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Birth order, daycare attendance, and childhood socioeconomic status in relation to gingivitis: a cross-sectional study in Turkish young adults

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Abstract

Aim Birth order, sibship size, breastfeeding, daycare attendance, and delivery method are known to influence the development of gut microbiota and the immune system, affecting the risk of many infectious diseases. This study aims to explore the impact of these factors, along with socioeconomic background and familial factors, on gingivitis and oral hygiene practices in early adulthood among the Turkish population.

Materials and methods Patients were diagnosed using periodontal clinical and radiographic assessments, adhering to the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. The study included 18-year-old individuals diagnosed with either generalized gingivitis or clinical gingival health. Data collected included sociodemographic factors, birth order, sibship size, delivery methods, breastfeeding duration, daycare attendance, and oral hygiene behaviors. Binary logistic regression was employed to analyze the associations between these factors and the presence of generalized gingivitis.

Results A total of 178 individuals were evaluated, including 124 with generalized gingivitis and 54 with clinical gingival health. Daycare attendance was significantly associated with gingival health. Among those with gingival health, 55.6% had attended daycare, whereas only 29% of participants with generalized gingivitis had attended daycare. Conversely, 71% of those with generalized gingivitis did not attend daycare, compared to 44.4% in the gingival health group ($p = 0.001$). Univariate logistic regression identified a significant association between daycare attendance and a reduced risk of generalized gingivitis (Odds Ratio [OR] = 0.327, $p = 0.001$). Later birth order was associated with a reduced risk of gingivitis (OR = 0.470, $p = 0.037$). Sibship size, delivery methods, and breastfeeding duration showed no clear associations with gingivitis ($p > 0.05$).

Conclusions The findings indicate a potential association between oral health status in adulthood and early childhood exposures, such as daycare attendance and birth order. Further research is necessary to confirm these associations and elucidate the mechanisms involved, even though these factors may contribute to gingival health in early adulthood. These insights may enhance our understanding of how early-life exposures relate to oral health outcomes and suggest that considering such factors could be beneficial in future oral health management strategies.

Trial registration Trial registration is also available at clinicaltrail.gov.

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Keywords Birth order, Oral health, Gingivitis, Siblings, Young adults, Periodontal health

Background

Plaque-induced gingivitis is characterized as an inflammatory disease primarily triggered by the accumulation of dental biofilm [1]. The primary characteristics of gingivitis are localized inflammation, bleeding, and erythema observed in the marginal periodontal tissues [2]. Consistently, numerous studies in the literature indicate that prevalence rates of gingivitis surpass 90% across various population groups [3–5]. Gingivitis is considered an essential precursor to the progression of periodontitis, leading to gradual attachment loss around teeth. Therefore, effective management of gingivitis is essential both as a primary preventive approach to protect against periodontitis and as a secondary strategy aimed at preventing recurrence [1, 6].

Gingivitis occurs when dental plaque builds up over days or weeks without being disrupted or removed, leading to a breakdown in the symbiosis between the biofilm and the host's immune-inflammatory response [1]. Several systemic factors, such as endocrinopathies, hematological disorders, dietary influences, and medications, can alter this immune-inflammatory response [7, 8].

Birth order and the sibship size have been regularly associated with several diseases thought to originate from infections, including peptic ulcers, allergies, asthma, atopic dermatitis, food allergies, and some types of cancer [9–14]. Birth order may influence the timing of children's initial exposure to common infectious diseases; firstborns might not be exposed until they begin school, whereas children born later could encounter these infections earlier due to interactions with their older siblings [15, 16]. Additionally, sibship size may indicate potential exposure to infectious agents in childhood. Larger families generally facing a greater exposure risk, thereby potentially increasing the likelihood of developing diseases in later life [17].

Periodontal pathogens can be transmitted through saliva, and increased exposure to infectious saliva raises the chances of bacterial colonization [18]. These pathogens can spread among family members, potentially serving as a risk factor for the progression of periodontal disease [18, 19]. Bacteria associated with oral diseases often begin colonizing during childhood. The risk of colonization increases for children who are not exposed to these bacteria until later in their development [17, 20].

The delivery method, maternal gut bacteria transferred via breast milk, daycare attendance during early childhood, along with birth order and sibship size significantly influences the development of the infant's gut microbiota and immune system. These factors influence the composition of gut bacterial flora, shaping the infant's immune responses [21–24].

Although increasing evidence suggests that birth order, sibship size, delivery method, breastfeeding, and daycare attendance influence immune system development, no clinical studies currently examine their relationship with gingivitis. This study aims to address this gap by hypothesizing that these factors may influence gingivitis risk by modulating immune system development through early-life microbial exposures during the perinatal period and early childhood. By focusing on a Turkish young adult population, it aims to provide a more comprehensive understanding of how early-life factors, such as birth order and daycare attendance, may contribute to gingival health, potentially informing future preventive strategies.

Methods

Study design

This cross-sectional study adheres to the guidelines set by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for cohort studies [25]. The research protocol received approval from the Ethics Committee of Necmettin Erbakan University Faculty of Dentistry (Protocol No: 2023/284). Participants were enrolled in the study following their review and signature on the written informed consent, consistent with the principles of the Declaration of Helsinki. Before beginning recruitment, the study protocol was officially registered on ClinicalTrials.gov (NCT06240247, 22.01.2024).

Participants

All consecutive patients aged 18 years attending the Department of Periodontology in the Faculty of Dentistry at Necmettin Erbakan University of Konya were screened between January 2024 and March 2024; the inclusion criteria were: (1) presence of generalized gingivitis or clinical gingival health [26]; (2) presence of at least 20 remaining teeth; (3) healthy patients without any uncontrolled systemic disease; (4) high school graduation; (5) the capability and readiness to provide informed consent. Exclusion criteria included: (1) pregnancy or lactation; (2) undergoing periodontal treatment within the past 12 months; (3) antibiotic use in the last 6 months; (4)

current smokers; (5) being an only child or having more than three siblings; (6) insufficient proficiency in Turkish for effective communication.

Sample size calculation

The sample size was calculated using the G*Power V. 3.1.9.6 software. Based on a 95% confidence level (1-α), a 95% test power (1-β), and an effect size of d = 0.60, the minimum number of cases required for the study was determined to be 122 [27].

Assessment of study variables

The sociodemographic information, oral hygiene habits, birth order, sibship size, perinatal characteristics, and childhood socioeconomic factors of all participants were recorded during a face-to-face interview. The English translation of the original data collection form, which was conducted in Turkish, is provided in Supplementary File 1.

Socio-demographic characteristics and oral health habits

Demographic variables were collected, including familial education level, monthly family income, place of residence, weight (kg) and height (m), frequency of dental check-ups, toothbrushing frequency, and use of oral care products such as dental floss, and inter dental brush.

Body mass index (BMI; kg/m^2) was determined using height and weight measurements. The BMI was then classified into categories: underweight (BMI < 18.5 kg/m^2), normal weight (18.5 kg/m^2 ≤ BMI < 25.0 kg/m^2), overweight (25.0 kg/m^2 ≤ BMI < 30.0 kg/m^2), and obese (BMI ≥ 30.0 kg/m^2) [28].

Birth order and sibship size

Participants were also requested to provide information regarding the number of siblings they have and the birth order of their siblings.

Perinatal characteristics and childhood socioeconomic factors

The investigation encompassed a comprehensive examination of various factors impacting the participants, focusing on critical aspects such as mode of birth, duration of breastfeeding, father's education, mother's education, the number of rooms in the childhood home, the number of rooms per person in the childhood home, daycare attendance status, and the presence of any period during the age of 15 and below where adequate food access was compromised.

Oral examination and clinical periodontal parameters

Before the clinical examinations, participants were informed about the clinical procedures to ensure consistent understanding. Clinical measurements were conducted by a single experienced and calibrated examiner (K.Y.). Intra-examiner reproducibility, assessed across three patients, demonstrated that the variability between repeated measurements (baseline and at 24 h) was less than 3% [29]. Since this study primarily involved a single examiner and focused on observable clinical outcomes, blinding was not employed. However, the examiner remained unaware of participants' sociodemographic and perinatal background information to reduce observational bias. Periodontal examinations were performed using the Williams periodontal probe (Hu-Friedy, Chicago, IL). On average, about 20 individuals were examined daily during the data collection phase. All procedures adhered to and ensured good clinical practice standards.

Periodontal clinical parameters for the full mouth were assessed at six sites per tooth, including mesio-facial, mid-facial, disto-facial, mesio-lingual, mid-lingual, and disto-lingual surfaces. Exclusions were made for third molars, crowded teeth, and teeth with cervical restorations. The collected parameters included pocket depth (PD), Bleeding on Probing (BoP), Plaque Index (PI) [30], and Gingival Index (GI) [31]. For PI, scores were determined as follows, as described by Silness [30]: a score of 0 indicated an absence of plaque, 1 indicated a fine film of plaque adhering to the free gingival margin and adjacent tooth surface, 2 indicated moderate plaque accumulation visible to the naked eye, and 3 indicated substantial plaque accumulation, including calculus, within the gingival pocket or along the gingival margin and tooth surface.

Panoramic radiographs (Morita, Veraviewepocs 3D F40, Japan) were obtained to evaluate marginal bone levels. Marginal bone loss was defined as the most coronal position of the bone margin adjacent to a clearly visible periodontal ligament space [32, 33]. Marginal bone loss was considered present when the distance between the cementoenamel junction and the marginal bone level exceeded 2 mm, taking into account physiological variations in these measurements [34].

Participants were evaluated according to the criteria from the consensus report of Workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions [26]. The classifications used were: (i) gingival health on intact periodontium, characterized by no probing attachment loss, PD (assuming absence of pseudo pockets) of ≤ 3 mm, BoP of less than 10%, and no radiological evidence of bone loss; (ii) generalized gingivitis on intact periodontium, marked by no probing attachment loss, PD (assuming absence of pseudo pockets) of ≤ 3 mm, BoP of more than 30%, and no radiological bone loss. Following the clinical evaluation, each participant was given both verbal and written diagnoses of their oral health status. They were also encouraged to pursue dental care for both prevention and treatment as needed.

Statistical analysis

Using IBM SPSS V23 (Software by IBM SPSS Statistics for Windows, Version 23.0, Armonk, NY: IBM Corp), the data were examined. The adherence to normal distribution was examined using the Kolmogorov–Smirnov Test. For the examination of categorical variables across groups, Yates Correction and Pearson Chi-Square Test were utilized, and multiple comparisons were conducted using the Bonferroni-adjusted Z Test. For the comparison of variables not following a normal distribution across groups, the Mann–Whitney U Test was employed. The Ordinal Logistic Regression Analysis was used to determine the factors affecting the frequency of use of dental floss and interdental brushes. To identify the factors influencing the risk of being diagnosed with generalized gingivitis, Binary Logistic Regression Analysis was utilized.

The analysis results were reported as frequency (percentage) for categorical variables and as mean ± standard deviation along with median (minimum–maximum) for quantitative variables. The threshold for statistical significance was established at $p < 0.050$.

Results

Socio-demographic characteristics and oral hygiene habits

The study was conducted with a total of 178 individuals. Among these, 124 individuals were diagnosed with generalized gingivitis, and 54 individuals were identified as gingivally healthy. All participants were 18 years old and high school graduates. Detailed demographic and clinical characteristics of the study cohort are presented in Table 1. Notably, both household income ($p < 0.001$) and the educational levels of mothers ($p < 0.004$) and fathers ($p < 0.003$) were significantly higher in the gingivally healthy group compared to those with generalized gingivitis.

Perinatal characteristics, childhood socioeconomic factors, and gingivitis

Binary Logistic Regression Analysis (Fig. 1) revealed key factors influencing the diagnosis of generalized gingivitis. Daycare attendance significantly reduced the risk of diagnosis (OR = 0.327; $p = 0.001$). Conversely, individuals who experienced food insufficiency before age 15 were 4.857 times more likely to be diagnosed with generalized gingivitis ($p = 0.005$). Higher maternal and paternal education levels (undergraduate or above) were associated with a reduced risk of generalized gingivitis compared to primary education (OR = 0.268 and OR = 0.263, respectively; $p = 0.005$ and $p = 0.001$).

Sibship size, birth order, and gingivitis

Binary Logistic Regression Analysis (Fig. 1) was used to assess the impact of birth order and sibship size on the diagnosis of generalized gingivitis. The analysis indicated that later birth order was associated with a decreased risk of gingivitis (OR = 0.470; $p = 0.037$). However, the sibship size did not significantly affect the diagnosis ($p = 0.285$).

Oral hygiene habits, birth order, and sibship size

The impact of daycare attendance, sibship size, birth order, and parental education level on oral hygiene habits was analyzed using Ordinary Logistic Regression Analysis (Fig. 2). Maternal education level was found to have a statistically significant effect on the frequency of dental floss and interdental brush usage ($p < 0.011$). No statistically significant effect on dental floss and interdental brush usage was observed for other variables ($p > 0.050$). The frequency distribution of the tooth brushing frequency variable was not analyzed due to its unsuitability for analysis.

Discussion

To our knowledge, this is the first study to explore the influence of birth order, sibship size, delivery method, breastfeeding, and daycare attendance on gingivitis in young adults. Our analyses indicate that the family environment during childhood may significantly influence the development of gingivitis in early adulthood. Furthermore, the observed inverse relationship between birth order and generalized gingivitis may suggest that early exposure to infectious agents could protect against such conditions later in life.

When studies on the relationship between parental education, family income, and children's gingival health are examined, various outcomes are observed. Most studies suggest that children with more educated parents have better gingival health compared to those with less-educated parents [35–37]. However, some studies report no significant association, showing controversial results in the literature [38, 39]. Our findings support the relationship between higher parental education levels and lower risks of generalized gingivitis.

Findings regarding the association between family income and gingival disease were controversial. While some research suggested that children from high-income families exhibit lower levels of gingival disease [40–43], others found no significant association [44]. In our study, household income status was found to be higher in the gingival health group compared to generalized gingivitis

Table 1 Demographic and clinical characteristics of study population ($n = 178$)

	Diagnosis Group		***p***
	Generalized Gingivitis	**Gingival Health**	
Category	n (%)	n (%)	
Gender			
Male	32 (25.8)	12 (22.2)	0.748†
Female	92 (74.2)	42 (77.8)	
Household Income Definition			
Low	58 (46.8) a	8 (14.8) b	< 0.001‡*
Medium	64 (51.7)	36 (66.6)	
High	2 (1.6) a	10 (18.5) b	
Residence			
City Center	104 (83.9)	46 (85.2)	1.000†
District	20 (16.1)	8 (14.8)	
Body Mass Index Category			
Underweight	8 (6.5)	4 (7.4)	0.053‡
Normal Weight	58 (46.8)	36 (66.7)	
Overweight	42 (33.9)	12 (22.2)	
Obese	16 (12.9)	2 (3.7)	
Daycare attendance			
Yes	36 (29)	30 (55.6)	0.001†
No	88 (71)	24 (44.4)	
Place of Upbringing			
City Center	76 (61.3)	34 (63)	0.895‡
District	36 (29)	14 (25.9)	
Village	12 (9.7)	6 (11.1)	
Period of Inadequate Food Access Before Age 15			
Never	84 (67.7)	48 (88.9)	0.009‡*
Rarely	34 (27.4)	4 (7.4)	
Often	6 (4.8)	2 (3.7)	
Mother's Education Level			
Illiterate	18 (14.5) a	2 (3.7) b	0.004‡*
Elementary School	80 (64.5)	30 (55.6)	
High School	16 (12.9)	8 (14.8)	
Bachelor's Degree and Above	10 (8.1) a	14 (25.9) b	
Father's Education Level			
Illiterate	4 (3.2)	0 (0)	0.003‡*
Elementary School	76 (61.3) a	20 (37)b	
High School	26 (21)	16 (29.6)	
Bachelor's Degree and Above	18 (14.5) a	18 (33.3) b	
Tooth Brushing Frequency			
Never	4 (3.2)	0 (0)	0.004‡*
Rarely	34 (27.4) a	4 (7.4) b	
Once a Day	30 (24.2)	12 (22.2)	
Twice a Day	56 (45.2) a	38 (70.4)b	
Use of Dental Floss and Interdental Brush Frequency			< 0.001‡*
Never	64 (51.6) a	10 (18.5) b	
Rarely	42 (33.9) a	38 (70.4) b	
Once a Day	18 (14.5)	6 (11.1)	

Table 1 (continued)

Dental Check-up Frequency			0.107‡
Never	6 (4.8)	0 (0)	
When Needed	82 (66.1)	32 (59.3)	
Every 6 Months—1 Year	36 (29)	22 (40.7)	
	Generalized Gingivitis	**Gingival Health**	***p***
	Mean ± Sd	Mean ± Sd	
Average Pocket Depth	2.58 ± 0.58	2.07 ± 0.29	< 0.001§*
Plaque Index	1.82 ± 0.53	1.23 ± 0.36	< 0.001§*
Gingival Index	1.77 ± 0.35	0.78 ± 0.15	< 0.001§*
Bleeding on Probing Percentage	0.68 ± 0.21	0.05 ± 0.017	< 0.001§*

† Yates Correction

‡ Pearson Chi-Square Test

§ Mann–Whitney U Test

a-b: No difference between groups sharing the same letter

* $p < 0.05$

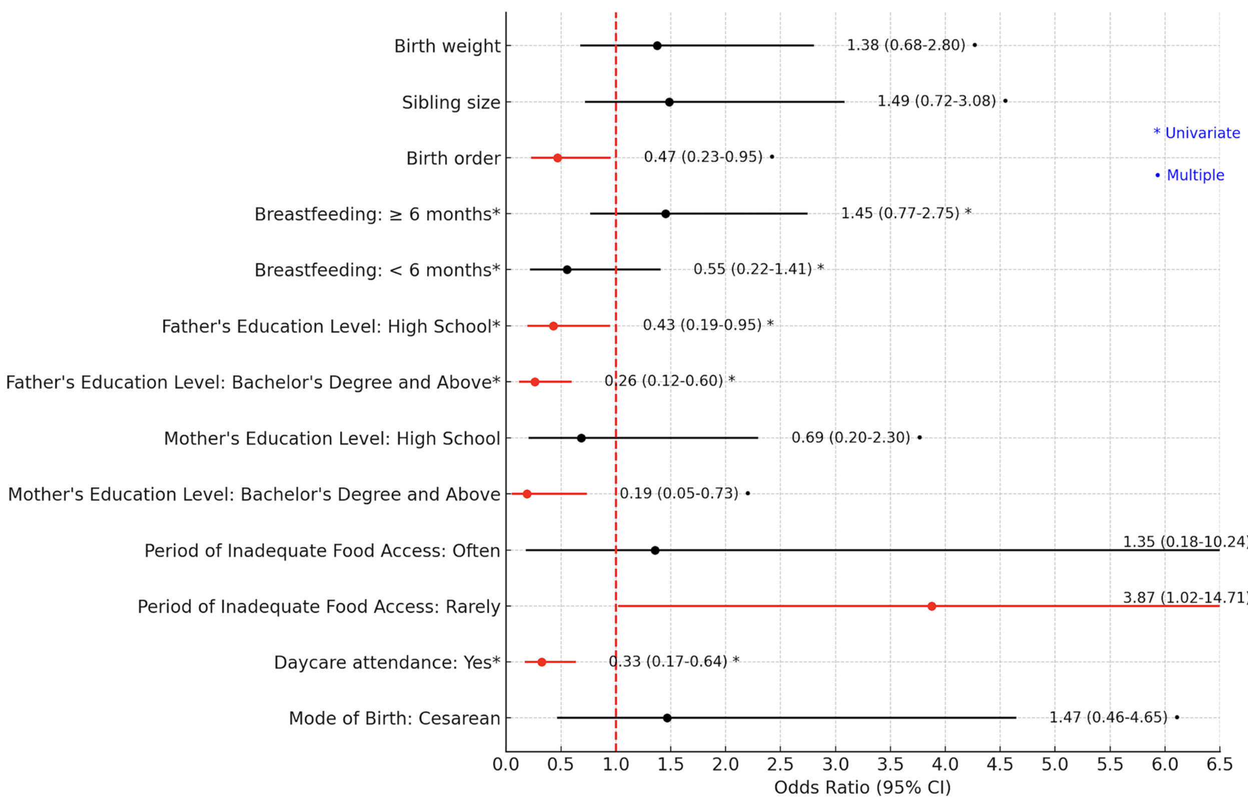

Fig. 1 Forest Plot Illustrating the Examination of Risk Factors Associated with the Diagnosis of Generalized Gingivitis via Binary Logistic Regression Analysis. The odds ratios (OR) and corresponding 95% confidence intervals (CI) visually illustrate the influence of each variable relative to a designated reference category. For maternal and paternal education levels, the reference category is defined as 'Elementary School,' whereas for the variable reflecting periods of inadequate food access before the age of 15, the reference category is 'Never.' The red dashed line at OR = 1 denotes the point of neutrality; values positioned to the right of this line suggest an increased probability, while those to the left indicate a decreased probability of a generalized gingivitis diagnosis. Variables highlighted in red are statistically significant, thereby underscoring their substantial impact on the diagnosis likelihood

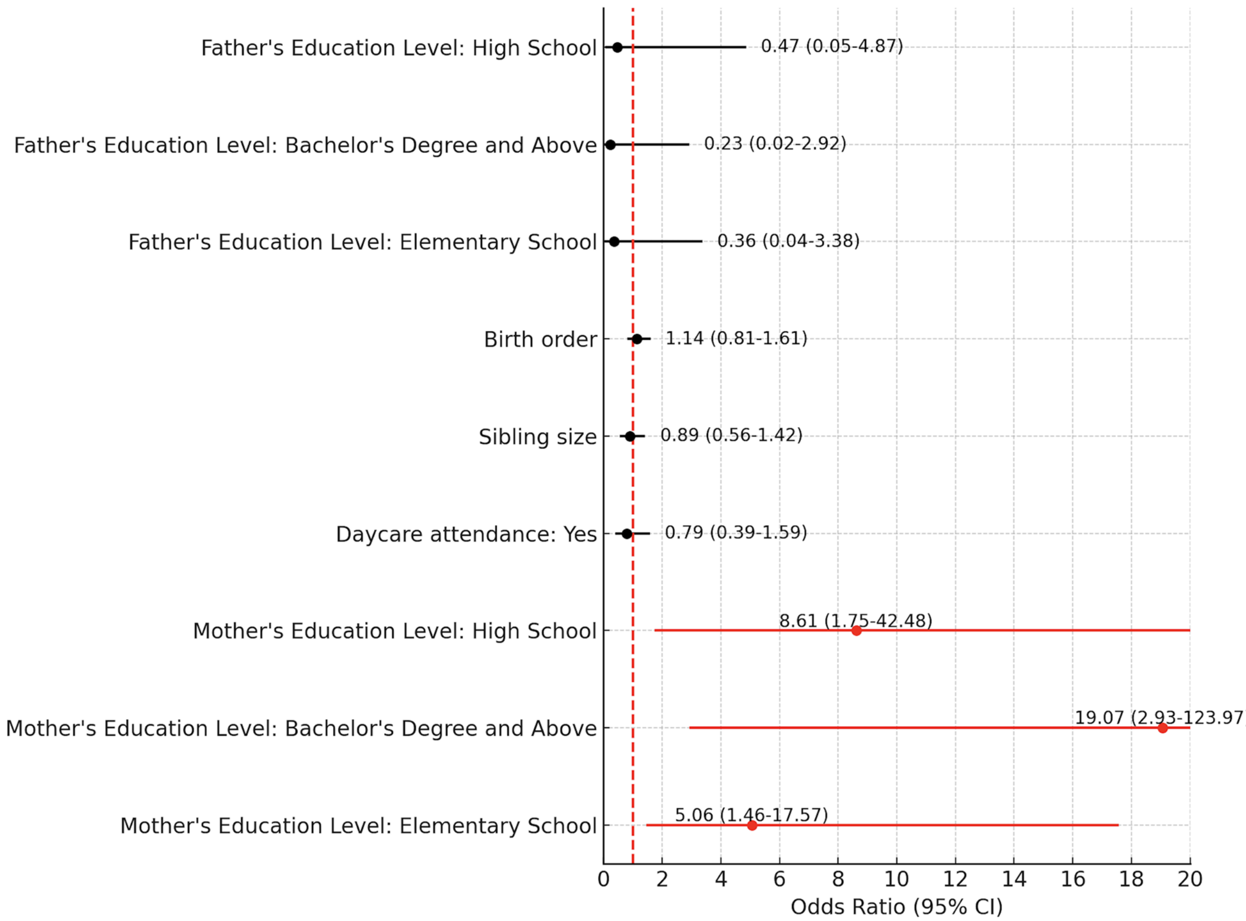

Fig. 2 Forest Plot Illustrating the Examination of Independent Variables Influencing the Frequency of Dental Floss and Interdental Brush Use Through Ordinal Logistic Regression Analysis. The odds ratios (OR) and 95% confidence intervals (CI) visually represent the association between the specified risk factors and usage patterns. The red dashed line at OR = 1 serves as a baseline; values to the right of this line signify an increased likelihood of dental floss and interdental brush use. For maternal and paternal education levels, the reference category is 'Illiterate'

($p < 0.001$). Additionally, individuals who rarely experienced inadequate access to adequate food before the age of 15 had a 4.857 times higher risk of being diagnosed with generalized gingivitis compared to those who did not experience such a period.

Breastfeeding significantly influences the infant's oral microbiome, with research showing that its duration impacts various health outcomes. The study by Dzidic et al. observed that infants who stopped breastfeeding before 12 months had a higher relative abundance of bacteria such as Porphyromonas at 12 months, Neisseria at 24 months, and Actinomyces at 7 years [45]. Notably, Porphyromonas is associated with periodontitis, which damages gingival tissue and can lead to tooth loss [46]. This suggests that early cessation of breastfeeding may increase the risk of oral diseases later in life [47]. Breastfeeding has been associated with a range of long-term health outcomes, though findings are sometimes inconsistent, and its influence on gingival health remains unclear [48, 49].

The delivery method can significantly affect a newborn's health. Children delivered via cesarean section (C-section) face increased risks for conditions like asthma, juvenile arthritis, inflammatory bowel disease, immune deficiencies, and leukemia, potentially due to the impact on neonatal immune development [50]. Despite these associations, there are no studies that directly explore the relationship between the delivery method and periodontal disease. In our research, C-section was not identified as a significant risk factor for gingivitis. It is postulated that C-sections may influence the risk of gingivitis in offspring by altering the early microbial exposure that is typically facilitated by vaginal delivery, which is crucial for shaping the infant's immune system [51]. However, the only study on the link between oral microbiota and delivery methods found no significant impact of C-section on the colonization of key oral bacteria such as Streptococcus mutans and Porphyromonas gingivalis [52].

A hypothesis suggests that enrolling children in daycare associated with the incidence of certain diseases; however, research on the impact of daycare on health outcomes reveals mixed findings. Some studies highlight potential negative effects. Madiba et al. found that children attending daycare or preschool, particularly in underprivileged areas, have an increased risk of underweight and stunting, conditions that could adversely affect oral health due to malnutrition and its association with suboptimal oral hygiene [53]. Similarly, Lü et al. observed that daycare attendance may increase the risk of common infectious diseases, indirectly contributing to gingivitis by compromising oral health [54]. Conversely, other research suggests potential benefits. Daycare attendance has been associated with protection against childhood diabetes, possibly by promoting immune-regulatory mechanisms [55, 56]. Additionally, while daycare is linked to a higher incidence of common colds among preschoolers, it appears to offer protection through acquired immunity as children progress to early school years [57, 58]. The 'hygiene hypothesis' suggests that early exposure to a diverse microbial environment may train the immune system to moderate its responses, influencing gut microbiome development [21]. Moreover, Hoog et al. [59] reported that early daycare attendance might provide initial protection against infections through maternal antibodies. Hall et al. [60] similarly suggest that daycare attendance can enhance overall immunity but may not directly improve oral health due to factors such as socioeconomic status and access to dental care [61, 62]. Despite these findings, there is limited research specifically addressing the long-term effects of daycare attendance on gingival health. Our study indicates that daycare attendance is associated with a lower likelihood of generalized gingivitis diagnosis (OR = 0.327; $p = 0.001$), suggesting that early microbial exposure from daycare might offer some protection for gingival health. This association may be explained by increased microbial diversity, which supports a balanced oral microbiome, or by a strengthened host response. Additionally, the social interactions in daycare could encourage the development of healthy oral hygiene habits, indirectly contributing to improved gingival outcomes.

Birth order and sibship size are potential factors that can influence the transfer of microorganisms responsible for the development of periodontal diseases. Studies have shown the transmission of pathogens associated with periodontal disease, such as Actinobacillus actinomycetemcomitans and Porphyromonas gingivalis, among family members [18, 63]. Mucci et al. found in their study that later birth order was associated with a lower likelihood of periodontal disease, while an increase in the sibship size was associated with an increased risk of periodontal disease [17]. Similar findings have been observed in studies assessing the relationship between birth order and other diseases. Previous studies have demonstrated associations between birth order and a variety of health outcomes, including diabetes and other immune-mediated inflammatory diseases [10, 64]. Other studies have shown varying associations between birth order and diseases like Hodgkin's disease, asthma, and glioma, further supporting the notion that early-life exposures can influence health outcomes through complex mechanisms [9, 11, 13]. Authors have attributed the decreasing disease risk with increasing birth order to age at initial exposure, which is a major determinant of infection outcome, favoring immunity over clinical disease. Early exposure to infections is often associated with durable immunity, whereas delayed exposure may result in a higher ratio of clinical disease to immunity [9–11, 13, 17, 64]. Consistent with these findings, our study also found a decreasing risk of generalized gingivitis as sibling birth order increased (OR = 0.470; $p = 0.037$). In our study, unlike the findings of Mucci et al. [17], we did not find a statistically significant effect of sibship size on generalized gingivitis. The differences in outcomes may be attributed to the constraint of including a maximum of four siblings in our study.

In our study, the frequency of dental floss and interdental brush use was analyzed through Ordinal Logistic Regression to evaluate the impact of various independent variables. The results indicated that sibship size, birth order, and daycare attendance did not have a statistically significant effect. However, the mother's educational level had a significant impact on the frequency of using dental floss and interdental brushes. Specifically, individuals whose mothers had completed elementary education were found to use dental floss and interdental brushes 5.063 times more frequently than those whose mothers had no formal education ($p = 0.011$). Those with mothers who had a bachelor's degree or higher were 19.068 times more likely to use these oral hygiene tools compared to those whose mothers were uneducated ($p = 0.002$). It seems that a mother's educational background may play a more crucial role than a father's in influencing the family's oral health behaviors. This notion aligns with findings from a study involving a Latino population, which highlighted that mothers predominantly took charge of brushing their children's teeth, monitoring their diet, and arranging dental care [65]. Similarly, Folayan et al. found that mothers' oral health behaviors significantly predicted their children's oral health habits [66]. Chen et al. showed that the mother's educational level might be more influential than the father's in shaping the family's oral health knowledge and practices [67].

This study presents several limitations. Firstly, its cross-sectional design restricts our ability to establish causality; longitudinal analysis would provide more robust evidence. Additionally, the absence of periodontitis patients in the study is a noteworthy limitation. Considering that the advancement of periodontal attachment loss is time-dependent, it can be hypothesized that gingivitis observed in younger individuals may evolve into periodontitis as they reach adulthood. The constrained sample size, a result of stringent inclusion criteria, may affect the generalizability of results, although it facilitated the identification of significant associations, such as the potential link between birth order and gingivitis. Moreover, retrospective self-reports, like childhood traumatization, may introduce memory bias, necessitating cautious interpretation. The study's inability to explore the impact of preterm birth on generalized gingivitis due to small participant numbers is another notable limitation. Another limitation is the potential influence of confounding factors that were not controlled, such as diet, physical activity, and sleep health. Lastly, the absence of information on the starting age and duration of daycare participation could potentially confound results.

In conclusion, the substantial time gap between childhood and perinatal exposures and the onset of oral diseases in adulthood may complicate direct associations. Nonetheless, these indicators may still reflect underlying developmental processes initiated during these early life stages. Our findings suggest that later birth order and daycare attendance could potentially reduce the risk of developing gingivitis, possibly through promoting exposure to a diverse microbiome. Public health strategies, such as encouraging daycare attendance, may support gingival health by fostering beneficial early microbial exposures. Additionally, understanding the influence of birth order may inform preventive strategies, particularly for firstborn children who might benefit from targeted early interventions to mitigate the risk of gingival disease. Future research could further examine the effects of birth order and sibship size on the severity and progression of periodontitis, potentially incorporating detailed microbiological analysis.

Abbreviations

OR	Odds Ratio
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
Kg	Kilogram
M	Meter
BMI	Body Mass Index
PD	Pocket Depth
BoP	Bleeding on Probing
PI	Plaque Index
GI	Gingival Index
C-section	Cesarean Section

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12903-024-05215-4.

Supplementary Material 1.

Supplementary Material 2.

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Clinical trial registration
This clinical trial was registered prior to participant recruitment on ClinicalTrials.gov (NCT06240247, 22.01.2024).

Authors' contributions
Z.T.E., O.B., and D.O.S. contributed to the study design, protocol and study materials. K.Y. performed the all periodontal measurements. D.O.S. and O.B. designed the statistical plan. Z.T.E. wrote the first draft of the manuscript. All authors contributed to the revision of the manuscript.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study protocol was in accordance with the Declaration of Helsinki of 1975 was submitted to and approved by the ethical committee of Necmettin Erbakan University Faculty of Dentistry (Protocol No: 2023/284). Participants were enrolled in the study following their review and signature on the written informed consent, consistent with the principles of the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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