Original Article

Association Of Nutritional Status And Dental Caries Among Anganwadi Children Of Jaipur City A 'Cross Sectional Study'

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Abstract

Introduction: Burden of malnutrition in children exists all over the world, either in the form of undernutrition or obesity. Poverty along with other socio-demographic factors act as important determinants of malnutrition which not only affect health but also oral health (enamel hypoplasia, dental caries, scurvy etc.)

Aim: To assess the association of nutritional status and dental caries among Anganwadi children of Jaipur City.

Methodology: A cross-sectional epidemiological study was conducted on a representative sample of 100 children, aged 36–72 months, at Anganwadi centres of Jaipur City. Nutritional status was evaluated by measuring body mass index (BMI) and mid-upper arm circumference (MUAC). Dental caries examination was carried out according to the WHO criteria. Statistical test used were Chi Square test and Student T test.

Results: Nutritional status according to BMI showed 60% of children to be underweight and according to MUAC 41% of children was undernourished. A highest (38.3%) number of underweight children were seen in 36-45 months age group, with a higher number of males being affected. Risk of dental caries was higher in 54-63 months age group with female being affected more than males. Association of BMI was significant and that of MUAC was non-significant with dental caries.

Conclusion: 60% of children were underweight And it decreased with the age with increase in dental caries respectively.

Key Words: Dental caries, Nutrition Status, Malnutrition, Anganwadi Children

Introduction

Malnutrition is a silent emergency as it contributes to a major portion of the risk factor for burden of diseases especially among preschool children(1).A double burden of malnutrition exists in the world in the form of under nutrition and obesity. Under-nutrition and obesity have become a "double burden" in low- and middle-income countries over the past few decades due to the global "nutrition transition," or the change from the traditional diet of breastfeeding, agriculturally based foods, and regular meals to the modern diet of processed, sugary, and nutrient-poor foods and drinks (2).Poverty is a major contributor to this problem of malnutrition in India, but there are also other factors like sociodemographic, sociocultural and lifestyle practices which have a role to play. Asia and Africa contribute to highest share of malnutrition globally.

Another consequence of the nutrition transition is the global pandemic of early childhood caries (ECC), or tooth decay, currently the most common chronic disease of childhood, affecting 60–90% of children worldwide (3). While ECC is caused by a combination of an oral bacterial biofilm, the diet, and factors relating to the host such as tooth morphology or medical conditiondietary sugars are considered the primary drivers of the progression of dental caries (4). Numerous studies have demonstrated associations between dental caries and malnutrition—with under-nutrition in some populations, and obesity in other (5). populations, depending on a complex set of socioeconomic and cultural characteristics Due to low political prioritization of oral health with general health , most children have poor access to dental care, leaving most caries untreated, commonly leading to bacterial invasion of the pulp and tooth-supporting structures, chronic infection and mouth pain(6).

There are a number of potential mechanisms through which dental caries could harm children's growth and nutrition. Children's appetites might be decreased, chewing skills can be impaired, sleep can be disrupted, glucocorticoid and growth factor regulation is effected, and metabolism and immunity are compromised by tooth loss, mouth pain, and chronic dental infection/inflammation(7). Furthermore studies(8-10)show a bi-directional relationship between caries and malnutrition—children with malnutrition are prone to tooth enamel defects with greater vulnerability to caries; and children with severe caries are at increased risk for developing malnutrition. Caries and obesity share a number of risk factors in common, such as a regular intake of sugary foods and drinks. This causes a link between the two disorders.However, there is a need for interventions to “move upstream” to demonstrate whether population-wide interventions designed to prevent early childhood caries from birth can also prevent caries-related malnutrition (11). Interventions such as the promotion of breastfeeding and healthy eating, tooth brushing with fluoride toothpaste, and the application of fluoride and other preventive procedure have been shown to be effective, low cost and deliverable by non-dental maternal child health care providers (12).

Thus, this study attempts to assess the nutritional status through anthropometric measurements and dental caries by a dental examination, among Jaipur city children going to anganwadis.

Materials and Methods

Study Design

This cross-sectional epidemiological study was conducted on a representative sample of 3–6-year-old children visiting the Anganwadis of Jaipur City, Rajasthan, India. Before commencement of the study, a list of all ICDC in Jaipur was obtained from the Department of Women and Child Development, Government of Rajasthan, India (13).The Jaipur was divided geographically into 5 different zones: north, south, east, west, and central. ICDCs from each of these 5 zones of Jaipur city were selected randomly.

Two Anganwadis from each zone were selected randomly. 10 children from each Anganwadi were selected randomly based on inclusion and exclusion criteria. A total of 100 children were selected for study.

Eligibility Criteria

Ethical clearance was obtained from Ethical committee of the Institute and the permission was obtained from the Anganwadisuper wiser of Jaipur, to carry out anthropometric measurements and oral examination of children in the Anganwadi. The study was explained to the authorities of ICDC and parents/guardians/caretakers. Following initial screening, children who fulfilled the criteria for selection were included in the study.

Inclusion criteria

1. Children present at anganwadi on the days of examination.
2. Children who gave informed consent signed by parents/ guardians

Exclusion criteria

1. Anganwadi which don't give permission for study.
2. Children who were unwilling/unable to participate.
3. Children with special health care needs/ mentally challenged children
4. Children who were absent on the day of examination.

Study Tool

A pre designed and pre tested performa was used to record information about demographic data, anthropometric measurements, and Dental caries.

Examination Procedure

Prior training and calibration of the examiner for examination was carried out in the department of public health dentistry at Rajasthan Dental College and Hospital Jaipur Rajasthan. All measurements were done by a single investigator to avoid interobserver error. For all children, anthropometric measurements such as body weight, height, and mid-upper arm circumference (MUAC) were measured followed by dental caries examination. Children were weighed using a portable standard glass electronic digital scale (HesleyInc, China) in kilograms to the nearest 100 g, without footwear and minimal clothing. (Figure1)

Figure 1 : Measurement of height

Figure 2 : Measurement of weight

Care was taken to ensure that the children did not lean forward or take support which could alter the reading (14). A vertical nonstretchable tape was fixed on the wall and was used as a measuring scale (15). For measurement of height, children were made to stand without footwear, keeping their heels together and with the shoulder, buttocks, and heels touching the vertical support. (Figure 2)

The child was made to look straight so that the Frankfort plane was parallel to the floor. The height was measured to the nearest 1 cm by keeping the scale parallel to the floor at the highest point of the vertex. Body mass index (BMI) was calculated dividing the individual child weight in kilograms by his/her height in square meter (14).Based on BMI value, children were categorized as:<18.5 (underweight), 18.5-24.9 (normal),25-29.9 (overweight) and >30 as (obese).

The BMI value obtained was plotted on age- and gender-specific charts from the Centers for Disease Control and Prevention 2000(15).Based on these percentile curves, the children were grouped as underweight, normal, risk of

overweight, and overweight (16). The device used for the measurement of MUAC of children was the MUAC tape (Ibis Medical Equipment and Systems Pvt Ltd., India) (Figure 3).

Figure 3: Measurement of mid-upper arm circumference Figure 4 : Oral examination to calculate def score

It is a colored, plastic insertion tape (incapable of stretching and unresponsive to temperatures) marked in centimeters, with cutoff points at 11.5 cm from red to yellow and at 12.5 cm from yellow to green. The measurement was taken midway between the tip of acromion and the olecranon process with the child keeping the hand in a relaxed position. The tape was placed gently but firmly around the arm to avoid compression of soft tissue. Measurement was taken to the nearest 0.1 cm (15). Based on MUAC, the children were categorized as:Undernourished (<11.5 cm, Red), Borderline (11.5-12.5 cm, Yellow), Normal (>12.5 cm, Green)

Examination of oral cavity

Oral examination was carried out with the child sitting in an upright position under good natural daylight. Sterile mouth mirror and CPI probe was used for examination of each child. Dental caries were recorded according to the WHO criteria (17).(Figure 4)

Data Analysis

Data obtained were subjected to statistical analysis using student t-test and chi- square test. Significance was considered at $P \leq 0.05$. Data were analyzed using Statistical Package for the Social Sciences(SPSS) software 22.0.

Results

The present cross sectional study assess the association between malnutrition and dental caries among children going to Anganwadis of Jaipur city. Among total study subjects (100), 56 (56%) were male children and 44 (44%) were female children. The age of children ranged from 36-72 months. Most of the subjects 37 (37%) were between the age of 36-54 months. Majority of them belonged to nuclear families 46 (46%) andnearly 36 (36%) of them belonged to BPL category. (Table 1)

Table1: Sociodemographic characteristics of study population

Age in months	**Frequency (%)**
36-45	37 (37%)
45-54	34 (34%)
54-63	28 (28%)
63-72	1 (1%)
Gender	**Frequency (%)**
Male	56 (56%)
Female	44 (44%)
BPL	**Frequency (%)**
Yes	36 (36%)
No	64 (64%)
MaritalStatus	**Frequency (%)**
Living together	90 (90%)
Divorced	10 (10%)
Family Size	**Frequency (%)**
<4	46 (46%)
4-7	38 (38%)
>7	16 (16%)

On surveying about educational and occupational status of parents, most of the children's father were educated till high school 30 (30%) or diploma holders 27 (27%) They were either involved in craft and related trade work 27 (27%) or skilled agricultural and fishery work 27 (27%) Majority of mothers were educated only till middle school 35 (35%) and were unemployed 39 (39%). (Table 2)

Table2:Distribution of study population according to education and occupation of their parents.

Education and Occupation of Parents	
Father's Education	**Frequency (%)**
Illiterate	1 (1%)
Primary School Certificate	15 (15%)
Middle School Certificate	22 (22%)
High School Certificate	30 (30%)
Intermediate or Diploma	27 (27%)
Graduate	5 (5%)
Mother's Education	**Frequency (%)**
Illiterate	13 (13%)
Primary School Certificate	21 (21%)
Middle School Certificate	35 (35%)
High School Certificate	22 (22%)
Intermediate or Diploma	7 (7%)
Graduate	2 (2%)
Father's Occupation	**Frequency (%)**
Unemployed	1 (1%)
Elementary Occupation	18 (18%)
Plant & Machine Operators and Assemblers	21 (21%)
Craft and Related trade workers	27 (27%)
Skilled agricultural and fishery workers	27 (27%)
Skilled workers and Shop & Market Sales Workers	6 (6%)
Mother's Occupation	**Frequency (%)**
Unemployed	39 (39%)
Elementary Occupation	24 (24%)
Plant & Machine Operators and Assemblers	24 (24%)
Craft and Related trade workers	8 (8%)
Skilled agricultural and fishery workers	5 (5%)

Table 3 shows distribution of population according to BMI status. Most of the children were found to be underweight 60 (60%) and belonged to 36-45 months of age group. Males were affected with malnutrition 37 (61.7%) more than females 23 (38.3%) It was seen that onset of malnutrition gradually decreased with increase in age. There was significant association seen between BMI and age of children(p value 0.00) whereas non-significant association was seen between BMI and gender of children (p value 0.4).

Table 3: Distribution of study population according to BMI.

BMI category	**Underweight**	**Normal**	**Overweight**	**Obese**	**Chi square**	**df**	**P value**
No. of children, n(%)	60 (60%)	37(37%)	2 (2%)	1(1%)			
Age							
36-45 months	23(38.3%)	14 (37.8%)	0 (0%)	0 (0%)	105.9	9	0.0
45-54 months	20(33.3%)	14 (37.8%)	0 (0%)	0 (0%)			
54-63 months	17 (28.3%)	9 (24.3%)	2(100%)	0 (0%)			
63-72 months	0 (0%)	0 (0%)	0 (0%)	1(100%)			
Gender							
Males	37 (61.7%)	18 (48.6%)	1 (50%)	0 (0%)	2.85	3	0.40
Females	23 (38.3%)	19 (51.4%)	1 (50%)	1(100%)			

Table 4 depicts distribution of children on the basis of age and gender according to MUAC which indicates non-significant association. Maximum number of children were falling under borderline category 54 (54%), 41 (41%) of children were undernourished and only 5(5%) were normal. Majority of undernourished children 18 (48.6%) belonged to 36-45 months age group and number was decreased with increase in age. Out of 41 (41%) undernourished, majority 26 (46.4%) were males and 15 (34.1%) were females. There was almost equal distribution of males 29 (51.8%) and females 25 (56.8%) in borderline category with only 1 (1.8%) males and 4 (9.1%) females falling into normal category. However non-significant association was found between MUAC, age of children (p value 1.60) and gender (p value 0.16).

Table 4: Distribution of study population according to MUAC.

MUAC category	Undernourished	Borderline	Normal	Chi square	df	P value
Number of children, n(%)	41(41%)	54(54%)	5(5%)			
Age						
36-45 months	18(48.6%)	18(48.6%)	1(2.7%)	3.66	2	1.60
45-54 months	13(38.2%)	20(58.8%)	1 (2.9%)			
54-63 months	10(35.7%)	16(57.1%)	2 (7.1%)			
63-72 months	0 (0.0%)	0 (0%)	1(100%)			
Gender						
Males	26(46.4%)	29(51.8%)	1 (1.8%)	3.66	2	0.16
Females	15(34.1%)	25(56.8%)	4(9.1%)			

Table 5 depicts distribution of study population according to def score. Majority of children 93 (93%) were at low caries risk (def<4) and 35 (37.6%) belonged to age group of 36-45 months. Only 6 (6%) children had def score between 5-9 and were at moderate risk of caries. However, non-significant (p value 0.83) association was found between def score and age of children. Out of 56 (56%) males, 53 (57%) males had low caries risk (def<4) while among 44 (44%) females, 40 (43%) had low caries risk and 3 (50%) had moderate caries risk. Association of def score with gender of children was found to be significant (p value 0.04).

Table 5: Distribution of study population according to def score

def category	Low caries risk	Moderate caries risk	High caries risk	Chi square	df	P value
def score						
Number of children, n (%)	93(93%)	6(6%)	1(1%)	2.77	6	0.83
36-45 months	35(37.6%)	2(33.3%)	0 (0%)			
45-54 months	32(34.4%)	2(33.3%)	0 (0%)			
54-63 months	25(26.9%)	2(33.3%)	1(100%)			
63-72 months	1(1.1%)	0 (0%)	0(0%)			
Gender						
Males	53(57%)	3 (50%)	0 (0%)	1.39	2	0.04
Females	40(43%)	3(50%)	1(100%)			

def: d = decayed, e = extracted due to caries, f = filled, n: frequency, %: percentage

Table 6 depicts association of def score with BMI and MUAC which indicates significant association between BMI and def score. Maximum number of children in underweight category 56 (60.2%) were at low risk of caries, 50% of children under normal and underweight category were at moderate risk of caries. All children (100%) under obese category were at high risk of caries. However non-significant (p value 3.85) association was found

between MUAC and def score, more than half number of children under borderline category (54.8%) had low caries risk, 33.3% of children under undernourished group had moderate caries risk and children under normal category were highest caries risk group.

Table 6 - Association of def score with BMI and MUAC

def score	Low risk	Moderate risk	High risk	Chi square	df	P value
BMI						
Underweight	57(60.2%)	3(50%)	0(0.0%)	1.24	6	0.03
Normal	34(36.6%)	3(50%)	0 (0%)			
Overweight	2 (2.2%)	0 (0%)	0 (0%)			
Obese	0 (0.0%)	0 (0%)	2(100%)			
MUAC						
Undernourished	38(40.9%)	2(33.3%)	0(0%)	3.28	4	3.85
Borderline	51(54.8%)	3 (50%)	0 (0%)			
Normal	4 (4.3%)	1(16.7%)	1(100%)			

Significant (p value= 0.00) association was found among BMI and dental caries with maximum mean of (1.08±0.37) was found among obese. However non-significant (p value- 0.38) association was found among MUAC and dental caries with maximum mean of 1.83±0.75 at borderline value. (Table 7)

Table 7: Association of dental caries with BMI and MUAC

BMI	Dental caries	MUAC	Dental caries
Underweight	1.00±0.00	Undernourished	1.63 ± 5.6
Normal	1.00±0.00	Borderline	1.83 ± 0.75
Overweight	1.08 ± 0.33	Normal	1.00 ± 0.38
Obese	1.08±0.277		
p value	0.00	P value	0.38

Discussion

The Government of India launched the ICDS programme to combat undernourishment and poor health in children under the age of six, as well as in expectant and nursing mothers. Through ICDCs, these initiatives are carried out in India's rural areas (anganwadi). It has expanded through time to become one of the world's largest integrated family and community welfare programmes. The Indian government has pledged to make this programme widely accessible due to its success over the past few decades (18). The extensive ICDS network is crucial in the fight against malnutrition, especially for children from disadvantaged communities (19).

According to this study, out of 100 Anganwadi children, 56were males and 44 were females. The ratio of males to females was 1.2:1; it was similar to the study conducted by Gupta et al., where the ratio of males to females was 1.14:1 (20).

Some studies have shown that BMI is one of the best methods to assess malnutrition as compare to MUAC (21-23).But calculating BMI requires a youngster to stand unaided, a measurement device, and mathematical calculations. In contrast, measuring MUAC is less complex, easier, and expensive than measuring BMI, and it also requires less technical knowledge.Thus, some studieshas considered MUAC as a more convenient tool for the assessment of nutritional status (24).In the present study, assessment of nutritional status by BMI showed 60% of children to be underweight, whereas assessment by MUAC showed 41% of children to be undernourished. Hence, in our study BMI was found to be more sensitive and accurate than MUAC.

The prevalence of underweight children in our study decreased with age. The highest number of underweight was found in the age group of 36-45 months and lowest in the older age group.This decrease in number of underweight

children seen with age can be due to programs and schemes launched by ICDS to curb malnutrition especially for children belonging to low socio-economic groups.Similarly, study conducted by Ray et al. reported that the prevalence of malnutrition was highest (74.19%) in the age group 12-23 months followed by 66.18% in the age group 24-35 months and 60.47% in the age group 36-59 months (25).

In the present study, there was difference in the nutritional status between male and female children with males having more predilections towards malnutrition.Thakur MS et al also observed higher prevalence of under nutrition among male children (26).This difference in the prevalence can be due to different geographical area, different food habits, and different sociocultural factors. However, other studies have reported higher prevalence of malnutrition in female children (27,28).It is commonly seen that in the rural areas, preference is still given to a male child. In spite of various schemes in favour of the girl child, most families consider a male child to be more important. The likelihood that female children would experience malnutrition rises when male children receive better food and healthcare services.

In the present study, 60% of the children were underweight, 37% of children were normal and 3% of the children were overweight/obese. It can be seen that there is wide variations in the prevalence of malnutrition. This can be attributed to variations in availability of food items, illiteracy rate, poverty, access to medical facilities and time period of data collection. This statement is supplemented by the work of Gulati on child malnutrition (29).

The present study shows inverse relationship of dental caries with malnutrition, which is contrary to a study done by Fawaz where there was a positive relationship of dental caries with BMI for age (9). In contrast, a crosssectional study of Iranian children showed no association between weight, height and dental caries (10). A possible explanation is that although both obesity and dental caries are often attributed to the high intake of carbohydrates and sugar, the true etiology of this disease is much more complex and multifactorial (30,31).

In the present study, we observed a significant association between overweight and dental caries which is consistent with the previous studies (32-34).On the contrary, studies on US children have shown that children who were overweight were less likely to have dental caries than normal weight counterparts (35).Reason could be more focus on preventive procedures in developed countries as compare to developing countries. However a systematic review has highlighted the inverse relationship between dental caries and BMI in developing countries (36).

Similarly, a substantial correlation between dental caries and underweight children was found in the current study. Boys often weigh more, have more muscle mass, and have delayed growth at birth. Therefore, it would be reasonable to assume that at birth, boys would require more nutrition and have lower caloric reserves than girls. The results of the current study make it clear how much nutrition affects oral health. Children who are underweight are less likely to develop dental caries because of their diet. (37).

Conclusion

Due to constraints of time, cost and facility, the present cross-sectional study was restricted to clinical examination and anthropometric measurements. Further longitudinal studies on nutritional status and oral health of children need to be carried out. Motivation of ICDC workers is essential for educating mothers on the relationship between nutrition and oral health. Oral health education for mothers should include feeding and dietary practices. Establishment of dental home is important in these areas to meet the oral health care needs of these children.

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