ASSOCIATION OF BODY MASS INDEX WITH DENTAL CARIES AMONG MALNOURISHED TRIBAL CHILDREN OF INDORE DIVISION

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Abstract

Background and aim. Nutrition is an essential component in human growth, development and maintenance of healthy life. Tribal communities are highly disease prone and do not have the required access to basic health facilities, also having a high degree of malnutrition.

The aim of this study was to determine the association of body mass index with dental caries among malnourished tribal children of Indore division (M.P.)

Methods. A cross-sectional house to house survey was carried out among 275 study subjects, 6-15 years old tribal children in two major tribal districts of Indore division. Permissions and consent was obtained from local administrative authorities, ethical committee and parents respectively. Anthropometric measurements like height, weight, mid-arm and head circumference were recorded. Children with confirmed malnourishment on basis of BMI index were considered for data collection. Oral examination for caries was conducted according to WHO 1997 survey methods. Descriptive tables and analytical tests such as ANOVA and chi-square test were employed. Independent effects of age, gender, BMI, oral hygiene status and daily intake sugar on caries status were tested using logistic regression analysis.

Results. The mean age was 9.75 (±2.43) years. The caries prevalence among permanent dentition of malnourished children was 61.4% with a mean of 1.61 (±0.48). Among tribes, malnourished children of Bhilala tribe showed significantly higher caries prevalence (1.82±0.46, p<0.01). Increase in caries prevalence was seen with increase in severity of malnourishment (p<0.05). Logistic regression indicated gender (males OR=1.19), age (5-10years OR=1.11) and high sugar intake (OR=1.49) were significantly associated with caries occurrence (p=0.001).

Conclusion. Caries was more prevalent in malnourished tribal children and was seen to increase with severity of malnourishment.

Keywords: body mass index, dental caries, tribal children

Introduction

India is a land of myriad culture and people. The health status of any community is influenced by the interplay of health consciousness of the people, socio-cultural, demographic, economic, educational and political factors [1]. The common beliefs, traditional customs, myths, practices related to health and disease in turn influence the health seeking behavior of autochthonous people [2,3]. A tribe is defined as a collection of families bearing a common name, speaking a common dialect, observing certain taboos regarding marriage, occupying

or professing to a common territory and is not usually endogamous though originally it might have been so [4]. Nutrition is an essential and important component in human growth, development and in maintaining healthy life [5].Tribal communities are highly disease prone and do not have required access to basic health facilities which leads to high degree of malnutrition[6]. Malnutrition is a prevalent issue in all developing countries [7]. In India this is further aggressive and critical because of 8% ethnic share in 70% of rural population as reported by NNMB (1978) to take unbalanced diet because of poverty stress. It is reported that, these tribal societies are very much ignorant about their oral health problems [8]. Dental caries is an irreversible microbiologic disease of calcified tissues of teeth characterized by demineralization of inorganic portion and destruction of the organic substance of the tooth which often leads to cavitation [9]. Dental caries have historically been considered an important component of the global disease burden especially in developing countries, affecting 60-90% of the children and the vast majority of adults [10]. In India, the prevalence of dental caries is reported to be 50-60%. The data of comprehensive National Health Survey conducted in 2004 in India showed 51.9% of 5-year-old children, 53.8% of 12-year-old children and 63.1% of 15-year-old teenagers are affected by dental caries [11].

Madhya Pradesh is a home land of many tribal races namely BHIL, BHILALA, PATEILIA have been identified as "Special Primitive Tribal Groups" [12]. The other main tribal groups include Gond followed by Baiga, Korku, Bhariya, Halba, Kaul, Mariya, and Sahariya, Katkaris, Koknas, Kolis and Warlis. Among these ethnic races, the BHIL, BHILALA, PATEILIA are more sensitive to nutrition and health issues because of their diet, dependence on forest, forest produce, traditional unproductive agricultural practices only in monsoon, unbalanced diet deficient in micronutrient's and non availability of modern health services resulting into burden of various diseases targeting specifically to children. Prevalence of hunger and malnutrition among the children are always there in their hamlets for years together due to their different linguistic, cultural and geographical environment, their forest habitats, extreme poverty, nutritional taboos and its peculiar complications; the diverse tribal world of Madhya Pradesh has been largely cut-off from the mainstream of development [13,14]

The subject gains more importance in tribal children, due to certain adverse realities like insufficient food intake, frequent infections, lack of access to health services, illiteracy, unhygienic personal habits, adverse cultural practices etc., which are the factors associated with the high prevalence of dental caries [1,4,9]. Health of people is strongly influenced by the social and economical environment in which they live. Burden of all diseases was more in disadvantaged and socially marginalized

individuals Oral diseases are the most common of chronic diseases and an important public health problem [15]. Till to date, there are no reports found in the scientific literature on oral health of these tribes of Madhya Pradesh. Hence, this study was undertaken to determine the association of body mass index with dental caries among malnourished tribal children of Indore division (M.P.).

Materials and methods

A descriptive cross-sectional house to house survey was carried out among 275 study subjects, 6-15 years old tribal children in two major tribal districts of Indore division, Madhya Pradesh, India.

The sample size estimation was based on the pilot study conducted to assess the feasibility and standardization of data collection. Considering the caries prevalence of 60 percent among 20 subjects of pilot study, 5% level of confidence and 0.8 power the estimated sample size was 256. A 10 percent increase in sample size was done taking into account the remote places and non-cooperation of study participants. So the final sample was 275 tribal children.

The ethical clearance was obtained by the Institutional Ethical Committee of Sri Aurobindo College of Dentistry, Indore. Permissions for conducting the study and clinical examinations on tribal children were also obtained from administrative authorities of both the districts. Only children with confirmed malnourishment were considered for the study. Only those participants whose parents or caregivers provided consent and were willing to participate were included in the study. Any condition which contraindicated or did not allow oral examination in the study subject was considered for exclusion.

Assessment of Nutritional status

Anthropometric measurements such as height and weight for each tribal child were recorded for calculating Body Mass Index (BMI). The WHO International growth chart [16] was used to evaluate the nutritional status. Z scores for boys and girls aged 5-19 years were generated in the WHO growth chart. A cut off of ±2 SD was used to identify children at significant risk for either inadequate growth or excessive growth. So a child who's BMI was-2 SD was considered malnourished and children below -3 SD were considered severely malnourished. Also, WHO Classification of Malnutrition (also Called Chronic Energy Deficiency) using Body Mass Index (BMI) [17] was used to categorize malnutrition into mild, moderate and severe. Cut off point using BMI; Mild=17.1-18.4; Moderate =16.1–17; Severe=≤16.

Data Collection

A house-to-house survey with the help of local authorities was planned in the villages selected for the study. Convenience sampling was employed to select the required sample size of 275 tribal children aged between 6 to 15 years. Oral examination was performed under adequate illumination (Type III), using a mouth mirror and

WHO CPI probe. Care was taken to avoid any discomfort to the participant. The data on periodontal status, dentition status and treatment needs were recorded using WHO 1997 proforma [18]. The family characteristics and oral hygiene practices were recorded on printed forms. Data regarding daily sugar intake were recorded using 24 hour recall diet frequency chart. The subjects were grouped into excellent, good and watch out zone based upon sugar sweet score [19].

Statistical analysis

The data collected was entered into Microsoft Excel and analyzed using SPSS 20.0 software (IBM, Chicago). Descriptive statistics was employed to calculate and tabulate frequency, mean and standard deviation. Caries experience and gingival findings were compared among age and gender using analytical tests like ANOVA and Chi-square test. Independent effects of age, gender, BMI, oral hygiene status and daily intake sugar on caries status were tested using logistic regression analysis.

Results

The results are based on the data collected from 275 tribal children of Dhar and Jhabua district of Indore division (M.P). The caries prevalence among permanent dentition of malnourished children was 61.4% with a mean of 1.61 (±0.48). Severity of malnourishment can be seen more in Bhil tribes (60.6%) compared to Bhilala (25.5%) and Patelia tribes (13.8%). The oral hygiene behavior in the majority of study subjects were cleaning tooth with toothpowder and finger (49%). Only 20 % malnourished tribal children uses toothbrush and toothpaste as an oral hygiene measure. There is a statistically significant difference found among age, BMI, oral hygiene means and sugar intake in relation to their tribes ($p < 0.05$) as shown in Table I.

Children belonging to Bhilala tribes suffering from severe malnourishment exhibited higher mean caries experience (1.82±0.38) ($p < 0.01$). Increase in caries experience was seen with increase in severity of malnourishment ($p < 0.005$) as illustrated in Table II.

There is a statistically significant difference found between age, dental caries and CPI score in relation to body mass index ($p < 0.05$). Children belonging to younger age group (68.4%) had severe malnourishment compared to children belonging to older age group (44.9%). Children suffering from severe malnourishment had more dental caries (43.8%) ($p < 0.05$).The CPI scores indicating the presence of bleeding conditions in 61% severely malnourished children followed by calculus (45%) ($p < 0.05$) are shown in Table III.

The regression model adjusting for all non-significant factors indicated age, gender and daily sugar intake to be significantly associated with dental caries ($p < 0.05$) shown in Table IV. The mean DMFT score of the study population was 1.68±1.18.

The treatment needs among the study subjects indicated that out of 275 malnourished tribal children 61.5% required some forms of treatment; the major treatment required was two surface filling (23.8%) followed by one surface filling (16.2%), pulp care/restoration (11.7%), extraction (7.3%) and others (2.5%) as illustrated in Figure 1.

Table I. Frequency distribution of demographic variables among study subjects with respect to their tribes.

Variables		Total	Bhil		Bhilala		Patelia		p-value
		N	n	%	n	%	n	%	
Age	6-10 years	57	28	49.2	19	33.3	10	17.5	<0.05
	11-15 years	218	95	43.6	52	23.8	71	32.6	
Gender	Male	156	64	41.2	52	33.3	40	25.6	<0.06
	Female	119	59	49.6	19	15.9	41	34.4	
BMI	Mild	72	20	27.8	19	26.4	33	45.8	<0.00
	Moderate	66	20	30.3	17	25.7	29	43.9	
	Severe	137	83	60.6	35	25.5	19	13.8	
Oral hygiene means	Toothbrush with toothpaste	56	23	41.0	21	37.5	12	21.4	<0.01
	Toothpowder with finger	135	71	52.6	25	18.5	39	28.8	
	Indigenous	84	29	34.5	25	29.7	30	35.7	
Sugar intake	Excellent	57	29	50.8	14	24.6	14	24.6	<0.05
	Good	125	44	35.2	43	34.4	38	30.4	
	Watch out zone	93	50	53.8	14	15.1	29	31.2	

Table II. Mean caries prevalence according to body mass index among tribes.

		Bhil	Bhilala	Patelia	Total
Body Mass Index	Mild (17.1-18.4)	1.92±0.26	1.17±0.38	1.65±0.48	1.58±0.38
	Moderate (16.1 – 17)	1.68±0.47	1.66±0.48	1.69±0.47	1.68±0.47
	Severe (>16)	1.64±0.48	1.82±0.38	1.72±0. 46	1.73±0.44
P value		0.106 (NS)	0.000 (S)	0.31 (NS)	0.001 (S)

Statistical test employed: = independent sample t test
   (S)   = Significant (p < 0.05)
   (NS) = Non-significant (p > 0.05)

Table III. Comparison of Body Mass Index with age, gender, dental caries and CPI score.

Variables		Total N(%)	Body Mass Index						p- value
			Mild (17.1-18.4)		Moderate (16.1 – 17)		Severe (>16)		
			n	%	n	%	N	%	
Age	6-10 years	57(20.7)	8	14.1	10	17.5	39	68.4	0.01 (S)
	11-15 years	218(79.3)	64	29.4	56	25.7	98	44.9	
Gender	Male	156 (56.7)	45	28.8	38	24.4	73	46.8	0.27 (NS)
	Female	119 (43.2)	27	22.7	28	23.5	64	53.8	
Dental caries	Present	169 (61.4)	52	25.4	43	30.8	74	43.8	0.02 (S)
	Absent	106 (38.6)	63	59.4	23	21.7	20	18.6	
CPI	CPI score 1	77 (28)	12	15.6	18	23.4	47	61	0.02 (S)
	CPI score 2	198 (72)	60	30.3	48	24.2	90	45.5	

Statistical test employed: = Chi square test
(S)   = Significant (p < 0.05)
(NS) = Non-significant (p > 0.05)

Table IV. Effect of independent variable on dental caries (dependent variable) using bivariate analysis.

| Variables		Unadjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Age	11-15	1	0.10–0.19	0.001*	1	0.08-0.18	0.001*
	6-10	0.14			0.12		
Gender	Female	1	0.19–0.35	0.001*	1	0.10-0.22	0.001*
	Male	0.27			0.15		
BMI	17.1-18.4	1					
	16.1-17	0.86	0.51–1.44	0.574			
	>16	1.28	0.79–2.07	0.308			
Daily sugar intake	Watch out zone	1			1		
	Good	0.46	0.20–1.04	0.064	0.33	0.13–0.85	0.035*
	Excellent	0.21	0.10–0.45	0.001*	0.30	0.09– 0.92	0.021*
Tribes	Bhil	1					
	Bhilala	0.87	0.43–1.79	0.847			
	Patelia	1.07	0.54–2.13	0.710			
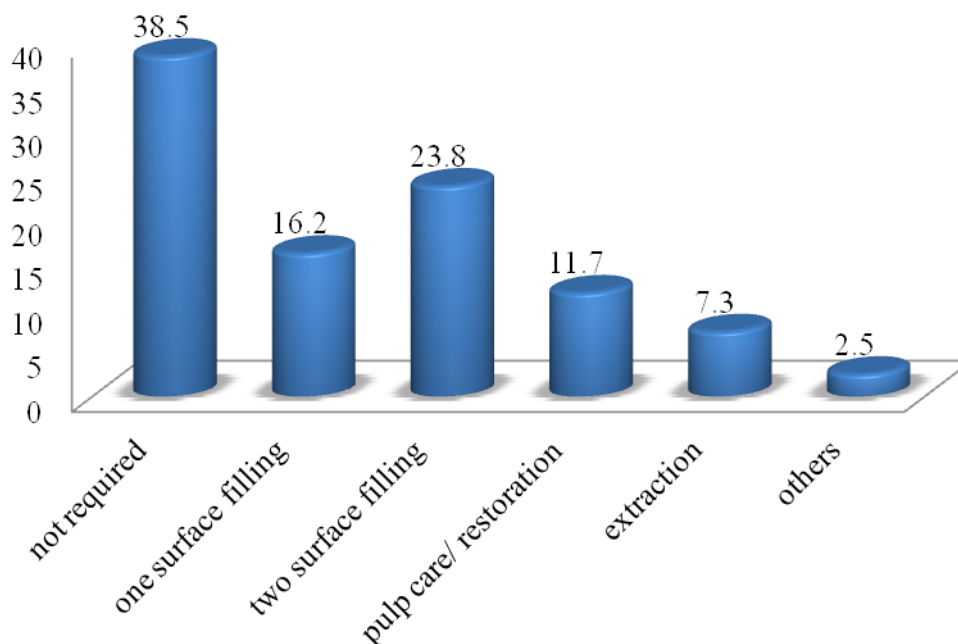
Figure 1. Dental treatment need among mentally disabled children.

Discussion

The present study was carried out to determine the association of body mass index with dental caries among the major tribal community of Madhya Pradesh who have been discriminated and marginalized due to several historical, cultural and socio-economic reasons.

The malnourished tribal children population aged 6 to 15 years belonging to the Dhar and Jhabua tribal districts were studied and reported. These children were mainly belonging to three main tribal communities namely: Bhil, Bhilala and Patelia tribes. Among them, Bhil tribe children were more common. The parental education was majorly limited to primary and secondary schooling. Agriculture and small business were the major source of income. It is an establish fact that both malnutrition and dental caries are complex conditions and many biologic, genetic, environmental and behavioral factors are known to be involved. A link between dental caries and underweight is biologically credible [20].

Our study reported that increase in caries prevalence was seen with increase in severity of malnourishment. Shakya A et al. have also reported that the children with less BMI score tend to have more caries affected teeth than children with normal BMI [21]. Similar results were found by Mohammadi TM et al.; Clarke M et al [22, 23]. The reason could be low literacy rates, no access to dental care, lack of balanced diet, lack of awareness about proper oral hygiene. Malnutrition reduces the secretion rate of stimulated saliva and chronic malnutrition in growing children enhances the cariogenic potential stemming from fermentable carbohydrate [24]. Above all, a collaboration of etiological factors causing dental caries and already hypothesized immunological complex mainly lead to the occurrence of dental caries [21]. On the contrary, Pinto A et al; Sheiham A; Panwar NK et al; Shahraki et al. reported inverse relationship between dental caries and weight [20,25-27].

Our study also found female were more malnourished and had more occurrence of dental caries compared to males (p<0.05). Similar results were reported by Punitha VC and Sivaprakasam P; George SM [5,28]. The female children are underfed due to gender inequalities and it is a well known fact that female infanticide is prevalent in India [28].

The results of the present study should be carefully generalized to other similar populations as this study may have some limitation of small study population and convenience sampling. The cross-sectional design of this study is also one of the limitations of this study as it does not allow establishment of the direction of the association. More longitudinal studies with higher sample size are needed to confirm this association. Additionally, the children included in the study were all coming from deprived areas; hence, the variation in the impact of socioeconomic position on the children's growth was not fully captured.

Therefore, research findings that link oral health to general health problems specific to low-income developing countries present an opportunity to put oral health on the agenda of health care policies. The association of untreated dental caries with undergrowth among deprived children

in Madhya Pradesh observed in this study highlights the importance of integrating oral health policies with general health policies and with different social, political and environmental policies to address a cluster of health problems that share common determinants.

Conclusions

This study found a high prevalence of dental caries among tribal children of Madhya Pradesh. Caries experience was more prevalent in malnourished tribal children and was seen to increase with severity of malnourishment. The unmet treatment need is also reported to be high. The periodontal condition like bleeding on probing and calculus was commonly found. Underweight and dental caries are public health issues of high priority affecting children at an important phase of their development. Therefore the oral health professionals should focus on meeting the need of this population and improve the knowledge and behavior regarding oral health maintenance.

Acknowledgements

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