Relationship between oral health knowledge, practices and oral health status of students, Tanga Tanzania

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Running Title: Oral health knowledge, care practices and oral health status

Abstract
Background: Studies have shown that strong knowledge on oral health demonstrates better oral care practice and an association between increased knowledge and better oral health exists. **Aim:** To assess the influence of oral health knowledge and oral care practices to oral health status of secondary school students in Tanga, Tanzania. **Subjects and Methods:** A structured questionnaire was used to assess students' oral health knowledge and oral care practices while oral health status was determined by a clinical examination. Bi-variate and logistic regression analyses were done and level of significance was set at $p < 0.05$. **Results:** 785 students participated in the study. Proportionately more students who reported to use charcoal, salt/or sand to clean their teeth (66.9%) were significantly more likely to be caries free compared to those who reported to use toothpaste (51.2%), (p= 0.001). Students who reported to brush their teeth after breakfast (57.5%) and/or having visited a dentist within the past 12 months (58.8%) were more likely to have one or more decayed teeth than their counterparts (45.2%), (p= 0.049) and (38.1%) (p= 0.0001) respectively. With the exception of using dental floss (p= 0.023), there were no statistical significant relationships between oral health knowledge, oral care practices with supra-gingival calculus accumulation. In logistic regression analysis students who reported to have visited a dentist during the past twelve months (OR= 2.32; 95% CI 1.728-3.115, p=0.0001), or used fluoridated tooth paste as an adjuvant while brushing their teeth (OR= 1.931; 95% CI 1.272-2.932, p= 0.002) were more likely to have at least one decayed tooth than their counterparts. **Conclusion**: Participants' knowledge on oral health issues has no influence on oral health status, visiting a dentist is associated with presence of dental caries and participants' who reported to use charcoal, salt and/or sand are more likely to have less caries than those using toothpaste.

Key Words: Oral Health Knowledge, Oral Care Practices, Oral Health Status, Students, Tanzania.

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Introduction
Oral health is an essential component of general health (1). It is defined as 'a standard of health of the oral and related tissues which enables an individual to eat, speak, and socialize without active disease, discomfort or embarrassment and which contributes to general well-being' (2).

Oral health knowledge is considered to be an essential prerequisite for health related behavior (3) and studies have shown that there is an association between increased knowledge and better oral health (4,5). Those who have assimilated the knowledge and feel a sense of personal control over their oral health are more likely to adopt self-care practices (6). Smyth and colleagues showed that strong knowledge on oral health demonstrates better oral care practice (7).

The most prevalent oral diseases that affect almost all people in the world are dental caries and periodontal diseases (8). An estimated 60–90% of school aged children worldwide and most adults have experienced dental caries (9) and periodontal diseases are widespread (10). The global disease pattern is said to be rapidly changing and this has been closely linked to changing lifestyles which include consuming diets rich in sugars, widespread use of tobacco and consumption of alcohol (11). The recent systematic analysis (12) of evidence on the role of diet in chronic diseases recommend that free (added) sugar should remain below 10% of the energy intake and the consumption of food/drinks containing free sugars should be limited to a maximum of four times per day. This can be achieved by strengthening the promoting preventive activities with joint efforts from different stakeholders in the oral health sector,

thereby reducing the burden of the common oral diseases.

The diagnostic criteria for decayed, missing, and filled teeth and surfaces (DMFT and DMFS, respectively) developed by the World Health Organization (WHO) (13) are the simplest and most commonly used in epidemiologic surveys of dental caries, since they quantify dental health status based on the number of carious, missing, and filled teeth and tooth surfaces.

The clinical diagnosis of plaque and caries has been used as indicators of oral health behavior (14). Also several diagnostic criteria have been employed in determining periodontal disease however presence or absence of plaque and calculus and location of formation sites are population specific and are affected by oral hygiene habits, access to professional care, diet, age, ethnic origin, time since last dental cleaning, systemic diseases and the use of prescription medications (15).

The risk behaviors for these common dental diseases includes frequent intake of sugary foods and drinks, irregular tooth brushing, smoking tobacco, alcohol consumption and irregular dental attendance (16). These risk behaviors could be habitual from early childhood or be initiated during adolescence related to an emerging autonomy from parental influence (17).

The aim of the present research was to assess the influence of oral health knowledge and oral care practices to oral health status of secondary school students in Tanga, Tanzania.

Material and Methods
This was a cross sectional study carried out between September and November, 2010 and included 785 secondary school students in Tanga Region, Tanzania. Tanga region was conveniently selected among other regions in Tanzania. Lushoto and Tanga districts were conveniently identified by two stage cluster sampling from the eight districts in Tanga region. Then, four schools having students from form I to form IV were randomly selected from each of the two districts.

In each school a sample size of hundred students, fifty students from form II (25 boys and 25 girls) and fifty students from form III (25 boys and 25 girls) were randomly selected by the teachers on duty giving a total sample of 800 students. Form I students were excluded from the study to avoid bias of previous oral health knowledge provided in primary schools while form IV students were not included because they were involved in the end of school examinations. Despite attempts to retain the study population, 15 students did not fully participate in the study and thus the response rate was 98%.

Consent to participate in the study was obtained from the secondary school students themselves. A self-administered questionnaire was used to assess the student's level of knowledge (9 questions) and oral care practices (7 questions). A student was rated to have acceptable level of knowledge when more than half the number of questions had been responded to correctly. Similarly oral care practices of participants were rated acceptable when more than half of the responses to the oral care practices were performed (18).

Using natural light and a dental mirror a clinical dental examination was performed on students who responded to the questionnaire. The number of decayed, missing and filled teeth (DMFT) was recorded using the World Health Organization (WHO) diagnostic criteria (13) and when the examiner was in doubt no caries was recorded. Students were then categorized according to their caries experience, those without caries experience (DMFT=0; absence of a decayed, missing tooth/teeth due to caries or filled tooth/teeth) or those with a caries experience (DMFT$\geq$1; presence of one or more decayed, missing tooth/teeth due to caries or filled tooth/teeth).

The supra-gingival surfaces of the index teeth (tooth 16, 11, 26, 36, 31, and 46) were assessed for presence/absence of supra-gingival plaque and calculus using a modified version of the WHO diagnostic criteria (13). The WHO diagnostic criteria was modified into two scores (0= absent and 1= present). Score=1 was given when visible plaque remnants were present on any of the index teeth and a score=0 was given when there were no visible remnants present on any of the index teeth. In doubtful instances plaque was scored as absent. When supra-gingival calculus was observed on any of the supra-gingival surfaces of the index teeth it was scored=1 and when no deposits were observed on any of the supra-gingival surfaces of the index teeth it was scored=0. Subjects were then categorized to be plaque free or calculus free (score=0) when there was absence of supra-gingival plaque or calculus in all of the index teeth and with plaque or calculus (score=1) when there was presence of supra-gingival plaque or calculus on one or more of the index teeth (19).

The self-administered questionnaire was pilot tested on student patients attending the dental clinic of School of Dentistry at Muhimbili University of

Health and Allied Sciences (MUHAS) followed by practiced examination.

Analysis using the SPSS (version 16) statistical package determined possible relationship between oral health knowledge, oral care practices and oral health status of participants. Chi-square tests were used to determine the level of statistical significant difference at p<0.05. Binary logistic regression at 95% Confidence Intervals was performed to all variables that showed significant association in the Bi-variate analyses.

Ethical clearance was obtained from MUHAS Research and Ethical Committee, Dar es Salaam, Tanzania.

Results

A total of 785 secondary school students with an age range of 14 to 22 years and mean age of 16.9 years participated in the study. As shown in Table 1, females students (n= 395; 50.3%) were more than males and majority (n=548; 69.8%) belonged to the 14-17 years age group. There were equal distribution of students in form II (392) and form III (393) as well as students from Tanga (394) and Lushoto (391) District schools.

Table 1:   Distribution of study participants by demographic characteristics

	Number	%
Age (years)		
14-17	548	69.8
18-22	237	30.2
Sex		
Male	390	49.7
Female	395	50.3
Class		
Form II	392	49.9
Form III	393	50.1
School		
School in Tanga	394	50.2
School in Lushoto	391	49.8

More than eighty percent (88.4%) had adequate level of knowledge on oral health and had acceptable level of oral care practices (91.3%) regardless of sex or age. Dental examination revealed that 53.6% (n=421) of the students had a DMFT= 0 while more students had visible plaque (n= 581; 74%) and supra-gingival calculus (n= 439; 56.9%).

Participants' dental caries status had no significant relationship with knowledge of different aspects of oral health issues (Table 2). Regarding oral care practices, proportionately more students who reported to use charcoal, salt/or sand to clean their teeth (66.9%) were significantly more likely to be caries free compared to those who reported to use toothpaste (51.2%), (p= 0.001). Students who reported to brush their teeth after breakfast (57.5%) and/or having visited a dentist within the past 12 months (58.8%) were more likely to have one or more decayed teeth than those who reported not to brush after breakfast (45.2%), (p= 0.049), and/or reported not to have visited a dentist within the past 12 months (38.1%) (p= 0.0001) respectively.

Table 3 shows the relationship between oral health knowledge, oral care practices and dental plaque accumulation among students in Tanga region. There was no statistical significant relationship between students' knowledge on various aspects of oral health and oral care practices with presence of dental plaque.

With the exception of using dental floss (p= 0.023), there were no statistical significant relationships between oral health knowledge, oral care practices with supra-gingival calculus accumulation (Table 4).

In logistic regression analysis students who reported to have visited a dentist during the past twelve months (OR= 2.32; 95% CI 1.728-3.115, p=0.0001), or used fluoridated tooth paste as an adjuvant while brushing their teeth (OR= 1.931; 95% CI 1.272-2.932, p= 0.002) were more likely to have at least one decayed tooth than their counterparts, (Table 5).

Table 2. **Relationship between oral health knowledge, oral care practices and dental caries status among students in Tanga region.**

Oral health knowledge	Dental caries status				Total	p-value
	DMFT=0		DMFT≥1			
	n	%	n	%		
Effective tooth brushing prevent gum diseases						
Yes	406	53.8	348	46.2	754	0.585
No	15	48.4	16	51.6	31	
Bleeding during brushing may indicate presence of gum diseases						
Yes	378	53.2	332	46.8	710	0.544
No	43	57.3	32	42.7	75	
Frequent consumption of sugary food stuffs and fizzy drinks can cause tooth decay						
Yes	408	53.5	355	46.5	763	0.699
No	13	59.1	9	40.9	22	
Tooth decay can be prevented by using fluoridated toothpaste twice a day						
Yes	296	52.9	264	47.1	560	0.527
No	125	55.6	100	44.4	225	
Smoking cigarettes and chewing tobacco for a long time may result in oral cancer						
Yes	366	52.7	329	47.3	695	0.145
No	55	61.1	35	38.9	90	
Oral Health care practices						
Type of tooth brush used to clean teeth						
Plastic toothbrush	404	53.6	350	46.4	754	
Wooden toothbrush	17	54.8	14	45.2	31	1.0
Devices used for cleaning teeth						
Dental floss	45	50.6	44	49.4	89	
Toothpicks, match stick or office pins	376	54.0	320	46.0	696	0.573
Adjuvant do you use to clean teeth						
Fluoridated toothpaste	340	51.2	324	48.8	664	
Charcoal, salt or sand	81	66.9	40	33.1	121	0.001
How many times per day do you practice oral hygiene						
Once a day	118	55.4	95	44.6	213	
Twice or more times a day	303	53.0	269	47.0	572	0.574
Oral hygiene practices Before breakfast						
Yes	387	54.4	325	45.6	712	0.219
No	34	46.6	39	53.4	73	
Oral hygiene practices after breakfast						
Yes	31	42.5	42	57.5	73	0.049
No	390	54.8	322	45.2	712	
Oral hygiene practices before going to sleep						
Yes	20	50.0	20	50.0	40	0.745
No	401	53.8	344	46.2	745	
In the past 12 months did you visit a dentist						
Yes	129	41.2	184	58.8	313	0.0001
No	292	61.9	180	38.1	472	

Discussion

This study determined the relationship between oral health knowledge and oral care practices with oral health status of secondary school students in Tanga region, Tanzania. A convenient sampling method was used to select schools to take part in the study. Therefore the results cannot be generalized to all Tanga students.

Table 3: Relationship between oral health knowledge, oral care practices and dental plaque accumulation among students in Tanga region

Oral health knowledge	Dental plaque accumulation				Total	p-value
	Plaque free		Plaque in at least one sextant			
	n	%	n	%		
Effective tooth brushing can prevent gum diseases						
Yes	194	25.7	560	74.3	754	0.408
No	10	32.3	21	67.7	31	
Bleeding during brushing may indicate presence of gum diseases						
Yes	186	26.3	524	73.8	710	0.782
No	18	24.0	57	76.0	75	
Frequent consumption of sugary food stuffs and fizzy drinks can cause tooth decay						
Yes	198	25.9	565	74.1	763	0.811
No	6	27.3	16	72.7	22	
Tooth decay can be prevented by using fluoridated toothpaste twice a day						
Yes	145	25.9	415	74.1	560	0.928
No	59	26.2	166	73.8	225	
Smoking cigarettes and chewing tobacco for a long time may result in oral cancer						
Yes	180	25.9	515	74.1	695	0.899
No	24	26.7	66	73.3	90	
Oral Health Oral care practices						
Type of tooth brush used to clean teeth						
Plastic toothbrush	198	26.3	556	73.7	754	0.531
Wooden toothbrush	6	19.4	25	80.6	31	
Devices used for cleaning teeth						
Dental floss	19	21.3	70	78.7	89	0.308
Toothpicks, match stick or office pins	185	26.6	511	73.4	696	
Adjuvant do you use to clean teeth						
Fluoridated toothpaste	167	25.2	497	74.8	664	0.216
Charcoal, salt or sand	37	30.6	84	69.4	121	
How many times per day do you practice oral hygiene						
Once a day	62	29.1	151	70.9	213	0.235
Twice or more times a day	142	24.8	430	75.2	572	
Oral hygiene practices Before breakfast						
Yes	185	26.0	527	74.0	712	1.0
No	19	26.0	54	74.0	73	
Oral hygiene practices after breakfast						
Yes	19	26.0	54	74.0	73	1.0
No	185	26.0	527	74.0	712	
Oral hygiene practices before going to sleep						
Yes	9	22.5	31	77.5	40	0.713
No	195	26.2	550	73.8	745	
In the past 12 months did you visit a dentist						
Yes	93	29.7	220	60.3	313	0.056
No	111	23.5	361	76.5	472	

18 (No. 2)

Table 4: **Relationship between oral health knowledge, oral care practices and calculus accumulation among students in Tanga region**

Oral health knowledge	Calculus accumulation				Total	p-value
	Calculus free		Calculus in at least a sextant			
	n	%	n	%		
Effective tooth brushing can prevent gum diseases						
Yes	325	43.1	429	56.9	754	1.0
No	13	41.9	18	58.1	31	
Bleeding during brushing may indicate presence of gum diseases						
Yes	311	43.8	399	56.2	710	0.221
No	27	36.0	48	64.0	75	
Frequent consumption of sugary food stuffs and fizzy drinks can cause tooth decay						
Yes	330	43.3	433	56.7	763	0.663
No	8	36.4	14	63.6	22	
Tooth decay can be prevented by using fluoridated toothpaste twice a day						
Yes	242	43.2	318	56.8	560	0.937
No	96	42.7	129	57.3	225	
Smoking cigarettes and chewing tobacco for a long time may result in oral cancer						
Yes	296	42.6	399	57.4	695	0.498
No	42	46.7	48	53.3	90	
Oral Health care practices						
Type of tooth brush used to clean teeth						
Plastic toothbrush	330	43.8	424	56.2	754	0.063
Wooden toothbrush	8	25.8	23	74.2	31	
Devices used for cleaning teeth						
Dental floss	28	31.5	61	68.5	89	0.023
Toothpicks, match stick or office pins	310	44.5	386	55.5	696	
Adjuvant used to clean teeth						
Fluoridated toothpaste	282	42.8	282	57.2	664	0.485
Charcoal, salt or sand	56	46.3	65	53.7	121	
How many times per day do you practice oral hygiene						
Once a day	101	47.4	112	52.6	213	0.145
Twice or more times a day	237	41.4	335	58.6	572	
Oral hygiene practices before breakfast						
Yes	304	42.7	408	57.3	712	0.537
No	34	46.6	39	53.4	73	
Oral hygiene practices after breakfast						
Yes	24	32.9	49	67.1	73	0.082
No	314	44.1	398	55.9	712	
Oral hygiene practices before going to sleep						
Yes	16	40.0	24	60.0	40	0.745
No	322	43.2	423	56.8	745	
In the past 12 months did you visit a dentist						
Yes	138	44.1	175	55.9	313	0.659
No	200	42.4	272	57.6	472	

Majority of participants had adequate level of knowledge on oral health and acceptable level of oral care practices. Possibly students may have had received oral health education previously.

Lack of statistical significant relationship between oral health knowledge and participants' caries status indicate that oral health knowledge is not a predictor of dental caries status in the population studied. The results of the current study are different from those of Oliveira et al (20) who reported that children with inadequate oral health knowledge are twice likely to have caries than children with adequate knowledge.

Students who reported to use charcoal, salt and/or sand were more likely to have less caries than those

who reported to use fluoridated toothpaste as their adjunct when brushing their teeth. These findings are contrary to expectations or advocacy of the World Health Organization Global Oral Health Program on the appropriate use of fluoride (1). A possible explanation is likely to be that those students who reported to use charcoal, salt and/or sand came from poor families that could not afford to buy sugary foods which have been shown to be the arch criminal in the causation of dental caries. Since fluoridated toothpastes reported to have been used were not verified of their fluoride content, there may be respondents who used toothpastes that did not contain adequate fluoride.

Table 5: **Logistic regression odds ratios (95% CI) of oral health care practices of students by their dental caries status**

Oral health oral care practices	Exp(B)	95% CI	P-value
Brushing teeth after breakfast	1.609	0.976-2.652	0.062
Use of fluoridated toothpaste	1.931	1.272-2.932	0.002
Visiting a dentist during the past 12 months	2.320	1.728-3.115	0.0001

Proportionately more students who reported to have visited a dentist within the past 12 months were statistically significantly more likely to have at least one decayed tooth. Most likely, those who reported to have visited a dentist in the past 12 months were seeking relief of pain since majority of Tanzanians seek dental care when they are in pain rather than check-up. These findings are similar to other studies conducted in Tanzania that reported pain as the main reason for seeking dental care (21-23).

Proportionately more respondents who reported to brush their teeth after breakfast were more likely to have one or more decayed teeth than those who were not brushing teeth after breakfast. This may imply that students with caries have been to a dentists and may have been advised to brush their teeth after breakfast as a preventive measure of dental caries. In vitro studies by Toumba (2012), indicate that brushing after a cariogenic challenge results to more mineral loss than brushing before the challenge. However, the clinical evidence from in vivo or even in situ studies is lacking or inconclusive. Therefore, the importance of brushing before or after breakfast remains an area for further studies.

Except for the use of dental floss as devices for cleaning the spaces between their teeth there were

no statistical significant differences in plaque and calculus accumulation between those who had knowledge on various oral health issues, or had good oral care practices than their counterparts. The finding that proportionately more students who reported to use dental floss for interdental cleaning were more likely to have calculus than those not using dental floss has no logical explanation. Whereas lack of significant association between knowledge, most oral care practices with plaque and calculus accumulation indicates that being knowledgeable does not translate into practice.

Conclusion

From the findings of this study, it can be concluded that participants' knowledge on oral health issues has no influence on oral health status, visiting a dentist is associated with presence of dental caries and participants' who reported to use charcoal, salt and/or sand are more likely to have less caries than those using toothpaste. Oral health educators should concentrate on motivating students to adopt practices conducive to oral health.

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