

Association Between Body Mass Index and Dental Caries Among 6 to 12-Year-Old Schoolchildren in Mysore City: A Cross-Sectional Study

Maurya M^{*1}, Bennadi D², Konakeri V³, Sushma R⁴

^{1*}Senior Lect, Dept. of Public Health Dentistry, JSS Dental College and Hospital, JSS Academy of Higher Education & Research, Mysore, India

²Reader, Dept. Of Public Health Dentistry, Sree Siddhartha Dental College and Hospital, Sri Siddhartha Academy Higher Education, Agalkote, Tumkur – 572107, India

³Reader, Dept. of Public Health Dentistry, Al-Azhar Dental College, Perumpillichira, P.O, Thodupuzha, Idukki, Kerala, India.

⁴Senior Lect, Dept. of Public Health Dentistry, JSS Dental College and Hospital, JSS Academy of Higher Education & Research, Mysore, India.

*Corresponding Author: E-mail: dr.mauryam@jssuni.edu.in

ABSTRACT

OBJECTIVE: To assess association between obesity and dental caries prevalence among school children aged 6 to 12 years in Mysore city.

MATERIAL AND METHODS: With simple random technique four primary schools were selected from the list obtained by the Education Department, Mysore. A sample of 250 (125 Obese, 125 Normal weight) children were examined. Dental caries experience was recorded using WHO criteria. A questionnaire was used to collect information regarding age, socioeconomic status, oral hygiene practices, physical activity and dietary habits.

RESULTS: The study group consisted of 65 obese males and 60 obese females and 63 normal weight males and 62 normal weight females. Mean dft (decayed, filled deciduous teeth) for obese and normal weight children was 1.94 and 1.10 respectively. Mean DMFT (Decayed Missing Filled Permanent teeth) for obese and normal weight children was 0.59 and 0.30 respectively. Frequency of consumption of sweets, fruit juices, soft drinks, fried food was more among obese children when compared with normal weight children. These differences were statistically significant between the two groups.

CONCLUSION: Obesity appears to have an association with dental caries prevalence..

Keywords: Childhood obesity; BMI; Dental caries; DMFT / dft

INTRODUCTION

Food occupies the first position in the hierarchical need of a man and is recognized as important for human being in health and disease. Food is any substance consumed to provide nutritional support for an organism..^[1] Food that we eat affects our body through its Systemic and Local action. Systemic action depends on their content of nutrients on general health, growth and development, cell renewal ability of tissues to repair and resistance to disease. Local effect consists of what food can do to the tissues and their environment. In dentistry most local effects results from the interaction between the food residues and oral bacteria that leads to the plaque formation. The metabolites from the plaque bacteria have effects on the soft and hard oral tissues..^[2]

Obesity epidemic has become one of the public health problem which has impact on physical and psychological health. Obesity is one of the multifactorial non communicable disease where environment, cultural and lifestyle preferences play a important role in making the obesity as one of the most prevalent health issue in current scenario. [childhood obesity] The highest prevalence rates of childhood obesity have been observed in developed countries; however, its prevalence is increasing in developing countries as well..^[3] Females are more likely to be obese as compared to males, owing to inherent hormonal differences..^[4]

Some systematic reviews^[5-7] on the association between obesity and dental caries and showed the inconclusive literature and the need for further analysis of this association and its confounding variables.

A more recent systematic review in 2015 included only longitudinal studies and concluded that the evidence of the association between obesity and dental caries was conflicting and remains inconclusive. These inconsistent results are influenced by discrepancies in assessments, setting, and measurements.^[8]

Hence an attempt has been made to know whether there is an association between obesity and dental caries prevalence among school children aged 6 to 12 years of Mysore city.

METHODOLOGY:

Comparative study was carried out to assess childhood obesity and dental caries in children aged 6 to 12 years in Mysore city. A list of schools was obtained by the Education Department, Mysore. The study was conducted with prior permission from the concerned authorities. Ethical clearance for the study was obtained from the Institutional Ethics Committee, JSS Dental College and Hospital, Mysore. 6 – 12 years age group school children from 4 schools were selected by simple random method. A questionnaire was used to collect information regarding age, socioeconomic status, oral hygiene practices, physical activity and dietary habits. A single examiner examined all the children. A total number of 1219 available subjects Height and Weight measurements were taken and BMI (kg/m^2) (Quetelet's index) status was determined for each subject (gender and age) using the system developed by the International Obesity Task Force in 2000. (Childhood obesity is defined as a BMI for age and sex greater than the 95th percentile) (BMI 16-18:Median range for normal weight children, BMI 18-20:Median range for over- weight children and BMI ≥ 20 are considered Obese).^[9,10]

A sample of 250 (125 Obese, 125 Normal weight children who were the Control group) was selected by matching age, sex with the study group) of 6 – 12 years age group was examined. The child's Medical Record, age and socioeconomic status of the children was obtained from the school authority and checked for any systemic disorders. Children with multiple congenitally missing teeth or a history of chronic infectious disease, nutritional disturbances, or endocrine disorders/ Subjects with recognized syndromes/ Children with Rampant caries were excluded from the study.

Examination Procedure:

Obese and normal weight children from class 1-7^{std} from four schools were examined using a mouth mirror and a CPI probe under day light on a wooden chair provided by the schools with prior permission obtained by the Education authority and the schools. Data regarding dental caries experience was collected using WHO criteria of all the primary and permanent teeth both in maxilla and the mandible. Information regarding age and socioeconomic status of the children was obtained from their concerned teachers and school authority. Socioeconomic status has been classified according to B.G.L Prasad's classification.^[11]

The questionnaire regarding the dietary habits was filled by the examiner himself by interviewing the children. Information regarding diet included qualitative information. The frequency of consumption of different food items provided the data.

RESULTS

Study included 250 children (125-obese & 125 normal children) who were matched for their age and gender where 52% were male in each group (n=65). 66%(n=83) of obese children belonged to upper middle class where as 63% (n=79) of normal children belonged to lower middle class. Every child used to brush at least once a day using tooth brush and paste. Snacking habit in between meals was more common among obese children (23%) compared to normal children (2.4%). In both a groups few children visited dentist for filling commonly. Statistical significant difference was observed among obese and normal children in relation to frequency of confectioneries, milk, fruit juice,soft drinks, fruits/vegetables and fried items ($p<0.05$) (Table 1)

TABLE 1: Dietary Habits And Frequency Among Study Population

FOOD ITEMS	GROUP	FREQUENCY										P
		ONCE DAILY		TWICE DAILY		THRICE DAILY		OCCAS- IONAL		TOTAL		
		No.	%	No.	%	No.	%	No.	%	No.	%	
SWEETS	OBESE	2	1.6	2	1.6	0	0.0	121	96.8	125	100	0.131
	NORMAL	0	0.0	0	0.0	0	0.0	125	100	125	100	
CONFECTIONARIES	OBESE	30	24	13	10.4	0	0.0	82	65.6	125	100	0.001 (S)
	NORMAL	16	12.8	3	2.4	3	2.4	103	82.4	125	100	
MILK	OBESE	33	26.8	77	62.6	13	10.6	0	0.0	123	100	0.04 (S)
	NORMAL	21	17.2	76	62.3	25	20.5	0	0.0	122	100	
COFFEE	OBESE	4	28.6	0	0.0	0	0.0	10	71.4	14	100	0.52
	NORMAL	13	38.2	0	0.0	0	0.0	21	61.8	34	100	
TEA	OBESE	0	0.0	0	0.0	0	0.0	12	100	12	100	0.11
	NORMAL	5	17.9	0	0.0	0	0.0	23	82.1	28	100	
FRUIT JUICE	OBESE	16	19.5	7	8.5	0	0.0	59	72	82	100	0.002 (S)
	NORMAL	4	6.2	0	0.0	0	0.0	61	93.8	65	100	
SOFT DRINKS	OBESE	21	40.4	3	5.8	0	0.0	28	53.8	52	100	0.00 (S)
	NORMAL	0	0.0	0	0.0	0	0.0	28	100	28	100	
ICE-CREAM	OBESE	1	1.4	0	0.0	0	0.0	69	98.6	70	100	0.411
	NORMAL	0	0.0	0	0.0	0	0.0	47	100	47	100	
FRUITS	OBESE	28	27.5	5	4.9	0	0.0	69	67.6	102	100	0.00 (S)
	NORMAL	19	15.2	29	23.2	0	0.0	77	61.6	125	100	
VEGETABLES	OBESE	22	21.8	7	6.9	0	0.0	72	71.3	101	100	0.004 (S)
	NORMAL	22	17.6	29	23.2	0	0.0	74	59.2	125	100	
EGG	OBESE	5	10	0	0.0	0	0.0	45	90	50	100	0.801
	NORMAL	5	11.6	0	0.0	0	0.0	38	88.4	43	100	
FISH	OBESE	0	0.0	2	14.3	0	0.0	12	85.7	14	100	0.118
	NORMAL	0	0.0	0	0.0	0	0.0	16	100	16	100	
POULTRY	OBESE	0	0.0	0	0.0	0	0.0	52	100	52	100	-
	NORMAL	0	0.0	0	0.0	0	0.0	52	100	52	100	
MEAT	OBESE	0	0.0	0	0.0	0	0.0	13	100	13	100	-
	NORMAL	0	0.0	0	0.0	0	0.0	13	100	13	100	
FRIED CHICKEN	OBESE	0	0.0	0	0.0	0	0.0	26	100	26	100	0.133
	NORMAL	0	0.0	0	0.0	0	0.0	20	100	20	100	
FRIED POTATOES / FINGER CHIPS	OBESE	0	0.0	0	0.0	0	0.0	46	100	46	100	0.001 (S)
	NORMAL	0	0.0	0	0.0	0	0.0	31	100	31	100	
CHIPS / CRACKERS	OBESE	0	0.0	0	0.0	0	0.0	58	100	58	100	0.79
	NORMAL	3	5.2	0	0.0	0	0.0	55	94.8	58	100	

Caries prevalence was more among obese children (60%) compared to normal children (table 2).

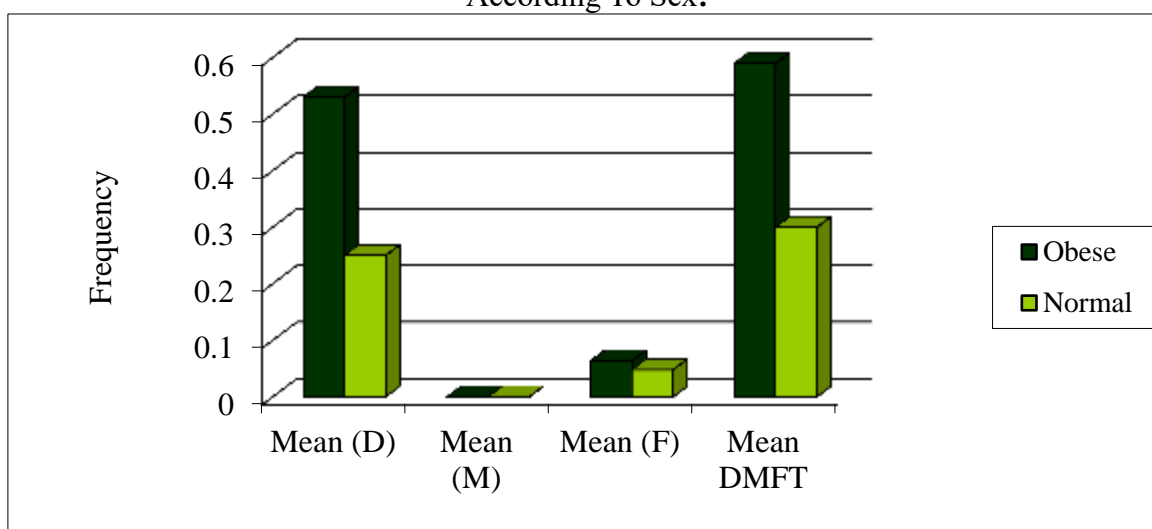
TABLE 2: Distribution Of Study Population According To Caries Prevalence

	GROUP				TOTAL	
	OBESE		NORMAL		No.	%
	No.	%	No.	%		
Caries affected	84	59.6	57	40.4	141	100
Caries free	41	37.6	68	62.4	109	100
Total	125	50	125	50	250	100
CC=0.213, P=0.001						

The mean caries experience (decayed, missing, and filled teeth [DMFT]) was higher in permanent dentition of overweight children 0.59 compared to normal children 0.30. and similar in deciduous dentition as well (obese mean dft 1.94 \pm 1.78 & 1.10 \pm 1.12 among normal children). Chisquare test revealed a statistical significant difference among obese and normal children

There was statistical significant difference was observed between mean DMFT in relation to gender among obese and normal children where males are commonly affected (obese & normal male mean dmft 1.82 \pm 1.28 0.87 \pm 0.92- Graph 1)

Graph 1: Mean Decayed, Missing And Filled Permanent Teeth Among The Study Population According To Sex:



DISCUSSION

Diet play a vital role in the causation of dental caries as well as obesity. Indian food has its own benefits but entry of modern civilization food has made a tremendous changes in our younger generation diet. Now a days the younger generation population are getting addicted to fried and refined carbohydrate rich diet. Exposure to this type of food might be one of the cause for dental caries and obesity. Some studies^[12,13] emphasize that frequent and excessive intake of fermentable sugars is the critical common predisposing factor for obesity and dental caries.

There was a preference for inclusion younger population is mainly due to easily available sample and it is established that as individuals grow, their dietary habits will constantly change due to

peer influence and show an increased tendency toward consumption of refined diet rich in carbohydrate leading to an increased body weight and dental caries.^[14,15]

The prevalence of dental caries among obese children was 60% which was higher compared to 8-13 yr obese children of Bhopal City^[14] lower in comparison with National oral health survey Oral Health Survey 2002–2003^[16] conducted in India where prevalence in 12-year-old urban children was 79.72%. It might be due to awareness and good oral health maintenance practices among children.

In the present study, we observed a significant association between overweight and dental caries which is consistent with the previous studies.^[14, 17-19] Mean DMFT was higher among obese children and similar trend was seen in other studies Marshall et al.^[19], Larsson et al.^[20] and Reddy et al.^[14] It might be due to caries related dietary practices during early childhood time may be continued during adulthood too which affected permanent teeth too. Even deciduous dentition showed high dft among obese children compared to normal. Similar findings were seen among Mexican preschool children.^[21] Some studies^[22-24] showed that prevalence of dental caries was more among underweighted children.

In our study, there was difference in caries experience between normal weight and overweight children. Contrary findings seen with studies done by Tuomi^[25], Chen et al.^[26], Moreira et al.^[27], and Assi et al.^[28], Cureus 2019^[24] This might be due to cultural, dietary difference among different areas.

Limitations & recommendations: In the present study the dietary habit was assessed only qualitative data and it depended only on the information given by the subjects, which may not be reliable. The sample size in each age group was small. It is advised to include larger population in different age groups. Since obesity and dental caries are, in principle, caused by the poor dietary habits, further studies should evaluate the relationship between these two most prevalent health and oral problems. Further studies have to be conducted among heterogeneous population including urban and rural areas as this study included sample of urban area. Many adult health problems have their early origins in childhood, because this is the time when lifestyles are formed (e.g. eating patterns, physical activity / exercise).

Prospective studies have to be conducted in this regard to assess the associated variables too. As with this study showed that obese children were more affected with dental caries than normal children. Diet is common factor for obesity and dental caries. Our oral health messages should be in a such a way that it should address the diet as a risk factors for oral health problems. An overall rational approach to dietary counseling is advised, as dietary patterns together with physical activity, determine both oral and overall health and well being of obese children. Parents and teachers should engage in and promote more healthful dietary intakes and active lifestyles (e.g., increased physical activity and more healthful dietary behaviors).

References

- [1] Maslow's hierarchy of needs. https://en.wikipedia.org/wiki/Maslow%27s_hierarchy_of_needs. Accessed on 19/11/2020
- [2] PD Marsh. Dental plaque as a biofilm and a microbial community –implications for health and disease. BMC Oral Health 2006, 6(Suppl 1):S14
- [3] Popkin BM, Doak CM. The obesity epidemic is a worldwide phenomenon. Nutr Rev. 1998;56:106–14
- [4] Gupta RK. Nutrition and the Diseases of Lifestyle. In: Bhalwar RJ, editor. Text Book of Public health and Community Medicine. 1st ed. Pune: Department of community

- medicine AFMC, New Delhi: Pune in Collaboration with WHO India Office; 2009. p. 1199.
- [5] C. Hayden, J. O. Bowler, S. Chambers et al., “Obesity and dental caries in children: a systematic review and metaanalysis,” *Community Dentistry and Oral Epidemiology* 2013;41(4):289-308
 - [6] M. Hooley, H. Skouteris, C. Boganin, J. Satur, and N. Kilpatrick, “Body mass index and dental caries in children and adolescents: a systematic review of literature published 2004 to 2011. *Systematic Reviews* 2012; 1(1): 57
 - [7] A. E. R. Silva, A. M. B. Menezes, F. F. Demarco, F. VargasFerreira, and M. A. Peres, “Obesity and dental caries: systematic review,” *Revista de Saude Publica* 2013; 47(4):799-812
 - [8] L.-W. Li, H. M. Wong, S.-M. Peng, and C. P. McGrath, “Anthropometric measurements and dental caries in children: a systematic review of longitudinal studies,” *Advances in Nutrition* 2015; 6(1):52–63.
 - [9] Cole TJ, Bellizzi MC, Flegal M, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. *BMJ*. 2000;320:1240–3.
 - [10] Wang Y, Wang JQ. A comparison of international references for the assessment of child and adolescent overweight and obesity in different population. *Eur J Clin Nutr*. 2000;56:973–82.
 - [11] Sharma R. Revision of Prasad's social classification and provision of an online tool for real-time updating. *South Asian J Cancer*. 2013 Jul;2(3):157.
 - [12] M. A. A. E. Qomsan, M. N. Alasqah, F. A. Alqahtani, M. A. Alobaydaa, M. M. Alharbi, and Z. Kola, “Intricate evaluation of association between dental caries and obesity among the children in Al-Kharj city (Saudi Arabia),” *Journal of Contemporary Dental Practice* 2017; 18(1): 29–33.
 - [13] G. Qadri, M. Alkilzy, Y.-S. Feng, and C. Splieth, “Overweight and dental caries: the association among German children,” *International Journal of Paediatric Dentistry* 2015; 25 (3): 174–182
 - [14] Reddy KV, Thakur AS, Moon N, Reddy KE, Chandrakala S, Saxena S. Association between overweight and dental caries among 8-13 year old school children in central India. *J Indian Assoc Public Health Dent* 2018;16:22-5.
 - [15] Mei Z, Grummer Strawn LM, Pietrobelli A, Goulding A, Goran MI, Dietz WH, et al. Validity of body mass index compared with other body composition screening indexes for the assessment of body fatness in children and adolescents. *Am J Clin Nutr* 2002;75:978 85.
 - [16] Dr. RK Bali, Dr. VB Mathur, Prof PP Talwar, HB Channa. National oral health survey and fluoride mapping 2002-03.
 - [17] Thippeswamy HM, Kumar N, Acharya S, Pentapati KC. Relationship between body mass index and dental caries among adolescent children in South India. *West Indian Med J* 2011;60:581 6.
 - [18] Willerhausen B, Blettner M, Kasaj A, Hohenfellner K. Association between body mass index and dental health in 1,290 children of elementary schools in a German city. *Clin Oral Investig* 2007;11:195 200.
 - [19] Marshall TA, Eichenberger Gilmore JM, Broffitt BA, Warren JJ, Levy SM. Dental caries and childhood obesity: Roles of diet and socioeconomic status. *Community Dent Oral Epidemiol* 2007;35:449 58
 - [20] Larsson B, Johansson I, Hallmans G, Ericson T. Relationship between dental caries and

- risk factors for atherosclerosis in Swedish adolescents? *Community Dent Oral Epidemiol* 1995;23:205-10.
- [21] Vázquez-Nava F, Vázquez-Rodríguez EM, Saldívar-González AH, Lin-Ochoa D, Martínez-Perales GM, Joffre-Velázquez VM, et al. Association between obesity and dental caries in a group of preschool children in Mexico. *J Public Health Dent* 2010;70:124-30.
 - [22] J. Liang, Z. Zhang, Y. Chen et al., “Dental caries is negatively correlated with body mass index among 7-9 years old children in Guangzhou, China,” *BMC Public Health*, 2016; 16(1): 638.
 - [23] Alvarez JO, Lewis CA, Saman C, et al.: Chronic malnutrition, dental caries, and tooth exfoliation in Peruvian children aged 3-9 years. *Am J Clin Nutr*. 1988, 48:368-372.
 - [24] Swaminathan K, Anandan V, H S, et al. (August 18, 2019) 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): e5421.
 - [25] Tuomi T: Pilot study on obesity in caries prediction. *Community Dent Oral Epidemiol*. 1989, 17:289-291.
 - [26] Chen W, Chen P, Chen SC, Shih WT, Hu HC: Lack of association between obesity and dental caries in three-year-old children. *Zhonghua Min Guo Xiao Er Ke Yi Xue Hui Za Zhi*. 1998; 39:109-111.
 - [27] Assi SP, Pires JR, Pontes AEF, Barroso EM, Zuza EP: Oral conditions and body weight in children from a public school in Manaus, AM, Brazil. *Rev Odontol UNESP*. 2016, 45:362-367.
 - [28] Moreira PV, Rosenblatt A, Severo AM: Prevalence of dental caries in obese and normal-weight Brazilian adolescents attending state and private schools. *Community Dent Health*. 2006, 23:251-253.