10.5005/jp-journals-10024-1941

ORIGINAL RESEARCH

Association between Body Mass Index and Dental Caries among Anganwadi Children of Belgaum City, India

[1]Eby Aluckal, [2]KSA Anzil, [3]Mathews Baby, [4]Eldhose K George, [5]Sanju Lakshmanan, [6]Shilpa Chikkanna

ABSTRACT

Introduction: Body mass index (BMI) is an index that measures height for weight, which is commonly used to categorize underweight, overweight, and obese individuals. Deviation from normal weight results from an imbalance between caloric consumption and energy expenditure. Childhood obesity and childhood dental caries are coincidental in many populations, probably due to common confounding risk factors, such as intake frequency, cariogenic diet, and poor oral hygiene. So the aim of the present study was to assess the BMI status and to corelate between dental caries and BMI among the Anganwadi children of Belgaum city, Karnataka, India.

Materials and methods: Four hundred and thirty three children from 20 Anganwadi's belonging to the age group of 2 to 6 years of both sexes were measured for BMI and dental caries status. The caries index was measured as the number of decayed (d) and filled (f) teeth (t) (dft). The BMI in units of kg/m^2 was determined and children were categorized according to age- and gender-specific criteria as underweight (<5th percentile), normal (5th–85th percentile), at risk for overweight (85th–95th percentile), and overweight (>95th percentile). The data were subjected to statistical analysis using Student's t-test, analysis of variance (ANOVA), and Karl Pearson's correlation coefficient test with the help of Statistical Package for the Social Sciences (SPSS) version 18.0.

Results: The proportion of subjects in Centre for Disease Control (CDC) weight categories was: 5% underweight, 79% normal, 9% under the risk for overweight, and 6% overweight.

Conclusion: A significant association was found between children with normal BMI and those who were underweight, overweight, and under the risk for overweight. Children with overweight/obese or underweight/malnourished children had higher decayed and filled surfaces compared to children with normal weight.

Clinical significance: Nutritional status has a profound effect on dental caries. Both underweight/malnutrition and overweight/obesity have significant adverse implications for health. Childhood obesity and childhood dental caries are coincidental in many populations.

Keywords: Body mass index, Dental caries, Malnutrition, Obesity.

How to cite this article: Aluckal E, Anzil KSA, 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 Pract 2016;17(10):844-848.

Source of support: Nil

Conflict of interest: None

[1,3]Department of Public Health Dentistry, Mar Baselios Dental College, Ernakulam, Kerala, India

[2]Department of Public Health Dentistry, St. Gregorios Dental College, Kothamangalam, Kerala, India

[4-6]Department of Oral and Maxillofacial Surgery, Annoor Dental College and Hospital, Ernakulam, Kerala, India

Corresponding Author: Eby Aluckal, Department of Public Health Dentistry, Mar Baselios Dental College, Ernakulam Kerala, India, Phone: +919496097570, e-mail: draluckal@gmail.com

INTRODUCTION

Dental caries is considered to be the most prevalent infectious disease which affects mankind. Although the prevalence of dental caries has declined in the past several decades, it continues to be a significant public health problem among children worldwide.[1] Dietary habits, i.e., when and how the beverage and food is consumed, can modify this risk with frequent consumption of sugars thought to increase risk.[2] The proportion of world's population affected by dental caries increased dramatically once refined carbohydrates became available to developed and developing nations.[3]

Body mass index (BMI) is an index that measures height for weight, which is frequently used to categorize underweight, overweight, and obese individuals. Among children, body fat amounts change as the body grows and are different from boys and girls. Unlike BMI assessments for adults, assessments for children take these growth

and gender-specific differences into account.[4] Deviation from normal weight results from an imbalance between caloric consumption and energy expenditure.

It is known that the nutritional status has an effect on dental caries. Both underweight/malnutrition and overweight/obesity have significant adverse implications for health.[5] Overweight and obese children are at increased risk for developing psychosocial and medical problems compared with children with normal weight. Perhaps even more importantly, obesity in the school years is an important independent risk factor for adult obesity. Childhood obesity and childhood dental caries are coincidental in many populations, probably due to common confounding risk factors, such as intake frequency, cariogenic diet, and poor oral hygiene.[1] Although theoretically overweight and obesity can be associated with dental caries, the documentation of such associations is sparse and seemingly inconsistent. Malnutrition refers to the syndrome of inadequate intakes of protein, energy, and micronutrients, combined with frequent infections.[6] Notably malnutrition (wasting or stunting) is associated with enhanced susceptibility to caries because of impaired saliva secretion due to salivary glandular hypofunction and saliva compositional changes. The consequences of all these can be prevented if these conditions can be identified early in life.

Larsson et al[7] reported that dental caries correlates positively with BMI in 15-year-old living in northern Sweden whereas Chen et al[8] found no association with obesity in Taiwanese 3-year-old and Tuomi[9] reports that obesity alone is not a good predictor for caries in Finnish 5 to 13-year-old. Thus further studies are needed to evaluate the impact of age (such as growth phase) and other study population characteristics (such as general nutrition status) on a possible association between overweight, malnutrition, and dental caries. The purpose of the present study was to assess the BMI status and to corelate between dental caries and BMI among the Anganwadi children.

MATERIALS AND METHODS

This study was a cross-sectional experimental study to assess the BMI status and to corelate it with dental caries among the Anganwadi children of two villages in Belgaum district, Karnataka. Both villages, Muttaga and Sulebhavi of Belgaum taluk in Belgaum district, were of similar sociodemographic profile. All the Anganwadi children in both villages were included in the study. After taking permission from the district and local authorities to conduct the survey, a total of 433 children from 20 Anganwadis were measured for BMI and dental caries status. Body mass index was calculated using the formula weight in kilograms (kg) divided by height in meter square (m^2). For 2 to 20-year-old, BMI is combined with age and gender and expressed as a percentile. The BMI percentile for age and sex were plotted on the growth chart developed by Centre for Disease Control (CDC) 2000 standards.[10] According to these curve, children are classified into four weight groups.

1. "Underweight" is defined as BMI for age less than 5th percentile.
2. "Normal" is defined as BMI for age greater than or equal to 5th percentile and less than 85th percentile.
3. "At risk for overweight" is defined as BMI for age greater than or equal to 85th percentile and less than 95th percentile.
4. "Overweight" is defined as BMI for age greater than or equal to 95th percentile.

For assessment of weight and height, weighing machines and height scales were used and for dental caries, decayed and filled teeth (dft) index was recorded. Project material (including study protocol and questionnaire) was sent to the ethical committee of the KLE Vishwanath Katti Institute of Dental Sciences, Belgaum for approval and permission was obtained.

The caries experience (dft index) was recorded using plane dental mirrors and dental explorers. For examination, the subject was made to sit in front of the examiner in a well-ventilated room and examination was carried out under natural lighting conditions.

In each child height was measured to the nearest full centimeter and body weight was measured to the nearest 0.1 kg by using a standard height scale and a weighing machine respectively. During these measurements which were performed in the class room of the Anganwadis, the children wore light clothing but no shoes. General information about their name, age, sex, etc., was gained from a questionnaire in which the class teachers helped to complete it. A single trained and calibrated examiner performed the comprehensive clinical examination with the assistance of one recorder. Only the children whose parents had signed an informed consent form were included.

The data collected from the study were subjected to statistical analysis using Student's t-test, analysis of variance (ANOVA), and *post hoc* test with the help of Statistical Package for the Social Sciences (SPSS) version 18.0. Karl Pearson's correlation coefficient test was used to test associations between BMI categories and dental caries status. A p-value of < 0.05 was considered statistically significant.

RESULTS

The BMI percentile of 433 children who were examined comprised 218 boys (mean age = 2.8 years) and 215 girls

(mean age = 2.6 years). The mean BMI percentile was 15.21 with standard deviation 2.15. The proportion of subjects in CDC weight categories was: 5% underweight, 79% normal, 9% under the risk for overweight, and 6% overweight (does not total 100% due to rounding).

The mean dft and standard deviation were 1.66 and 2.62 respectively. An overview of the mean dft scores and standard deviation for each groups was summarized in Table 1. When the pairwise comparison of four categories of BMI with dft scores was done by t-test, it was found that the correlations between underweight and risk for overweight children (p-value = 0.002), normal and risk for overweight children (p-value = 0.015), and risk for overweight and overweight children were statistically significant (p-value = 0.037). The comparison categories of BMI with respect to the dft scores were illustrated in Graph 1.

The comparison categories of BMI with respect to dft by one-way ANOVA test were found to be statistically significant (f-value = 2.900, p-value = 0.0347). The correlation between BMI scores with dft scores by using Karl Pearson's correlation coefficient was found to be statistically significant (correlation coefficient = –0.1402, p-value = 0.0035). The results were shown in Graph 2.

Table 1: Summary statistics of dft by BMI categories

BMI groups	*Mean*	*SD*	*CV*
Underweight	2.545	2.890	113.555
Normal	1.716	2.671	155.612
Risk for overweight	0.697	1.871	268.215
Overweight	1.863	2.474	132.780
Total	1.6651	2.6231	157.532

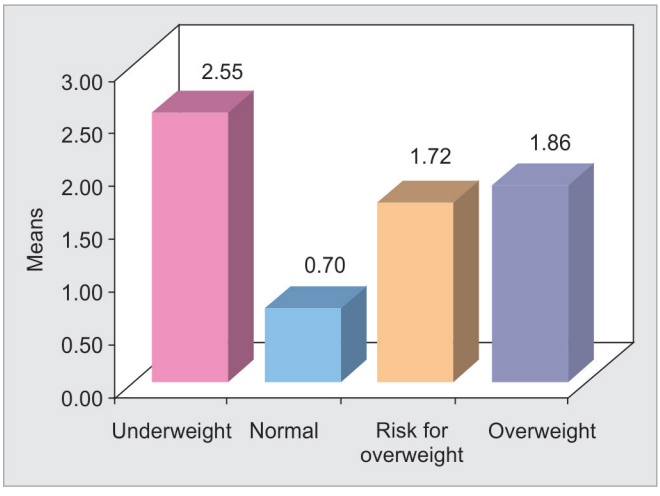
SD: Standard deviation; CV: Coefficient of variation

DISCUSSION

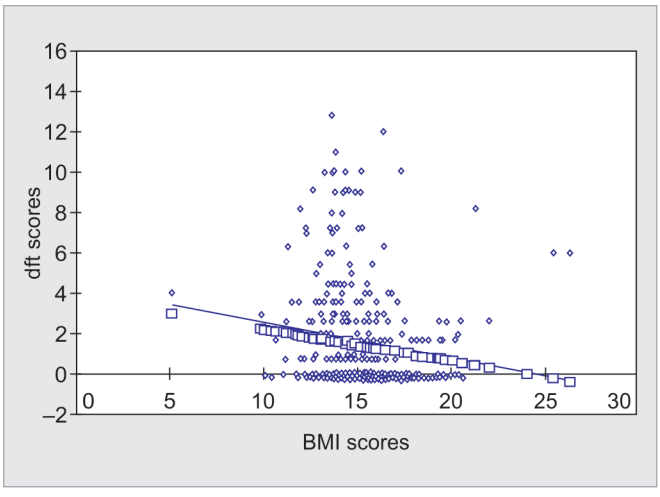
Body weight of a population can be viewed as a continuum from underweight/malnutrition to overweight/obesity. Most of the children in the study had normal BMI; however, 5% were underweight, 6% overweight, and 9% were under the risk for overweight. The observation is consistent with other studies related to childhood BMI. Although the mechanisms are not clear, caries coexisted with the risk of being underweight/overweight in these studies. Marshall et al[2] suggested that neither "obesity increases risk of caries" nor "caries increase risk of obesity", but rather a common risk factor increased the likelihood of both diseases. Dietary factors and socioeconomic status (SES) were hypothesized to be common risk factors that potentially link obesity, malnutrition, and dental caries.

Another finding in the present study was that the underweight children had the highest mean decay score of 2.55. Underweight/malnutrition (wasting or stunting) is associated with enhanced susceptibility to caries because of impaired saliva secretion due to salivary glandular hypofunction and saliva compositional changes. Also poor eating habits in early childhood, especially during tooth development, can impair tooth mineralization and increase the risk of caries.[11]

When comparison of BMI categories with dft scores was done, children with overweight/obese or underweight/malnourished children had higher dft compared to children with that of normal weight. Similar findings were previously reported by Sharma and Hegde.[3] However, our study is a cross-sectional study and cannot identify risk factors. So the results of the statistical tests should be carefully interpreted: Only associations and risk indicators of caries experience can be shown from



Graph 1: Comparison categories of BMI with respect to dft scores using one-way ANOVA test (f-value = 2.9002, p-value = 0.0347*, *p < 0.05, significant at 5% level)



Graph 2: Relationship between dft and BMI scores of study subjects (Correlation coefficient = –0.1402, p-value = 0.0035*; *p < 0.05, significant at 5% level)

the present analysis. Indeed, caries may occur simultaneously with high sugar consumption and obesity. But after a sugar-free diet or after having switched to low consumption of sweet food, BMI can return to a normal level, although dft score remains high. Similarly, low dft scores can be found associated with high BMI values, depending on the period in which the subjects are examined. This particularly occurs among children, because their growth and weight are changing fast, so overweight could be present in a short period. After having performed a systematic review of obesity and dental caries, Kantovitz et al[1] concluded that few studies had high levels of evidence, and only one study with high level of evidence showed direct association between obesity and dental caries. Another aspect of obesity and overweight comes from the increased intake of dietary fats. In this case, overconsumption of fatty food has less influence on caries development than sugary diet. This could play a role in the lack of association between obesity and caries presence.

Measuring the link between weight and pediatric dental health has always been controversial. A recent study in Germany[12] among elementary school children showed a positive correlation between weight and dental caries in both deciduous and mixed dentitions. Other studies, however, have not found any association.[1,13,14] Some studies show that children with low BMI may be at risk of caries development.[15,16] The hypothesized nature of protective effect of the weight on dental caries experience in the primary dentition is still uncertain, as many other factors which influence this relationship have not been considered. Although a formal socioeconomic assessment was not performed in the study subjects, the known characteristics of the study region and an appropriate geographic localization of our samples provided homogeneity to the group.

In spite of the fact that the results of this study do not agree on a very strong association between obesity, malnutrition, and dental caries, a longitudinal research in future should include dietary aspects, oral hygiene compliance, SES, and other confounding factors.

CONCLUSION

A significant association was found between children with normal BMI and those who were underweight, overweight, and under the risk for overweight. Children with overweight/obese or underweight/malnourished children had higher dft compared to children with normal weight.

It is important that dental professionals be exposed to the epidemiology of BMI of children, as many of these children will need noteworthy oral care modifications for safe care provision. As obesity and malnutrition results in many health-related problems, dental health parameters association seems probable, but not very much supported by the present evidence. Even if a relationship between weight and dental health in children is unclear, our obligation as health care professionals is to find innovative methods which bring profound change in our child patients. The BMI estimation should be included in the standard case history taking of any child patient, as it can help in screening for potential health problems of the growing child. The impact of weight in total health should also be given emphasis in curricula for dental students. Exploring the role of the dentist in this gives an excellent horizon for future clinical practice and research.

REFERENCES

1. Kantovitz KR, Pascon FM, Rontani RMP, Gaviao MBD. Obesity and dental caries – A systematic review. Oral Health Prev Dent 2006;4(2):137-144.
2. 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 Dec;35(6):449-458.
3. Sharma A, Hegde AM. Relationship between body mass index, caries experience and dietary preferences in children. J Clin Pediatric Dent 2009 Fall;34(1):49-52.
4. Macek MD, Mitola DJ. Exploring the association between overweight and dental caries among US children. Pediatr Dent 2006 Jul-ug;28(4):375-380.
5. Baker JL, Losen LW, Sorensenn TIA. Childhood body mass index and the risk of coronary heart disease in adulthood. N Engl J Med 2007 Dec;357:2329-2337.
6. Semba RD, Bloem MW. Nutrition in health in developing countries. Totowa, NJ: Humana Press; 2001.
7. 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 Aug;23(4):205-210.
8. 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 Mar-Apr;39(2):109-111.
9. Tuomi T. Pilot study on obesity in caries prediction. Community Dent Oral Epidemiol 1989 Dec;17(6):289-291.
10. US Department of Health and Human Services. National center for Health Statistics. Clinical growth charts. BMI for age, ages 2-20 males and female. Public use data files. Available from: http://www.cdc.gov/growthcharts/.
11. Psoter WJ, Reid BC, Katz RV. Malnutrition and dental caries: a review of the literature. Caries Res 2005;39(6):441-447.
12. Willerhausen B, Haas G, Krummenauer F, Hohenfellner K. Relationship between high weight and caries frequency in German elementary school children. Eur J Med Res 2004 Aug;9(8):400-404.
13. D'Mello G, Chia L, Hamilton SD, Thomson WM, Drummon BK. Childhood obesity and dental caries among paediatric dental clinic attenders. Int J Paediatr Dent 2011 May;21(3): 217-222.

14. Costacurta M, Di Renzo L, Bianchi A, Fabiocchi F, De Lorenzo A, Docimo R. Obesity and dental caries in paediatric patients. A cross-sectional study. Eur J Paediatr Dent 2011 Jun;12(2):112-116.
15. Norberg C, Hallstrom S, Ulla, Matsson L, Thorngren-Jerneck K, Klingberg G. Body mass index (BMI) and dental caries in 5-year-old children from southern Sweden. Community Dent Oral Epidemiol 2012 Aug;40(4):315-322.
16. Eda K, Meryem T, Siddika SY, Belma T, Suzan Y, Gulden P. Association between anthropometric measurements and dental caries in Turkish school children. Cent Eur J Public Health 2011 Sep;19(3):147-151.