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Association between body mass index and dental caries among public primary school pupils in a southern-Nigerian metropolis

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Abstract

Background: The relationships between BMI and caries have been observed in many previous studies. Some studies have reported that normal and underweight children were at higher risk for dental caries compared to those who were overweight. Conversely, other studies have also reported that overweight/obese children were at higher risk. Yet, others concluded there was no association between BMI and dental caries. However, this information is sparse among children in South-South, Nigeria.

Objectives: To determine the relationships between BMI status and dental caries among public primary school children in Port Harcourt.

Methodology: This was a cross-sectional study among selected primary school pupils in Port Harcourt. Information elicited included socio-demographic characteristics and pattern of refined sugar consumption. BMI was calculated using the following formula: weight in kg/ height in meters squared. Based on BMI scores, the children were classified into four categories; underweight (BMI ≤5th percentile), normal weight (BMI >5th and <85th percentile), overweight (BMI ≥85th and <95th percentile), and obese (BMI ≥95th percentile).

Oral examination was conducted to assess for dental caries, which was recorded using DMFT/dmft index. Data was analyzed using SPSS version 21 and the level of significance was $p < 0.05$

Results: One hundred and eighty-nine pupils participated, comprising 100(52.9%) females and 89(47.1%) males, with a median age of 11 years. Prevalence of caries was 13.8%. The mean DMFT/dmft among the children was 1.6 (±0.9). Mother's and Father's levels of education were the statistically significant factors ($p = 0.01$). BMI was however not statistically significant ($p = 0.06$).

Conclusion: BMI was not statistically significant in its association with dental caries, but more of normal and overweight children were prone to dental caries compared to the underweight children.

Keywords: Body Mass Index; Dental caries; Obesity

1. Introduction

Body mass index (BMI) is an index which measures height for weight of an individual. Dental caries and BMI are known to constitute important public health challenges globally[1,2]. These conditions have been observed to share common

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contributory factors, including biological, genetic, socioeconomic, cultural, dietary, environmental, and lifestyle factors[3]. They have adverse impacts on wellbeing and quality of life and are associated with significant costs to the society[4]. Increase in the prevalence of both dental caries and higher BMI status (overweight and obesity) have been attributed to excessive consumption of carbohydrate-rich, high-calorie food and drinks[2,5].

The relationships between BMI and dental caries have been studied and reported in many previous studies, although evidence of the association have been largely inconsistent[4,6,7]. In 2016, Aluckal et al[5], reported that overweight/obese or underweight/malnourished children had higher decayed and filled surfaces compared to children with normal weight. On the other hand, other reports have also observed that normal and underweight children had an almost 2 times greater risk of developing caries compared with their overweight and obese counterparts[8, 9.]

Meanwhile, Fotedar et al[10] reported an inverse relationship between dental caries and BMI, showing that underweight children tend to have higher DMFT due to poor socio-economic status and lack of knowledge about general and oral health. It was even reported in a study that carious lesions may have been affecting the growth and development of children[11].

Also, a positive association was observed between an increase of dental caries and high weight in elementary school children in a report by Willershausen et al[12] in 2004. In fact, it is thought that a relationship between obesity and dental caries seems logical[3]. However, a study has reported that obese and overweight children presented with lower dental caries experience[13]. They observed that high BMI or obesity was associated with lower odds of caries. It was specifically reported that overweight and obese children were more likely to be caries free in their primary dentition[14]. A report specifically concluded that until more evidence were seen, obesity should not be considered a predictor of dental caries[11]. This is because it is believed there is increase in saliva production due to increased food consumption among obese children. The protective effect of saliva as a mechanical cleanser and pH buffer could thus reduce the incidence of dental caries[3].

Another study has also observed that there was only a weak negative association that exists between caries severity and weight status while some other literatures have out rightly reported that there were no relationships between the two[11,15]. Specifically, Frias-Bulhosa et al[16] in their study concluded that there was no association between dental caries and BMI. Also, Denloye et al[17] found no conclusive relationship between DMFT and BMI among a studied population of 12-15 year old students of private secondary schools in Ibadan.

Although, there have been a few studies on the relationships between BMI and dental caries in Nigeria, there is a paucity of data on this subject in the South-South region, especially in Port Harcourt. This study was therefore, to determine these relationships between BMI and dental caries in our environment.

2. Material and methods

This was a cross-sectional study carried out among some public primary school in Obio/Akpor local government of Rivers state in Nigeria. Children who gave assent to participate in the study, and were cooperative for the clinical examination were the ones included in the study.

Sample size was calculated to be 185 children using the Cochran's formula:

$$n = Z^2 \, p \, q / \, e^2$$

Where:
e is the desired level of precision (i.e. the margin of error),
p is the proportion of the population which has the attribute in question (p = 12.6%)[18]
q is 1 – p.
Z is 1.96

An interviewer-administered pro forma was used to collect the data regarding demographic details:

- Age as at the last birthday and this was further categorized into three groups; 9 – 10 years, 11 – 12 years and 13 – 14 years
- Gender
- Sugar consumption pattern

- Oral hygiene practices
- Parental level of education
- Height and weight: weight of the children were recorded using a calibrated weighing scale. Height was measured using measuring tape. BMI was calculated using the following formula: weight in kg/(height in meters squared)[19]. Weight status was defined by gender-related bmi according to the centers for disease control and prevention (CDC) guidelines:[19] underweight (BMI ≤5th percentile), normal weight (BMI >5th and <85th percentile), overweight (BMI ≥85th and <95th percentile), and obese (BMI ≥95th percentile).

Oral examination was conducted inside the school premises. All the participants were examined in the sitting position under adequate daylight. Sterilized instruments including mouth mirrors, caries and periodontal probes and tongue depressors (wooden spatula) were used for the examination. Dental caries was recorded using decayed, missing, and filled teeth (DMFT) index. The data were entered and analysis was done using the SPSS version 21 (SPSS Inc., IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp., USA) software. The Chi-square test was done to determine the association between BMI, dental caries and other assessed factors. $P \leq 0.05$ was considered statistically significant.

3. Results

A total of 189 pupils were seen in the course of this study. One hundred (52.9%) of these children were females while 89(47.1%) were males. The children were categorized into three age group which were 9 – 10, 11 – 12 and 13 – 14 years constituting 30.7%, 55% and 14.3% respectively. Prevalence of caries among these children was 13.8%. (Table 1)

Among the factors predicting dental caries assessed in this study, mother's educational level (p = 0.01) and father's educational level (p = 0.01) were the only statistically significant factors. The children of those parents with no education had the highest proportion of dental caries among the children. This is 46.2% and 50.0% for mother's and father's levels of education respectively. Concerning BMI (p = 0.06), it was only 2.6% of those that were underweight that developed dental caries. Meanwhile, 16.7% of those with normal weight and 15.4% of the overweight children had dental caries. (Table 2)

Those that had dental caries among 9-10 years was 13.8% while 14.4% of ages 11-12 had the disease. Also, 11.1% of those aged 13-14 developed the lesion. Among those with gingivitis, 16.5% had dental caries while only 12.6% of those without it had dental caries. This is however not statistically significant. (Table 2)

It was only 11.2% of male had dental caries, while as much as 16.0% of female had dental caries, although not statistically significant. Concerning oral hygiene measures, those who clean once daily (13.6%), twice daily (14.4%), twice weekly (20.0%) had dental caries. Those who claim they do not take refined sugar and had dental caries were 15.2%, those who take less than 3 times per day is 12.9% while those with 3 or more times of intake per day 14.8%. Those with previous dental visits that had dental caries was 12.6% while those without previous dental visits with dental caries were 14.7%. (Table 2)

The mean DMFT/dmft among the children is 1.6 ± 0.9. (Table 3)

Among the carious teeth, the lower right first molar is the most (30.7%) affected by caries. This is followed by the lower left first molar (23.1%). The two upper first molars took 10.2% each. Meanwhile, lower left second primary molar took 7.6% of the total carious teeth. The least affected teeth are premolars and the generality of the primary teeth which was 2.6%. (Figure 1)

Table 1 The socio demographic characteristics of the participants

Variables	N	%
Gender		
Male	89	47.1
Female	100	52.9
Total	189	100.0
Age		

9 – 10	60	31.7
11 – 12	104	55.0
13 – 14	25	13.2
Total	189	100.0
Mother's level of education		
None	13	6.9
Primary	89	47.0
Secondary	85	45.0
Tertiary	2	1.1
Total	189	100.0
Father's level of education		
None	10	5.3
Primary	91	48.1
Secondary	82	43.4
Tertiary	6	3.2
Total	189	100.0
Caries		
Yes	26	13.8
No	163	86.2
Total	189	100.0
BMI		
Underweight	38	20.1
Normal weight	138	73.0
Overweight	13	6.9
Total	189	100.0

Table 2 The risk factors for dental caries among the participants

Risk factors of dental caries	Yes %	No %	Total %	x^2	*P value*
Gender					
Male	10(11.2)	79(88.8)	89(100.0)	**0.90**	**0.40**
Female	16(16.0)	84(84.0)	100(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Age					
9 – 10	8(13.8)	50(84:2)	58(100.0)	0.20	1.00†
11 – 12	15(14.4)	89(64.5)	104 (100.0)		
13 – 14	3(11.1)	24(88.9)	27 (100.0)		
Total	26(13.8)	163(86.2)	189 (100.0)		

BMI					
Underweight	1(2.6)	37(97.4)	38(100.0)	4.98	0.06†
Normal weight	23(16.7)	115(83.3)	138(100.0)		
Overweight	2(15.4)	11(84.6)	13(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Gingivitis					
Yes	9(16.5)	45(83.3)	54(100.0)	0.49	0.54
No	17(12.6)	118(87.4)	135(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
What respondents use to clean teeth					
Toothbrush and paste	26(14.0)	160(86.0)	186(100.0)	0.49	0.64†
Toothbrush and chewing stick	0(0.0)	2(100.0)	2(100)		
Toothpaste and finger	0(0.0)	1(100.0)	1(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Frequency of tooth cleaning					
Once daily	6(13.6)	38(86.4)	44(100.0)	1.48	0.69†
Twice daily	19(14.4)	113(85.6)	132(100.0)		
Once in two days	0(0.0)	8(100.0)	8(100.0)		
Twice weekly	1(20.0)	4(80.0)	5(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Frequency of sugar intake					
None	7(15.2)	39(84.8)	46(100.0)	0.18	0.92†
Less than 3 times	15(12.9)	101(87.1)	116(100.0)		
3 or more times	4(14.8)	23(85.2)	27(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Previous dental visits					
Yes	11(12.6)	76(87.4)	87(100.0)	0.17	0.83
No	15(14.7)	87(85.3)	102(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Mother's level of education					
None	6(46.2)	7(53.8)	13(100.0)	12.86	0.01†
Primary	9(10.1)	80(89.9)	89(100.0)		
Secondary	11(12.9)	74(87.1)	85(100.0)		
Tertiary	0(0.0)	2(100.0)	2(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		
Father's level of education					
None	5(50.0)	5(50.0)	10(100.0)		
Primary	10(11.0)	81(89.0)	91(100.0)		

Secondary	11(13.4)	71(86.6)	82(100.0)	12.62	0.01†
Tertiary	0(0.0)	6(100.0)	6(100.0)		
Total	26(13.8)	163(86.2)	189(100.0)		

†Fisher's exact

Table 3 The distribution and mean of the decayed missing and filled teeth (DMFT/dmft) among the participants

Variable	Number of children	Number of teeth	Mean ± SD
BMI			
Underweight	1	1	1.0
Normal weight	23	35	1.5 ± 0.9
Overweight	2	5	2.5 ± 0.7
Total	26	41	1.6 ± 0.9
Age group			
9 – 10	9	11	1.2 ± 0.4
11 – 12	15	25	1.7 ± 0.9
13 – 14	2	5	2.5 ± 2.1
Total	26	41	1.6 ± 0.9
Gender			
Male	10	20	2.0 ± 1.2
Female	16	21	1.3 ± 0.6
Total	26	41	1.6 ± 0.9
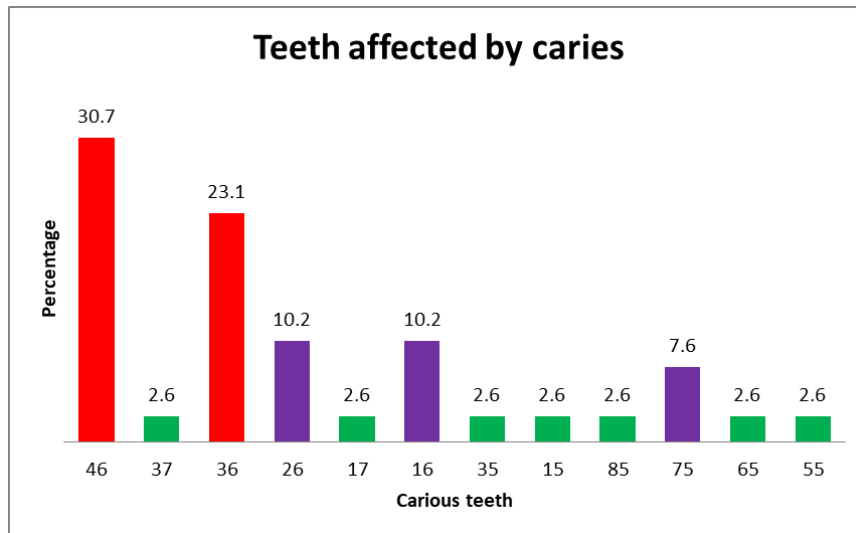
Key: 15 – Upper right second premolar; 16 – Upper right first permanent molar; 17 – Upper right second permanent molar; 26 – Upper left first permanent molar; 35 – Lower left second premolar; 36 – Lower left first permanent molar; 37 – Lower left second permanent molar; 46 – Lower right first permanent molar; 55 - Upper right second primary molar; 65 - Upper left second primary molar; 75 – Lower left second primary molar; 85 - Lower right second primary molar

Figure 1 Teeth affected by dental caries

4. Discussion

Prevalence of caries in this present study is similar to what was previously obtained in this environment[18]. It is however lower compared to what obtains in some of the more advanced countries[20]. The reasons for the disparities observed may be related to the affordable and abundant availability of cariogenic snacks in developed countries.

More of normal weight and overweight children had higher number of carious lesions compared to those who were underweight in this present study. This was in consonance with findings of Goodarzi et al[21] who found that there was a positive association between dental caries and body mass index-for-age among 10-12-year-old female students in Tehran. This may be a result of excessive consumption of sweet and other cheap refine sugar alongside with poor oral hygiene practices as observed in the study. However, Swaminathan et al[22] reported that overweight children had lower caries risk in primary dentition.

Majority of those that were affected by caries in this present study were children whose parents had none or little formal education. Prevalence of dental caries is said to be high among children whose mothers are of low education[23,24]. This may be due, in part, to their inability to recognize those factors that contribute to dental caries and the measures in preventing it[10].

Those ages 13 – 14 years had lower caries prevalence compared to those of lower age groups like 9 – 10 and 11 – 12 in the study. This may be because those of the lower age groups were on mixed dentition stage where the mobile primary teeth were not adequately cleaned because of pain and the fear of traumatic exfoliation. Also, brushing techniques used by those age 9 -10 years may not be as effective as those of 13 -14 years. This is in agreement with the study of Demirci et al[25] and Al-Sultani[26] who found that the incidence of dental caries decreases with age. However, this finding differ from that of Sogi et al[27] and Mario Sergio Fonseca et al[28] where dental caries experience on permanent teeth were found to be worsened with increase in age. Meanwhile, Sgan-Cohen et al[29] reported no difference among different age groups as regards dental caries prevalence.

More of those with gingivitis in this present study had dental caries compared to those who did not. This is an indication that there appears to be a direct relationship between dental caries and gingivitis. This is also alluded to by Jessri et al[30] in their study of the oral health behaviours in relation to caries and gingivitis in primary school children in Tehran.

Also, more females were affected by dental caries in this study than males. This is in agreement with the findings of Ur-Rehman et al[31] who reported a higher mean DMFT for girls (3.82±3.42) compared to boys (2.79±2.50). It may be an indication that the female children tend to consume more refined sugar compared to males[32]. However, Dawani et al[33] found a higher male prevalence with the mean dmft for males was 2.30 (±3.08) and that of the females was 1.90 (±2.90). Meanwhile, some studies reported that there is no difference in the prevalence of dental caries between male and female[34-35].

Less of those that had previous visits to the dentist had dental caries compared to those who never visited the dentist. It is thought that visits to the dentist allows for early detection of dental caries which will prompt the institution of counselling and preventive measures. This is in consonance with the findings of Adekoya-Sofowora et al[36] in among 12-year-old suburban Nigerian school children.

According to the present study, the teeth mostly affected by dental caries were the lower permanent molars. This has been attributed to the presence of buccal grooves, oclussal pits and fissures which harbor cariogenic bacteria as reported by previous studies[37,38]. However, a contrary finding was observed by Demirci et al[25] where the prevalence of dental caries was found to be more on maxillary than mandibular molars.

5. Conclusion

It may be concluded in this study that more of normal and overweight children were prone to dental caries compared to the underweight children. Parental level of education has significant influence on the presence or absence of dental caries in a child.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

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

References

[1]   Ashour NA, Ashour AA, Basha S. Association between body mass index and dental caries among special care female children in Makkah City. Ann Saudi Med. 2018, 38(1):508-515.

[2]   Swaminathan K, Anandan V, H S, Thomas E. Correlation Between Body Mass Index and Dental Caries Among Three- to 12-Year-Old Schoolchildren in India: A Cross-Sectional Study. Cureus. 2019, 11(8):1–8.

[3]   Alshihri AA, Rogers HJ, Alqahtani MA, Aldossary MS, El Tantawi M. Association between Dental Caries and Obesity in Children and Young People: A Narrative Review. Int J Dent. 2019, 2019:1–9.

[4]   Paisi M, Kay E, Bennett C, Kaimi I, Witton R, Nelder R, et al. Body mass index and dental caries in young people : a systematic review. BMC Pediatr. 2019, 19(122):1–9.

[5]   Aluckal E, Anzil K, Baby M, George EK, Lakshmanan S, Chikkanna S. Association Between Body Mass Index and Dental Caries Among Anganwadi Children of Belgaum City, India. J Contemp Dent Pr. 2016, 17(10):844-848.

[6]   Cheng Y, Liao Y, Chen D, Wang Y, Wu Y. Prevalence of dental caries and its association with body mass index among school-age children in Shenzhen , China. BMC Oral Health. 2019, 19(270):1–9.

[7]   Basha S, Mohammad RN, Hiremath Shivalinga Swamy. Incidence of dental trauma among obese adolescents – a 3-year-prospective study. Dent Traumatol. 2014, 31(2):125–9.

[8]   Cabello R, Reyes M, Faleiros S, Ruiz B. Association Between Body Mass Index and Caries Lesions in Preschool Children in Santiago, Chile. Int J Odontostomat. 2017, 11(3):369–75.

[9]   Bhayat A, Ahmad MS, Fadel HT. Association between body mass index , diet and dental caries in Grade 6 boys in Medina , Saudi Arabia. East Mediterr Heal J. 2016, 22(9):687–93.

[10]   Fotedar S, Sogi G, Sharma K. Association Between Dental Caries and Body Mass Index Among 12 and 15 years School Children in Shimla , Himachal Pradesh. J Adv Oral Res. 2013, 4(1):6–10.

[11]   Yang F, Zhang Y, Yuan X, Yu J, Chen S, Chen Z, et al. Caries experience and its association with weight status among 8-year-old children in Qingdao, China. J Int Soc Prev Community Dent. 2015, 5(1):52-58.

[12]   Willershausen B, Haas G, Krummenauer F, Hohenfellner K. Relationship Between High Weight and Caries Frequency in German Elementary School Children. Eur J Med Res. 2004, 9(8):400-404.

[13]   Fernandez MR, Goettems ML, Demarco FF, Correa MB. Is obesity associated to dental caries in Brazilian schoolchildren ? Braz Oral Res. 2017, 31(e83):1–9.

[14]   Liang J, Zhang Z, Chen Y, Mai J, Ma J, Yang W, et al. Dental caries is negatively correlated with body mass index among 7-9 years old children in Guangzhou , China. BMC Public Health [Internet]. 2016, 16(638):4–10. Available from: http://dx.doi.org/10.1186/s12889-016-3295-3

[15]   Idrees M, Hammad M, Faden A, Kujan O. Influence of body mass index on severity of dental caries: cross-sectional study in healthy adults. Ann Saudi Med. 2017, 444-448.

[16]   Frias-Bulhosa J, Barbosa P, Gomes E, Vieira MR, Manso MC. Association between body mass index and caries among 13-year-old population in Castelo de Paiva, Portugal. Next Doc Rev Port Estomatol Med Dent Cir Maxilofac. 2015, 56:3–8.

[17]   Denloye O, Popoola B, Ifesanya J. Association between dental caries and body mass index in 12-15 year old private school children in Ibadan, Nigeria. Pediatr Dent J. 2016, 26:28–33.

[18]   Eigbobo JO, Alade G. Dental caries experience in primary school pupils in Port Harcourt, Nigeria. Sahel Med J. 2017, 20:179-186.

[19] Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, et al. 2000 CDC growth charts for the United States: Methods and development. Vital Heal Stat. 2002, 11:1-190.

[20] Dye BA, Li X, Thorton-Evans G. Oral health disparities as determined by selected healthy people 2020 oral health objectives for the United States, 2009-2010. NCHS Data Brief [Internet]. 2012, (104):1–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23101968

[21] Goodarzi A, Heidarnia A, Tavafian SS, Eslami M. Association between Dental Caries and Body Mass Index-for-Age among 10-12-Year-Old Female Students in Tehran. Int J Prev Med. 2019, 10(28):10.

[22] Swaminathan K, Anandan V, Haridoss S, Thomas E. Correlation Between Body Mass Index and Dental Caries Among Three- to 12-Year-Old Schoolchildren in India : A Cross-Sectional Study. Cureus. 2019, 11(8):1–8.

[23] Hakan Ç, Çoruh TD, Mehmet D, Mehmet MH. Early childhood caries update: A review of causes, diagnoses, and treatments. J Nat Sci Biol Med. 2013, 4:29–38.

[24] Crocombe LA, Allen P, Bettiol S, Babo Soares LF. Parental Education Level and Dental Caries in School Children Living in Dili, Timor-Leste. Asia-Pacific J Public Heal. 2018, 30(2):128-136.

[25] Demirci M, Tuncer S, Yuceokur AA. Prevalence of Caries on Individual Tooth Surfaces and its Distribution by Age and Gender in University Clinic Patients. Eur J Dent. 2010, 4(3):270–9.

[26] Al-Sultani HFF, Al-Azawi AM, Al-Shammari HAH. Demands and Dental Treatment Needs among Children Attending the Clinic of Pedodontics , College of dentistry. J Kufa Nurs Sci. 2013, 3(3):9.

[27] Sogi G, Bhaskar D. Dental caries and oral hygiene status of 13-14 year old school children of Davangere. J Indian Soc Pedod Prev Dent. 2001, 2001:113–7.

[28] Fonseca MS, Costa FO, Penido SRC, Cruz RA. Dental caries and gingivitis prevalence: risk factor analysis in institutionalized children. Arq bras odontol. 2010, 6(1):10–8.

[29] Sgan-Cohen H, Margvelashvili V, Bilder L, Kalandadze M, Gordon M, Margvelashvili M, et al. Dental caries among children in Georgia by age, gender, residence location and ethnic group. Community Dent Heal. 2014, 31(3):163–7.

[30] Jessri M, Jessri M, Rashidkhani B, Kimiagar SM. Oral health behaviours in relation to caries and gingivitis in primary-school children in Tehran, 2008. East Mediterr Heal J. 2013, 19(6):527–34.

[31] Ur-Rehman M, Mahmood N, Ur-Rehman B. The Relationship of Caries With Oral Hygiene Status and Extra – Oral Risk Factors. J Ayub Med Coll Abbottabad. 2008, 20(1):103–8.

[32] Giacaman RA, Fernández CE, Díaz S. N. Fermentable carbohydrate dietary consumption measured by a cariogenicity scoring system and caries experience in youth and adults. Rev Chil Nutr. 2012, 39(4):116-122.

[33] Dawani N, Nisar N, Khan N, Syed S, Tanweer N. Prevalence and factors related to dental caries among pre-school children of Saddar town, Karachi, Pakistan a cross-sectional study. BMC Oral Health. 2012, 12:59.

[34] Saravanan SM, Lokesh S, Polepalle T, Shewale A. Prevalence, Severity and Associated Factors of Dental Caries in 3-6 Year Old Children – A Cross Sectional Study. Sci Educ Publ Sci Res to Knowledge) [Internet]. 2014, 2(6A):5–11. Available from: http://pubs.sciepub.com/ijdsr/2/6A/2/

[35] López IY, Bustos BC, Ramos AA, Espinoza RM, Jara MN, Smith LP. Prevalence of dental caries in preschool children. Rev odonto ciênc. 2009, 24(2):116–9.

[36] Adekoya - Sofowora CA, Nasir WO, Oginni AO, Taiwo M. Dental caries in 12-year-old suburban Nigerian school children. Afr Heal Sci. 2006, 6(3):145-150.

[37] Popoola BO, Denloye OO. Pattern and surface prevalence of dental caries on posterior teeth of children in a Nigerian teaching hospital. Niger Dent J. 2009, 17(2).

[38] Chirca EMC, Luca R, Georgescu D. The prevalence of caries in first permanent molar in a group of school children aged 6 to 7 years in piteşti. Proc Rom Acad. 2015, Seris B(Supplement 1):41–4.