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Razlike u prevalenciji karijesa i u rizičnim čimbenicima između privilegirane i neprivilegirane djece u Kolumbiji

Differences in Caries Status and Risk Factors among Privileged and Unprivileged Children in Colombia

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Sažetak
Cilj: Željela se usporediti prevalencija karijesa prema klasifikaciji ICDAS-a II i čimbenici povezani s karijesom između djece iz seoskih i gradskih škola u Pastou u Kolumbiji. **Materijali i metode:** Istraživanje je obuhvatilo 120 djece (od 4 do 6 godina) iz seoskih i gradskih škola. Postojanje karijesnih lezija ocijenjeno je prema kriterijima ICDAS-a II. Primijenjena je i anketa o čimbenicima povezanima s karijesom. Hi-kvadrat i Fisherovi testovi upotrijebljeni su za procjenu razlika u svakoj varijabli između dviju skupina. Za usporedbu broja zuba između skupina prema kategoriji ICDAS-a II odabran je Mann-Whitneyjev U test. Negativna binomna regresija korištena je za procjenu postotne promjene srednjeg broja zuba prema kategoriji ICDAS-a II među seoskim i gradskim učenicima. **Rezultati:** Utvrđene su statistički značajne razlike između učenika iz seoskih i gradskih škola za ICDAS-II 0 i 3. do 6. kategorije (p < 0,001). Srednji broj zuba s umjerenim do teškim stupnjem karijesa povećao se za 233 % kod djece iz seoskih škola u usporedbi s onima koji su pohađali škole u gradu (p = 0,0). Učestalost četkanja zuba (p = 0,006), kariogena prehrana, vrijeme proteklo od posljednjeg posjeta stomatologu, socijalno-ekonomski status i vrsta zdravstvenog osiguranja (p < 0,001) bili su među značajnim čimbenicima prema kojima su se razlikovale škole u ruralnom i urbanom području. **Zaključak:** Ovo je prvo istraživanje koje je uspoređivalo dentalni status prema klasifikaciji ICDAS-a II između učenika seoskih i gradskih škola u Kolumbiji. Kod učenika iz seoskih škola ustanovljen je lošiji oralni status. Ovo istraživanje identificiralo je socijalno-ekonomske i kliničke čimbenike koji mogu poslužiti kao smjernice za specifične intervencije kod seoske djece primjenom programa promicanja oralnoga zdravlja i prevencije bolesti.

Uvod

Zubni karijes smatra se diljem svijeta jednim od najčešćih patoloških stanja usne šupljine (1). Može uzrokovati funkcijske i estetske probleme, što često utječe i na opće zdravlje i kvalitetu života (2). U Kolumbiji prevalencija karijesa iznosi između 52,20 % i 52,38 % (za 5-godišnju djecu) u mliječnoj i mješovitoj denticiji (3). Na lokalnoj razini, među učenicima iz Genoya (Pasto, Kolumbija), istraživanje iz 2008. (objavljeno 2012.) pokazalo je da je dmft iznosio 5,16 kod 5-godišnje djece, a prevalencija karijesa 88 % (4). U drugom istraživanju na populaciji iz Genoya, prevalencija karijesa bila je slična – 88 % (5). Napori vlasti nisu bili dovoljni, naime oralne bolesti još su drugi najčešći uzrok morbiditeta u populaciji Kolumbije i Genoya, a karijes je jedno od najčešćih patoloških stanja (6). Zubni karijes mnogostruka je bolest povezana s intraoralnim bakterijama, oralnom higijenom (7) i prehrambenim navikama (7, 8). Na oralno zdravlje također utječu sociološki, ekonomski, okolišni i zemljopisni čimbenici (9, 10). U ruralnim područjima češće je veće siromaš-

Introduction

Dental caries is considered to be one of the most prevalent pathologies in the history of oral morbidity worldwide (1). Caries can cause functional, physical and esthetic deterioration, which can affect both the general health and quality of life of children(2). In Colombia, the prevalence of caries was 52.20% and 52.38% (in 5 year- old children) in primary and mixed dentition, respectively(3). At a local level, in students from Genoy (Pasto, Colombia) a 2008 study (published in 2012) showed that the dmft was 5.16 in 5 year- old children and the caries prevalence was 88%(4). In another study of the Genoy population, the prevalence of caries was similar: 88%(5). The efforts made by the government were not sufficient; oral diseases are still the second most common cause of morbidity in the Colombian population and the population of Genoy, and caries is one of the most prevalent pathologies(6). Dental caries is a multifactorial disease related to intraoral bacteria, oral hygiene(7), and good dietary practices(7, 8). Oral health is also affected by social,

tvo i niža razina obrazovanja te socijalno-ekonomskog statusa negoli u urbanim sredinama (10). U Kolumbiji, prema EN-SAB-u IV, prevalencija zubnog karijesa u seoskim područjima mjerena indeksom DMFT/dmft-a bila je niža u mliječnoj i mješovitoj denticiji (32,33 %), a u gradskim sredinama bila je veća u mliječnoj (46,41 %) i mješovitoj (57,88 %). Kad je riječ o prevalenciji karijesa izmjerenoj modificiranom verzijom DMFT-a koja je uključivala kriterije ICDAS-a (International Caries Detection and Assessment System) (D (2-6 ICDAS) MFT), bila je veća u seoskim područjima u trima vrstama denticije – 69,59 % u mliječnoj, 93,59 % u mješovitoj i 82,59 % u trajnoj (3). Ovi podaci pokazuju da je DMFT/dmft podcijenio dijagnosticirane slučajeve karijesa.

Dječja populacija, posebno u ruralnim područjima, osjetljiva je na karijes pa je nužno uspostaviti dijagnostičke kriterije koji omogućuju pravodobno otkrivanje karijesnih lezija. Sustav ICDAS-a II nastao je kao vizualna metoda otkrivanja karijesa u ranoj fazi te određivanja veličine i mjerenja razine aktivnosti, a koristi se u kliničkoj praksi, istraživanjima i u javnim programima oralnoga zdravlja (11 – 13). Učinkovitost ICDAS-a II uspoređena je s transiluminacijom, fluorescencijom i radiografskim metodama (14 – 17). ICDAS-II sastoji se od dvoznamenkastog koda koji se dodjeljuje svakom zubu. Prva znamenka (0 – 9) odnosi se na stanje zuba (intaktan, djelomično zapečaćen, potpuno zapečaćen itd.) (18), a druga označava kategorije koje opisuju stupanj karijesa (13). Cilj ovog istraživanja bio je usporediti dentalni status mjeren kriterijima ICDAS-a II, te čimbenike vezane za razvoj karijesa među djecom iz seoskih i gradskih škola u Pastou (Kolumbija). Ovo istraživanje omogućit će usmjeravanje javnih programa oralnoga zdravlja specifičnih za populaciju prema socijalno-demografskim uvjetima. To će znatno smanjiti učestalost karijesa u tim seoskim populacijama (19).

economic, environmental, and geographic factors(9, 10). In rural areas, it is more common to find higher levels of poverty and lower educational and socioeconomic levels than in urban areas(10). In Colombia, according to the ENSAB-IV, the prevalence of dental caries in rural areas, as measured by the DMFT/dmft index, was lower in primary and mixed dentition (32.33%), while in urban areas the prevalence was higher for primary (46.41%) and mixed (57.88%) dentition. On the other hand, the prevalence of caries, as measured by a modified version of the DMFT that included the ICDAS (International Caries Detection and Assessment System) criteria ($D_{(2\text{-}6\ \text{ICDAS})}$MFT), was higher in the rural areas for three kinds of dentition (69.59% in primary, 93.59% mixed and 82.59% in permanent dentition)(3). These data show that DMFT/dmft underestimated the diagnosed cases of caries.

The infant population, especially in rural areas, is vulnerable to the presence of caries, which makes it necessary to establish diagnostic baselines that allow the identification of caries lesions in a timely manner. The ICDAS-II system was developed as a visual method to detect caries in its early phase, determine its severity and measure its level of activity; it is utilized in the clinical practice, research and development of public oral health programs (11-13). The efficacy of the ICDAS-II has been compared to transillumination, fluorescence, and radiographic methods(14-17). The ICDAS-II consists of a two-digit code that is assigned to each tooth. The first digit (0-9) refers to dental condition (intact, partially sealed, fully sealed, etc.)(18). The second digit refers to the categories that establish the caries status(13). The objective of this study was to compare the caries status, measured by the ICDAS-II criteria, and the factors related to the caries development among children from rural and urban schools in Pasto (Colombia). This study will allow for the reorientation of public oral health programs specific to the study population, according to their sociodemographic conditions. This will cause a major reduction in the prevalence of caries in these rural populations(19).

Materijali i metode

Obavljena je opservacijska analitička analiza poprečnog presjeka. Prikupljanje uzoraka među upisanim učenicima tijekom 2014. godine provedeno je u četirima seoskim školama u Genoyi i u gradskoj školi – sve obrazovne institucije bile su u gradu Pastou, u Narińu (Kolumbija). Seoske škole bile su javne, a gradska je bila privatna. Odabrana su djeca u dobi od četiri do pet godina (n = 120) s mliječnom denticijom. Isključena su ona sa sustavnim bolestima i stomatološki pacijenti s teškim stanjima. Od ukupno 64 djeteta upisana u seoske škole uključeno je njih 60 (neprivilegiranih), pa su njihovi roditelji potpisali informirani pristanak. Na taj način određen je i broj djece iz gradske škole. U njoj su bila 72 djeteta u dobi od 4 do 6 godina, a 60 (privilegiranih) odabrano je za istraživanje slučajnom metodom. Roditelji djece iz gradske škole također su potpisali informirani pristanak. Istraživanje je provedeno na temelju Helsinške deklaracije i odobrio ga je Odbor za bioetiku Kolumbijskoga sveučilišta u Pastou (Etički odbor, broj odobrenja: 04-2014).

Materials and methods

This was an observational analytical cross-sectional study. A convenience sampling among registered students during 2014 was performed in 4 rural schools in the town of Genoy and an urban school; all the educational institutions were in Pasto city, Narińo (Colombia). The rural schools were public, and the urban school was private. Four to five- year-old children (n=120) with primary dentition were selected. We excluded children with systemic diseases and dental patients with severe conditions. From a total of 64 children registered in rural schools, 60 children (unprivileged) were included and their parents signed a voluntary informed consent; this determined the number of children selected in the urban school. There were 72 registered children, 4 to 6 years olds , in the urban school and 60 (privileged) were randomly selected for the study. The parents of the children from the urban school also signed a voluntary informed consent. This research was ethically conducted based on the Declaration of Helsinki and the Bioethics Subcommittee of the Universidad

Kriteriji ICDAS-a II korišteni su za klasifikaciju svakog zuba prema zahvaćenosti karijesom (13). Dijagnoze je postavljao kalibrirani pedodont klasifikacijom prema ICDAS-u II. Tijekom postupka radio je na čistim, suhim zubima uz odgovarajuće osvjetljenje. Podatci su registrirani uporabom odontograma iz UCC-a Pasto. Ukupno su analizirane 22 varijable. Uključivale su broj zdravih zuba (ICDAS-II 0), broj zuba s početnim karijesom (ICDAS-II 1 – 2) te broj zuba s umjerenim do teškim karijesom (ICDAS-II 3 – 6). Deset važnih kliničkih i dentalnih varijabli izmjerio je drugi doktor dentalne medicine, ili su uzete iz ankete o kariogenoj prehrani (UCC format). Varijable su bile sljedeće: vrijeme od posljednjeg posjeta stomatologu, korištenje četkice za zube, zubnog konca i otopina za ispiranje usta, učestalost četkanja zuba, krvarenje iz desni tijekom četkanja zuba, bakterijski plak, kariogena prehrana te primjena fluora i dmft-a. Dmft je klasificiran kao vrlo nizak (0 – 1, 1), nizak (1,2 – 2,6), umjeren (2,7 – 4,4), visok (4,5 – 6,5) i vrlo visok (≥ 6,6). Jedanaest socijalno-demografskih varijabli mjereno je u anketi koju su ispunili roditelji djece, a sastavio ju je glavni istraživač – uključuju spol, dob, socijalno-ekonomski status, razinu obrazovanja, te pristup struji, kanalizaciji, televiziji, telefonu, internetu, mobitelu i zdravstvenoj skrbi. Provedeno je pilot-istraživanje u kojem je sudjelovalo 28 roditelja kako bi se validirala socijalno-demografska anketa – upotrijebljen je Alfa Cronbachov test u kojemu je vrijednost blizu jedan značila visoku valjanost i dosljednost. Alfa Cronbachova vrijednost za pilot-istraživanje iznosila je 0,884.

Statistička analiza

Kliničke i socijalno-demografske varijable sažete su u skupine (ruralna ili urbana) koristeći se tablicama rizika s apsolutnim i relativnim frekvencijama. Da bi se sažele zavisne varijable, upotrijebljene su srednje vrijednosti i disperzije. Pearsonovim hi-kvadratnim testom identificirane su statistički značajne razlike za svaku kliničku ili socijalno-demografsku varijablu među skupinama. Kada su očekivane vrijednosti za više od 20 % čimbenika u tablici bile niže od 5, primijenjen je Fisherov egzaktni test. Usporedba broja zuba u kategoriji karijesa prema kriterijima ICDAS-a II (zdravi, početni i umjereni-teški) među djecom iz seoskih i gradskih škola obavljena je Mann-Whitneyjevim U testom. Jednostavna i višestruka negativna binomna regresija korištena je za procjenu postotka promjene prosječnih vrijednosti zdravih zuba (ICDAS-II 0) i zuba u umjerenoj do teškoj kategoriji (ICDAS-II 3 – 6) između učenika seoskih i gradskih škola. Višestruka regresija korištena je za prilagodbu dobi radi procjene promjene postotka. Razina značajnosti p-vrijednosti postavljena je na 0,05. Analize su obavljene s pomoću R v.3.3.3 te knjižnica *tableone* i *MASS* (20).

Cooperativa de Colombia (UCC) Pasto approved the study (Ethics Committee approval number: 04-2014).

The ICDAS-II criteria were used to classify each tooth according to the caries status(13). The diagnosis was established using a calibrated ICDAS-II pediatric dentist. During the procedure, the pediatric dentist worked on clean, dry teeth using adequate light. The data were registered using the odontogram formats from the UCC Pasto. A total of 22 variables were analyzed. The variables which were analyzed included the number of healthy teeth (ICDAS-II 0), the number of teeth in the initial stage of caries (ICDAS-II 1-2), and the number of teeth in the moderate-severe stages of caries (ICDAS-II 3-6). Ten important clinical and dental health variables were measured by a second dentist or taken from a survey of the cariogenic diet (UCC format). The variables were as follows: time since the last dental visit; use of a toothbrush, dental floss, and mouthwash; toothbrushing frequency; bleeding gums during toothbrushing; bacterial plaque; cariogenic diet; application of fluoride, and dmft. The dmft was classified as very low (0 – 1.1), low (1.2 – 2.6), moderate (2.7 – 4.4), high (4.5 – 6.5), and very high (≥ 6.6). Eleven sociodemographic variables were measured using a survey answered by the parents of the children and created by the principal investigator, including: gender, age, socioeconomic status, educational level, access to electricity, sewer systems, television, telephone, internet, cellphone, and type of health service. A pilot test was performed on 28 parents to validate the sociodemographic survey; an Alfa Cronbach test was used in which a value near one represented high validity and consistency. The pilot test Alfa Cronbach value was 0.884.

Statistical analysis

The clinical and sociodemographic variables were summarized per group (rural or urban) using contingency tables with absolute and relative frequencies. To summarize the dependent variables, we used measures of central tendency and dispersion. The Pearson's chi-square test was used to identify the significant differences for each clinical or sociodemographic variable between the groups. When the expected values of more than 20% of cells in a contingency table were lower than 5, the Fisher's exact test was applied. The comparison of the number of teeth per caries category, according to the ICDAS-II criteria (healthy, initial, and moderate-severe), among children from the rural and urban schools was performed using the Mann–Whitney U test. Simple and multiple negative binomial regressions were used to estimate the percentage change in the mean of healthy teeth (ICDAS-II 0) and teeth in the moderate-severe category (ICDAS-II 3-6) between the rural and urban students. The multiple regression was used to age-adjust for the estimated percentage change. The significant p-value threshold was set at 0.05. The analyses were performed using R v.3.3.3 and the libraries "tableone" and "MASS"(20).

Rezultati

Analiza dentalnog statusa prema klasifikaciji ICDAS-II

Vrijednosti za ICDAS-II umjerene i teške kategorije grupirane su u jednu kategoriju zbog male veličine uzorka po kategoriji. Zato je Mann-Whitneyjev U test obavljen samostalno za tri kategorije ICDAS-a II – za zdrave zube (ICDAS-II 0), početni karijes (ICDAS-II 1 – 2) i umjereni do teški karijes (ICDAS-II 3 – 6) te su uspoređene ruralne i urbane skupine. U tablici 1. rezultati su tih analiza. Uočene su značajne razlike između učenika iz seoskih i gradskih škola u zdravoj i umjerenoj do teškoj kategoriji (p < 0,001). U objema školama većina djece imala je zdrave zube (n = 20). Prosječan broj zdravih zuba bio je 16 u seoskim školama (srednja vrijednost

Results

Analysis of the caries status according to ICDAS-II criteria

The ICDAS-II moderate and severe categories were grouped into one category called the moderate-severe category due to the small sample size per category. Therefore, the Mann–Whitney U test was performed independently for three ICDAS-II categories: healthy teeth (ICDAS-II 0), initial stage of caries (ICDAS-II 1-2), and moderate-severe caries (ICDAS-II 3-6), comparing the rural and urban groups. Table 1 shows the results of these analyses. Significant differences were found between the rural and urban students with respect to the healthy and moderate-severe (p < 0.001) categories. In both schools, most of the teeth were healthy (n = 20).

Tablica 1. Učestalost distribucije varijabli važnih za kliničku praksu i usporedba dentalnog zdravlja između učenika iz seoskih i gradskih škola
Table 1 Frequency distribution table of variables important to clinical practice and to comparison of dental health between rural and urban students.

Varijabla • Variable	Razina • Level	Seoska škola • Rural school (n=60) Sredina • Mean (SD)	Gradska škola • Urban school (n=60) Sredina • Mean (SD)	p
Zdravi zubi • Healthy teeth (ICDAS-II 0)		14.9 (4)	18.2 (2.0)	**<0.001***
Zubi s početnim karijesom • Teeth in initial stage of caries (ICDAS-II 1 – 2)		0.3 (1)	0.2 (0.5)	0,737*
Zubi s umjerenim do teškim karijesom • Teeth in moderate-severe stage of caries (ICDAS-II 3 – 6)		4.0 (3)	1.2 (1.5)	**<0.001***
		n (%)	n (%)	
Vrijeme proteklo od posljednjeg posjeta stomatologu • Time since the last dental visit	1 mjesec • month	12 (20.0)	6 (10.0)	**<0.001**
	2 mjeseca • months	**20 (33.3)**	**6 (10.0)**	
	3 mjeseca • months	18 (30.0)	20 (33.3)	
	> 3 mjeseca • months	**10 (16.7)**	**28 (46.7)**	
Korištenje četkice za zube • Use of toothbrush	Da • Yes	57 (95.0)	60 (100.0)	0.242
	Ne • No	3 (5.0)	0 (0.0)	
Korištenje zubne svile • Use of dental floss	Da • Yes	18 (30.0)	23 (38.3)	0.441
	Ne • No	42 (70.0)	37 (61.7)	
Korištenje otopina za ispiranje • Use of mouthwash	Da • Yes	9 (15.0)	33 (55.0)	**<0.001**
	Ne • No	51 (85.0)	27 (45.0)	
Učestalost četkanja (puta na dan) • Toothbrushing frequency (times/day)	Jedan • One	7 (11.7)	2 (3.3)	**0.006**
	Dva • Two	30 (50.0)	18 (30.0)	
	≥ 3	**23 (38.3)**	**40 (66.7)**	
Krvarenje iz gingive tijekom četkanja • Bleeding gums during toothbrushing	Da • Yes	**7 (11.7)**	**21 (35.0)**	**0.005**
	Ne • No	53 (88.3)	39 (65.0)	
Bakterijski plak • Bacterial plaque	Da • Yes	**59 (98.3)**	**42 (70.0)**	**<0.001**
	Ne • No	1 (1.7)	18 (30.0)	
dmft (%)	Vrlo nizak • Very low	3 (5.0)	27 (45.0)	**<0.001**
	Nizak • Low	4 (6.7)	7 (11.7)	
	Srednji • Moderate	8 (13.3)	9 (15.0)	
	Visok • High	14 (23.3)	10 (16.7)	
	Vrlo visok • Very high	31 (51.7)	7 (11.7)	
Kariogena prehrana • Cariogenic diet	Visoka • High	**57 (95.0)**	**23 (38.3)**	**<0.001**
	Prosječna • Average	3 (5.0)	31 (51.7)	
	Niska • Low	0 (0.0)	6 (10.0)	
Primjena fluora • Fluoride application	Da • Yes	**3 (5.0)**	**35 (58.3)**	**<0.001**
	Ne • No	57 (95.0)	25 (41.7)	

*Mann-Whitneyjev U test; razlike između varijabli procijenjene su hi-kvadratnim ili Fisherovim testom; vrijednosti manje od 0,05 su podebljane; SD: standardna devijacija • Mann-Whitneyjev U test. The differences between category variables were evaluated using chi-square or Fisher's tests, as appropriate. Values lower than 0.05 are shown in bold. SD: standard deviation.

14,9 ± 4,0), a 19 u gradskoj (srednja vrijednost 18,2 ± 2,0). U umjerenoj do teškoj kategoriji, 15 zuba učenika u seoskoj školi u usporedbi s 5 u gradskoj, klasificirano je ocjenama od 3 do 6 prema ICDAS-u II. Medijan zuba s umjerenim do teškim karijesom bio je 3,5 (sredina 4 ± 3,0) u seoskim školama i 0 (sredina 1,2 ± 1,5) u gradskoj. Izračunata je promjena broja zuba u postotcima u zdravoj ili umjerenoj do teškoj kategoriji između seoskih i gradskih učenika. Na slici 1. rezultati su negativne binomne regresije prilagođene dobi ili ne, kako bi se ustanovio mogući utjecaj dobi na razlike koje su se promatrale između skupina. Prije prilagodbe dobi i poslije nje, srednji broj zuba u umjerenoj do teškoj kategoriji značajno je porastao za 233 % kod djece iz ruralnog područja u odnosu prema djeci iz urbanog područja. Srednji broj zdravih zuba bio je značajno manji (16 %) među učenicima iz seoskih škola u usporedbi s gradskom.

U tablici 1. rezultati su usporedbe varijabli važnih za kliničku praksu i zdravlje zuba djece iz seoskih i gradskih škola. Značajne varijable u skupinama (p < 0,001) bile su vrijeme od posljednjeg posjeta stomatologu, korištenje otopina za
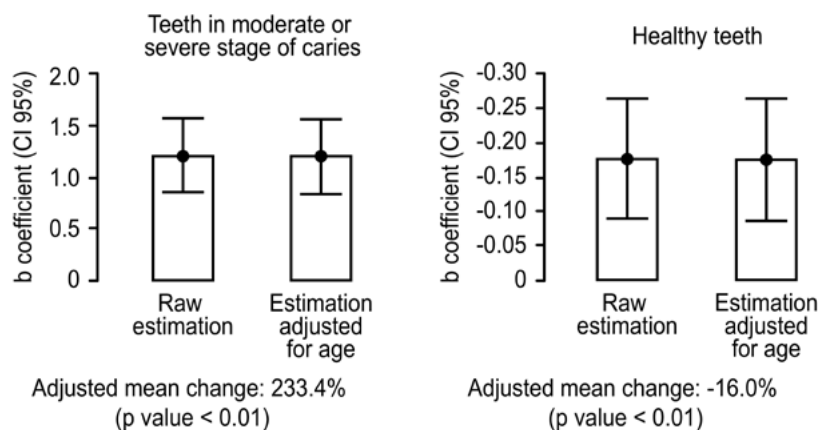
The median number of healthy teeth was 16 in the rural school (mean = 14.9 ± 4.0) and 19 for the urban school (mean = 18.2 ± 2.0). In the moderate-severe category, 15 teeth in the rural school compared to 5 in the urban school were classified with ICDAS-II codes 3 to 6. The median of moderate-severe teeth was 3.5 (mean = 4 ± 3.0) in the rural school and 0 (mean = 1.2 ± 1.5) in the urban school. The estimated percentage change in the number of teeth in the healthy or moderate-severe categories among the rural and urban students was calculated. Figure 1 shows the results of the negative binomial regression adjusting for age or not, to identify the possible effect of age on the differences observed between the groups. Before and after adjustment for age, the median number of teeth in the moderate-severe category increased significantly by 233% in the children from the rural area compared to children in the urban area. The mean number of healthy teeth was significantly lower (16%) in the rural students compared to the urban students.

Table 1 shows the results of comparing variables important for the clinical practice and dental health of children from the rural and urban schools. The significant variables

Tablica 2. Distribucija socijalno-demografskih varijabli između privilegirane i neprivilegirane djece
Table 2 Distribution of the sociodemographic variables among privileged and unprivileged children.

Varijable • Variable	Razina • Level	Seoske škole • Rural school (%)	Gradske škole • Urban school (%)	p
n		60	60	
Spol • Gender	Ženski • Female	24 (40.0)	33 (55.0)	0.144
	Muški • Male	36 (60.0)	27 (45.0)	
Dob • Age	4	**0 (0.0)**	**11 (18.3)**	**<0.001**
	5	25 (41.7)	12 (20.0)	
	6	**35 (58.3)**	**37 (61.7)**	
Socijalno-ekonomski status • Socioeconomic status	1	**57 (95.0)**	**0 (0.0)**	**<0.001**
	2	3 (5.0)	1 (1.7)	
	3	0 (0.0)	40 (66.7)	
	4	0 (0.0)	19 (31.7)	
Razina edukacije • Educational level	Predškolska • Preschool	**8 (13.3)**	**22 (36.7)**	**<0.001**
	Dječji vrtić • Kindergarten	33 (55.0)	9 (15.0)	
	Prvi stupanj • First grade	19 (31.7)	29 (48.3)	
Struja • Electricity	Da • Yes	59 (98.3)	60 (100.0)	1
	Ne • No	1 (1.7)	0 (0.0)	
Kanalizacija • Sewer systems	Da • Yes	**41 (68.3)**	**60 (100.0)**	**<0.001**
	Ne • No	19 (31.7)	0 (0.0)	
Televizija • Television	Da • Yes	56 (93.3)	59 (98.3)	0.361
	Ne • No	4 (6.7)	1 (1.7)	
Telefon • Telephone	Da • Yes	**10 (16.7)**	**48 (80.0)**	**<0.001**
	Ne • No	50 (83.3)	12 (20.0)	
Internet • Internet	Da • Yes	**10 (16.7)**	**53 (88.3)**	**<0.001**
	Ne • No	50 (83.3)	7 (11.7)	
Mobitel • Cellphone	Da • Yes	52 (86.7)	54 (90.0)	0.776
	Ne • No	8 (13.3)	6 (10.0)	
Zdravstveno osiguranje i režim • Health regime	Subvencionirano • Subsidized	**60 (100.0)**	**3 (5.0)**	**<0.001**
	Dopunsko • Contributory	0 (0.0)	57 (95.0)	

Razlike između varijabli procijenjene su hi-kvadratnim ili Fisherovim testom; vrijednosti manje od 0,05 su podebljane; SD: standardna devijacija •
The differences between category variables were evaluated using chi-square or Fisher's tests as appropriate. Values lower than 0.05 are shown in bold.
SD: standard deviation.

Slika 1. Procijenjena promjena postotka zuba u zdravoj ili umjerenoj do teškoj kategoriji među studentima seoskih i gradskih škola (rezultati negativne binomne regresije prilagođene za procjenu dobi); dob nije imala znatan utjecaj na promjenu postotka

Figure 1. The estimated percentage change in the number of teeth in the healthy or moderate-severe categories among the rural and urban students (results of the negative binomial regression for the raw and adjusted for age estimates). Age did not have a significant effect on the percentage change.

ispiranje usta, bakterijski plak, kariogena prehrana, primjena fluora i dmft-a (%). Značajna je bila i učestalost četkanja zuba i pojavnost krvarenja tijekom četkanja (p < 0,05). Za razliku od gradske škole, u seoskima je dmft bio visok i prehrana vrlo kariogena (tablica 1.). Četkanje četkicom tri ili više puta na dan i korištenje sredstava za ispiranje usta bili su rjeđi u ruralnim područjima. U tablici 2. sažeti su rezultati bivarijantne analize između seoskih škole i gradske škole. Nije bilo značajnih razlika u spolu između škola. Utvrđene su značajne razlike (p < 0,001) za dob, socijalno-ekonomski status, razinu obrazovanja, pristup kanalizaciji, telefonu i internetu te u vrsti zdravstvenog osiguranja. Najčešći socijalno-ekonomski status od pet mogućih bio je prvi (najniži) u seoskim školama i treći i četvrti u gradskoj školi. Sva djeca u seoskim školama imala su subvencionirano zdravstveno osiguranje, u usporedbi s 5 % učenika u gradskoj školi. Kad je riječ o pristupu javnim uslugama, ruralno područje imalo je značajno manji pristup kanalizaciji (68,3 %) u usporedbi s urbanim područjem (100 %). Pristup internetu bio je ograničen u ruralnom području (16,7 %) u odnosu prema urbanome (88,3 %). Korištenje mobitela bilo je u oba područja slično.

in the groups (p < 0.001) were time since the last dental visit, use of mouthwash, presence of bacterial plaque, cariogenic diet, fluoride application, and dmft (%). The toothbrushing frequency and presence of bleeding gums during toothbrushing (p < 0.05) were also significant. In contrast to the urban school, in the rural school, the dmft was considered high and the diet was highly cariogenic (Table 1). Toothbrushing 3 or more times per day and the use of mouthwash were less frequent in the rural area. Table 2 summarizes the results of the bivariate analysis between the rural and urban schools. There were no significant differences in gender between the schools. Significant differences (p < 0.001) were found for age, socioeconomic status, educational level, access to sewer systems, telephone, and internet, and type of health regime. The most frequent socioeconomic status among the 5 statuses was 1 (the lowest) in the rural schools and 3 and 4 in the urban school. All children in the rural schools belonged to the subsidized health regime, compared to 5% of the urban students. In terms of access to public services, the rural area had significantly less access to sewer systems (68.3%) compared to the urban area (100%). The access to internet was limited in the rural area (16.7%) compared to the urban area (88.3%). The use of cellphones was similar between the two areas.

Rasprava

Ovo istraživanje uspoređivalo je dentalni status prema kriterijima ICDAS-a II te kliničke i socijalno-demografske čimbenike povezane s karijesom kod djece iz seoskih i gradske škole u Pastou u Kolumbiji. Nekoliko istraživanja analiziralo je status oralnoga zdravlja opće populacije i uspoređivalo prevalenciju karijesa u ruralnim i urbanim sredinama na temelju indeksa DMFT/dmft-a (4, 10, 21). U ovom radu procijenili smo stanje zuba primjenom obiju metoda – ICDAS-a II i dmft-a, te istaknuli rezultate klasifikacije ICDAS-a II. Osim populacije iz Genoye koja je proučavana (ruralna), ovo je prvi put da je dentalni status djece procijenjen s pomoću klasifikacije ICDAS-a II koja omogućuje praćenje evolucije karijesa. Jedno drugo istraživanje procijenilo je dentalni status prema kriterijima ICDAS-a II u ruralnim i urbanim populacijama (22). To francusko istraživanje obuhvatilo je 6-godišnju djecu iz seoskih i gradskih škola i pronašlo značajne razlike između dviju populacija za ocjene 1 – 2 ICDAS-a II.

Discussion

The present study compared the caries status according to the ICDAS-II criteria and caries-related clinical and sociodemographic factors for children from rural and urban schools in Pasto, Colombia. Several studies have evaluated the oral health status of the general population and have compared the prevalence of caries in rural and urban areas based on the DMFT/dmft indices (4, 10, 21). In the present study, we evaluated the history of caries using both methods, ICDAS-II and dmft, and emphasized the ICDAS-II results. In the population studied from Genoy (rural), this is the first time that the caries status of children has been evaluated using the ICDAS-II system, which will allow for a follow-up of the evolution of the caries in those children. One other study evaluated the caries status using the ICDAS-II criteria in rural and urban populations(22). This French study included 6-year-old children from rural and urban schools and found significant differences between the two zones for the ICDAS-

Korištenjem metode ICDAS-a II, 39 % djece bilo je bez karijesa, a korištenjem osnovne metode WHO-a 67,2 % djece nje imalo karijes – ti rezultati upućuju na veću preciznost ICDAS-a II u mjerenju nekavitiranih karijesnih lezija u (22).

U ovom istraživanju najčešća kategorija dmft-a bila je *vrlo visok* među učenicima iz seoskih škola i *vrlo nizak* među učenicima iz gradske škole. To je u skladu s rezultatima ICDAS-a II. U drugim istraživanjima provedenima u Genoyu mjerilo se stanje zuba metodom dmft-a (4, 5). Prosječni dmft iznosio je 5,16 (visok) za 5-godišnju djecu i 4,58 (visok) za 12-godišnjake (4). Rezultati za petogodišnju djecu bili su slični našim rezultatima u kojima je prevladavala *vrlo visoka* razina karijesa. Važno je uzeti u obzir da je ovo istraživanje uključivalo djecu u dobi od 4 do 6 godina i moglo bi utjecati na srednju vrijednost dmft-a. Istraživanje obavljeno u Popayani (pokrajina Cauca), u južnom gradu kolumbijske pokrajine Nariňe, gdje se nalazi Genoy, pronašlo je 96 % karijesa kod 12-godišnje djece i dmft od 3,02 (23) – te su vrijednosti bile slične onima pronađenima u Genoyu.

Općenito, u ovom istraživanju karijesni je status bio lošiji kod učenika iz seoskih škola u usporedbi s gradskom školom, što se može usporediti s rezultatima o kojima su izvijestili Cabrera i suradnici (10), Fernandez-Gonzalez i suradnici (24) iz Čilea te Ribeiro de Campos Mello i suradnici (25) iz Brazila. Istraživanja diljem svijeta pokazala su kontradiktorne rezultate u prevalenciji karijesa u urbanim i ruralnim područjima, ovisno o zemlji. U Sjedinjenim Državama, Kini, Švedskoj, Burkini Faso i Senegalu (26) prevalencija karijesa kod djece i adolescenata bila je veća u urbanim negoli u ruralnim područjima. No u drugim istraživanjima veća učestalost zabilježena je u ruralnim područjima u usporedbi s urbanima (Indija, Rusija i Poljska) (27 – 29). Ti kontradiktorni rezultati dijelom se mogu objasniti time što u vrlo izoliranim ruralnim područjima, iako je donekle moguć pristup uslugama oralne zdravstvene zaštite, nepovoljni socijalno-ekonomski uvjeti ograničavaju pristup kariogenoj hrani koja se vrlo jednostavno može nabaviti u gradovima (26). Ta kontradiktorna istraživanja pokazala su da se oralno zdravlje u ruralnim i urbanim područjima razlikuje između razvijenih država i zemalja u razvoju. Nadalje, razlikuje se i među regijama unutar iste države ili između zemalja s istom ekonomskom razinom. Preporučuju se daljnja istraživanja i intervencije u populacijama s obzirom na socijalno-ekonomske uvjete i aspekte ponašanja svake regije koji stvaraju prepreke u održavanju dobroga oralnog zdravlja (26).

Usporedba varijabli važnih za kliničku praksu i dentalno zdravlje

Devet varijabli važnih za kliničku praksu i dentalno zdravlje znatno se razlikovalo među učenicima seoskih i gradskih škola. Djeca sa sela imala su više bakterijskoga plaka i krvarenja tijekom četkanja – ukratko, imala su lošije oralno zdravlje. Druge važne varijable dentalnog zdravlja u skladu s niskom kvalitetom oralnoga zdravlja zabilježene su u seoskim školama u Genoyu. Bakterijski plak i kariogena prehrana bili su češći među učenicima seoskih škola, a i četkanje zuba,

II 1-2 codes. Using the ICDAS-II method, 39% of the children were identified as free of caries, while using the WHO basic method, 67.2% of the children were identified as free of caries; these results indicate the better precision of the ICDAS-II system to measure carious lesions from the non-cavitated stages(22).

In the present study, the most frequent dmft category was "very high" in rural students and "very low" in urban students; this is concordant to the ICDAS-II results. Other studies performed in Genoy measured the history of caries using the dmft method(4, 5). A mean dmft of 5.16 (high) in 5-year-old students and 4.58 (high) in 12-year-old students were reported(4). The results for the 5-year-old students are close to our results in which a "very high" level of caries was predominant. It is important to consider that the present study included 4- to 6-year-old children and could have an impact on the mean dmft measurement. A study carried out in Popayan (province of Cauca), a southern Colombian city in the province next to Nariño, where Genoy is located, found a 96% history of caries in 12-year-old children and a dmft of 3.02(23); these values were similar to the ones found in Genoy.

In general, the caries status was worse in the rural students compared to the urban students in the present study, which was comparable to results reported by Cabrera *et al.*(10), Fernandez-Gonzalez *et al.*(24) in Chile and Ribeiro de Campos Mello *et al.*(25) in Brazil. Worldwide, the studies showed contradictions for the prevalence of caries in urban and rural areas depending on the country. In the United States, China, Sweden, Burkina Faso and Senegal(26), the prevalence of caries in children and adolescents was higher in the urban areas than in the rural areas. However, in other studies the highest prevalence of caries occurred in rural areas compared to urban areas (India, Russia and Poland)(27-29). These contradictory results can be explained in part because in very isolated rural areas, although there is less access to oral health services, the unfavorable socioeconomic conditions limit the access to cariogenic food, which can be easily found in urban zones(26). These contradictory studies have shown that the differences in oral health found in rural and urban areas differ between developed and developing countries; furthermore, they differ among regions inside the same country or between countries with the same economic levels. It is recommended to conduct a follow-up investigation and intervene in populations at a small regional scale, considering the socioeconomic conditions and behavioral aspects of each region that create barriers to maintaining good oral health(26).

Comparison of variables important for clinical practice and dental health

Nine variables important for clinical practice and dental health were significantly different in rural students compared to urban students. Children from the rural schools had more bacterial plaque and bleeding during toothbrushing; in summary, they showed worse oral health. Other important dental health variables agree with the low quality of oral health observed in the rural schools from Genoy. The presence of bacterial plaque and a cariogenic diet was higher in the rural stu-

uporaba otopina za ispiranje usta i primjena fluora bili su rjeđi među tom djecom. Kariogena prehrana, uz slabu oralnozdravstvenu zaštitu, smatra se rizičnim čimbenikom za razvoj karijesa kod djece i odraslih (25, 26, 28, 30).

Usporedba socijalno-demografskih varijabli

Korištenje mobitela bilo je slično u ruralnim i urbanim područjima jer Kolumbija ima pristup niskoprofitnim mobilnim tarifama. Važno je uzeti u obzir različite tehnologije koje su dostupne stanovništvu kada se definiraju programi poboljšanja zdravstva i prevencije bolesti. Na primjer, u kućanstvima djece iz seoskih i gradskih škola oko 90 % ima pristup telefonima i televiziji te se ti medijski kanali mogu iskoristiti za širenje informacija o intervencijskim programima s pomoću mobilnih aplikacija ili televizijskih reklama. Većina učenika sa sela najnižega je socijalno-ekonomskog statusa. Uz to, seoske škole bile su javne, a gradska je bila privatna. U istraživanju Doa i suradnika (31) (2015.) provedenom u Australiji, kod djece od 5 do 8 godina iz javnih škola (51,7 %) prevalencija karijesa bila je veća nego u privatnim (37,8 %) ili katoličkim školama (38,4 %). Uočena je i veća učestalost karijesa kod obitelji s niskim primanjima (54,4 %) u usporedbi s onima srednjeg (44,0 %) do visokog (37,8 %) dohotka (31). Razlike u socijalno-ekonomskom statusu i vrsti škole (privatna ili javna) bile su povezane s vrstom zdravstvenog osiguranja djece u ruralnom i urbanom području. U ovom istraživanju svi sa sela pripadali su subvencioniranom zdravstvenom osiguranju, a većina djece u gradskoj školi doplaćivala je zdravstveno osiguranje. Vrsta zdravstvenog osiguranja utječe na zdravlje pojedinca, uključujući i oralno zdravlje (32). Zdravstveni sustav u Kolumbiji je neujednačen – obuhvaćenost nije univerzalna te postoje razlike u zdravstvenim planovima i izdatcima sustava prema prihodima stanovništva (33). Razlike između subvencioniranog osiguranja i onoga s doplaćivanjem ograničavaju pristup preventivnim uslugama u ruralnim područjima (3) jer je u slučaju nedoplaćivanja osiguranja vrijeme do dobivanja zdravstvene usluge dulje. Uz to, zahtjev i dobivanje termina, lijekova i terapija traju dulje, zbog čega neki građani često odbijaju pravo na pristup zdravstvenoj zaštiti. Na primjer, u Kolumbiji se u 2010. godini 65 % ljudi iz ruralnih područja konzultiralo o zdravlju u medicinskom centru u usporedbi sa 73 % u urbanim sredinama (34). Osim toga, u ruralnim područjima Kolumbije ljudi si ne mogu priuštiti medicinsku terapiju koja nije obuhvaćena njihovim zdravstvenim osiguranjem ili ako je tretman dostupan samo u urbanim sredinama (što je uobičajeno), jer si ne mogu platiti prijevoz u liječnički centar izvan svojega mjesta stanovanja (32).

Ovo je istraživanje imalo ograničenja – broj učenika u seoskim školama bio je malen jer je populacija toga područja s pristupom obrazovanju bila malobrojna. Bilo je poteškoća u dobivanju informiranog pristanka zato što neki roditelji nisu mogli biti na sastanku s istraživačima u školi radi prikupljanja dokumenata. Kad je to bilo moguće, roditelje se posjetilo kod kuće kako bi potpisali informirani pristanak. U seoskim školama nije bilo četverogodišnje djece, pa je zato zabilježena dobna razlika između seoskih i gradskih skupina. Ipak, razlike u dobi nisu utjecale na rezultate, kao što se vidi u tablici 2.

dents; toothbrushing, the use of mouthwash and application of fluoride were less frequent in rural students. A cariogenic diet, along with poor oral health care, is considered a risk factor for caries in children and adults(25, 26, 28, 30).

Comparison of sociodemographic variables

The utilization of cellphones was similar in the rural and urban areas because, in Colombia, there is access to low cost low-end and prepaid cellphones. It is important to consider the different technologies available to the population when health promotion and disease prevention programs are designed. For example, in the homes of children from the rural and the urban schools, there is approximately 90% access to cellphones and television; thus, these media channels can be used for dissemination of intervention programs using cellphone applications or television commercials. Most rural students belonged to the lowest socioeconomic status, which was 1 in Colombia. In addition, the rural school was public, and the urban school was private. In a study by Do *et al.*(31) (2015) completed in Australia, there was a higher weighted prevalence of caries in children from 5 to 8 years old from public schools (51.7%) than private (37.8%) or catholic schools (38.4%). There was also a higher weighted prevalence of caries from families with low incomes (54.4%) compared to families of mid (44.0%) to high (37.8%) incomes(31). The differences in the socioeconomic status and the kind of school, private or public, were related to the type of health regime to which the children were affiliated in both the rural and urban area; in the present study, all the rural students belonged to the subsidized health regime and most children in the urban school belonged to the contributory health regime. The kind of regime with which a person is affiliated has an impact on their health, including their oral health(32). The health system in Colombia is inequitable; the coverage is not universal, and there are differences in the health plans and the system's expenditure according to the population's income(33). The differences between the contributory and subsidized regimes create limitations for accessing preventive services and timely oral health attention in the rural areas(3), because in the contributory regime, the time to get health attention is longer. Additionally, the request and authorization of appointments, medications and treatments takes longer, causing some citizens to drop their right to access health care in many cases. For example, in Colombia, in 2010, 65% of the people from rural areas consulted about their health in a medical center compared to 73% of people in the urban areas(34). In addition, in the rural areas of Colombia, people cannot afford medical treatments not covered by their health regimes, or if the treatments are available only in urban zones (which is common), they cannot afford transportation to visit a medical center outside their towns(32).

This study had limitations; the number of students in the rural schools was small because the population of this rural area with access to education was also small. There were difficulties collecting the voluntary informed consent due to some parents being unable to attend the researchers' visit to the school to collect the documents. When possible, the parents were visited at home to get the signed voluntary informed

consent. There were no 4-year-old children registered at the rural schools; for this reason, there was an age difference between the rural and urban groups. Nonetheless, the differences in age did not affect the results, as shown in Table 2.

Zaključak

U ovom istraživanju ustanovljena je razlika u dentalnom statusu između djece iz seoskih i gradskih škola u Pastou (Kolumbija) na temelju klasifikacije ICDAS-aII i dmft-a. Ovo istraživanje bilo je prvo koje je procijenilo dentalni status na temelju kriterija ICDAS-a II u tim populacijama. Primjena ICDAS-a II za mjerenje zahvaćenosti karijesom u ovom istraživanju omogućit će donošenje mjera za zaštitu zdravih zubnih ploha kako bi se izbjegao razvoj karijesa u aktivnim ili neaktivnim lezijama te otkrila djeca izložena riziku od pogoršanja oralnoga zdravlja. Šesnaest od 22 analizirane varijable značajno su se razlikovale među djecom iz seoskih i gradskih škola. Kao i ostala istraživanja koja su procjenjivala dentalni status ruralnih populacija, otkrili smo da su četkanje zuba, kariogena prehrana, vrijeme od posljednjega stomatološkog posjeta te socijalno-ekonomski i zdravstveni status povezani s težinom karijesa. Statistički značajno različite varijable između seoske i gradske skupine mogu djelomično objasniti razinu karijesa zabilježenu kod djece sa sela i na taj način upozoriti na aspekte oralnoga zdravlja i socijalno-demografske parametre koje treba iskoristiti za intervencije u tim populacijama na temelju provedbe specifične promidžbe oralnoga zdravlja i programa prevencije bolesti kako bi se smanjili visoki indeksi karijesa na tom ruralnom području.

Conclusion

The present study found differences in the caries status between the children from rural and urban schools in Pasto (Colombia) using the ICDAS-II criteria and the dmft index. This study was the first to evaluate caries using ICDAS-II criteria in these populations. The application of the ICDAS-II system to measure the caries status in this study will allow the creation of actions to protect healthy dental surfaces, to avoid the development of caries in active or inactive lesions and to detect children at risk of worsening their oral condition. Sixteen out of 22 variables analyzed were significantly different in children from the rural and urban schools. Like other studies that evaluated the caries status of rural populations, we found that toothbrushing, a cariogenic diet, time since the last dental visit; socioeconomic status and health regime were related to caries severity. The significantly different variables between the rural and urban group could explain in part the caries levels observed in rural children, and thus, which aspects of oral health and sociodemographic parameters are to be used for interventions in these populations through the implementation of specific oral health promotion and disease prevention programs to reduce the high caries indices observed in this rural zone.

Sukob interesa

Nije naveden.

Conflict of interest

None declared

Abstract
Objective: The objective of this study was to compare the ICDAS-II caries status and caries-related factors among children from rural and urban schools in Pasto, Colombia. **Materials and Methods:** The study included 120 children (4 - 6 year- old children) from rural (privileged) and urban (unprivileged) schools. Caries was evaluated using the ICDAS-II criteria. A survey about the factors related to the presence of caries was applied. Chi-square and Fisher's tests were used to assess the differences in each study variable between the two groups. A Mann–Whitney U test was used to compare the number of teeth, per ICDAS-II category, between the groups. Negative binomial regression was used to estimate the percentage change in the mean number of teeth, per ICDAS-II category, among the rural and urban students. **Results:** Significant differences were found between the rural and urban students for the ICDAS-II 0 and 3-6 categories (p<0.001). The mean number of teeth with moderate-to-severe caries status increased 233% in children from the rural school compared to those attending the urban school (p=0.0). Toothbrushing frequency (p=0.006), cariogenic diet, time elapsed from last dental visit, socioeconomic status, and type of health regime (p<0.001) were among the significant factors related to the rural and urban schools. **Conclusions:** This was the first study to compare ICDAS-II caries status between rural and urban students in Colombia. A worse caries status was found in rural students. This study identified the socioeconomic and clinical factors to guide specific interventions for rural children by modifying the available oral health promotion and disease prevention programs.

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