REFINED CARBOHYDRATE INTAKE AND KNOWLEDGE OF ORAL HEALTH AMONG STUDENTS IN PRIVATE AND PUBLIC SECONDARY SCHOOLS IN IBADAN, NIGERIA

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Submission Date: 7th May, 2024
Date of Acceptance: 25th Dec., 2024
Publication Date: 31st Dec., 2024

ABSTRACT

Background: **The knowledge of an individual about oral health and the practice of good oral hygiene will go a long way in determining the oral health status of such an individual. Frequent intake of refined carbohydrates, without optimum oral hygiene procedure, has been implicated in the aetiology of oral diseases such as dental caries and periodontitis. The aim of the study was to assess the oral health knowledge of some secondary school students in two LGAs in Ibadan, Oyo State.**

Methodology: **This descriptive cross-sectional study was done using multistage sampling techniques and conducted across the classes in the selected senior secondary school. A pretested, self-administered, structured questionnaire with 12 items, adopted from Sternberg et al, was used for the data collection. A total of 248 participants consisting of 97 (39.1%) males and 151 (60.9) females completed and submitted the questionnaires. Data analysis was done using the statistical product and service solutions (SPSS 26.0).Statistical significance was set at $p < 0.05$.**

Results: **Knowledge assessment of oral health education; 94.4% of the participants had good knowledge, while 5.6% of the participants had poor knowledge. More females (60.3%) than males (39.7%) had good knowledge of oral health. The age range of participants was from 11 to 19 years, with a mean (SD) –14.68 (±1.45). On the knowledge of oral health, 234(94.4%) of participants perceived excessive consumption of sweet food can cause dental caries; 9(3.6%) did not; and; 5(2.0%) undecided. On teeth brushing at least twice daily 238 (96.0%) participants agreed, and 6(2.4%) did not, and 4(1.6%) were undecided. Participants from public schools had a higher frequency of refined carbohydrate intake, with a low pattern of 9.2%, a moderate pattern of 52.7%, and a high pattern of 38.1%. The socio-demographic characteristics of the participants were not statistically significant against the pattern of intake of refined carbohydrates following bivariate analysis.**

Conclusion: **The supposedly good knowledge of oral health education of respondents in this study was not matched equally with a good pattern of refined carbohydrate intake. This calls for a concerted effort towards improving oral health campaigns among secondary school students.**

Keywords: Knowledge, Oral health, Refined carbohydrate, Secondary school students.

INTRODUCTION

General health and well-being is fundamentally related to oral health.[1] A healthy mouth enables an individual to talk, eat and socialize without experiencing active disease, discomfort or embarrassment.[2] Undoubtedly, oral diseases are caused by a range of modifiable risk factors common to many non-communicable diseases, and this is connected to the rapidly changing lifestyles arising from urbanization and the associated increased intake of diets rich in sugars.[3,4] On account of their high prevalence and incidence in all regions of the world, oral diseases represent a major public health problem.[4,5] Oral health behavior, environmental and life style factors like nutritional status, tobacco smoking, alcohol, poor oral hygiene, stress, and systemic conditions have been found to be associated with oral conditions.[5,6,7] It is not unlikely that a lot of people experience poor oral health without proper knowledge and oral health.[7,8,9] Studies have shown that better oral

care practice is strongly related to the knowledge of oral health.[6,8] Globally, the lack of oral health awareness and over consumption of refined carbohydrate have been linked to dental caries in about 90% of children and adolescent of school age.[8,9,10] Thus resulting in the loss of more than 50 million school hours annually following oral health conditions, with attendant negative effect on children's performance at school and success in future career.[9]

In developed countries, dental care has been systematically organized to improve dental health, knowledge and oral health attitude among children and young adults; with a consequential positive impact on their dental health.[10,11] Consequently this impact on the overall general health of the individuals as they age and lead to more adults maintaining their teeth into the advanced stages of life[12,13] but this is not exactly the case in Nigeria.[15] Ogunrinde *et al.* indicated that students and adolescents in Nigeria are predisposed to dental caries and periodontal disease coupled with poor oral hygiene following increase daily intake of sugary foods and drinks.[14] In another study, Akpata posited that the prevalence of dental caries is as high as 20 to 45% among school children and adolescents in the country, hence constituting a major health challenge.[16]

Good oral health knowledge and behaviour is an indication of the efficacy of applied dental health education programs.[17] Increased awareness has to be associated with improved oral hygiene and a more positive attitude towards oral health.[18] Therefore, in line with the thought of enhancing positive oral health practices, the World Health Organization prioritized promotion of oral health education among adolescents.[19] In order to embark on a timely and appropriate health education program, it is important to know the target populations, oral health behaviour, mindset and practice towards oral health.[20,17]

On account of the dearth of studies on oral health knowledge and poor oral health practice in relation to the frequency and pattern of refined carbohydrate intake among children and adolescents from low and middle-income countries, such as Nigeria, compared to those from developed countries, this study is therefore aimed at knowing the oral health behavior and knowledge of oral health among public and private secondary schools and its socio-demographic relationship. In addition, it seeks to provide data for future research and allows comparisons with adolescents' knowledge of oral health in relation to refined carbohydrate intake among public and private secondary schools in Ibadan North West and North Local Government Areas of Oyo State.

METHODOLOGY

This descriptive cross-sectional study was conducted among secondary school students in Ibadan North West and Ibadan North LGA of Oyo State, Nigeria. It was done from May to October, 2023. Multistage sampling technique was applied. Two local governments were randomly chosen from 33 local government of Oyo State. A total of seven senior secondary schools were purposively selected from the two local governments comprising both males and females across the classes in the public and private senior secondary schools. At the final stage a total of 248 comprising of 97 male and 151 female were conveniently selected.

The Sample size was calculated to be students numbering 229 using the formula $n = Z^2pq/d^2$ while allowing for attrition rate of 8% resulting in total sample size at 248.

A pretested, self-administered, structured questionnaire with 12 items, adopted from Petersen *et al.* and Stenberg *et al.*, with four parts that was modified to include only two parts and socio demographic component. The parts adopted were to assess the respondents' oral health knowledge (part 1) and to assess the respondents' dietary habits (frequency of intake) on sweet foods, sweet snacks and soft drinks (Part 4). Pretesting was done on 25 students who met the inclusion criteria prior to the study without any further modification. The questionnaire consisted of 3 parts. The first part had 5 questions on sociodemographics, and the second part had 9 questions to assess the respondents' oral health knowledge based on the effects of brushing, use of fluoride on dentition, gum bleeding, dental plaque, and sweet food and drinks on dentition. Each correct answer is given 1 mark and wrong answer 0 mark. This gave rise to a minimum score of 0 and a maximum score of 9. A simple average of the maximum score (9) was obtained (50% of 9 =4.5) and used to categorize the participants into good and poor knowledge classes. Those that scored ≥5 were categorized as having good knowledge (since the questions had whole number scores, 4.5 was not used). Those that scored <5 were categorized as having poor knowledge. The third part consisted of questions to assess the respondents' frequency and pattern of refined carbohydrate intake in relation to sweet foods, sweet snacks and soft drinks. Concerning the frequency of intake of refined carbohydrates among the participants, a 3-point, 4-point and a 6-point scale respectively was used to grade the various levels of ingestion of refined carbohydrates among the participants. Students were gathered in one classroom

with the help of the teacher and the questionnaires were self-administered.

Data analysis was done using the statistical product and service solutions (SPSS 26.0). Statistical tests done included frequencies for the univariate analysis, Chi-square test and Fisher's Exact Test for the bivariate analysis. Categorical variables such as gender, LGA, school, school type and so on were cross tabulated against the participants' oral health knowledge, frequency and pattern of intake of refined carbohydrates. For cross tabulations that had a smaller sample frame, a Fisher's exact test was carried out to obtain a representative outcome.

Ethical approval to carry out this study was granted from the University of Ibadan and University College Hospital (UI/UCH) Health Research Ethics Committee. Approval ID:NHREC/05/01/2008a.

RESULTS

A total of 248 students comprising of 97 males and 151 females participated in the study by completing and submitting the questionnaires. The ages ranged between 11 and 19 years and mean age of the participants was 14.68(±1.45). The gender distribution showed more females 151 (60.9%) than the males 97 (39.1%). The religion, school type (private and public), class, and LGA frequency distributions are presented in Table 1, showing the frequency distribution of socio-demographic characteristics of the study participants. Following the responses of the participants to questions testing their knowledge on oral health education, each of the nine questions were given a score of one (1) for correctly answered questions and zero (0) for incorrectly answered questions. This gave rise to a minimum score of 0 and a maximum score of 9. A simple average of the maximum score (9) was obtained (50% of 9 =4.5) and used to categorize the participants into good and poor knowledge classes. Those that scored ≥5 were categorized as having good knowledge (since the questions had whole number scores, 4.5 was not used). Those that scored <5 were categorized as having poor knowledge. 234 (94.4%) of the participants had good knowledge while 14(5.6%) of the participants had poor knowledge.

In comparing the knowledge of the participants on oral health education based on the type of school - Private against Public, 4 participants had poor knowledge and 113 had good knowledge from private schools while 10 participants had poor knowledge and 121 had good knowledge from public schools.

A good knowledge level was found among the participants irrespective of their LGAs. Hence 9 (5.8%) participants had poor knowledge and 146 (94.2%) had good knowledge from Ibadan North while 5 (5.4%) participants had poor knowledge and 88 94.6% had good knowledge from Ibadan North West.

Concerning the frequency of intake of refined carbohydrates among the participants, a 3-point, 4-point and a 6-point scale respectively was used to grade the various levels of ingestion of refined carbohydrates among the participants.

Table 3 shows the frequency distribution of the participants' responses to the questions testing the frequency of their ingestion of refined carbohydrates. In comparing the pattern of intake of refined carbohydrates based on the type of school - Private against Public, using a Likert 3-point scale of "High, Moderate and Low", the pattern was categorized. Participants from public schools had a higher frequency of refined carbohydrate intake, with a low pattern of

Table 1: Frequency distribution of socio-demography of the study participants (N=248)

Socio-Demographic Characteristics	Frequency (N)	Percentage (%)
Age Range (In Years)		
• 11-15	182	73.4
• 16-19	61	24.6
• Missing	5	2.0
Gender		
• Male	97	39.1
• Female	151	60.9
Religion		
• Christianity	196	79
• Islam	51	20.6
• Traditional	1	0.4
Private School(PrS)		
• PrS 1	21	8.5
• PrS 2	30	12.1
• PrS3	11	4.4
• PrS3	55	22.2
Total (Private)	117	47.2
Public School(PuS)		
• PuS1	54	21.8
• PuS2	46	18.5
• PuS3	31	12.5
Total (Public)	131	52.8
Class		
• SS1	123	49.6
• SS2	117	47.2
• SS3	8	3.2
Local Government Areas(LGA)		
• Ibadan North	155	62.5
• Ibadan North West	93	37.5

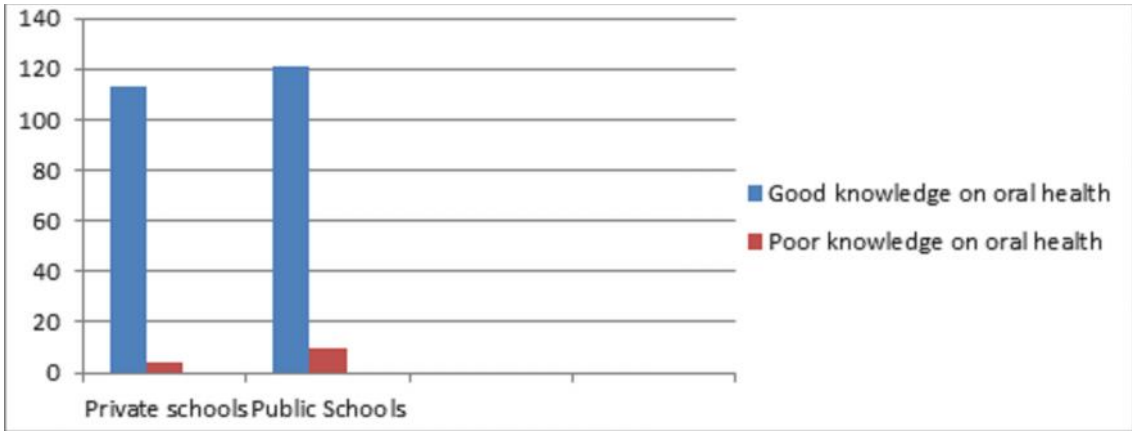

Figure 1: The knowledge of the participants on oral health education based on the type of school - Private against Public

9.2%, a moderate pattern of 52.7%, and a high pattern of 38.1% compared to the private schools and a p-value of 0.915 was found which was statistically insignificant.

To obtain the pattern of consumption of refined carbohydrate among the participants, their response to three questions aimed at determining their intake was recorded. On the daily intake of sweet food, a

Table 2: Frequency distribution of participants' responses to the questions testing their knowledge about oral health education. (N=248)

Knowledge About Oral Health Education Among the Participants	Frequency (N) [Percentage (%)]		
	True	False	I Don't Know
1. Too Much Sweet Food Causes Caries?	234 [94.4]	9 [3.6]	5 [2.0]
2. Gum Bleeding Means Inflamed Gum?	164 [66.1]	27 [10.9]	57 [23]
3. Dental Plaque Means Soft Debris on Teeth?	121 [48.8]	33 [13.3]	94 [37.9]
4. Dental Plaque Can Lead to Tooth Decay?	179 [72.2]	21 [8.5]	48 [19.4]
5. Carious Teeth Can Affect Teeth Appearance?	226 [91.1]	9 [3.6]	13 [5.2]
6. Use of Fluoridated Toothpaste Strengthens the Teeth?	183 [73.8]	24 [9.7]	41 [16.5]
7. Bad Oral Hygiene Affects the Health of The Body?	197 [79.4]	28 [11.3]	23 [9.3]
8. Regular Use of Toothbrush Provides Healthy Mouth with Reduced Gingivitis?	206 [83.1]	15 [6.0]	27 [10.9]
9. Brushing of Teeth Is Done At Least Twice Daily?	238 [96.0]	6 [2.4]	4 [1.6]

Table 3: Frequency distribution of the knowledge categories of participants about oral health education (N= 248).

Knowledge Category	Frequency (N)	Percentage (%)
• Good knowledge	234	94.4
• Poor knowledge	14	5.6
Knowledge Category (School type)		
Public School		
• Good Knowledge	121	92.4
• Poor Knowledge	10	7.6
Private School		
• Good Knowledge	113	96.6
• Poor Knowledge	4	3.4
Knowledge Category (Local Governments)		
Ibadan North		
• Good Knowledge	146	94.2
• Poor Knowledge	9	5.8
Ibadan North West		
• Good Knowledge	88	94.6
• Poor Knowledge	5	5.4

The mean knowledge score among the participants was 7.05 (±1.558) with a minimum score of 2 and a maximum score of 9.

score of 1 was given to those that consumed less than once daily, score of 2 for those who consumed between 2-4 times daily and score of 3 for those that consumed between 4-6 times daily. On intake of chocolates, sweets, candy, etc. a score of 1 was given to those that consumed once in a while, 2 for those that consumed 1-2 times weekly and score of 3 for those that consumed them daily. On consumption of soft drinks, those that consumed once in a while were scored of 1, score of 2 for those that consumed 1-2 times weekly, score of 3 for those that consumed more than twice weekly and a score of 4 for those that

Table 4: Frequency distribution of participants' response to questions testing the frequency of the ingestion of refined carbohydrates (N= 248).

Frequency of refined carbohydrate intake among the participants	**Frequency (N)**	**Percentage (%)**
1. How many times do you eat sweet food per day?		
• Less than 1 time	72	29.0
• 2-4 times	138	55.6
• 4-6 times	38	15.3
2. How often do you eat chocolate, sweet, biscuits, gums and candy?		
• Never / once in a while	59	23.8
• Once per week	31	12.5
• Twice per week	45	18.1
• Everyday	113	45.6
3. How often do you take soft drinks (e.g coke, fanta, etc.)?		
• Never/ once in a while	78	31.5
• Once in a week	20	8.1
• Twice in a week	45	18.1
• More than twice a week	35	14.1
• Every day	46	18.5
• Several times per day	24	9.7

Table 5: Frequency distribution of the pattern of consumption of refined carbohydrates among the participants.

Pattern Of Consumption of Refined Carbohydrates Among the Participants.	**Frequency (N)**	**Percentage (%)**
Low Pattern	24	9.7
Moderate Pattern	132	53.2
9.7High Pattern	92	37.1
Pattern of Intake of Refined Carbohydrate (School type)		
Private		
• Low pattern	12	10.3
• Medium pattern	63	53.8
• High pattern	42	35.9
Public		
• Low pattern	12	9.1
• Medium pattern	69	52.7
• High pattern	50	38.2
Pattern of Intake of Refined Carbohydrate (LGA)	Frequency(N)	Percentage (%)
Ibadan North		
• Low pattern	13	8.4
• Medium pattern	82	52.9
Pattern of Intake of Refined Carbohydrate (LGA)	Frequency(N)	Percentage (%)
Ibadan North		
• Low pattern	13	8.4
• Medium pattern	82	52.9
• High pattern	60	38.7
Ibadan North West		
• Low pattern	11	11.8
• Medium pattern	50	53.8
• High pattern	32	34.4

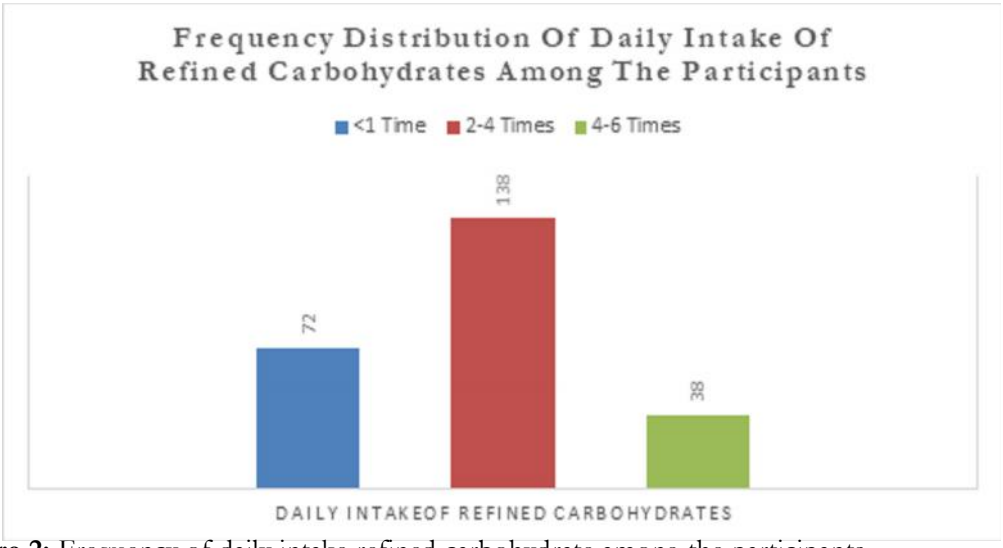

Figure 2: Frequency of daily intake refined carbohydrate among the participants

Table 6: Relationship between school type, gender and pattern of intake of refined carbohydrate intake.

	Pattern of Intake of Refined Carbohydrate Intake			**χ^2**	**p-value**
School Type	Low Pattern	Moderate Pattern	High Pattern	**0.179**	**0.915**
Private school	12	63	42		
Public school	12	69	50		
Gender				4.329	0.115
Male	5	57	35		
Female	19	75	57		

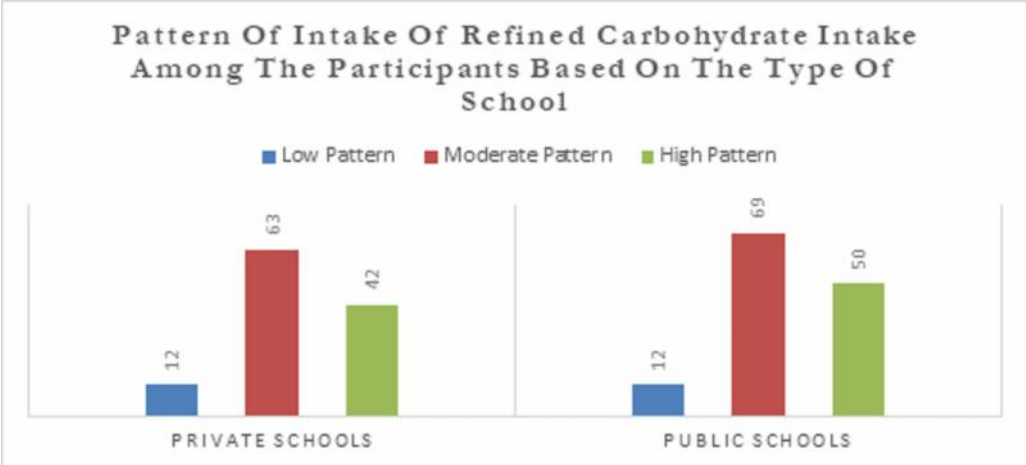

Figure 3: Pattern of intake of refined carbohydrate intake among the participants based on the type of school

consumed daily and several times a day. For each question, a score of 0 was given to those that do not consume the items. In adding the scores, each participant could have a maximum score of 10. Those that had a total score between 0-3 were categorized as low pattern, those that scored between 4-6 as moderate pattern and 7-10 as high pattern. Table 4 and 5 shows participants with Low pattern of refined carbohydrate as having 9.7%, moderate pattern; 53.2% and high pattern; 37.1%. The bivariate analysis using Pearson's

Prototype Questionnaire
Section A: Bio-Data
1. Age
2. Gender: Male [ ] Female [ ]
3. Religion: Christianity [ ] Islam [ ] Traditional [[Others please specify……
4. Name of school:
5. Class: SS 1[ ] SS11 [ ] SS111[ ]

Section B: Oral Health Knowledge

1	Consuming too much sweet food causes tooth decay/dental caries?	True	False	I don`t know
2	Gum bleeding means inflamed gum	True	False	I don't know
3	Dental plague means soft debris on teeth	True	False	I don't know
4	Dental plaque can lead to tooth decay	True	False	I don't know
5	Carious or decayed teeth can affect teeth appearance	True	False	I don't know
6	Does the use of fluoridated tooth paste strengthen the teeth?	True	False	I don't know
7	Does bad oral hygiene affect the health of the body?	True	False	I don't know
8	Does regular use of toothbrush and paste provide a healthy mouth and reduce gingivitis?	True	False	I don't know
9	Brushing of teeth is done at least twice daily	True	False	I don't know

Frequency and Pattern of Refined Carbohydrate Intake

Q10. How many times do you eat sweet food per day? [Less than 1 time] [2-4 times] [4-6 times]

Q11. How often do you take chocolate/sweet biscuits and gums/candy? [Never or once in a while] [Once per week] [Twice per week] [Ever day]

Q12. How often do you take soft drinks like coke, Fanta etc.? [Never/Once in a while] [Once week] [Twice in a week] [More than twice in a week] [Every day] [Several times in per day]

Chi-squared parametric test showed that the school type of the participants (p-value 0.915) and gender type (p-value 0.115), as shown in Table 6, were not statistically significant

DISCUSSION

The aim of this study was to assess the knowledge of oral health as well as pattern of refined carbohydrate intake among the participants. There were more female participants (60.9%) than male participants (39.1%) in the study. In the assessment of their knowledge of oral health education, 94.4% of the participants had good knowledge, while 5.6% had poor knowledge. More females (60.3%) than males (39.7%) had good knowledge of oral health education. This finding is similar to the findings in two studies carried out in Saudi Arabia among university students (21,22). It was found that females had a higher mean knowledge score than males in assessing their knowledge of oral health education. Additionally in a study done by Mohammad N. Alshloul *et al.*, there was a significant gender difference in aspects of oral health knowledge ($p<.05$) as it was shown that female students' scores were higher than those of male students in all aspects of knowledge and practice, even though the female students were fewer in number: 54.8% were male and 45.2% were female.[18] This could suggest that the female students are more conscious of their oral health than their male counterparts. In another study carried out at the University of Calabar, Nigeria, the majority of the participants also had a good knowledge of oral health education; which also translated into a good oral health practice among the participants, suggesting that a good knowledge of oral health education can translate into a good oral health practice.[23]

In another study carried out among two higher secondary schools in Wah Cantt, an urban area in Islamabad, Pakistan, out of the total students, 18 (5%) had good knowledge, 170(46%) had average knowledge and 182 (49%) had poor knowledge about oral health.[24] This result is in contrast to this study, as the majority had average to poor knowledge, which is unexpected as the school is a private one within an urban centre with the result culminating in the majority of the students having poor practice.

In a study carried out in Jakarta, Indonesia, among preschoolers, on average, students consume carbohydrates 4-6 times a day, and 62.5% of the students consumed carbohydrates in the moderate category (4-6 times a day).[25] This shows that the preschoolers took a more refined carbohydrate diet than the teenagers in Jakarta study. In another observational study done , in a semi-urban community in Osun State, Southwestern Nigeria, among adolescents; 36.1% of the participants consumed refined carbohydrates in-between meals less than once daily.[26] The foregoing studies present almost similar findings on the daily intake of refined carbohydrates among the participants in this study.

The frequent daily intake of refined carbohydrates could be as a result of easy access to refined carbohydrate-based food items. These food items are sold at schools and within the communities the participants live in, which makes it easy for them to consume them more frequently. In addition, the younger age group tends to go for food items that are sweet and less nutritious than the more nutritious options.[27,28].Additionally, the economic status of the parents, which has a direct bearing on the students, may also influence purchasing power, hence the increase in consumption of unhealthy sweet items.[29]

Participants from public schools had a higher frequency of refined carbohydrate intake (low pattern: 9.1%; moderate pattern: 52.7%; and high pattern: 38.2%), unlike their private counterparts. This slight difference when compared with their counterparts in private schools could be because public schools have higher access to vendors of refined carbohydrates-based food items as well as other factors such as skipping school or classes.

The participants, however, showing good knowledge in oral health did not show good application of the knowledge, as the majority still participated in frequent daily intake and patterns of intake (a predominantly moderate pattern of intake) of refined carbohydrate substances. It has been established that intake of refined carbohydrates is associated with some oral disease conditions, such as dental caries and periodontitis.[30,31,32] They have also been implicated in some diseases of general health. Efforts should be geared towards further education of all the members of society, including the participants' age group, to achieve an overall better knowledge of oral health. However, it should not stop at this point; the populace should be encouraged to reduce their intake of refined carbohydrates and go for more nutritious alternatives. Oral health awareness programs being incorporated into secondary school curriculum (as health awareness program) can be instituted to further reinforce the knowledge and practices of good oral health. Schools can incorporate nutritious food items such as fruits in forms that are similar to the way refined carbohydrate-based foods are packaged, which would be economical for the students. This is to ultimately promote healthy diets in school, where students spend a lot of time during the week. The government can also grant tax relief to retailers of food items that are nutritious to encourage their sales. The government, in tandem, can increase taxes on refined carbohydrates-based items.

CONCLUSIONS

The participants in this study showed an overall good knowledge of oral health education; however, this did not translate into a good oral health practice of reduced refined carbohydrate intake, implicated in the pathogenesis of certain oral diseases. Instead, an increased (moderate pattern of intake of refined carbohydrates—intake between 2 and 4 times weekly) was found among the participants. This could result from easy access to these food items and the younger age group being fond of sweeter and less nutritious food items.

Conflict of Interest Statement

The authors affirm that they have no conflict of interests to declare.

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