SNACKING HABITS OF SECONDARY SCHOOL ADOLESCENTS AND AWARENESS OF THEIR EFFECTS ON THE TEETH

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Abstract

The study assessed the snacking habits of secondary school adolescents and their awareness of the effects of diet on the teeth.

The survey was conducted among students attending two secondary schools located in Obafemi Awolowo University campus, Ile Ife Nigeria. Information was collected by self-administered questionnaires through the school class teachers.

422 questionnaires were analyzed with 240 (56.8%) females and 182 (43.1) males. Biscuit is the most consumed snack with fresh fruits, doughnut, sweets, chocolate and ice cream having scores above the average. Water is the most consumed drink at meal times (45.5%) while soft drink drinks are the most consumed in-between meal (58.3%). Taste mostly determines the choice of food and drinks. Fresh oranges, fresh pineapple, salad, fruit juice, bread, milk and lime were perceived to be good for the teeth. 29.9% had previous dietary advice. 0.5% brushed more than twice/day.

A generally accepted sugary food is the most consumed snack with erosive drinks preferred in-between meals. Choice of food is determined by taste and cost. There exists inappropriate knowledge about the dental effects of some erosive and carious diet; inadequate dietary advice; and poor oral hygiene practices.

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Introduction

Adolescents, as a group, are highly receptive to nutritional products especially snacks and drinks, largely due to peer group influence. These school-aged children are subject to inadequate parental supervision as regards the number of meals, snacks and amount of food consumed. This is largely because many of them are left alone at home for long periods each day, with no company other than television, the game console, and the refrigerator packed with foods of every description. In addition, many of them do not have breakfast or lunch at home but rather in the school restaurants or a nearby café. In such circumstances, children tend to choose snacks (biscuits, sweets, cakes, soft drinks, etc.) to be eaten away from home.

Besides, television clearly transmits conflicting messages as regards dietary habits. Television thus encourages the consumption of certain foods and drinks, presented as "socially prestigious," "healthy" (i.e: you can eat as much as you like), and/ or simply as "tasty." The permissiveness and tolerance of many parents

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further contributes to the tendency for children to eat these "TV meals".[1]

The most significant effect of nutrition on teeth is the local action of diet in the mouth on the development of dental caries and enamel erosion.[2] The role of dietary sugars in the aetiology of dental caries has been generally described by observational and experimental studies and sugars i.e. mono and disaccharides are undoubtedly the most important dietary factor—and the factor studied most often—in the development of dental caries.[3] Dental caries that was of low incidence in Nigeria some 20 years ago is on the increase particularly among adolescents. This was attributed to the shift from the traditional to more 'westernized' diet and increase in the consumption of sugar,[4]

Dental erosion (erosive tooth wear) is the result of a pathologic, chronic, localized loss of dental hard tissue that is chemically etched away from the tooth surface by acid and/or chelation without bacterial involvement.[5] Epidemiological and observational studies have shown an association between dental erosion and the consumption of a number of acidic foods and drinks including frequent consumption of vinegar and pickles, citrus fruits and berries,[6] and drinking cola continuously or holding cola in the mouth.[7] Beside acidic drinks, many solid and semisolid foodstuffs are also acidic in nature.[8,9] Table I. Though the potential erosive effects of acidic foodstuffs are not well understood, it is believed that frequent ingestion of these types of foods may contribute to dental erosion.

Fruits	pH	Foodstuffs	pH
Apples	2.9-3.5	Cranberry sauce	2.3
Apricots	3.2-3.6	Fruit jams/jellies	3.0-4.0
Blueberries	3.2-3.5	Italian salad dressing	3.3
Cherries	3.2-4.7	Ketchup	3.7
Grapes	3.3-4.5	Mayonnaise	3.8-4.0
Grapefruits	3.0-3.5	Mustard	3.6
Lemons/limes	1.8-2.4	Pickles	2.5-3.0
Oranges	2.8-4.0	Relish	3.0
Peaches	3.1-4.2	Rhubarb puree	2.8
Pears	3.4-4.7	Sauerkraut	3.1-3.7
Pineapples	3.3-4.1	Sour cream	4.4
Plums	2.8-4.6	Tomatoes	3.7-4.7
Raspberries	2.9-3.7	Fermented vegetables	3.9-5.1
Strawberries	3.0-4.2	Yogurt	3.8-4.2

Table I. pH values of common fruits and foodstuffs.

Of recent, Lussi et al.[10] noted that awareness of dental erosion by the public is still not widespread and studies have also shown that adolescents tend to have insufficient knowledge of healthy dietary habits,[11] therefore there is a need to understand the snacking patterns of this group of children and the level of awareness of the effects of diet on the teeth. This is necessary before any instituted oral health education strategy can be effective.

Study Subjects and Methods

The survey was conducted among students attending two secondary schools located in Obafemi Awolowo University campus, Ile Ife Nigeria. Information was collected by self-administered questionnaires through the school class teachers. The content validity of the questionnaire was determined by presenting it alongside the objectives to the supervisor after which modifications were made. Reliability of the questionnaire was guaranteed by administering it to the target population who participated in the research through test and re-test method. In each school, 220 questionnaires were administered and participants made to complete the questionnaires anonymously and retrieved immediately by the second author.

In the first part of the questionnaire, they were asked to provide information on their bio-data.

From a list of common snacks (Chocolate, Sweets, Fresh fruits, Doughnuts, Nigerian puff puff, Burns, Vegetables and Salad, Ice cream, Meat pie, Fish pie, Biscuits and Sausage roll), they were asked to indicate the frequency of consumption with responses that ranged from "very frequently" and "very rarely".

They were asked to indicate the time at which some common acidic and sugary drinks were consumed (meal times and in-between meals). Also factors which influence the choice of food and drinks were assessed with responses that ranges from "almost always" and "never".

The participants' awareness of the effect of consumed food and drinks on the teeth were tested with response that ranges from "very good for my teeth" and very bad for my teeth".

Previous dietary counseling through various sources by dental personnel and frequency of tooth brushing were evaluated.

Data Analysis

The data was analyzed based on the information provided by the respondents and SPSS Software Version 16.0 was used to run some of the statistics. Sections of the questionnaire where variables were measured according to the Likert's scale of measurement was assigned weight values of 5 (very frequently), 4 (frequently), 3 (occasionally), 2 (rarely) and 1 (very rarely). Weight values of 5 for (Very good for my teeth), 4 (Good for my teeth), 3 (Undecided), 2 (Bad for my teeth) and 1 (Very bad for my teeth). Also weight values of 5 for (Almost always), 4 (often), 3 (sometimes), 2 (seldom) and 1 (Never).

The total weight value (TWV) for each variable was obtained through the summation of the products of the frequency (F) of responses for each rating and the respective weight value (W). This is also expressed mathematically below:

$$TWV = \sum_{i=1}^{5} F_i . W_i$$

(where TWV is the total weight value, Fi is the frequency of respondents that rated the variable i; and Wi the weight assigned to the rating of the variable i.

The score for each variable (VS) was arrived at by dividing the TWV for each item by the total number of respondents which is expressed mathematically below:

$$Variable\ score\ (VS) = \frac{TWV}{N}$$

where N=number of study population.

The variable scores ranged from 1 to 5; the closer the value to 5 the higher the significance of the variable for the participants. The average variable score (AVS) for each section was calculated by the summation of all the scores divided by the number of variables measured in the section.

Results

Four hundred and forty questionnaires were administered but 422 were adequate for analysis and interpretation. 240 (56.8%) females and 182 (43.1) males were analyzed. Their ages ranged from 11 to 22 years.

Table II show the frequency of consumption of various snacks, biscuit has the highest variable score (3.46) and therefore the most consumed snack followed by fresh fruits (3.45) and doughnuts (2.89) while sausage (1.25)

is the least consumed snack. Biscuits, fresh fruits, doughnut, sweets, chocolate and ice cream have variable scores above the average variable score (AVS) of 2.21. Meat pie, fish pie, Burns, puff puff and sausage roll have values below the AVS. Water is the most consumed drink at meal times (45.5%) followed by milk (36%) while lime is the least (10.4%). Soft drink drinks (regular) is the most consumed in-between meal (58.3%) followed by fresh oranges (54%) while yoghurt drink is the least consumed (37.4%) in-between meal. Table III.

S/N	Snacks	Very frequently W=5	Frequently W=4	Don't Know W=3	Rarely W=2	Very rarely W=1	Total Weight Value	Variable Score
1	Chocolate	170	96	444	100	166	976	2.31*
2	Sweets	170	232	282	128	172	984	2.33*
3	Fresh fruits	540	584	216	40	76	1456	3.45*
4	Doughnuts	290	384	336	108	102	1220	2.89*
5	Nigerian puff puff	200	280	156	82	70	788	1.87
6	Burns	160	100	135	60	112	567	1.34
7	Vegetables and Salad	50	160	366	136	182	894	2.12
8	Ice cream	80	136	390	176	154	936	2.22*
9	Meat pie	120	80	156	52	298	706	1.67
10	Fish pie	80	220	213	80	96	689	1.63
11	Biscuits	490	584	282	44	62	1462	3.46*
12	Sausage roll	150	124	135	50	70	529	1.25
	Average variable Score (AVS)							2.21

*Scores above Average Variable Score of 2.21
W: weight
Table II. Rate of consumption of various snacks

	Drinks	Meal times	%	In between meal	%
1	Water	192	45.5	198	46.9
2	Yoghurt drink	138	32.7	158	37.4
3	Tea	112	26.5	190	45.0
4	Fresh oranges	92	21.8	228	54.0
5	Fruit juice	108	25.6	192	45.5
6	Soft drink (diet)	96	22.7	160	37.9
7	Milk	152	36.0	166	39.3
8	Soft drinks (regular)	80	19.0	246	58.3
9	Lime	44	10.4	184	43.6
10	Fresh pineapple	66	15.6	222	52.6
11	Other sugar containing drinks	46	10.9	206	48.8

Table III. Consumption of drinks at meal times and in-between meals

Table IV shows that taste has the highest variable score (3.89) and therefore the most dominant factor in their choice of food and drinks. This is followed by price (3.75) and Brand name

(2.36) is the least. Taste, price, volume/size, family/friends and availability have variable scores higher than the average variable score of 3.13 while nutritional value, brand name, packaging, effects on general health and teeth have values below the AVS.

S/N	Factors	Almost always W=5	often W=4	Sometimes W=3	Seldom W=2	Never W=1	Total Weight Value	Variable Score
1	Taste	1140	316	99	6	79	1640	3.89*
2	Packaging	395	340	339	72	101	1247	2.95
3	Volume/Size	815	220	219	50	96	1400	3.32*
4	Effect on general health	310	412	381	56	84	1243	2.95
5	Effect on your teeth	375	260	315	98	128	1176	2.79
6	Price	960	376	159	14	72	1581	3.75*
7	Brand name	340	216	294	96	150	996	2.36
8	Availability	565	368	297	50	94	1374	3.26*
9	Nutritional value	355	228	342	116	125	1166	2.76
10	Family and friends	670	260	255	120	70	1375	3.26*
	Average Variable Score							3.13

*Scores above Average Variable Score of 3.13
W: weight

Table IV. Factors that influence the choice of food and drink.

On the perception of dietary effects on the teeth (Table V), fresh oranges has the highest variable score (3.47) followed by fresh pine apple (3.32) while chocolate has the lowest score (2.04). Fresh oranges, fresh pine apple, salad, fruit juice, bread, milk and lime have scores above the average variable score of 2.88 while yoghurt, coffee, soft drinks, biscuit and chocolates have values below the AVS.

29.9% claimed to have previous dietary advice on oral health. 60.2% brushed before food or drink while 25.5% brushed after food. 0.5% brushed more than twice/day.

Discussion

There is a great variety of foods offered by various societies and the criteria of choice are not always in accordance with the needs of the human body. Following this, improper food habits may develop and exert negative effects on human well-being.[12] As stated by the Surgeon General's report[13] on Oral Health in America, diet and nutrition are major multifactorial environmental factors in the etiology and pathogenesis of craniofacial diseases.

S/N	Food and drinks	Very good for my teeth W =5	Good for my teeth W=4	Undecided W=3	Bad for my teeth W=2	Very bad for my teeth W=1	Total Value	Variable score
1	Chocolates	40	120	228	372	122	862	2.04
2	Biscuit	45	592	318	36	60	1051	2.49
3	Lime	240	518	426	52	74	1310	3.10*
4	Milk	350	264	414	248	24	1300	3.08*
5	Soft drinks	100	232	414	212	100	1058	2.51
6	Bread	170	436	510	36	88	1240	2.94*
7	Coffee	150	332	483	84	81	1130	2.68
8	Fruit juice	385	452	360	70	72	1339	3.17*
9	Salad	275	492	384	18	105	1274	3.02*
10	Fresh pine apple	460	556	276	28	81	1401	3.32*
11	Yoghurt	205	388	399	44	127	1163	2.76
12	Fresh oranges	580	540	249	12	82	1463	3.47*
	Average Variable Score							2.88

*Scores above Average Variable Score of 2.88
W: weight

Table V. Perception of the effects some food and drinks on the teeth

Our findings show that biscuit is the most consumed snack. Biscuits are sticky foods and are example of long-lasting source of refined dietary sugars with the tendency for extended exposure time in the oral cavity because the sugars are gradually released during consumption. Very little precise information is available on the effect of the texture of foods on dental caries, but it is commonly held that sticky foods are likely to be more cariogenic than those which can be removed from the teeth more easily.[14] The form of the fermentable carbohydrate directly influences the duration of exposure and retention of the food on the teeth. Prolonged oral retention of cariogenic components of food may lead to extended periods of acid production and demineralization and to shortened periods of remineralization.[15]

Nigeria has a well-established market for biscuit, ready to eat and available in various convenient packing throughout the federation. Presently, sixteen biscuit manufacturers are operating in the country and the total biscuit consumption is estimated between 450,000 to 500,000m.t.annually. The main raw materials are wheat flour, sugar and vegetable fat, all of which are locally produced and readily available

Also predominantly consumed by the participants are fresh fruits. This is similar to the findings of Chu et al.[16] among the Hong Kong Chinese. Fruits are generally considered a healthy food. Pure fruit juice is often advocated as a healthy drink, but it actually contains a lot of acid and can have a very low pH. Moreover, its high buffering capacities may induce a prolonged drop in oral pH that can contribute to dental erosion. Table I revealed that most common fresh fruits have pHs that are quite lower than the critical ph of enamel dissolution. In addition to biscuits and fresh fruits; chocolate, sweets and ice cream were above the mean score for their snack options. Anaise[17] in 1978 made this finding significant, it was reported that confectionery industry workers had 71% higher dental caries experience than factory workers from other industries.

Soft drinks were mostly consumed in-between meal. In a study by Gustafsson et al.[18] increased frequency of consumption of sugar in-between meals was associated with a marked increase in dental caries. Also on note is that soft drinks have been associated with many potential health problems, including dental caries and enamel erosion.[19] Although, compared with caries, dental erosion seems to have much stronger relationship with soft drinks.[20] According to a study[21] of 1000 secondary school students within ages of 10 to 20 years soft drink consumption by Nigerian adolescents is increasing, therefore dental practitioners in the federation have daunting task in preventing the consequences of this i.e. soft drink-incited dental diseases.

Consumption of fresh oranges in-between meal directly follows that of soft drinks. This is not surprising, in recent times, Citrus fruits are increasingly found in the daily diet of many people because of increased preference for more healthy food. Some of the more common ones are orange, lemon, tangerine and grapefruits. Orange juice that is commonly served contains citric acid and its acidity is said to be comparable to that of soft drinks.[22]

Taste was predominantly indicated to determine the choice of food and drink with price, volume/size, family/friends and availability above average score. The major influence reported on food behaviour is consistently taste. In reality 'taste' is the sum of all sensory stimulation that is produced by the ingestion of a food. This includes not only taste per se but also smell, appearance and texture of food. From an early age, taste and familiarity influence behaviour towards food. A liking for sweetness and a dislike for bitterness are considered innate human traits, present from birth.[23] This makes children vulnerable to the modern diet with increasing concern of health risks associated with high intakes of sweet foods. Soft drinks are widely naturally sweetened with sucrose which attracts children, this may not be unconnected with the prevalent use of soft drinks in-between meal by the participants. Food choice is also influenced by social factors even when eating alone, because attitudes and habits develop through interaction with others. In making and sustaining dietary change family and friends can be a source of encouragement and the family is widely recognized as being significant in food decisions.[24] Also it has been argued that children are more influenced by portion size as they age and it's one of many factors that may encourage the overconsumption of food. The abundance of large portions of inexpensive, energy-dense foods in the eating environment appears to override satiety mechanisms so that individuals consume more than is required for physiologic needs.[25]

The participants demonstrated inaccurate knowledge in their claim that fresh oranges, pineapple, lime are good for the teeth. Fruits particularly lime have been found to be erosive.[26] However, milk was correctly identified as good for the teeth. Cows' milk contains lactose and calcium, phosphorus and casein all of which are thought to inhibit caries. This may be due to the high content of these minerals which can aid in remineralisation of tooth enamel. Also believed to play a role in the protective effect of milk products is the phosphoprotein casein. Rugg-Gunn et al.[27] found an inverse relationship between the consumption of cows' milk and caries increment in a study of English adolescents.

Although it was in the UK, despite messages that dental practitioners should give dietary advice as an important part of their health education to patients, many dentists do not give dietary advice and when given, it is often ad hoc, usually as a single statement with little interaction with the patient.[28] A similar situation may probably be found in Nigeria because low dietary advice on oral was reported by the participants.

The reticence to provide dietary advice was attributed to time, physical space and financial constraints. It may also be due to a lack of clear, consistent information on what advice should actually be given regarding sugary and acidic food and drinks, and their mode and frequency of consumption.[28]

Tooth brushing is generally recommended to be performed after meals to eliminate both bacterial plaque and food impaction, majority of the participants brushed before their meal. Also found is that 0.5% percent of them brushed twice daily which is in contrast to two studies in other populations; one study found that 64% of Polish school children reported that they brushed their teeth twice per day.[29]

In the United Kingdom, the 2003 national Child Dental Health Survey[30] reported a finding that 75% of children from all age groups brushed their teeth twice per day. Suffice to say that oral hygiene practices of participants in this study may sufficiently encourage prolonged exposure of the teeth to caries and erosion incited food and drinks.

Conclusion

Biscuits a generally accepted sugary and stick food is the most consumed snack and soft drinks the preferred drink in-between meal. Taste and price were significantly high among the factors that influence the participants' choice of food and drinks.

Given their inappropriate knowledge about the dental effects of some established erosive and carious diet; inadequate dietary advice; and poor oral hygiene practices majority of them have the tendency of suffering from these dental diseases. Dental practitioners' have daunting task of providing appropriate oral heal education to this group children.

Further studies may require seeking the quantities of daily food and drinks servings and clinical correlates to some observed variables in this study. Given some obvious limitations of this study, generalization can only be done to schooling adolescents.

References

1. P. M. Fernández San Juan. Dietary habits and nutritional status of school aged children in Spain Nutr Hosp. 2006;21(3):374-378
2. Moynihan P., Petersen P.P. Diet, nutrition and the prevention of dental diseases. Public Health Nutrition 7(1A), 201–226
3. Sreebny LM. Sugar availability, sugar consumption and dental caries. Community Dentistry and Oral Epidemiology 1982; 10: 1–7.
4. Olusile A O. Improving low awareness and inadequate access to oral health care in Nigeria: The role of dentists, the government & non-governmental agencies. Niger Med J 2010;51:134-6
5. ten Cate JM, Imfeld T. Dental erosion, summary. Eur J Oral Sci 1996;104:241
6. Linkosalo E, Markkanen H. Dental erosions in relation to lactovegetarian diet. Scandinavian Journal of Dental Research 1985; 93: 436–41.
7. Guggenheimer J, Schneider LG. Tooth erosion associated with excessive use of an artificially sweetened cola beverage. Journal of Preventive Dentistry 1980; 6: 261–2.
8. Jain P, Nihill P, Sobkowski J, Agustin MZ. Commercial soft drinks: pH and in vitro dissolution of enamel. Gen Dent. 2007 2007 55(2):150-4; quiz 5.
9. Lussi A, Jaeggi T. Chemical factors. Monographs Oral Sci. 2006;20:77-87.
10. Lussi A., Hellwig E., Zero D., Jaeggi T. Erosive tooth wear: Diagnosis, risk factors and prevention. Am J Dent 2006;19:319-325
11. Hassapiduo M, Fotiaduo E, Maglara E, Papadopoulou SK. Energy intake, diet consumption, energy expenditure and body fatness of adolescents in Northern Greece. Obesity (Silver Spring) 2006;14(5):855-862.
12. Shepherd R., Dennison C.M., Influences on adolescent food choice. Proc. Nutr. Soc., 1996; 55:345–357.
13. US Department of Health and Human Services. US Public Health Service. Oral health in America: a report of the surgeon general. Rockville, MD: National Institutes of Health, 2000.
14. Grenby T. H., Paterson F.M. Effect of sweet biscuits on the incidence of dental caries in rats Br. J. Nutr (1972); 27:195-199
15. Lingstrom P, van Houte J, Kashket S. Food starches and dental caries. Crit Rev Oral Biol Med 2000;11:366–80.
16. CH Chu, Karie KL Pang, Edward CM Lo. Dietary behavior and knowledge of dental erosion among Chinese adults. BMC Oral Health. 2010; 10: 13.
17. Anaise JZ. Prevalence of dental caries among workers in the sweets industry in Israel. Community Dentistry and Oral Epidemiology 1978; 8: 142–5.
18. Gustafsson BE, Quensel CE, Lanke LS, Lundquiat C, Grahnen H, Bonow BE, et al. The Vipeholm dental caries study. The effect of different levels of carbohydrate intake on caries activity in 436 individuals observed for 5 years. Acta Odontologica Scandinavica 1954; 11: 232–364.
19. Majewski RF. Adolescent caries: a discussion on diet and other factors, including soft drink consumption. J Mich Dent Assoc. 2001;83(2):32–34.
20. Ran Cheng, Hui Yang, Mei-ying Shao, Tao Hu, Xue-dong Zhou. Dental erosion and severe tooth decay related to soft drinks: a case report and literature review. J Zhejiang Univ Sci B. May 2009; 10(5): 395–399.
21. Ansa V.O., Anah M.U., Ndifon W.O. Soft drink consumption and overweight/obesity among Nigerian adolescents. CVD Prevention and Control 2008; 3(4): 191-196
22. Edwards M, Creanor SL, Foye RH, Gilmour WH. Buffering capacities of soft drinks: The potential influence on dental erosion. J Oral Rehab 1999;26:923-927.
23. Steiner JE (1977). Facial expressions of the neonate infant indicating the hedonics of food-related chemical stimuli. In: Weiffenbach J. ed. Taste and development: The Genesis of Sweet Preference. (DHEW Publication No. NIH 77-1068). Washington DC: US Government Printing Office, pp 173.
24. Anderson AS, Cox DN, McKellar S, Reynolds J, Lean MEJ, Mela DJ (1998) Take Five, a nutrition education intervention to increase fruit and vegetable intakes: impact on attitudes towards dietary change. Br J. Nutr 80: 133-140
25. Ello-Martin JA, Ledikwe JH, Rolls BJ. The influence of food portion size and energy density on energy intake: implications for weight management. Am J Clin Nutr July 2005 vol. 82 no. 1 236S-241S

26. Bamise CT, Dinyain VE, Kolawole KA. Dental erosion due to lime consumption; review of literature and case report. East Afr J Public Health. 2009 Aug;6(2):141-3.
27. Rugg-Gunn AJ, Hackett AF, Appleton DR, Jenkins GN, Eastoe JE. Relationship between dietary habits and caries increment assessed over two years in 405 English adolescent schoolchildren. Archives of Oral Biology 1984; 29: 983–92.
28. Barton KL, Anderson AS, Pine CM, Paterson MG, Burnside G. Dietary interventions in general dental practice – an unexplored opportunity for promoting dietary change in low income communities? Proceedings of the Nutrition Society 2001; 60: 5A.
29. Wierzbicka M, Petersen PE, Szatko F et al. Changing oral health status and oral health behaviour profile of schoolchildren in Poland. Comm Dent Health 2002 19: 243-250.
30. Harker R, Morris J. Children's dental health in the United Kingdom 2003. London, Office for National Statistics, 2005