A CROSS-SECTIONAL STUDY IN RURAL AND URBAN PRESCHOOL CHILDREN TO EVALUATE INTER RELATIONSHIP BETWEEN DENTAL CARIES AND OVERWEIGHT/OBESITY

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ABSTRACT:
Aim: The aim of the present study for rural and urban preschool children to evaluate inter relationship between dental caries and overweight/obesity

Methods: This was a cross- sectional epidemiological study conducted in the department of pedodontics of a private dental college in Uttar Pradesh, India, from November 2019 to December 2020. The correlation between BMI and dental caries and its comparative evaluation in preschool children in rural and urban areas of Azamgarh Uttar Pradesh India. Total 400 children with 200 participants per group. Children with the chronological age between 3 and 6 years, children going to rural schools and belonging to rural area, children going to urban schools and belonging to urban area and children for whom the parental consent is given were included in this study.

Results: The present study was conducted on a sample of 400 preschool children (235 males and 165 females) with a mean age of 4.5 ± 1.15 years equally divided into two groups of rural and urban areas (n = 200 each). The mean age was statistically non- significant across rural and urban locations (P = 0.87) and across genders (P = 0.58). Overall, males had significantly higher BMI than females (P < 0.05) and urban preschool children had significantly higher BMI than rural preschool children (P < 0.05). The overall prevalence of obesity and overweight was 20% with 25% prevalence in urban preschool children and 15% prevalence in rural preschool children. More rural preschool children were underweight (24%) than urban preschool children (15%) with the overall prevalence of underweight being 19.5%. The prevalence of dental caries was 51.5% overall with maximum prevalence in overweight category (53%) and least in the normal BMI category children (51%).

Conclusions: We concluded that the males had significantly higher (P < 0.05) BMI than females and urban preschool children had significantly higher BMI than rural preschool children (P < 0.05).

Keywords: Dental caries, overweight, obesity.

Introduction
Globally, non-communicable diseases square measure more and more recognized as a significant reason behind morbidity and mortality. The increasing burden of non-communicable diseases, particularly in developing countries of Asia including India, threatens to overwhelm already stretched health services. Among them, overweight and obesity are the
foremost necessary. The problem of overweight and obesity is not solely confined to adults however conjointly to children and adolescents. Various studies have also indicated that the prevalence of overweight and obesity among children of all ages is increasing in developing countries. This ‘nutritional transition’ and the lifestyle changes are becoming relevant among school children. India is also passing through such a transitional phase of socio-economic development which has the potential of altering the nutritional status of her population groups. Oral health and overall health and well-being are inseparably related. The role of nutrition in the maintenance of health, growth and also its relation to the dental caries is well known. Food choices and nutritional intake may affect the dental health. It would even be stricken by poor dental health. Dental caries in young children is commonly untreated, representing a public health problem and has also reported to affect their anthropometric outcomes. Obesity and dental caries are both multi-factorial, and has an impact on children’s health and psychosocial development; both conditions contribute substantially to health expenditure. Due to the strong evidence, supporting the association of dental caries with irregular dietary patterns and quality and also the fact that the abnormal dietary intake has been linked to the development of obesity at a young age, a link between dental caries and weight is biologically plausible. Growth is a significant indicator of child health; World Health Organization acknowledges it as the best single measure for delineating the nutritional condition and health of children. There are particular ways to follow up a child’s normal growth pattern. The growth charts consist of a series of percentile curves that illustrate the distribution of selected body measurements in children. The charts designated by CDC (Center of Disease Control) and WHO growth charts are the examples. WHO growth charts are considered as the standard charts. The growth and gender- specific differences need to be taken into account in the BMI assessment for children and teenagers. These child- specific BMI values are referred to as “BMI for age”. It is believed that dental caries may be deliberated as an imperative underlying factor for the condition of wrong dieting; it is able to influence child growth negatively. The relationship between dental caries and body mass index (BMI) in children was evaluated in different countries and the results were inconsistent. In some advanced countries, frequent and high consumption of carbohydrates were reported to be the reason of increasing obesity and dental caries. It has been shown that diagnosis of dental caries at the cavitation level results in a significant underestimation of the actual caries experience in populations. Use of a caries diagnostic system which includes non-cavitated caries has the distinct advantage that the classical stages of lesion formation – development of cavitation through non-cavitated stages of caries – may be reflected in the recordings. In 1999; Nyvad et al introduced a visual method for the classification of caries lesions according to their activity. Given that dental caries and BMI both measure diet-related health outcomes; an association between the two is not surprising. The results of a systematic review show that there is a significant disagreement as to the existence and nature of an association between dental caries and BMI. 48% of studies reviewed found no association between dental caries and BMI; 35% found a positive association while 19% found an inverse association.

Material and Methods
This was a cross-sectional epidemiological study conducted in the department of Department Pedodontics of a private dental college in Uttar Pradesh, India, from November 2019 to December 2020, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives if the patient was not in good condition. The technique, risks, benefits, results and associated complications of the procedure were discussed with all patients. The correlation between BMI and dental caries and its comparative evaluation in preschool children in rural and urban areas of Azamgarh, total 400 children with 200 participants per group.
with the chronological age between 3 and 6 years, children going to rural schools and belonging to rural area, children going to urban schools and belonging to urban area and children for whom the parental consent is given were included in this study. Children with long-standing systemic illness and/or on medications for long duration, children with physical or mental disability, children for whom parental consent was not given, children residing in rural areas and attending the schools in urban area and children residing in urban areas and attending the schools in rural area were excluded from this study.

The principal investigator was trained and calibrated in the Department of Pediatric and Preventive Dentistry under the guidance of the chief supervisor before proceeding for the study till consistent results were obtained. Each individual/group of individuals in a classroom was explained about the method of examination and the entire procedure using the study models. Assistance from the school teachers was obtained during the measurement of weight and height. Oral examination was carried out by a single examiner with a recording assistant both who were blinded to the weight and height of the child. In all the locations, natural light was used and the patient was placed in such a way that maximum illumination was obtained.

Extra oral and intraoral examinations were carried out. Dental caries was recorded as per index specified by the WHO which grades primary teeth into following categories (A – sound, B – caries, C – filled, with caries D – filled, no caries, and E – missing due to caries). Tooth was counted as decay when any of the following were met: (a) the lesion was clinically visible and obvious, (b) the explorer tip could penetrate deep into soft yielding material, (c) there were discolorations or loss of translucency typical of undermined or denmineralized enamel, (d) the explorer tip in a pit or fissure had a catch or resisted removal after moderate-to-firm pressure on insertion, or (e) when there was softness at the base of the area. For recording the BMI, weight and height of each child was recorded. Weight of each child barefooted was measured to the nearest 0.1 kg using a digital and a portable glass personal weighing scale placed on a flat floor which was calibrated before use. Each child was instructed to stand still, with mass equally distributed between feet, until the scale reading stabilized. The reading was then recorded. Height was measured to the nearest 0.1 cm using a stature meter attached to the wall provided in each school. Each child was asked to stand barefoot against the stature meter, and the value was recorded. BMI values were calculated for every individual at the end of each day with the formula: BMI= Weight in kg/(Height in cm). BMI percentile was calculated according to Center for Disease Control (CDC) BMI-for age growth chart. Using age- and gender-specific criteria, participants were categorized as: Underweight – <5%, Normal – <5%–<85%, Overweight – 85%–<95%, Obese – ≥95%.

All the quantitative variables (age, d, e, f, body weight, and height) were entered into Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 25.0, IBM Corp., Armonk, NY) for comparison of means among different groups and subgroups. Independent sample t-test was used to compare means at significant level of P < 0.05. Pearson correlation coefficient was computed between BMI and deft among different subgroups and statistically analyzed at P < 0.05.

Results
The present study was conducted on a sample of 400 preschool children (235 males and 165 females) with a mean age of 4.5 ± 1.15 years equally divided into two groups of rural and urban areas (n = 200 each). Table 1 depicts the distribution of age according to genders and geographical areas. The mean age was statistically non-significant across rural and urban locations (P = 0.87) and across genders (P = 0.58). The mean BMI among males and females across both urban and rural locations is presented in Table 2. Overall, males had significantly higher BMI than females (P < 0.05) and urban preschool children had significantly higher BMI than rural preschool children (P < 0.05) [Table 2]. Mean deft was statistically
non-significant across the genders and both geographical areas [Table 3]. Pearson correlation coefficient ($r$) was calculated between BMI and dmft in urban and rural preschool children according to genders and has been enlisted in Table 4. The value of $r$ was $-0.041$ for the overall population of 400 children, thus signifying no correlation between dental caries and BMI in preschool children. Although all the values of $r$ were negative suggestive of inverse correlation between dental caries and BMI, none of them reached statistically significant level, thus speculating that dmft is not correlated with BMI.

The overall prevalence of obesity and overweight was 20% with 25% prevalence in urban preschool children and 15% prevalence in rural preschool children. More rural preschool children were underweight (24%) than urban preschool children (15%) with the overall prevalence of underweight being 19.5%. The prevalence of dental caries was 51.5% overall with maximum prevalence in overweight category (53%) and least in the normal BMI category children (51%). The difference in the prevalence of dental caries among all the 4 categories in the overall population was statistically not significant ($P \sim 0.59$)

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<th>Table 1: Demographic distribution of the study population</th>
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<th>Table 2: Mean body mass index distribution of the study population</th>
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<th>Table 3: Mean decayed, missing, and filled teeth distribution of the study population</th>
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<th>Table 4: Pearson correlation coefficients between body mass index, dmft, and gender in urban and rural populations</th>
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#P value calculated using Fisher’s r- to- z transformation. Zobserved=((Z1−Z2)/(square root of [(1/N1−3) + (1/N2−3)]) where Z1 and Z2 represent Z values of the groups and N1 and N2 represents the sample size of the respective groups. Once the observed Z value has been determined, statistical significance was assessed by checking to see if the observed value is greater than the critical value.

Discussion

Historically, assessing and addressing childhood overweight/obesity has been the purview of the pediatrician or family physician. As the obesity epidemic escalates, it is apparent that screening solely during well-child visits may no longer be an expedient strategy for addressing this emerging issue. Dentists likely will aid in diagnosing a small percentage of children compared to the percentage diagnosed by physicians. These small successes, however, make a significant difference on a population level. Considering that weight status and its dietary correlates are related to dental health, the dental team has a unique opportunity to collaborate with other health providers such as pediatricians, family physicians, and dietitians to address the epidemic.

In the present study the urban children had significantly higher BMI than rural children possibly due to one or more of these reasons: low levels of physical activity, consuming junk foods, less emphasis on outdoor games and sports, lack of parental influence, abuse, anxiety, depression and family stress, and genetic and environmental factors. Urban females from developing countries especially have higher chances of obesity possibly due to changing lifestyles19 which can be seen in present study from the significant difference between mean BMI between urban and rural females. In the present study The overall prevalence of obesity and overweight was 20% with 25% prevalence in urban preschool children and 15% prevalence in rural preschool children which are similar to another study on South Indian children with the reported prevalence of overweight and obesity being 17% and 3%, respectively (combined 20%).20

Many studies involving body weight use BMI percentile as the measure of “body fatness,” as it is age and sex adjusted and allows for the ability to accurately compare children of differing ages and gender.21 Growth charts can be computed for different genders and age groups and compared to CDC norms. However, since growth chart below 2 years is not specified by CDC, the age group selected in the present study was above 2 years (i.e., 3–6 year age group). Various authors have tried to identify the relationship between dental caries and BMI utilizing different methods of recording obesity, different age groups, and impact of obesity on dental caries or vice versa. Inverse relationship between caries activity and BMI and waist circumference has been reported in elemental schoolchildren of Jeddah, Saudi Arabia.22 Negative relationship between obesity/overweight and dental caries have also been found by many authors.23,24 The results of the present study show weak- negative correlation between dental caries and BMI in preschool children which are similar to the results obtained by another study in 744 children aged 8 years in China.25 Various other studies done on different population groups have also not found a significant correlation between dental caries and BMI or obesity.26-28 A systematic review and meta-analysis29 did not find a significant association between obesity and dental caries in primary dentition which supports our data that dental caries in primary dentition is not correlated significantly to BMI. In contrast, dental caries in permanent dentition of adults was found to be significantly positively correlated with BMI after controlling confounding factors of smoking and brushing.30 Similarly, studies done in child participants have also found higher BMI Z-scores in children with severe early childhood caries compared to caries-free children.31 The direct relationship between dental caries and obesity or overweight has also been found in many other studies.32,33
With the increased migration and expansion of cities, strict boundaries of urban and rural areas are difficult to establish. We used definitions of urban and rural from Census of India for differentiating urban and rural populations and selected the children from these areas. Since the data were cross-sectional, causal relationships cannot be established, and the observed association could be due to other unexplored factors. Both overweight/obesity and caries are conditions with multifactorial causes which can be influenced by several factors (dietary habits, genetic factors, or host factors). Although the investigators tried to eliminate confounding due to migration of rural population to urban areas and vice versa (as specified in the inclusion and exclusion criteria), some amount of confounding due to better transportation facilities and rapid urbanization spreading across the cities might have influenced the results. Therefore, the possibility of residual confounding may always be present and cannot be totally eliminated in similar type of studies. Another limitation of the study was that early carious lesions were not recorded (white spot lesions) due to settings of the examination in school premises rather than dental clinic. Inclusion of noncavitated early carious lesions using ICDAS II criteria was found to change the higher prevalence of caries in obese when WHO decayed, missing, and filled teeth (dmft) criteria was used which showed higher prevalence in nonobese. Furthermore, caries detection was carried out visually without taking radiographs which could have not disclosed proximal caries or occult caries. Thus, the deft estimated in the present study could be slightly underestimated. Dentists who care for children are in a unique position to help address the childhood obesity epidemic for several reasons. First, dentists may see children by 1 year old, providing an opportunity for longitudinal counseling and monitoring of weight status starting at an early age. Normative BMI percentiles are not available for children younger than 2 years old. For these children, the dental team is encouraged to rely upon anticipatory guidance that includes a discussion of appropriate dietary habits, the importance of avoiding calorie-dense, low nutrition foods, and the consequences of nonideal growth trajectories that lead to development of overweight or obesity. Beginning at 2 years old or as soon as is reasonably achievable, dental teams should measure and record height, weight, and BMI percentiles at regular intervals. This will facilitate the provision of longitudinal data regarding the child’s growth and development.

Second, dentists have a higher likelihood than pediatricians of seeing older children on a regular basis for recall visits. The implication is not that dentists should replace pediatricians or family physicians in addressing childhood overweight or obesity, but that dentists can utilize dental visits to add additional screening and counseling that complements a physician’s efforts in addressing overweight or obesity. Third, dentists are credible sources for dietary counseling and already counsel about caries prevention. Most dentists who treat children feel that dietary counseling is an important component of oral health. The main thrust of dietary counseling from dentists, however, focuses on the reduction of cariogenic foods and related consumption habits. Dentists could easily expand their dietary counseling efforts to emphasize the implications of poor diet on oral and systemic health that extend well into adulthood. It is encouraging that initial studies exploring dental office-based dietary counseling have proven to be successful, feasible, well-accepted, and effective in changing the dietary habits of parents and children. In addition, these efforts have been well received by caregivers of pediatric patients as found in a study, wherein greater than 94% of parents who participated in a dental office-based healthy weight intervention program felt that it was an appropriate place to address healthy eating and weight issues. Fourth, some dentists currently measure children’s weight and height for other purposes. Weight is essential to calculate safe dosages of local anesthesia for young children, and obtaining weight is important for most conscious sedation procedures or dental rehabilitation under general anesthesia. For these practitioners, calculation and longitudinal tracking of BMI percentiles requires only minor changes in routine protocols. Fifth, minimal equipment is needed to collect weight/height measurements, which
can be collected with little disruption to patient flow. The equipment needed to institute BMI percentile measurements includes only a scale for measuring weight and a stadiometer for measuring height – both can be obtained for low start-up and maintenance costs.

Conclusions
Males had significantly higher ($P < 0.05$) BMI than females and urban preschool children had significantly higher BMI than rural preschool children ($P < 0.05$). Mean deft was statistically non-significant across the genders and both geographical areas. Nonsignificant negative correlation was observed between dmft and BMI in males and females and urban and rural preschool children. The overall prevalence of obesity and overweight was 20.2% with 25.6% in urban preschool children and 14.8% in rural preschool children. More rural preschool children were underweight (23.8%) than urban preschool children (14.4%) with the overall prevalence of underweight being 19.1%.

References
