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Research Article

BMI And Clinical Consequences Of Untreated Dental Caries In 3 To 6 Years Old Children.

Dr. Priyanka Goyal[1*], Dr. Bhupinder Pal[2], Dr. RavneetKour[3], Dr. Sarvesh Arora[4], Dr. Manumeet Kaur Bhathal[5], Dr. Ansari Assjad Hussain Hason Jaweed[6]

[1*]Reader, Department of Pedodontics & preventive dentistry, Desh Bhagat Dental College, Mandi Gobindgarh, Punjab, India.
[2]Reader, Department of Prosthodontics, Desh Bhagat Dental College, Mandi Gobindgarh, Punjab, India.
[3]Reader, Department of Pedodontics & preventive dentistry, Desh Bhagat Dental College, Mandi Gobindgarh, Punjab, India.
[4]Reader, Department of Prosthodontics, Desh Bhagat Dental College, Mandi Gobindgarh, Punjab, India.
[5]Reader, Department of Prosthodontics, MM College of Dental Sciences and Research Mullana, Ambala, Haryana, India
[6]Senior lecturer, Department of Pedodontics & preventive dentistry, Saraswati dhanwantri dental college and hospital, Parbhani, Maharashtra, India.

***Corresponding Author:** Dr. Priyanka Goyal
*Reader, Department of Pedodontics & preventive dentistry, Desh Bhagat Dental College, Mandi Gobindgarh, Punjab, India.
Email – drpriyankagoyal2012@gmail.com. M- 7015281167

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ABSTRACT

Dental caries and their consequences are known to impact the oral health related quality of life in children. Considering the relationship between refined carbohydrates and odontogenic infections, it is hypothesized that nutritional status and oral health are closely associated. The present study was undertaken to assess the relationship of body mass index (BMI) and odontogenic diseases. Sample consisted of 260 children (3-6 year-old). Dental Caries status assessed using WHO criteria (1997) and prevalence of clinical consequences of dental caries was assessed using PUFA/pufa scale (2010). Anthropometric measurements assessed included; height measured in meters using height chart and weight in kilograms using portable weighing scale. The BMI (Body Mass Index) was calculated using formula Weight (Kg) ÷Height (meter). The results of our study showed no statistically significant relationship between body mass index (BMI) with either dmft/ dmfs or pufa.

Index Terms— BMI, dmft, pufa

Introduction

Dental caries is a dynamic process, varying between periods of progression and arrest or partial repair. This progression/arrest is determined by a multitude of etiological factors namely oral microbial load, host biological factors, diet, oral hygiene, socioeconomic status, family structure, lifestyle factors, etc.1,2 Health promotions whether dental or general, ought to be directed at these underlying determinants. Our focus today should be a "common risk factor approach" i.e. control few risk factors impacting a larger magnitude of diseases, thus making health strategies economical, efficient and effective.3

Bunon first laid emphasis on the importance of good dietary habits for prevention of dental disease in children as early as 1743. Diet influences both the general, as well as, oral health of an individual in turn influencing the overall quality of life.4 Both diet and activity patterns have drastically changed over the past decade. The global "nutrition transition" from traditional diets towards the consumption of processed food and refined carbohydrates has resulted in a dramatic increase in both under-nutrition and overnutrition.5,6 A study reported that age-standardized mean body mass index (BMI)(the most widely used metric system to assess the weight status) has increased by 0.4-0.5kg/m2/year, over the past three decades.7When assessing the association between BMI and dental caries, some researchers have suggesteda positive, while others a negative association.8-12 Still more studies have found no relationship.13

Besides dental caries, studies have also evaluated the association between BMI and various other odontogenic infections but the relationship remains argumentative.1-2,14-16 Additionally, it is not just the presence but the severity of these odontogenic infections that may influence a child's nutritional status.To measure the clinical consequences of untreated dental caries Monse et al., in 2010 developed the PUFA index. PUFA/pufa index have been utilized to assess odontogenic infections in both the permanent (PUFA), as well as, primary (pufa)teeeh.17 The index assesses advanced odontogenic infections which may influence the overall health of an individual to a greater extent than dental caries alone. Thus, we planned our study to assess the association between BMI and odontogenic diseases, in 3-6 year-old school going children.

I. Materials and Methods

1.2.1 Sample selection

The study was conducted among children reporting to the department of paediatric dentistry at B.R.S Dental College and General Hospital, Village Sultanpur, Panchkula. The study cohort consisted of 260 children aged 3 to 6 years. Prior to inclusion in the study, the parents/legal guardians were informed about the research protocol and requested to sign a letter of consent. Children were excluded if they suffered from any other systemic illness as it would influence the nutritional status.

1.2.2 Dental caries assessment

Standard oral examination procedures were performed by two calibrated examiners using a mouth mirror and probe under dental operatory light. A blunt ended CPI-TN probe was used to evaluate dental caries prevalence according to WHO criteria (1997). The children were instructed to brush their teeth prior to the examination. Any debris if remaining was removed either with gauze or utilizing the probe.

1.2.3 Evaluation of clinical consequences of dental caries

The clinical manifestations of untreated dental caries were assessed visually using the PUFA/pufa index (2010). The index was recorded and scored for the presence of either visible pulp involvement (P), ulceration of oral mucosa due to root fragments (U), a fistula (F) or an abscess (A). No probing was performed to confirm the diagnosis of pulpal involvement. Only one code was scored per tooth.

The PUFA score per person is calculated in the same cumulative way as the DMFT score. An individual's pufa score can range from 0 to 20 for primary teeth. In case of doubt concerning the extent of odontogenic infection, the basic score (P) for pulp involvement was assigned.

1.2.4 Anthropometric measurements

The anthropometric measurements were performed a week after the clinical examination to prevent bias. The height was measured to the nearest 0.1 cm, using a stadiometer. The children were made to stand barefoot and erect on the base of the stadiometer to get an exact measure.

The weight was measured to the nearest 0.1 kg using a pin moving weighing machine. The measurements were conducted with the child's neck, spinal column and knees in physiological extension and soles of both feet supported horizontally on the machine. All measurements were carried out by a single examiner and recorded by a trained assistant.

The two variables were then utilized to calculate BMI using the formula; weight/height (kg/m2) specific forth subjects age and gender. The obtained BMI values for each subject were then plotted on clinical growth charts proposed by World Health Organization (WHO, 2007) for both percentile and z-scores. Interpretation of z-score cut-offs were used to divide subjects into four weight categories as described in Table 1.18

1.2.5 Statistical Analysis

Descriptive statistics were calculated, which consisted of mean and standard deviation for continuous variables, and frequency/ percentage for categorical variables. Difference of means of oral health variables were assessed using t-test and one-way ANOVA. Regression equations were calculated to assess the correlation between BMI and dental caries (dmft/dmfs), and BMI and odontogenic infections (pufa), Data analysis was performed using the SPSS 21.0 package and P values were considered significant at 0.05.

II Results

The subjects included 260 children (146 male and 114 female) with a mean age of 4.62 ± 1.02 years. Intra-examiner and inter-examiner reliability was determined by re-examining 10% of the subjects and the kappa coefficients were 0.81 and 0.89, respectively, which were interpreted as good.

Table 1. Weight status categories according to BMI Z-score cut-offs defined by WHO, 2006

Weight Status Category	Z-score cut-offs < 5years	Z-score cut-offs >5years
Obesity	BMI Z-score >3	BMI Z-score >2
Overweight	2 < BMI Z-score < 3	1 < BMI Z-score < 2
Normal Weight	-2< BMI Z-score < 2	-2 < BMI Z-score < 1
Underweight	-2 < BMI Z-score < -3	-2 < BMI Z-score < -3
Severe underweight	BMI Z-score1<-3SD	BMI Z-score1<-2SD

The mean prevalence of caries in the sample (dmft> 0) was 87.7% while the mean prevalence of odontogenic infections (pufa> 0) was only 15.4%. The mean values of dmft/dmfs and pufa for the total sample are summarized in Table 2. There was no significant difference in mean dmft, dmfs and pufa values between genders (p=0.79, 0.69 and 0.98, respectively) (Table 2).

Table 2. Percentage of children in the different weight categories

Weight Status Category	Girls N(%)	Boys N(%)
Obesity	0	0
Overweight	4 (1.5)	7 (2.7)
Normal Weight	96 (39.9)	113 (43.5)
Underweight	7 (2.7)	16 (6.2)
Severe underweight	7 (2.7)	10 (3.8)

The total sample was segregated according to age and gender specific BMI percentiles. Major percentage of the sample was in the 3rd to 50th percentile range, with 27.3% between 3rd to 15th, and 24.2% in the 15th to 50th percentile. 25% of the sample fell below the 3rd percentile with only 4.2% above the 97th percentile (Fig 1).

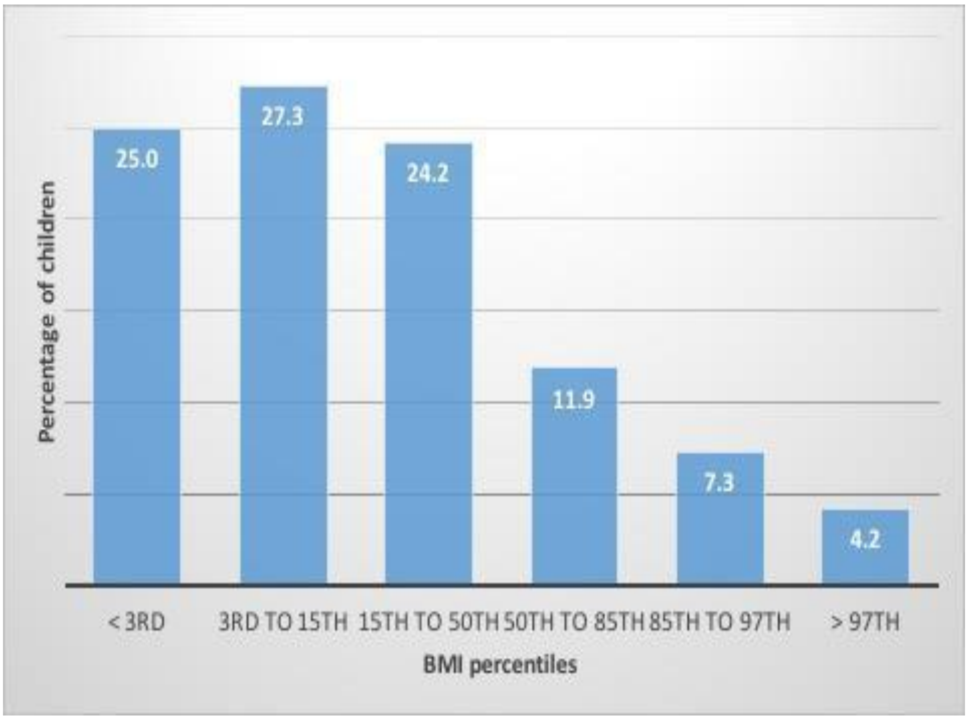

Fig-1 Percentile

Children were also divided into five weight categories i.e. severely underweight, underweight, normal weight, overweight and obese, as per the Z-score cutoffs. The overall prevalence of the four categories in descending order were; normal weight (79.23%), severely underweight (8.85 %), underweight (6.54%) and overweight (3.5%). None of the children in the study cohort were found to be obese (Fig 2).

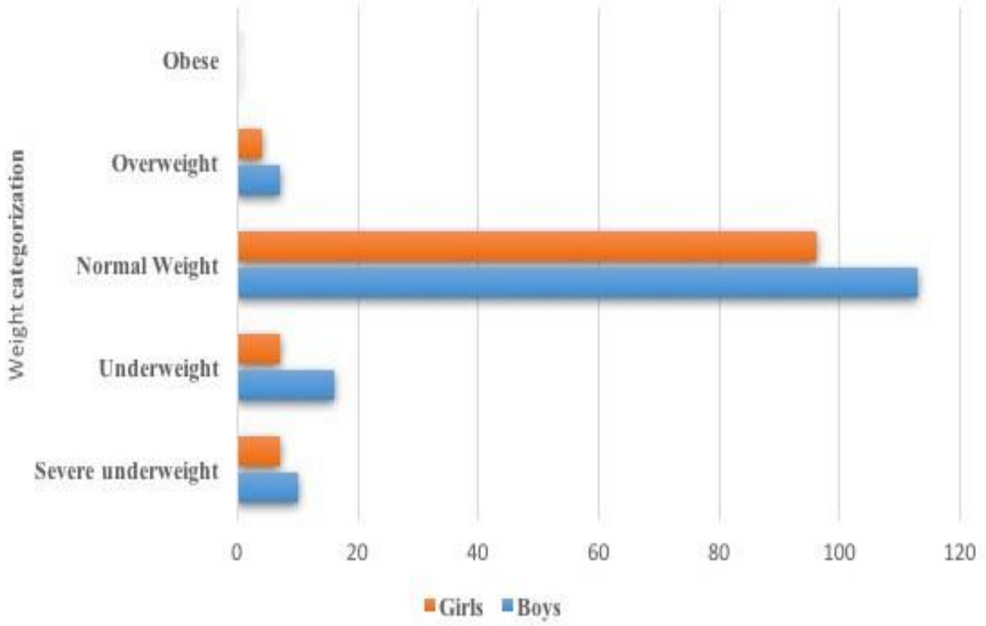

Fig-2 Categorization

On comparing the mean dmft and dmfs values in the different weight categories no significant difference was found (p=0.13 and 0.25, respectively). However, when comparing mean pufa scores a highly significant difference was found with children in the underweight category having the highest score (Table 2).
A negative linear correlation was found when assessing the relationship between BMI and dmft/dmft, as well as,pufa. Computed regression equations found a weak association in all three categories i.e. BMI &dmft(r= -0.1395, R2 = 0.0195), BMI&dmfs(r= -0.1614, R2 =0.026) and BMI & pufa (r= -0.2227, R2 = 0.0026) (Fig 3).

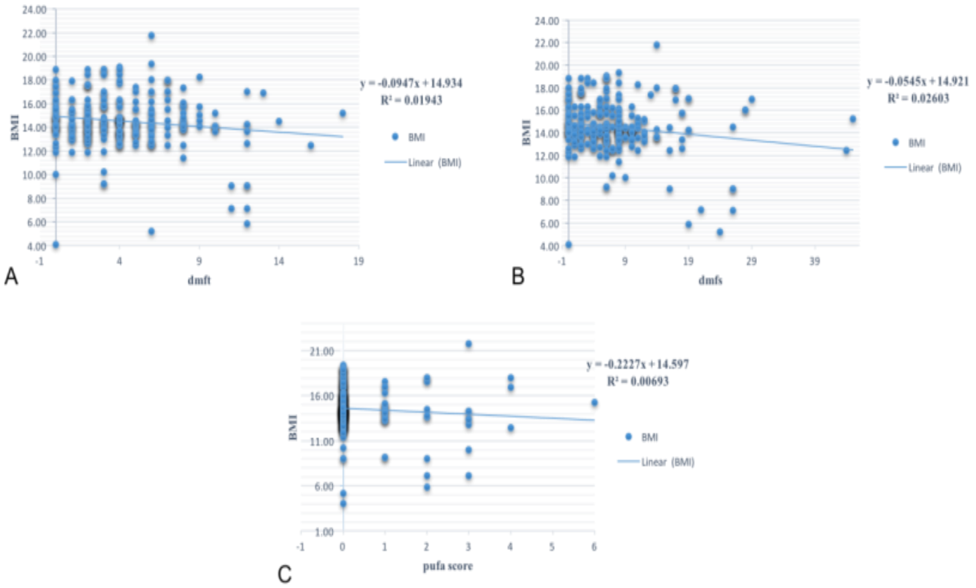

Fig-3 Correlation

III Discussion

Anthropometric assessments are widely regarded as the best measure for health and nutritional status in children regardless of aetiology.19 Of the various measurements, BMI is the most commonly employed as it is an index of current energy deficit computed using the present weight and height of the child.

We assessed the BMI and weight categorization of children using Child Growth Standard for infants and children up to 5 years of age and from 5 to 19 years of age published by the World Health Organization (WHO) based on a multi-country study on growth in April 2006. In February 2007, the Ministry of Women and Child Development and the Ministry of Health and Family Welfare in India recommended a change from the Indian Academy of Paediatrics (IAP) growth charts in use to the WHO growth charts. A study carried out to assess the applicability of these new growth charts in a population of 0-5 year of Indian children found the WHO charts to be far superior to using IAP standards.20 Other studies also recommend using BMI (utilizing WHO Growth

Charts) to assess current nutritional status in Indian Children.21
The children assessed in our study were residing in rural areas of Haryana. Majority of the children were found to have normal nutritional status with only 15.38% being underweight. This is similar to the findings of a study conducted in a cohort of Indian pre-schoolers where only 16.9% were found to be underweight.21 Another study carried out in 1-3 year-old pre-schoolers from rural areas of Haryana reported that most children were in the normal weight category when residing in wet zones of Haryana.22On the contrary, a much higher prevalence of underweight (44%) and severe underweight (15.7%) has been reported in a study also conducted in rural areas of Haryana. The latter study reported that the highest prevalence of underweight was in the 12-23 months' age group. The difference in age range selected could be the reason for the difference in findings as the lower limit of age range in our sample was 36 months.23 All children go through a "food learning" curve ranging from total dependence on their caregiver to autonomous feeding limited by availability. At the age of 36 months' children discover a sense of autonomy and establish independent feeding.24 Additionally, children at this age are exposed to feeding environments outside the home and develop food preferences.25 These factors may contribute towards the correction of under-nutrition which may be present in early childhood.
The overall dmft score of the study cohort was 4.28 + 0.41 while the pufa score was found to be low with an overall prevalence of only 15.4%. Thus a very small percentage of children suffered from caries which had progressed to pulpal involvement. Contradictory to our findings Mehta A et al., in their study reported a prevalence of 38.6%.26 However, the age group assessed in this study was 5-6 years while in our study was 3-6 years. In another study conducted in 5-year olds the prevalence of odontogenic infections was reported to be 42.4%.27 As age increases the prevalence of odontogenic infections may increase as caries progresses from enamel towards the pulp. The rate of caries progression in primary teeth has been reported to be approximately 0.8 years for caries to progress from outer enamel to DEJ, and an additional 1.4 years to reach the inner part of dentin.28Additionally, the difference may result from the urban-rural divide that exists in India, as both studies were conducted in an urban setting while ours assessed a rural population.
On evaluating the oral health status in different weight categories, no significant difference was found in the mean dmft/dmfs but a significantly higher mean pufa score was found in the underweight & severe underweight category. Thus presence of odontogenic infections may influence the overall health status. Studies have reported that a positive pufa score has a detrimental effect on the oral health related quality of life.29
In spite of this finding data collected herein found no correlation between dmft or pufa scores and BMI-for age. As in our study various studies report no association between dental caries and BMI. A study carried out in young children from low income families found no association between the two parameters mentioned.30Sheller B et al., also conducted a study in 293 children aged 2 to 5 years and reported no correlation of BMI percentile with dmft or pufa.31 Contrary to these findings, a study conducted by Dua R et al., reported a strong correlation between PUFA/pufa scores and BMI.32Bhoomika W et al., in their study also reported a positive correlation between BMI and S- ECC.33Davidson K et al., in their study found that a higher BMI is associated with S-ECC.34 The difference in findings may be due to the fact that the authors in these studies used CDC growth charts for categorization of nutritional status. Another finding common to these studies was that a percentage of children were obese while there were none in ours. Studies have reported that when both obesity and poverty are present, dental caries is seen to rise.35 Thus absence of obesity in our study cohort may have contributed to the difference in findings.
The primary disadvantage of our study is its cross-sectional design which limits the ability to identify causal factors. A more profound longitudinal study design would prove beneficial to assess the relation between nutritional status and dental caries/ odontogenic infections.

Conclusion

Although our study did not find an association between BMI and dental caries, there remains a complex interaction between the two parameters and epidemiological studies continually suggest bi- directional causation and comorbidity.36-38 Keeping in mind that nutritional status and oral health are intrinsically entwined, we reiterate that it would prove beneficial to implement programmes undertaking a common risk factor approach instead of focusing on disease-specific methods.

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