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Caries Prevalence and Its Correlation with Nutritional Status among Preschool Children Using Anthro-Plus Software

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Abstract: *The objective of this study was to investigate whether dental caries status was correlated to nutritional status in children with primary dentition. Dental and anthropometric examinations were conducted on 376 children aged 5-6 years attending government municipal schools in Nashik city. Dental caries status was measured using the decayed, filled teeth (dft) index. Anthro-plus software with WHO 2007 Reference was used to evaluate nutritional status. Nutritional status was presented as z-scores for weight for age, height for age and BMI for age. Bivariate Pearson Correlation test was applied to investigate the relationship between nutritional parameters and the status of children's dental caries. Caries was present in 68% of children with mean dft of 3.24±3.54. The correlation between the dft index and the nutritional parameters were not statistically significant (p>0.05), even as the r value was positive for weight for age and height for age (r = 0.6 and r = 0.1 respectively), but negative for BMI for age (r = - 0.37). Although there was no statistically significant relationship between caries experience of children in primary dentition and their nutritional status, an increase in weight and height can increase the dft and also an increase in dft can reduce the BMI.*
Key words: *Caries prevalence, malnutrition, nutritional status, children*

I. Introduction

Chronic malnutrition in growing children enhances the cariogenic potential of fermentable carbohydrates. Indian children with chronic malnutrition have been found susceptible to dental caries due to change in the saliva secretion rate. [1] Chronic malnutrition reduced the secretion rate of stimulated saliva and also the salivary buffer capacity continuously decreased as the secretion rate decreased with the level of malnutrition. [2] Therefore oral health and nutrition have a synergistic bidirectional relationship. [3] It is a common observation that children with symptoms of dental caries particularly in primary dentition have preference for soft sticky and refined carbohydrate diet. This preference may be due to two reasons. Firstly the caries process has reduced the functional ability to masticate. This would cause reduced intake of balanced diet and therefore influences the nutrition status. Or it is likely that poor nutrition and diet to begin with, has affected the development and integrity of the teeth leading to rapid progression of caries process. Therefore there may exists a vicious cycle where early childhood caries affects the nutritional status through food fads which in turns leads to defects in development and maturation of teeth structure or protective mechanism, predisposing teeth to caries process.

In the author's review of literature no study was found which correlated the two parameters using the tool developed by World Health Organization (WHO) that is Anthro-plus which is based on 2007 update. Advantage of Anthro-plus software is that it is updated, standardized with ease of application in field studies. Therefore the current study was planned among the preschool children with the objective of (1) to provide the base line data of prevalence of dental caries using WHO 2007 criteria (2) to assess the nutritional status using WHO's AnthroPlus software and (3) finally correlate the two parameters.

II. Materials And Methods

A cross sectional observational study was conducted among children between 5 years to 6 years of age enrolled in municipal schools of Nashik city. It was assumed that children enrolled in the municipal school would come from the same socio-economic strata and would have the same dietary pattern and oral hygiene status. The age group of 5 years to 6 years was considered because the cumulative caries experience in the primary dentition could be best studied in this age group as mentioned in Pathfinder survey. [4]

A sample size of 350 students was calculated considering the caries prevalence of approximately 50% among 5 – 6 year old. The precision was set to 5% and confidence limit at 95%. A total of 101 municipal run schools were identified. Among them 7 schools was selected using multi-stage sampling. The study population was selected by first obtaining a map of Nashik city which was divided into four equal zones namely north, south, east and west. All the schools were mapped into the four zones. Considering the probability proportional

to size (PPS), 7 schools were selected. From each zone the required number of schools was randomly selected. Each of these schools was considered as a cluster and all the children between the ages of 5 years and 6 years were included in the study.

A single trained examiner conducted both the dental and the anthropometric examination. The dental examination was conducted for all the children, using the methodology as described by the WHO. [5] Decayed; filled teeth (dft) index was recorded for each child. The anthropometric measurement (height in centimetres and weight in kilograms) was recorded using the guidelines given by WHO. [6] These measurements along with the date of birth of each child were used in the WHO Anthro-plus software (WHO 2007 reference) to evaluate nutritional status. Nutritional status was presented as z-scores for weight for age, height for age and BMI for age. [7] The z-score of zero was considered as cut-off point. Children with z-score less than zero were considered as malnourished.

The statistical analysis was done using SPSS 9 software. Mean and proportion were used to describe the data. Bi-variate Pearson Correlation test was applied to investigate the relationship between the nutritional status (respective z-scores) and the status of children's dental caries (dft score). The analysis was done using 95% confidence interval and p value of less than 0.05 was considered as significant.

III. Results

Three hundred and seventy six children were examined from 7 schools with an average of 53.71 students per school. The number of girls examined was 201 (53%) and boys were 175 (47%). The mean age was 5.36 years. The caries prevalence (n=376) was 68% with only 32% children being caries free. The mean dft score was 3.24±3.04 and the median dft score was 2 (range 0 - 18). Among the girls (n=201), 33% were caries free and 67% had caries. The mean dft score was 3.36 (range of 0 to 15). Among the boys (n=175), 31% were caries free and 69% had caries. The mean dft was 3.1 (range of 0 to 18). Though more girls were caries free, they had higher dft score compared to boys. But there was no statistical significance difference between the dft scores of girls and boys (p=0.468).

The mean height (n=376) was 108±6 cm with the range from 92 cm to 124.8 cm (Table 1). Among the girls (n=201) mean height was 107.9±5.5 cm and the boys (n=175) the mean height was 108 ±6.1 cm. The mean weight (n=376) was 15.4±2.43 kg with range from 10 kg to 25 kg. Among the girls (n=201) mean weight was 15.21±2.2 kg and the boys (n=175) the mean weight was 15.61±2.65 kg. There was statistically no difference between the height (p=0.85) and weight (p=0.11) of girls and the boys.

The mean z-score for height for age (n=376) was -1.13±1.01. Among the girls (n=201) mean z-score was -1.12 ±0.92 and the boys (n=175) the mean z-score was -1.13±1.11. The mean z-score for weight for age (n=376) was -1.87±1.00. Among the girls (n=201) mean z-score was -1.91±0.92 and the boys (n=175) the mean z-score was -1.83±1.09. The mean z-score for BMI for age (n=376) was -1.78±1.15. Among the girls (n=201) mean z-score was -1.80±1.02 and the boys (n=175) the mean z-score was -1.75±1.28. There was statistically no difference between the height for age (p=0.95), weight for age (p=0.48) and BMI for age (p=0.70) of girls and the boys.

Considering there was no gender difference between the dft score and the z-scores of the nutritional status, the study population was considered as homogenous and Pearson bi-variate correlation test was applied. The r value was positive for weight for age and height for age (r=0.6 and r=0.1 respectively), but negative for BMI for age (r= -0.37). The correlation between the dft index and the nutritional parameters were not statistically significant (p=0.48).

IV. Discussion

This study reported caries prevalence of 68% among 5-6 year olds from Nashik city, Maharashtra which is higher than the W.H.O goals for Oral Health for all 2010 (10% caries prevalence at age 5years or 90% should be caries free) and also higher as compared other studies conducted across India in the same age group (Table 2). This difference can be attributed to the selection of children. Most of the studies have included schools from affluent areas of the city or from rural areas of larger cities of India. Present study has been conducted on municipal school children, who during festive season go begging door to door rather than attend school even with free midday meal.

The study also reports on the nutritional status of municipal school children using WHO AnthroPlus Software, which is a unique tool developed by the WHO for community nutritional survey. This tool uses the growth references updated in 2007, pooled from six countries (Brazil, Ghana, USA, India, Oman and Norway) based on the fact that children grow similarly when their healthcare needs are met. This is the first study using the software in the Indian population. The present study showed that the selected children not only had acute malnutrition (mean z-score for weight for age = -1.87), but also had chronic malnutrition (mean z-score for height for age = -1.13). Only 5% of children had weight for age equal or above the mean (z-score = 0) and only 15% children had height for age equal or above the mean (z-score=0). This indicates that children had more of

acute malnutrition than chronic but the overall this picture is far from ideal. The mean of a more composite variable for measuring malnutrition, BMI for age was also -1.78. Only 6% of children had BMI for age equal or above the mean (z-score = 0). These finding are in consensus to the Malnutrition Monitoring Committee 2007-2012. [8]

Though there was no statistical significance between measures of dft and nutritional status, girls showed less caries prevalence but higher dft score. Also the girls were shorter and weighed less than the boys. Even the mean BMI for age for girls was less than the boys. These finding highlight probable gender difference. Diet deficient of vitamin D, vitamin A and protein energy malnutrition are associated with enamel hypoplasia and salivary gland atrophy, both of which needless to say increase susceptibility to caries. [9] The tooth formation and development require presence of macro and micro nutrients. Importantly the influence of nutritional status on the teeth pre-eruptively, is of greater concern than the post-eruptive local effect of diet. [10]

The results of this study are similar to studies comparing nutritional status and caries experience. In a study conducted to determine the association between BMI-for-age and dental caries in children 5 to 12 years of age from private, government and government schools, the authors found higher caries score in primary dentition in underweight children than in normal children even as dental caries scores showed no relationship between BMI-for-age in children. [11] A meta-analysis showed that early childhood caries to be highly prevalent in low income communities, where malnutrition is a common factor of great relevance. The authors concluded that protein-energy malnutrition during tooth formation leads to delayed eruption and structural enamel hypoplasia, in addition to possibly affecting the salivary glands, increasing the risk for dental caries. [12] A case control study among 84 malnourished and 89 well-nourished children aged 5 years, authors found that decay fraction (ds) and filling surface (fs) was higher among malnourished than well-nourished, but the differences were not statistically significant. [13] The authors also found that malnutrition increased the dental caries experience and reduced salivary flow rate, pH, and inorganic phosphorus, calcium, copper and lead. In a review of literature on association of caries in primary dentition and early childhood malnutrition, the authors stated that there was an association and the possible mechanisms responsible for the association may be enamel hypoplasia, salivary glandular hypofunction and saliva compositional changes. [14] In animal studies, it was concluded that in small animals malnutrition affects tooth formation and causes increased dental caries. [15] Two other seminal cross-sectional studies and one longitudinal study among Peruvian children conducted to investigate the effect of early malnutrition on oral health, showed that in malnourished children the pattern of caries development as a function of age is significantly altered as a result of a delayed eruption and exfoliation of the deciduous teeth. [16] The use of peak caries activity allowed the observation of a strong association between malnutrition and increased dental caries. A longitudinal study by the same author confirmed the results of the cross-sectional studies and demonstrated that one mild to moderate malnutrition episode occurring during the first year of life is associated with increased caries in both the deciduous and permanent teeth many years later. [17] Other studies have also shown positive relationships between malnutrition, enamel hypoplasia and primary dentition caries [18] and particularly increased primary dentition caries levels in stunted children. [19-21]

The municipal school children may be considered as the target group for nutritional rehabilitation, correction of which should decrease the caries incidence in primary teeth. There is likelihood that these malnourished children are missed during dental examination because physically they appear normal. Prentice found that children who are both underweight and stunted have adequately proportioned appearance because their short stature offsets their underweight. [22] This frequently conceals the true levels of malnutrition in communities. Therefore it would be prudent to assess the nutritional status of children visiting for dental treatment. These children would benefit most from diet counseling itself and anti-helminthic drugs where indicated. Apart from the midday meal scheme of ICDS program for the municipal school children, there is need for more participation of private practitioners to increase the dietary awareness among the low socio-economic community. The change in dietary behavior is a long term process which can be hastened by offering suitable replacements and substitutes for food fads. It may not be feasible for the busy dentist to offer this help and therefore services of trained nutritionist would be mandatory. The study shows the need to integrate of oral health with nutrition services, education, and research. Screening, baseline education, and referral to and fro between dentist and nutritionist should be part of comprehensive dental treatment.

The cut-off point of z-score = 0 was used to simplify the study. It should be noted that children follow their own unique growth curve which could lie between z-score of +1 to -1. Any growth faltering can only be measured by plotting of growth chart. The limitations of cross sectional study can be overcome by longitudinal study with objective to describe the food preferences and dietary habits along with new incidence of caries in the different spectrum of malnutrition. The versatile relationship between diet, nutrition, and oral health in practice, education, and research in both dietetics and dentistry merits further research.

V. Conclusion

This study shows the positive relationship between malnutrition and BMI for age. The most appropriate intervention recommended is that of an effective dietary counselling which is amiss in developing countries. Prenatal counselling should included dental health education which should be reinforced post natal as well. Dietary changes will not only improve the oral health, but most importantly improve the general health which is more visible motivator for parents of malnourished children. It is time that trained nutritionist to be part of the dental health team.

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Table 1: Mean values of nutritional parameters and gender differences (n=376)

Nutritional parameter	**Mean (SD)**	**Range**	**p value for gender**
Height (in cm)	108 (6)	92 – 124.8	0.85
Weight (in kg)	15 (2)	10 - 25	0.39
	Mean (z score)		
Height for age	-1.13		0.95
Weight for age	-1.87		0.48
BMI for age	-1.78		0.7

Table 2: Summary of caries prevalence in primary dentition in India

Sr. no	Authors	Year	Area	Caries prevalence (%)	dft score
1.	Sarumathi	2013	Chennai	63.4	--
2.	Sankeshwari	2013	Belgaum	63.1	--
3.	Sachit	2012	Greater Noida City, UP	30.06	1.68
4.	Singh	2012	Bangalore	40	1.89
5.	Renakumari	2012	Kerala	50.6	--
6.	Sakeenabi	2012	Davangere city	28.9	2.1
7.	Simratvir	2009	Ludhiana city	58.55	--
8.	Dhar	2007	Udaipur	46.75	--
9.	Goyal	2007	Chandigarh	--	4
10.	Mahejabeen	2006	Dharwad city	54.1	--
11.	Mahesh	2005	Chennai	--	3.53
12.	Saravanan	2003	Pondicherry	44.4	1.91
13.	Tewari	2001	Haryana	33.8	--
14.	Ali	1998	Akola	61.41	2.75
15.	Gangawar	1990	Rural Lucknow, UP	36	--