

## Original Article

# Assessment of Oral Health Status and Nutritional Status of Tribal Children Residing in Tribal Area of Maharashtra State, India

Harish C Jadhav<sup>1</sup>, Mahesh R Khairnar<sup>2</sup>, Rahul G Naik<sup>3</sup>, Prashanth Kumar Vishwakarma<sup>4</sup>,  
Manjiri A Deshmukh<sup>5</sup>, Akhilesh Chandra<sup>6</sup>

<sup>1,3</sup>Senior Lecturer, <sup>4</sup>Professor, Department of Public Health Dentistry, ACPM Dental College and Hospital, Dhule, Maharashtra; <sup>2</sup>Assistant Professor, Unit of Public Health Dentistry, <sup>6</sup>Assistant Professor, Unit of Oral Pathology, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh; <sup>5</sup>Reader, Department of Public Health Dentistry, YMT Dental College and Hospital, Kharghar, Navi Mumbai, Maharashtra, India.

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## ABSTRACT

**Introduction:** Nutritional deficiencies affect the structural integrity of oral tissues and these changes are frequently the first clinical signs of deficiency. The study was conducted to assess the nutritional status and to determine the prevalence of oral diseases among tribal children.

**Methodology:** It was a cross-sectional study of 524 children up to five years of age from the tribal villages of the Nandurbar district in India. Assessment of caries (def index), enamel opacities/hypoplasia, gingival bleeding, plaque status, intra-oral and extra-oral, soft tissue examination along with weight, height, and nutritional status were recorded.

**Results:** 27.7% and 19.7% of the studied children belonged to the very severe and severe malnutrition categories. Mean def index of the study children was 1.03±1.056. Enamel hypoplasia, plaque, and gingival bleeding were seen in 29.77%, 70.2%, and 33.01% of the children, respectively. All the conditions except caries showed high prevalence and significant positive association among malnourished children as compared to normal children except for caries.

**Conclusion:** Malnutrition is associated with poor oral health, which calls for immediate action to rehabilitate their nutrition and restore their oral health.

**Keywords:** Deciduous dentition, Dental caries, Malnutrition, Oral health, Periodontal diseases.

## INTRODUCTION

Inspite of remarkable progress worldwide in terms of technology, industrialization, standard of living, etc. a large proportion of the Indian population resides in remote

areas in natural surroundings. These are known as tribal people and live in various ecological and geo-climatic conditions ranging from plains and forests to hills and inaccessible areas. Tribal people are considered to be the indigenous people of the land with their own distinct cultures, languages, customs and institutions, which distinguish them from other parts of society. Tribal people constitute 8.6% of India's total population, about 104.3 million according to the 2011 census, constituting the largest population of tribal people in the world.<sup>1</sup> These tribes are notified in 30 states/Union territories of India and the number of individual ethnic groups, etc. notified as tribes are 705.<sup>2</sup> These tribal populations mostly depend on locally available natural resources for healthcare as they live in isolation, away from modern civilization, confining themselves to their own beliefs.<sup>3</sup>

Health is a valuable asset not only for an individual but also for the entire community. There is an understanding that the health status of the tribal population is very poor because of their isolation and inaccessibility to healthcare. The tribal population is at a higher risk of developing malnutrition (under-nourishment) because of their dependence on primitive agricultural practices, frequent occupation as daily wagers, and the irregularity of food supply. Inadequate food intake leads to protein energy malnutrition and chronic energy deficiency. Malnutrition also affects oral health since nutrition is critical for proper growth, development, and maintenance of oral tissues and healthy dentition.<sup>4</sup>

The tribal population comprises 69.3% of the population of the Nandurbar district in Maharashtra state, predominated by the Bhills, Gavits, Kokanis, Mavachis, Valvis, Pawras,

Kokna, and Vasaves tribes.<sup>2</sup> In the past these tribes were mostly dependent on thick forests to satisfy their needs for food, fodder, and livelihood. However, due to indiscriminate cutting of forests, the region has become dry and barren. The local people now face the problem of providing adequate nutrition to the child population, pregnant women, and nursing mothers.<sup>5</sup> Some people are still in the practice of open defecation, which poses a higher risk of infectious diseases, which in turn may exacerbate malnutritional status. The district accounts for the highest proportion of severely or moderately underweight children in Maharashtra state. The prevalence of underweight children below five years of age is 42.6%.<sup>6</sup> Hence, the present study was conducted on children below five years of age in the tribal village of Padas of Dhadgaon (Akrani) tehsil of Nandurbar district. The aim of the study was to describe the prevalence of oral disease and nutritional status and to examine the association between nutritional status and oral health in the tribal area.

## **METHODS**

A cross-sectional study was conducted in the tribal district of Nandurbar, Maharashtra state. As per Census 2011, 3.1% people of the population live in the village, while 96.9% live in the surrounding rural areas. The tribe constitutes 95.9% of the total population in the Akrani region. One-fifth (21%, 40584 children) of the population is aged 0-6 years in Akrani region.<sup>7</sup>

524 children (226 males and 298 females) up to five years of age (mean age 29.10±14.09 months) were included in the study. The children were examined from different tribal communities. Ethical clearance and informed consent approval were obtained from the Institutional Ethical Committee and the research was conducted in full accordance with the World Medical Association Declaration of Helsinki. All parents with children up to 6 years of age were asked to gather at a central place in their community and were explained the purpose of the study in their local language by an interpreter. Written informed consent was obtained from those parents who gave permission to examine their children. Oral consent was obtained from parents who could not read and write, in the presence of a witness who signed the written informed consent on their behalf.

Intraoral examination was carried out by using a plane mouth mirror and Community Periodontal Index Treatment Needs Probe on an ordinary chair under adequate natural light (Type III) by a single trained examiner. The examiner was trained in the Department of Public Health

Dentistry under the supervision of expert faculty members at ACPM Dental College, Dhule, India. Calibration was achieved by conducting duplicate examinations on every tenth subject throughout the survey. Intra-examiner reliability for various measurements was assessed using the kappa statistic which was in the range of 0.78–0.81.

The weight of every child was measured using a calibrated analogue weighing machine whilst wearing minimal clothing and no shoes. The term “height” used here refers to both standing height and supine length (recumbent). If a child was less than 2 years old, supine length was measured, and if the child was aged 2 years or older and able to stand, standing height was measured.

The severity of malnutrition was derived using the Indian Academy of Pediatrics (1972) classification.<sup>8</sup> The different grades of malnutrition are shown in table 1. Caries status was assessed using def index as described by Gruebbel in 1944.<sup>9</sup> Other intra-oral findings such as enamel opacities/hypoplasia (present/absent), gingival bleeding (present/absent), dental plaque (present/absent), soft tissue examination (oral mucosa and extra-oral) were recorded as described by World Health Organization.<sup>10</sup> Oral mucosal conditions were recorded in the regions of vermilion borders, commissures, lips, tongue, buccal mucosa, floor of the mouth, hard and soft palate, sulci, gingiva or alveolar ridge. Extra-oral conditions included ulcerations, sores, erosions or fissures and the regions examined were the region of head, neck, limbs, nose, cheeks and chin, cancrum oris, abnormalities of upper and lower lips, etc.<sup>10</sup>

Data collected were tabulated and analyzed using SPSS software, version 20. Mean and standard deviation were calculated for age and deft. Other intra-oral and extra-oral findings were reported using frequency distributions (frequency and percentage). All the conditions assessed including malnutrition were transformed into a dichotomous variable (present/absent) to check for the association. Using malnutrition as an independent variable, the hypothesis that the children's nutritional status would predict their dental health was tested by calculating odds ratio and confidence interval.

## **RESULTS**

Table 1 shows the prevalence of malnutrition of children. One-third (37.6%) belonged to the normal category while 27.7% and 19.7% belonged to very severe (Grade 4) and severe (Grade 3) malnutrition categories, respectively. The caries prevalence was 24.00% (dt = 24% and et = 3.6%) (Table 2). Mean deft was 1.03±1.06. None of the study

children had any restored teeth. Enamel hypoplasia was observed in 29.77%. Oral mucosal ulcerations were seen in 41.03% of the study population, with 26.15% showing multiple ulcerative lesions. 41.22% of the children had extra-oral lesions in the head, neck or limb region.

Table 3 shows the association of malnutrition with intra-oral conditions and extra-oral conditions. All the conditions assessed except caries status showed more prevalence among malnourished children as compared to normal children. Malnutrition appeared to be a protective factor for caries (OR: 0.39; 95% CI: 0.260-0.588) in the present study. Enamel hypoplasia (OR: 1.86; 95% CI: 1.268-2.736), gingival bleeding (OR: 2.08; 95% CI: 1.426-3.040), plaque (OR: 1.60; 95% CI: 1.095-2.350), extra-oral lesions (OR: 2.08; 95% CI: 1.434-3.025) and oral mucosal ulcerations (OR: 2.06; 95% CI: 1.417-2.988) were significantly associated with malnourishment.

### DISCUSSION

This study was aimed to assess the nutritional and oral health status of children up to five years of age residing in the tribal areas of Nandurbar district. The report from National Family Health Survey-4 (NFHS-4) shows that a considerable number of children under five years of age (47.6%) were stunted and 55.4% were underweight in Nandurbar district of Maharashtra state.<sup>11</sup> The prevalence of malnourishment among children under the age of five

years in Maharashtra as per NFHS-4 was 36% whereas the overall prevalence of malnourishment in the study was 62.4%.<sup>11</sup> The high proportion of malnourished children might be because of their low standard of living. The Maharashtra Human Development Report 2012 has documented that Nandurbar and Gadchiroli, which are tribal districts, are the bottom ranked districts in terms of the Human Development Index which depends upon their lifestyle and per capita income.<sup>12</sup> Poverty is a cause and consequence of under-nutrition.

Malnutrition consistently disturbs immunity of the host, including phagocytic function, cell-mediated immunity, complement system, secretory antibody, and cytokine production and function. In PEM, there are noticeable changes in the oral microbial flora leading to an increase in the pathogenic anaerobic organisms and tendency of bacteria to bind to oral mucosal cells, reduction of acute phase protein response, and dysfunction of the cytokine system. Cellular depletion of the antioxidants promotes immuno-suppression and increased oral disease progression. The oral tissues are subtle indicators of the nutritional status of the body and are often the first indicators of latent and obvious deficiencies. The impact of malnutrition can be seen in the oral tissues in all stages of life from conception to old age. Malnutrition has an impact on craniofacial development and the development of the teeth.

**Table 1: Status of malnutrition (IAP 1972)**

Grade of malnutrition	Weight for age (% of Harvard Standard)	Prevalence, n (%)
Normal	> 80% of expected weight	197 (37.5%)
Grade 1 (Mild)	71-80% of expected weight	56 (10.7%)
Grade 2 (Moderate)	61-70% of expected weight	23 (4.4%)
Grade 3 (Severe)	51-60% of expected weight	103 (19.7%)
Grade 4 (Very severe)	< 50% of expected weight	145 (27.7%)

**Table 2: Prevalence of intra-oral and extra-oral conditions (n=524)**

Condition	Mean±SD n (%)
Mean def	1.03±1.056
Caries prevalence - decayed teeth (dt)	126 (24)
Caries prevalence - indicated for extraction/extracted because of caries (et)	19 (3.6)
Enamel hypoplasia	186 (35.5)
Plaque	368 (70.2)
Gingival bleeding	204 (38.9)
Oral mucosal ulcerations	215 (41.03)
1. Single ulcerations	78 (14.89)
2. Multiple ulcerations	137 (26.15)
Extra-oral lesions	216 (41.22)

The caries prevalence in the present study was 24% which was lesser than as reported in the studies by Mandal et al<sup>13</sup> (46.42%) and Dinesh et al<sup>14</sup> (49.27%). Mean deft score for the present study was 1.03 which was less than the study conducted by Bazmi et al.<sup>13</sup> Caries process is a consequence of the intake of fermentable carbohydrates. However, dietary practices and sugar consumption patterns were not assessed in the present study which is a limitation of the study. Other than carbohydrates intake, protein energy malnutrition can also be responsible for development of dental caries.<sup>15</sup> In case of malnutrition, protein deficiency results in poor structural integrity of the dentition and the poor resistance to oral pathogens. When assessed for association of caries with malnutrition, caries score showed an inverse association (OR=0.39) with malnutrition status in the present study. Similar results were seen in a study conducted by Reyes-Perez et al<sup>16</sup> which showed that malnutrition was inversely associated with caries risk (RR=0.58; 95%CI, 0.490.69). However, a study conducted in Brazil on 3-5 years old pre-school children showed that children with malnutrition had a mean def of 4.<sup>17</sup> Another study conducted among 6, 10, and 12 years old children in Nepal showed 68.6% underweight children suffering from dental caries.<sup>18</sup> A study conducted among 6-8 years old primary school children of Bangladesh, who had at least one decayed tooth, were underweight with odds ratio of 1.6 (95% CI 1.1, 2.3).<sup>19</sup> Other studies also showed a significant positive association between malnutrition and dental caries.<sup>15</sup> These results are in contrast to the present study where dental caries showed inverse association with malnutrition. These differences might be attributed to variations across study populations in terms of socio-economic status, dietary practices, standard of living, affordability, etc. Low caries score in the present study might have been attributed to the poor affordability resulting in infrequent snacking.

Early childhood malnutrition is associated with enamel

hypoplasia which was evident from the results of this study. Malnutrition may cause enamel hypoplasia as a result of lack of the materials that are required by the cells to produce the enamel matrix. Malnourished children showed more prevalence of enamel hypoplasia (31.5%) than normal children (26.9%) in the present study and the association between the two was significant (OR: 1.86; 95% CI: 1.268-2.736). The results are in accordance with previously conducted studies, including among 2-6 years old children of Riyadh, Saudi Arabia, where malnutrition was associated with greater prevalence of enamel defects.<sup>15,20,21</sup> In the present study, 45.3% of malnourished children had bleeding gums as compared to 28.4% of the normal children (OR: 2.08; 95% CI: 1.426-3.040). Malnutrition, in addition to protein deficiency, also comprises deficiency of vitamins, minerals, and other nutrients which are required to maintain healthy tissues and organ functions. Insufficient nutrients in a diet that leads to certain vitamin deficiencies, especially vitamin C, can lead to bleeding gums. Similar results were seen by Singh et al<sup>22</sup> where 44% of the 5-year-old children examined, had bleeding gums.

Vitamin deficiency, especially vitamin B group deficiency can affect various oral structures as a result of basic changes in the metabolism of oral epithelial cells. This contributes to the development of conditions such as cracked lips, angular cheilosis, ulceration and inflammation of oral mucosa, and ulcerative or erosive lesions in the region of the head, neck, face and limbs. More than one quarter of the study children had multiple ulcerative lesions in the oral cavity and others had single ulcerative lesions. Malnourished children showed a greater risk of developing oral mucosal lesions (OR: 2.06) as well as extra-oral lesions (OR:2.08). These results are in accordance with the study conducted by Majorana et al<sup>23</sup>, which showed that oral mucosal lesions are more common among children with immune disorders, malabsorption and malnutrition.

**Table 3: Nutrition as a predictor of enamel hypoplasia, gingival bleeding, plaque status, intra-oral ulceration, and extra-oral conditions**

Condition	Malnourished children (%)	Normal children (%)	OR	95% CI
Enamel hypoplasia	40.7	26.9	1.86	1.268-2.736
Gingival bleeding	45.3	28.4	2.08	1.426-3.040
Plaque	74.0	64.0	1.60	1.095-2.350
Extra-oral lesion	47.7	30.5	2.08	1.434-3.025
Oral mucosal ulcerations	47.4	30.5	2.06	1.417-2.988
Def	17.7	35.5	0.39	0.260-0.588

OR: Odds ratio; 95% CI: 95% Confidence Interval; Caries status was categorized as either present or absent irrespective of the number of carious teeth



However, a study conducted in Dhanbad district showed only 5.2% prevalence of oral ulcerations.<sup>24</sup>

One of the most astounding observations of the present study was that none of the study subjects had restored tooth in their oral cavities which shows lack of dental health awareness amongst the tribal populations of Nandurbar and reliance of tribal people mainly on traditional systems of medicines for their oral healthcare needs.<sup>25</sup> The reasons for large unmet dental needs among these children may be lack of accessible to affordable dental healthcare services, low priority given to oral health, etc. This calls for immediate actions in terms of basic oral healthcare programs which should include free emergency and low cost basic dental treatment services including preventive care at the community level by appropriately trained tribal oral health care personnel. This can be accomplished by involving tribal people (community participation) in the healthcare program itself to bring about sustainable oral health change and also, the provision of an accessible and affordable oral health care facility, which is the need of the hour, can also help.<sup>26</sup> This can be achieved with the help of tribal head and voluntary organizations. These services can be provided along with nutritional rehabilitation services to tackle the issue of malnutrition. Dental preventive measures and therapeutic measures such as atraumatic restorative treatment (ART) along with existing nutritional programs can be conducted at Nutritional Rehabilitation Centers (NRC) by trained non-dental personnel.

The Government of Maharashtra has initiated provision of supplementary nutrition to pregnant women and children below 6 years of age through the Integrated Child Development Scheme (ICDS). It has set up 15 NRC in tribal regions where severely acute malnourished children undergo a 14-day session of supervised feeding under the guidance of dieticians. The Government has also signed a MoU with the Jamshedji Tata Trust and UNICEF for implementation of the Community Management of Acute Malnutrition (CMAM Project) at Nandurbar District. The establishment of a State Nutrition Mission and embedding nutrition in agricultural programs can further contribute towards addressing child under-nutrition in the region.

The nature of our study sample prevents generalization of the findings to other ethnic groups in India. The findings may represent tribal children of Nandurbar district and the relationships between malnutrition and oral health are unlikely to have been affected by the sampling. In addition, other factors affecting oral health, such as child tooth-brushing behavior, dental visiting, exposure to fluoride and

consumption of sweet foods were not recorded. However, data from this study can serve as the baseline data and can be used to plan appropriate programs to improve oral health among the tribal people of Nandurbar district.

## CONCLUSION

Most of these children in Nandurbar district experienced malnutrition and various oral conditions, which may be attributed to poverty, cultural beliefs, lack of accessible and affordable oral health care services among the tribal people. Hence, appropriate and sustainable oral health care services at low cost along with the provision of agricultural support seem to be the need of the hour. Implementation of such services will require the involvement of community, oral health care professionals and the government.

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### **Corresponding Author**

Dr Mahesh R Khairnar, Assistant Professor, Unit of Public Health Dentistry, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India.

email: kmahesh222@gmail.com