http:// jpp.mums.ac.ir

Original Article (Pages: 20146-20157)

Maternal Oral Health Indicators and Gastroenteritis-Related Hospitalization Among Children Under Four Years: An Exploratory Case-Control Study

Mahdi Rahbar [1], Manouchehr Barak [2], Sanaz Izadi [1], * Aziz Kamran [3]

[1] Department of Restorative Dentistry, School of Dentistry, Ardabil University of Medical Sciences, Ardabil, Iran.

[2] Department of Pediatrics, School of Medicine, Bu'ali Hospital, Ardabil University of Medical Sciences, Ardabil, Iran.

[3] Department of Community Medicine, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran.

Abstract

Background: Maternal oral health literacy (OHL) and oral health status may reflect broader health-related behaviors that influence child health outcomes. This study aimed to investigate the association between maternal OHL, dental status (DMFT index), and hospitalizations related to gastroenteritis among children under four years of age.

Methods: This case-control study included 120 mother-child dyads recruited in 2024 from primary health centers and a pediatric hospital in Ardabil, Iran. The case group included 60 mothers of children hospitalized with acute gastroenteritis, while the control group included 60 mothers of children with no documented history of gastroenteritis-related hospitalization. Maternal OHL was assessed using a validated questionnaire, and oral health status was evaluated using the Decayed, Missing, and Filled Teeth (DMFT) index. Multivariable logistic regression analysis was conducted to identify independent predictors of pediatric gastroenteritis.

Results: Overall maternal OHL was significantly lower in the case group (9.20 ± 2.77 vs. 10.58 ± 4.09, P = 0.032), with the largest difference observed in the decision-making domain (2.42 ± 1.28 vs. 3.28 ± 1.45, P = 0.001). Higher maternal DMFT scores were independently associated with increased odds of gastroenteritis-related hospitalization (adjusted OR = 1.18, 95% CI: 1.05–1.32; P = 0.006), whereas higher decision-making scores were associated with lower odds (adjusted OR = 0.51, 95% CI: 0.34–0.77; P = 0.001). Conversely, higher numeracy scores were associated with increased odds of hospitalization (adjusted OR = 1.86, 95% CI: 1.15–3.02; P = 0.011).

Conclusion: Lower maternal oral health literacy, particularly poorer decision-making skills, and higher maternal DMFT scores were independently associated with gastroenteritis-related hospitalizations in children. These findings indicate associations rather than causality. Prospective studies are needed to confirm these findings.

Key Words: DMFT, Gastroenteritis, Literacy, Mothers, Oral health, Pediatric.

* Please cite this article as: Rahbar M, Barak M, Izadi S, Kamran A. Maternal Oral Health Indicators and Gastroenteritis-Related Hospitalization Among Children Under Four Years: An Exploratory Case-Control Study. J Ped Perspect 2026; 14 (6): 20146-20157. **DOI: 10.22038/jpp.2026.97115.5698**

Corresponding Author:

Aziz Kamran: Professor of Health Education and Promotion, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran. Tel: 00989141599416; Email: aziz_kamran@ymail.com

1- INTRODUCTION

Oral health is an integral component of overall health; however, despite numerous preventive strategies, dental caries remains highly prevalent in developing countries (1). According to the Global Burden of Disease Study, untreated dental caries in permanent teeth is among the most prevalent health conditions worldwide, affecting billions of individuals across all age groups (1). Despite the availability of sufficient information and effective preventive measures, maintaining optimal oral health continues to pose a significant public health challenge (2).

Mothers' oral health literacy influences not only their own oral health status but also their children's oral health behaviors and outcomes, potentially extending into adolescence and adulthood. Preventive behaviors established early in life are associated with improved long-term health trajectories (3). Health literacy is defined as an individual's capacity to obtain, process, and understand health information necessary to make appropriate health decisions (4). Low parental health literacy has been associated with poorer child health outcomes, higher hospitalization rates, and lower use of preventive services (5).

Similarly, studies indicate that limited caregiver health literacy is linked to suboptimal disease management and adverse pediatric outcomes (6). Recent studies conducted in Iran indicate that a substantial proportion of mothers demonstrate insufficient oral health literacy (2, 7), raising concerns given evidence that low maternal health literacy is associated with inappropriate health behaviors and can negatively influence children's health outcomes (8, 9). Mothers with lower oral health literacy generally have less awareness of children's preventive health behaviors (10). Furthermore, inadequate health literacy is associated with unhealthy lifestyle choices, delayed healthcare utilization, ineffective chronic disease management, increased emergency service use, and higher healthcare costs (11-13).

Poor oral health has been recognized as a potential risk indicator for several systemic conditions, including cardiovascular disease, diabetes, and certain malignancies (14, 15). In particular, associations have been reported between poor oral health and gastrointestinal cancers such as esophageal, gastric, liver, and pancreatic cancers (16). Evidence suggests that individuals with poor oral hygiene may have an elevated risk of upper gastrointestinal malignancies (17). However, Jordão et al. (18) reported inconsistent findings regarding the overall gastrointestinal cancer risk, although an increased risk of hepatobiliary cancers was observed among individuals reporting poor oral health. These inconsistencies highlight the complex and multifactorial nature of the oral–systemic health relationship, often influenced by shared behavioral and socioeconomic determinants.

Although several studies have confirmed the link between maternal health literacy and child oral health outcomes (19, 20), to date, no study has specifically examined the relationship among maternal oral health literacy, maternal Decayed, Missing, and Filled Teeth (DMFT) index, and acute pediatric gastrointestinal diseases. Acute gastroenteritis (AGE) remains one of the leading causes of morbidity and mortality among children under five years of age. It imposes a substantial burden on healthcare systems, particularly in low- and middle-income countries, and is characterized by diarrhea, vomiting, abdominal pain, and dehydration (11, 21). Age is one of the most common causes of healthcare visits in these settings (22) and contributes significantly to global childhood mortality (23). Despite global declines in mortality, diarrheal diseases

continue to account for hundreds of thousands of deaths annually among children under five (24).

AGE is primarily caused by viral, bacterial, or parasitic infections and is transmitted predominantly via the fecal–oral route. Therefore, environmental sanitation, water quality, and hygiene behaviors play central roles in disease transmission. Maternal caregiving practices—including hand hygiene before food preparation, safe feeding behaviors, and food and water sanitation—are critical determinants in preventing enteric infections in early childhood (25).

Recent studies in Iran indicate that mothers have limited knowledge regarding the management of childhood diarrhea (26). The oral cavity harbors one of the most diverse microbial communities in the human body, second only to the gut microbiota in complexity (27). Increasing evidence suggests that oral microorganisms can translocate to the gastrointestinal tract via enteral or hematogenous pathways (28). Importantly, the DMFT index reflects cumulative lifetime dental disease experience and may serve as an indirect indicator of long-term oral hygiene practices and broader health-related behaviors within households (29).

Considering the high prevalence of acute gastroenteritis among young children in Iran (30), the central caregiving role of mothers in early childhood, and the lack of studies examining the association between maternal oral health literacy, maternal DMFT, and gastroenteritis in children under four years of age in Ardabil, further investigation is warranted.

The present study was designed as an exploratory case–control analysis to evaluate whether maternal oral health literacy maternal DMFT index are associated with a recent history of gastroenteritis in children under four years of age. Given the multifactorial nature of gastroenteritis, this study aims to explore potential associations rather than establish causality.

2- MATERIALS AND METHODS

2-1. Study Design and Setting

This case–control study was conducted from June to September 2024 in Ardabil, Iran. Cases were identified through hospital medical records at Bou-Ali Children's Hospital, the main pediatric referral hospital in Ardabil, while controls were recruited from the same Primary Health Care (PHC) center serving the same catchment population. Both groups were selected from the electronic health information system (SIB), ensuring that participants originated from the same underlying source population and had comparable access to healthcare services.

2-2. Participants

Sixty mothers of children younger than 4 years diagnosed with gastroenteritis within the past six months, as confirmed by a specialist physician and documented in hospital medical records, requiring hospitalization, were included in the case group. Another 60 mothers of children with no documented history of hospitalization due to gastroenteritis were included in the control group. Participants were selected from eligible mothers identified through the SIB electronic health records. Both cases and controls were recruited during the same study period from the same PHC catchment area.

Diagnosis of gastroenteritis was based on clinical evaluations documented in hospital medical records. Etiological classification (viral, bacterial, or parasitic) was not available in the dataset. To reduce recall bias, only cases with documented hospitalizations were included.

2-3. Inclusion and Exclusion Criteria

Inclusion criteria for the case group were mothers of children under 4 years old, whose children had a documented hospitalization for acute gastroenteritis

within the previous six months, based on specialist diagnosis. Inclusion criteria for the control group were mothers of children under 4 years old whose children had no documented history of hospitalization due to gastroenteritis. Children in both groups were required to be free from any known chronic systemic diseases based on available medical records.

Exclusion criteria for both groups included mothers with chronic systemic diseases or medical conditions that could substantially affect oral health status (e.g., uncontrolled diabetes or autoimmune disorders). Mothers currently using medications known to significantly affect salivary flow were excluded when identifiable through medical history. Maternal demographic information, including age, educational level, and occupation, as well as paternal educational level and occupation, was collected using a structured questionnaire.

2-4. Sampling and Matching

Eligible participants were selected using simple random sampling from the SIB electronic health records. The groups were matched based on the child's birth order. Frequency matching was performed during participant selection to improve comparability between the case and control groups. Furthermore, recruiting both groups from the same PHC catchment area ensured a relatively homogeneous socioeconomic and environmental background, thereby reducing the impact of residual confounders such as healthcare accessibility and environmental conditions.

2-5. Data Collection

2-5-1. Oral Health Literacy Assessment

Oral health literacy of the mothers was assessed using the validated Persian version of the questionnaire developed by Naqibi et al. (2014). The internal consistency of the instrument was previously reported with a Cronbach's alpha of 0.72, and its inter-rater reliability (ICC) of 0.84 (31). The questionnaire consists of 17 items divided into four domains: reading skills, calculation skills, listening skills, and decision-making skills. Each correct response was scored as 1, and incorrect responses as 0. The total score ranged from 0 to 17 and was categorized as 0–9: Inadequate literacy, 10–11: Moderate literacy, 12–17: Adequate literacy. This questionnaire evaluates functional oral health literacy and does not directly measure hygiene behaviors related to the prevention of gastrointestinal infections.

2-5-2. Clinical Oral Health Assessment (DMFT)

Maternal dental status was assessed using the DMFT index, following the World Health Organization (WHO) diagnostic criteria. The DMFT score was calculated as the sum of decayed (D), missing (M), and filled (F) permanent teeth. Clinical examinations were performed by a trained dental examiner using a sterile dental mirror and a community periodontal index (CPI) probe under standardized illumination (portable headlamp). The CPI probe was used in accordance with WHO recommendations for oral epidemiological examinations during the DMFT assessment and was not used for periodontal evaluation.

To ensure intra-examiner reliability, the examiner underwent a calibration session under the supervision of a senior faculty member prior to the study, achieving a Kappa coefficient of >0.80.

2-5-3. Data Collection Procedure

Each questionnaire required approximately 20 minutes to complete. After obtaining verbal informed consent, the questionnaires were administered with interviewer guidance. The DMFT of the mothers was examined by a trained final-year dental student using a headlamp to ensure adequate visibility. Data were collected after the child's hospitalization for gastroenteritis; therefore, the temporal

sequencing between exposure and outcome cannot be definitively established.

2-5-4. Sample Size Considerations

No a priori sample size calculation was performed before the study initiation. The final sample size (n=120; 60 per group) was determined based on feasibility and the number of eligible participants during the study period. Given the exploratory nature of the study, the results should be interpreted with caution, particularly in multivariable analyses.

2-6. Data Analysis

After data collection, responses were reviewed for completeness and accuracy and entered into SPSS software (version 26). Descriptive statistics were used to summarize demographic characteristics and main variables. Comparative analyses were conducted using independent t-tests, one-way ANOVA, and chi-square tests as appropriate. No missing data were observed for the variables included in the analyses.

Multivariable logistic regression analysis was performed to evaluate the independent associations between maternal oral health literacy, DMFT index, and hospitalization due to gastroenteritis in children. Variables considered clinically relevant or demonstrating evidence of association in univariable analyses were entered into the multivariable model. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were calculated.

Continuous variables were entered into the regression model as continuous measures. Prior to multivariable logistic regression, multicollinearity among the independent variables was assessed using tolerance values and variance inflation factors (VIFs). No evidence of problematic multicollinearity was observed (all VIFs < 5 and all tolerance values > 0.20). To reduce model instability, only a limited number of predictor variables were included in the final multivariable model. A p-value < 0.05 was considered statistically significant.

2-7. Ethics Approval

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human participants were approved by the Biomedical Ethics Committee of Ardabil University of Medical Sciences (approval number IR.ARUMS.REC.1402.009). Verbal informed consent was obtained from all participating mothers prior to enrollment, as approved by the institutional ethics committee.

3- RESULTS

Table 1 presents the baseline demographic characteristics of the study participants. No statistically significant differences were observed between the case and control groups regarding child age distribution (P = 0.900), birth order (P = 0.488), maternal age (28.42 ± 6.14 vs. 28.90 ± 5.10 years, P = 0.640), residential area (P = 0.791), or maternal occupation (P = 0.449). These findings indicate that the two groups were comparable with respect to the assessed baseline demographic and socioeconomic characteristics (Table 1).

Similarly, no statistically significant differences were found between the two groups with respect to maternal education (P = 0.132) or paternal education (P = 0.118) (Table 2).

3-1. DMFT Findings

A statistically significant difference was observed in the number of missing teeth between mothers in the case and control groups (P = 0.006), with higher mean values in the case group. Although the mean number of decayed and filled teeth differed between groups, these

differences were not statistically significant (P > 0.05). Furthermore, a significant difference in total maternal DMFT scores was observed between groups (P = 0.004) (Table 3).

Given the cross-sectional measurement of DMFT, these findings indicate an association between maternal dental status and case–control grouping, but do not establish temporal directionality.

3-2. Maternal Oral Health Literacy

When comparing the dimensions of maternal oral health literacy, a statistically significant difference was found in the decision-making domain between the two groups (P = 0.001). The overall mean oral health literacy score was also significantly different (P = 0.032).

No statistically significant differences were observed in reading comprehension, numeracy skills, or listening skills between groups (P > 0.05). The proportion of mothers classified as having inadequate oral health literacy was higher in the case group (36 mothers, 60%) compared to the control group (16 mothers, 26.7%) (P < 0.001) (Table 4).

Table-1. Baseline demographic characteristics of the study participants.

Variable		Case (n=60)	Control (n=60)	P-value
Child age, n (%)	≤1 year	11 (18.3)	10 (16.7)	0.900
	1–2 years	22 (36.7)	21 (35.0)	
	2–3 years	14 (23.3)	17 (28.3)	
	3–4 years	13 (21.7)	12 (20.0)	
Birth order, n (%)	First	44 (73.3)	47 (78.3)	0.48
	Second	15 (25.0)	12 (20.0)	
	Third or higher	1 (1.7)	1 (1.7)	
Maternal age (years), Mean ± SD		28.42 ± 6.14	28.90 ± 5.10	0.640
Residential area, n (%)	Region 1	15 (25.0)	19 (31.7)	0.791
	Region 2	15 (25.0)	15 (25.0)	
	Region 3	16 (26.7)	12 (20.0)	
	Region 4	14 (23.3)	14 (23.3)	
Maternal occupation, n (%)	Housewife	40 (66.7)	36 (60.0)	0.449
	Employed	20 (33.3)	24 (40.0)	

Table-2. Parental educational level according to study group.

Education Level	Mother		Father	
	Case	Control	Case	Control
< High School	11 (18.3%)	6 (10%)	10 (16.7%)	5 (8.3%)
Diploma	17 (28.3%)	10 (16.7%)	14 (23.3%)	7 (11.7%)
Associate's Degree	12 (20%)	14 (23.3%)	10 (16.7%)	12 (20%)
Bachelor's Degree	13 (21.7%)	13 (21.7%)	15 (25%)	14 (23.3%)
Master's Degree	6 (10%)	11 (18.3%)	8 (13.3%)	12 (20%)
Doctorate	1 (1.7%)	6 (10%)	3 (5%)	10 (16.7%)
P-value	0.132		0.118	

Table-3. Comparison of maternal DMFT components between study groups.

Variable	Group		P-value
	Case	Control	
Decayed teeth (D)	3.45 ± 1.72	3.07 ± 2.18	0.288
Missing teeth (M)	4.12 ± 3.34	2.72 ± 1.92	0.006
Filled teeth (F)	4.98 ± 3.87	4.38 ± 3.2	0.359
DMFT	12.55 ± 5.02	10.17 ± 3.82	0.004

Multivariable logistic regression analysis showed that higher maternal DMFT scores were independently associated with increased odds of gastroenteritis-related hospitalization (adjusted OR = 1.18, 95% CI: 1.05–1.32, P = 0.006), whereas higher maternal decision-making scores were associated with lower odds of hospitalization (adjusted OR = 0.51, 95% CI: 0.34–0.77, P = 0.001). Higher numeracy scores were also independently associated with increased odds of hospitalization (adjusted OR = 1.86, 95% CI: 1.15–3.02, P = 0.011). Maternal age, parental education, and maternal occupation were not significantly associated with the outcome. The overall model demonstrated good fit (Hosmer–Lemeshow P = 0.655) and was statistically significant (Omnibus χ^2 = 34.43, P = 0.003) (Table 5).

Compared with the reference category (< high school), none of the maternal education categories (Diploma: P = 0.719; Associate degree: P = 0.089; Bachelor's degree: P = 0.334; Master's degree: P = 0.124; Doctorate: P = 0.132) or paternal education categories (Diploma: P = 0.463; Associate degree: P = 0.521; Bachelor's degree: P = 0.342; Master's degree: P = 0.572; Doctorate: P = 0.728) showed a statistically significant association with the outcome.

Table-4. Comparison of maternal oral health literacy status in the case and control groups.

Variable	Group		P-value
	Case	Control	
Reading Comprehension	2.80±1.27	3.22±1.54	0.109
Numeracy Skills	2.78±1.04	2.78±1.29	0.98
Listening Skills	1.20±0.68	1.30±0.72	0.437
Decision-Making	2.42±1.28	3.28±1.45	0.001
Total oral health literacy score	9.20±2.77	10.58±4.09	0.032

Table-5. Multivariable logistic regression analysis of factors associated with gastroenteritis-related hospitalization in children.

Variable	Adjusted OR	95% CI for OR	P-value
Maternal DMFT score	1.18	1.05–1.32	0.006
Decision-making score	0.51	0.34–0.77	0.001
Numeracy skills	1.86	1.15–3.02	0.011
Maternal age	1.06	0.96–1.17	0.278
Maternal education†	-	-	0.329
Paternal education†	-	-	0.948
Maternal occupation Housewife (reference)	1.08	0.39–3.01	0.879

Model performance: Omnibus χ^2 = 34.43, P = 0.003; Hosmer–Lemeshow χ^2 = 5.93, P = 0.655; Nagelkerke pseudo-R^2 = 0.333; overall classification accuracy = 70.0%. † Entered into the model as categorical variables (reference category: < high school).

4- DISCUSSION

The present study found that mothers of children with gastroenteritis-related hospitalization had significantly lower oral health literacy scores and higher DMFT indices compared with mothers of children without gastroenteritis-related hospitalization. These findings indicate an association between maternal oral health indicators and gastroenteritis-related hospitalization in children rather than gastroenteritis itself.

Childhood gastroenteritis is influenced by multiple environmental, behavioral, and biological determinants, including sanitation and hygiene (WASH),

breastfeeding practices, vaccination status, and exposure to daycare or crowded households. These variables were not available in the current dataset and may have contributed to residual confounding. Accordingly, the observed associations should be interpreted cautiously, as maternal oral health literacy and DMFT may partly reflect broader socioeconomic and health-related behavioral characteristics rather than independent causal factors. However, the primary aim of this study was exploratory, focusing on whether maternal oral health indicators could serve as proxies for broader health-related behaviors (6, 7).

To date, no prior studies have directly investigated the relationship between maternal oral health literacy, DMFT, and acute gastroenteritis in young children, limiting direct comparisons with existing literature. However, associations between parental oral health literacy and children's oral health outcomes are well-documented.

Nevertheless, existing evidence suggests that maternal health literacy and oral health behaviors substantially influence children's oral health outcomes, particularly dental caries development from early childhood (20).

Caregivers' oral health literacy has been shown to be significantly associated with children's oral health–related quality of life (32). A systematic review by Firmino et al. (2018) reported that lower parental oral health literacy is consistently associated with higher prevalence and severity of dental caries in children, as well as poorer oral health–related quality of life (33).

Maternal knowledge, attitudes, and practices (KAP) during early childhood have also been linked to dental caries in preschool children, and positive parenting practices may improve children's oral health outcomes (34).

Oral health literacy is increasingly recognized as an important determinant of oral health outcomes, reflecting an individual's ability to access, process, and understand oral health information needed to make appropriate health decisions (35).

Low oral health literacy has been linked with poorer oral health behaviors and outcomes, including less frequent preventive dental visits, suboptimal oral hygiene practices, and increased risk of dental diseases (36). Oral health literacy is therefore considered a potential determinant of oral health disparities in populations, as it influences individuals' capacity to engage in preventive behaviors and seek appropriate care (37).

The oral microbiota comprises diverse communities of bacteria and other microorganisms that play critical roles in maintaining oral health, and disruptions in this community (dysbiosis) are associated with common oral diseases such as dental caries, gingivitis, and periodontitis (38). Emerging evidence suggests that oral microbial dysbiosis and inflammation may influence systemic health and could be involved in the pathogenesis of non-oral diseases by modulating host immune responses and metabolic pathways (39). However, no microbiological or inflammatory biomarkers were measured in the present study; therefore, these mechanisms remain speculative and should not be interpreted as explanatory pathways for the observed associations

Moreover, mothers of children with gastroenteritis-related hospitalization had significantly higher DMFT scores and a greater number of missing teeth than mothers in the control group. In the adjusted logistic regression model, higher maternal DMFT scores and lower decision-making scores remained independently associated with gastroenteritis-related hospitalization after adjustment for maternal age, parental education, and maternal occupation.

Higher numeracy scores were also positively associated with the outcome. These findings suggest that maternal oral health status and functional oral health literacy may serve as indicators of broader preventive health behaviors that are associated with children's susceptibility to infectious diseases, including gastroenteritis (35).

Although inflammatory bowel disease differs substantially from acute gastroenteritis in etiology and clinical course, these findings support the concept that oral health status may be associated with gastrointestinal health, while direct extrapolation to pediatric gastroenteritis should be avoided (40).

4-1. Limitations

Several limitations should be considered when interpreting these findings. First, maternal oral health literacy was assessed after the child's hospitalization; therefore, the temporal relationship between exposure and outcome could not be established, and reverse causation cannot be excluded. Second, the control group consisted of children without gastroenteritis-related hospitalization rather than children confirmed to be free of gastroenteritis, meaning that some children may have experienced mild outpatient episodes. Third, the study did not evaluate the severity, etiology, or specific pathogens responsible for gastroenteritis episodes. In addition, important potential confounders—including sanitation and hygiene (WASH), breastfeeding practices, vaccination status, daycare attendance, household crowding, dietary habits, and child nutritional status—were not available and may have contributed to residual confounding. Finally, although this exploratory case-control study identified significant associations, its findings should not be interpreted as evidence of causality. Future prospective studies incorporating microbiological, environmental, behavioral, and socioeconomic factors are warranted to clarify the pathways linking maternal oral health, oral health literacy, and pediatric gastroenteritis.

5- CONCLUSION

Mothers in the case group had significantly higher DMFT scores and lower overall oral health literacy than mothers in the control group. In multivariable logistic regression analysis, maternal DMFT score, decision-making skills, and numeracy skills remained independently associated with gastroenteritis-related hospitalization in children after adjustment for maternal age, parental education, and maternal occupation. These findings indicate an association rather than a causal relationship and suggest that maternal oral health literacy and oral health status may serve as indicators of broader preventive health behaviors. Strengthening maternal education on oral health, preventive practices, and health-related decision-making may contribute to child health promotion; however, prospective studies are needed to confirm these associations.

6- ACKNOWLEDGMENT

We acknowledge all participants involved in our research and all the personnel who helped make this study.

7- FUNDING

This study received no specific grant from any funding agency, commercial or not-for-profit sectors.

8- CONFLICT OF INTEREST STATEMENT

There was no conflict of interest.

9- DATA AVAILABILITY

The datasets used during the current study are available from the corresponding author on reasonable request.

10- REFERENCES

1. Kassebaum NJ, Smith AG, Bernabé E, Fleming TD, Reynolds AE, Vos T, et al. Global, regional, and national prevalence, incidence, and disability-adjusted life years for oral conditions for 195 countries, 1990–2015: a systematic analysis for the global burden of diseases, injuries, and risk factors. Journal of Dental Research. 2017 Apr;96(4):380-7.

2. Marandi M, Babaei A, Momeni Z. Association of maternal oral health literacy with dental caries status of 6-9-year-old children according to the caries assessment spectrum and treatment (CAST) index. BMC oral health. 2025 Apr 11;25(1):538.

3. Glick M, Williams DM, Kleinman DV, Vujicic M, Watt RG, Weyant RJ. A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. British dental journal. 2016 Dec 16;221(12):792-3.

4. Khoshnevisan MH, Shariatpanahi SP, Sadeghipour-Roudsari M, Namdari M, Niknejad F, Malek-Mohammadi M. Influence of maternal oral healthcare behavior during childhood on children's oral health care during adolescence. Journal of Oral Health and Oral Epidemiology. 2020 Jan 1;9(1):45-53.

5. DeWalt DA, Hink A. Health literacy and child health outcomes: a systematic review of the literature. Pediatrics. 2009 Nov 1;124(Supplement_3):S265-74.

6. Sanders LM, Thompson VT, Wilkinson JD. Caregiver health literacy and the use of child health services. Pediatrics. 2007 Jan 1;119(1):e86-92.

7. Salarian S, Ansari Bejestani MR, Owlia F. Mothers' Oral Health Literacy and its Relationship with Children's dmft: A Cross-Sectional Study in an Iranian Population. Journal of Mashhad Dental School. 2025 Mar 21;49(1):60-72.

8. Hom JM, Lee JY, Divaris K, Baker AD, Vann Jr WF. Oral health literacy and knowledge among patients who are pregnant for the first time. The Journal of the American Dental Association. 2012 Sep 1;143(9):972-80.

9. Azizi N, Karimy M, Abedini R, Armoon B, Montazeri A. Development and validation of the health literacy scale for workers. The international journal of occupational and environmental medicine. 2019 Jan 1;10(1):30.

10. Firmino RT, Martins CC, Faria LD, Martins Paiva S, Granville-Garcia AF, Fraiz FC, et al. Association of oral health literacy with oral health behaviors, perception, knowledge, and dental treatment related outcomes: a systematic review and meta-analysis. Journal of public health dentistry. 2018 Jun;78(3):231-45.

11. Kyu HH, Vongpradith A, Dominguez RM, Ma J, Albertson SB, Novotney A, et al. Global, regional, and national age-sex-specific burden of diarrhoeal diseases, their risk factors, and aetiologies, 1990–2021, for 204 countries and territories: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet Infectious Diseases. 2025 May 1;25(5):519-36.

12. Afshari G, Omidvar S, Kordbagheri M. The role of health literacy in the relationship between mothers' knowledge and practices of iron supplementation in children (aged 12 to 24 months): A structural equation model. Plos one. 2025 Apr 3;20(4):e0319845.

13. Coughlin SS, Vernon M, Hatzigeorgiou C, George V. Health literacy, social determinants of health, and disease prevention and control. Journal of environment and health sciences. 2020 Dec 16;6(1):3061.

14. Mai X, LaMonte MJ, Hovey KM, Freudenheim JL, Andrews CA, Genco RJ, et al. Periodontal disease severity and

cancer risk in postmenopausal women: the Buffalo OsteoPerio Study. Cancer Causes & Control. 2016 Feb;27(2):217-28.

15. Huang J, Roosaar A, Axéll T, Ye W. A prospective cohort study on poor oral hygiene and pancreatic cancer risk. International journal of cancer. 2016 Jan 15;138(2):340-7.

16. Thistle JE, Yang B, Petrick JL, Fan JH, Qiao YL, Abnet CC, et al. Association of tooth loss with liver cancer incidence and chronic liver disease mortality in a rural Chinese population. PLoS One. 2018 Sep 17;13(9):e0203926.

17. Yano Y, Abnet CC, Poustchi H, Roshandel G, Pourshams A, Islami F, et al. Oral health and risk of upper gastrointestinal cancers in a large prospective study from a high-risk region: Golestan cohort study. Cancer Prevention Research. 2021 Jul 1;14(7):709-18.

18. Jordao HW, McKenna G, McMenamin UC, Kunzmann AT, Murray LJ, Coleman HG. The association between self-reported poor oral health and gastrointestinal cancer risk in the UK Biobank: A large prospective cohort study. United European Gastroenterology Journal. 2019 Nov;7(9):1241-9.

19. Adil AH, Eusufzai SZ, Kamruddin A, Wan Ahmad WM, Jamayet NB, Karobari MI, et al. Assessment of parents' oral health literacy and its association with caries experience of their preschool children. Children. 2020 Aug 18;7(8):101.

20. Sowmya KR, Puranik MP, Aparna KS. Association between mother's behaviour, oral health literacy and children's oral health outcomes: A cross-sectional study. Indian Journal of Dental Research. 2021 Apr 1;32(2):147-52.

21. Mohammadi Z, Poortahmasebi V, Baghi HB, Kafil HS, Abdinia B, Oskouee MA. Prevalence of gastrointestinal viral infections in pediatrics with gastroenteritis referred to hospital in northwest Iran. The Microbe. 2025 Jun 1;7:100296.

22. Walker CL, Rudan I, Liu L, Nair H, Theodoratou E, Bhutta ZA, et al. Global burden of childhood pneumonia and diarrhoea. The Lancet. 2013 Apr 20;381(9875):1405-16.

23. Purnama TB, Wagatsuma K, Saito R. Prevalence and risk factors of acute respiratory infection and diarrhea among children under 5 years old in low-middle wealth household, Indonesia. Infectious diseases of poverty. 2025 Feb 10;14(01):95-104.

24. Mohammadpoor A, Zamani M, Sadeghloo Z, Jameie M, Mousavi H, Pooresmaeil Niaki SR, et al. Global and regional trends in under-five diarrheal disease burden: impact of human development index and geographic disparities, 1990-2021. Gastroenterology and Hepatology From bed to Bench. 2025 Jan 1;18(2):177-95.

25. Ogutu EA, Ellis A, Rodriguez KC, Caruso BA, McClintic EE, Ventura SG, et al. Determinants of food preparation and hygiene practices among caregivers of children under two in Western Kenya: a formative research study. BMC Public Health. 2022 Oct 6;22(1):1865.

26. Shafizadeh F, Nasiri-Amiri F, Sayyari A, Imanzadeh F. Mothers' knowledge and perception of childhood diarrhea and its management with diet in north and east of Tehran. Caspian Journal of Pediatrics. 2019 Mar 10;5(1):342-9.

27. Escapa IF, Chen T, Huang Y, Gajare P, Dewhirst FE, Lemon KP. New insights into human nostril microbiome from the expanded human oral microbiome database (eHOMD): a resource for the microbiome of the human aerodigestive tract. Msystems. 2018 Dec 26;3(6):10-128.

28. Kitamoto S, Nagao-Kitamoto H, Hein R, Schmidt TM, Kamada N. The bacterial connection between the oral cavity and the

gut diseases. Journal of dental research. 2020 Aug;99(9):1021-9.

29. Broadbent JM, Page LF, Thomson WM, Poulton R. Permanent dentition caries through the first half of life. British dental journal. 2013 Oct 12;215(7):E12-.

30. Sedighi P, Karami M, Razzaghi M, Emamjamaat M, Karimi A, Ghanaiee RM, et al. The frequency of rotavirus gastroenteritis in children from West of Iran and genotyping of rotavirus isolates: a suggestion for further changes in childhood immunization program. Journal of Research in Health Sciences. 2024 Jul 31;24(3):e00621.

31. Naghibi Sistani MM, Montazeri A, Yazdani R, Murtomaa H. New oral health literacy instrument for public health: development and pilot testing. Journal of investigative and clinical dentistry. 2014 Nov;5(4):313-21.

32. Velasco SR, Moriyama CM, Bonecker M, Butini L, Abanto J, Antunes JL. Relationship between oral health literacy of caregivers and the oral health-related quality of life of children: a cross-sectional study. Health and Quality of Life Outcomes. 2022 Jul 30;20(1):117.

33. Firmino RT, Ferreira FM, Martins CC, Granville-Garcia AF, Fraiz FC, Paiva SM. Is parental oral health literacy a predictor of children's oral health outcomes? Systematic review of the literature. International journal of paediatric dentistry. 2018 Sep;28(5):459-71.

34. Alkaabi B, Hashim R, Shetty RM, Walia T, Berdouses ED. Maternal knowledge, attitudes, and practices are associated with dental caries in preschool children in eastern United Arab Emirates. Frontiers in Oral Health. 2026 Feb 18;7:1706385.

35. Alzahrani AY, El Meligy O, Bahdila D, Aljawi R, Bamashmous NO, Almushayt A. Health and oral health literacy: a comprehensive literature review from theory to practice. International journal of paediatric dentistry. 2025 Mar;35(2):434-45.

36. Yu S, Huang S, Song S, Lin J, Liu F. Impact of oral health literacy on oral health behaviors and outcomes among the older adults: a scoping review. BMC geriatrics. 2024 Oct 22;24(1):858.

37. Naghibi Sistani MM, Yazdani R, Virtanen J, Pakdaman A, Murtomaa H. Determinants of oral health: does oral health literacy matter?. International Scholarly Research Notices. 2013;2013(1):249591.

38. Arweiler NB, Netuschil L. The oral microbiota. Microbiota of the human body: implications in health and disease. 2016 May 10:45-60.

39. Jia G, Zhi A, Lai PF, Wang G, Xia Y, Xiong Z, et al. The oral microbiota–a mechanistic role for systemic diseases. British dental journal. 2018 Mar 23;224(6):447-55.

40. Marruganti C, Discepoli N, Gaeta C, Franciosi G, Ferrari M, Grandini S. Dental caries occurrence in inflammatory bowel disease patients: a systematic review and meta-analysis. Caries research. 2021 Sep 1;55(5):485-95.