DOI: 10.1590/1413-812320202510.24732018

Dental caries and associated factors at age 12 in the Brazilian Midwest region in 2010: a cross-sectional study

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Abstract *This study aims to analyze the index of decayed, missing and filled teeth (DMFT) at age 12 in the Midwest Region and to identify associated factors, according to the National Oral Health Survey "SB Brasil 2010". This is a cross-sectional population-based study from the SB Brasil 2010 database, conducted in the capitals of Mato Grosso, Mato Grosso do Sul, Goiás, Federal District and a sample of municipalities in the region. Data were analyzed by the chi-square test and prevalence ratios with their respective confidence intervals, at a significance level of 5%. The Poisson regression was used in the multiple analysis to study the association between the outcome variable and the explanatory variables. The independent variables that were associated with the DMFT were: the state of residence in Mato Grosso, Goiás and Mato Grosso do Sul; the per capita income ≤ R$500.00; difficulties eating and sleeping, and reason for the visit was Pain/Extraction/Treatment/Other. Mean DMFT was 2.14 and the prevalence of dental caries affected 41% of adolescents.*

Key words *Oral health, Dental caries, DMFT, Adolescent*

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Introduction

Oral health is an integral and inseparable part of general health and is related to the biological, psychic and social aspects of individuals and can, therefore, have a significant impact on their quality of life[1,2].

Dental caries and periodontal disease are still a major global concern regarding oral health, especially in industrialized countries[1,3]. Caries disease has a higher prevalence in Asian and Latin American countries, and is less frequent and severe in African countries, probably due to the lower consumption of sugar in this region[4].

The low prevalence of dental caries can be considered an indicator of a better quality of life[1]. The DMFT index is the most widely used indicator of dental caries in oral health epidemiological surveys and expresses the mean number of decayed, missing and filled teeth in a group of individuals at a given age. The age of 12 is one of the index ages for the oral health epidemiological survey, and is appropriate for the global monitoring of dental caries in permanent dentition, allowing international comparisons of this disease[4].

Oral health epidemiological surveys provide a solid basis for assessing the current state of oral health of a population, allowing the investigation of their determinants and the implementation of actions aimed at their control[5,6]. In Brazil, oral health epidemiological surveys were recorded in 1986, 1996, 2003, and the last one in 2010[6,7].

Although dental caries fell in the Brazilian population, the decline of their prevalence occurs unevenly. This was evidenced in the Midwest region of the country, where the average DMFT index at age 12, obtained in the SB Brasil 2003 survey, was higher than in the South and Southeast regions. This may be a result of the care model of each region, as well as socioeconomic factors, collective measures used to combat dental caries, such as water fluoridation and access to dental services, among other factors[6].

Thus, this study aimed to analyze the DMFT index of 12-year-olds from the Brazilian Midwest and to identify associated factors, according to data from the National Oral Health Survey, namely, SB Brasil 2010.

Methods

This study analyzed data from the National Oral Health Survey - SB Brasil 2010 for the state capitals of Mato Grosso, Mato Grosso do Sul, Goiás and the Federal District, as well as a sample of 30 municipalities in inland Brazilian Midwest Region. The participants of this study were 12-year -olds of both genders, interviewed and examined in their homes to investigate the DMFT index, as well as demographic, socioeconomic characteristics, use of dental services and self-perception of oral health and oral health impact.

The SB Brasil 2010 carried out a probabilistic sampling considering stratified and cluster sampling methods. The primary source of reference for these procedures was SB Brasil 2003. Thus, the sample size was calculated for the index ages and age groups, with caries as a standard problem, totaling 1,250 adolescents aged 12 years in the region considered. However, 1,192 adolescents participated in the study. The Informed Consent Form was signed by the person in charge. The SB Brasil 2010 project was approved by the Research Ethics Committee of the Ministry of Health and was registered at the National Research Ethics Commission (CONEP), CNS. This study was approved by the Human Research Ethics Committee of the Júlio Müller University Hospital, to ensure compliance with all the terms of Resolution CNS 466/12.

Institutionalized adolescents (hospitals, etc.) and those with physical and mental limitations that prevented the clinical examination and the application of the questionnaire were not included in the study.

The questionnaire used to evaluate socioeconomic conditions, dental services and health self-perception was shown in three parts: (a) demographic and socioeconomic characterization; (b) use of dental services and reported oral morbidity; and (c) self-perception of oral health and OIDP (Oral Impacts on Daily Performance), which measures the impact of oral health on daily activities. The first block (questions 1-4) was answered by the head of the household, and the second and third blocks were directed to the individuals who participated in the study[8].

Clinical examinations were performed using the flat mouth mirror and the clinical probe for oral epidemiological examination under natural light, with both the examiner and the person examined sitting[8]. The codes and criteria used to perform the clinical examination were those recommended by the World Health Organization[4]. The index used in the research was DMFT (permanent dentition), which is recommended by the WHO and expresses the sum of decayed, missing and filled teeth[4]. The mean DMFT in-

dex was calculated by the sum (total) of decayed, missing and filled teeth, divided by the number of individuals examined[4].

In this study, the dependent variable was the caries index, namely, DMFT, which was categorized as follows: DMFT = 0 (absence of decayed, missing and filled teeth) and DMFT ≥ 1 (presence of one or more decayed, missing and filled teeth)[6].

The independent variables of the study were gender (female or male), ethnicity/skin color (white, black, yellow, brown, indigenous), number of people in the household, household income (per capita), years of study (≤ median (6) and > median (6)), state, the use of dental service (visit to the dentist, frequency of visits, place of visit, reason for the visit, evaluation of the visit), self -perception of oral health concerning teeth (very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied and very dissatisfied), and the OIDP index (presence and absence of impact).

The data of the present study were analyzed using statistical packages SPSS version 17 and Stata Version 13. Initially, a descriptive analysis of the data was performed through proportions, means, median and measures of variation. The quantitative variables, number of people and years of study were categorized using the median as a cutoff point since they did not show symmetrical distribution. In the inferential analysis, the associations were analyzed using the chi-square test and prevalence ratios with their respective confidence intervals, considering a significance level of 5%. The Poisson regression model was employed to perform multiple analysis. In this model, we considered the independent variables with a p-value < 0.20 in the bivariate analysis. Variables with p-values < 0.05 remained in the final model[9].

Results

SB Brazil 2010 analyzed 1,192 12-year-olds from the Midwest region, of whom 51.01% were female. Regarding skin color, white and brown totaled 39.68% and 47.40%, respectively.

Most of the families of adolescents reported a per capita income from R$ 501.00 and R$ 1,500.00 reais (58.82%), that is, up to three minimum wages for the year 2010. Income greater than R$ 2,501.00, was found in 8.87% of households, and income less than R$ 500.00 was found in 15.93% of the respondents.

The mean DMFT index rates of the states of the Midwest region were as follows: Mato Grosso (2.41), Goiás (1.75), Mato Grosso do Sul (1.58), Federal District (1.06). When comparing every two of these means by the Tukey test considering a level of significance of 5%, we observed that Mato Grosso state mean was statistically different from the other states, and Goiás also showed a difference compared to the Federal District.

In the bivariate analysis (Table 1), the DMFT index showed significant results (p-value < 0.05) with the following demographic and socioeconomic variables: state of the federation (Mato Grosso, Goiás, Mato Grosso do Sul), race (brown skin color), per capita income (≤ 500 and that of 501 to 1,500).

The DMFT index showed a significant association with all OIDP variables, except for the variable difficulty speaking (Table 2). Regarding the self-perceived oral health variable, there was a significant difference between the categories "Very dissatisfied/ dissatisfied" and "Neither satisfied nor dissatisfied" compared to the reference category (Satisfied/very satisfied) (Table 2).

In the analysis between the DMFT index and the dental service use variables, the variables that showed a significant association were visit to the dentist, place of visit and reason for the visit (Table 3).

Table 4 shows the results adjusted by the robust Poisson multiple regression model, where all the variables with p < 0.20 values were considered in the bivariate analysis. The variables that remained associated to DMFT after adjustments were state (Mato Grosso, Goiás, Mato Grosso Sul), ethnicity/skin color (yellow), household income (≤ 500), difficulty eating (yes), difficulty sleeping (yes) and reason for visit (Pain/Extraction/Treatment/Others).

Discussion

This study showed that the Brazilian Midwest region has been following the worldwide trend of a decreased prevalence of dental caries[1,6,10]. The DMFT index for age 12 in this region in 2003 (SB Brasil, 2003) was the highest in the country (DMFT=3.16), and for 2010 (SB Brasil, 2010), the DMFT index was 2.14[6]. According to the World Health Organization, the rate of 2.14 is a low level of dental caries[1].

The establishment of the National Oral Health Policy, the *Brasil Sorridente* (Smiling Brazil), was responsible for the improved DMFT index of adolescents in the Midwest, resulting from higher investment in oral health-promoting

Table 1. Absolute observed frequency (n), crude prevalence ratio (PR) and 95% confidence interval and p-values of the DMFT index associated with socioeconomic demographic variables in 12-year-old schoolchildren in the Brazilian Midwest region, 2010.

Variable	Categories	DMFT≥1	DMFT=0	n	PR	CI (95%)	P
States	MT	164	77	241	1.64	1.36-1.98	<0.001*
	GO	286	187	473	1.46	1.21-1.75	<0.001*
	MS	160	110	270	1.43	1.18-1.73	<0.001*
	DF	81	114	195	1.00	-	-
Gender	Female	364	236	600	1.07	0.98-1.18	0.144
	Male	327	252	579	1.00	-	-
Ethnicity	Yellow	26	13	39	1.25	0.99-1.59	0.105
	Indigenous	7	4	11	1.20	0.76-1.89	0.492
	Brown	345	212	557	1.16	1.05-1.30	0.005*
	Black	63	39	102	1.16	0.98-1.38	0.115
	White	250	220	470	1.00	-	-
Number of people in the residence	> Median (4)	333	222	555	1.05	0.95-1.15	0.360
	≤ Median (4)	358	266	624	1.00	-	-
Household Income[a]	≤ 500	120	55	175	1.46	1.16-1.85	<0.001*
	501-1500	397	247	644	1.32	1.05-1.64	0.006*
	1501-2500	87	90	177	1.05	0.81-1.36	0.719
	> 2500	45	51	96	1.00	-	-
Years of study	≤ Median (6)	430	301	731	1.01	0.91-1.12	0.848
	> Median (6)	261	187	448	1.00	-	-

PR: crude prevalence ratio; n: number of individuals by category; CI: confidence interval; p: p-value associated with Pearson's Chi-square test (χ^2); *Significant at 5%. MS: Mato Grosso do Sul. MT: Mato Grosso. GO: Goiás. DF: Federal District. [a]: values in Brazilian Reals (R$).

Table 2. Absolute frequency observed (n), crude prevalence ratio (PR), 95% confidence interval and p-values of DMFT index associated with OIDP variables in 12-year-old schoolchildren in the Brazilian Midwest Region, 2010.

Variable	Categories	DMFT≥1	DMFT=0	n	PR	CI (95%)	P
Difficulty eating	Yes	149	57	206	1.30	1.18-1.44	<0.001*
	No	536	431	967	1.00	-	-
Discomfort when brushing	Yes	98	39	137	1.26	1.12-1.42	<0.001*
	No	590	449	1039	1.00	-	-
Nervousness or irritation	Yes	103	45	148	1.22	1.09-1.38	0.003*
	No	584	443	1027	1.00	-	-
Influence on leisure	Yes	70	23	93	1.32	1.16-1.50	<0.001*
	No	619	465	1084	1.00	-	-
Influence on sports	Yes	52	13	65	1.40	1.22-1.59	<0.001*
	No	638	475	1113	1.00	-	-
Difficulty speaking	Yes	37	23	60	1.06	0.86-1.30	0.623
	No	653	464	1117	1.00	-	-
Shame while smiling	Yes	133	72	205	1.13	1.01-1.27	0.046*
	No	556	414	970	1.00	-	-
Hampers study/work	Yes	44	14	58	1.31	1.13-1.53	0.006*
	No	646	474	1120	1.00	-	-
Difficulty sleeping	Yes	92	15	107	1.54	1.40-1.69	<0.001*
	No	597	473	1070	1.00	-	-
Self-perceived oral health	Very dissatisfied/Dissatisfied	186	101	287	1.20	1.08-1.34	0.002*
	Neither satisfied nor dissatisfied	144	85	229	1.17	1.03-1.32	0.019*
	Very satisfied/Satisfied	348	297	645	1.00	-	-

PR: crude prevalence ratio; n: number of individuals by category; CI: confidence interval; p: p-value associated with Pearson's Chi-square test (χ^2); *Significant at 5%.

Table 3. Absolute frequency (n) observed, crude prevalence ratio (PR), 95% confidence interval and p-values of the DMFT index associated with variables of dental service use in 12-year-old schoolchildren in the Brazilian Midwest region, 2010.

Variable	Categories	DMFT≥1	DMFT=0	n	PR	CI (95%)	P
Visit to the dentist	No	102	95	197	0.86	0.75-0.99	0.033*
	Yes	589	393	982	1.00	-	-
Visit frequency	≥ 1 year	227	139	366	1.05	0.95-1.17	0.347
	< 1 year	355	247	602	1.00	-	-
Place of visit	Public service	332	185	517	1.16	1.05-1.29	0.004*
	Private/Health Plan/Covenant / other	254	206	460	1.00	-	-
Reason of visit	Pain/Extraction/Treatment/Other	435	205	640	1.53	1.34-1.74	<0.001*
	Revision/Prevention	149	186	335	1.00	-	-
Assessment of visit	Poor/Very poor	23	13	36	1.08	0.84-1.39	0.461
	Fair	44	20	64	1.17	0.98-1.39	0.126
	Very good/Good	513	356	869	1.00-	-	-

PR: crude prevalence ratio; n: number of individuals by category; CI: confidence interval; p: p-value associated with Pearson's Chi-square test (χ^2); *Significant at 5%.

Table 4. Adjusted prevalence ratio (PR) of the association between DMFT, with its respective 95% confidence intervals (CI) and p-values, Brazilian Midwest region, 2010.

Variable	Category	PR_a	CI 95%	P-value
State	MT	1.77	1.43-2.18	<0.001*
	GO	1.53	1.24-1.88	<0.001*
	MS	1.52	1.23-1.88	<0.001*
	DF	1.00	-	-
Ethnicity	Yellow	1.42	1.15-1.75	0.001*
	Brown	1.05	0.94-1.17	0.355
	Black	0.92	0.75-1.12	0.396
	Indigenous	0.82	0.54-1.23	0.333
	White	1.00	-	-
Household income[a]	≤ 500	1.33	1.04-1.69	0.023*
	501-1500	1.21	0.97-1.52	0.097
	1501-2500	0.92	0.71-1.20	0.546
	> 2500	1.00	-	-
Difficulty eating	Yes	1.19	1.05-1.33	0.005*
	No	1.00	-	-
Difficulty sleeping	Yes	1.24	1.11-1.40	<0.001*
	No	1.00	-	-
Reason of visit	Pain/Extraction/Treatment/Other	1.40	1.23-1.60	<0.001*
	Revision/Prevention	1.00	-	-

PR_a: prevalence ratio adjusted by the Robust Poisson regression model with backward selection of variables. CI: confidence interval. * Significant at 5%. MS: Mato Grosso do Sul. MT: Mato Grosso. GO: Goiás. DF: Federal District. [a] Values in Brazilian Reals (R$).

measures, such as implantation of oral health in primary care via the Family Health Team and in secondary care, through the creation of the Dental Specialties Centers (CEO)[6,11-13].

Despite the lower prevalence of dental caries in the Midwest region of the country, there was a significant association of risk of the DMFT index with the states of Mato Grosso, Mato Grosso do

Sul and Goiás when compared to the Federal District. This association could be explained by the Human Development Index (HDI) of the Federal District, which was the highest in the country[14] in 2010, and also by the dental service visited, which was public[15]. Also, the Federal District was the only one to reach a shallow level in the DMFT index, as recommended by the World Health Organization[1,10].

The DMFT index showed a significant association with low per capita income ≤ 500 and 501 to 1,500 reais and with brown skin color adolescents, suggesting that the socioeconomic disadvantages of a low-income household and brown skin color could be determining factors in the experience with the disease[3,16-20], and also influence in the difficulty of using the services, as well as the lack of knowledge about the importance of maintenance and oral health rights[21].

About the impact of oral health conditions on quality of life, evaluated by the OIDP index, 41.11% of 12-year-olds in the Midwest had at least one negative impact on the performance of their daily activities. In this study, all OIDP-related variables, except for the variable difficulty speaking, showed statistical significance in the analyses related to the CPO-D index. That is, adolescents had at least one impact on their quality of life, which may be related to social, psychological and functional factors[22,23].

For the variables of the dental service use, the condition of not visiting the dentist was a protective factor when associated with the DMFT, which could be explained by some studies due to the lack of knowledge of the individual regarding the need for control and maintenance of the oral health and also for seeking treatment only when the oral problem becomes severe or when they feel some discomfort or pain[21,24]. The public service had a significant association with the DMFT, probably caused by unequal care models, constraints in the distribution of resources in each region, or even lack of quality in services[13,15,21,25]. The reason for the visit for pain/ extraction/ treatment/other also showed a significant association with the DMFT index, this can be explained by the fact that the adolescents may have little knowledge about the need to control and maintain oral health and seek treatment only when the oral problem becomes severe and when they feel some discomfort or pain[21,26].

The multiple analysis of the DMFT index using the robust Poisson regression model (PRa) showed a significant association with the state variables (Mato Grosso, Goiás and Mato Grosso Sul), which probably require more substantial and better investments and resources for oral health, improved access to the service and expanded artificial fluoridation system of public water supply[15,27,28], but more studies are required in the region for better confirmation.

The yellow skin color variable had a significant association with dental caries after multiple analysis, which may be a result of socioeconomic disadvantages and lack of knowledge about oral hygiene practices[4,29]. Therefore, the Midwest region requires further studies concerning this association for a better understanding of this condition.

Twelve-year-olds from the Midwest who belonged to low-income households (≤ 500) had a significant association with the DMFT index in the multiple analysis. Economic disadvantages show difficulties accessing dental services, influence the lack of knowledge about their rights and the relevance of oral health on general health and quality of life, thus increasing the risk of dental caries disease[16,17,21,23].

The principal daily activities that showed a significant association with the DMFT index in the multiple analysis were the difficulty eating and sleeping, those related to problems of functional and biological aspects, which cause negative social impacts on the quality of life of adolescents, affecting themselves as well as the people around them[30].

Another significant association with the DMFT index, after multiple analysis, was the reason for the visit for Pain/Extraction/Treatment/ Other, probably caused by the lack of information by adolescents regarding the relevance of oral health prevention and maintenance[21,26].

One of the limitations of this study was the non-association of the DMFT index with the artificial fluoridation variable of public water supply since this variable was not considered in the questionnaire of the National Oral Health Survey – SB Brazil 2010. Thus, it was not possible to identify the states/cities of the Midwest region that have this service. Therefore, further studies are required to investigate this relationship, since the artificial fluoridation system of public water supply is one of the most efficient collective methods for the reduction of dental caries[15,27,28].

Conclusions

In this study, approximately 41% of the adolescents aged 12 in the Brazilian Midwest region were affected by dental caries, but a mean decline

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in the DMFT index (2.14) was observed in this population when compared to the previous epidemiological survey, namely, the SB Brasil 2003 (DMFT = 3.16). In the adjusted final model, a higher prevalence of caries disease was found in the state of Mato Grosso, followed by the states of Goiás and Mato Grosso do Sul. Dental caries was more prevalent in families with a household income ≤ R$ 500.00, who self-reported as being yellow and caused difficulties eating and sleeping. There was also an association between the DMFT index and the reason for visiting the dentist. Therefore, the information obtained in this study may help in the construction of future public policies aimed at planning strategies for care and oral health care, which may positively affect the quality of life of the population studied.

Collaborations

HCA Silva participated in the conception, planning, analysis, interpretation and writing of the work. MM Espinosa participated in the planning, statistical analysis and interpretation of the data, contributed to the writing and critical review of the manuscript. GP Moi participated in the planning, statistical analysis and interpretation of data, contributed to the writing and revision of the manuscript. MG Ferreira participated in the planning, discussion and interpretation of data, contributed to the writing and revision of the manuscript.

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Article submitted 15/08/2017
Approved 11/02/2019
Final version submitted 13/02/2019