

Oral Health and Nutritional Status of Children Dwelling in Urban and Suburban Areas

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ABSTRACT

Background: Literature has suggested that there is evidence regarding the impact of nutritional status on the overall oral health of children and adolescents. The study objectives were to investigate oral health and nutritional status in children in terms of dietary intake, and to determine the anthropometric measures and correlate the oral health & nutritional status in urban and sub-urban children.

Methods: An analytical cross-sectional study was conducted from September 2022 to March 2023. Total 267 children from Urban and sub-urban regions age 12-18 years were included using the convenience sampling technique. Urban data was collected from Dow University's dental OPD and private schools in Karachi, while suburban data was gathered from Long Khoso village near Hyderabad. Non-clinical data as well as clinical data which included oral examinations like dental caries status, oral hygiene status, periodontal condition, fluorosis malocclusion, and anthropometric measurements were gathered. SPSS v.21 was used to analyze data. Chi-square and correlation were applied between oral health status and anthropometric measurements. P-value ≤ 0.05 was considered statistically significant.

Results: Area of residence was found to be significantly associated with habits, milk intake, oral hygiene practices, dental caries, and oral hygiene index (p-value < 0.001). A significant relationship was found between the area of residence and height (p-value 0.001). It was seen that anthropometric scores were low in suburban children.

Conclusion: This study highlights a positive oral health status among all, with a high prevalence of healthy periodontal tissue and low caries severity reported in Urban as compared to suburban children.

Keywords: Oral Health, Nutritional Status, Sub-Urban, Urban, Children.

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INTRODUCTION

The oral cavity, a complex ecosystem integral to overall well-being, reflects an individual's general health and nutritional status. Children, particularly in their developmental years, are vulnerable to oral health issues that can considerably influence their quality of life. While considerable progress has been made in improving global oral health, disparities persist between different populations, often influenced by socioeconomic factors and living environments¹.

Literature has suggested that there are evidence regarding the impact of nutritional status on the overall oral health of children and adolescents. According to the UNICEF, one of the most important direct predictors of children's nutritional health is inadequate food intake². Globalization and urbanisation have resulted in a transition to a more nutritious diet in low and intermediate-income countries^{2,3}. Geomapping studies have shown that the spatial distribution of public oral health facilities is often skewed, leaving slum areas underserved and impaired growth in children. Changes in growth all over world have been measured by anthropometry taken as an important indicator of child's growth and development. It involves measurements and proportions of human body. Anthropometric measurements like measurement of height and weight are prime indicators of acute and chronic malnutrition and can be used as a proxy for a child's nutritional and growth status whereas, dental caries status, fluorosis status, periodontal health, and oral hygiene are the indicators of individual oral health^{4,5}. The environment in which children grow has an impact on their health^{6,7,8,9}. Unfortunately, insufficient attention has been given to the oral health of those residing in urban and sub-urban areas in developing countries^{10,11}.

Untreated caries can negatively impact child development through two main pathways. First, pain and inflammation hinder proper eating, leading to undernutrition¹². Second, caries disrupts hormonal and metabolic processes, further contributing to growth and developmental issues¹³.

A recent study discovered that children facing nutritional transitions may experience increased ECC, mouth discomfort, and malnutrition⁷. Another study identified a strong negative link between ECC and children^{1,14}. The findings of another study indicated that the children had a mean DMFT score of 4.57, with a range of sufficient, mild, moderate, and severe¹⁵.

In the light of above evidence, the study objectives were to investigate the oral health of children specifically examining the prevalence and severity of dental caries and periodontal disease, to investi-

gate nutritional status in children in terms of dietary intake and anthropometric measures, and to correlate the oral health & nutritional status in urban and suburban children with low to middle socioeconomic background.

METHODS

Ethical approval was obtained from the Institutional Review Board of the Dow University of Health Sciences IRB-2590/DUHS/Approval/2022/933. An analytical cross-sectional study was conducted from September 2022 - March 2023 with a six-month data collection period. The sample size was calculated by OpenEpi sample size calculator. A minimum sample of 222 has been calculated on the basis of 89.7% underweight school children with high dental caries, at 95% confidence interval, 5% margin of error⁵. The sample was increased to 267. Convenience sampling was used for the recruitment of participants. The study setting was differentiated on Urban population data which was gathered from dental OPD of Dow University of Health Sciences Karachi, as well as private primary schools located in district Malir of Karachi. For the Suburban population data was gathered from Long Khoso village (Located in the periphery of Hyderabad). Both populations belonged to a low to middle socio-economic background. A self-administered structured questionnaire was administered which was validated using Cronbach alpha ($\alpha = 0.80$). The inclusion criteria for the study were all children between 12-18 years of age, permanent dentition of both genders was assessed and Consent from parents was taken. Children not willing to participate or absent on the day of examination were excluded from the study. Data collection proceeded after choosing volunteers for the research and gaining informed consent. Both study participants and schools were selected using a convenience sampling technique. Oral examinations as well as anthropometric measurements were performed by the principal investigator. All examinations were performed using WHO criteria for dental examination 2013⁵. All data collected was kept confidential and ownership of data will remain with DUHS. Data was collected as non-clinical data which was gathered in the form of a self-administered structured questionnaire, based on sociodemographic details of participants, frequency of milk intake, and oral hygiene habits and other clinical data which includes oral examinations to assess oral health and anthropometric measurements to assess nutritional status. Oral Health is the state of the mouth, teeth, and orofacial structures that enable individuals to perform essential functions such as eating, breathing, and speaking, and encompasses psychosocial dimensions such as self-confidence, well-being, and the ability to socialize and work without pain, discomfort whereas nutritional status can be measured by anthropometric measures⁵. An anthropometric

examination is based on the measurement of height and weight these are indicators of malnutrition. Height was measured in cm by measuring tape whereas weight was measured in kilograms using the portable electronic weighing machine. Clinical examinations like dental caries status of permanent tooth, oral hygiene status, periodontal condition, fluorosis, and malocclusion were performed. Dental caries was measured using the CAST scoring system, periodontal status was measured using the CPITN index, fluorosis was measured with Dean's fluorosis index, and oral hygiene index was measured using the Oral hygiene index.

Study variables included two types of variables independent variables followed by dental caries score, fluorosis score, and periodontal score, and dependent variables followed by overall height, overall weight, and overall BMI. SPSS v.21 was used for data analysis. The calculation of mean and Standard deviation was for continuous variables.

The calculation of Percentages and Frequencies was for categorical variables. The chi-square test was applied to investigate associations between categorical variables. Independent sample t-test was applied to find mean differences in height and weight of urban and sub-urban population. Correlation was applied between clinical and anthropometric measurements.

RESULTS

In this study, 267 participants were recruited. Table 1 gives the distribution of participants according to area of residence. Overall, there were 113 (92.6%) males with a smaller proportion of females 9 (7.3%) in Urban area, while 45 (31%) males and 100 (69%) females in Suburban areas. Participants' age ranged from 2 to 18 years. Area of residence was found to be significantly associated with gender (p-value <0.001) and socioeconomic status (p-value <0.001).

Table 1: Descriptive Statistics for the Sociodemographic Variables according to area of residence:

Sociodemographic Variables	Area of residence		p-value
	Urban (n=122)	Suburban (n=145)	
Age (years)	10.1±1.2	11.1±1	0.06*
Gender			<0.001**
Male	113(92.6%)	45(31%)	
Female	9(7.3%)	100(69%)	
Socioeconomic Status			<0.001**
Lower	70(57.3%)	81(55.8)	
Middle	52(42.6%)	64(40%)	

**χ²= Chi-Square test (p-value 0.05 for statistical significance)

*Independent sample t-test was applied

Table 2 presents the health profile of the participants according to urban and sub-urban region. There was a statistically significant difference found for intra-oral lesions between urban and suburban areas (p-value = 0.001)

Table 2: Health Profile of Participants: Medical Conditions, Oral Health Status, and Disability according to area

Health Profile of Participants:	Area of residence		p-value
	Urban (n=122)	Suburban (n=145)	
Medical conditions			
Yes	2(1.63%)	0	0.294
No	120(98.3%)	145(100%)	
Intra Oral Lesions			
Yes	23(18.9%)	1(0.7%)	0.001
No	99(81.1%)	144(99.3%)	
Any disability			
Yes	0 (0%)	1 (0.7%)	0.543
No	122(100%)	144(99.3%)	

$\chi^2 = \text{Chi-Square test}$ (p -value 0.05 for statistical significance)

Overall a small percentage 18(6.7%) of participants exhibited parafunctional habits. The majority of participants consumed milk, with powder/packet milk without sugar being the most prevalent 103(38.6%), followed by powder/packet milk with sugar 72(27.0%). Over half of the participants 140(52.4%) reported brushing with toothpaste, while a notable proportion 36(13.5%) brushed without toothpaste (Table 3) shows the Distribution of habits according to the area. Area of residence was found to be significantly associated with consumption of pan, chalia, gutka, milk intake, and oral hygiene practices ($p < 0.001$). Approximately 18(12.4%) of the suburban population consumed pan, chalia gutka, and more intake of powdered milk with sugar was reported in urban population 71(49%). It was also found that 113(92.6%) urban population had better oral hygiene practices.

Table 3: Distribution of Habits Among Participants according to area

Habits	Area of residence		p-value
	Urban (n=122)	Suburban (n=145)	
Pan, chalia, Gutka			
Yes		18(12.4)	<0.001
No	0(0%) 122(100)	127(87.6%)	
Milk Intake			
Cattle milk with sugar	6(4.9%)	29(20%)	<0.001
Cattle milk without sugar			
Powder/packet milk with sugar	8(6.6%)	2(1.4%)	
Powder/packet milk without sugar			
No	71(49%)	1(0.8%)	
	103(84.4%)	0(0%)	
	4(8.3%)	43(29.7%)	
Oral Hygiene Practices			
Toothbrush with paste	113(92.6%)	3(2.1%)	<0.001
Toothbrush without paste			
Tooth powder			
Miswak	6(4.9%)	12(8.3%)	
Nothing			
	3(2.4%)	103(71%)	
	0(0%)	0(0%)	
	0(0%)	0(0%)	

X²= Chi -Square test (p -value 0.05 for statistical significance)

Table 4 presents a comprehensive overview of the oral health status of the participants, encompassing tooth condition, oral hygiene, periodontal health, fluorosis, and malocclusion. The majority of participants 166(62.2%) exhibited sound tooth structure. However, a notable proportion showed signs of dental caries, ranging from distinct visual changes in enamel 40(15.0%) to involvement of the pulp chamber 34(12.7%). Assessment of oral hygiene revealed that 118(44.2%) of participants demonstrated good oral hygiene. The vast majority of participants 258(96.6%) presented with healthy periodontal tissues. A significant association was found between the area of residence, dental caries status (p= 0.001), oral hygiene status (p= 0.001), and malocclusion (p= 0.002). Participants from urban areas showed more sound teeth 112(77.2%), and good oral hygiene 70(48.3%) whereas malocclusion was observed more in suburban participants 13(9%).

Table 4: Comparison of Oral health status between urban and suburban area

(Parameters of Oral Health status)	Area of residence		Total (n=267)	p-value
	Urban (n=122)	Suburban (n=145)		
Dental Caries Status				
Sound	112(77.2%)	54(44.3%)	166 (62.2)	0.001
Sealed				
Restored with no caries	0	2(1.4%)	2 (0.7)	
Distinct visual change in enamel	2(1.6%)	4(2.8%)	6 (2.2)	
Internal caries-related discoloration in dentine	29 (23.8%)	11(7.8%)	40 (15)	
Distinct cavitation in dentine but no pulp involvement	2 (1.6%)	5(3.4%)	7 (2.6)	
Involvement of pulp chamber				
Tooth removed due to caries	5(4.1%)	5(3.4%)	10 (3.7)	
	29(23.8%)	5(3.4%)	34 (12.7)	
	1(0.8%)	1(0.7%)	2 (0.8)	
Oral Hygiene Index				
Good				0.001
Fair	70(48.3)	48(39.3%)	118 (44.2)	
Poor	33 (27%)	59(40.7%)	92 (34.5)	
	41 (33.6)	16(11%)	57 (21.3)	

<p>Periodontal Condition</p> <p>Healthy periodontal tissue</p> <p>Bleeding after gentle probing Supra or Sub gingival</p> <p>Calculus or defective margin of filling or crown</p> <p>4mm or 5mm pocket</p>	<p>115(94.3%)</p> <p>6(4.9%)</p> <p>1 (0.8)</p> <p>0(0%)</p>	<p>143(98.6%)</p> <p>1(0.7%)</p> <p>1(0.7%)</p> <p>0(0%)</p>	<p>258 (96.6)</p> <p>7 (2.6)</p> <p>1 (0.4)</p> <p>1 (0.4)</p>	<p>0.083</p>
<p>Loss Of Attachment</p> <p>LA 0-3 (CEJ not visible and CPI score 0-3)</p> <p>LA 6-8 mm</p>	<p>122(100%)</p> <p>0</p>	<p>144(99.3)</p> <p>0</p>	<p>266 (99.6)</p> <p>1 (0.4)</p>	<p>0.543</p>
<p>Fluorosis</p> <p>Normal</p> <p>Questionable</p> <p>Very Mild</p> <p>Mild</p> <p>Moderate</p>	<p>98(80.3%)</p> <p>14 (11.5%)</p> <p>8(6.6%)</p> <p>0</p> <p>2(1.6%)</p>	<p>115(79.3%)</p> <p>6(4.1%)</p> <p>9(6.2%)</p> <p>11(7.6%)</p> <p>4(2.8%)</p>	<p>213 (79.8%)</p> <p>6 (2.2%)</p> <p>23 (8.6%)</p> <p>19 (7.1%)</p> <p>6 (0.02%)</p>	<p>0.105</p>
<p>Malocclusion</p> <p>Present</p> <p>Absent</p>	<p>1(0.8%)</p> <p>121 (99.2%)</p>	<p>13(9%)</p> <p>132(91%)</p>		<p>0.002</p>

X²= Chi-Square test (p-value 0.05 for statistical significance)

Table 5 summarizes the Comparison of nutritional status between urban and suburban areas. Area of residence was found to be significantly associated with height only (p-value =0.001). The score for mean height and weight was higher in urban children as compared to suburban children. Table 6 and 7 give a correlation between oral health status and nutritional status in Urban and suburban children respectively. Weaker correlations were found between oral health and nutritional parameters for both urban and suburban populations for the majority of variables. Whereas a moderate correlation was found between dental caries and weight in suburban children ($r = -0.503$). However, dental caries and nutritional status were inversely related in the case of both urban and suburban populations. A significant association was found between dental caries, height, and weight for suburban children (p-value = 0.009) and (p-value =0.003) respectively. Similarly, oral hygiene status and nutritional status were found significantly associated (p-value 0.001 and 0.002) respectively. Also, fluorosis and nutritional status were found to be significantly associated (p-value 0.001) in suburban children.

Table 5: Comparison of Nutritional Status Between Urban and Suburban Areas

(Parameters of Nutritional status)	Area of residence			p-value
	Urban (n=122)	Suburban (n=145)	Overall (n=267)	
Height (cm) (mean ± SD)	146.37±24.7	136.92±22.22	141.22±23.809	0.001
Weight (kg) (mean ± SD)	39.81±13.0	35.02±14.9	37.19±14.231	0.325

Independent sample t-test was applied

Table 6: Correlation between Oral health status & Nutritional status in Urban areas(n=122)

(Parameters of oral health)	Parameters of Nutritional Status			
	Height		Weight	
	r	p-value	r	p-value
Dental caries	-0.200	0.329	-0.125	0.134
Oral hygiene	-0.107	0.198	-0.049	0.561
Periodontal status	0.110	0.189	-0.073	0.384
Fluorosis	-0.297	0.01	-0.289	0.01
Malocclusion	0.097	0.246	0.106	0.206

r: Spearman's correlation coefficient
p-value 0.05 for statistical significance

Table 7: Correlation between Oral health status & Nutritional status in Suburban areas(n=145)

(Parameters of oral health)	Parameters of Nutritional status			
	Height		Weight	
	<i>r</i>	p-value	<i>r</i>	p-value
Dental caries	-0.503	0.009	-0.271	0.003
Oral hygiene	-0.296	0.001	-0.278	0.002
Periodontal status	-0.125	0.170	-0.177	0.052
Fluorosis	-0.409	0.001	-0.366	0.001
Malocclusion	-0.039	0.669	-0.117	0.198

r: Spearman's correlation coefficient
p-value 0.05 for statistical significance

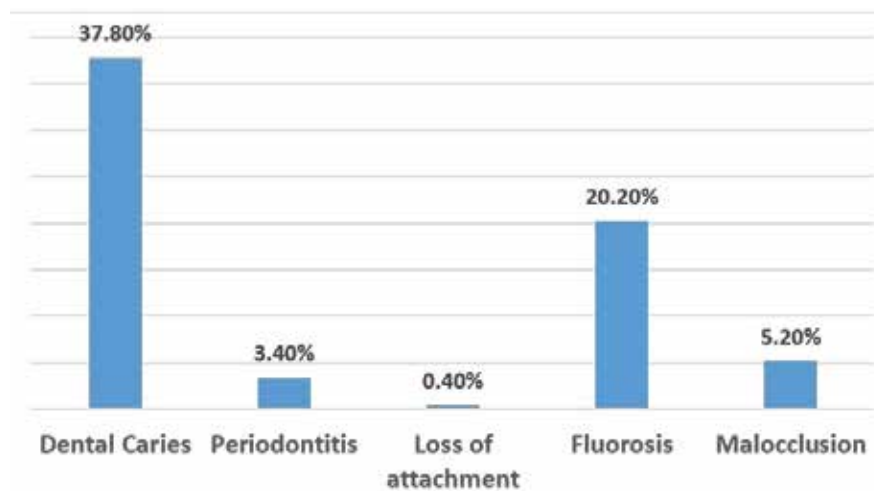


Figure 1: Prevalence of Oral Health Conditions

Figure 1 shows that overall dental caries was found in 37.8% of the participants, followed by fluorosis (26.2%) and malocclusion (5.2%).

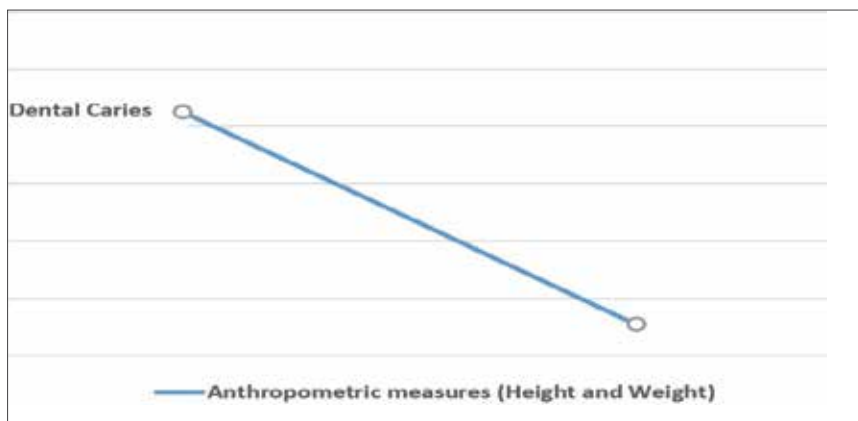


Figure 2: Inverse Relationship between Dental Caries and Anthropometric Measures

Dental caries is inversely related to anthropometric measures as shown in figure 2.

DISCUSSION

This study investigated the oral and nutritional health status of 267 children. Notably, the prevalence of parafunctional habits within our study population was 18(6.7%), contrasting with a significantly higher prevalence of 147(46%) reported among preschool children¹⁶. This discrepancy underscores the potential influence of factors such as age, cultural practices, and geographical location on the prevalence of parafunctional habits.

A significant portion of participants 103(38.6%) reported consuming powder/packet milk without sugar, while 72(27%) consumed it with sugar. These findings are noteworthy given the American Heart Association's recommendation of less than 25g of added sugar daily for children aged 2–18^{17,18}. Oral hygiene practices varied considerably within the study population. These findings highlight a critical area for intervention, as inadequate oral hygiene is a major risk factor for dental caries and other oral diseases^{19,20}.

Examination of intraoral health status revealed a 24(9%) prevalence of intraoral lesions within our study population. This finding contrasts with a lower prevalence of 11(1.8%) as reported in a study²¹. Geographical variations in oral hygiene practices, dietary habits, and access to dental care likely contribute to these observed differences in intraoral lesion prevalence^{22,23}. Assessment of overall oral hygiene status revealed that 118(44.2%) of participants exhibited good oral hygiene, while 92(34.5%) and 57(21.3%) demonstrated fair and poor oral hygiene, respectively. Comparatively, a study reported a higher prevalence of good oral hygiene 350(81.7%). This discrepancy underscores the importance of considering cultural and socioeconomic factors that influence oral hygiene. This study examined the prevalence of dental caries across various stages of carious lesion development revealing a substantial burden of oral conditions, including the prevalence of caries as 100(37.8%). A statistically significant inverse relationship was found between dental caries and nutritional status in this study. Comparatively, a study reported a higher overall caries prevalence of 250(65.3%) among children aged 5-15 years. This discrepancy highlights the influence of geographical and socioeconomic factors on caries prevalence^{22,24}. The findings of this study, coupled with the alarming statistics from 2019^{25,26}.

This study provides valuable insights into the oral health status of participants from dental schools, primary schools, and a village setting. The high prevalence of healthy periodontal tissue 258 (96.6%) is encouraging. Comparing these findings to global periodontal disease prevalence rates (20-50%)²⁷. A Moroccan study emphasizes the varied nature of

oral health influenced by factors like access to care and oral hygiene practices²⁸. Fluorosis prevalence (ranging from questionable to moderate) underscores the need for balanced fluoride intake. While fluoride is crucial for dental health, excessive exposure can lead to fluorosis. This study's findings align with a reported 14.5% fluorosis prevalence, emphasizing the global relevance of this issue²². Malocclusion prevalence 14(5.2%) is relatively low compared to a Nigerian study reporting 15.2% in males and 11.6% in females. This variation could be attributed to genetic, environmental, and dietary factors²⁹.

The study acknowledges its limited sample size, potentially impacting the generalizability of findings. However, it effectively highlights the interconnectedness of oral health, diet, and nutrition. Promoting good oral hygiene, consuming a nutritious diet, and ensuring access to fluoridated water are crucial steps towards improving overall oral health.

CONCLUSION

This study highlights a generally positive oral health status among all participants regardless of residing in urban or suburban locations, with a high prevalence of healthy periodontal tissue and low caries severity reported in Urban children and low anthropometric outcomes in Suburban children. However, the presence of periodontal issues, fluorosis, and malocclusion, even at low percentages, underscores the need for continued oral health promotion, emphasizing good oral hygiene, balanced fluoride intake, and nutritious diets.

DECLARATIONS

Not applicable

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I would like to acknowledge the teachers and administration of the schools who allowed data collection

CONFLICT OF INTEREST

All authors declare no conflict of interest

ETHICAL APPROVAL

It was obtained from the Institutional Review Board of Dow University of Health Sciences. IRB-2590/DUHS/Approval/2022/933.

FUNDING

It was a self-funded project.

PATIENT CONSENT

Informed consent was obtained from the participants before enrolling in the study

AUTHORS CONTRIBUTION

WA: Had major contribution in writing the manuscript, **MI:** Major contribution in writing the manuscript, **MBB:** Formal Analysis and Editing, **HA:** Major contribution in writing the manuscript, **QAB:** Major contribution in writing the manuscript, **AQ:** Data Collection and Analysis, **NI:** Data Collection and Analysis.

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