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Research Article

Prevalence of caries in 3-5 year old children using ICDAS and Nyvad's scoring criteria- a retrospective study

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ABSTRACT

INTRODUCTION

Early childhood caries represents a prevalent chronic ailment that impacts young children universally. It exerts a substantial influence on both highly developed and industrialized nations alike. Among preschool-aged children, ECC emerges as a noteworthy public health concern. Epidemiological surveys assume a pivotal role in tracking the prevalence of dental caries and evaluating the dental healthcare requirements within a community.

AIM

The aim of the present study was to elucidate the correlation between the ICDAS and Nvyad's criteria in assessing the prevalence of caries in 3-5 year-old children visiting a private dental institution and those belonging to the Chennai population.

MATERIALS & METHOD

A retrospective study was conducted among patients who sought treatment at the Department of Pedodontics within a private dental college from January 2019 to December 2023. The study involved the assessment of caries prevalence in a sample of 985 participants aged 3-5 years, utilizing the ICDAS scoring system and Nyvad's criteria. Data were organized and tabulated using Microsoft Excel before being entered into IBM SPSS software, version 23, for performing descriptive statistical analyses.

RESULTS AND DISCUSSION

The age group of 4-year-olds displayed the highest prevalence of dental caries, at 41.33%, while the lowest prevalence was observed in the 3-year-old age group, at 26.67%. Dental caries was more prevalent among male children (60.67%) than female children (39.33%). Among the deciduous molars, mandibular molars exhibited the highest caries prevalence, followed by maxillary molars, and then incisors. When comparing the scoring system, there was no significant difference in the number of sound teeth. However, significant differences were observed in cases involving caries affecting enamel, dentin, distinct/active cavity lesions, and pulp involvement. Additionally, there was a significant difference in restored teeth, but no significant difference was noted in the case of missing teeth due to caries.

CONCLUSION

This study reveals a prevalence of 33.36 percent for ECC among children aged 3-5 who visited a private dental institution and those from the Chennai population, utilizing ICDAS and Nyvad's criteria. Given the implications of these findings, it becomes imperative to prioritize the oral health of preschoolers and engage in parental education to prevent and detect ECC effectively.

KEYWORDS: Dental caries, prevalence, Early childhood caries, epidemiology, significant caries index, ICDAS, nyvad’s

INTRODUCTION

"Early childhood caries" [ECC] stands out as a pervasive chronic ailment that has a substantial impact on young children, affecting both well-developed and industrialized nations.(1) Left untreated, ECC, accompanied by pain or toothache, can result in premature loss of primary teeth and disrupt the growth and development of secondary, adult dentition. Additionally, it may lead to dental malocclusion, weight gain, irregular sleeping patterns, and have adverse effects on the quality of life for young children, including their cognitive development.

The prevalence of ECC varies among different populations, but it is particularly pronounced among disadvantaged subpopulations, irrespective of their race, ethnicity, or culture. Dental epidemiological research conducted by Heima et al. indicates that globally, ECC affects one to twelve percent of children under the age of six.(2) In Tamil Nadu, India, as of 2015, the prevalence of ECC was recorded at 15.9%.(3)

In recent years, several approaches for collecting data have been suggested to detect dental caries in both individual and group contexts.(4,5) Among these methods, the International Caries Detection and Assessment System [ICDAS] and the Nyvad Criteria are currently in use. The ICDAS, developed in 2001, provides criteria for assessing both non-cavitated and cavitated caries lesions. These criteria have proven to be reliable and valid in epidemiological studies, offering a valuable tool for caries assessment in recent years.(6)

The Nyvad Criteria is founded on a visual-tactile caries classification system, allowing for the detection of caries lesion severity and activity. Caries are categorized into nine stages, ranging from non-cavitated to cavitated and from sound to active or inactive.(7)

Epidemiological surveys play a pivotal role in monitoring dental caries trends, assessing the dental needs within a community and analysis the treatment cost.(8,9) Consequently, The aim of the present study was to elucidate the correlation between the ICDAS and Nvyad's criteria in assessing the prevalence of caries in 3-5 year-old children visiting a private dental institution and those belonging to the Chennai population.

MATERIALS AND METHOD

A retrospective study was conducted among patients who visited the Department of Paediatric and preventive dentistry at a private dental college between March 2019 and February 2021. Case sheets were meticulously reviewed to determine the prevalence of caries in children aged 3-5 years. A single calibrated examiner assessed the digital case records of patients who sought treatment at the outpatient department of the hospital. The data collected included age, gender, ICDAS score, and Nyvad's criteria for each tooth.

The study included healthy children aged 3-5 years who visited the pediatric dental department. To ensure an unbiased sample, children were selected through a simple randomization process, while those with pre-existing medical conditions and special health care needs were excluded. The prevalence of caries was then evaluated among a total of 985 participants in the 3-5 age group. Data were organized and tabulated using Microsoft Excel and subsequently entered into IBM SPSS software version 23 for analysis. Descriptive statistics were applied, with categorical variables presented in terms of frequency and percentage. The Chi-square test was employed to examine correlations between variables, with a p-value less than 0.05 considered statistically significant.

RESULT

The sample comprised 985 children. Among these, the age group of 4-year-olds exhibited the highest prevalence of dental caries at 41.33%, while the age group of 3-year-olds had the lowest prevalence at 26.67% (shown in Figure 1). Further examination of the data revealed that within the 3-year-old age group, 15.33% were male, and 11.33% were female. In the 4-year-old age group, 26.33% were male, and 16.0% were female, while in the 5-year-old age group, 20.0% were male, and 12.0% were female. The chi-square test was conducted, yielding a P-value of 0.042 [$p < 0.05$], indicating statistical significance (shown in Figure 2)

The distribution of the sample concerning tooth conditions, as per the ICDAS and Nyvad Criteria, is presented in Table 1. There was no statistically significant difference [$p > 0.05$] observed in the percentage of sound teeth recorded using both methods.

We observed a significant prevalence of ICDAS scores among different tooth surfaces. Specifically, ICDAS 0, indicating no visible changes on the tooth surface, was most common in upper molars, accounting for 19.33% of cases. White spot lesions [ICDAS score 1] were present in 4.67% of upper molars. Distinct visual changes in enamel [ICDAS score 2] were identified in 10.67% of lower molars. Localized enamel breakdown without dentin involvement [ICDAS score 3], representing visible changes, was most frequently observed in lower molars, with a prevalence of 5.33%. Underlying dark dentin shadows [ICDAS score 4] were found in 5.67% of lower molars. Distinct cavities with visible dentin [ICDAS score 5] were present in 3.33% of upper molars, while extensive distinct cavities [ICDAS score 6] were observed in 7.33% of lower molars.

Nyvad's criteria have shown an underestimation of caries prevalence when assessing non-cavitated lesions. The chi-square test yielded a P-value of 0.143 [$p > 0.05$], which is not statistically significant. Extensive decay in anterior teeth was observed in 5-year-olds. Statistically significant differences were found in cases involving pulp lesions. Information regarding fillings displayed statistical differences, while the absence of teeth due to caries did not exhibit any significant difference.

DISCUSSION

In contemporary dentistry, the management of carious lesions primarily relies on a non-operative approach, as highlighted by NPT Innes et al. in 2016. Consequently, caries detection criteria that encompass early injuries and non-cavitated lesions prove particularly advantageous, especially when applied in populations with a low prevalence of the disease.

The ICDAS system boasts the highest accuracy and aids clinicians in distinguishing between various stages of dental caries progression. Additionally, ICDAS demonstrates proficiency in assessing non-cavitated lesions.(10,11) Compared to the Nyvad criteria, ICDAS demonstrates significantly higher sensitivity, as indicated by Amid I. Ismail et al. in 2007. An analysis of the ICDAS scores of individual teeth in relation to the children's ages reveals that most children exhibit early stages of dental caries. This suggests that the majority of these children are in the initial phases of dental caries development.(10)

Referring to Figure 1, it is evident that the 4-year-old age group had the highest prevalence of dental caries at 41.33%, whereas the 3-year-old age group exhibited the lowest prevalence at 26.67%. In contrast, a separate study conducted by N. W. Njoroge et al., which investigated the prevalence of caries among 3-5-year-old children in Kiambaa, Kenya, reported that 5-year-olds showed the highest prevalence of dental caries.(12) According to Figure 2, the prevalence of caries was higher in male children [60.67%] compared to female children [39.33%]. This observation aligns with another study by Al Malik et al., which reported a slightly higher prevalence of caries among males compared to females in their diagnosed cases.(13)

The distribution of Early Childhood Caries [ECC] within our study cohort revealed that mandibular deciduous molars had the highest prevalence of caries, with rates of 42.67% and 44.0% on the right and left sides, respectively. Following closely were the maxillary deciduous molars, with rates of 34.00% and 39.33% on the right and left sides, respectively. Maxillary incisors exhibited the next highest prevalence, with rates of 28.67% and 28.0% on the right and left sides, respectively. This finding aligns with prior research conducted by Wyne et al. and Singh et al., Varshini et al., Harini et al., whose studies among preschool children in Saudi Arabia and Marathahalli, Bangalore and chennai respectively, reported similar outcomes.(14) (15–17) It is essential to note that the majority of children with dental decay also exhibited involvement of their anterior teeth, suggesting that, alongside suboptimal oral hygiene, irregular nursing practices, snacking habits may have contributed to the development of caries(18). In individuals at high risk, the Nyvad Criteria method can prove valuable in managing disease activity, aiding clinicians in selecting the most suitable treatment approach. Furthermore, this method can assist in the planning and assessment of population-based preventive programs.

In our current survey, the Nyvad Criteria demonstrated its accuracy in evaluating secondary caries, albeit it appeared to underestimate initial caries lesions. Nyvad's criteria exhibited a high level of precision when assessing secondary caries.

The children underwent examinations for both non-cavitated lesions, including white spot lesions, and cavitated lesions. Our study reports a 33.366% prevalence of dental caries among 3-5-year-old children who visited a private dental institution and those from the Chennai population, employing the ICDAS and nyvad’s criteria. In contrast to Askarizadeh et al., who documented a prevalence of 17.2 percent, this population exhibited a higher prevalence of caries.(19) Another

study conducted in Hubli and Dharwad city among preschool children reported a caries prevalence of 54.1 percent, which is higher in comparison to the prevalence observed in our current study.(20) This could be attributed to the fact that the current study considered early carious lesions, non-cavitated lesions, and secondary caries lesions when making diagnoses.

Interventions aimed at improving the intraoral environment can prevent or halt dental caries. A person's past experience with caries is a significant predictor of future risk, and individuals with a history of high caries levels during childhood are more likely to require complex and costly treatments as adults. Implementing effective early preventive measures can lead to reduced expenses for treating this group, which is prone to caries, in adulthood. The primary objective should be to reduce the overall caries risk within the preschool-age population through population-based prevention efforts.

CONCLUSION

This study reveals a 33.36 percent prevalence of early childhood caries (ECC) among children aged 3-5, encompassing those who visited a private dental institution and those from the Chennai population. We employed the ICDAS scoring system and Nyvad's criteria for this assessment. It's important to note that the classification of caries identification using common methods can be ambiguous. ICDAS comprehensively addresses all progressive stages of caries, while Nyvad’s criteria are particularly useful in evaluating secondary caries.

The findings from this study emphasize the importance of prioritizing the oral health of preschool-aged children and promoting parental education to facilitate prevention and early detection of Early Childhood Caries.

Statements

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Author Contributions:

Dharsan R– Conceptualization, Validation, Formal analysis, Investigation Resourses, data curation, Writing - Original Draft, Project administration.

Dr. Deepa G - Conceptualization, Methodology, Validation, Formal analysis, data curation, Writing - Review & Editing, Visualization, Supervision, Project administration.

Dr. Pooja V.R- Conceptualization, validation, data curation, Writing - Review & Editing, Visualization, Supervision, Project administration.

Data Availability Statement: on email request to the corresponding author.

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figures

Fig 1: Represents the age group of the patients among 3-5 years of age visiting the private dental college with dental caries. X axis represents the age of the children and Y axis represents the prevalence of dental caries.

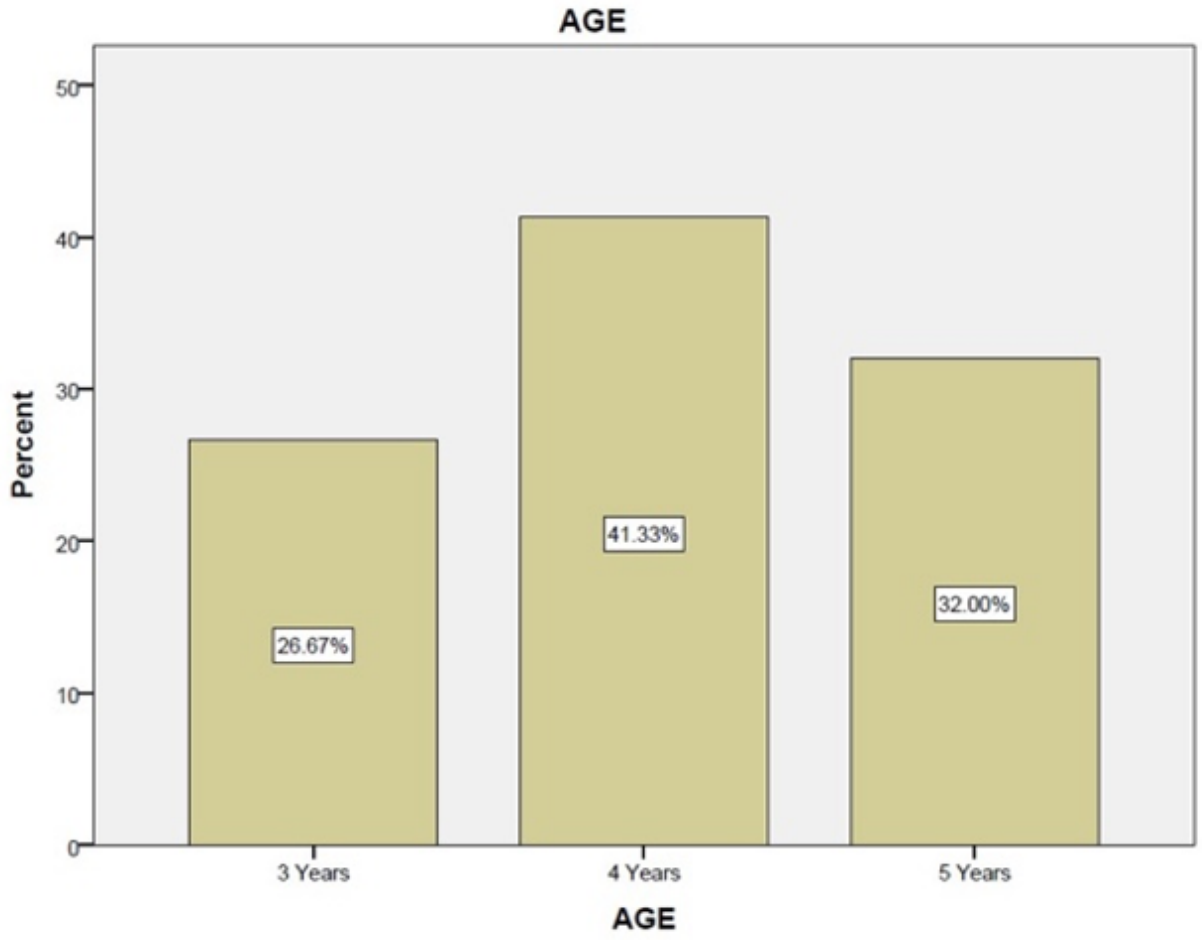
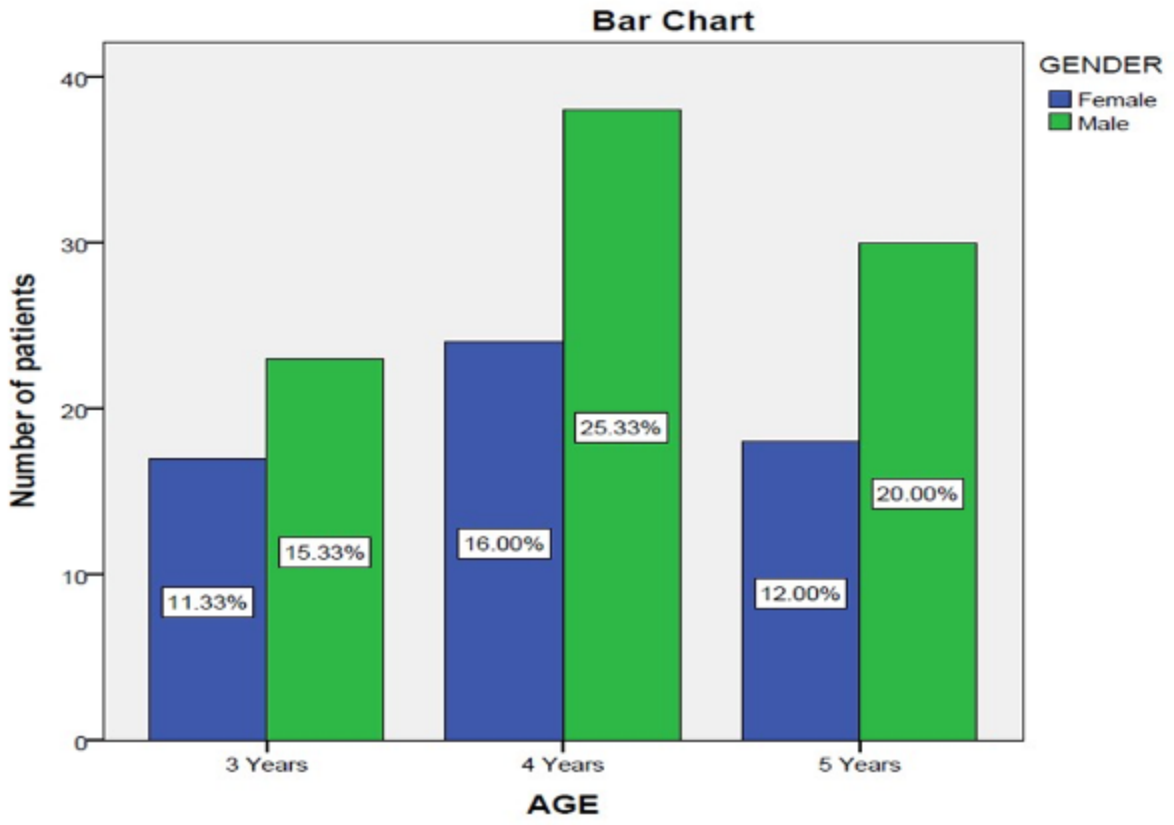


Fig 2: This is a bar graph depicting the difference of gender among various age groups of 3-5 years of children visiting a private dental college.



TOOTH CONDITION	ICDAS			NYVADS P Value			
AGE	3YRS	4YRS	5YRS	3YRS	4YRS		5YRS

	UM	LM	A	UM	LM	A	UM	LM	A	UM	LM	A	UM	LM	A	UM	LM	A
Sound	14	14.6	32.1	19.33	15.33	28.4	18	18.67	15.7	14	14.67	32.1	19.33	15.33	28.4	18	18.67	15.7 0.125
First visual change in enamel / Active caries [intact surface]	3.8	0.6	1.6	4.67	1.33	2.7	2.6	1.33	0.9	2.67	0	1.2	1.23	0.3	2.2	0.8	0	0.5 0.143
Distinct visual change in enamel/ Active caries [surface discontinuity]	3	2.6	1.9	5	10.67	4.1	3.3	2.33	6.1	2	1.33	1.9	5.33	8.0	4.1	3.33	1.8	6.1 0.026
Localized enamel breakdown due to caries with no visible dentin/ Active caries [cavity]	3	2.6	2.6	2	4.67	6.1	4.4	5.33	1.7	2	2.1	1.9	0.67	2.67	4.5	1.2	2	5.8 0.06
Non-cavitated surface with underlying dark shadow from dentin/ Inactive caries [intact surface]	4	3.3	4.3	3.33	1.33	3.2	2.6	5.67	1.1	2	2.67	4.2	2.67	1.0	1.3	0.6	5.0	5.3 0.127

Distinct cavity with visible dentin/ Inactive caries [surface discontinuity]	2.8	0	3.1	3.33	2.67	5.6	0.6	2	7.8	2.0	0	0.7	2.7	1.8	1.5	0.3	1.3	2.1 0.08
Extensive distinct cavity with visible dentin/ Inactive caries [cavity]	6	4	5.1	6	7.33	7.2	7.3	3.33	9.6	4.67	2.67	1.1	5.2	6.67	1.7	6	2.67	2.4 0.012
Filling [sound surface]	-	-	-	-	-	-	-	-	-	2	3.33	4.1	3.2	4.1	3.7	6.5	7.2	5.3 -
Filling + active caries	-	-	-	-	-	-	-	-	-	0	0	0.3	1.1	0.8	1.3	2.3	1.1	2.4 -
Filling + inactive caries	-	-	-	-	-	-	-	-	-	0	0	0.2	2.4	1.1	0.6	2.8	1.1	1.1 -
Extracted because of caries	0.2	0	0.1	0.3	0.4	0.3	0.8	1.1	0.8	0.2	0	0.1	0.3	0.4	0.3	0.8	1.1	0.8 0

Table 1: The distribution of the sample concerning tooth conditions, as per the ICDAS and Nyvad Criteria**.**