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Contextual and individual factors associated with oral health literacy in adolescents: A multi-level approach

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This study aimed to evaluate the association of contextual and individual factors with Oral Health literacy (OHL) in early adolescence. This is a population-based cross-sectional study carried out with 740 12-year-old adolescents randomly selected by a two-stage probabilistic cluster sampling process from schools in Campina Grande, Brazil. The guardians provided sociodemographic information. Adolescents answered the Brazilian version of the Family Adaptability and Cohesion Scales (FACES III) to measure family functioning, and the Brazilian Rapid Estimate of Literacy in Dentistry (BREALD-30) to measure OHL. Descriptive analysis was conducted, followed by robust Poisson's regression analysis for complex samples with a multilevel approach ($p<0.05$). Rate ratio (RR) and 95% confidence intervals (CI) were calculated. The two levels of the analysis were students and schools. Adolescents enrolled at schools with higher grade-retention rate had slightly worse OHL scores (RR = 0.99; 95% CI: 0.98 to 0.99). The following individual factors were associated with the level of OHL: the female sex (RR = 1.05; 95% CI: 1.01 to 1.10), mother's schooling more than eight years (RR = 1.13; 95% CI: 1.08 to 1.19), younger guardians (RR = 0.94; 95% CI: 0.90 to 0.97) and a balanced family functioning (RR = 1.08; 95% CI: 1.01 to 1.14). Individual and contextual factors were associated with OHL in early adolescence.

Key Words: Adolescent, Oral Health, Health Literacy, Schools, Family Relation

Introduction

Health literacy is a multidimensional concept that involves the acquisition and processing of theoretical and practical knowledge related to health and affects both the individual and society (1). The study of oral health literacy (OHL) in adolescence is important because it is recognized a structural and social determinant of health that is associated with oral health status. It was demonstrated previously that worse levels of OHL impact negatively on dental caries among adolescents (2). Moreover, cognitive and behavioral changes occur in this period that affect health-related behaviors and the decision-making capacity of youths (1). Greater oral health literacy (OHL) can contribute to reducing inequalities in the use of dental services and strengthening better oral health practices (3).

Data from the National Education Plan in Brazil reveal that the number of illiterate individuals in 2017 was approximately 11.4 million (4). Moreover, the prevalence of adequate health literacy is low among youths from different countries, with rates ranging from only 8.1 to 14.4% (5,6). To address this situation, the National Action Plan to Improve Health Literacy (7) issued by the U.S. Department of Health and Human Services suggests an integrated action involving different sectors of society, such as health providers, individuals, communities and policymakers, to make health information accessible and easy to understand. In Brazil, researchers have evaluated the effect of health education interventions directed at adolescents for the development of validated materials and to facilitate the understanding of dental advice (8). The purpose of these actions is to improve the quality of health services, reduce operational costs and improve the quality of life of the general population (7). Thus, the study of factors associated with OHL in adolescents can offer important information to assist these actions.

Sociodemographic factors, such as social class, schooling and sex, have been associated with health literacy (9). However, the association between these factors and OHL in adolescents has been

little explored in the literature. Studies about this topic are needed, since OHL is a key concept in the prevention of oral health problems. This scenario is even more uncertain in children and adolescents, as few studies have focused on young people and the data produced thus far consider only the reports of parents/guardians (10), with little attention given to the self-reports of adolescents.

Balanced family functioning contributes to improve mental health and reduce behavioral problems in adolescents. A previous study demonstrated that family functioning is associated with depressive and emotional symptoms in adolescents aged 12-17 years (11). This aspect may interfere in oral health information acquisition and should be explored as a possible factor associated with OHL in adolescents.

It is estimated that approximately 12 million adolescents in Brazil are enrolled in the final years of primary school and that 98% of children and adolescents between six and 14 years of age were enrolled in basic education schools in 2018 (12). The combined offer of interdisciplinary teaching makes the school a favorable environment for stimulating critical thinking and improving the level of health literacy among students (13). Thus, the school context is important to promoting teaching conditions that enable adolescents to achieve adequate levels of OHL. Factors such as academic yield, the background of the teachers and structural issues may also affect the level of OHL in adolescence. This is the first study to consider a multilevel approach to evaluate the association of school level variables with oral health literacy in early adolescence. This is important because school environment changes learning outcomes and may be associated with the acquisition of health information (1). The conceptual hypothesis of this study is that individual and school factors are associated with the level of oral health literacy in early adolescence. It is expected that a balanced family environment and better school learning context favour oral health literacy. Thus, the aim of the present study was to evaluate the association of school and individual factors with oral health literacy in 12-year-old adolescents.

Material and methods

Ethical commitments

This study was conducted in accordance with the guidelines established in the Declaration of Helsinki and received approval from the Human Research Ethics Committee of the State University of Paraiba Committee on Human Research (certificate number: 55953516.2.1001.5187). The parents/guardians received clarifications regarding the objectives of the study and authorized the participation of their children by signing a statement of informed consent. The adolescents also signed a statement of consent agreeing to participate in the study.

Sample size and settings

An observational, analytical, cross-sectional study was conducted at public and private schools in the city of Campina Grande, Brazil, between October 2016 and July 2017. Campina Grande is a medium-sized city in the state of Paraiba, Brazil, and has a population above 400.000 inhabitants. The target population of the study was 12-year-old adolescents. According to the National Institute for Educational Studies and Research, the total number of 12-year-old students enrolled in the initial years of primary school in Campina Grande was 24.911 in 2017 (14).

Two-stage probabilistic cluster sampling was used to obtain the sample of this study. There are 58 private schools and 73 public schools in the city. The sample was representative of the city and the final number of students in the sample was proportional to the total number of students enrolled in public and private schools. In the first stage, the participating schools were selected randomly, resulting in 14 public schools and 18 private schools. This number was achieved according to the number of students enrolled in each school. In the second stage, the participants were selected randomly from each school using a simple random sample based on the attendance list furnished by the school. The city in which the study was conducted is divided into six administrative districts. To ensure representativeness, the number of participants was proportional to the number of 12-year-old students in each district. The sample size was calculated considering a 5% margin of error, 95% confidence interval and a design effect of 1.6 to ensure greater sample variability. As there is no consensus on the prevalence of low OHL in the study population, a rate of 50% was considered

to give the largest sample. The minimum sample was calculated to be 615 students, to which 20% was added to compensate for possible dropouts, resulting in a sample of 769 12-year-old adolescents: 520 from public schools and 249 from private schools.
Twelve-year-old adolescents enrolled in basic education schools of the city were included in the study. Exclusion criteria were individuals with medical conditions or syndromes that can affect cognition and reading capacity (based on the reports of parents/guardians and teachers).

Training and calibration exercises

Two dentists were trained to administer the Brazilian version of the Rapid Estimate of Adult Oral Health Literacy (BREALD-30), which has been validated for use on adolescents (15). Training occurred in three steps (16). An expert in the field first explained the theoretical aspects and evaluation criteria of the instrument, followed by a training phase and, finally, a calibration step involving 15 videos of individuals with different levels of OHL. The level of agreement of the examiners for the total BREALD-30 score was calculated using the intraclass correlation coefficient (ICC) [inter-examiner agreement: ICC = 0.98 (95% CI: 0.97 to 0.99); intra-examiner agreement: ICC = 0.97 (95% CI: 0.92 to 0.99) and 0.99 (95% CI: 0.98 to 0.99)]. The Kappa (K) coefficient was used to calculate the level of agreement regarding each item on the instrument (agreement between each examiner and the expert: K = 0.88 to 0.89; agreement between the two examiners: K = 0.87; intra-examiner agreement: K = 0.87 to 0.89).

Pilot study

A pilot study was conducted with 50 12-year-old adolescents (25 from a public school and 25 from a private school). This step was performed to evaluate the logistics of the study and the application of the questionnaires addressing sociodemographic characteristics and family cohesion/adaptability. The results revealed no need to alter the proposed methods. The participants in the pilot study were not included in the final sample.

Data collection

Contextual variables

Eight contextual variables were considered in the present study: type of school (public or private), average number of students per class, average number of class hours, pass rate, failure rate, grade-retention rate (number of students held back to repeat a grade two or more times due to insufficient academic performance), teachers with a university degree and income of the neighborhood in which the school is located. Information on neighborhood income was obtained from the Brazilian Institute of Geography and Statistics (4). The school (contextual) variables were used as quantitative continuous rates according to Brazilian school sense from the Anisio Teixeira National Institute of Educational Studies and Research (INEP) (14).

Individual factors

The sociodemographic data of the sample were provided by the parents/guardians and included the adolescent's sex, guardian's age (categorized by the median), adolescent's ethnicity, mother's schooling and number of residents in the home. It has been recognized that oral health problems are common among minorities. In this sense a previous study that used white and non-white classification in Brazil found that non-white adolescents aged 15-19 had worse OHL levels (17). About mothers' schooling, it has been demonstrated that adolescents whose mothers studied less than 8 years present poorer oral health literacy compared to those whose mothers studied 8 or more years (17,18). Social class was categorized using the Brazilian economic classification criteria used by the Brazilian Association of Research Companies. This criterion is a broader evaluation to explore social status rather than only family income (19), which consider the power to purchase consumer goods, educational level of the head of the household and access to treated water and a paved street. The social class of the adolescents was categorized as either high (Classes A and B) or low (Classes C, D and E). The adolescents provided information on family characteristics and OHL (BREALD-30) (15).

Data collection was performed in a reserved room at the schools to ensure confidentiality. Family characteristics were evaluated using the Family Adaptability and Cohesion Scale (FACES-III) (20), which consists of 20 items. The sum of the odd-numbered items indicates the level of family cohesion and the sum of the even-numbered items indicates the level of family adaptability. Family cohesion regards the level of closeness and dependence among the components of a family and is categorized as follows: enmeshed (maximum level of dependence and cohesion), connected (intermediate level of dependence, with high to moderate closeness), separated (considerable degree of independence and moderate to low cohesion) or disengaged (high degree of independence and low cohesion). Family adaptability regards the degree of flexibility in the family environment and is categorized as follows: rigid (very low family flexibility with practically no changes in relations of authority), structured (low to moderate flexibility with possible changes in relations of authority), flexible (moderate to high flexibility with changes in relations of authority) or chaotic (very high level of flexibility with changes in relations of authority). The circumplex model of family function classify family in different types based on family cohesion and adaptability. A balanced functioning refers to balanced cohesion and adaptability; a mid-range functioning occurs when only one of these parameters is in the extremes (very high or very low).

Additionally, unbalanced family functioning means that both cohesion and adaptability are in the extremes (20).

BREALD-30 is an instrument that measures functional literacy in oral health through the identification and reading of words. It consists of 30 dental terms organized in an increasing order of complexity in terms of pronunciation. The adolescent was asked to read the words and the examiner evaluated the pronunciation of each item, classifying it as either correct or incorrect.

Each correctly pronounced term corresponds to one point, whereas incorrectly pronounced terms receive no score. The total is used to determine the level of OHL. As there are no defined cutoff points for the categorization of the scores, the BREALD-30 was considered in its quantitative form in the present study (15).

The adolescents also reported their perception of their last dental appointment using the item on the questionnaire used for the national oral health survey (OH Brazil) (21).

Statistical analysis

Descriptive analysis was used for the characterization of the sample. No problems of collinearity were found among the variables. After this step, associations between the dependent variable and predictors of the study were evaluated using unadjusted and adjusted multilevel Poisson regression models. The theoretical framework of this study was based in previous studies that have demonstrated the association of individual factors such as family and sociodemographic aspects with health literacy and oral health literacy in adolescence (9,17). In addition, school environment has demonstrated to be a potential predictor of health literacy (1). However, at this point, there is no available study to evaluate the association between school factors and oral health literacy in early adolescence. The statistical procedures were performed in STATA version 15 (STATA Corp). The dependent variable was the level of OHL among the students associated with variables on the level of participant (first level) and school (second level). A random-effects model was used to conduct the robust multilevel Poisson regression for complex samples, with random intercepts and fixed slopes for the evaluation of associations between the dependent variable and the individual and contextual predictors. Rate ratios (RR) between exposed and non-exposed groups were calculated, along with respective 95% confidence intervals (CI). An initial null model was used to evaluate the variation in the data without the inclusion of the predictors. The individual predictors were incorporated into the second model and the contextual predictors were incorporated into the third model. Individual predictors with a p-value <0.20 in the univariate multilevel Poisson regression were included in Model 2 and those with a p-value <0.05 after the adjustments remained in the final model. Next, contextual predictors with a p-value <0.20 in the univariate multilevel Poisson regression were included in Model 3 and those with a p-value <0.05 after the adjustments remained in the final model. The goodness-of-fit of the models considered deviation values (–2 log likelihood).

Results

The final sample was composed of 740 12-year-old adolescents, which corresponds to a response rate of approximately 96%. The loss of 29 adolescents occurred for the following reasons: absence from school on the days scheduled for data collection (n = 16), refusal to participate in the study (n = 9) and disabilities that affected cognitive capacity and reading ability (n = 4). The mean OHL score for the sample was 17.03 (SD = 5.87). Considering the terciles it was observed that only 19.6% of adolescents presented adequate OHL (BREALD-30 ≥21), while 38.3% presented low (BREALD-30≤ 15) and 42.1% presented marginal (14< BREALD-30 < 21) OHL. A total of 492 students (66.5%) were enrolled in public schools and 248 (33.5%) were enrolled in private schools. The female sex accounted for 43.2% of the sample and more than two thirds of the adolescents were non-white. Most caregivers had 8 or more years of schooling (58.0%) and were from low social class (74.1%). Table 1 displays the characterization of the sample.

Table 1. Individual and school level characteristics of the sample

Variables	n (%)/ Mean (SD)
Individual level	
Sex	
Male	320 (43.2)
Female	420 (56.8)
Guardian's age	
≤ 38 years	360 (49.0)
> 38 years	374 (51.0)
Mother's schooling	
≤ 8 years	426 (58,0)
> 8 years	308 (42,0)
Ethnicity	
Non-white	525 (70.9)
White	215 (29.1)
Social class	
Low	547 (74.1)
High	191 (25.9)
Number of residents in the home	
≥6 residents	577 (79.3)
≤5 residents	151 (20.7)
Guardian's marital status	
Married	419 (56.8)
Unmarried	319 (43.2)
Family cohesion	
Enmeshed	14 (1.9)
Connected	87 (11.8)
Separated	293 (39.6)
Disengaged	346 (46.7)
Family adaptability	
Chaotic	194 (26.2)
Flexible	230 (31.1)
Structured	226 (30.5)
Rigid	90 (12.2)
Family functioning	
Balanced	226 (30.6)
Mid-range	338 (52.4)
Unbalanced	126 (17.0)
School level	
Type of school	
Public	492 (66.5)
Private	248 (33.5)
Average number of students per class	28.38 (5.54)
Average number of class hours	6.13 (2.08)
Pass rate	75.24 (15.64)
Fail rate	15.94 (10.05)
Grade retention rate	34.13 (19.25)
Teachers with a university degree	90.74 (10.66)
School neighborhood income	788.18 (358.84)

In the bivariate multilevel Poisson regression analysis, the variables associated with OHL in the adolescents were sex, guardian's age, mother's schooling, social class, guardian's marital status, family cohesion, family adaptability, family functioning, type of school, pass rate, failure rate, grade-retention rate and teachers with a university education ($p < 0.05$) (Table 2).

Table 2. Unadjusted robust Poisson regression for the association of individual and school variables with Oral Health Literacy among school adolescents.

Variables	Mean (SD)	Unadjusted RR* Oral Health Literacy	
		p-value	(95% CI)
Individual-level			
Sex			
Male	16.4 (5.81)		1.00
Female	17.4 (5.87)	0.006**	1.05 (1.01-1.09)
Guardian's age			
≤ 38 years	16.2 (5.95)	0.005**	0.94 (0.91-0.98)
> 38 years	17.8 (5.72)		1.00
Mother's schooling			
≤ 8 years	15.4 (5.97)		1.00
> 8 years	19.2 (4.96)	<0.001**	1.13 (1.08-1.18)
Ethnicity			
Non-white	16.6 (5.94)		1.00
White	17.9 (5.59)	0.613	1.01 (0.97-1.05)
Social class			
Low	16.4 (6.11)		1.00
High	18.8 (4.57)	0.027**	1.00 (1.00-1.09)
Number of residents in the home			
≥6 residents	15.7 (6.21)		1.00
≤5 residents	17.3 (5.74)	0.144**	1.03 (0.98-1.08)
Type of School			
Private	20.0 (4.40)		1.00
Public	15.5 (5.94)	<0.001**	0.79 (0.73-0.84)
Guardian's marital status			
Married	17.7 (5.79)		1.00
Unmarried	16.0 (5.79)	0.010**	0.95 (0.91-0.98)
Family cohesion			
Disengaged	16.2 (6.27)		1.00
Separated	17.3 (5.57)	0.080**	1.03 (0.99-1.07)
Connected	18.8 (4.70)	0.002**	1.09 (1.03-1.15)
Enmeshed	17.8 (7.89)	0.658	0.97 (0.85-1.10)
Family adaptability			
Rigid	18.2 (5.58)		1.00
Structured	18.0 (5.57)	0.993	0.99 (0.94-1.06)
Flexible	16.4 (5.70)	0.012**	0.92 (0.87-0.98)
Chaotic	15.9 (6.27)	<0.001**	0.89 (0.83-0.94)
Family functioning			
Balanced	18.2 (4.89)		1.00
Mid-range	16.5 (6.11)	<0.001**	0.92 (0.98-0.96)
Unbalanced	16.4 (6.43)	0.004**	0.92 (0.97-0.97)
School level			
Average number of students per class	-	0.197**	0.99 (0.98-1.00)
Average number of class hours	-	0.276	0.97 (0.93-1.02)
Pass rate	-	<0.001**	1.00 (1.00-1.01)

* Unadjusted Rate Ratio (RR) for multilevel Poisson regression to evaluate the association of individual and school level variables with Oral Health Literacy among early adolescents.

** Variables included in the multivariate model (p <0,20).

Standard Deviation (SD)

Confidence Intervals (CI)

Rate Ratio (RR)

In the multivariate multilevel Poisson regression analysis (Table 3), the following remained associated with the OHL of the adolescents in Model 2 (individual variables): female sex (RR = 1.06; 95% CI: 1.02 to 1.10), guardian's age less than or equal to 38 years (RR = 0.94; 95% CI: 0.90 to 0.97), mother's schooling (RR = 1.14; 95% CI: 1.09 to 1.19) a mid-range family functioning (RR = 0.93; 95% CI: 0.89 to 0.97) and an unbalanced family functioning (RR = 0.92; 95% CI: 0.87 to 0.97). After the adjustments with the incorporation of the contextual variables in Model 3, the female sex (RR = 1.05; 95% CI: 1.01 to 1.10), guardian's age less than or equal to 38 years (RR = 0.91; 95% CI: 0.88 to 0.95) and mother's schooling more than eight years of study (RR = 1.13; 95% CI: 1.08 to 1.19) remained associated with OHL among the adolescents. Having a balanced family functioning (RR = 1.08; 95% CI: 1.01 to 1.14) and a lower grade-retention rate (RR = 0.99; 95% CI: 0.98 to 0.99) were associated with a higher level of OHL among the adolescents.

Table 3. Multilevel adjusted assessment of oral health literacy among adolescents associating individual and contextual variables

	Model 1 ("null")		Model 2		Model 3
	RR (95% CI)	p-value	RR (95% CI)	p-value	RR (95% CI)
Intercept	17.72 (16.78-18.71)		16.11 (14.82-17.52)		17.65 (15.74-19.79)
Individual level					
Sex					
Male	-	-	1.00		1.00
Female	-	0.002	1.06 (1.02-1.10)	0.018	1.05 (1.01-1.10)
Guardian's age					
≤ 38 years	-	0.002	0.94 (0.90-0.97)	0.002	0.91 (0.88-0.95)
> 38 years	-	-	1.00		1.00
Mother's schooling					
≤ 8 years	-	-	1.00		1.00
> 8 years	-	<0.001	1.14 (1.09-1.19)	<0.001	1.13 (1.08-1.19)
Ethnicity					
Non-white	-	-	-	-	-
White	-	-	-	-	-
Social class					
Low	-	-	-	-	-
High	-	-	-	-	-
Number of residentes in home					
≥6 residents	-	-	-	-	-
≤5 residents	-	-	-	-	-
Guardian's marital status					
Married	-	-	-	-	-
Unmarried	-	-	-	-	-
Family cohesion					
Disengaged	-	-	-	-	-
Separated	-	-	-	-	-
Connected	-	-	-	-	-
Enmeshed	-	-	-	-	-
Family adaptability					
Rigid	-	-	-	-	-
Structured	-	-	-	-	-
Flexible	-	-	-	-	-
Chaotic	-	-	-	-	-
Family functioning					
Balanced	-	0.001	0.93 (0.89-0.97)	0.009	1.08 (1.01-1.14)
Mid-range	-	0.004	0.92 (0.87-0.97)	-	-
Unbalanced	-	-	1.00	-	1.00
School level					
Type of school					
Public	-	-	-	-	-
Private	-	-	-	-	-
Average number of students per class	-	-	-	-	-
Average number of class hours	-	-	-	-	-
Pass rate	-	-	-	-	-
Failure rate	-	-	-	-	-
Grade retention rate	-	-	-	0.007	0.99 (0.98-0.99)
Teachers with a university degree	-	-	-	-	-
School neighborhood income	-	-	-	-	-
Deviance	-2519.08		-2453.42		-2020.38

Model 1 ("null"): represents the unconditional model; Model 2: represents individual covariates; Model 3: represents subject and school-level covariates.
Standard Deviation (SD)
Confidence Intervals (CI)
Rate Ratio (RR)

Discussion

In the contextual level, the grade-retention rate was slightly associated with the OHL level of the participants. Among the factors evaluated in the present study, the female sex, older parents and a higher level of mother's schooling were important individual predictors of a higher level of OHL among the students. Moreover, students with unbalanced family functioning had a lower level of OHL. Individual and school factors were associated with oral health literacy in early adolescence. In this sense, the conceptual hypothesis of this study was accepted. This study evaluated the association of school context with the OHL of adolescents and the results suggest the importance of considering sociodemographic factors, family functioning and the school environment when implementing intersectoral measures for improving the level of OHL in this population.

Among the contextual factors considered in this study, the grade-retention rate was associated with a slightly lower OHL among the adolescents. In Brazil, there is need to improve oral health information access in schools. This situation exerts a negative impact on students and teachers, who may not receive adequate preparation for discussing this topic. The school environment is a strategic space for developing health literacy early in life and reducing health inequalities (13). However, there are no previous studies on the effect of school context on OHL.

These findings are important, as health literacy programs at schools can offer benefits to the education sector, affecting the self-confidence of students to improve health literacy (13). Thus, adolescents enrolled at schools with a higher grade-retention rate are a priority population and should receive additional support to improve levels of OHL.

The type of school was not associated with the level of OHL in early adolescence. Since the vast majority of adolescents in the sample belonged to public schools and it has been recognized that this type of school in Brazil performs less health promotion activities compared to private schools (22), it is possible that grade retention rate was a more sensitive predictor of the learning environment and OHL than the type of school itself. This may explain why the type of school only remained associated with OHL in the unadjusted model.

Female adolescents had higher OHL scores than males. Similar results have been reported in early adolescents considering only individual variables (18). A previous study involving adolescents and young adults reported greater knowledge and a higher level of health literacy in female students (5). This may be because female adolescents customarily exhibit a better standard of oral health care, greater interest in dental issues and more visits to the dentist (23). These findings underscore the importance of developing educational strategies to improve the interest of adolescent males about oral health.

Students whose mothers had more than eight years of schooling, and those whose caregivers aged more than 38 years had higher OHL. A previous study involving adolescents confirmed the association between a higher level of schooling of adolescent's parents and OHL (6). Moreover, a study conducted in Brazil indicated that higher age and schooling impact higher earns (24), which may affect dental services utilization and access to oral health information. These findings may indicate that older caregivers and mothers with more years of formal education have greater knowledge regarding preventive oral health practices and the importance of visiting a dentist. Consequently, mothers with more schooling and caregivers aged above 38 years are likely to provide greater support to their children regarding oral health education, thereby contributing to better OHL among adolescents.

In contrast, social class was not associated with OHL. A previous study using a sample of adolescents in Brazil reported a similar finding (18). These results suggest that social class may not be directly associated with OHL among adolescents aged 12 years old. In contrast, another study in Brazil with a sample of students aged 15-19 years old found a significant association of social class with OHL. This study used a validated instrument (BREALD-30) (17). These differences may have occurred due to the populations analyzed that varied from early adolescents in a primary school setting to older students. In this sense a poorer social environment probably plays a stronger role on the middle and latter adolescence, because in these stages critical thinking and more sophisticated cognitive functions are required and a lack of access to adequate information may impact on oral health literacy. Further population-based studies are essential to allow comparisons.

Another individual aspect of the adolescents associated with OHL was family functioning. Adolescents who had a balanced family functioning exhibited higher OHL. An unbalanced family

environment may reduce the search for family support on the part of adolescents and affect their cognitive capacity, exerting an influence on emotional and behavioral aspects (12). Moreover, the oral health habits of parents are associated with the oral health of their children, which highlights the role of the family in the acquisition of knowledge about prevention of oral problems and establishment of healthy habits (25). It is therefore important to consider integrated health actions that involve different components of the family to improve the OHL of adolescents.

The cross-sectional design does not enable establishing direct causality between variables. However, methodological strategies were employed to strengthen the validity of the results, such as the calibration of the examiners, the execution of a pilot study, the use of validated measures and multilevel statistical analysis. Another limitation of this study regards the nature of the dependent variable, which only evaluates a conceptual dimension of literacy limited to the recognition and reading of words. However, this approach is considered adequate, as the level of functional literacy is related to more complex levels, such as interactive and critical health literacy. Moreover, the results of the present population-based study contribute to a better understanding of the association of individual and contextual factors with OHL, which can assist in the planning of school programs and public policies directed at oral health literacy among adolescents.

Adolescence is a strategic period for actions to increase OHL and factors as the social status, family functioning, and school environment should be incorporated into educational practices by oral health providers and policymakers. Sociodemographic factors, family functioning and a low grade-retention rate impacted positively on OHL of 12-year-old adolescents.

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References

Resumo

O objetivo deste estudo foi avaliar o efeito de um nanocomplexo recém-desenvolvido formado entre hidroxipropil-β-ciclodextrina e 1% de tetrafluoreto de titânio (TiF4) após distintos períodos de complexação (12/72 horas) na desmineralização do esmalte bovino in vitro. Blocos de esmalte (n = 60) foram alocados para cada grupo: água Mili-Q, hidroxipropil-β-ciclodextrina, TiF4 a 1%, hidroxipropil-β-ciclodextrina + TiF4 1% após 12 horas de complexação e hidroxipropil-β-ciclodextrina + TiF4 1% após 72 horas de complexação. As amostras foram avaliadas pela microdureza superficial, microdureza transversal e micro-CT. Microscopia eletrônica de varredura / espectrometria de raios X por dispersão de energia (MEV / EDX) foram obtidas. A hidroxipropil-β-ciclodextrina + TiF4 1% após 12h de complexação resultou em um menor percentual de perda de microdureza superficial em comparação com água Mili-Q, hidroxipropil-β-ciclodextrina, TiF4 a 1% e hidroxipropil-β-ciclodextrina + TiF4 1% após 72 horas de complexação com uma ampla magnitude de efeito (de 1,307 a 2,943) e alto poder (84,9 a 99%). Todos os grupos resultaram em similar perda integrada de minerais (ΔZ) obtida por ambas as técnicas de microdureza e micro-CT. O esmalte tratado com os grupos TiF4 e TiF4 + hidroxipropil-β-ciclodextrina apresentou camada de esmalte TiO2, enquanto a avaliação de EDX identificou Ti. A solução contendo o complexo de inclusão de hidroxipropil-β-ciclodextrina + TiF4 com 12 horas de período de complexação demonstrou uma capacidade significativa para reduzir a desmineralização superficial do esmalte hígido sob um desafio cariogênico artificial.

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