth cleaning instrument †					0.215
Finger/Piece or tissue	19 (28.2%	11 (06.1%)	48 (04.7%)	86 (20.6%)	
Chewing sticks	84 (60.5%	74 (40.4%)	106 (10.3%)	201 (48.1%)	
Toothbrush	1028 (11.3%	98 (53.5%)	873 (85.0%)	131 (31.3%)	
Duration of brushing †††					---
Less than 2 mn	829 (88.4%)	98 (76.6%)	599 (80.5%)	262 (81.9%)	
2 mn and more	109 (11.6%)	30 (23.4%)	145 (19.5%)	88 (18.1%)	
Method of brushing †††					0.131
Vertical	273 (29.1%)	71(55.5%)	200 (26.9%)	194 (60.6%)	
Horizontal	577(61.5%)	39 (30.5%)	443 (59.5%)	77 (24.1%)	
Combination of above and circular	88 (09.4%)	18 (14.0%)	101 (13.6%)	49 (15.3%)	
Toot cleaning aids used †					0.117
Chewings	138 (43.9%)	79 (43.2%)	282 (27.4%)	207 (49.5%)	
Toothpowder	52 (34.4%)	31 (16.9%)	103 (10.0%)	127 (30.4%)	
Fluoridated Toothpaste	941 (21.7%)	73 (39.9%)	642 (62.6%)	84 (20.1%)	
Dietary habits†					0.002
Foods rich in adhesive sugars	477 (42.2%)	39 (21.3%)	111 (10.8%)	21 (05.0%)	
Sweet drinks	418 (36.9%)	27 (14.7%)	75 (07.3%)	14 (03.3%)	
Regular consumption of alcohol	143 (12.7%)	96 (52.4%)	527 (51.3%)	261 (62.4%)	
Regular consumption of tobacco	93 (08.2%)	21 (11.6%)	314 (30.6%)	122 (29.2%)	
What do you do if having signs of tooth decay†					0.014
Don't care if no pain	347 (30.7%)	102(55.7%)	401 (39.0%)	126 (30.1%)	
Just try to cope with the problem	710 (62.8%)	81 (44.3%)	500 (48.7%)	292 (69.9%)	
Go and see a dentist	74 (06.5%)	--------	126 (12.3%)	--------	

Number of times having visited a dentist†					
Never	1047(92.6%)	168(91.8%)	917 (89.3%)	388 (92.8%)	0.003
1-2 times	71 (06.3%)	15 (08.2%)	84 (08.2%)	30 (07.2%)	
3 times and more	13 (01.1%)	------	26 (02.5%)	-----	
Preventive actions during last 1-2 years†					
None	969 (85.8%)	171(93.4%)	836(31.0%)	372 (89.0%)	---
Check-up buccal cavity	----	----	31 (03.1%)	07 (01.7%)	
Fissure sealing	38 (03.3%)	----	27 (02.6%)	12 (02.9%)	
Teeth scaling	124 (10.9%)	12 (06.6%)	133 (12.9%)	27 (06.4%)	

†: n=2759, with 1131 urban youths, 183 rural youths, 1027 urban adults, and 418 rural adults; ††: n=502, with 182 urban youths, 97 rural youths, 145 urban adults, and 78 rural adults; †††: n=2130, with 938 urban youths, 128 rural youths, 744 urban adults, and 320 rural adults

Table 2 provides details concerning oral health habits in the community. Tooth cleaning habits were more reported by urban participants than rural participants (Chi^2 57.72 ddl=1, P<0.113), and some difference according to group age, as rural adults claim seldomly or never clean their teeth (57.6%). For those who said they clean their teeth, regardless of age group and place of residence, it is much more to make teeth bright than to prevent bleeding gums or oral diseases. The majority of respondents reported that they make use of toothbrushes for cleaning their teeth, with the exception of adults living in rural areas who are still bound to chewing sticks. Most of the respondents claimed to brush their teeth at least twice a day and such practice was reported regardless or the residency areas. The majority of participants brushed their teeth in the morning and very less in the evening, relatively more often by urban respondents. For respondents who claimed to brush their teeth once a day, most reported brushing in the morning, more often by adults living in the urban areas (71.0%). Furthermore, regardless of age and residency area, most of the participants brushed their teeth with a hard-bristled brush, though it is tending to happen in rural areas (Chi^2 89.59 ddl=2, P<0.001). At both group ages and living areas, three-quarters of study participants clean their teeth for less than 2 minutes. Regarding the direction of brushing stroke, only 12.0% brush their teeth in a combination of vertical, horizontal, and circular motion, according to the WHO recommendations. This recommended method was performed most frequently by adults, while horizontal or vertical brushing technique was more common in youths living either in rural or urban areas (Chi^2 61.42 ddl=2, P<0.131). In general, fluoridated toothpaste was used frequently (63.1%). This practice showed only minor variation by age or residency area. Besides, let's mention the significant use of other aids such as chewings (26.3%) and toothpowder (11.3%), with a balanced trend in rural and urban participants (Chi^2 49.83 ddl=1, P<0.117). The findings indicate consumption of sweet/sugar foods and drinks and statistically significant differences by location appeared for most of the answers (P<0.002). Majority of participants claimed consuming alcohol and tobacco, however with higher levels in youths (52.4% for alcohol and 11.6 for tobacco) and adults (62.4% for alcohol and 29.2% for tobacco) living in rural areas. The findings also highlight the utilization of dental services, with almost all the participants, regardless of age group or residency areas, reporting that they had never seen a dentist. About one-fifth of the participants had seen a dentist within the previous 1-2 years, particularly participants living in urban areas (06.3% of youth's vs 08.2% of adults). Among respondents who claimed having had a dental visit, 10.9% of youths and 12.9% of adults living in urban areas, versus 06.6% of youths and 06.4% of adults living in rural areas, reported that this was for teeth scaling. The vast majority of participants did not report practicing regular tooth brushing at least 1/day (85.4%). With respect to access to dental care, less than one-tenth of the sample reported having attended the dental office in the 12 months (7%) and half of all these visits were for curative reasons.

3.3. Variables associated with oral health indicators

The oral cavity is part of the orofacial complex. Therefore, we had to record any evident abnormality of the tissues of the face, cheek or chin. Apart from rural adults, primary and permanent teeth of youth and urban adults display a sound crowd and sound root, more among city dwellers (almost 30%) than among young rurals (26.8%). Apart from rural adults with a higher proportion of carious root and crown (31.1%), both youths, regardless residency area, and urban adults, substantially have the same proportion of caries. When considering permanent restorations and/or one or more areas that are decayed, participants natural teeth substantially have the same proportion of filled crown o filled root with caries or not (Table 3), and consequently both the total DMFT index and the number of natural teeth in the whole population were statistically significantly associated with age groups and area of residency ($P = 0.001$). Missing primary or permanent teeth within the whole population is low, however with a significant proportion in rural adults (16.5%). Gingivae of all teeth present in the mouth were examined by carefully inserting the tip of the probe between the gingiva and the tooth to assess absence or presence of bleeding response. Findings show that gingival bleeding was more present among adults (rural or urban), and more in rural youths (44.8%) than in urban youths (28.1%).

Table 3 Variables associated with oral health indicators according to group age and area of residence in Bafia

Variables	Youths (5-17 years)		Adults (+18 years)		P value
	Urban	Rural	Urban	Rural	
Condition of primary/permanent teeth					
Sound	345 (30.5%)	49 (26.8%)	300 (29.2%)	41 (09.8%)	0.001
Caries	247(21.8%)	40 (21.8%)	237 (23.1%)	130 (31.1%)	
Filled (with/no caries)	436 (38.5%)	79 (43.2%)	399 (38.8%)	178 (42.6%)	
Missing	103 (09.1%)	15 (08.2%)	91 (08.9%)	69 (16.5%)	
Periodontal status					0.003
Gingival bleeding					
Absence	813 (72.9%)	101(55.2%)	421 (41.0%)	103 (24.7%)	
Presence	318 (28.1%)	82 (44.8%)	606 (59.0%)	315 (75.3%)	
Periodontal pockets					
Absence	422 (37.3%)	57 (31.2%)	311 (30.3%)	97 (23.2%)	
Presence	709 (62.7%)	126 (68.8%	716 (69.7%)	321 (76.8%)	
Loss of attachment †					0.045
Yes	----	---	587 (57.1%)	330 (79.0%)	
No	---	---	440 (42.9%)	88 (21.0%)	
Enamel fluorosis					
Normal	372 (32.9%)	27 (14.7%)	397 (38.6%)	76 (18.2%)	0.006
Mild or Moderate	430 (38.0%)	61 (33.3%)	288 (28.0%)	141 (33.7%)	
Severe	329 (29.1%)	95 (52.0%)	342 (33.4%)	201 (48.1%)	
Dental erosion					
No sign of erosion	246 (21.7%)	21 (11.5%)	103 (10.0%)	47 (11.2%)	0.111
Enamel lesion	477(42.2%)	98 (53.5%)	567 (55.2%)	203 (48.6%)	
Dentinal lesion	320 (28.3%)	42 (22.9%)	259 (25.2%)	87 (20.8%)	
Pulp involvement	88 (07.8%)	22 (12.1%)	88 (08.6%)	81 (19.4%)	
Traumatic dental injuries					
No sign of injury	638 (56.4%)	85 (46.4%)	642 (62.6%)	207 (49.5%)	0.276
Enamel&dentine fracture	452 (39.9%)	80 (43.7%)	282 (27.4%)	147 (35.2%)	
Missing tooth due to trauma	41 (03.7%)	18 (09.9%)	103 (10.0%)	64 (15.3%)	
Oral mucosal lesions					
Absence	570 (50.4%)	96 (52.4%)	527 (51.3%)	158 (37.8%)	0.002
Presence	418 (36.9%)	60 (32.8%)	375 (36.5%)	175 (41.9%)	
Suspected presence	143 (12.7%)	27 (14.8%)	125 (12.2%)	85 (20.3%)	

†: n= 1,314 because and according to WHO recommendations, loss of attachment should not be recorded for youth individuals.

On the other hand, periodontal pockets were present within the whole population, however with a slightly high proportion among rural adults (76.8%; P=0.003). Information on loss of attachment was collected from the index teeth and was recorded by dividing the mouth in sextants. Each sextant was recorded immediately after recording the gingival status and pocket scores. Using the Community Periodontal Index (CPI) probe and applying the following codes (0–3 mm=absence or less loss; 4 mm and above=presence of loss), findings show that loss of attachment in each adult individual was significantly more predominant in rural adults (79.0%) than in urban adults (21.0%). Following close observations of the premolars, second molars and the maxillary incisors, distribution pattern of any defects was recorded. Using Dean's index criteria, most defects fell into the mild or moderate and severe categories. Within the severe category, rural individuals were more concerned than city dwellers, while controlling for age groups (52% youths vs 42% adults, P=0.006). According to dental erosion, its severity was recorded according to the tooth with the

highest score of erosion. Of the 2,759 individuals, less showed no sign of dental erosion (15.1%). Majority of participants had enamel erosion (48.7%) and dentinal erosion (25.7%). Presence of those signs were statistically significant while controlling with age groups and area of residency (P=0.111). Besides, no sign of teeth injury was globally reported (57.0%). Traumatic dental injuries reported were related to Enamel fracture only or to Enamel and dentine fracture (34.8%), with rural young people being more exposed (43.7%) than the others. With respect to oral mucosal lesions, one observes a balanced situation. However, if we consider that individuals with suspected presence are likely to present mucosal lesions, then proportion of individuals with mucosal lesions is slightly high.

3.4. Oral health assessment

Oral health was assessed using WHO diagnostic criteria that can be readily understood and applied in public health programmes worldwide. Those criteria serve as basis for assessing the current oral health status of a population and its future needs for oral health care. We adapted the Oral Health Assessment Tool (OHAT) by including oral health indicators described in table 3. Table 4 provides insights on the state of selected variables related to the oral cavity.

Table 4 Oral health assessment of individuals in Bafia, according to group age and area of residence

Variables	Youths (5-17 years)		Adults (≥18 years)		P value
	Urban (n=1131)	Rural (n=183)	Urban (n=1027)	Rural (n=418)	
Lips					
Healthy^Φ	799 (70.6%)	98 (53.5%)	728 (70.9%)	198 (47.4%)	0.001
Minor problems^ΦΦ	234 (20.7)	49 (26.8%)	179 (17.4%)	88 (21.0%)	
Major problems^ΦΦΦ	98 (08.7%)	36 (18.7%)	120 (11.7%)	132 (31.6%)	
Gums, oral mucosa					
Healthy^Ψ	214 (19.0%	39 (21.3%)	111 (10.8%)	39 (09.3%)	0.015
Minor problems^ΨΨ	611 (54.0%)	80 (43.7%)	314 (30.6%)	92 (22.0%)	
Major problems^ΨΨΨ	306 (27.0%)	64 (35.0%)	602 (58.6%)	287 (68.7%)	
Natural teeth					
Healthy^φ	197 (17.4%)	19 (10.4%)	293 (28.5%)	29 (07.0%)	0.005
Minor problems^φφ	523 (46.2%)	67 (36.6%)	318 (31.0%)	144 (34.4%)	
Major problems^φφφ	411 (36.3%)	97 (53.0%)	416 (40.5%)	245 (58.6%)	
Buccodental hygiene					
Healthy (good)^♦	239 (21.1%)	27 (14.7%)	256 (24.9%)	48 (11.5%)	0.023
Minor problems (poor)^♦♦	392 (34.6%)	59 (32,3%)	400 (38.9%)	102 (24.4%)	
Major problems (very poor)^♦♦♦	500 (44.3%)	97 (53.0%)	371 (36.2%)	268 (64.1%)	
Tooth pain					
Healthy ^β	400 (35.4%)	61 (33.4%)	198 (19.3%)	26 (06.2%)	0.001
Minor problems ^ββ	509 (45.0%)	98 (53.5%)	315 (30.7%)	242 (57.9%)	
Major problems ^βββ	222 (19.6%)	24 (13.1%)	514 (50.0%)	150 (35.9%)	
Saliva, dry mouth					
Healthy^*	723 (64.0%)	97 (53.0%)	406 (39.5%)	29 (07.0%)	0.003
Minor problems ^**	251 (22.2%)	56 (30.6%)	348 (33.9%)	184 (44.0%)	
Major problems ^***	157 (13.9%)	30 (16.4%)	273 (26.6%)	205 (49.0%)	
Tongue					
Healthy†	670 (59.2%)	97 (53.0%)	616 (60.0%)	200 (47.8%)	0.121
Minor problems††	311 (27.5%)	61 (33.4%)	318 (31.0%)	180 (43.1%)	
Major problems†††	150 (13.3%)	29 (15.6%)	93 (09.0%)	38 (09.1%)	

Oral health indicators					
Few #	520 (46.0%)	30 (16.4%)	311 (30.3%)	24 (05.7%)	0.014
Enough ##	341 (30.1%)	66 (36.1%)	290 (28.2%)	174 (41.6%)	
Too many###	270 (23.9%)	87 (47.5%)	426 (41.5%)	220 (52.6%)	

Φ: Smooth, pink, moist; ΦΦ: Dry, chapped, or red at corners; ΦΦΦ: growing lump, ulcer, or lesion; white, red, and/or ulcerated patch; bleeding and/or ulcer at corners

Ψ: Pink, moist, smooth, no bleeding; Ψ Ψ: Dry, rough, swollen area; one small ulcer, lesion; Ψ Ψ Ψ: Swollen and bleeding ulcer, tender area around tooth, (suspected abscess)

φ: No decay or broken or worn down teeth ; φφ: 1-3 decayed or broken and/very worn down teeth ; φφφ: very loose teeth, 4 or more decayed teeth

♦: Clean and no food particles or tartar ; ♦♦: Food particles, tartar and/or plaque in 1-2 areas of the mouth ; ♦♦♦: Food particles, tartar, and/or plaque in most areas of the mouth

β: No physical signs of dental pain ; ββ: Nonspecific behavioural signs of pain such as pulling at face, chewing lips ; βββ: Physical signs of pain (swelling

of cheek or gum, broken teeth, ulcers)

*: Moist tissues, watery, free flowing saliva; **: Dry, sticky tissues, little saliva; ***: Tissues parched, no saliva

†: Normal, moist, roughness, pink; ††: Patchy, fissured, coated; †††: Patch that is red, ulcerated, and/or swollen

#: 0-2 oral health indicators; ##: 3-4 indicators; ###: more than 5 indicators

The oral health level or status was finally assessed by summing the scores assigned to each variable of the modified OHAT (Oral Health Assessment Tool). The assigned scores were as follows: healthy=0, minor problems=1, major problems=2. Table 5 shows the oral health level of the population, according to the appropriate rating. Findings show that only 8.7% of the whole population has a good oral health level, and all live in urban area. The same trend is observed when looking at those with fair oral health: 97.3% are city dwellers out of which 71.1% are young people, and 28.9% are adults. Otherwise, the oral health level of the population is globally poor (79%) when considering poor level (50.4%) and very poor level (28.6%).

Table 5 Level of oral health in Bafia

Level	Youths (5-17 years)		Adults (≥18 years)		Total
	Urban (n=1131)	Rural (n=183)	Urban (n=1027)	Rural (n=418)	
Very poor	84 (07.4%)	126(68.8%)	325(31.6%)	254(60.8%)	789
Poor	611(54.0%)	45(24.6%)	573(55.8%)	162(38.7%)	1,391
Fair	233(20.6%)	7 (03.8%)	95(09.2%)	02(00.5%)	337
Good	203(17.9%)	5 (02.7%)	34(03.3%)	00 (00.0%)	242

Good = 0<OHAT<4: the oral cavity is considered healthy, no specific care is required: Fair = 4<OHAT<8: the oral cavity is healthy, but monitoring is necessary; Poor = 8<OHAT≤10: the oral cavity is in a worrying state, care must be considered; Very poor = 10≤OHAT >12: the oral cavity is in a pathological state, care is mandatory, need of a dentist

4. Discussion

Health is a fundamental right of every individual. WHO emphasized that despite great improvements in the oral health of population, global problems still persist [12]. Oral health being an integral part of general health and having a substantial impact on general health and well-being, oral health assessment is nowadays a requirement because assessment results serve as core health indicators that are needed to monitor health level of a population. There are two major outcomes in our study. The first is that general level of oral hygiene in Bafia is poor. This unsatisfactory and worrying level stems from population's behaviors, habits and practices regarding their bucco-dental hygiene. In fact and according to field investigations, most individuals in Bafia brush their teeth irregularly or just once a day, when they wake up. This habit, mentioned in some previous studies, clearly indicates that brushing remains a pattern related to personal hygiene only, without connection with meals [13]. Yet, it is recognized by Jahangiry et al [14], that, to properly fight against plaque buildup, brushing should be done after meals, and that in the case of a single brushing, the best is to do so in the evening, so the bacterial plaque is eliminated before sleep because during the night, salivary secretion decreases. We also found that almost the entire population brush their teeth for less than 2 minutes, a finding close to that of Miura [15]. However, we should mention that such a time duration is insufficient because dental plaque responsible for dental caries builds up very slowly, and therefore brushing should be two or 3 minutes [16]. In their studies, Garcia [17] and Chen et al [18] have emphasized on the cleaning technique as a determining factor for good oral hygiene. However, in Bafia, only few inhabitants use the right technique (combination of vertical, horizontal, and circular), as previously reported by Sarita et Tuominen [19]. Among the cleaning products associated with brushing in

Bafia, fluoridated toothpaste is the most frequently used (54.7%). This result is similar to studies on oral hygiene habits and practices conducted by Thornton-Evans et al [20] and Mason et al [21], whose findings show that toothpaste was the main cleaning product due to the fluoride it contains and which stops the development of bacteria, protects tooth enamel, and eliminates tooth staining. It is unfortunate to know that a large proportion in Bafia don't have the habit of cleaning the tongue, slightly higher than that reported by Sofola et al. [22]. In a study among university students in Benin, Djossou et al [23] indicated that nearly 70% had the habit of rinsing the mouth after every meal, whereas little reported the habit in the present study, indicating their poor practice of cleansing out the tucked food particles. Overall, oral hygiene among individuals in Bafia is poor. A general finding shared by several studies conducted in sub Saharan Africa including Abid et al [24] and Moussa et al [25].

Another important outcome resulting directly from the first outcome is that, the overall oral health status of the population is also at least poor, otherwise very poor. With respect to condition of primary or permanent teeth, lesion in pits and on smooth tooth surface having an unmistakable cavity, undermined enamel and detectably softened floor or wall. Also, teeth were filled with caries, showing most decayed areas. Those carious crowns and carious roots suggest the presence of tooth decay, a result close to previous studies conducted by Aleksejuniene et al. [26] and Varenne et al [27]) who came out with a DMFT prevalence of about 50%, with no real difference among subjects, confirming that there was no residency area related decline in caries experience. Two indicators of periodontal status were used for this assessment: gingival bleeding and periodontal pockets. Occasional bleeding of the gums recorded mostly among urban adults can be caused by the fact that they too vigorously brush their teeth, using hard bristles. However, frequent gum bleeding recorded among rural adults indicate more serious conditions, including periodontitis and vitamin deficiency [28]. Periodontal pockets are the major clinical manifestation of periodontitis, a chronic inflammatory oral disease affecting the teeth-supporting tissues and has high prevalence in the adult population. Periodontal pockets are ideal environments for subgingival bacterial biofilms, that interact with the supragingival oral cavity, mucosal tissues of the pocket and a peripheral circulatory system. Presence of periodontal pockets in oral health studies is common [29] [30] [31]. However, its presence in nearly three-quarters of individuals in Bafia is worrying because periodontal pockets have been found to harbor viral species such as the Herpes simplex viruses' family [32] and are hypothesized to be a favorable anatomical niche for the virus and thus acting as a reservoir for SARS-CoV-2 [33]. Information on loss of attachment was collected from the index teeth. The Community Periodontal Index (CPI) system was designed, not actually to describe the full extent of loss of attachment in individual, rather to obtain an estimate of the lifetime accumulated destruction of the periodontal attachment and thereby permits comparisons between population groups. In our study, loss of attachment was present in half of adults, mostly those living in rural areas. As described by Zuhair et al [34], at least one of these four factors could be related to teeth loss in our specific groups: gender, pocket depth, education level and smoking habits. Considered as a change in the appearance of the tooth's enamel surface, enamel fluorosis was partitioned approximately equally among populations and among individuals within residency areas. Fluorotic lesions were usually bilaterally symmetrical and tend to show a horizontal striated pattern across the tooth. The premolars and second molars were most frequently affected, followed by the maxillary incisors. Globally, enamel fluorosis was either normal (in urban young people), mild or moderate (in urban adults and young rurals), and severe (in rural adults). Onoriobe et al [35] had reached this conclusion and also to the one that dental fluorosis was caused by consumption of too much fluoride over the period of time when teeth were forming (before 8 years of age). However, in our study, sources of fluoride were beverages (including fluoridated tap water and foods processed with fluoridated water), and not overuse of toothpaste, topical fluoride, and dietary supplements as reported by Beltrán-Aguilar et al [36] and Krisdapong et al [37]. Data on prevalence, severity and number of teeth affected by dental erosion are useful to assist public health administrators in estimating whether this condition is a public health problem. In this study, teeth of 2,342 (84.9%) individuals showed sign of erosion, including enamel lesion, dentinal lesion, and pulp involvement. Dental erosion results from the progressive loss of calcified dental tissue by chemical processes not associated with bacterial action. Enamel tissue is lost by exposure to acids which may come from diverse sources. According to Gambon et al [38], several developments in developed societies may have contributed to the increased prevalence of dental erosion among citizens in the sense that, exposition of children to sour taste at an early age has increased their preference for acidic food and drinks later in life; mostly that acidic fruits and beverages have become widely available due to economic prosperity [39]. In fact, new types of acidic candies have been developed, some of which are kept in the mouth for very long times and children are exposed to intense marketing of these acidic products, which are widely available in supermarkets and school canteens. In the meantime, much less attention has been paid to the development and marketing of less erosive food products. In Bafia however and it has been previously reported in other developing societies by Elamin et al [40], it was found that sources of dental erosion were intrinsic i.e. in individuals suffering from bulimia, eating disorders, gastro esophageal reflux or heavy alcohol consumption. Enamel and dentine fracture having prevalence (34.8%) found in present study was due to impact on front teeth while getting into fights or falling down during working. We performed a careful examination of the oral mucosa and soft tissues in and around the mouth of participants. About 37.2% of the participants had one or more oral mucosal lesions present at the time of the examination, while 13.8 % presumptive diagnosis were reported. The most prevalent lesions clinically observed were

recurrent aphthous ulcers, recurrent herpes labialis, smokeless tobacco lesions, traumatic ulcerations, herpes simplex virus, geographic tongue, and candidiasis. Papilloma virus lesions, multiform erythema, oral lichen planus and granular cell tumor were also diagnosed.

In addition to the clinical review of those oral health indicators, oral health self-assessment showed that, regardless of the part of the oral cavity considered, it had problems. For example, lips of over a quarter of the survey population had either minors' problems (dry, chapped, or red at corners) or major problems (growing lump, ulcer, bleeding). With regard to natural teeth, the majority mentioned broken or decayed teeth along with the extent to which such a situation impacts their oral health–related quality of life (OHRQoL), as previously reported by Tan et al [41]. Most rural dwellers and urban adults of the survey population suffered from dry, sticky tissues, and no or little saliva, which is troubling because saliva is an extremely vital fluid in the maintenance of oral homeostasis. Adequate salivary flow and composition are recognized as important, and is effective in maintaining pH in the oral cavity by its buffer capacity and contributes to the regulation of dental biofilm pH and enamel surface integrity [42]. For these reasons' individuals with impaired salivary synthesis and secretion may have difficulties in eating, swallowing and become prone to oral diseases such as mucosal infections and dental caries [43].

5. Conclusion

Our study is the first to evaluate oral health in Cameroon at a community-based level. This study has shed the light on both poor oral hygiene and poor oral health statuses. The combination of inadequate habits and insufficient knowledge regarding oral hygiene creates a synergistic effect which is evident from the poor oral hygiene status exhibited by the majority of the population. There is a dire need to improve the motivation and knowledge level of dwellers regarding oral hygiene practices. From the above discussion, it is clear that the entire population needs better bucco-dental hygiene education and care to enable them to take care of their oral health in a better way. Life in a semi-urban setting, under challenging circumstances is not without concerns. That is why, it is important that inhabitants are given complete information about correct dental hygiene protocols and oral health. Local and national authorities, including health professionals and Decision makers, should also develop comprehensive dental hygiene programs which have shown to make a profound effect on overall oral health of any community. Due to their unique lifestyle, rural dwellers represent a vulnerable group as far as oral health is considered. That is why more research is required on their bucco-dental hygiene habits to expand our current understanding of the problems they face in maintaining their oral health, which has direct implications on overall health. In view of the poor oral health status of the population and of the difficult access to health and dental care in the setting, telemedicine-based applications for dentistry (tele dentistry) could represent a way for providing a reasonable level of oral assistance. Implementation and use of tele dentistry have proved to be effective in the management of oral health issues in remote and rural areas, where access to dentists and oral health specialists is limited. Its implementation throughout the country may become a new instrument for tending to the poor oral/dental conditions of both city and rural dwellers.

Compliance with ethical standards

Disclosure of conflict of interest

The author declares that there's no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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