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DENTAL CARIES IN 12-YEAR-OLD CHILDREN AND ASSOCIATED FACTORS: SOCIO-ECONOMIC, FAMILY ENVIRONMENT, ACCESS AND USE OF DENTAL SERVICES ASPECTS

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ABSTRACT

A cross-sectional and quantitative study aimed at analyzing socio-economic, family environment, access and use of dental services, subjective aspects and their relationship with dental caries in 253 children aged 12 years old enrolled in municipal schools of a medium-sized municipality of south of Brazil. A clinical examination was carried out to collect cases of dental caries using the decayed, missing and filled teeth index (DMFT), classifying children into two groups: Group 1: Caries Free and Group 2: With caries experience. A questionnaire was applied to mothers or women in charge for the children. The presence of dental caries was observed in 41.1% of the children with an average DMFT index of 0.96. The multivariate analysis identified that, among socioeconomic factors, income and quantity of goods were associated with dental caries. The factors related to the family environment are not characterized as predictive factors for dental caries. In the perception of the mothers, the children with experience of dental caries seek more the service for treatment. In this context, it is necessary to understand the complexity involved in the development of dental caries, and interprofessional work may represent an important strategy, since it aims the integral care in oral health care.

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INTRODUCTION

Health promotion actions aim at the well-being and quality of life of individuals. In this context, it is pertinent to consider that health can be influenced by social, environmental and cultural factors called Socioeconomic Determinants of Health (Paula *et al*. 2015). According to the National Commission on Socioeconomic Determinants of Health (CNDSS), these are characterized as social, economic, cultural, ethnic / racial, psychological and behavioral factors that relate to the occurrence of health problems and their risk factors in the population (Buss and Pellegrini Filho, 2007). Oral health is an integral element of general health and can interfere with the quality of life of individuals, with functional and psychosocial impacts (Blumenshine *et al*. 2008). In this sense, curative actions are not sufficient for health promotion, and preventive and educational actions with a focus on these social determinants of health are necessary, since oral health behaviors involve complex socioenvironmental conditions (Fisher-Owens *et al*. 2007).

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In this context, the prevalence of caries has been related to socioeconomic aspects (Polk *et al*. 2010; Tonello Benazzi *et al*. 2012). Family environment conditions, such as schooling, occupation and social class of the parents are related to the oral pathologies of the children (Almeida and Vianna, 2014). Based on the assumption that the family is the object of health research and intervention, it assumes an important role in the organization and functioning of everyday issues (Almeida and Vianna, 2014). Aspects related to mother's level of education, oral hygiene habits, caries experiences, children's oral health perception and access to oral health services also seem to interfere with the prevalence of caries (Torres de Freitas *et al*. 2013). That is, studies have shown that family behavior and habits impact on children's oral health (Polk *et al*. 2010; Castilho *et al*. 2013). Considering that dental caries continues to be the main oral health problem in most countries, affecting a high percentage of children and practically all adults, the present study aimed to assess socioeconomic, family environment, access and use of dental services subjective aspects, and their relationship with dental caries in 12-year-old school children.

MATERIAL AND METHODS

This cross-sectional and quantitative study was carried out in a medium-sized municipality in the state of Santa Catarina, Brazil, with an estimated population of 156,727 inhabitants and a Human Development Index (HDI) of 0.770(IBGE, 2010). The urbanization rate is 98.2%, the infant mortality rate is 17.41% and the basic sanitation coverage is 96.2%(Semasa, 2017). Participants in the study were 12-year-old children and their respective mothers or guardians who agreed to participate with the signing of the Informed Consent Form (ICF), allowing the accomplishment of two steps: clinical examination of the child and questionnaire. Children should be regularly enrolled in the municipal public school system and attend school in the urban area of the municipality. For the calculation of the sample, information from the database of the Municipal Education Department was used, according to which 706 children aged 12 years were enrolled in 2016. This age is considered to be the one of global caries monitoring by means of the DMFT Index for international comparisons (OMS, 1999).

For the calculation of the sample, 95% confidence level and estimated accuracy of 50 ± 5% were used as parameters, resulting in a sample of 249 participants. From the agreement of the schools, the relation of the classes with students in the age group of 12 years old was made available. With the relation of the groups, a meeting was arranged with the children during class hours, in the corresponding classrooms. At this meeting, after the explanation of the study, researchers were able to collect verbal assent from children who were interested in participating. Based on this assent, the families and the Health Unit in which they lived were identified. They received the ICF in two copies, with the necessary information about the study for completion and signature of the mothers or women in charge. To obtain a standardization of dental caries diagnosis criteria, the examiners and annotators participated in a calibration that followed the same orientations of the process carried out in the SBrasil 2010 Project(Brasil, 2011). To evaluate the inter- and intra-examiner agreement, the Kappa test was performed and indexes of 0.92 and 0.94, respectively, were obtained. The research had the collaboration of professional dental surgeons of Primary Care (PC), with 11 examiners and 11 annotators, along with community health agents (CHA) in the area of coverage to assist in accessing the residences. Thus, the study was organized into two steps: the first one being the clinical examination of the children to determine the DMFT; and the second one being the questionnaire applied to the mothers or women in charge for assessing the socioeconomic and family environment aspects, the perception of them on the oral health of the child and the access and use of the dental services.

For the diagnosis of caries, the DMFT Index - Decayed, Missing and Filled Teeth Index recommended by the WHO was used(OMS, 1999). Clinical examinations were conducted using flat mouth mirrors, wooden spatula and sterile gauze. They were held at the school itself, in the classroom, where the children sat on chairs facing the natural light source of the room, with their head against the wall. Children who needed treatment received referral to dental care in their area of coverage. A questionnaire composed of 17 questions was then applied to the mothers or the women in charge to analyze the socioeconomic, family environment, access and use of dental services aspects, and the mothers' or women's perception regarding the oral health of their children. To analyze the factors associated with the presence of caries, the binary logistic regression analysis was used. The dependent variable of the study was the presence or absence of caries (DMFT = 0 or DMFT> 0). The independent variables were grouped in socioeconomic, family environment aspects, mothers' perception regarding the oral health conditions of the children, access and use of the dental services. Initially, a descriptive analysis of the variables was performed. Then, in order to estimate the associations between the dependent variable and each independent variable, the chi-square test with a significance level of 5% was used. The multiple analyseswas performed through the Binary Logistic Regression, following the theoretical model of determination, hierarchically divided into four blocks of variables. The first block was formed by the socioeconomic variables that hypothetically condition the variables of block 2 - factors related to the family environment aspect which, in turn, influence the clinical variables of blocks 3 and 4 (factors related to access and use of dental services and the mothers' perception regarding the oral health conditions of the children, respectively), and finally, the outcome of the study. The variables with $p < 0.20$ in the bivariate analysis were selected for the multiple analysis. An analysis of the association between independent variables to assess multicollinearity was also performed. Model adjustment was assessed by -2 Reg Likelihood and p-value (≤ 0.05). The statistical software program SPSS version 22.0 was used. The present study was approved by Ethics Committee according to consolidated opinion No. 1.643.673 of July 21, 2016.

RESULTS

The sample consisted of 253 children, being 130 (51.4%) boys and 123 (48.6%) girls. In the characterization of families, the predominant income was higher than a minimum wage (74.3%); the level of schooling of the majority of mothers or women in charge was elementary school; and the number of goods was less than or equal to nine (53.1%). Still, 66.7% of the mothers were married or living in a stable union, 80.6%, had up to 3 children, 55.6% of the families were composed of up to 4 people, and the distribution per room was higher than one person (Table 1). The analysis of the perception of the mother or women in charge revealed that 72.6% of them consider the oral health of their children excellent, very good or good. However, 75.7% reported that their children needed dental treatment. The number of children who experienced pain in the last six months was 22% (Table 2). The presence of dental caries was observed in 104 (41.1%) children, and 149 (58.9%) were free of this oral affection. Of the total teeth examined, 5,805 were healthy, 281 decayed, 52 restored, 10 lost and 1,693 teeth encoded as dental trauma and fluorosis. These data resulted in a DMFT index of 0.96 (± 1.59), with a minimum DMFT of 1 and maximum of 11. The polarization of the disease was identified in 11 (4.34%) children. Next, Table 3 presents the bivariate analysis of the four blocks. In the demographic and socioeconomic aspects, the gender variable was not associated with a worse caries experience ($p = 0.374$); only the amount of goods showed an association with caries experience. Children with more goods at home had a 2.5 times higher risk of having caries experience than other children ($p = 0.001$). In the family environment, the number of people living in the same household was associated with caries experience ($p = 0.039$). Children belonging to families with more members had a higher occurrence of caries.

Table 1. Descriptive analysis of the demographic, socioeconomic and family environment aspects

	Variables	n	%
Demographic and socioeconomic aspects	Gender of the child (253)		
	Male	130	51.4
	Female	123	48.6
	Grade of the child (253)		
	5th grade	29	11.5
	6th grade	132	52.0
	7th grade	92	36.5
	Race / Mother's skin color (253)		
	White	152	60.1
	Medium brown	83	32.8
	Black	13	5.1
	Yellow	5	2.0
	Mother's age (253)		
	≤ 30 years old	22	8.7
	31 to 40 years old	132	52.2
	41 to 50 years old	71	28.1
	51 to 60 years old	22	8.7
	Over 60 years old	6	2.3
	Family Income		
	≤1 minimum wage	65	25.7
	> 1 minimum wage	188	74.3
	Schooling of the mother / women in charge (236)		
	Up to 8 years of study	125	53
	More than 8 years of study	111	47
	Amount of family goods		
	≤ 9 goods	127	53.1
Family environment aspects	Civil Status of the Mother (249)		
	Married/Stable Union	166	66.7
	Single / divorced / separated / widow	83	33.3
	No. of mother's biological children (253)		
	Up to 3 children	204	80.6
	>3 children	49	19.4
	No. of people in the residence (252)		
	> 4 people	112	44.4
	≤ 4 people	140	55.6
	Nº of people by room (248)		
	1 person per room	29	11.7
	More than one person per room	219	88.3

Table 2. Perception of the mothers in relation to the oral health of their children

Variables	n	%
How they consider their children's oral health (252)		
Excellent / very good / good	183	72.6
Regular / Bad	69	27.4
Does your child need dental treatment?		
Yes	190	75.4
No	62	24.6
The child had pain in the last 6 months		
Yes	53	22.1
No	187	77.9

Regarding access and use of dental services, it was observed that children with caries use the public service more (p = 0.041). Most of the children have already consulted with the dental surgeon, and more than 50% of the children have had this consultation for more than a year, with no difference between children free of caries and with caries. It was observed an association between the reason for the consultation and the experience of caries. Regarding the subjective aspects answered by the mothers, statistical significance was identified for the mothers' perception of the oral health of their children, and mothers of children in the DMFT> 0 Group tended to negatively evaluate their oral health (p = 0.03). Still, according to the mothers' perception, this group sought the dental service for curative procedures (p = 0.002) and, in some situations, because of pain (p = 0.044).

The results of the logistic regression analysis are shown in Table 4.

In the most distal block (demographic and socioeconomic aspects), there were factors associated with dental caries: income (p = 0.009) and quantity of goods (p = 0.001). Income can be considered a protective factor, because the higher the income, the lower the risk of caries. In contrast, the higher the number of goods, the greater the risk of dental caries. In the intermediate blocks (aspects of the family environment and access and use of dental services), the number of people in the residence and the use of public services were not confirmed as predictors of dental caries. The last block, proximal, confirmed that children with dental caries experience seek more the service for treatment (p = 0.025). The Hosmer-Lemeshow test showed that the final model adjustment was adequate (p = 0.095).

Table 3. Bivariate analysis of the association between socioeconomic, family environment and caries disease aspects, considering caries-free children (DMFT = 0) and with caries (DMFT> 0) in SC, Brazil 2016

		DMFT=0 (n=149)	DMFT >0 (n=104)	Bivariate Analysis		
	Variables	n (%)	n (%)	OR	IC 95%	p-value
	Gender of the child					
	Male	73 (49)	57 (54.8)	0.792	0.479 -1.309	0.374
	Female	76 (51)	47 (45.2)			
Demographic and socioeconomic aspects	Income					
	<=1 minimum wage	33 (22.1)	32 (30.8)	0.640	0.363 - 1.130	0.144
	> 1 minimum wage	116 (77.9)	72 (69.2)			
	Mother's education					
	Up to 8 years of study	79 (56)	46 (51.6)	1.357	0.805 - 2.288	0.288
	More than 8 years of study	62 (44)	49 (48.4)			
	Amount of goods					
	≤ 9 goods	88 (62.4)	39 (39.8)	2.512	1.480 - 4.263	0.001
	> 9 goods	53 (37.6)	59 (60.2)			
Family Environment Aspects	Mother's Marital Status					
	Married/Stable Union	103 (69.6)	63 (62.4)	1.381	0.810 - 2.354	0.274
	Single / divorced / separated / widow	45 (30.4)	38 (37.6)			
	Number of biological children					
	Up to 3 children	121 (81.2)	83 (79.8)	1.093	0.582 - 2.055	0.872
	>3 children	28 (18.8)	21 (20.2)			
	No. of people in the residence					
	> 4 people	58 (38.9)	54 (52.4)	0.578	0.348 - 0.961	0.039
	≤ 4 people	91 (61.1)	49 (47.6)			
	N. people per room					
	1 person per room	16 (11)	13 (12.7)	0.843	0.386 - 1838	0.692
	More than one person per room	130 (89)	89 (87.3)			
	Dental Coverage					
	Yes	131 (87.9)	88 (84.6)	1.039	0.939 -1.150	
Aspects related to access and use of dental services	No	18 (12.1)	16 (15.4)			0.282
	Has the child ever consulted with a C.D.?					
	Yes	134 (92.4)	94 (91.3)			
	No	14 (7.6)	9 (8.7)	1.166	0.465 - 2.925	0.459
	When was the last appointment?					
	up to 1 year					
	More than a year					
	Place of carePublic	91 (67.4)	74 (78.7)	0.559	0.303 -1.030	0.041
	Private / dental insurance	44 (32.6)	20 (21.3)			
Subjective Aspects	Perception of the mother on the child's health					
	Excellent / very good / good	114 (77)	68 (65.4)	1.7775	1.017 - 3.097	0.03
	Regular / Bad	34 (23)	36 (34.6)			
	Reason for the child's last visit					
	Prevention	59 (43.1)	22 (23.9)	0.415	0.231 -747	0.002
	Treatment	78 (56.9)	70 (76.1)			
	Does your child need dentaltreatment?					
	Yes					
	No	38 (26)	21 (20.4)	0.728	0.397 -1.333	0.190
	Has your child consulted for pain in the last six months?	108 (74)	82 (79.6)			
	Yes	25 (17.9)	28 (28)	1.789	0.968 – 3.307	0.044
	No	115 (82.1)	72 (72)			

DMFT: Decayed, missing and filled teeth in permanent dentition; OR: Odds Ratio; IC: Confidence Interval

Table 4. Hierarchical binary logistic regression analysis for presence of dental caries in 12-year- old schoolchildren, SC, Brazil 2016

	Variables	B (EP)*	OR (IC95%)**	p-value
Block 1: Demographic and socioeconomic aspects	Income	- 1.142 (0.437)	0.319 (0.136-0.752)	0.009
	<=1 minimum wage			
	> 1 minimum wage			
	Amount of goods	1.144 (0.338)	3.3139 (1.618 - 6.092)	0.001
	≤ 9 goods			
	> 9 goods			
Block 2: Family Environment Aspects	No. of people in the residence	-0.250 (0.552)	0.779 (0.264 - 2.299)	0.651
	> 4 people			
	≤ 4 people			
Block 3: Aspects related to access and use of dental services	Place of care	- 0.527 (0.369)	0.590 (0.286 - 1217)	0.153
	Public			
	Private / dental insurance			
Block 4: Subjective Aspects	Perception of the mother on the child's health	0.378 (0.396)	1.460 (0.672 -3.171)	0.339
	Excellent / very good / good			
	Regular / Bad			
	Reason for the child's last visit	0.758 (0.338)	2.133 (1.100 - 4.137)	0.025
	Prevention			
	Treatment			
	Does your child need dentaltreatment?	0.005 (0.396)	1.005 (0.462 - 2.184)	0.990
	Yes			
	No			
	Has your child consulted for pain in the last six months?	0.244 (0.401)	1.276 (0.582 - 2.801)	0.543
	Yes			
	No			

B (EP): estimated coefficient (standard error); **OR: Odds Ratio; IC: Confidence Interval

DISCUSSION

The evaluation results of factors related to the determinants of caries are important information for managers in the planning of actions in oral health[1]. Dental caries continues to be a public health problem and has been the object of study of national and international surveys (Paula *et al*. 2015; Brasil, 2011; Gokhale and Nuvvula, 2016). In Brazil, a polarization of the disease has been observed particularly in some groups that live in worse socioeconomic conditions (Pereira *et al*. 2007). The children participating in the study presented a DMFT index (0.96) lower than the index obtained in the last national survey conducted in 2010(Brasil, 2011). Another relevant finding is that most of the children were caries-free, with about 5,000 healthy teeth. Even so, the polarization of the disease was identified in a small group of children. Among the factors that may have contributed to this low DMFT, the following stand out: the fluoride heterocontrol in the municipality; access and use of dental services with a dental coverage of 77.1% of the population; the preventive actions developed by the oral health teams in Primary Care; and the distribution of dental creams, toothbrushes and dental floss for free by the municipality. Despite the significant number of studies evaluating children's oral health conditions, few investigate the relationship between oral problems and the family environment, including at the international level (Kumar *et al*. 2016).

Some socioeconomic characteristics of the parents have been related to caries(Hooley *et al*. 2012) and the children's quality of life in relation to oral health(Kumar *et al*. 2016). These socioeconomic factors interfere approximately 50% in the prevalence of caries in 12-year-old children (Hobdell *et al*. 2003). That is, children from families with lower socioeconomic conditions have more caries(Kumar *et al*. 2016). Those who have parents with higher levels of education, income and professional status have a lower risk of developing the disease (Hooley *et al*. 2012). This statement may be represented by financial and social reasons that lead to difficulties in obtaining care and practices related to oral health, difficulties in accessing health services and healthy environments. The risk behavior of families is linked to poor housing and income. Individuals exposed to these conditions are more susceptible to the disease process. However, the results of the variables related to the family environment and oral hygiene habits of the parents are conflicting among the studies, which makes it difficult to make inferences about this relationship with dental caries. Knowing the socioeconomic factors that affect health is indisputable, with the objective of establishing public policies to balance these social inequalities (Boing *et al*. 2013) since they are important predictors for the use of dental services(Machry *et al*. 2013). The hierarchical analysis model used (demographic, socioeconomic, family environment, access and use of dental services and subjective variables) is characterized by an important methodological model of analysis, confirming that the distal and proximal variables are

important indicators in the analysis of dental caries in schoolchildren(Fisher-Owens *et al*. 2007; Paula *et al*. 2015). At the macro level dental caries, as well as other oral problems, is influenced by political, economic and social factors (Hooley *et al*. 2012). At the individual level, these conditions relate to psychosocial behaviors and aspects (Watt and Sheiham, 2012). The results of the multivariate analysis revealed in the distal block that income and quantity of goods are factors associated with caries. Income can be considered a protective factor, because the higher the income, the lower the risk of caries, corroborating with other studies (Da Costa *et al*. 2016; Kumar *et al*. 2016). However, children with more goods at home presented three times greater risk of having caries experience than the other children, disagreeing with other studies in which more goods are related to a lower risk of developing the disease (Da Costa *et al*. 2016; Kumar *et al*. 2016). In this sense, perhaps for national studies, one should reconsider the use of "number of goods" as a variable to identify economic conditions since, in recent years, in Brazil, government policy has encouraged and facilitated the acquisition of goods for the less favored economic classes. This may be a hypothesis that justifies the contradictory result found in the study, that a greater number of goods is a risk factor for dental caries.

In this line of discussion, Baker *et al*. (2018) investigated in 11 countries the relationship between the DMFT index and the self-perception of health with four key structural determinants according to the World Health Organization: governance, macroeconomic policy, public and social policies. The results indicated that the type of political regime, amount of governance, gross domestic product, employment index, income inequality, human development index, government and private health expenditures, among other factors, were associated with the oral health condition of children (WHO, 2010). The authors reinforce the need to invest in studies regarding this little studied area, contributing to the reduction of inequalities in oral health. In the gross analysis, although the variables "number of people at home and place of service" were significant, the adjusted analyzes of these variables of intermediate levels did not identify them as predictors of dental caries. However, positive correlations were found in the caries experience and the number of people living in the home, concluding that environments with more individuals increase the risk for the disease (Cypriano *et al*. 2011; De Sousa Eskenazi *et al*. 2015). Being a woman was identified as a protective factor for dental caries(Melo *et al*. 2011). Studies have positively related the perception of the mother about the oral health conditions of the children (De Sousa Eskenazi *et al*. 2015; Pinto *et al*. 2016). In this study, the majority of the mothers presented these characteristics: white color, living with the companion and the children in a number of up to four people, having three or more rooms in the house, which characterizes a structured family. Approximately half of the mothers completed primary school in both groups. The literature indicates the relationship between schooling and oral disorders, stating that the educational level of those responsible for the children can enable access to health information, stimulate healthy habits and consequently children present a lower risk of caries (Cypriano *et al*. 2011; Da Costa *et al*. 2016; De Sousa Eskenazi *et al*. 2015). More educated mothers have more access to the oral health service, linked to prevention, which is related to the low caries index. On the other hand, precarious health education can diminish the parents' discernment on their children's oral health status and the ability to take care measures (Da Costa *et al*. 2016). Regarding the subjective variables, the majority of the mothers or women in charge of both groups consider the oral health of the child to be good, very good or excellent. In the gross analysis, it was observed that the mothers of the group with caries experience evaluated the oral health of the children in a more negative way, and sought the dental service mainly for curative treatment, in addition to the children presenting more experience of dental pain. However, in the composition of the proximal block of the multivariate analysis, only the reason for the consultation presented significance, demonstrating that children with caries experience seek 2.1 times more the dental service for treatment. This result differs from that found in a study which demonstrated that the variable 'reason for routine consultation' was negatively associated with the caries experience and the high dental caries experience group (Da Costa *et al*. 2016). Although the DMFT index of the children evaluated was low, one cannot generalize this reality to the whole municipality. This is because dental caries is an important health problem and actions aimed at social, economic and environmental aspects, at all levels of health, are essential(Watt and Sheiham, 2012). In this sense, we corroborate with the understanding that health promotion policies should include policies that seek to eradicate poverty, prioritize oral health within primary health care, that oral health product taxes be abolished and that there be sufficient infrastructure to serve poor and vulnerable populations (Watt and Sheiham, 2012). Such actions could establish an approach to risk factors through health education. Thus, in order for professionals and services to have an effective role in the prevention of dental caries, it is necessary to understand the complexity involved in the development of this condition, which permeates the context of the environment where people are inserted and it means the conditions and styles of life, cultural and behavioral issues. And, in this bias, health training processes need to be improved in multilevel and encompass interprofessional teams. However, the insertion of integrality, interdisciplinarity and interprofessionality in the oral health training processes are incipient in Brazil.

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