



Seray Sahin¹, Betül Sen Yavuz¹, Betül Kargul^{1,2}

The Effects of Untreated Caries on Oral-Health-Related Quality of Life and Body Mass Index in 11-12-Year-Old Children

Utjecaj neliječenoga karijesa na kvalitetu života povezanu s oralnim zdravljem i indeks tjelesne mase kod djece od 11 do 12 godina

¹ Department of Pediatric Dentistry, Faculty of Dentistry, Marmara University, Istanbul, Türkiye
Sveučilište Marmara, Stomatološki fakultet, Zavod za dječju stomatologiju, Istanbul, Turska

² Queen Mary University of London, London, UK
Queen Mary University of London, Ujedinjeno Kraljevstvo

Abstract

Objectives: Untreated dental caries is a very widespread childhood disease that can damage the quality of life (QoL), growth, and education, while increasing healthcare costs. This study aimed to determine whether untreated and current dental caries affect both QoL and growth and development. **Materials and Methods:** This cross-sectional study included 145 systemically healthy children aged 11–12 who visited the Pediatric Dentistry Department at Marmara University. Body Mass Index (BMI) was calculated using height and weight and categorized as underweight, normal, or overweight. Oral Health-Related Quality of Life (OHRQoL) was evaluated using the Child Oral Impacts on Daily Performances (C-OIDP) scale. Caries severity was assessed with the International Caries Detection and Assessment System (ICDAS)-II system and classified as: no caries (ICDAS 0), initial (1–2), moderate (3–4), or extensive (5–6). Untreated caries were evaluated using the Pulpal Involvement, Ulceration, Fistula, and Abscess (PUFA/pufa) index and grouped as PUFA/pufa=0 (none) or PUFA/pufa>0 (present). **Results:** Of the children, 56.5% were female. The mean score of pufa and PUFA was 0.6 ± 1.2 and 0.1 ± 0.3 , with a total C-OIDP score of 10.1 ± 12.3 . The distribution of BMI by sex and age showed no significant differences ($p = 0.451$ and $p = 0.129$). Additionally, no significant relationship was found between BMI and clinical complications resulting from untreated caries ($p = 0.317$) or caries severity ($p = 0.219$). **Conclusions:** This study underscores the role of oral health in children's well-being. Higher ICDAS-II scores were associated with lower OHRQoL, while caries-free children showed better outcomes, possibly due to greater awareness or psychosocial factors. Caries severity negatively affected emotional well-being. These findings highlight the need for comprehensive assessments and early preventive care.

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Address for correspondence

Seray Sahin
Marmara University, Faculty of
Dentistry
Basibuyuk yolu, 9/3, Istanbul, Türkiye
Phone: +905422342448
serayshn95@gmail.com

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Seray Sahin 0009-0000-3691-5876
Betül Sen Yavuz 0000-0002-7561-8396

Betül Kargul 0000-0002-3294-8846

Introduction

The definition determined by the World Health Organization (WHO) defined health in 1948 as “a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity” (1). The deterioration of health can negatively impact the Quality of Life (QoL) in many ways. QoL refers to the level of satisfaction a person derives from life based on physical, psychological, social, and environmental factors. The deterioration of health can decrease a person's QoL by affecting one or more of these factors (2). Moreover, the health definition provided by WHO is also applicable to oral health, as oral health is not limited to the teeth alone. It also affects an individual's function-

Uvod

Definicija koju je 1948. godine prihvatila Svjetska zdravstvena organizacija (*World Health Organization* – WHO) opisuje zdravlje kao *stanje potpunoga tjelesnog, mentalnog i socijalnog blagostanja, a ne samo odsutnost bolesti ili slabosti* (1). Pogoršanje zdravlja može na više načina negativno utjecati na kvalitetu života (QoL). Kvaliteta života odnosi se na razinu zadovoljstva koju pojedinac ostvaruje, a temelji se na tjelesnim, psihološkim, socijalnim i okolišnim čimbenicima. Narušavanje zdravlja može smanjiti QoL djelovanjem na jedan ili više navedenih čimbenika (2). Nadalje, definicija zdravlja prema SZO-u može se primijeniti i na oralno zdravlje zato što ono nije ograničeno samo na zube. Oralno zdravlje utje-

al capacities and social interactions in daily life. The deterioration of oral health can affect functions such as chewing and speaking, thus impacting nutrition and general health. From the perspective of social interactions, oral health issues can reduce self-confidence and lead to social isolation. Early tooth loss, bad breath, and facial appearance may affect social development (3).

The Pulpal involvement, Ulceration, Fistula, and Abscess (PUFA) index is a tool used to describe advanced clinical complications of untreated caries. These complications may be linked to lower Body Mass Index (BMI) in affected individuals. Clinical complications arising from untreated dental caries constitute one of the most widespread chronic conditions in childhood worldwide. These complications present substantial challenges, not only in terms of designing and implementing effective public oral health strategies but also for the well-being of affected children and the burden placed on their parents or caregivers (4). In developed countries, it is thought that individuals with higher socioeconomic levels have less tooth decay, which can be attributed to improved oral hygiene practices and easier access to dental care services. However, in developing countries, there may be an increase in problems related to oral and dental health (5). Oral and dental health problems rank among the top five diseases in the 0-6 age group (6.4%) and third in the 7-14 age groups (14.2%) in Türkiye (Turkish Statistical Institute 2022) (6). It has also been found that dental caries is one of the most prevalent pathologies encountered in general health screenings conducted among school-aged children in Türkiye (7).

Untreated dental caries is associated with clinical outcomes such as toothache, difficulty chewing, and early tooth loss. As a result of these factors, there is an increased need for more complex treatments in children, the emergence of cooperation issues, an increased need for general anaesthesia, an increase in early tooth loss, a higher need for space maintainers, and a growing need for advanced orthodontic treatment, leading to a significant need for treatment (8). The severity and untreated nature of dental caries result in more comprehensive and costly treatments, which add additional costs to the healthcare system. This increases public health expenditures and the financial burden on individuals for necessary health expenses (9). In education, pain and discomfort caused by dental caries can lead to school absenteeism and learning difficulties in children. In the long term, this situation may negatively impact economic growth by affecting individuals' participation in education and reducing workforce quality (10). Additionally, untreated oral and dental health problems can lead to growth and developmental disorders due to appetite loss, eating disorders, and sleep problems, causing low weight and developmental delays. Therefore, dental caries may lead to nutritional problems in children, negatively affect their quality of life, and indirectly cause changes in body mass index (11).

Oral and dental health issues are known to influence the QoL among children and adolescents. Various measurement tools have been developed to assess Oral Health-Related Quality of Life (OHRQoL) in pediatric populations, including the Child Oral Impacts on Daily Performances

č e i na funkcionalne sposobnosti pojedinca te na njegovu socijalnu interakciju u svakodnevnom životu. Ako se pogorša može narušiti funkcije poput žvakanja i govora, a to posljedično utječe na prehranu i opće zdravstveno stanje. S aspekta socijalnih odnosa, problemi oralnoga zdravlja mogu smanjiti samopouzdanje i potaknuti socijalnu izolaciju. Rani gubitak zuba, halitoza i izgled lica mogu negativno utjecati na socijalni razvoj (3).

Indeks *Pulpal involvement, Ulceration, Fistula and Abscess* (PUFA) koristi se za opisivanje uznapredovalih kliničkih komplikacija neliječenoga karijesa. Te komplikacije mogu biti povezane s nižim indeksom tjelesne mase (BMI) kod zahvaćenih osoba. Kliničke komplikacije koje nastaju zbog neliječenoga zubnog karijesa jedno je od najraširenijih kroničnih stanja u dječjoj dobi na globalnoj razini. One su velik izazov ne samo kad je riječ o planiranju i provedbi učinkovitih javnozdravstvenih strategija oralnoga zdravlja, nego i kad se radi o dobrobiti djece te o opterećenju njihovih roditelja ili skrbnika (4). U razvijenim zemljama smatra se da osobe višega socioekonomskog statusa imaju manju prevalenciju karijesa, što se pripisuje boljim oralno-higijenskim navikama i lakšem pristupu dentalnim uslugama. No u zemljama u razvoju bilježi se porast problema povezanih s oralnim i dentalnim zdravljem (5). U Turskoj se ti zdravstveni problemi nalaze među pet najčešćih bolesti u dobnoj skupini od 0 do 6 godina (6,4 %) te na trećem mjestu u skupini od 7 do 14 godina (14,2 %) prema podacima Turskoga statističkog instituta (2022.) (6). Također je utvrđeno da je u toj zemlji zubni karijes jedna od najčešćih patoloških promjena otkrivenih tijekom općih zdravstvenih pregleda školske djece (7).

Neliječeni zubni karijes povezan je s kliničkim ishodiima poput zubobolje, otežanog žvakanja i ranog gubitka zuba. Posljedično se povećava potreba za složenijim zahvatima, pojavljuju se problemi u suradnji djeteta, raste potreba za općom anestezijom, za održavačima prostora te za kompliciranim ortodontskim liječenjem, što sveukupno povećava terapijske zahtjeve (8). Težina i neliječenost karijesa rezultiraju opsežnijim i skupljim terapijama, čime se povećavaju troškovi zdravstvenog sustava i financijsko opterećenje pojedinaca (9). U obrazovnom kontekstu, bolovi i nelagodje prouzročene karijesom mogu utjecati na izostanke iz škole i poteškoće u učenju. Dugoročno, to može negativno utjecati na gospodarski rast zbog smanjenja obrazovne participacije i kvalitete radne snage (10). Dodatno, neliječeni oralni problemi mogu prouzročiti poremećaje u rastu i razvoju zbog gubitka apetita, poremećaja u hranjenju i problema sa spavanjem, što može rezultirati niskom tjelesnom težinom i kašnjenjem u razvoju. To su razlozi zbog kojih karijes može izazvati nutritivne probleme, negativno utjecati na kvalitetu života te neizravno izazvati promjene u BMI-ju (11).

Poznato je da oralno i dentalno zdravlje utječe na QoL djece i adolescenata. Razvijeni su različiti instrumenti za procjenu kvalitete života povezane s oralnim zdravljem (OHRQoL) u pedijatrijskoj populaciji, uključujući *Child Oral Impacts on Daily Performances* (C-OIDP), *Child Oral Health Impact Profile* (COHIP), *Child Perceptions Questionnaire* (CPQ) i *Early Childhood Oral Health Impact Scale* (ECHOIS) (12).

(C-OIDP), the Child Oral Health Impact Profile (COHIP), the Child Perceptions Questionnaire (CPQ), and the Early Childhood Oral Health Impact Scale (ECHOIS) (12).

The C-OIDP scale is designed to try to understand both functional and psychological effects related to oral health status (13, 14). It offers a multidimensional framework that “incorporates individual perceptions of oral functionality, emotional and psychological well-being, personal expectations, satisfaction with care, and self-esteem” (13). This scale evaluates the influence of oral health on eight aspects of daily life: “eating, cleaning the mouth, speaking, resting or sleeping, emotional stability, smiling or laughing, carrying out schoolwork, and interacting socially”. Initially tested among Thai children aged 11–12 (15), the C-OIDP has since been validated across multiple languages and countries (16 – 18).

Dental caries and weight problems are multifactorial conditions related to nutrition, socioeconomic status, genetics, and environmental factors (19). BMI is a measure that evaluates individuals’ height and weight relative to each other and having a low or high BMI can lead to some health problems. Therefore, the relationship between BMI and dental caries can be considered a measure for evaluating the general health status of children (20). In the literature, while some studies have reported that children with high BMI may be more susceptible to developing dental caries (21,22), other studies have not found a direct association between BMI and dental caries (20). These differences suggest that the multifactorial nature of caries, including factors such as oral hygiene practices, diet, genetics, and socioeconomic status, can influence this relationship (3).

In the literature, there are studies examining whether clinical complications resulting from untreated caries affect children’s daily QoL (8), but this study is unique in that it examines the impact of both untreated and the severity of current dental caries assessed with the ICDAS-II system on children’s daily life, growth and development. Therefore, this study aimed to identify the differences in OHRQoL (C-OIDP score) and BMI among systemically healthy children aged 11–12 years attending a pediatric dentistry clinic—classified according to the PUFA/pufa and ICDAS-II criteria—by comparing those with and without untreated dental caries and children with varying levels of caries severity. The primary null hypothesis of the study was that there is no difference in BMI between children with and without clinical complications resulting from untreated caries. The following secondary null hypotheses were also addressed: no association between clinical complications resulting from untreated caries and QoL; and no association between the severity of current dental caries and QoL.

Materials and Methods

The ethical conduct of the study was ensured through adherence to the principles set out in the Declaration of Helsinki. The study protocol was assessed and approved by the Ethics Committee of the Institute of Health Sciences, Marmara University. This study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (23). After the children

Ljestvica C-OIDP osmišljena je za procjenu funkcionalnih i psiholoških učinaka oralnoga zdravstvenog statusa (13,14). Ona daje multidimenzionalni okvir koji obuhvaća individualnu percepciju oralne funkcionalnosti, emocionalnoga i psihološkoga blagostanja, osobnih očekivanja, zadovoljstva sa skrbi i samopoštovanja (13). Ljestvicom se procjenjuje utjecaj oralnoga zdravlja na osam aspekata svakodnevnog života: hranjenje, čišćenje usta, govor, odmor ili spavanje, emocionalnu stabilnost, osmijeh ili smijeh, obavljanje školskih zadataka i socijalnu interakciju. Najprije je testirana među djecom u Tajlandu u dobi od 11 do 12 godina (15), a zatim validirana u više zemalja i na različitim jezicima (16 – 18).

Zubni karijes i problemi s tjelesnom masom multifaktorijska su stanja povezana s prehranom, socioekonomskim statusom, genetikom i okolišnim čimbenicima (19). BMI-jem se procjenjuje odnos tjelesne visine i mase, pri čemu i nizak i visok BMI mogu biti povezani sa zdravstvenim rizicima. Zato se odnos između BMI-ja i karijesa može promatrati kao pokazatelj općega zdravstvenog stanja djece (20). Dok autori nekih istraživanja navode da su djeca s povišenim BMI-jem podložnija razvoju karijesa (21, 22), drugi ističu da nisu pronašli izravnu povezanost (20). Te razlike upućuju na multifaktorijsku prirodu karijesa, pri čemu oralna higijena, prehrana, genetika i socioekonomski status mogu modulirati odnos između BMI-ja i karijesa (3).

Iako postoje studije u kojima se ispituje utjecaj kliničkih komplikacija neliječenoga karijesa na svakodnevnu kvalitetu života djece (8), ovo istraživanje specifično je zato što istodobno analizira utjecaj neliječenoga karijesa i težine postojećih lezija procijenjenih sustavom ICDAS-II na svakodnevni život, rast i razvoj djece. Cilj rada bio je utvrditi razlike u OHRQoL-u (rezultat C-OIDP-a) i BMI-ju među sistemski zdravom djecom u dobi od 11 do 12 godina koja dolaze u pedijatrijsku stomatološku kliniku, klasificiranom prema PUFA/pufa i kriterijima ICDAS-II, uspoređujući djecu s neliječenim karijesom i bez neliječenoga karijesa te djecu s različitom težinom karijesa. Primarna nulta hipoteza glasila je da ne postoji razlika u BMI-ju između djece s kliničkim komplikacijama zbog neliječenoga karijesa i onom bez tih komplikacija. Sekundarne nulte hipoteze odnosile su se na nepostojanje povezanosti između kliničkih komplikacija i QoL-a te između težine trenutačnog karijesa i QoL-a.

Materijali i metode

Etička provedba istraživanja osigurana je tako što su postavljena načela Helsinške deklaracije. Protokol istraživanja procijenio je i odobrio Etički odbor Instituta za zdravstvene znanosti pri Sveučilištu Marmara. Istraživanje je obavljeno u skladu sa smjernicama STROBE (*Strengthening the Reporting of Observational Studies in Epidemiology*) (23). Nakon što su djeca pristala sudjelovati, a prije uključivanja u istra-

had agreed to participate in the study, written consent was obtained from their legal guardians before participation.

Participants

This study included 145 children aged 11-12 who visited Department of Pediatric Dentistry at Marmara University. This study was planned as a cross-sectional study including systemically healthy children aged 11-12. Children with mental and physical capacity to answer questions were included in the study, while those who refused to participate or had psychological and physical disabilities were excluded.

Demographic information such as sex and age were recorded. The height and weight of the children were also recorded. Then, the BMIs of children were calculated (21). The OHRQoLs was measured by the C-OIDP scale (15). The Turkish validation of this index at the age of 11-12 years was conducted by Peker et al. (2020) (24). International Caries Detection and Assessment System (ICDAS-II) scores, and the children's PUFA scores (25) were recorded.

Initially, intraoral examinations were conducted by a pediatric dentist with two years of clinical experience, under the supervision of the study director, using dental mirrors and probes and recorded through visual examination using the ICDAS-II to assess the severity of current dental caries. The teeth had to be cleaned and dried during grading. Dental caries can be classified based on observable changes in the enamel and the extent of dentin involvement, as defined by clinical scoring systems such as ICDAS-II. A score of 0 indicates a sound tooth surface with no visible signs of decay. A score of 1 represents the earliest visible change in the enamel, usually appearing as a slight opacity or minor discoloration. A score of 2 is assigned when there is a distinct visual change in the enamel, such as more pronounced alteration in color or surface texture. A score of 3 refers to localized enamel breakdown without clinical evidence of dentin exposure, although there is clear structural loss in the enamel. A score of 4 reflects the presence of a dark shadow under the enamel surface, suggesting underlying dentin involvement. When a distinct cavity with visible dentin is observed, the lesion is scored as 5, indicating significant severity of the caries. Finally, a score of 6 denotes an extensive cavity involving more than half of the tooth surface with exposed dentin, representing a severe stage of tooth decay (26). To facilitate the analysis in this study, ICDAS-II codes were combined as follows: "ICDAS: 0 no caries, ICDAS: 1 and 2 initial lesion, ICDAS: 3 and 4 moderate lesion, ICDAS: 5 and 6 extensive lesion", divided into 4 categories (25). In the classification of participants for analysis, each child was categorized according to their worst-affected tooth (highest ICDAS score recorded in their mouth). Thus, each participant was assigned to one of the four groups (ICDAS=0, 1-2, 3-4, or 5-6), based on their most severe caries lesion.

The PUFA/pufa index was utilized to evaluate the clinical consequences of complications arising from untreated dental caries (27). This index includes the following categories:

- "P/p: Pulp involvement is recorded when the pulp chamber is open or when only roots or root fragments remain due to the destruction of coronal structures.

živanje, njihovi zakonski zastupnici potpisali su informirani pristanak.

Sudionici

U istraživanje je bilo uključeno 145 djece u dobi od 11 do 12 godina koja su se javila na Odjel pedijatrijske stomatologije pri Sveučilištu Marmara. Studija je planirana kao presječno istraživanje koje obuhvaća sistemski zdravu djecu navedene dobi. Uključena su djeca s mentalnim i tjelesnim sposobnostima potrebnima za odgovaranje na pitanja, a isključena su ona koja su imala ili psihičke ili fizičke poteškoće.

Zabilježeni su demografski podatci (spol i dob) te tjelesna visina i masa. Na temelju tih mjerenja izračunat je indeks tjelesne mase (BMI) (21). Kvaliteta života povezana s oralnim zdravljem (OHRQoL) procijenjena je primjenom ljestvice C-OIDP (15). Tursku validaciju toga instrumenta za dob od 11 do 12 godina proveli su Peker i suradnici (2020.) (24). Zabilježeni su rezultati prema sustavu ICDAS-II (*International Caries Detection and Assessment System*) te rezultati PUFA-e za djecu (25).

Intraoralne preglede obavio je pedijatrijski stomatolog s dvogodišnjim kliničkim iskustvom, pod nadzorom voditelja istraživanja. Pregledi su učinjeni uz uporabu stomatološkog zrcala i sonde, a težina karijesa procijenjena je vizualnim pregledom prema kriterijima ICDAS-II. Tijekom ocjenjivanja zubi su morali biti očišćeni i osušeni. ICDAS-II klasificira karijes prema vidljivim promjenama cakline i stupnju zahvaćenosti dentina. Ocjena 0 označava zdravu površinu bez vidljivih znakova karijesa; ocjena 1 označava najraniju vidljivu promjenu cakline, najčešće u obliku blage opacifikacije ili diskoloracije; ocjena 2 upisuje se kada je se jasno uočava promjena boje ili teksture cakline; ocjena 3 označava lokalizirani gubitak kontinuiteta cakline bez klinički vidljive ekspanzije dentina; ocjena 4 odnosi se na tamnu sjenu ispod cakline koja upućuje na zahvaćenost dentina; ocjena 5 označava jasno vidljivu kavitaciju s ekspanziranom dentinom, a ocjena 6 opsežnu kavitaciju koja zahvaća više od polovine površine zuba (26). Radi olakšanja analize, kodovi ICDAS-II grupirani su u četiri kategorije: 0 = bez karijesa; 1 – 2 = inicijalna lezija; 3 – 4 = umjerena lezija; 5 – 6 = opsežna lezija (25). Za analizu je svako dijete svrstano prema najteže zahvaćenom zubu, odnosno prema najvišoj vrijednosti ICDAS-a zabilježenoj u usnoj šupljini. Stoga je svaki sudionik svrstan u jednu od četiriju skupina (ICDAS = 0, 1 – 2, 3 – 4 ili 5 – 6) na temelju najteže karijesne lezije.

Indeks PUFA/pufa korišten je za procjenu kliničkih posljedica neliječenoga karijesa (27). Obuhvaća sljedeće kategorije:

- P/p – zahvaćenost pulpe kada je pulpna komora otvorena ili su ostali samo korijeni/korijenski fragmenti zbog destrukcije krune
- U/u – traumatska ulceracija mekih tkiva prouzročena oštrim fragmentima zuba
- F/f – fistula s gnojnim iscjetkom povezana sa zubom s pulpnom zahvaćenošću
- A/a – apsces s gnojem povezan sa zubom s pulpnom zahvaćenošću.

- U/u: Recorded when sharp tooth fragments cause traumatic ulceration in the surrounding soft tissues.
- F/f: Scored when there is a pus-discharging fistula associated with a tooth with pulpal involvement.
- A/a: Scored when there is an abscess containing pus associated with a tooth with pulpal involvement.”

Clinical complications resulting from untreated caries were visually examined without the use of dental instruments, adhering to standard observational protocols. Each tooth in the primary and permanent dentition was scored separately to ensure accurate assessment. PUFA values were recorded for each tooth (permanent and primary). Total pufa+PUFA values were calculated by adding these two scores. Total scores were divided into two categories as clinical complications resulting from untreated caries status: pufa+PUFA=0 and pufa+PUFA>0.

To calculate the BMI of the patients, weight and height measurements of each child were taken. Body weight was measured barefoot using a portable scale. Height measurements were taken barefoot and with feet together, with the back of the head lightly touching the wall, using a ruler (28). The BMI metric was computed as the quotient of body mass (kg) and the square of stature (m), consistent with established health assessment practices and subsequently interpreted using age- and sex-adjusted percentile charts derived from WHO growth standards for children (29, 30).

The C-OIDP questionnaire includes eight daily activities affected by oral health in children. These are parameters such as “eating, speaking, cleaning the mouth, sleeping, emotional stability, smiling, schoolwork, and playing”. The instrument comprises eight standardized questions designed to assess both the frequency and intensity of the impact of oral health conditions on specific daily functioning domains. For the analysis, the percentage of participants who reported an impact on the C-OIDP (i.e., reported an impact in at least one of the domains) as well as for each of the eight individual domains was calculated. These percentages reflect the prevalence of OHRQoL impacts across specific daily activities. To evaluate frequency, a score of 3 was assigned if the child experienced the impact of an oral health issue on a daily activity for more than three months. If the impact persisted for more than one month but less than three months, a score of 2 was given. Impacts lasting from one or two days up to one month were scored as 1. In addition, the perceived severity of each impact was rated on a four-point scale ranging from 0 to 3, where 0 indicated no impact and 3 signified a very severe impact. The response options were categorized as follows: “0 (no impact), 1 (mild impact), 2 (moderate impact), and 3 (severe impact)”. The overall C-OIDP score was calculated by summing all performance scores, dividing the total by 72, and then multiplying by 100. This yielded a final C-OIDP value expressed on a scale from 0 to 100. As the C-OIDP score increases, the adverse impact of oral health on daily life also intensifies, reflecting deterioration in the individual’s QoL (30). At the beginning of the C-OIDP assessment, participants were asked to indicate any oral health problems they had experienced or noticed over the past three months. These problems included clinical conditions such

Kliničke komplikacije nastale kao posljedica neliječenoga karijesa procijenjene su vizualnim pregledom, bez uporabe stomatoloških instrumenata, u skladu sa standardnim opservacijskim protokolima. Svaki zub u mlječnoj i trajnoj dentaciji ocjenjivan je zasebno radi osiguravanja točne procjene. Vrijednosti PUFA-e zabilježene su za svaki zub (trajni i mlječni). Ukupna vrijednost pufa + PUFA dobivena je zbrajanjem pojedinačnih rezultata. Ukupni rezultat zatim je podijeljen u dvije kategorije prema statusu kliničkih komplikacija neliječenoga karijesa: pufa + PUFA = 0 i pufa + PUFA > 0.

Za izračun BMI-ja obavljena su mjerenja tjelesne mase i visine svakog djeteta. Tjelesna masa mjerena je prijenosnom vagom, a djeca su bila bosonoga. Visina je, uz uporabu mjerne letve, mjerena također bosonogoj djeci, sa stopalima priljubljenima jedno uz drugo, pri čemu je stražnji dio glave lagano dodirivao zid (28). BMI je izračunat kao omjer tjelesne mase (kg) i kvadrata tjelesne visine (m²), u skladu sa standardnim zdravstvenim postupcima procjene, te je interpretiran prema percentilnim tablicama prilagođenima dobi i spolu, temeljenima na standardima rasta djece Svjetske zdravstvene organizacije (29, 30).

Upitnik C-OIDP obuhvaća osam svakodnevnih aktivnosti na koje može utjecati oralno zdravlje djece: jedenje, govor, čišćenje usta, spavanje, emocionalnu stabilnost, osmijeh, školske obveze i igru. Instrument se sastoji od osam standardiziranih pitanja kojima se procjenjuju učestalost i intenzitet utjecaja oralno-zdravstvenih stanja na pojedine domene svakodnevnog funkcioniranja. Za analizu je izračunat postotak sudionika koji su prijavili utjecaj (odnosno, barem u jednoj domeni) te postotci za svaku pojedinu domenu. Ti postotci odražavaju prevalenciju utjecaja na OHRQoL u specifičnim svakodnevnim aktivnostima. U procjeni učestalosti dodijeljena je ocjena 3 ako je utjecaj trajao dulje od tri mjeseca, ako je trajao dulje od jednog mjeseca, ali kraće od tri mjeseca, dodijeljena je ocjena 2. Utjecaji u trajanju od jednog ili dva dana do jednog mjeseca bodovani su s 1. Težina utjecaja procjenjivana je na ljestvici od 0 do 3, pri čemu 0 označava izostanak utjecaja, a 3 vrlo izražen utjecaj. Odgovori su kategorizirani kao: 0 (bez utjecaja), 1 (blagi utjecaj), 2 (umjereni utjecaj) i 3 (izraženi utjecaj). Ukupni rezultat C-OIDP-a izračunat je zbrajanjem svih bodova za pojedine aktivnosti, dijeljenjem ukupnoga zbroja sa 72 te množenjem sa 100. Time je dobiven rezultat na ljestvici od 0 do 100. Viša vrijednost rezultata C-OIDP-a označava izraženiji negativni utjecaj oralnoga zdravlja na svakodnevni život, odnosno pogoršanje kvalitete života (30). Na početku procjene C-OIDP-a sudionici su naveli oralno-zdravstvene probleme koje su primijetili ili doživjeli u protekla tri mjeseca. Ti su problemi uključivali klinička stanja poput zubobolje, osjetljivosti zuba, karijesa i fiziološkog ispadanja mlječnih zuba, estetske smetnje vezane uz frakture, diskoloracije, veličinu i oblik zuba te parodontne probleme poput krvarenja i otekline gingive, zubnog kamenca i oralnih ulceracija. Procjene su se temeljile na individualnim samoprijavama djece.

Drugi dio C-OIDP-a proveden je izravnim intervjuom, što je obavio glavni istraživač. Djeca su upitana jesu li navedeni oralno-zdravstveni problemi utjecali na njihove svakodnevne aktivnosti u protekla tri mjeseca. Procijenjene su

as toothache, tooth sensitivity, dental caries, and exfoliating primary teeth; esthetic concerns related to tooth fractures, discoloration, size, and shape; and periodontal issues such as bleeding gums, swollen gums, dental calculus, and oral ulcers. The subjective evaluations related to these clinical conditions were self-reported by the children individually.

Subsequently, the second part of the C-OIDP was administered through direct interviews conducted by the main researcher. In this part, children were asked whether the previously mentioned oral health problems had affected their daily activities over the past three months. This section covers eight different daily performance domains: "eating, speaking, cleaning mouth, sleeping or resting, emotional balance, smiling or laughing, school performance, and social interaction". The frequency and severity scores for each domain were multiplied to obtain an individual impact score and a final intensity score was obtained (31, 32).

The formula used is:

$$C - OIDP = \sum(\text{frequency} \times \text{severity}) / 72 \times 100 \quad (31)$$

Statistical analysis

All statistical computations were executed using the IBM SPSS Statistics Version 26.0 (IBM SPSS, Chicago, Illinois, USA) software package. Frequencies and percentage values were used to depict categorical variables, whereas continuous variables were reported as mean values accompanied by standard deviations (SD).

To assess normality in continuous variables, the Shapiro-Wilk test was employed. Total pufa+PUFA scores were used for correlation analyses as a scale variable and were dichotomized according to clinical complications due to untreated caries status for comparison of categorical data: pufa+PUFA=0 and pufa+PUFA>0. The Chi-square test was used to examine the association between categorical variables. In the comparison of C-OIDP domains, a comparison was made between those who reported an impact in this domain and those who did not report an impact in this domain. The comparison of the C-OIDP scores according to untreated dental caries and the severity of current caries were conducted using Independent Samples t-test and One-way ANOVA. Spearman's correlation coefficient was employed to assess the relationships between pufa+PUFA scores, ICDAS scores, BMI, and C-OIDP. A p-value below 0.05 was interpreted as indicative of statistical significance throughout the analyses.

Results

The sample of the study consisted of 145 children aged 11-12 years. Of the children, 82 (56.5%) were females, and 63 (43.5%) were males. An overall mean of 0.6 ± 1.2 (mean \pm SD) was recorded for the pufa score and the calculated mean for the PUFA score was 0.1 ± 0.3 . Moreover, the average of pufa+PUFA was 0.3 ± 0.5 . The total C-OIDP score was 10.1 ± 12.3 . The distribution of BMI among children according to sex and age groups was analysed (Table 1). BMI did not differ according to both sex ($p = 0.451$) and age ($p = 0.129$). The relationship between BMI and children's clinical complications resulting from untreated caries status and

sljedeće domene: jedenje, govor, čišćenje usta, spavanje ili odmor, emocionalna ravnoteža, osmijeh ili smijeh, školski uspjeh i socijalna interakcija. Rezultat utjecaja za svaku domenu dobiven je množenjem ocjene učestalosti i težine, čime je izračunat individualni rezultat intenziteta (31, 32).

Primijenjena formula bila je:

$$C - OIDP = \sum(\text{učestalost} \times \text{težina}) / 72 \times 100 \quad (31)$$

Statistička analiza

Sve statističke analize obavljene su u programu IBM SPSS Statistics (IBM SPSS, Chicago, Illinois, SAD). Kategorijske varijable prikazane su frekvencijama i postotcima, a kontinuirane varijable izražene su aritmetičkom sredinom i standardnom devijacijom (SD).

Normalnost distribucije kontinuiranih varijabli procijenjena je Shapiro-Wilkovim testom. Ukupne vrijednosti pufa + PUFA korištene su kao kontinuirana varijabla u korelacijskim analizama te su, za potrebe usporedbe kategorijskih podataka, dihotomizirane prema statusu kliničkih komplikacija (pufa + PUFA = 0 i pufa + PUFA > 0). Za ispitivanje povezanosti kategorijskih varijabli korišten je hi-kvadrat test. U analizi domena C-OIDP-a uspoređivane su skupine djece koja su prijavila utjecaj u određenoj domeni i one koja to nisu učinila. Usporedba rezultata C-OIDP-a prema prisutnosti neliječenoga karijesa i težini postojećeg karijesa provedena je t-testom za nezavisne uzorke i jednofaktorskom analizom varijance (ANOVA). Za procjenu povezanosti između rezultata za indeks pufa + PUFA, rezultata ICDAS-a, BMI-ja i C-OIDP-a korišten je Spearmanov koeficijent korelacije. Razina statističke značajnosti postavljena je na $p < 0,05$.

Rezultati

Uzorak istraživanja sastojao se od 145 djece u dobi od 11 do 12 godina. Od ukupnog broja djece, 82 (56,5 %) bile su djevojčice, a 63 (43,5 %) dječaci. Ukupna srednja vrijednost rezultata pufa iznosila je $0,6 \pm 1,2$ (aritmetička sredina \pm standardna devijacija), a izračunata srednja vrijednost rezultata PUFA-e iznosila je $0,1 \pm 0,3$. Nadalje, prosječna vrijednost pufa + PUFA iznosila je $0,3 \pm 0,5$. Ukupni rezultat C-OIDP-a iznosio je $10,1 \pm 12,3$. Analizirana je raspodjela BMI-ja među djecom prema spolu i dobnim skupinama (tablica 1.). BMI se nije statistički značajno razlikovao ni prema spolu ($p = 0,451$), ni prema dobi ($p = 0,129$). Analiziran

Table 1 The Body Mass Indexes of children according to sex and age groups
Tablica 1. Indeks tjelesne mase djece prema spolu i dobnim skupinama

Variables	BMI<Normal N (%)	BMI Normal N (%)	BMI>Normal N (%)	Total	Chi-square value	p-value
Sex						
Females	15 (18.3)	65 (79.3)	2 (2.4)	82 (100)	1.594 [‡]	0.451
Males	13 (20.6)	46 (73.0)	4 (6.3)	63 (100)		
Age						
11 years	11 (15.9)	53 (78.8)	5 (7.2)	69 (100)	4.094 [‡]	0.129
12 years	17 (22.4)	58 (76.3)	1 (1.3)	76 (100)		

N: Number of the children, BMI: Body Mass Index, * values mean statistically significant ($p < 0.05$). ‡: Likelihood ratio.

N: broj djece; BMI: indeks tjelesne mase; * vrijednosti označavaju statistički značajnu razliku ($p < 0,05$); ‡: omjer vjerojatnosti (*likelihood ratio*)

Table 2 The relationship of Body Mass Index with untreated caries status and severity

Tablica 2. Odnos indeksa tjelesne mase s prisutnošću neliječenoga karijesa i njegovom težinom

Performance	Total N (%)	pufa+PUFA=0 N (%)	pufa+PUFA>0 N (%)	Chi-square value	p-value
Eating food	82 (56.6)	55 (67.1)	27 (32.9)	0.316 [‡]	0.574
Speaking clearly	21 (14.5)	16 (72.7)	6 (27.3)	0.171 [‡]	0.679
Cleaning mouth	53 (36.6)	35 (64.8)	19 (35.2)	0.693 [‡]	0.405
Sleeping or relaxing	31 (21.4)	19 (63.3)	11 (36.7)	0.561 [‡]	0.454
Maintaining usual emotional stability	17 (11.7)	11 (57.9)	8 (42.1)	1.252 [‡]	0.263
Smiling or laughing	36 (24.8)	27 (75.0)	9 (25.0)	0.815 [‡]	0.367
Carrying out schoolwork	12 (8.3)	8 (61.5)	5 (38.5)	NA	0.542 [§]
Contact with people	8 (5.5)	3 (37.5)	5 (62.5)	NA	0.108 [§]
	Total mean±SD	pufa+PUFA=0 mean±SD	pufa+PUFA>0 mean±SD	test ist.	p-value
Total C-OIDP score	10.1 ± 12.3	9.3 ± 11.5	11.7 ± 14.1	1.733	0.274 [‡]

N: Number of the children, C-OIDP: Child Oral Impacts on Daily Performances, PUFA, pufa: Pulpal involvement, Ulceration, Fistula, Abscess, SD: Standard Deviation, NA: Not applicable, †: Pearson Chi-square value, §: Fisher-exact test, ¶: Independent Samples t-test, * values mean statistically significant ($p < 0.05$). • N: broj djece; C-OIDP: Child Oral Impacts on Daily Performances (Utjecaj oralnoga zdravlja na svakodnevne aktivnosti djeteta); PUFA/pufa: zahvaćenost pulpe, ulceracija, fistula, apsces; SD: standardna devijacija; NA: nije primjenjivo; †: Pearsonov hi-kvadrat test; §: Fisherov egzakti test; ¶: t-test za nezavisne uzorke; * vrijednosti označavaju statistički značajnu razliku ($p < 0,05$)

Table 3 Comparisons of C-OIDP domain impacts and total score according to clinical complications of untreated caries

Tablica 3. Usporedba utjecaja pojedinih domena C-OIDP-a i ukupnoga rezultata prema prisutnosti kliničkih komplikacija neliječenoga karijesa

Variables	BMI<Normal N (%)	BMI Normal N (%)	BMI>Normal N (%)	Total	Chi-square value	p-value
Untreated Caries Status						
pufa+PUFA=0	17 (17.0)	80 (80.0)	3 (3.0)	100 (100)	2.297 [‡]	0.317
pufa+PUFA>0	11 (24.4)	31 (68.9)	3 (6.7)	45 (100)		
Caries Severity						
No caries	1 (5.6)	17 (94.4)	0	18 (100)	8.275 [‡]	0.219
Initial lesions	3 (17.6)	14 (82.4)	0	17 (100)		
Moderate lesions	4 (22.2)	12 (66.7)	2 (11.1)	18 (100)		
Extensive lesions	20 (21.7)	68 (73.9)	4 (4.3)	92 (100)		
Total	28 (19.3)	111 (76.6)	6 (4.1)	145 (100)		

N: Number of the children, BMI: Body Mass Index, PUFA, pufa: Pulpal involvement, Ulceration, Fistula, Abscess, * values mean statistically significant ($p < 0.05$). ‡: Likelihood ratio. • N: broj djece; BMI: indeks tjelesne mase; PUFA/pufa: zahvaćenost pulpe, ulceracija, fistula, apsces; * vrijednosti označavaju statistički značajnu razliku ($p < 0,05$); ‡: omjer vjerojatnosti (*likelihood ratio*).

the severity of current dental caries (ICDAS-II) was analyzed (Table 2). There was no statistically significant difference between BMI and the presence of untreated caries ($p = 0.317$). Also, there was no statistically significant relationship between caries severity and BMI ($p = 0.219$). The comparison of C-OIDP impacts across groups categorized by the clinical complications of untreated caries is presented in Table 3.

je odnos između BMI-ja i kliničkih komplikacija neliječenoga karijesa kod djece te težine postojećega zubnog karijesa (ICDAS-II) (tablica 2.). Nije ustanovljena statistički značajna razlika između BMI-ja i neliječenoga karijesa ($p = 0,317$). Također nije utvrđena statistički značajna povezanost između težine karijesa i BMI-ja ($p = 0,219$). U tablici 3. prikazana je usporedba utjecaja C-OIDP-a između skupina kategori-

Table 4 Comparisons of C-OIDP domain impacts and total score according to the severity of current dental caries
Tablica 4. Usporedba utjecaja pojedinih domena C-OIDP-a i ukupnoga rezultata prema težini trenutnog zubnog karijesa

Performance	Total N (%)	No caries N (%)	Initial lesions N (%)	Moderate lesions N (%)	Extensive lesions N (%)	Chi-square value	p-value
Eating food	82 (56.6)	8 (9.8)	11 (13.4)	8 (9.8)	55 (67.1)	2.999 [†]	0.392
Speaking clearly	21 (14.5)	7 (31.8)	2 (9.1)	2 (9.1)	11 (50.0)	7.165 [‡]	0.067
Cleaning mouth	53 (36.6)	5 (9.3)	4 (7.4)	7 (13.0)	38 (70.4)	2.728 [†]	0.435
Sleeping or relaxing	31 (21.4)	5 (16.7)	1 (3.3)	4 (13.3)	20 (66.7)	3.561 [‡]	0.313
Maintaining usual emotional stability	17 (11.7)	7 (36.8)	0 (0)	1 (5.3)	11 (57.9)	13.485 [‡]	0.004*
Smiling or laughing	36 (24.8)	6 (16.7)	6 (16.7)	4 (11.1)	20 (55.6)	2.127 [‡]	0.546
Carrying out schoolwork	12 (8.3)	1 (7.7)	0 (0)	1 (7.7)	11 (84.6)	4.701 [‡]	0.195
Contact with people	8 (5.5)	1 (12.5)	0 (0)	0 (0)	7 (87.5)	4.667 [‡]	0.198
	mean±SD					test ist.	p-value
Total C-OIDP score	10.1 ± 12.3	18.2 ± 19.5	6.8 ± 6.1	7.4 ± 9.0	9.6 ± 11.5	3.504	0.017 [‡]

N: Number of the children, C-OIDP: Child Oral Impacts on Daily Performances, SD: Standard Deviation NA: Not applicable, †: Pearson Chi-square value, ‡: Likelihood ratio, ¥: One-way ANOVA, * values mean statistically significant (p<0.05). • N: broj djece; C-OIDP: Child Oral Impacts on Daily Performances; SD: standardna devijacija; NA: nije primjenjivo.

The percentage of participants reporting an impact for each domain was calculated, with no statistically significant differences detected between the two groups for most of the domains. However, the total C-OIDP score did not significantly differ between the groups (p = 0.274).

Table 4 compares the C-OIDP impacts by different caries lesion categories. Significant differences were observed in the 'Maintaining usual emotional stability' domain (p = 0.004), with participants in the extensive lesion group reporting a higher impact. The One-way ANOVA revealed a statistically significant difference in the total C-OIDP score (p = 0.017).

No significant correlation was identified between the C-OIDP score and pufa+PUFA (r = 0.036; p = 0.665) or ICDAS-II scores (r = -0.064; p = 0.443). No significant correlation was also detected between BMI and pufa+PUFA, ICDAS-II (p > 0.05).

Discussion

This research aimed to investigate whether untreated caries and the severity of current dental caries assessed using the ICDAS-II system affect both QoL and growth and development in children aged 11-12 years, reflecting an average causal effect under the assumptions of exchangeability and consistency. The high incidence and impact of dental caries underscore its status as a critical concern in global health discourse, affecting populations across both low- and high-income nations. This condition not only affects dental tissues but can also affect other structures in the oral cavity and cause various diseases in other body systems (33). Advanced caries can cause serious problems in children, such as pain, difficulty maintaining regular eating and sleeping habits, low BMI, missed school days, and, in severe cases, hospitalization. Therefore, early prevention and timely treatment are crucial to protect the systemic and psychosocial health and the quality of life of affected children (34).

ziranih prema kliničkim komplikacijama neliječenoga karijesa. Izračunat je postotak ispitanika koji su prijavili utjecaj u svakoj domeni, pri čemu za većinu domena nisu utvrđene statistički značajne razlike između dviju skupina. Međutim, ukupni rezultat C-OIDP-a nije se statistički značajno razlikovao između skupina (p = 0,274). U tablici 4. uspoređeni su utjecaji C-OIDP-a prema različitim kategorijama karijesnih lezija. Statistički značajne razlike uočene su u domeni održavanje uobičajene emocionalne stabilnosti (p = 0,004), pri čemu su ispitanici iz skupine s opsežnim lezijama prijavili veći utjecaj. Jednofaktorska analiza varijance (jednofaktorska ANOVA) pokazala je statistički značajnu razliku u ukupnom rezultatu C-OIDP-a (p = 0,017). Nije utvrđena statistički značajna korelacija između rezultata C-OIDP-a i pufa + PUFA (r = 0,036; p = 0,665), ni rezultata za ICDAS-II (r = -0,064; p = 0,443). Također nije utvrđena statistički značajna korelacija između BMI-ja i indeksa pufa + PUFA, odnosno rezultata za ICDAS-II (p > 0,05).

Rasprava

Ovo istraživanje imalo je za cilj ispitati utječu li neliječeni karijes i težina postojećega zubnog karijesa procijenjena primjenom sustava ICDAS-II na kvalitetu života (QoL) te na rast i razvoj djece u dobi od 11 do 12 godina, odražavajući prosječni kauzalni učinak pod pretpostavkama zamjenjivosti i konzistentnosti. Visoka incidencija i utjecaj zubnog karijesa ističu njegov status kao kritičnog problema u globalnome zdravstvenom diskursu koji pogađa populacije u zemljama s niskim i visokim prihodima. To stanje ne zahvaća samo zubna tkiva, nego se može pojaviti i na drugim strukturama u usnoj šupljini te prouzročiti različite bolesti u drugim tjelesnim sustavima (33). Uznapredovali karijes može potaknuti ozbiljne probleme kod djece, poput bolova, poteškoća u održavanju redovitih prehranbenih navika i navika pri spavanju, niskoga BMI-ja, izostanaka iz škole te, u težim slučajevima, hospitalizacije. Zato su rana prevencija i pravodobno liječenje ključni za zaštitu sistemskoga i psihosocijalnoga zdravlja te kvalitete života zahvaćene djece (34).

In oral epidemiological studies, dmft/DMFT and IC-DAS-II indices were used to assess dental health (35). However, these methods did not include advanced clinical outcomes of untreated dental caries. Therefore, the pufa/PUFA index was developed to assess clinical complications arising from untreated caries (27). In developed countries, where dental health education is provided early, and preventive practices are more common, delayed treatment-related clinical findings are less prevalent due to the presence of advanced healthcare systems and easy access to health services. Studies conducted in Italian schools have contributed to the reduction of caries-related complications among children. School-based oral health programs have been shown to reduce caries complications and maintain low pufa+PUFA values (36). In developing countries, Türkiye represents a case of "opposite" trends. Dental health policies in developing countries are inadequate. Comprehensive preventive programs are either not implemented or not adequately funded. Since health budgets are often directed towards more urgent health problems, oral health is not a prioritized policy (21). As a result, the treatment of dental caries is delayed, leading to higher treatment costs and greater burden on the national economy.

PUFA and DMFT are indices that measure the severity of dental caries. DMFT indicates the presence of "decayed, missing, and filled" teeth, while PUFA provides information on the clinical findings of untreated teeth. In this case, PUFA highlights more severe conditions that DMFT fails to address. In individuals with high DMFT scores, PUFA scores also tend to increase, as clinical complications resulting from untreated caries can lead to more serious oral health problems over time (27, 35, 37). IC-DAS is a system that allows a more detailed assessment of dental caries, even identifying the presence of early-stage caries (25). Thus, the impact of the clinical symptoms of existing caries at different stages can be examined on oral and general body health. In the current study, IC-DAS-II scoring was used to detect the severity of dental caries and examined their relationship with QoL and BMI.

Body mass index (BMI), calculated as weight divided by height squared, is a widely used marker of adiposity and general health status. Evidence from previous research suggests that higher BMI levels in pediatric populations may be associated with a higher risk of developing dental caries (8, 22, 37). It is generally believed that a diet rich in sugars and carbohydrates may increase caries incidence while increasing BMI. However, the relationship between low BMI and dental caries is more confusing. Certain studies (21, 22) suggest a greater prevalence of caries among underweight children, potentially associated with nutritional deficiencies. In the current study, the outcomes revealed no meaningful correlation between children's BMI and either the occurrence or advancement of dental caries. This finding is in line with previous studies. For instance, research conducted in India among children aged 3 to 12 years reported no significant correlation between age-adjusted BMI and dental caries prevalence (37). Likewise, a recent meta-analysis by Manohar et al. (2020) (38) also failed to demonstrate a significant

U oralno-epidemiološkim istraživanjima za procjenu dentalnoga zdravlja korišteni su indeksi dmft/DMFT i IC-DAS-II (35). Međutim, te metode nisu uključivale uznapredovale kliničke ishode neliječenoga zubnog karijesa. Zato je razvijen indeks pufa/PUFA za procjenu kliničkih komplikacija koje proizlaze iz neliječenoga karijesa (27). U razvijenim zemljama, gdje se edukacija o dentalnome zdravlju provodi rano i gdje su preventivne zaštitne prakse češće, odgođeni klinički nalazi povezani s liječenjem rjeđi su zato što postoje razvijeni zdravstveni sustavi i jednostavan je pristup zdravstvenim uslugama. Istraživanja provedena u talijanskim školama pridonijela su smanjenju komplikacija povezanih s karijesom kod djece. Pokazalo se da školski programi oralnoga zdravlja smanjuju komplikacije u slučaju karijesa i održavaju niske vrijednosti indeksa pufa + PUFA (36). U zemljama u razvoju, poput Turske, situacija je suprotna. Politike, kad je riječ o dentalnome zdravlju u zemljama u razvoju, nisu odgovarajuće. Sveobuhvatni preventivni programi ili se ne provode ili nisu odgovarajuće financirani. Budući da se zdravstveni proračuni često usmjeravaju prema hitnijim zdravstvenim problemima, oralno zdravlje nema prioritet u zdravstvenoj politici (21). Rezultat toga jest odgađanje liječenja zubnog karijesa, što znači da se povećavaju troškovi liječenja i veće je opterećenje nacionalnoga gospodarstva.

Indeksima PUFA i DMFT mjeri se težina zubnog karijesa. DMFT označava prisutnost *karioznih, izgubljenih i ispunjenih* zuba, a PUFA pruža informacije o kliničkim nalazima neliječenih zuba. U tom kontekstu, PUFA ističe teža stanja koja DMFT ne obuhvaća. Kod osoba s visokim vrijednostima DMFT-a, vrijednosti indeksa PUFA također imaju tendenciju porasta, zato što kliničke komplikacije koje nastaju zbog neliječenoga karijesa tijekom vremena mogu rezultirati ozbiljnijim problemima u oralnome zdravlju (27, 35, 37). IC-DAS je sustav koji omogućuje detaljniju procjenu zubnog karijesa, uključujući prepoznavanje njegovih ranih stadija (25). Time se može ispitati utjecaj kliničkih simptoma postojećeg karijesa u različitim stadijima na oralno i opće tjelesno zdravlje. U ovom istraživanju bodovanje IC-DAS-II korišteno je za utvrđivanje težine zubnog karijesa te je ispitivan njegov odnos s QoL-om i BMI-jem.

Indeks tjelesne mase (BMI), izračunat kao omjer tjelesne mase i kvadrata tjelesne visine, široko je primijenjen pokazatelj adipoziteta i općega zdravstvenog statusa. Dokazi iz dosadašnjih istraživanja sugeriraju da viši BMI u pedijatrijskoj populaciji može biti povezan s većim rizikom od pojave zubnog karijesa (8, 22, 37). Općenito se smatra da prehrana bogata šećerima i ugljikohidratima može povećati incidenciju karijesa, istodobno povećavajući i BMI. Međutim, odnos između niskoga BMI-ja i zubnog karijesa manje je jasan. U određenim studijama (21, 22) autori upućuju na veću prevalenciju karijesa kod pothranjene djece, potencijalno povezanu s nutritivnim deficitima. U ovom istraživanju rezultati nisu pokazali značajnu povezanost između BMI-ja djece i pojave ili progresije zubnog karijesa. Ovaj nalaz u skladu je s dosadašnjim istraživanjima. Primjerice, u istraživanju provedenom u Indiji među djecom u dobi od 3 do 12 godina nije pokazana značajna korelacija između BMI-ja prilagođenoga dobi i prevalencije zubnog karijesa (37). Slično tomu, u ne-

association between obesity and dental caries (38, 39). Furthermore, a systematic review by Silva et al. (40) based on studies published between 2007 and 2012, concluded that current evidence is insufficient to confirm a clear relationship between obesity and dental caries. The authors highlighted the importance of further investigating dietary habits and other possible contributing factors (38). However, there are also studies in the literature that report contrasting findings. Some research suggests that overweight and obese children may be at a higher risk of developing dental caries. For example, a study conducted in China found that children in the highest BMI category had a 44% greater likelihood of experiencing early childhood caries (ECC) compared to those in the lowest BMI category. These discrepancies across studies may be attributed to differences in study populations, dietary patterns, oral hygiene behaviors and genetic factors (39).

The C-OIDP is a scale that measures how dental and oral problems affect daily life activities (15). With this scale, it is possible to assess the multifaceted effects of oral health on the physical, emotional and social dimensions of a child's life. The Turkish version of the C-OIDP scale, which has been validated for children aged 11–12 years, was employed in this study (24). Contrary to expectations, the results demonstrated that children classified as caries-free reported higher mean C-OIDP scores than those with moderate or extensive carious lesions, suggesting an unexpected trend in perceived impact on daily life. Likewise, domain-specific impacts did not exhibit a consistent trend in relation to caries severity. This unexpected outcome may be explained by the complex and subjective nature of OHRQoL. Locker and Allen (2007) (41) also emphasised the subjective nature of OHRQoL by defining it as the impact of oral diseases and disorders on aspects of daily life that individuals value, and that may influence their overall perception of well-being. Accordingly, even in the absence of clinical oral health problems, C-OIDP scores may be elevated in children due to various personal perceptions and contextual influences. Recent research suggests that psychological stress significantly contributes to increased OHRQoL scores in children (41). Children experiencing elevated stress levels may perceive oral health issues as more severe and report greater disruption to their daily activities. Likewise, the lack of parental support can hinder a child's ability to cope with oral health challenges, leading to a negative impact on their perceived QoL (42). Socioeconomic status also plays a critical role in shaping both access to oral healthcare and children's perceptions of their oral health. Children belonging to socioeconomically disadvantaged groups may experience higher rates of dental caries, yet they often underreport its impact due to normalization or limited ability to verbalize their discomfort. In contrast, children from higher socioeconomic backgrounds may exhibit greater health awareness and report even minor issues as significant limitations. Furthermore, parental health literacy regarding oral health and nutrition is known to influence children's behaviors and perceptions. Increasing caregivers' knowledge in these areas has been shown to positively affect children's OHRQoL (43). Collectively, these findings highlight that OHRQoL is not solely determined by

давnoj metaanalizi Manohara i suradnika (2020.) (38) također nije istaknuta značajna povezanost između pretilosti i zubnog karijesa (38, 39). Nadalje, u sustavnome pregledu Silve i suradnika (40), temeljenom na studijama objavljenima između 2007. i 2012., zaključeno je da trenutačni dokazi nisu dostatni za potvrdu jasne povezanosti između pretilosti i zubnog karijesa. Autori su istaknuli važnost daljnjeg istraživanja prehrambenih navika i drugih mogućih čimbenika (38). Međutim, u literaturi postoje i studije u kojima se izvještava o suprotnim nalazima. U nekima se sugerira da djeca s prekomjernom tjelesnom masom i pretilošću mogu biti u većem riziku od razvoja zubnog karijesa. Primjerice, autori istraživanja provedenoga u Kini pokazali su da su djeca u najvišoj kategoriji BMI-ja imala 44 % veću vjerojatnost za pojavu ranoga dječjeg karijesa (ECC) u usporedbi s djecom u najnižoj kategoriji. Te razlike među studijama mogu se pripisati razlikama u populacijama ispitanika, prehrambenim i oralno-higijenskim navikama te genetskim čimbenicima (39).

C-OIDP je ljestvica kojom se mjeri kako dentalni i oralni problemi utječu na svakodnevne aktivnosti (15). Njome se mogu procijeniti višedimenzionalni učinci oralnoga zdravlja na tjelesnu, emocionalnu i socijalnu dimenziju djetetova života. U ovom istraživanju korištena je turska verzija ljestvice C-OIDP validirane za djecu u dobi od 11 do 12 godina (24). Suprotno očekivanjima, rezultati su pokazali da su djeca klasificirana kao bez karijesa imala više srednje vrijednosti C-OIDP-a u usporedbi s djecom s umjerenim ili opsežnim karijesnim lezijama, što upućuje na neočekivani trend u percepciji utjecaja na svakodnevni život. Utjecaji po pojedinim domenama također nisu pokazali dosljedan trend u odnosu na težinu karijesa. Taj neočekivani ishod može se objasniti složenom i subjektivnom prirodom OHRQoL-a. Locker i Allen (2007.) (41) također su istaknuli subjektivnu prirodu OHRQoL-a definirajući ga kao utjecaj oralnih bolesti i poremećaja na aspekte svakodnevnog života koje pojedinci smatraju važnima, a mogu utjecati na njihovu ukupnu percepciju dobrobiti. Sukladno tomu, čak i u odsutnosti kliničkih oralno-zdravstvenih problema, rezultati C-OIDP-a mogu biti povišeni kod djece zbog različitih osobnih percepcija i kontekstualnih utjecaja. U nedavnim istraživanjima sugerira se da psihološki stres znatno pridonosi povećanim rezultatima OHRQoL-a kod djece (41). Djeca koja doživljavaju povišene razine stresa mogu percipirati oralno-zdravstvene probleme kao teže i prijaviti veće ometanje svakodnevnih aktivnosti. Nedostatak roditeljske potpore također može otežati djetetu suočavanje s oralno-zdravstvenim izazovima, što negativno utječe na percipiranu kvalitetu života (42). I socioekonomski status ključan je u oblikovanju pristupa oralnoj zdravstvenoj skrbi i percepciji oralnoga zdravlja djece. Djeca iz socioekonomski nepovoljnijih skupina mogu imati višu prevalenciju zubnog karijesa, ali često podcjenjuju njegov utjecaj zbog normalizacije problema ili ograničene sposobnosti pri verbalizaciji nelagode. Suprotno tomu, djeca iz viših socioekonomskih slojeva mogu pokazivati veću zdravstvenu osviještenost i prijavljivati čak i manje probleme kao značajna ograničenja. Nadalje, zdravstvena pismenost roditelja kad je riječ o oralnome zdravlju i prehrani, poznata je kao čim-

the presence or absence of dental caries, but is significantly shaped by psychosocial, behavioral, and environmental factors. Similarly, in the presence of enamel defects, disease severity has been reported to be an important determinant of the perceived impact on OHRQoL (44). Consequently, the evaluation of children's OHRQoL requires a multidimensional and integrative approach that reflects the complexity of their lived experiences.

According to previous studies, individuals with high PUFA scores experience more complicated problems due to delayed dental treatments, which may lead to greater restrictions in daily life activities (18, 27, 31). For example, persistent pain in the mouth makes it difficult for individuals to sleep, eat, and interact socially. This could result in worse C-OIDP scores (27), but this situation is generally limited to specific activities and may have less impact on total C-OIDP scores. In the current study, no significant relationship was detected between clinical complications resulting from untreated caries and daily activities, except for a significant relationship in the human communication subscale. This may be due to the older age group of this study, potentially affecting social interactions negatively. Additionally, as in other studies, no significant relationship was found between total C-OIDP scores and clinical complications resulting from untreated caries in this study. Similar to other studies, significant correlations were identified between QoL subscales and ICDAS scores in this study.

With the limitations of the study, this study found that children with clinical complications resulting from untreated caries had lower BMI. Therefore, the primary null hypothesis was rejected. However, the secondary null hypotheses were accepted because there was no correlation between the QoL with clinical complications resulting from untreated caries or the severity of current dental caries. One limitation of this study is that the sample was drawn from a single center in a single province. Participants were selected using a convenience sampling method among children attending routine dental visits, which may have introduced selection bias. This approach might have resulted in the inclusion of children with greater oral health awareness or better access to dental care compared to the general population. Conversely, since the study was conducted in a dental hospital setting, it is also possible that the sample included a higher proportion of children presenting with oral health problems, potentially overestimating the prevalence of caries-related outcomes. These factors together may limit the external validity and generalizability of our findings. In addition, potential confounding factors that were not measured in this study, such as dietary habits, socioeconomic background, and oral hygiene practices, may have influenced both the occurrence of dental caries and children's oral health-related quality of life. The lack of adjustment for these variables could have led to residual confounding, which should be considered when interpreting the findings. Future studies should incorporate these variables in multivariate analyses to provide a clearer understanding of causal relationships. Although this was a cross-sectional study and causality cannot be fully established, the analyses were conducted under a causal framework in which untreated

benik koji utječe na ponašanje i percepciju djece. Pokazano je da povećanje znanja skrbnika u tim područjima pozitivno utječe na OHRQoL djece (43). Zajedno, ti nalazi ističu da OHRQoL nije određen isključivo prisutnošću ili odsutnošću zubnog karijesa, nego je itekako oblikovan psihosocijalnim, bihevioralnim i okolišnim čimbenicima. Slično tomu, u slučaju defekata cakline, težina bolesti prijavljena je kao važan čimbenik koji određuje percipirani utjecaj na OHRQoL (44). Posljedično, procjena OHRQoL-a kod djece zahtijeva multidimenzionalni i integrativni pristup koji odražava složenost njihovih životnih iskustava.

Prema dosadašnjim istraživanjima, osobe s visokim vrijednostima PUFA-e imaju složenije probleme zbog odgođenoga dentalnog liječenja, što može rezultirati većim ograničenjima u svakodnevnim aktivnostima (18, 27, 31). Primjerice, perzistentni bolovi u ustima otežavaju spavanje, konzumaciju hrane i socijalnu interakciju. To može rezultirati lošijim rezultatima C-OIDP-a (27), ali je takva situacija obično ograničena na specifične aktivnosti i može slabije utjecati na ukupni rezultat C-OIDP-a. U ovom istraživanju nije utvrđena značajna povezanost između kliničkih komplikacija neliječenoga karijesa i svakodnevnih aktivnosti, osim značajne povezanosti u podljestvici komunikacije. To može biti povezano sa starijom dobnom skupinom ispitanika, što potencijalno negativno utječe na socijalne interakcije. Dodatno, kao i u drugim istraživanjima, nije utvrđena značajna povezanost između ukupnoga rezultata C-OIDP-a i kliničkih komplikacija neliječenoga karijesa. Slično drugim studijama, u ovom istraživanju ustanovljene su značajne korelacije između podljestvica kvalitete života i rezultata ICDAS-a.

Uz ograničenja, ovo je istraživanje pokazalo da su djeca s kliničkim komplikacijama neliječenoga karijesa imala niži BMI. Zato je primarna nulta hipoteza odbačena. Međutim, sekundarne nulte hipoteze prihvaćene su jer nije utvrđena povezanost između kvalitete života i kliničkih komplikacija neliječenoga karijesa, ni između kvalitete života i težine postojećega zubnog karijesa. Jedno od ograničenja ove studije jest to što je uzorak prikupljen iz jednog centra u jednoj pokrajini. Sudionici su odabrani metodom prigodnog uzorkovanja među djecom koja su dolazila na rutinske dentalne preglede, što je moglo dovesti do selekcijske pristranosti. Takav pristup mogao je rezultirati uključivanjem djece s većom sviješću o oralnome zdravlju ili boljim pristupom dentalnoj skrbi u usporedbi s općom populacijom. S druge strane, s obzirom na to da je studija provedena u dentalnoj bolničkoj ustanovi, možda je uzorak uključivao veći udio djece s postojećim oralno-zdravstvenim problemima, što je moglo rezultirati precjenjivanjem prevalencije ishoda povezanih s karijesom. Ti čimbenici mogu ograničiti vanjsku valjanost i utemeljenost nalaza. Dodatno, potencijalni konfuzni čimbenici koji nisu mjereni u ovoj studiji, poput prehrambenih navika, socioekonomskog statusa i oralno-higijenskih navika, mogli su utjecati i na pojavu karijesa i na kvalitetu života povezanu s oralnim zdravljem. Izostanak prilagodbe za te varijable mogao je potaknuti rezidualnu konfuziju, što treba uzeti u obzir pri interpretaciji rezultata. U buduća istraživanja trebalo bi uključiti te varijable u multivarijatne analize kako bi se omogućilo jasnije razumijevanje kauzalnih odnosa.

ed caries and its severity were considered exposures potentially affecting BMI and oral health-related quality of life. Following the principles outlined by Schuch et al. (2023) (45), an estimand of interest can be interpreted as the average difference in outcomes that would be expected if the exposure to untreated caries were hypothetically removed in this population. Future research using longitudinal or quasi-experimental designs is warranted to strengthen causal inference. However, the evaluation of clinical complications arising from untreated caries with the ICDAS stands out as strength. Another strength of the study is that it examined not only the impact of clinical complications resulting from untreated caries on QoL but also its effect on BMI.

Preventing these oral health problems requires collaboration between the government, families, and the community. Preventive approaches have demonstrated effectiveness in reducing the occurrence of dental caries (46). In England, the National Health Service offers free dental treatments to encourage regular check-ups for children (47). In countries like Sweden and the Netherlands, programs that provide parents with dental health education have been implemented to raise awareness. These programs have been effective in reducing children's caries rates (48). In Türkiye, the family dentist model has been discussed, taking into account successful practices in Europe, and has been piloted in some provinces. The aim of this model is to have family members regularly followed by the same dentist and to increase preventive health services (49). This model aims to shift the healthcare system, which is primarily treatment-oriented, towards a more preventive approach. By spreading preventive and protective health services through the family dentist model, it aims to prevent dental caries, thereby improving the overall oral health of individuals and the community (50).

Therefore, effective oral hygiene practices are essential not just for preserving dental structures, but also for promoting overall systemic health. A well-maintained oral condition positively influences the quality of life by easing fundamental tasks such as chewing, speaking, and participating in social life. Furthermore, good oral hygiene increases self-confidence and plays a vital role in maintaining both physical and psychological well-being (49, 50).

Conclusions

In conclusion, this study highlights the impact of oral and dental health on children's overall well-being and QoL. The present study did not reveal a statistically significant relationship between children's BMI scores and either the presence or severity of untreated dental caries. These results indicate that oral and dental health problems do not have a direct impact on BMI in children; however, indirect effects may still exist. Given the influence of oral health problems on dietary behaviors and general well-being, timely identification and preventive strategies are essential. Children with higher ICDAS-II scores were found to have lower subscale scores related to OHRQoL. Notably, children without caries report-

Iako je riječ o presječnom istraživanju i uzročnost se ne može potpuno utvrditi, analize su provedene unutar kauzalnog okvira u kojemu su neliječeni karijes i njegova težina promatrani kao izloženosti koje potencijalno utječu na BMI i kvalitetu života povezanu s oralnim zdravljem. Slijedeći načela Schucha i suradnika (2023.) (45), procjenjivani parametar može se interpretirati kao prosječna razlika u ishodima koja bi se očekivala kada bi se izloženost neliječenom karijesu hipotetski uklonila iz ove populacije. Buduća istraživanja s longitudinalnim ili kvaziekperimentalnim dizajnom opravdana su radi jačanja kauzalne inferencije. Međutim, procjena kliničkih komplikacija neliječenoga karijesa primjenom sustava ICDAS jedna je od snaga ovog istraživanja. Dodatna snaga jest to što se ispitivao ne samo utjecaj kliničkih komplikacija neliječenoga karijesa na kvalitetu života, nego i njihov učinak na BMI.

Prevenција tih oralno-zdravstvenih problema zahtijeva suradnju vlade, obitelji i zajednice. Preventivni pristupi pokazali su učinkovitost u smanjenju pojavnosti zubnog karijesa (46). U Velikoj Britaniji besplatne dentalne tretmane pruža National Health Service kako bi potaknuo redovite preglede djece (47). U zemljama poput Švedske i Nizozemske organizirani su programi edukacije roditelja o dentalnome zdravlju radi povećanja osviještenosti. Ti programi pokazali su učinkovitost u smanjenju stope karijesa kod djece (48). U Turskoj se raspravlja o modelu obiteljskog stomatologa, uzimajući u obzir uspješne europske prakse, te je model pokusno proveden u nekim pokrajinama. Cilj je bio da članove obitelji redovito prati isti stomatolog te da se poveća obuhvat preventivnih zdravstvenih usluga (49). Na taj se način želi presmjeriti zdravstveni sustav koji je primarno orijentiran na liječenje, prema preventivnom pristupu. Širenjem preventivnih i zaštitnih zdravstvenih usluga na temelju modela obiteljskoga stomatologa nastoji se spriječiti zubni karijes te poboljšati cjelokupno oralno zdravlje pojedinaca i zajednice (50).

Zato su učinkovite oralno-higijenske prakse važne ne samo za očuvanje zubnih struktura, nego i za promicanje općega sistemskog zdravlja. Dobro održavano oralno stanje pozitivno utječe na kvalitetu života i olakšava osnovne aktivnosti poput žvakanja, govora i sudjelovanja u društvenom životu. Nadalje, dobra oralna higijena povećava samopouzdanje i važna je u očuvanju tjelesnoga i psihološkoga blagostanja (49, 50).

Zaključak

Zaključno, u ovom istraživanju ističe se utjecaj oralnoga i dentalnoga zdravlja na opće blagostanje djece i njihovu kvalitetu života. Istraživanje nije pokazalo statistički značajnu povezanost između vrijednosti BMI-ja djece i prisutnosti ili težine neliječenoga zubnog karijesa. Ti rezultati upućuju na to da oralni i dentalni problemi ne utječu izravno na BMI kod djece, iako neizravni učinci mogu postojati. S obzirom na utjecaj oralno-zdravstvenih problema na prehranbena ponašanja i opće blagostanje, nužne su pravodobna identifikacija i preventivne strategije. Djeca s višim rezultatima ICDAS- II imala su niže rezultate na podljestvicama povezanima s OHRQoL-om. Zanimljivo, djeca bez karijesa prijavi-

ed higher total OHRQoL scores, which may suggest either greater awareness of oral health or the influence of other psychosocial factors. In addition, a statistically significant difference was detected between the groups in the area of 'maintaining emotional stability', suggesting that the severity of dental caries may negatively affect the emotional well-being of children. Taken together, these findings indicate that the interplay between untreated caries, OHRQoL, and BMI is complex. Although BMI did not vary significantly with caries severity (ICDAS-II) or PUFA/pufa findings, some differences across ICDAS-II categories were detected in emotional stability and the total C-OIDP score. This may imply that the impact of caries in this age group is more strongly reflected in the quality-of-life-related outcomes than in BMI.

It has also been shown that the presence of clinical complications resulting solely from untreated dental caries does not directly affect QoL. Therefore, prevention of oral health problems should not rely solely on clinical findings; instead, it should be guided by a holistic evaluation that considers the physical, psychological, and social aspects of the child's well-being. Such a comprehensive approach is essential for improving both general and oral health. In addition, early diagnosis and the implementation of preventive strategies should be regarded as fundamental components for minimizing the long-term effects of oral health problems.

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la su više ukupne rezultate OHRQoL-a, što može upućivati na veću osviještenost o oralnome zdravlju ili na utjecaj drugih psihosocijalnih čimbenika. Nadalje, utvrđena je statistički značajna razlika između skupina u području *održavanja emocionalne stabilnosti*, što sugerira da težina zubnog karijesa može negativno utjecati na emocionalnu dobrobit djece. U cjelini, ovi nalazi upućuju na to da je složeno međudjelovanje između neliječenoga karijesa, OHRQoL-a i BMI-ja. Iako se BMI nije značajno razlikovao prema težini karijesa (ICDAS-II), ni prema nalazima za indeks PUFA/pufa, razlike između kategorija ICDAS-II uočene su u emocionalnoj stabilnosti i ukupnom rezultatu C-OIDP-a. To može upućivati na to da se utjecaj karijesa u ovoj dobnoj skupini snažnije odražava na ishode povezane s kvalitetom života nego na BMI.

Također je pokazano da kliničke komplikacije zbog neliječenoga zubnog karijesa ne utječu izravno na kvalitetu života. Zato se prevencija oralno-zdravstvenih problema ne bi trebala temeljiti isključivo na kliničkim nalazima, nego bi trebala biti vođena holističkom procjenom koja uzima u obzir tjelesne, psihološke i socijalne aspekte dobrobiti djeteta. Takav sveobuhvatni pristup nužan je za poboljšanje općega i oralnoga zdravlja. Dodatno, rana dijagnostika i preventivne strategije trebaju se smatrati temeljnim komponentama za minimiziranje dugoročnih posljedica oralno-zdravstvenih problema.

Etičko odobrenje: Protokol istraživanja procijenio je i odobrio Etički odbor Instituta za zdravstvene znanosti pri Sveučilištu Marmara (br. 22.02.2016-24).

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Sažetak

Ciljevi: Neliječeni zubni karijes vrlo je raširena bolest u dječjoj dobi koja može narušiti kvalitetu života (QoL), rast i obrazovanje te povećati troškove zdravstvene skrbi. **Svrha:** Cilj ovog istraživanja bio je ustanoviti utječu li neliječeni i postojeći zubni karijesi na kvalitetu života te na rast i razvoj djece. **Materijali i metode:** Ovo presječno istraživanje obuhvatilo je 145 sistemski zdrave djece u dobi od 11 do 12 godina koja su se javila na Odjel pedijatrijske stomatologije pri Sveučilištu Marmara. Indeks tjelesne mase (BMI) izračunat je na temelju visine i tjelesne mase te kategoriziran kao pothranjenost te normalna ili prekomjerna tjelesna masa. Kvaliteta života povezana s oralnim zdravljem (OHRQoL) procijenjena je primjenom ljestvice *Child Oral Impacts on Daily Performances* (C-OIDP). Težina karijesa procijenjena je prema sustavu *International Caries Detection and Assessment System* (ICDAS)-II i razvrstana kao: bez karijesa (ICDAS 0), inicijalna lezija (1 – 2), umjerena lezija (3 – 4) ili opsežna lezija (5 – 6). Neliječeni karijes procijenjen je primjenom indeksa *Pulpal Involvement, Ulceration, Fistula and Abscess* (PUFA/pufa) te podijeljen u skupine PUFA/pufa = 0 (bez komplikacija) i PUFA/pufa > 0 (prisutne komplikacije). **Rezultati:** Od ukupnog broja djece 56,5 % bile su djevojčice. Srednja vrijednost rezultata za pufa i PUFA iznosila je $0,6 \pm 1,2$, odnosno $0,1 \pm 0,3$, a ukupni rezultat C-OIDP-a bio je $10,1 \pm 12,3$. Raspodjela BMI-ja prema spolu i dobi nije pokazala statistički značajne razlike ($p = 0,451$ i $p = 0,129$). Također nije utvrđena statistički značajna povezanost između BMI-ja i kliničkih komplikacija neliječenoga karijesa ($p = 0,317$), ni između BMI-ja i težine karijesa ($p = 0,219$). **Zaključci:** Rezultati ističu važnost oralnoga zdravlja u kontekstu općeg blagostanja djece. Viši rezultati za ICDAS-II bili su povezani s nižim vrijednostima OHRQoL-a, a djeca bez karijesa pokazala su povoljnije ishode, što se može objasniti većom sviješću o zdravlju ili psihosocijalnim čimbenicima. Težina karijesa negativno je utjecala na emocionalnu dobrobit. Nalazi upućuju na potrebu za sveobuhvatnom procjenom i ranom primjenom preventivnih mjera.

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Adresa za dopisivanje

Seray Sahin
Sveučilište Marmara, Stomatološki fakultet
Basibuyuk yolu, 9/3, Istanbul, Turska
Telefon: +905422342448
serayshn95@gmail.com

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