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ICDA-S-II index improves early-stage diagnosis of carious lesions among schoolchildren in northern Brazil

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ABSTRACT

The Decayed, Missing and Filled Teeth (DMFT) index is widely used for detecting carious lesions, primarily focusing on established cavities, while the International Caries Detection and Assessment System (ICDA-S-II) is designed to identify incipient lesions. ***Aim:*** *The aim of this cross-sectional study was to assess the diagnostic effectiveness of the DMFT index compared to the ICDA-S-II criteria designed for early-stage carious lesion diagnosis in schoolchildren from Belém (Brazil).* ***Materials and Method:*** *A cohort of 107 twelve-year-old schoolchildren from Belém (Brazil) underwent dental examinations by three calibrated examiners using the DMFT and ICDA-S-II indices. The ICDA-S-II assessment involved prophylaxis, relative isolation, and a standardized drying period. Statistical analyses included ANOVA, chi-squared and G tests.* ***Results:*** *No statistically significant differences were observed among examiners for either the DMFT (p = 0.699) or the ICDA-S-II (p = 1.000) indices. Gender did not influence results (DMFT: p = 0.697; ICDA-S-II: p = 0.310). Caries-free prevalence differed significantly, at 32% according to DMFT and 2.8% according to ICDA-S-II (p<0.001).* ***Conclusions:*** *The DMFT index consistently underestimated carious lesions, whereas the ICDA-S-II index enhanced the identification of incipient potentially reversible lesions. DMFT and ICDAS-II indices have demonstrated their efficacy in cavity detection, with the most significant distinction arising in ICDAS-II in the identification of early-stage carious lesions.*

Keywords: *dental caries - oral diagnosis - epidemiology - cross sectional studies.*

O índice ICDA-S-II aumenta diagnóstico de lesões iniciais de cárie em escolares do norte do Brasil

RESUMO

O índice de Dentes Cariados, Perdidos e Obturados (CPOD) é uma ferramenta amplamente utilizada para detectar lesões cariosas, concentrando-se principalmente em cavidades estabelecidas. No entanto, o Sistema Internacional de Detecção e Avaliação de Cárie (ICDA-S-II) é projetado para identificar lesões incipientes. ***Objetivo:*** *Este estudo transversal tem como objetivo avaliar a eficácia diagnóstica do índice CPOD em comparação com os critérios do ICDA-S II projetados para o diagnóstico de lesões cariosas em estágio inicial em crianças escolares de Belém (Brasil).* ***Materiais e Método:*** *Uma coorte de 107 crianças escolares de doze anos de idade, de Belém (Brasil), foi submetida a exames odontológicos usando os índices CPOD e ICDA-S-II por três examinadores calibrados. A avaliação do ICDA-S-II envolveu profilaxia, isolamento relativo e um período de secagem padronizado. As análises estatísticas incluíram ANOVA, qui-quadrado e testes G.* ***Resultados:*** *Não foram observadas diferenças estatisticamente significativas entre os examinadores usando os índices CPOD (p = 0,699) ou ICDA-S-II (p = 1,000). O gênero não influenciou os resultados (CPOD: p = 0,697; ICDA-S-II: p = 0,310). A prevalência de crianças livres de cárie diferiu significativamente, com CPOD em 32% e ICDA-S-II em 2,8% (p < 0,001).* ***Conclusões:*** *Este estudo revela que o índice CPOD subestima consistentemente as lesões cariosas, enquanto o índice ICDA-S-II, projetado para detecção precoce, melhora a identificação de lesões incipientes, potencialmente reversíveis. Os índices DMFT e ICDAS-II demonstraram sua eficácia na detecção de cáries, com a diferença mais significativa surgindo no ICDAS-II na identificação de lesões cariosas em estágio inicial.*

Palavras-chave: *cárie dentária - diagnóstico oral - epidemiologia - estudos transversais.*

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INTRODUCTION

Dental caries is an important health indicator, and its epidemiology explores the broader aspects of health and disease within a population[1,2]. In addition to providing a comprehensive evaluation of the health status in a population, epidemiological data guide the development of preventive and treatment initiatives in oral healthcare[3,4]. The information gathered can be used to plan effective strategies and track disease trends, ultimately informing the design of appropriate oral healthcare interventions[2,3].

In epidemiological surveys, the Decayed, Missing and Filled Teeth (DMFT) index provides a standardized collective diagnosis of dental caries, and enables swift, straightforward comparisons between studies conducted at different times[4-6]. Recent surveys employing the DMFT index have identified a noteworthy reduction in global prevalence and severity of dental caries in different countries, including Brazil[7,8], where a substantial decline in caries prevalence among 12-year-olds has been reported[8,9]. However, Latin American studies have shown the limitations of the DMFT index for detecting non-cavitated lesions, with research from Colombia, Brazil, Argentina and Venezuela demonstrating that the DMFT index underestimates caries prevalence by failing to account for early-stage lesions, which account for a significant portion of dental caries[10-14].

Previous studies have shown that the decrease in the DMFT index is associated exposure to fluoride from water and toothpaste, focus on oral health education, and improved access to dental services[15,16]. However, this trend should be interpreted with caution because it may not fully reflect the true prevalence of the disease and treatment requirements in the population[17,18]. In Brazil, for instance, dental caries predominantly affects a small segment of the population, leading to disparities among regions, cities, and various demographic groups[8,11,14]. This regional disparity is consistent with findings from other Latin American countries such as Venezuela and Colombia, where socioeconomic factors and access to care contribute to variations in caries prevalence[11,14]. However, with the decline in dental caries prevalence, and progress in caries research, there is a need for an index that can be used to assess pre-cavitated lesions, such as the International Caries Detection and Assessment System (ICDAS-II), the accuracy of which is reported to be comparable to the DMFT[13,19-21].

A limited number of studies compare the DMFT and ICDAS-II indices in Brazil[4,11,13,20,22-27], and because of the importance of identifying lesions in their initial phases, there is a need to evaluate the compatibility between the two indices. This observational cross-sectional investigation was designed to compare caries lesion detection using the DMFT index, which focuses on the decayed component, and the ICDAS-II criteria, in a cohort of schoolchildren from northern Brazil.

MATERIALS AND METHOD

Ethics statement

The study was approved by the Ethics Committee of São Leopoldo Mandic School in Campinas, São Paulo, Brazil (CAAE: 15165913.0.0000.5374). Authorization to conduct the study was granted by the primary schools República de Portugal and Amância Pantoja, affiliated with the Department of Education of Belém (Pará, Brazil). Parents or guardians of the children were provided with detailed information on research aims and procedures and requested to sign an Informed Consent Form. All procedures were carried out in strict accordance with the ethical standards established by the relevant institutional and national committees overseeing human experimentation.

Sample Size

The sample size was determined based on a confidence level of 95%, an absolute sampling error of 10%, a prevalence of caries of 50%, and a non-response rate of 10%. The calculation yielded 107 individuals (BioEstat 5.0 software (Mamirauá Institute in Solimões, Amazonas, Brazil).

Study design

This was an observational cross-sectional study of 107 12-year-olds of both genders, whose DMFT and ICDAS-II indices were evaluated by three examiners. One examiner (DLC) was designated as the "gold standard" examiner due to his specialization in public health, and entrusted with the preliminary screening of participants. The results recorded by the other examiners were subsequently compared to those acquired by the gold standard examiner.

Inclusion and Exclusion Criteria

Eligible participants were children formally enrolled

at municipal schools, whose parents or guardians duly endorsed the consent form. Ineligible were children undergoing orthodontic treatment, or with severe fluorosis, hypoplasia or systemic illness.

Conditions of Examinations and Calibration Training

The examinations and clinical training were conducted in a dental office setup, specially assembled on the school premises exclusively for the research, and equipped with a chair, compressor, cuspidor, saliva ejectors, and an equipment unit with a triple syringe, a stool, and a reflector. Clinical mouth mirrors, clinical tweezers, and a WHO periodontal probe with a 0.5 mm spherical-tipped end were used. The probe was employed for diagnostic purposes without exerting pressure on the dental surface, solely to clarify any uncertainties arising from visual diagnosis. Initial active lesions on smooth surfaces were defined as dental elements presenting as opaque white patches, rough in texture, and lacking luster[28].

Examiner Calibration

The gold standard examiner oversaw the examiner calibration process, which consisted of four stages:

First stage: Theoretical foundation pertaining to DMFT[29,30] and ICDAS-II[20] criteria. Examiners received theoretical materials, instruction on the diagnosis of caries lesions, dental specimens exemplifying incipient and cavitated lesions, and detailed explanations of the codes and criteria for the indices (Tables 1 and 2).

Second Stage: Examination of 10% of the sample

Table 1. DMFT codes and index following WHO classification.

DMFT index		
Code	**Condition**	**Description**
0	Sound	No evidence of caries lesions is present; early disease stages are not considered. The following signs should be categorized as sound: whitish spots, rough spots resistant to CPI probe pressure, grooves and fissures in stained enamel without visible signs of softening, enamel cavities, or softening of walls detectable with the CPI probe, as well as dark, shiny, hard, and fissured areas of enamel on teeth with moderate or severe fluorosis, and lesions resulting from abrasion based on their distribution, history, or tactile/visual examination.
1	Cavitated	A cavitated lesion is when a groove, fissure, or smooth surface exhibits evident cavitation, softened tissue at the base, discoloration of the enamel or wall, or has a temporary restoration (except for glass ionomer). The CPI probe should be used to confirm visual evidence of caries lesions on occlusal, buccal, and lingual surfaces. When in doubt, consider the tooth as sound.
2	Restored with caries	There are one or more restorations, and at the same time, one or more areas have caries. There is no distinction between primary and secondary carious lesions, meaning whether the lesions are or are not in physical association with the restoration(s).
3	Restored and caries-free	There are one or more permanent restorations, and there is no presence of primary or recurrent carious lesions. A tooth with a crown placed due to a carious lesion falls into this category. If the crown results from other causes, such as prosthesis support, it is coded as 7 (H).
4	Lost due to caries	A permanent or deciduous tooth was extracted due to a carious lesion and not for other reasons. This condition is recorded in the box corresponding to the crown. Deciduous teeth: apply only when the individual is in an age group where normal shedding is not a sufficient justification for the absence.
5	Lost for other reasons	Absence is due to orthodontic, periodontal, traumatic, or congenital reasons.
6	Fissure sealant	There is a fissure sealant, or the occlusal fissure has been widened to receive composite. If the tooth has a sealant and is carious, code 1 or B (caries lesion) takes precedence.
7	Bridge or Crown/ Implant Support	Indicates a tooth that is part of a fixed prosthesis. This code is also used for crowns installed for reasons other than carious lesions or for teeth with cosmetic veneers. Extracted teeth replaced by a fixed bridge component are coded in the crown condition box as 4 or 5.
8	Unerupted tooth	When a permanent or deciduous tooth has not yet erupted, consider the eruption timeline. This does not include teeth lost due to congenital problems, trauma, etc.
T	Trauma	Part of the coronal surface has been lost as a result of trauma, and there is no evidence of caries lesion.
9	Excluded tooth	Applied to any permanent tooth that cannot be examined (orthodontic bands, severe hypoplasia, etc.

Table 2. ICDAS-II codes and index following WHO classification.

ICDAS-II index	
Code	**Description**
0	Healthy dental surface: no evidence of caries after prolonged drying (5 s).
1	First visual change in enamel: opacity or discoloration (white or brown) visible in fissures after prolonged drying.
2	Distinct visual change in the enamel when wet; the lesion must be visible when dry.
3	Cavity in enamel (without clinical signs of dentin involvement) visible when wet and after prolonged drying.
4	Shadowing of the underlying dentin.
5	Cavity with visible dentin: visible demineralization with exposed dentin.
6	Extensive cavity (more than half of the surface), with visible dentin exposure.

by all three examiners to address any ambiguous points and reach consensus by discussing clinical findings, diagnostic criteria, codes and how errors were recorded, to achieve an appropriate level of agreement (Kappa > 0.85). After achieving satisfactory performance in the final assessment, clinical training commenced.

Third stage: Examination of 10% of the 107 children by all three examiners. Prior to clinical inspection, the gold standard examiner conducted prophylaxis and used dental floss on each child. During clinical inspection, all teeth were classified using the DMFT and ICDAS-II indices. Following the ICDAS-II criteria manual[31], teeth were initially examined moist, then re-examined after 5 seconds of drying.

Fourth stage: Final discussion of the results, to conclude the exercise. During this stage, emphasis was placed on the need to achieve a high level of agreement before commencing data collection in the field. The clinical data collected were transcribed onto individual forms by a single recorder who had undergone prior training. In the calibration process, inter-examiner agreement among the three examiners was excellent (90.8% to 99.0%), both for DMFT and ICDAS-II (Kappa agreement coefficient 0.80 to 0.96, indicating almost perfect agreement).

Statistical Analysis

The data underwent descriptive statistics, including frequency distributions for categorical variables and calculations of central tendency and variability for quantitative variables. Inter-examiner agreement was assessed using Kappa statistics (k), providing agreement coefficients with a 95% confidence interval. Analysis of Variance (ANOVA) was used to compare DMFT data from different examiners. For categorical variables, the chi-square test was used, with the G-test as an alternative when criteria were not met. Comparisons of observations concerning the presence of caries lesions based on both DMFT and ICDAS-II indices involved the creation of two new variables for each tooth, indicating absence (coded as 0) or presence (coded as 1 or 2 for DMFT and 1 to 6 for ICDAS-II) of caries lesions. This methodology enabled a robust comparison of the two indices using the chi-square test. Median and quartile values of teeth with caries lesions diagnosed using DMFT and ICDAS-II (codes 1 to 6) were subjected to the Wilcoxon test. The statistical analyses were conducted using BioEstat 5.0 software (Mamirauá Institute in Solimões, Amazonas, Brazil) at 5% significance level (α).

RESULTS

Among the 107 participants, 67 (62.6%) were female and 40 (37.4%) were male.

Inter-examiner agreement was excellent (Table 3). Agreement was higher for examinations employing the DMFT index than the ICDAS-II index (Table 3). The component denoting dental decay had the highest prevalence, accounting for 89.4% of cases, followed by filled teeth at 8.4%, and missing teeth at 2.2%. The DMFT index, as observed by the gold standard examiner (#1), was determined to be 2.11 teeth. Examiners 2 and 3 reported DMFT indices of 1.88 and 1.91, respectively (Table 4). There was no statistically significant variance among the observations made by the different examiners (p = 0.69).

DMFT indicated absence of caries in 32.7% of

Table 3. Agreement between the examiners and the gold standard examiner, and Kappa statistics by index used for dental caries detection.

		Examiner 1		Examiner 2		Examiner 3	
Index	**N**	**%**	**k (CI95%)**	**%**	**k (CI95%)**	**%**	**k (CI95%)**
DMFT	107	99.6	0.97 (0.96-0.97)	98.9	0.89 (0.88-0.90)	99.4	0.94 (0.93-0.95)
ICDAS-II	107	97.8	0.94 (0.94-0.95)	93.5	0.85 (0.83-0.86)	95.4	0.89 (0.88-0.90)

Legends: N: sample size; %: agreement; k: Kappa coefficient 95% CI: 95% confidence interval.

Table 4. Mean and proportions relative to DMFT.

		Sound	Decayed		Filled		Missing		DMFT		ANOVA
Examiner	**N**	$\bar{x}$	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	***S***	***p-value***
1	107	23.78	1.88	89.4	0.18	8.4	0.05	2.2	2.11	2.22	
2	107	24.11	1.69	90.0	0.14	7.5	0.05	2.5	1.88	1.94	0.69
3	107	24.02	1.73	90.6	0.13	6.9	0.05	2.5	1.91	2.09	

Legends: N: sample size; $\bar{x}$: mean; %: percentage composition; S: standard deviation.

Table 5. Proportion of individuals with (DMFT ≥ 1) and without caries lesion (DMFT = 0).

	DMFT = 0		DMFT ≥ 1		chi-square
Examiner	**AF**	**%**	**AF**	**%**	**p-value**
1	35	32.7	72	67.3	
2	36	33.6	71	66.4	0.98
3	36	33.6	71	66.4	

Legends: AF: absolute frequency; %: Percentage.

the children when assessed by the gold standard examiner, and 33.6% when assessed by the other examiners (Table 5). The chi-square test showed no statistically significant disparities among the observations recorded by the various examiners (p = 0.98).

For the ICDAS-II index, the predominant condition observed was denoted by code 1, which, when cumulatively considered alongside code 2, accounted for 77.0% of the cases scrutinized by the gold standard examiner. Statistical analysis employing the G-test indicated a consistent level of observation among all three examiners, with a p-value of 1.00 (Table 6).

The gold standard examiner identified 2.8% of children as caries-free according to the ICDAS-II index, while examiner 2 recorded a slightly higher rate at 3.7%. All three examiners observed that a considerable portion of participants (29.9%) had at least one tooth with an incipient lesion lacking cavitation. Cavitated carious lesions were found in at least one tooth in 67.3% of the children examined by the gold standard examiner and examiner 3, while examiner 2 documented a slightly lower percentage of 66.4%. There was no statistically significant discrepancy among the three examiners, as indicated by a p-value of 0.99 (Table 7).

Table 6. Mean and proportion of the components of the ICDAS-II index and of teeth with caries.

			ICDAS-II														
			Code 1		Code 2		Code 3		Code 4		Code 5		Code 6		Σ Code 3-6		G-test
		N	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	**%**	$\bar{x}$	**S**	**P-value**
Examiner	1	107	3.57	40.9	3.15	36.1	1.41	16.2	0.05	0.5	0.37	4.3	0.17	1.9	2.00	2.19	
	2	107	3.15	41.0	2.69	35.0	1.29	16.8	0.05	0.6	0.34	4.4	0.17	2.2	1.85	1.94	1.00
	3	107	3.49	42.4	2.87	34.9	1.29	15.7	0.05	0.6	0.36	4.4	0.17	2.0	1.87	2.05	

Legend: N: sample size. Σ Code 3-6: Sum of teeth coded 3 to 6 according to ICDAS-II. $\bar{x}$: mean. %: percentage. S: standard deviation.

Table 7. Patients according to caries severity using the ICDAS-II index.

		ICDAS-II						
		Without cavity or initial lesion (code 0)		Without cavity and with initial lesion (codes 1 and 2)		With cavity (codes 3, 4, 5, and 6)		G-test
Examiner	N	AF	%	AF	%	AF	%	P-value
1	107	3	2,8	32	29,9	72	67,3	
2	107	4	3,7	32	29,9	71	66,4	0.99
3	107	3	2,8	32	29,9	72	67,3	

Legend: AF: absolute frequency; %: percentage.

The relatively infrequent occurrence (2.8%) of individuals without caries lesions detected by the ICDAS-II index differed significantly ($p < 0.001$) from observations using the DMFT index, where 34.6% were found to be free of caries lesions (Fig. 1A). When the DMFT and ICDAS-II indices were evaluated within the context of caries cavity detection, no significant difference was found ($p = 0.88$) (Fig. 1B).

Median DMFT was 2, with the 1st and 3rd quartiles reported as 0 and 3 teeth, respectively. For the ICDAS-II index (codes 1 to 6), the median number of teeth exhibiting visible lesions was 8, with the 1st and 3rd quartiles reported as 5 and 12 teeth, respectively. Evaluation of these observations showed a statistically significant contrast between ICDAS-II index (codes 1 to 6) and DMFT ($p < 0.001$) (Fig. 1C).

Similarly, for the ICDAS-II index (codes 3 to 6), the median number of teeth with caries cavities was 1, with the 1st and 3rd quartiles reported as 0 and 3 teeth with cavities, respectively. Interestingly, this specific aspect of cavity observations did not yield any significant differences ($p = 0.76$) (Fig. 1D).

DISCUSSION

Dental caries has long been recognized as a global public health concern[1-3], though its prevalence and severity have been reduced by scientific development, increased awareness of the significance of oral health, and improved access to treatment[20,21]. As a result, dental caries indicators have been adapted and made more stringent for epidemiological surveys[20,31]. For instance, a study in Venezuela found that DMFT significantly underestimated the prevalence of non-cavitated lesions, whereas including initial caries lesions in the index increased the DMFT score by 33% in a Venezuelan population[14]. Research from Argentina and Colombia also highlights the importance of detecting non-cavitated lesions, which account for a significant portion of total carious lesions[10,12]. In Brazil, according to the latest census data from 2022, 12-year-old children present a DMFT index of 1.6, which is lower than the value found in our current study[9]. Dental caries is a substantial concern in many countries, some of which report prevalence rates exceeding 50% among 12-year-olds[32-34], and disproportionate impact on socioeconomically disadvantaged populations. In these countries, division, polarization, and significant economic and social disparities exert direct influence on the overall health of the population[35].

According to DMFT, 32.7% of participants were caries-free. The prevalence of dental lesions was higher than in the previous survey conducted in Brazil, which reported that 43.5% of 12-year-old children were free from dental caries[31]. This difference could be attributed to social factors correlated to the causes of the disease, such as family dynamics, workplace environment and economic policies[36]. The DMFT results were compared to ICDAS-II, given its international relevance and widespread utilization in other countries. The current study found similar results using the DMFT and the ICDAS-II indices.

The ICDAS-II index for dental caries lesions (codes 1 to 6) showed that codes 1 and 2 accounted for 77.0% of the cases, highlighting incipient lesions. This is supported by findings by Melgar et al.[23], who reported that non-cavitated lesions accounted for 60% of the total caries burden in young children in Brazil, demonstrating the need for tools like ICDAS to capture the full spectrum of caries stages. This

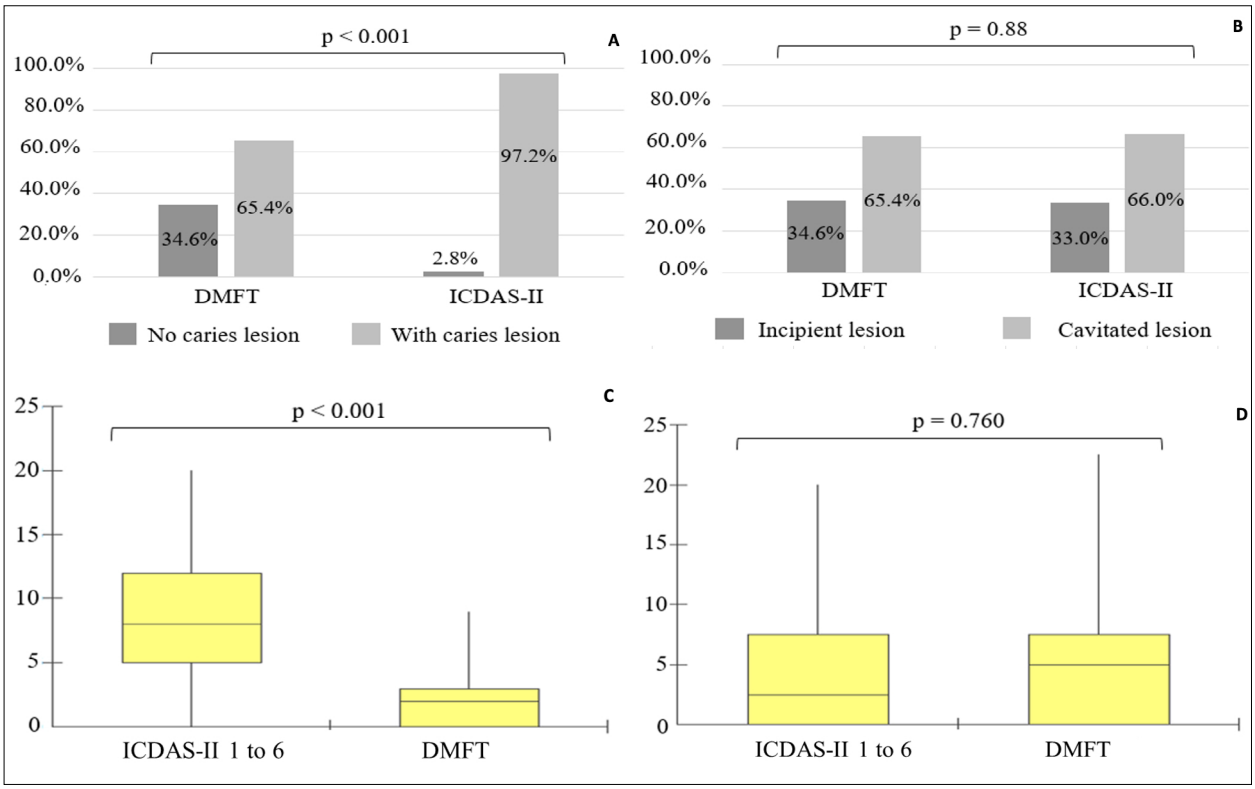

Fig. 1: Graphic results of the statistical analysis. A) Patients with or without dental caries lesions considering DMFT and ICDAS-II indices. B) Patients with or without dental cavities due to caries based on DMFT and ICDAS-II indices. C) Median and quartile values of teeth with caries lesions diagnosed using DMFT and ICDAS-II (codes 1 to 6) in Wilcoxon test. D) Median and quartile values of teeth with cavities due to caries observed using the DMFT and ICDAS-II in Wilcoxon test (codes 3 to 6).

underscores the importance of paying attention to non-cavitated white spot lesions, which are potentially reversible[22,31], but if not diagnosed in a timely manner, can progress to cavities, making oral hygiene and disease control more challenging, and often requiring invasive treatment.

The prevalence of dental caries, as assessed by the ICDAS-II index in this study, is considered high, as 97.2% of the examined children had at least one tooth classified with codes 1 to 6. This agrees with previous studies by Guido *et al*.[37] and Soto-Rojas *et al*.[38], which also employed this index. Furthermore, 67.3% of the children presented caries lesions in the cavitated stage (codes 3 to 6), indicating the need for restorative treatment. The importance of early diagnosis is thus emphasized, particularly when caries lesions are still in stages 1 and 2 of the ICDAS-II scale.

A consensus has yet to be established regarding the cutoff point for defining cavitated dental caries lesions using the ICDAS-II scoring system[39,40]. Some studies designate lesions as cavitated when classified with code 4 or higher[41,42]. Similar issues regarding the classification of cavitated versus non-cavitated lesions have been reported in Venezuela and Colombia, where researchers emphasize the importance of defining appropriate cutoff points to ensure consistent reporting in epidemiological studies[11,14]. In the current study, lesions scoring 3 or higher were considered cavitated. Score 3 is often used as the threshold for comparison with the DMFT [2,20] because it closely resembles the DMFT criteria, given that the World Health Organization criteria only recognize dental caries when lesions penetrate into the dentin[7,29,30].

It is important to highlight that in the current study, the number of individuals identified with no dental caries differed significantly depending on whether the DMFT or ICDAS-II indices were used. According to DMFT, 34.6% of children were considered free from caries lesions (DMFT = 0), whereas according to ICDAS-II, only 2.8% showed no signs of dental caries (code 0). This discrepancy arises because DMFT code 0 includes ICDAS-II codes 1 and 2. These findings align with the conclusions reported in other studies that DMFT

underestimates the presence of dental caries because it does not account for the early stages of carious lesions[43,44]. They also agree with other studies from Latin America, such as de Souza et al.[11] and Acevedo et al.[14], highlighting the advantages of ICDAS in capturing early-stage lesions, which DMFT typically overlooks. As a result,, children identified as "caries-free" by the DMFT index who have non-cavitated lesions do not receive personalized treatment, despite collective preventive measures being in place[45,46], and these lesions may progress to irreversible stages. Interestingly, the findings in the current study regarding the absence of caries in permanent teeth using the ICDAS-II differ from Kuhnisch et al.[46], who reported that 70% of children were free from dental caries in their permanent dentition. This discrepancy may be attributed to the fact that Kuhnisch et al. collected data from Europeans.

ICDAS-II is still relatively unfamiliar to dentists, and despite its advantage of detecting incipient caries lesions, it has limitations. Training for ICDAS-II calibration takes approximately twice as long as for DMFT[43]. While the DMFT is faster and easier to administer, it tends to underestimate the presence of caries lesions, potentially leading public health programs overlooking the true extent of dental caries in the population. Including ICDAS in public health programs has proven beneficial in countries like Brazil, where research shows, it can help target preventive measures more effectively by identifying lesions in the early stages of development[11,23].

The results of the current study underscore the strategic importance of including early-stage lesions in epidemiological surveys, and show that the use of resources such as artificial light and professional prophylaxis prior to clinical examination would be helpful to improve efficiency[29]. Examiner calibration is crucial to identify incipient lesions that may be underestimated by traditional criteria, with the subject being classified as healthy. Diagnosing lesions in early stages is fundamental for applying minimally invasive interventions and adopting a more conservative approach with disease control measures[30,41]. This change in diagnosis would contribute to achieving more precise allocation of public health services, improving diagnostic techniques, and providing appropriate guidance for preventive and therapeutic measures in oral health programs[41,42,46]. In Latin American countries such as Venezuela and Brazil, adopting ICDAS in public health surveys has already demonstrated its potential to provide more precise data on caries prevalence, particularly in underserved populations where non-cavitated lesions are often missed[14,23].

In conclusion, our study shows that the DMFT index is a valuable tool in dental caries diagnosis, but may tend to underestimate its extent. It also underscores the effectiveness of the ICDAS-II index in identifying incipient lesions, which, in turn, provides a critical contribution to early-stage treatment. This insight emphasizes the importance of enhancing the accuracy of caries detection and enabling timely interventions, ultimately promoting better oral health outcomes. In Latin America, ICDAS can improve caries detection and prevention efforts significantly by capturing early-stage lesions, which can halt the progression of the disease and reduce the need for invasive treatments in the future.

CONFLICT INTERESTS

The authors declare no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

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