

# Oral Health of Primary Schoolchildren and Oral Health Knowledge of Their Parents in Two Rural Communities of Armenia

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## Abstract

**Background and Aim:** Parental knowledge of oral hygiene is shown to be protective for their children's oral health (OH). This study sought to estimate primary schoolchildren's OH status, OH behavior, and eating habits in rural Armenia and investigate whether OH knowledge of parents influenced their children's oral health measured by Plaque index

**Design:** The study population were primary schoolchildren and their parents living in two rural communities of Armavir province. The study included: 1) cross-sectional telephone survey among parents exploring their OH knowledge, child's OH behavior, child's eating habits, and socio-demographic characteristics, and 2) clinical examination of children's OH status measured by Plaque index and the number of Decayed, Missing, and Filled Teeth (DMFT/dmft index). The adjusted association between parental oral health knowledge and child's Plaque index was explored through multivariable linear regression analysis.

**Results:** Overall, 400 parents participated in the study. Their children's OH assessment demonstrated their mean Plaque and DMFT/dmft indices equal to 3.1 (SD 0.7) and 7.3 (SD 3.3), respectively. Children's mean OH behavior score was 1.8 (out of 5.0) and their mean eating habit score was 6.0 (out of 14.0). The mean parental OH knowledge score was 6.9 (out of 9.0). After adjusting for confounders, each one-unit increase in parental OH knowledge score was associated with a 0.06-unit decrease in the child's plaque index score (95% CI (-0.10); (-0.01)).

**Conclusions:** This study revealed high prevalence of plaque and caries among primary schoolchildren, as well as their suboptimal OH behavior and eating habits, indicating the need for complex interventions among them including the performance of caries-prevention procedures, educating children, and providing them with better access to dental care. Also, this study demonstrated the importance of interventions aimed at increasing parental knowledge for improving children's OH.

**Keywords:** Parental knowledge; primary schoolchildren; oral health; Plaque Index; DMFT Index; rural health

## Introduction

According to Global Burden of Disease estimates, from 1990 to 2017, the age-standardized prevalence of all oral conditions decreased by 5.5% globally, while untreated caries in permanent teeth saw a substantial reduction of 8.8%.<sup>1</sup> Yet, despite these encouraging trends, oral health (OH) conditions considerably influenced worldwide public health, affecting over 3.5 billion people in 2017, with an age-standardized prevalence rate of 450 cases per 1000 individuals [1].

Universally, the most prevalent OH condition among school-aged children affecting 60-90% of them worldwide is dental caries [2, 3]. This preventable disease is considered dietary-microbial, and is heavily associated with the frequent consumption of simple carbohydrates and chemical demineralization of the tooth surfaces arising from continuous metabolic interactions between microbial biofilm (such as those in dental plaque) and dental hard tissues [2]. Quigley and Hein Index or Plaque Index (quantifying the presence of plaque on all surfaces of teeth) and DMFT/dmft index (reflecting the number of decayed, missing, and filled teeth) are internationally recognized standardized methods to measure oral health [4, 5].

Children with dental caries suffer from oral pain, discomfort, tooth loss, poor growth, delayed speech development, as well as impairment of daily activities, academic performance, school attendance, and oral health related quality of life (OHRQoL) [6-8]. Studies have shown that oral health of children can be affected by socioeconomic status and area of residence (urban vs. rural) [9, 10].

There is limited data on the prevalence of caries among children in Armenia, as only a few small-scale studies have been conducted. However, the available research suggests a notably high prevalence of caries among schoolchildren ranging from 81.3% to 96.8% in various communities and age groups [11-13].

Studies have found that factors protective against the development of caries in children include tooth brushing with fluoridated toothpaste twice a day, as well as usage of sealant and topical fluoride.<sup>2</sup> Parental knowledge on caries prevention and parents' own behavior regarding oral hygiene are widely shown to be both important for shaping children's tooth brushing behaviors and protecting them from caries [14, 15]. Therefore, interventions aimed at improving children's oral hygiene behavior usually include both education of children and counseling of caregivers, preferably mothers, on proper oral care [15, 16]. During our literature review we haven't come across any studies measuring the influence of parental OH knowledge on children's OH in Armenia.

In the scope of the Entrepreneurs in Health (EIH) program of the American University of Armenia (AUA) Turpanjian College of Health Sciences, a previously unavailable pediatric dental service was established in Mrgashat village of Armavir province (one of the eleven provinces of Armenia), and a preventive dentistry project was initiated among primary schoolchildren, which includes OH awareness raising and caries prevention activities. The current paper summarizes the results of a cross-sectional study conducted among primary schoolchildren and their parents in two rural communities of Armavir province: Mrgashat and Sardarapat, to identify the baseline situation with the parents' OH knowledge and children's OH status before the initiation of the preventive dentistry project in one of these communities. Additionally, the study sought to explore the association between parental OH knowledge and child's OH status in these communities.

## Methods

### Study Design

The cross-sectional study consisted of: 1) an interviewer-administered telephone survey among parents of primary schoolchildren to measure their OH knowledge, as well as their children's OH behavior and eating habits, and 2) a clinical examination of the OH status of primary schoolchildren with calculation of their Plaque Index and DMFT/dmft index.

## Study Population and Recruitment of Participants

All primary schoolchildren aged 6-10 years living in Mrgashat and Sardarapat communities, as well as their parents constituted the study population. The two existing primary schools in Mrgashat village and the single primary school in Sardarapat village served as the study settings for clinical examination of children's OH. The overall number of primary schoolchildren in the targeted villages was 536 (271 in Mrgashat and 265 in Sardarapat). The study attempted to cover all these children and their parents applying a census method.

To recruit the study participants, an approval was obtained from the regional governmental authority. The study coordinator met with the principals and primary school teachers of the schools and introduced the study. With the help of the school principals and primary school teachers, a written oral consent form in two copies was distributed to all parents of primary schoolchildren in both communities, asking for their consent to participate in a telephone survey on OH knowledge and practice, and for permission to conduct a clinical examination of their child's OH status. The names of the parents and children, as well as the parents' contact information, were collected from the second copy of the signed consent form – returned in a sealed envelope. The study protocol was reviewed and approved by the institutional Review Board of the American University of Armenia (approval #AUA-2022-003).

## Study Instruments

### Data Collection

Data collection started with the telephone survey of parents, performed by three trained interviewers, using the online survey tool Alchemer on electronic devices. The collected data was extracted in SPSS format.

OH examinations were performed by two teams, each consisting of a dentist and a nurse. Both dentists and nurses were thoroughly trained prior to data collection in order to assure inter-rater reliability. The study teams were supplied with the necessary equipment for OH examination in a non-dental setting, including proper lighting, sterilized and disposable equipment, as well as first aid kit. Several spot-checks have shown proper arrangement of data collection. Each child was given a unique ID. Paper-based data of clinical examination was entered into SPSS database and merged with the parents' survey data. The main challenge faced during the data collection process was related to the lack of trust among some parents, mainly from Sardarapat community, related to the usage of coloring agent to identify dental plaque of their children. The explanations of the process by the primary investigator and the dentist in the field, as well as keeping the process of OH examination open to the parents partially addressed this issue. Yet, the response rate in this community was substantially lower than in Mrgashat community.

## Study Variables

The main outcome variable of interest for this study was child's Plaque index. The main independent variable of interest was parental OH knowledge score. This score was a sum of the right answers to nine knowledge items included in the questionnaire and thus ranged from 0 to 9. The control variables were parental characteristics (age, sex, education, marital status), family's socioeconomic status variables (family size, perceived living standards, and monthly expenditures), and child's characteristics including demographic (age, sex, birth order) and health status variables (nutritional status, perceived general health, perceived teeth and gum health, OH behavior score, and eating habits score). The OH behavior score was based on 5 items and ranged from 0 to 5. The eating habits score was based on the weighted sum of 9 items and ranged from 0 to 14.

The majority of variables were either dichotomous or dichotomized (child's order, perceived general health of the child, parental education, marital status). For those variables having more than two categories (child's nutritional status, perceived teeth/gum health of the child, family's living standards and monthly expenditures), dummy variables were created for each category before en-

tering them into linear regression analysis. All continuous variables (child's and parent's age, scores of parental OH knowledge, child's OH behavior, eating habits, Plaque and DMFT indices, and family size) were entered into linear regression analysis as such after checking the linearity of their association with the outcome.

## Data Analysis

The data were cleaned and analyzed using "IBM SPSS Statistics 22" and "STATA 13" software. After conducting range checks to ensure data accuracy, descriptive statistics using means and standard deviations for continuous variables and percentages for categorical variables was performed to summarize participants' characteristics and compare these between the communities. Chi-square test was used to compare proportions, while t-test was used to compare means.

The null hypothesis of the study was formulated as "There is no association between parental OH knowledge and their children's OH measured by Plaque index". We conducted multivariable linear regression analysis with the outcome of child's Plaque index, the dependent variable of parental OH knowledge score, and all possible confounders included in the model, to see if this hypothesis can be rejected. The potential confounders of the association between parental OH knowledge score and child's Plaque index were identified using empirical approach. Each of the control variables was entered in univariate linear regression analysis with the dependent variable of the study – child's Plaque index. All those variables that were significantly related to this outcome (with a p-value less than 0.05) were tested in univariate linear regression analysis for their association with the independent variable of the study – parental OH knowledge score. Those variables that were significantly associated with both dependent and independent variables were treated as confounders of the association between the two and, thus, controlled for in the multivariable linear regression analysis to find the adjusted association between parental knowledge score and child's Plaque index.

## Results

Overall, 400 parents took part in the survey, of whom 229 were from Mrgashat and 171 from Sardarapat. The overall response rate among parents was 74.6% (84.5% in Mrgashat and 64.5% in Sardarapat). The overall number of children who underwent examinations for Plaque and DMFT/dmft indices was 385 and 389, respectively.

Since the study applied a census method, we did not calculate a sample size. Instead, we calculated the power of the study to ensure that our design was robust to detect meaningful differences in the outcome variable. With the sample size of 385 (the number of children with the Plaque index measured), the study power to detect a 10.0% difference in the Plaque index between two independent samples was equal to 97.6%.

The mean age of surveyed parents was 33.5 years (ranging between 23 and 51), and the mean age of children was 8.3 years (ranging between 6 and 10). The vast majority of the parents were mothers (95.3%), while the sex distribution among children was nearly equal (Table 1). At the time of the interview, 96.0% of the parents were married and the remaining 4.0% divorced. Slightly less than half of the parents (47.5%) had higher than secondary education. Twenty-seven percent of the parents rated the teeth and gum health of their children as good or excellent, while 73.0% of them rated the OH of their children as fair (52.6%) or poor (20.4%). A rather high percentage (43.7%) of the respondents rated their family's general standards of living as above average, while only 5.0% considered it to be below average (Table 1).

The characteristics of the study participants were generally similar in the two communities. However, parents rated their children's teeth and gum health as poor more frequently in Mrgashat than in Sardarapat, which was an unexpected finding given that the Plaque index was higher among children from Sardarapat compared to those from Mrgashat. Another significant difference was found with respect to children's mean eating habit score, which was higher in Sardarapat compared to Mrgashat (Table 1).

The OH assessment identified serious health issues among children from both communities with high mean Plaque index (3.1), in-

dicating that, on average, three-fifth of the teeth of children were covered with plaque. The DMFT/dmft index was also high (7.3). OH behavior score of the children was 1.8 out of 5.0 (36.0%) and eating habit score was 6.0 out of 14.0 (42.9%), as reported by their parents (Table 1).

**Table 1:** Demographic characteristics of the study participants by their place of residence, baseline assessment, Armavir province, Armenia, 2022

Characteristics		N*	Community			Total sample(n=400)
			Mrgashat(n=229)	Sardarapat(n=171)	p-value	
<i>Child's characteristics</i>						
Age in years, mean (SD)		387	8.35 (1.20)	8.27 (1.15)	0.521	8.32 (1.18)
Sex:	Male, %	400	55.0	49.7	0.292	52.8
	Female, %		45.0	50.3		47.3
Under/overweight:	Normal weight, %	323	68.9	76.4	0.318	72.1
	Underweight, %		20.2	15.7		18.3
	Overweight, %		10.9	7.9		9.6
Child's order:	First/second, %	400	80.8	74.9	0.155	78.3
	Third/higher order, %		19.2	25.2		21.8
<i>Parent-reported child's health</i>						
General health:	Good to excellent, %	398	81.5	76.0	0.183	79.1
	Fair/poor, %		18.5	24.0		20.9
Teeth and gum health:	Poor, %	397	24.7	14.7	0.005	20.4
	Fair, %		53.7	51.2		52.6
	Good to excellent, %		21.6	34.1		27.0
Oral health behavior score, mean (SD)		400	1.71 (1.01)	1.92 (1.15)	0.055	1.80 (1.07)
Eating habit score, mean (SD)		399	4.16 (1.68)	4.71 (1.79)	0.002	4.40 (1.74)
<i>Objective measures of child's teeth health</i>						
DMFT score, mean (SD)		389	7.01 (3.21)	7.64 (3.48)	0.065	7.28 (3.34)
Plaque index, mean (SD)		385	2.94 (0.72)	3.22 (0.53)	<0.001	3.06 (0.66)
<i>Parent's characteristics</i>						
Age in years, mean (SD)		399	33.13 (4.41)	34.04 (5.32)	0.062	33.52 (4.83)
Sex:	Male, %	400	2.6	7.6	0.020	4.8
	Female, %		97.4	92.4		95.3
Education:	Secondary or less, %	400	55.0	49.1	0.242	52.5
	More than secondary, %		45.0	50.9		47.5
Marital status:	Married, %	400	95.2	97.1	0.343	96.0

	Divorced/Widowed, %		4.8	2.9		4.0
Oral health knowledge score, mean (SD)		400	6.88 (1.37)	6.95 (1.43)	0.621	6.91 (1.39)
<i>Family's socioeconomic status</i>						
Number of family members, mean (SD)		397	6.11 (1.65)	6.20 (1.85)	0.646	6.15 (1.74)
Living standards:	Below average, %	398	4.8	5.3	0.952	5.0
	Average, %		50.9	51.8		51.3
	Above average, %		44.3	43.0		43.7
Monthly expenditures:	Below 100,000 AMD, %	346	22.0	30.7	0.059	25.4
	101,000-300,000 AMD, %		64.1	62.0		63.3
	301,000 AMD or more, %		13.9	7.3		11.3

<sup>†</sup>Number of valid responses.

The mean OH knowledge score of parents was relatively high (6.9 of 9.0, or 76.7%) (Table 1). However, the percentages of their correct answers to the knowledge questions varied in a wide range – from 59.9% to 97.7% (Table 2). The lowest percentages of correct answers received the statements on the benefits of using fluoride-added toothpaste and fluoride-added water, and the usefulness of dental flossing. Consistent with this, only 8.8% of parents reported using fluoride containing toothpaste for their children and only 2.0% of them reported dental flossing by their children (Table 3). Only 75.0% of parents believed that caries is preventable and only 39.2% of them took their children to dentist for preventive dental checkups at least once a year (Table 3). The remaining knowledge questions, including those on the benefits of teeth brushing and dangers of sweetened food/drink consumption received very high percentages of correct answers (Table 2). Nevertheless, almost 60.0% of parents reported introducing sweetened beverages, and over half of them – confectionary or other sweets into their child's diet during infancy (Table 4). In almost 90% of these cases, sweetened beverages were given to the infant using a bottle with nipple. According to the parental reports, only 70.4% of children were regularly having breakfast at home (Table 4).

**Table 2:** Percentages of correct answers to oral health knowledge questions by parents of primary schoolchildren in Mrgashat and Sardarapat communities of Armavir province, Armenia, 2022

	Items	N	%
1.	The health of teeth and mouth affects one's general health.	330	84.4
2.	Brushing teeth at least twice a day helps to maintain good oral health.	388	97.7
3.	Dental flossing is an important measure for proper oral hygiene.	200	60.4
4.	Irregular tooth brushing can cause gum disease.	354	90.1
5.	Irregular tooth brushing can cause decay.	382	97.0
6.	Plaque removal procedure once every 6 months is important measure for proper oral hygiene.	318	90.9
7.	Fluoride added in water or toothpaste helps preventing caries.	139	59.9
8.	Consumption of sugar in food or beverages can cause teeth decay.	371	94.4
9.	Caries is usually preventable.	281	75.1

**Table 3:** Oral health behavior of primary schoolchildren in Mrgashat and Sardarapat communities of Armavir province, Armenia, 2022

Items	Total study populationn (%)
Frequency of brushing teeth (parent):	
<i>Less than 2 times a day</i>	191 (47.8)
<i>Two or more times a day</i>	209 (52.3)
Frequency of brushing teeth (child):	
<i>Less than 2 times a day</i>	248 (62.0)
<i>Two or more times a day</i>	152 (38.0)
Child's age at starting brushing teeth regularly, mean (SD)	4.47 (1.54)
Toothpaste currently used by child:	
<i>Fluoride containing</i>	35 (8.8)
<i>Fluoride free</i>	365 (91.3)
Frequency of child's preventive visits to dentist:	
<i>At least once in 6 months</i>	34 (8.5)
<i>Less frequently/ never</i>	366 (91.5)
Frequency of child's curative visits to dentist:	
<i>At least once a year</i>	156 (39.2)
<i>Less frequently than once a year</i>	242 (60.8)
Any usage of antiseptic mouthwash over the past 3 months:	
<i>Yes</i>	36 (9.0)
<i>No</i>	363 (91.0)

**Table 4:** Eating habits of primary schoolchildren in Mrgashat and Sardarapat communities of Armavir province, Armenia, 2022

Items	Total study populationn (%)
Duration (months) of child's breastfeeding in months. <i>Mean (SD)</i>	12.35 (11.0)
Age of introduction of sweetened beverages into the child's diet:	
<i>At 12 months or below</i>	238 (59.8)
<i>More than 12 months</i>	160 (40.2)
Giving the child sweet tea/beverages using a bottle with nipple:	
<i>Yes</i>	213 (53.4)
<i>No</i>	186 (46.6)
Age of introduction of confectionary/other sweets into the child's diet:	
<i>At 12 months or below</i>	199 (50.1)
<i>More than 12 months</i>	198 (49.9)
Age of introduction of carbonated sweetened beverages into the child's diet:	
<i>At 12 months or below</i>	57 (14.4)
<i>More than 12 months</i>	340 (85.6)
Current frequency of child's consumption of sweetened/carbonated beverages:	



More frequently than once a week	227 (57.2)
Once a week or less frequently/ never	170 (42.8)
Child having regular breakfasts at home:	
Yes	281 (70.4)
No	118 (29.6)
Number of child's meals per day, Mean (SD)	2.84 (0.64)

In unadjusted linear regression analysis, parental knowledge score and child's Plaque index were associated negatively ( $B = (-0.06)$ , 95% CI  $(-0.11)$ ,  $(-0.02)$ ). Out of the variables tested as potential confounders of this association, child's age, parent's gender, parent's education, child's perceived teeth health, and child's eating habit score were significantly associated with the dependent variable – child's Plaque index, while parent's education, child's weight, child's eating habit score, and child's OH behavior score were significantly associated with the independent variable – parental OH knowledge score. Hence, only two variables – child's eating habit score and parent's education were significantly associated with both dependent and independent variables and, thus, were found to be possible confounders of the association of interest (Table 5). After adjusting the association between parental OH knowledge score and child's Plaque index for both these possible confounders, the association remained significant. Each one-unit increase in parental OH knowledge score was associated with 0.06-unit decrease in child's plaque index score. Notably, the strength of association between these variables did not change after controlling for the confounders.

**Table 5:** Confounders of the association between parental OH knowledge and child's Plaque index

	Association with Plaque index			Association with parental knowledge		
	B	95% CI	p-value	B	95% CI	p-value
Child's eating habit score	0.04	0.001; 0.08	0.043	0.09	0.01; 0.16	0.031
Parent's education:						
Secondary or less	Ref.			Ref.		
Higher than secondary	-0.19	-0.32; -0.06	0.004	0.63	0.36; 0.89	<0.001

**Table 6:** Adjusted association between parental OH knowledge and child's Plaque index, Armavir province, Armenia, 2022

Characteristics	B	95% CI for B	p-value
Parental OH knowledge score	-0.06	-0.10; -0.01	0.025
Parents' education: Secondary or less	0.00		
Higher than secondary	-0.18	-0.31; -0.04	0.009
Child's eating habit score	0.05	0.01; 0.09	0.010

## Discussion

This study created a baseline dataset that will enable to evaluate the impact of the preventive dentistry-oriented project among rural primary schoolchildren undertaken in the scope of the EIH program of AUA. Besides, it revealed the current situation with regards to OH status and OH-related behavior of primary schoolchildren and OH-related knowledge of their parents, as well as the association between parental OH knowledge and child's OH in rural communities of Armavir province, Armenia.

The OH assessment of children has identified severe issues represented in very high Plaque and DMFT/dmft indices. The mean DMFT/dmft index among children in the studied communities was substantially higher than that reported in studies from India, African countries and Croatia [20-23]. As to the identified mean Plaque Index in this study, studies conducted in other countries



reported comparable or lower mean values for this index, indicating better condition in terms of dental plaque among primary schoolchildren in these countries [24, 25]. The literature provides convincing evidence of positive correlation between poor oral hygiene and the prevalence of plaque and caries [26]. This underlines the importance of encouraging better oral hygiene practices for preventing dental plaque and caries among children.

This study was the first to evaluate the level of parental OH knowledge in Armenia's rural communities. It demonstrated, overall, rather high knowledge on OH among parents of primary schoolchildren, which is generally in line with similar studies [27, 28]. However, OH behavior and eating habits of their children were far from being satisfactory. This study found a number of inconsistencies between what the parents know and what they and their children actually do. For example, despite the high percentage of parents knowing that consumption of sugar in food or beverages can cause caries, they reported rather poor eating habits of their children, heavily relying on consumption of added sugar in food and beverages starting from an early age. Similarly, although almost all parents thought that brushing teeth at least twice a day helps to maintain good OH, and over half of them brushed their teeth twice a day, only slightly above one-third of their children brushed their teeth regularly.

Evidence from literature supports the observed inconsistencies between knowledge and actual practice. There are studies showing that having sound knowledge and favorable attitudes towards OH do not necessarily guarantee the development of appropriate OH practices [29, 30]. A cross-sectional study from Karnataka found that despite parents possessing good OH knowledge and positive attitudes toward preventing early childhood caries in their children, the parents' actual practices were poor, indicating that adequate knowledge and positive attitude of parents alone do not inevitably lead to proper practices among their children [29]. The disparity between OH behavior of parents and their children shown in tooth brushing is described in other studies as well [31].

Nevertheless, we were able to reject the null hypothesis of the study and confirm that there is a protective association between parental OH knowledge score and child's Plaque index, demonstrating that, still, higher parental knowledge on oral hygiene protects the child from dental plaque and, subsequently, caries. Similar protective associations between parental oral health literacy and various indicators of child's oral health status were widely demonstrated in the literature [32-34].

One of the possible limitations of this study was the limited number of participating rural communities in the study, which could affect the generalizability of the findings. Additionally, the two communities were located in the same province, which could further restrict the applicability of the findings to other provinces of Armenia. However, this limitation was dictated by the main purpose of the overall study, for which this study served as a baseline assessment prior to a small-scale preventive dental health intervention to be initiated in one of the two selected communities – otherwise comparable with each other. Another potential limitation of this study was measuring the majority of independent variables, including children's OH behavior and eating habits, based on parental reports that could be subject for both response (socially desirable answers) and recall bias. However, both these biases could potentially affect only the intervening variables of this study, as the dependent variable (Plaque index) was objectively measured by a specialist using a valid technique, and the independent variable (parental OH knowledge) inherently cannot be a subject to either of these biases.

The findings of this study demonstrated the importance of interventions aimed at increasing parental knowledge for improving children's OH. Educational programs to be developed for parents and children should focus on the identified gaps in OH knowledge and preventive behaviors. This study revealed high prevalence of plaque and caries among children as well as their poor OH behavior and eating habits, indicating the need for complex interventions among them in addition to the training efforts, including the performance of caries-prevention procedures and their provision with better access to dental care. Possibly, the findings of this study and ensuing recommendations could be applicable for other rural communities in Armenia and countries with similar-to-Armenia socioeconomic profiles.

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## Conflict of Interest

The corresponding author and co-authors do not have any conflict of interest.

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