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ORIGINAL ARTICLE

Addressing the Climate Change on Oral Health and Caries in Early Childhood

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ABSTRACT

Background: Dental caries is fundamentally a chronic health problem that may be prevented, but recent worldwide estimates indicate that oral health has not improved over the last 25 years. However, environmental change causes dry weather and high alkalinity in ground waters, which promotes fluoride release from mud and fluorite-bearing rocks. High temperatures cause ground waters to have prolonged home seasons, resulting in high fluoride levels in the water from water-rock interactions, even though fluorides in water are beneficial to tooth health and reduce the risk of caries in early childhood. Excessive fluoride exposure can cause severe fluorosis, which increases the risk of caries.

Objective: Research aims to examine how climate change, water accessibility, and diet affect ECC.

Methods: A descriptive cross-sectional study was conducted at different clinics of Hyderabad city in time frame of three months. Through purposive sampling, 100 children aged 1-5 years, both genders with dental caries, with parents' permission, were included in the present study, whereas children with systemic diseases affecting the oral region were excluded. Data was collected in time period of three months by employing a purposive sampling technique. SPSS version 26.0 was used for data analysis. Chi-square test was applied with a significant level of p-value <0.05.

Results: Children using tap water had significantly higher caries prevalence (43 cases) than those using bottled water (26 cases) ($p < 0.0001$). Water source type did not show a significant association with caries ($p = 0.335$). Similarly, changes in water availability ($p = 0.47$) and fluoride content awareness ($p = 0.465$) were not significantly associated with caries prevalence. However, climate change awareness was significantly associated with caries prevalence, with 66 cases among aware families compared to 3 cases among those unaware ($p = 0.011$)

Conclusion: The present research showed the complexity of the background of early childhood caries and identified numerous environmental factors, oral hygiene practices, and parents' roles in this process.

Keywords: Caries, Childhood, Climate Change, Oral Health

INTRODUCTION

The early childhood caries (ECC) is a highly prevalent public health problem that concerns infants and toddlers with a set of criteria that outline the diagnosis of ECC, such as one or more decayed, missing, or filled surfaces in any primary tooth of a child under six years[1] Research suggests that ECC is present in about 48% of preschool children and occurs differently depending on both socioeconomic and environmental factors[2] The prevalence rates are usually higher than 60% in developing nations, especially in areas where there is poor knowledge regarding oral health and restricted access to dental services[3]

Diet, oral hygiene measures, and early environmental factors combine to determine oral health in infancy. Climate change, mediated by water quality, food availability, and public health infrastructure, has therefore emerged as an influencing factor of oral health[4] For instance, high temperatures accompanied by drought decrease the water supply, and it can be used for both drinking and cleaning teeth. Furthermore, fluctuations in water fluoride concentrations, which are mainly a consequence of changes in the environment, play a vital role in the caries process[5] It has been revealed that adequate Fluoride exposure through water leads to 30% to 35% less dental caries in the affected communities[6]

Other factors associated with ECC include dietary habits like the regular consumption of snack foods and sugar-sweetened beverages[7] In the WHO report issued in 2021, it was gathered that caries in children under five is attributed to more than 80% by excessive intake of sugar[8] However, regarding the parental education level, the results are significant: kids with their parents having a higher level of education showed better oral hygiene and less ECC occurrence[9]

The presented research aims to examine how climate change, water accessibility, and diet affect ECC. It is therefore the intention of the current study to assess demographic, environmental, and lifestyle correlates of ECC, thereby informing preventive strategies for high-risk groups of young children. These results propose the necessity of a public health multifaceted approach regarding the challenges of environmental health as well as oral health management.

Objective: Research aims to examine how climate change, water accessibility, and diet affect ECC.

METHODOLOGY

A descriptive cross-sectional study was conducted at different clinics of Hyderabad city in a time frame of three months from July 2023 to September 2023 by authorization of the research ethics committee of LUMHS (LUMHS/REC/-436). Through the purposive sampling technique, 100 children aged 1-5 years, both genders with dental caries, with parents' permission, were included in the present study, whereas children with systemic diseases affecting the oral region were excluded. The standardized questionnaire was divided into five sections. The first component survey collected the respondents' age and gender, and the parents' or guardians' education level. The second part was related to the frequency of brushing and use of fluoridated toothpaste and past dental treatments for caries. This third part evaluated groups' dietary and lifestyle practices, focusing on the regularity of consumption of sweet snacks and the kind of water consumed at home. The fourth section looked at changes in environmental history when it comes to water exposure, including the type of water available, any changes in water source, and awareness of the content of water with fluoride in the community. The last part focused on the child's medical history and the medical histories of

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dental caries or fluorosis of the family members. Clinical review of subjects was done by a calibrated dentist according to the WHO criteria on caries definition for ECC, assessing decayed, missing, or filled primary tooth surfaces. Data were analyzed using analysis software called SPSS, and the outcome was recorded, summarized by descriptive statistics of most parameters. Cross-tabulation results were used to determine associations between ECC and environmental, dietary, and oral health factors using chi-square tests, while binary logistic regression was used to test independent predictors of ECC at a significance of $p < 0.05$.

RESULTS

The study included 100 children aged 1–5 years with a mean age of 3.01±1.46 years. The sample comprised 55% males and 45% females. Regarding parent/guardian education levels, 32% had higher education, 29% had secondary education, 25% had primary education, and 14% had no formal education. A significant portion of the participants (77%) reported a history of medical or dental health issues, while 70% had a family history of dental caries or fluorosis (Table 1).

In terms of oral health practices, 48% of children brushed their teeth twice daily, 41% brushed once daily, 10% brushed occasionally, and 1% did not brush at all. The majority (87%) used fluoridated toothpaste, 12% did not, and 1% were unsure. Dental treatments for caries were received by 69% of the children, while 31% had no history of such treatments (Table 2).

Table 1: Demographic parameters

Variables	Mean and percentage
Age (years)	3.01±1.46
Gender	
Male	55 (55)
Female	45 (45%)
Parent/Guardian's Education Level	
Higher education	32 (32%)
Secondary	29 (29%)
Primary	25 (25%)
No formal education	14 (14%)
Medical/Dental Health History	77 (77%)
Family History of Caries/Fluorosis	70 (0%)

Table 2: Oral health Variables

Variable	Frequency (%)
Brushing Frequency	
Twice daily	48 (48%)
Once daily	41 (41%)
Occasionally	10 (10%)
Never	1 (1%)
Fluoridated Toothpaste	
Yes	87 (87%)
No	12 (12%)
Don't Know	1 (1%)
Dental Treatments for Caries	
Yes	69 (69%)
No	31 (31%)

Table 3: Lifestyle variables

Variable	Frequency (%)
Sugary Snacks/Drinks	
A few times a week	35 (35%)
Multiple times a day	31 (31%)
once daily	13 (13%)
Rarely/ never	21 (21%)
Water Source	
Tap	52 (52%)
Bottled	48 (48%)
Water Source Type	
Public well	51 (51%)
Private well	29 (29%)
River/lake	20 (20%)
Changes in Water Availability	67 (67%)
Fluoride Content Awareness	84 (84%)
Climate Change Awareness	91 (91%)

Dietary and lifestyle habits revealed that 35% of children consumed sugary snacks or drinks a few times a week, 31% multiple times daily, 13% once daily, and 21% rarely or never. Water consumption patterns showed an even split, with 52% drinking tap water and 48% bottled water. Among water sources, 51% relied on public wells, 29% on private wells, and 20% on rivers or lakes. Changes in water availability were reported by 67% of families, while 84% were aware of fluoride content in their local water supply. Climate change awareness was high, with 91% of families reporting recognition of environmental changes (Table 3).

Caries prevalence was stratified based on lifestyle factors. Children using tap water had significantly higher caries prevalence (43 cases) than those using bottled water (26 cases) ($p < 0.0001$). Water source type did not show a significant association with caries ($p = 0.335$). Similarly, changes in water availability ($p = 0.47$) and fluoride content awareness ($p = 0.465$) were not significantly associated with caries prevalence. However, climate change awareness was significantly associated with caries prevalence, with 66 cases among aware families compared to 3 cases among those unaware ($p = 0.011$) (Table 4).

Table 4: Stratification of carries prevalence based on lifestyle changes

variables	Caries		P value
	Yes	No	
Water type			
Tap	43	9	<0.0001
Bottled	26	22	
Water sources			
Public well	38	13	0.335
Private well	17	12	
River/lake	14	6	
Changes in Water Availability			
Yes	50	17	0.47
No	19	14	
Fluoride Content Awareness			
Yes	58	26	0.465
No	11	5	
Climate Change Awareness			
Yes	66	25	0.011
No	3	6	

DISCUSSION

From the findings of this study, strong relations between environmental variables, parents' education, and the prevalence of ECC can be noted. Most importantly, children who drank tap water had a higher proportion of caries than those who only drank bottled water. This can be evidenced by current debates on the use of tap water; even though the correct fluoride concentrations help deter tooth decay, high concentrations can be risky to individuals' health. An article published in 2022 reiterated that communities that had optimally fluoridated water had, on average, one-quarter dentition rates of cavities than were in non-fluoridated areas[10]

It was also realized that the level of education of parents was an important catalyst towards a child's oral health behaviors. Education of parents and their children also showed a positive relationship with child oral health, with a positive correlation between higher education and better oral habits among the children. A survey conducted in Wuhan in 2020, sampling 8,446 families, shows that parents with higher education levels had a higher level of oral health knowledge, and their children displayed better oral hygiene practices[11]

Interestingly, water source type and changes in water availability, as well as awareness of the fluoride content, did not influence results regarding caries prevalence. This implies that although the environmental factors seem to be important, the behaviours of children and parents might be more determinative of ECC. This fact raises even more interest when considering the close relationship between the surveyed individuals' climate change awareness and their caries rates. The ECC incidence was higher among families who reported awareness of climate change, though in this case, it is equally probable that the awareness also

raises the degree of health concern, and, therefore, increases detection of the disease[12-13] It might also indicate the mediating influence of other environmental factors on lifestyle behaviours implicated in ECC. These results therefore highlight the complex interendogenous and exogenous antecedent factors that precipitate ECC, such as parenting practices, and child behaviors[14] ECC prevention measures should also encompass a wide range of directives and practices that concern the optimal levels of fluoride in water, parental education on the oral health of children, and the environmental conditions[15]

In 2015, it was predicted that 573 million children did not receive treatment for dental caries in their primary teeth. Two primary teeth that are damaged, missing, or filled in children 71 months (5 years of age) or under are considered to have early childhood caries (ECC). The risk of ECC may also increase with economic development, industrial development, and urbanization, which are associated with increased gas output and ozone depletion[16-18]

Since 1880, the average global temperature has increased by around 1 °C (1.7 °F). By 2050, temperatures are expected to rise by about 1.5 degrees Celsius (2.7 degrees Fahrenheit), with a more significant increase of 2-4 degrees Celsius (3.6-7.2 degrees Fahrenheit) by 2100. This change is noteworthy because of the vast amount of heat energy required to raise the global average yearly surface temperature, even by a little amount, considering the extent and ability of the seas to retain heat. Changes in the environment are also linked to food fragility, which is linked to caries[19-21]

CONCLUSION

The present research showed the complexity of the background of early childhood caries and identified numerous environmental factors, oral hygiene practices, and parents' roles in this process. Intervention of ECC calls for intervention with a combination of single structural, community, and individual interventions, which include: advertisement for appropriate levels of fluoride, increasing education to parents, and reversing climate change indirectly. Such results underscore the importance of global concepts for the organization of public health measures to decrease ECC incidence in high-risk groups.

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