

Research Article

Awareness and practices related to use fluorides for caries prevention among health sciences university students in Tanzania

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ABSTRACT

Objectives: The objective of the study was to assess awareness and practices related to fluoride use for caries prevention as well as identifying the influencing sociodemographic and behavioral factors.

Materials and Methods: A cross-sectional study was conducted among students in Health Sciences Training University in Tanzania. Data were collected through self-administered structured questionnaire inquiring on sociodemographics, usage of fluorides and awareness of fluorides for caries prevention, and relevant oral health-related behaviors. Data processing was done using SPSS version 23. Cross tabulation with Chi-square test and adjusted binary logistic regression assessed presence, strength, and direction of association between awareness of as well as practices related to fluoride for caries prevention with sociodemographic and oral health behaviors.

Results: Three hundred and eighteen university students were assessed with a mean age of 22.7 (SD 2.8) years. Overall, 55.0% of the participants were aware of the role of fluoride in caries prevention and 44.3% had appropriate practice related to fluoride use. Significantly higher proportion of older students (64.9%) and those in senior years (65.5%) of the study were aware of fluoride use in caries prevention compared to their counterparts. The statistically significant differences for appropriate practices related to fluoride use were only for the females (27.1%), senior students (28.1%), and those who visited dental facilities (35.0%). The odds of being aware (Odds ratio 2.5, 95% confidence interval 1.6, 4.0) of and having appropriate practices related to use of fluorides for caries prevention were higher among senior (Odds Ratio 2.4, 95% Confidence interval 1.3, 4.2) participants than the junior participants.

Conclusion: Relatively low proportion of university students was aware of fluoride use for caries prevention. Likewise, a few had appropriate practices related to fluoride uses. Sociodemographically, those who were in their senior years of study were more likely to be aware and use fluoride for caries prevention than the juniors.

Keywords: Fluoride, Use, Caries, Awareness, Practices, Students

INTRODUCTION

Fluoride is a naturally occurring non-metal element existing as either a free ion or released from rocks into the soil, water, and air.^[1] Fluoride has been observed to have several positive and negative effects on human beings, depending on its concentration and form. The protective effect of tooth decay it confers is among the benefits of fluoride to humans and the use of fluoride as a protection against tooth decay is considered to be one of the most successful public

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health interventions in history.^[2-4] Fluoride counteracts tooth demineralization in three ways; neutralizing the acid by scavenging for free hydrogen protons, making the tooth resistant to acidic dissolution and favoring the tooth remineralization process.^[4,5] The same fluoride also is effective as therapeutic agent in non-restorative caries treatment for the inactivation or arrest of caries lesions.^[6]

Topical delivery of fluoride on teeth in the form of fluoride-containing toothpastes, mouth rinses, lozenges, and varnishes shows a far superior anti-cariogenic effect.^[2] Topical fluoride's presence in low concentration and high frequency is more effective at preventing caries than high levels of fluoride used in low frequency. The content of fluoride in toothpaste varies between 500 ppm and 1500 ppm, predominantly in the form of sodium fluoride (NaF), sodium monofluorophosphate or combination, other contents of a toothpaste include abrasives, triclosan, stannous fluoride, potassium nitrate, and sweeteners such as xylitol.^[7,8] Tooth brushing with fluoridated toothpaste is the most common form of caries control in use today. Brushing teeth twice a day with fluoridated toothpaste is the best way to prevent dental caries.^[8]

There is an established scientific knowledge and consensus on the preventive effect of fluoride on dental caries and few studies have been done globally on the assessment of the public awareness and uses of fluoride in prevention of dental caries among university students.^[9-11] Their overall observation is that the use of fluoride was unsatisfactory; knowledge was low and hence needed to be improved. In addition, year of study and type of undergraduate courses students are studying have been shown to be associated with the use of fluoride as well as their awareness; with more senior and medical students and dietetic and nutritional based students being aware of fluoride use for caries than their comparative groups.^[11]

University students in most of the sub-Saharan African countries are young adults, beginning to live independently and mostly depend on parents or government loan for financial support. However, their students' lifestyle poses them at risk for dental caries. Therefore, the study aimed at assessing awareness and practices related to fluoride use for caries prevention as well as identifying the sociodemographic factors that influence their awareness and use of fluoride.

MATERIALS AND METHODS

Study design, setting, and population

This was a cross-sectional study conducted among undergraduate students at Health Sciences Training University in Tanzania. It included students who were pursuing all other degrees in health sciences and excluded foreign students studying dentistry, as it was assumed they could have been informed through their training in doctor

of dental surgery. The university involved in this study is a public university located in Dar es Salaam, the commercial capital city of Tanzania. It enrolls students from varying socioeconomic strata, and the majority are sponsored by the Government Loan board. They are usually aged 18–35 years, where majority are fresh from high school and few from service.

Sample size and sampling technique

The estimated sample size was 385 students, assuming a 95% two-sided significant level, 5% standard error, 0.001 inter-cluster correlation, cluster size of 100 adolescents, and previous proportion of students who had accepted practices related to fluoride use was not known; hence, it was taken at being 50%. A proportionate cluster sampling unit was employed with the cluster being the degree program the participant was undertaking and from each program, the required number of participants was achieved by systematic sampling where every third candidate in the class list was selected.

Data collection

Data were collected through self-administered structured questionnaire. The questionnaire was in English and was made for this study based on the set specific objectives. The questionnaire was pilot tested for content and face validity among students at the same university taking diploma courses. It inquired on sociodemographics, usage of fluorides, and awareness of fluorides for caries prevention as well as oral health-related behaviors relevant to fluoride use or awareness. The sociodemographic variables were age, sex, year of study, the degree program studying, and source of financial resources.

Age of the participants was assessed by inquiring about their age in years at the last birthday while the year of study was assessed by inquiring about academic years of study as being a 1st, 2nd, 3rd, 4th, or 5th year. The degree program studied by the participants was inquired as an academic program he/she is currently admitted at the university. It ranged from Doctor of Medicine, Bachelor in Medical Laboratory Sciences, Bachelor of Science in Diagnostic and Therapeutic Radiography, Bachelor of Pharmacy, Bachelor of Science in Nursing, and Bachelor of Science in Environmental Health Sciences. The participants' source of financial resources was assessed by inquiring asking them to state their main source of financial support which ranged from Higher Education Students' Loans board, sponsored by parents or employer or other sponsor than government sources.

The questions in oral health-related behaviors included frequency of tooth brushing as "How often do you brush in a day?" and the responses were; "once per day, twice per

day, thrice per day or more, and I don't know." Dental visit was assessed by inquiring as to whether the participant has visited dental facility in the past 6 months for treatment and/or check-up and the response was "yes, no, or I do not remember."

Awareness of fluoride for caries prevention was assessed by a composite of four questions; question one asked "What do you think is the main role of fluoride in toothpastes?" and the response was "(a) it has no importance, (b) it prevents bad mouth odor, (c) it prevents gum diseases, (d) it prevents tooth decay, and (e) I don't know." Question two on awareness inquire "How often do you think it is recommended to use fluoridated toothpaste per day?" the response was "(a) once per day, (b) twice per day, (c) thrice or more than thrice per day, and (d) I don't know." The third question on awareness of fluoride asked, "What do you think is the required amount of fluoride in parts per million (ppm) in a toothpaste that should be used by adults?," the response was (a) below 500 ppm, (b) 500–999 ppm, c) 1000–1500 ppm, (d) above 1500 ppm, and (e) I don't know." The fourth question inquired that "Besides fluoridated toothpaste, what are other ways to applying fluoride to the teeth that you know? (You can select more than one option)," the response was "(a) varnishes, (b) fluoridated drinking water, (c) fluoridated table salt, (c) mouthwashes, (d) fluoride gel, (e) Lozenges, and (f) I do not know any."

The questions on practices related to fluoride use were "Name the brand of toothpaste that you usually use," "How often do you brush with toothpaste in a day?," and the responses were "(a) once per day, (b) twice per day, (c) thrice per day or more, and (d) I don't know," "Have you ever checked for the fluoride content on toothpaste you usually use?" and the response was (a) often, (b) sometimes (c) seldom, and (d) never. The other question on use of fluoride asked "Have you been to a dentist where fluoride was applied as part of treatment? and the response was (a) often, (b) sometimes, (c) seldom, and (d) never. Finally, a question on other forms of fluoride used was asked; "Do you use a mouthwash that contains fluoride as part of your self-dental care?," and the response was from (a) often, (b) sometimes, (c) seldom, and (d) never.

Thirty participants responded to the questionnaire for the second time 14 days after the first attempt to ensure consistency of their responses over time. Test re-test Pearson correlation coefficient was 0.82.

Data management and analysis

Data entry, cleaning, and analysis were done using IBM SPSS for Windows (version 23). The independent variables, sociodemographics and oral health-related behaviors relevant to fluoride use or awareness, were inquired and

scored as age {in years}, sex {1 = male, 2 = female}, year of study {1st–5th year}, the degree program studying {Doctor of Medicine (MD), Medical Laboratory Scientist, Bachelor of Pharmacy, Bachelor of Science in Radiology, Bachelor of Science in Nursing General, Bachelor of Science in Nursing Anesthesia, Bachelor of Science in Nursing Midwifery, Bachelor of Science in Biomedical Engineering, and Bachelor of Science in Environmental Health}, and source of financial resources {government loan, sponsored by parents, employer, and others which were specified}. During analysis, age was categorized as the young (17–22 years) and older (23–38 years), study program was transformed into junior (1st–2nd years) and senior students (3rd–5th years), degree program as medical (MD) and allied health (all program other than MD) including two categories and source of financial resources was dichotomized into government loan and private sponsored which included all other funding sources.

Frequency of tooth brushing per day was scored as once per day, twice per day, thrice per day, more than thrice per day, and I don't know and dichotomized into brush once per day and brush at least twice per day. Visited dental facility in past 6 months facility for treatment or check-up was scored as yes, no, or do not remember and dichotomized into did not visit and visited.

Awareness and practices related to fluorides for prevention of dental caries were constructed out of four independent questions (item) for each. Awareness of fluoride for caries prevention was obtained as a dichotomized of an aggregate sum score of four items inquiring on whether the participant is aware or not on: (1) Role of fluoride in toothpastes, (2) concentration of fluoride in toothpaste, (3) modes of fluoride application, and (4) recommended frequency for using fluoridated toothpaste per day. Those scoring correctly for at least two of the items were considered of being aware. For the participant to be considered as having acceptable practices related to fluoride use had to score at least two of the four items assessed: (1) Report to use of toothpaste containing fluoride by brand, (2) check for fluoride content in the toothpaste use, (3) had professionally applied fluoride, and (4) report to use mouthwash containing fluoride as part of self-care.

Sociodemographic, oral health behaviors, awareness and practices related to fluorides for prevention of dental caries, and pattern of dental caries data were summarized and presented as frequency distributions. Cross tabulation with Chi-square test assessed the relationship between awareness of as well as practices related to fluoride for caries prevention with sociodemographic and oral health behaviors at bivariate level. Adjusted binary logistic regression reported as OR (95% CI) was used to assess strength and direction of the relationship between dental caries with sociodemographic

and oral health behaviors at multivariate level. The level of statistical significance was set at 5%.

Institutional review board approval and informed consent

The ethical approval for the study was granted by Muhimbili University of Health and Allied Sciences Institutional Review Board on September 20, 2020. Permission to conduct research and engage the participants was granted by the relevant authorities. Written informed consent was obtained from participants and participation was entirely voluntary.

RESULTS

Participants' characteristics

Three hundred and eighteen university students in health sciences were accessed for this study of the 384 expected participants who were required as per sample estimation, making a participation rate of 82.8%. The reason for non-participation was due to participants not returning the questionnaire after several follow-ups exceeding the period of data collection. The mean age of the participant was 22.7 years SD 2.8.

The study participants were composed of relatively higher proportions of people aged 17–22 years (51.6%), males (66.4%), studying medicine (58.8%), and finance through government loan. In terms of the year of study, 46.2% (147) were in their junior years of study as either first or second years while the remaining 53.8% (171) were the seniors (3rd–5th year of study).

Dental visit for treatment and visit for check-up in the past 6 months were not common practices, whereby < 20.0% of the participants reported doing so. Likewise, less than half reported tooth brushing at least twice a day among all the participants [Table 1].

Awareness of fluoride for caries prevention

Overall, 55.0% of the participants were aware of the role of fluoride in caries prevention; specifically, the function of fluoride in toothpaste, frequency of using fluoridated toothpaste, various modes of fluoride application, and required concentration of fluoride in toothpaste.

The most known fact regarding fluoride was its role/function in toothpaste (63.5%) while the least know was the required concentration of fluoride in toothpaste (7.9%) [Figure 1].

Practices related to fluoride use

Practices related to fluoride use, namely, use of fluoridated toothpaste, checking for presence of fluoride in toothpastes, use of fluoridated mouthwash or having received

Table 1: Demographic distribution of participants ($n=318$).

Demographic variable	Categories	% (n)
Age group (years)	17–22 years	51.6 (164)
	23–38 years	48.4 (154)
Sex	Male	66.4 (211)
	Female	33.6 (107)
Study program	Medicine	58.8 (187)
	Allied health	41.2 (131)
Year of study	Junior years	46.2 (147)
	Senior years	53.8 (171)
Financial support	Government loan	67.0 (213)
	Private sponsor	33.0 (105)
Visited dental in the past 6 months facility for treatment	Did not visit	81.1 (258)
	Visited	18.1 (60)
Visited dental facility in the past 6-month facility for check-up	Did not visit	87.7 (279)
	Visited	12.3 (39)
Frequency of tooth brushing	Brush once per day	54.7 (174)
	Brush at least twice per day	45.3 (144)

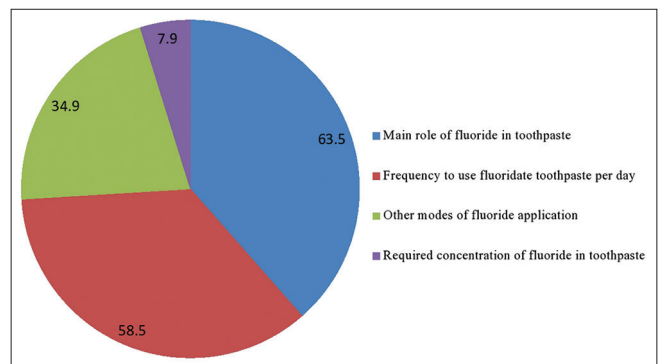


Figure 1: Percentage of participants according to their awareness on fluoride for caries prevention.

professionally fluoride revealed that most of the participants reported to be using fluoridated toothpaste compared to actual use of fluoridated toothpaste as assessed reported brands (78.3% vs. 50.3%). Other supplementary forms of fluoride application such as professional fluoride application and use of fluoridated mouthwashes were reported in 3.1% and 15.4%, respectively [Figure 2].

An overall, appropriate practice related to fluoride use was in 44.3% (141) of all the participants.

Sociodemographic and behavioral factors for awareness of fluoride for caries prevention

The results for bivariate association of awareness and practices related to appropriate use of fluoride for caries prevention to sociodemographics and oral health behaviors are presented in [Table 2]. Higher proportions of participants who were aware of fluoride use for caries prevention were the

Table 2: Sociodemographic and behavior distribution of participants according to their awareness and practices related to use of fluoride for caries prevention.

Demographic and behavioral variable	Categories	Aware of fluoride % (n)	Appropriate practices related to fluoride use % (n)
Age group	17–22	45.7 (75)	18.9 (31)
	23–38	64.9 (100)**	24.0 (37)
Sex	Male	54.0 (114)	18.5 (39)
	Female	57.0 (61)	27.1 (29)*
Study program	Medicine	54.5 (102)	19.3 (36)
	Allied health	55.7 (73)	24.4 (32)
Year of study	Junior	42.9 (63)	13.6 (20)
	Senior	65.5 (112)**	28.1 (48)**
Financial support	Government loan	55.4 (118)	18.8 (40)
	Private sponsor	54.3 (57)	26.7 (28)
Visited dental in the past 6-month facility for treatment	Did not visit	53.7 (139)	18.2 (47)
	Visited	60.0 (36)	35.0 (21)*
Visited dental facility in the past 6-month facility for check-up	Did not visit	54.5 (152)	19.4 (54)
	Visited	59.0 (23)	35.9 (14)*
Frequency of tooth brushing	Brush once per day	54.0 (94)	20.1 (35)
	Brush at least twice per day	56.2 (81)	22.9 (33)

**P=0.001, *P≤0.05

older, female, from allied health sciences, seniors in studies, those receiving government loan, and the ones who had visited dental facilities for treatment and check-up as well as those who brushed at least twice a day. Age of participants and seniority in studies were the only variables that showed statistically significant association with awareness of fluoride; whereby a significantly higher proportion of older participants and those in senior years of their studies were aware than their counterparts.

Sociodemographic and behavioral factors for practices related to fluoride use for caries prevention

Regarding the practices related to the use of fluoride for caries prevention, substantially higher proportion of older, females, those in allied health programs, senior students, private sponsored, and those reporting to have visited a dental facility for treatment or check-up as well as the ones reporting to brush their teeth at least twice daily had appropriate practices compared to their counterparts. The statistical significance differences for appropriate practices related to fluoride use were only for the females, senior students, and those who visited dental facilities for treatment or check-up.

Factors influencing awareness and practices related to fluoride for caries prevention

[Table 3] presents the multivariate output for the awareness and practices related to fluoride use for caries prevention. The bivariate statistically significant sociodemographic variables,

namely, age, sex, and seniority in studies as well oral health behavior (visit to a dental facility for treatment and visit for dental check-up) were subjected to binary logistic regression. The odd of being aware of fluoride use for caries prevention was higher among older participants than younger and seniors' students. On the other hand, higher odds of having appropriate practices for fluoride use in dental caries prevention were among female, senior students, and those who visited dental facility for treatment or check-up.

However, the only variable that retained the statistical significance association for awareness and practice related to the use of fluorides for caries prevention was the year of study; where odds of senior students being aware and using fluorides were 2.5 times and 2.4 times, respectively, compared to the junior students.

The odds of being aware of and having appropriate practices related to use of fluorides for caries prevention were higher among senior participants than the junior participants.

DISCUSSION

The paper presents findings from students in health professional training community in East Africa that aimed at assessing their awareness and practices related to the use of fluoride for caries prevention as a fundamental approach to caries prevention. The students in health training institution were considered for this study in a view that are trained to be health professionals, have basics in health sciences, live together with dental students as colleagues, have dental school, university dental clinic services, and health insurance

Table 3: OR 95% CI for sociodemographic and behavioral factors influencing awareness and practices related to fluoride use for caries prevention.

Demographic variable	Categories	Being aware of fluoride OR (95% CI)	Having appropriate practices related to fluoride use OR (95% CI)
Age group years	17–22	1	1
	23–38	3.0 (1.0, 9.9)	0.9 (0.3, 3.1)
Sex	Male	1	1
	Female	1.0 (0.6, 1.7)	1.6 (0.9, 2.7)
Year of study	Junior years	1	1
	Senior years	2.5 (1.6, 4.0)	2.4 (1.3, 4.2)
Visited dental in the past 6-month facility for treatment	Did not visit		1
	Visited		1.6 (0.7, 3.4)
Visited dental facility in the past 6-month facility for check-up	Did not visit		1
	Visited		1.7 (0.7, 4.3)

will positively influence their awareness and practices in oral health along the course of the studentship. It has been previously reported that university students' general health awareness is substantial.^[12]

The finding of the present study displays relatively low proportion of participants who were aware of the role of fluoride in caries prevention. It is an unexpected observation from the sampled population of health professional students. The findings correspond with some reports from India, Malaysia, and Indonesia where university students with varying professional training in undergraduate had low awareness of fluoride for caries prevention.^[11,13,14] Similarly, less than half of the participants had appropriate practices related to fluoride use. Usually, awareness is a prerequisite for practice, as only a few were aware of fluoride's role in caries prevention hence the practice. Non-dental health professionals are key stakeholders in prevention of oral health diseases if they are not custodian of health issues specifically in prevention and health promotion; it is unlikely to do so to their clients. The findings are similar to those reported among Indian college students.^[10,15]

The lack of statistical difference for most of the assessed sociodemographic covariates in multivariate analysis is indicative of a homogeneous community during university life in Tanzania. Most of the students' finances as catered by government loan boards or parents' funds which are only sufficient for basic human life and are mostly accommodated in hostels or rental homes around the university premises. However, the fact, those senior students were aware and had appropriate practices related to fluorides, shows the effect of inter-professional brotherhood that student life offers during their life as students for social and personal growth. The findings are analogous to those of Ahmad *et al.* (2021)^[11] and Allam (2018)^[16] among Malaysian and Egyptian university students where most of the 5th-year students were more aware of fluoride use for caries prevention than the juniors, respectively.

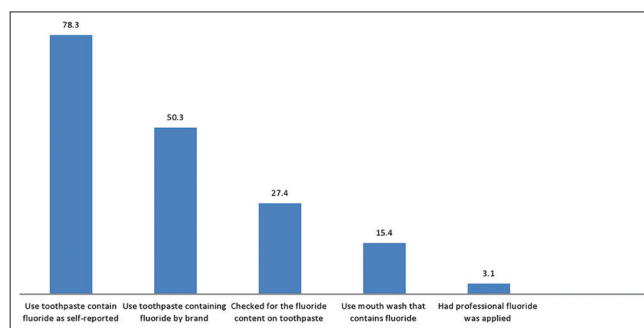


Figure 2: Percentage of participants according to practices related to fluoride use.

The fact that most of the participants visiting a dental facility for treatment or check-up reported appropriate practices related to fluoride use could be an outcome of chair-side oral health information that these participants received during the dental visit. This finding underscores the importance of dental visits where oral health information could be provided as it is well known that through an efficient health service, patients can be advised on how to control disease and the related risk factors.^[17] In communities with insufficient oral health networks,^[18] dental facilities play an important source in information for prevention of oral disease. It has been reported that having no or few dental visits increases the incidence of the oral disease.^[19]

The profile of the study participants offers generalizability of the sample to the university students in health training of similar backgrounds where our participants were mostly; in their late teens to early 20s, male and supported by government students' loan for studies fees, meals, and accommodation.^[20] Government loan is the main source of finance for students in universities in Tanzania, and for majority being male students due to existing gender imbalance in students being enrolled in universities and much worse for science-based disciplines.^[21]

CONCLUSION

Relatively low proportion of these university students was aware of fluoride use for caries prevention. Likewise, a few had appropriate practices related to fluoride uses. Toothpaste was the most common fluoride application method known and reported to be used more than other methods. Sociodemographically, those who were in senior years of study were more likely to be aware and use fluoride for caries prevention than the juniors.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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