



ISSN: 2230-9926

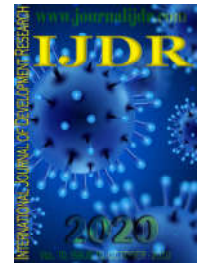
Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 10, Issue, 10, pp. 41565-41573, October, 2020

<https://doi.org/10.37118/ijdr.18762.10.2020>



RESEARCH ARTICLE

OPEN ACCESS

SEVERITY OF DENTAL CAVITY EXPERIENCE IN TEENAGERS: A POPULATION-BASED STUDY

*Liliane Cristina de Oliveira Santos Palma, Carla Silvana de Oliveira Silva, Luana Leal Roberto, Naiara Gonçalves Fonseca Maia and Desirée Sant'Ana Haikal

Universidade Estadual de Montes Claros (UNIMOMTES)

ARTICLE INFO

Article History:

Received 20th July, 2020
Received in revised form
19th August, 2020
Accepted 26th September, 2020
Published online 30th October, 2020

Key Words:

Adolescent, dental caries,
DMF index, Risk factors,
Oral health.

*Corresponding author: Vanessa Novaski,

ABSTRACT

Objective: To identify the factors associated with the severity of dental cavity experience among teenagers. **Methods:** This was a cross-sectional study conducted among 600 teenagers (10-16 years). The dependent variable – severity of the dental cavity - was classified in three categories: no dental cavity experience (DMFT = 0), low dental cavity experience (DMFT <4) and high dental cavity experience (DMFT = 4). The independent variables were grouped according to the theoretical model adapted from Andersen and Davidson (1997). The estimates were corrected by the effect of sample design and were conducted by Ordinary Logistic Regression. **Results:** It was observed that 48.7% had no dental cavity experience, 34.2% had low dental cavity experience and 17.9% had high dental cavity experience. In the final model, the chances of having higher dental cavity severity were higher among older teenagers (OR = 2.08), who self-perceived the need of dental treatment (OR = 1.60) and who reported toothache in the last six months (OR = 2.83). On the other hand, it was lower among teenagers who had altered levels of total cholesterol (OR = 0.67). **Conclusion:** The severity of dental cavity was associated with sociodemographic, subjective conditions of oral health and objective of general health.

Copyright © 2020, Liliane Cristina de Oliveira Santos Palma et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Liliane Cristina de Oliveira Santos Palma, Carla Silvana de Oliveira Silva, Luana Leal Roberto, Naiara Gonçalves Fonseca Maia and Desirée Sant'Ana Haikal, 2020. "Severity of dental cavity experience in teenagers: a population-based study", *International Journal of Development Research*, 10, (10), 41565-41573.

INTRODUCTION

The dental cavity is considered a public healthy issue Freire *et al* (2013). Although it has been presenting a decline in the last years Ely *et al* (2014), the dental cavity is pointed as the main cause of tooth loss Frazão (2012); Silveira *et al* (2015) and considered endemic worldwide, especially among children and teenagers Freire *et al* (2013). The last National Research of Oral Health carried out in Brazil in 2010 indicated that the country is in a condition of low prevalence of dental cavity. However, the CPOD index (number of decayed teeth, lost and obturated), which measures the dental cavity experience, examined in teenagers between 15 and 19 years old was on average 4,25 affected teeth, more than the double at 12 years old Ministério da Saúde (2012). This increase in the CPOD between childhood and teenage years is a common result in investigations in oral health carried out in Brazil and over the world Ministério da Saúde (2012), Ditmyer *et al* (2011), suggesting the existence of factors that may be responsible for the increase of dental cavity in this stage of life. It is known that the dental cavity is a disease of complex origin,

multifactorial, that comprehends biological and non-biological factors with particular reference to the family income, oral hygiene cares, fluorine input, diet, access to health services and others Frazão (2012). In addition, the dental cavity distribution has been more and more pointed as polarized, with disease in the lower classes Ely *et al* (2014). Though, the existence of many other possible etiological factors yet less explored, but that have been gathering attention in the current scientific literature have to be considered. Some researches have been investigating the relation of dental cavity with overweight/obesity, cholesterol, triglycerides, high blood glucose, and others Zardeto (2004), ACA (2008); Silva M.F.C.S (2013); Silva A.E.R. *et al* (2013). Identifying other predictors related to the experience of dental cavity; such as health conditions (vitamin D, total cholesterol, triglycerides, blood glucose, body mass index, waist circumference, quality of life, body miage, eating disorders), behaviors in health, use of dental services, and others; and its higher/lower severity will allow to propose prevention actions more and more specific, control and even eradication of the disease, providing useful data to plan, to the orientation and to the management of

the actions and suitable public health policies. Considering the uneven distribution of dental cavity in teenagers and shortages of studies held in this stage of life, the present study aimed to identify factors related to the severity of the experience of dental cavity in a population of teenagers.

METHODS

It is a transversal study, carried in teenagers participants of an epidemiologic survey, in the period between august and december of 2016, the total population was composed of 77.833 teenagers of both genders at ages between 10 and 16 years old, enrolled in 2016, distributed in 63 public elementary and high schools in Montes Claros – MG. Montes Claros is considered the main urban center of the north of the state Minas Gerais, presenting characteristics of regional capital, with influence radius going all the north of Minas Gerais and part of the South of Bahia. It has a population of 361.975 inhabitants, of these, 32.651 are males between 10 and 19 years old and 33.045 females between 10 and 19 years old. It presents human development Index of 0,77 and economy based on industry, services and agriculture.

Sample: The sample size was set considering infinite population, occurrence of the event studied in 50%, level of confidence of 95%, and sampling error of 5%, totalizing an n of 385 teenagers. It was added, for the correction of the effect of the draw, a-se deff (design effect) equal to 1,5, resulting in an n of 578. Besides that, it was established an increase of 10% to make up for the possible losses. The sample units were selected by probabilistic sampling per conglomerate in two stages. In the first stage, the population was selected by proportional probability to the size (PPT), in schools that represents the 4 regions of the city of Montes Claros: North, South, East, West. In the second stage the teenagers in each school were selected by systematic sampling throughout the search listing for enrollment number, considering the age range of interest of the research. When the participant refused to be involved, the person were replaced by the previous one on the list. Thus, the study provided the same chance of participation to the teenagers. To incorporate the structure of the complex sampling plan in the statistical analysis of the data, each student interviewed was related to a point (w) that corresponded to the inverse of its probability of inclusion in the sampling per region (f), taking into account the projection of the number of teenagers enrolled in schools located in the geographic strata. Teenagers who weren't present on the collection day, that refused to participate, that didn't have their parents consent, that reported pregnancy or use of controlled medication that affects the metabolic and hemodynamic profile, were excluded from the data collection.

Data collection procedure: The data collection was made in schools, in the period from august to december of 2016, previously scheduled, by a multi-professional staff composed of doctors, nurses, physical education teachers, physiotherapists, dentists and graduates in the health area, properly trained and calibrated previously to the data collection, hitting numbers of CCI and Kappa inter – examiner and intra-examiner ranging from 0,85 to 0,99 considered great (0,81 to 0,99) Silva AF *et al* (2016). The data collection considered 4 ratings: 1) structured interview, 2) physical condition, 3) dental condition and 4) laboratory tests. The structured interview included socio-demographic data, life quality, physical activity, eating habits, evaluation of the body

image, eating disorder, oral care, self-reported oral morbidity, use of the dentist services, self-perception of oral health and impact of oral health on daily activities. The physical condition evaluation included anthropometric data (weight, height, waist circumference). On this evaluation, the examiners were previously trained and calibrated, hitting inter/intra-examiner match satisfactory (Kappa or CCI $\geq 0,90$) Silva AF *et al* (2016).

On the dental condition evaluation, exams were conducted in natural light, with the use of flat mouth mirror and community periodontal probe (CPI probe), by WHO (CPI probe), previously sterilized, adopting codes/criteria of the 5^o edition of Oral Health Surveys: Basic Methods, by the World Health Organization (WHO). On the evaluation of the dental crown, a previously training and calibration was made with the examiners, hitting Kappa measured inter/intra-examiners match values considered great (between 0,81 and ,99) Silva AF *et al* (2016).

The laboratory exams were made by venous puncture, after 12 hours fasting and glucose, triglycerides, cholesterol (total, LDL and HDL) and D vitamin tests were held. It was used the automatic analyzer model *LabmaxPlennodaby Labtest*[®] to make the biochemical tests. The kit used to measure the levels of TC, HDL-c and TG was enzymatic – Trinder. The LDL-c was calculated with the use of the *Friedewal* equation: $LDL-c = Total\ Cholesterol - (HDL-c + triglyceride/5)$, and enzymatic colorimetric method. The fasting blood glucose was evaluated by the enzymatic method GOD-PAP using the equipment Roche analytical modular.

Conducted Analysis

The dependent variable – dental cavity – was made using the CPOD index, obtained by the evaluation of the condition of the dental crown during the intraoral exam. The index refers to the total of elements registered as dental cavities, lost teeth and/or restored. The teenagers without complete registration of the crown condition, in which it was unable to calculate the CPOD index, were excluded from the analysis in this study. According to the CPOD, the individuals were classified in three categories: with no dental cavity experience (CPOD=0), low dental cavity experience (CPOD<4) and high dental cavity experience (CPOD ≥ 4). This classification allowed to investigate the severity of the dental cavity experience, since the cutoff point for the CPOD adopted in this study was based in the literature Zardeto (2004), Pontigo-Loyola *et al* (2007), Mello *et al* (2008), Moura *et al* (2016).

The independent variables were grouped using the multidimensional theoretical model adapted from Anderson e Davidson (Figura 1). (Andersen e Davidson, 1997). According to this model, the independent variables are grouped in 3 groups: primary determinants of dental health (sociodemographic conditions, objective and subjective conditions of general health), oral health behaviors (individual actions, formal use of dental services) and oral health outcomes (subjective and objective conditions of oral health).

In the group of primary determinants of dental health, the following variables were included as sociodemographic conditions: age group (15 years old or more; 14 years old or less), self declared skin color (White; Indigenous/black/brown/yellow), gender (male; female), parents marital status (common law partners; non common law partes) and family income (<3 minimum wages; 3<minimum wages). The objective conditions of general health consider total cholesterol (normal <170 mg/dl; altered ≥ 170 mg/dl) Santos DR (2001), D vitamin (altered <30 ng/ml; normal ≥ 30 ng/ml) Silva BCC *et al* (2008), BMI (normal

≤percentile 85; overweight>percentile 85) Pereira *et al* (2009), waist circumference (normal > 130 mg/dl; altered ≤130 mg/dl) Santos DR (2001) and glucose (normal ≤100 mg/dl; altered >100 mg/dl) Buff CG *et al* (2007). It was considered the evaluation of the body image, the presence of eating disorder and quality of life when studying the subjective health conditions. The body image was evaluated using the Stunkard, Soresen, Schilsinger silhouette scale Stunkard AJ *et al* (1983) composed by a group of human figures, numbered from 1 to 9, representing a gradient from thinness (silhouette 1) to severe obesity (silhouette 9). Among the presented figures, the teenagers chose a silhouette that better represent their physical appearance (real silhouette) and other to represent the silhouette they would like to have (ideal silhouette). The evaluation of the body image was identified by the discrepancy between the real silhouette number and the indicated as ideal silhouette (real silhouette – ideal silhouette). That way, the teenagers who presented positive or negative numbers were classified as “dissatisfied” and that ones that presented number equal to zero were classified as “satisfied”. It was used a teenagers validated version of the Bulimic Investigatory Test of Edinburgh – BITE) to investigate the presence of eating disorder for the teenagers who scored more or equal to 20 it was considered the presence of eating disorder Ximenes RCC *et al* (2011).

It was used the instrument KIDSCREEN-27 to evaluate the life quality, this instrument has psychometric properties similar to the original version of KIDSCREEN-52 Ravens-Sieberer U *et al* (2007). The total score is the sum of all the answers of the items, and the highest scores indicate better life quality Ravens-Sieberer (2006), the teenagers who presented scores until percentile 25 were considered with compromised life quality. In relation to oral health behaviors, the individual actions contemplated information about the use of dental floss (never/rarely; Always/usually), sugar intake (positive adherence ≤ twice a week; negative adherence > twice a week) Vinholes DB *et al* (2009), alcoholic habit (consume or not) and physical activity, evaluated using the Brazilian teenagers validated version of the International Physical Activity Questionnaire – IPAQ) Ceschini Fl *et al* (2016), considered as sedentary (those who haven't made any physical activity for at least 10 continued minutes during the week) or irregularly active (those who have made physical activity but couldn't be classified as active because don't fit the recommendations on frequency or duration of 150 minutes a week considering walking, moderated activity or Strong activity) Ceschini Fl *et al* (2016). The formal use of dental services included time since the last consultation (more than a year; less than a year) and the type of the dental service used (public; private). The sugar intake was measured by the question “*Thing of the following foods: sweets of any kind, stuffed cake with icing, cookies, soda and industrialized juices. Do you usually eat any of these often?*”. This question is part of the Eating and Nutrition Evaluation of the Ministry of Health.

In the group of oral health, the subjective conditions of oral health were represented by the self perception of the oral health (dissatisfied/very satisfied; indiferente; satisfied/very satisfied), self perception of the need for a dental treatment (yes; no), pain of dental origin in the last six months (yes; no) and the impact of the oral health on daily activities. This variable was evaluated by the the instrument Oral Impacts on Daily Performances (OIDP) Adulyanon S *et al* (1996)

and dichotomized as with or without impact, characterizing the presence of impact by “yes” answer in at least one question Bulgareli JV *et al* (2018). The analysis were conducted using the statistical software Statistical Package for the Social Science (SPSS®), version 20.0 for Windows®. All variables were used categorically. A descriptive analysis was conducted, presenting the absolute frequencies (n) and estimated the relative frequencies correct by the sampling design, using the “Complex Sample” command in the SPSS. Furthermore, it was estimated the medium values and the standard deviation for the variable age. A bivariate analysis was conducted using the chi-squared test by Pearson or Fisher's exact test. The variables that presented descriptive levels lower or equal to 0,2 ($p \leq 0,20$) were selected to construct the multiple model. The absence of multicollinearity was tested by the correlation matrix ($r \leq 0,7$ among the independent variable). The multiple models were adjusted by the Ordinal Logistic Regression (proportional odds model) Abreu MNS *et al* (2009), adopting the stepwise backward procedure estimating the odds ratio (OR) and the confidence interval of 95% (CI95%). In the final model, only the variables that featured statistical significance lower or equal to 0,05 ($p \leq 0,05$) were kept. The quality of the adjustments of the final model was evaluated by the deviance test, and the assumption of proportional odds, by the testing for parallel lines. It was also estimated, the pseudo R square (R^2).

Ethical Issues: This study was conducted attending the ethical principles of the Resolution of the Conselho Nacional de Saúde (CNS) (n°466/2012). It was approved by the Comitê de Ética em Pesquisa da Universidade Estadual de Montes Claros (process n° 186375/2016). The teenage participants on the research and their guardians signed. Respectively, the Termo de Assentimento Livre e Esclarecido e o Termo de Consentimento Livre e Esclarecido.

RESULTS

Although 635 teenagers were evaluated, this study considered the data of 600 teenagers. 35 (5,5%) teenagers were excluded from the analysis because they haven't presented information that made the CPOD results possible. It was observed that 47,7% of the teenagers didn't present dental cavity experience, 34,2% presented low dental cavity experience and 17,9% presented high dental cavity. The médium CPOD was 1,61 (0,9 decayed tooth + 0,06 lost + 0,65 restored). In the descriptive analysis, it was observed that most part were females and had family income lower than three minimum wages. The average age of the teenagers was 13,8 ($\pm 1,8$) years old. There was a predominance of insatisfied with the body image (67%), with eating disorder (74%) and physically active/very active (66%). Most teenagers reported the need of a dental treatment and impact of oral health on the daily activities. (Chart 1). In the bivariate analysis, also seen in the Chart 1, the severity of the dental cavity ($p \leq 0,20$) was related to the age group, self declared skin color, parents marital status, total cholesterol, body image and eating disorder; among the primary determinants of oral health. Drinking habit and time since the last dentist consultation, among the oral health behaviors. In relation to the oral health outcomes, the variables self perception of the need of a dental treatment, toothache in the last six months and the impact of oral health on daily activities also presented relation to the outcome to 0,2 descriptive level. It wasn't verified the presence of multicollinearity between independent variables.

Tabela 1. Descriptive and bivariate analysis of the teenager population, according to the dependent variable and the primary determinant in oral health, behaviors and outcomes of oral health (n = 600). Montes Claros – MG, 2016/2017

Variáveis	No dental cavity experience		Low dental cavity experience		High dental cavity experience		P value		
	n	%†	n	%†	n	%†			
<i>Primary determinants of oral health</i>									
<i>Sociodemographic conditions</i>									
Age range (in years)									
15 years old or more	272	49,3	112	41,2	101	37,1	59	21,7	0,002
14 years old or less	328	50,7	180	54,9	104	31,7	44	13,4	
Self declared race#									
Indigenous/black/brown/yellow	501	83,6	238	47,5	170	33,9	93	18,6	0,139
White	97	16,4	52	53,6	35	36,1	10	10,3	
Gender									
Female	369	60,9	170	46,1	131	35,5	68	18,4	0,257
Male	231	39,1	122	52,8	74	32,0	35	15,2	
Parents marital status#									
No stable union	211	35,9	94	44,5	69	32,7	48	22,7	0,031
Stable union	377	64,1	194	51,5	129	34,2	54	14,3	
Family Income#									
Less than 3 MW	487	84,0	238	48,9	167	34,3	82	16,8	0,805
More than 3 MW	90	16,0	45	50,0	28	31,1	17	18,9	
<i>Objective conditions of general health</i>									
Total cholesterol#									
Altered	160	27,5	93	58,1	41	25,6	26	16,3	0,016
Normal	429	72,5	195	45,5	158	36,8	76	17,7	
D Vitamin#									
Altered	378	67,5	184	48,7	133	35,2	61	16,1	0,368
Normal	193	32,5	97	50,3	58	30,1	38	19,7	
BMI#									
Overweight	198	40,1	95	48,0	69	34,8	34	17,2	0,949
Normal	388	59,9	190	49,0	130	33,5	68	17,5	
Waist circumference#									
High	142	31,4	67	47,2	52	36,6	23	16,2	0,723
Normal	445	68,6	219	49,2	147	33,0	79	17,8	
Triglycerides#									
Altered	56	10,9	44	51,2	29	33,7	13	15,1	0,818
Normal	533	89,1	243	48,5	169	33,7	89	17,8	
Glucose#									
Altered	07	1,2	03	42,9	03	42,9	01	14,3	0,877
Normal	582	98,8	285	49,0	196	33,7	101	17,4	
<i>Subjective conditions of general health</i>									
Body Image#									
Unsatisfied	388	66,6	197	50,8	133	34,3	58	14,9	0,126
Satisfied	194	33,3	89	45,9	63	32,5	42	21,6	
Eating disorder#									
Present	420	74,3	198	47,1	152	36,2	70	16,7	0,166
Absent	158	25,7	85	53,8	44	27,8	29	18,4	
Life Quality#									
Compromised	141	24,7	64	45,4	52	36,9	25	17,7	0,592
Appropriate	419	75,3	210	50,1	137	32,7	72	17,2	
<i>Health behaviors</i>									
<i>Individual actions</i>									
Dental floss use#									
Never/Rarely	316	52,2	147	46,5	114	36,1	55	17,4	0,529
Always/usually	283	47,8	144	50,9	91	32,2	48	17,0	
Sugar intake#									
Negative adhesion	268	45,0	245	48,3	177	34,9	85	16,8	0,275
Positive adhesion	319	55,0	42	52,5	21	26,3	17	21,3	
Drinking habit#									
Consumes	102	18,4	50	49,0	28	27,5	24	23,5	0,112
Doesn't consume	485	81,6	237	48,9	171	35,3	77	15,9	
Physical activity#									
Sedentary	205	34,1	96	46,8	69	33,7	40	19,5	0,575
Active/Very active	383	65,9	191	49,9	130	33,9	62	16,2	
<i>Formal use of dental services</i>									
Time since last consultation#									
More than a year	162	33,4	87	53,7	50	30,9	25	15,4	0,147
Less than a year	336	66,6	149	44,3	125	37,2	62	18,5	
Type of dental service#									
Public	230	45,7	103	44,8	81	35,2	46	20,0	0,307
Private	272	54,3	135	49,6	96	35,3	41	15,1	
<i>Oral health outcomes</i>									
<i>Subjective condition of oral health</i>									
Self perception of oral health#									
Unsatisfied/very unsatisfied	113	19,5	48	42,5	45	39,8	20	17,7	0,574
Indifferent	178	30,0	86	48,3	62	34,8	30	16,9	
Satisfied/very satisfied	298	50,6	153	51,3	95	31,9	50	16,8	

Selfperceptionofthenessof a dental treatment [#]									
Yes	419	73,6	182	43,4	158	37,7	79	18,9	0,001
No	157	26,4	95	60,5	42	26,8	20	12,7	
Toothache in the last 6 months [#]									
Yes	204	34,6	69	33,8	82	40,2	53	26,0	0,000
No	388	65,4	222	57,2	117	30,2	49	12,6	
Oral health impact [#]									
With impact	427	71,2	197	46,1	149	34,9	81	19,0	0,093
No impact	172	28,8	94	54,7	56	32,6	22	12,8	

[#]Variation in n=600 by lost information.

† Estimates corrected by the sample design effect.

The selected variables to compose the multiple model were Bold (p < 0,2).

Tabela 2. Multiple model of ordinal logistic regression of the gravity of the dental cavity experience in teenagers (n=557). Montes Claros – MG, 2016/2017

Variables	OR (IC 95%)	p value
Primary determinants of oral health		
Age group (in years)		
15 years old or more	2,08 (1,50-2,88)	<0,001
14 years old or less	1	
Total cholesterol		
Altered	0,67 (0,47-0,97)	0,036
Normal	1	
Oral health outcomes		
Self perception of the need of a treatment		
Yes	1,60 (1,10-2,33)	0,014
No	1	
Toothache in the last 6 months		
Yes	2,83 (2,01-3,99)	<0,001
No	1	

Pseudo R² = 13%

Deviance and parallel line tests are not significant

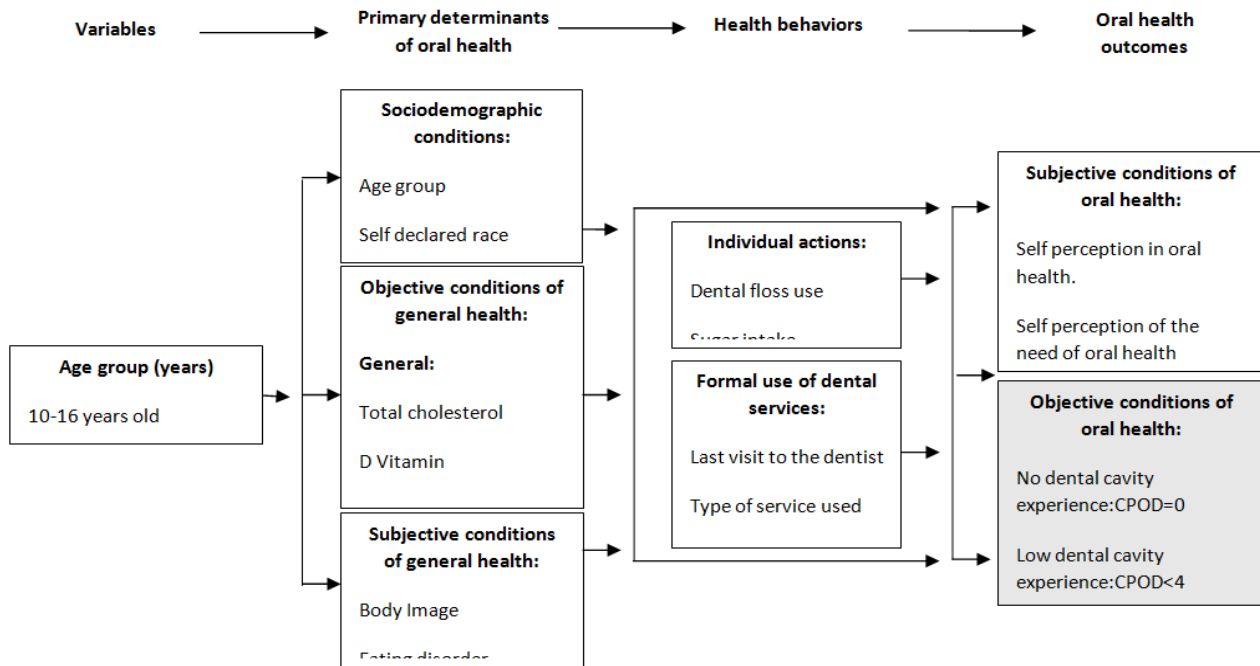


Image 1. Adapted model by Andersen and Davidson (1997)

The adjusted multiple model (Chart 2) showed that the chance to present a better dental cavity experience (dental cavity severity) was higher among the older ones (OR=2,08), the ones that self perceived the need of a dental treatment (OR=1,60) and the ones that reported toothache in the last six months (OR=2,83). On the other hand, the chance to present higher dental cavity severity was lower in teenagers who had high levels of total cholesterol (OR=0,67).

DISCUSSION

Among the evaluated teenagers 47,7% didn't present dental cavity experience (CPOD=0), 34,2% presented low experience

(CPOD<4) and 17,9 presented high dental cavity experience (CPOD≥4). This study showed, a higher chance to present high severity of dental cavity experience among older teenagers, who self perceived the need of a dental treatment and reported toothache in the last six months. On the other hand, the chance was lower among teenagers who had altered levels of total cholesterol. The prevalence of teenagers free from dental cavity identified in this study (47,7%) was higher than the results observed in studies carried among Brazilian teenagers participants of the National Research of Oral Health (SB Brasil 2010) (23,9%) Ministério da saúde (2012), among teenagers in Indaiatuba in 2004 (28,7%)

Silveira MF *et al* (2015). Although the present study adopted an age range diferente than the studies named above, the results suggest a reduction in the dental cavity experience in the recente years, as it was also verified by the last national inquiries Ministério da saúde (2004), Ministério da saúde (2012). Considering the dental cavity severity, 17,9% of the teenagers presented high dental cavity experience. An investigation conducted in Mexico, with individuals between 12 and 15 years old, verified that 9,6% presented higher dental cavity severityPontygo-Loyola *et al* (2007). High levels of dental cavity experience also were identified among 33,9% of teenagers in Portugal Mello *et al* (2008). In national studies, the high dental cavity experience affected 22,2% of Brazilian teenagersFreire *et al* (2013), 11,5% of teenagers in the state of PiauíMoura *et al* (2016), 36,6% in the state of RecifeACA (2008), 47% in São Paulo – SPzardeto (2004) and 60,6% in Ribeirão Preto – SP Oliveira SS (2015).

It's important to highlight that the CPOD cut off point used to classify the dental cavity severity diverged between the studies, being adopted CPOD>3 Oliveira SS (2015), CPOD≥4 Pontygo-Loyola *et al* (2007), Mello *et al* (2008), Freire *et al* (2013); Moura *et al* (2016) as it was considered in this investigation and CPOD≥5(zardeto CGDC 2004; ACA CRP 2008). Although there's no pattern in the concept of dental cavity, the percentage of teenagers with high dental cavity experience was lower than the verified in previous studies zardeto (2004), Mello *et al* (2008), ACA(2008), Freire *et al* (2013), Oliveira SS (2015). The fact that the teenagers investigated presented, in general, better oral health conditions doesn't imply that it's possible to say that the verified conditions are ideals and that it can be any negligence relating to the promotion strategy of oral health directed to this community. In the final model, it was observed that the older teenagers presented higher dental cavity experience when compared to the younger ones. The relation between the dental cavity severity and the progressive increase of the age in teenagers is recurrent in the scientific literaturezardeto CGDC (2004), ACA(2008), Silva MFCS(2013), Oliveira SS (2015). The cumulative feature of CPOD index is responsible for this finding. It is hoped that Montes Claros population presents a good access to the oral health services, considering that the city offers assistance to the primary attention in oral health covering about 90%. Additionally, the city still offers services provision of second attention, such as endodontics, periodontics, surgery and others (e-Gestor AB). It's also important to say that the city of Montes Claros is considered university polo (IBGE), having many universities and postgraduate studies in the dentist area. Despite this scenario, the dental caring Index verified (reason O/CPOD * 100) was 40,4%. Subjective conditions of oral health revealed to be associated to the severity of the dental cavity. Teenagers that self perceived the need of a dental treatment and the ones that reported toothache in the last six months presented higher dental cavity experience. It is known that the self perception in oral health refers to the individual and subjective capacity to perceive and evaluate the own health, being useful in the evaluation, organization and financing of health services, in interventions in the promotion of health and in the evaluation of the need of a treatment Silveira MF *et al* (2015), Vale *et al* (2013); Lundegren *et al* (2004). The higher severity of dental cavity identified among the teenagers that reported the need of a dental treatment evidences the need of subjective measures as indicators of oral health. Previous studies also verified higher chance of dental cavity among teenagers and self

perception measures of oral health Silveira MF *et al* (2015), Gibilini *et al* (2010) supporting the findings in this investigation. The observed association between the severity of dental cavity and pain of dental origin was already expected, as the dental cavity is one of the main causes of toothacheBorges *et al* (2008). This association was also confirmed in a study carried with teenagers in northeast of BrazilSilva MFCS (2013) and in the North of Minas GeraisSilveira MF *et al* (2015). An investigation conducted among Brazilian teenagers verified that the prevalence of toothache was higher among individuals with 4 or more decayed teethBorges *et al* (2008) similar to the verified in this study. The pain report in the last six months among teenagers with higher dental cavity experience is logical as the important contribution of the "decayed element" in the CPOD (56,3%). Teenagers that had altered levels of total cholesterol presented lower chance of dental cavity experience. This association is being researched in the literature and is not enough enlightened. An investigation carried in 2004 with teenagers in the city of São Paulo, has not found the statistical association between total cholesterol and CPODzardeto(2004). Other study carried in 2011 among teenagers in Portugal, evidenced that the "low" total cholesterol level was significantly associated with the increase of the number of "decayed teeth" and "restored"Norton (2013), according to what was verified in our study. According to the I Diretriz Brasileira de Hipercolesterolemia Familiar (Brazilian Guideline for Familial Hypercholesterolemia) (HF), high cholesterol levels in kids and teenagers, many times, are more associated to genetic factors than to behavioral factorsSantos RD *et al* (2012) even though it should be considered the genetic factors associated to familial hypercholesterolemia are usually defined as higher values to the cut off point established. Besides that, some authors believe that the fat content of some foods and obesity work as protection factors for the dental cavity development Kopycka-Kedzierawskiet *al* (2008), Yévenes IL *et al* (2012), Porcelli ICS *et al* (2016). This finding needs to be improved. It is good to emphasize that it was not verified an association between the dental cavity severity and obesity. A systematic review, conducted to analyze the evidences on this association, verified that 18 of the 28 articles identified also haven't found this association Silva AER *et al* (2013) corroborating to the results of this study. Yet, it's emphasized the need of new study, especially with longitudinal designs, directed to answer this question. Previous studies investigated the possible relation between dental cavity and serum levels that influence the eating patterns, although there's no consensus about this. While a study verified the dental cavity related to blood glucose, triglycerides and cholesterolNorton (2013), other study showed an opposite resultzardeto (2004). Although the relation between dental cavity and metabolic disorders, such as cardiovascular diseases, obesity and diabetes may exist as a result of the eating habits, the scientific evidence of this association is hard, because it is about multifactorial diseases, of complex etiology and pathophysiologyzardeto (2004).

Although the levels of dental cavity are reducing over the years, many studies point to the maintenance of the association between low family income and high dental cavity severityFreire *et al* (2013); Silva MFCS (2013). In this study, the severity of the dental cavity experience was not associated to the family income, what was also verified in other investigations zardeto(2004); Pontygo-Loyola *et al* (2007). Possibly the homogeneity of the economic conditions of the teenagers investigated (84% reported family income lower to 3

minimum wages), as well as their unfamiliarity with the family income may have hampered the identification of this association. So, this result needs to be analyzed carefully, because the adopted dichotomization used in this investigation since the data collection may be the responsible for the non-identification of this association. Although the adopted multidimensional theoretical model adapted from Andersen and Davidson predicts a possible relation between the dental cavity severity and the oral health behaviors, this relation was not found in this investigation. Some life styles, such as the hypercaloric diet (rich in sugar), frequency of food intake, and oral hygiene habits, such as tooth brushing and using dental floss, represent risk factors to the prevalence and severity of the dental cavity disease (Zardeto (2004), Mello *et al* (2008), Moura *et al* (2016). However, the daily use of fluoride, by supply water, by toothpastes or yet, as a topical administration, through individual and/or collective dental programs, represent a significant factor for the dental cavity contentment Frazão (2012). So, behavior considered inappropriate, as sugar intake, can become weak risk factors for the development of the dental cavity when oral hygiene and/or fluoride use is present. Also, it should be said that all the information referring to oral health behavior were obtained by the teenagers report, the possibility of information bias. It should be also considered, that the public supply water in the city of Montes Claros has adequate fluoridation (average 0,7) based on the parameters of the Ministério da Saúde (Ministry of Health) according to the Relatório de Qualidade da Água (Water Quality Report) provided by COPASA. This data can be possible answers for the non-association of the dental cavity severity and the variables referring to the oral health behaviors. Regarding this study limitations, it has to be said that the percent variance explained by the final model was moderate (R^2 adjusted = 13%), specially because the dental cavity severity measured by the CPOD represents a complex and multifactorial outcome, and it's probable that the important independent variables has not been analyzed. It has to be considered that although the independent variables has been measured crosswise, the investigated outcome (CPOD) has longitudinal character, showing an accumulation of disease over the time. It is important to comprehend that the factors that are used in the model only show aspects of a complex process, which result can be revealed in the dental cavity experience. Also, the possible existence of non-differential measurement bias in the self report of the teenagers (memory and/or report bias) on behavior or even social questions in the interview. On the other hand, the sample planning, the examiners calibration and the conduction of the analysis considering the correction by the drawing effect were strategies that had higher validation and reliability to the data. The high number of variables considered, including sociodemographic factors to laboratory measures must be highlighted.

Conclusion

Relating to the severity of the dental cavity experience, this study identified that 34,2% of the teenagers evaluated presented low experience and 17,9% presented high dental cavity experience. The dental cavity severity was associated, specially, to the subjective and sociodemographic oral health conditions. Older teenagers that self perceived the need of a dental treatment and that reported toothache in the last six months presented higher dental cavity severity. On the other hand, the dental cavity severity was lower in teenagers that had altered levels of total cholesterol. So, the importance of

the creation of programs and public policies of health capable of attending the teenagers, considering their vulnerability. The facilitated access to the healing/recuperative dental consultations and the incentive to periodic return to the review and prevention consultations are important. The oral health education programs aiming teenagers need to be fostered, searching for alternatives that encourage the participation, the permanence and the commitment in this age group, to prevent the progression of the dental cavity.

Acknowledgement

LLR has a scholarship in doctorate degree by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). DSH has a scholarship in productivity in FAPEMIG To the teenagers, their families and schools for the important collaboration in this research.

Contributions

1. LCOSP operated in all aspects of the paper.
2. NGFM operated in the conception, data collection and final approval of the version to be published.
3. LLR operated in the data interpretation, composing, the article critical review and the final approval of the version to be published.
4. JEN operated in the analysis, data interpretation and final approval of the version to be published.
5. CSOS operated in the conception, analysis, data interpretation and final approval of the version to be published.
6. DSH operated in all aspects of the paper.

REFERENCES

- Abreu MNS, Siqueira AL, Caiaffa WT. Regressão logística ordinal em estudos epidemiológicos. *Rev Saude Publica*. 2009;43(1):183-94.
- Aca CRP. Estado nutricional associado à carie dentária em escolares adolescentes na cidade de Recife-2008 [dissertação]. Recife: Pós-graduação em saúde da criança e do adolescente, Universidade Federal de Pernambuco; 2008.
- Adulyanon S, Vourapukjaru J, Sheiham A. Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol*. 1996;24(6):385-389.
- Andersen RM, Davidson PL. Ethnicity, aging, and oral health outcomes: a conceptual framework. *Adv Dent Res*. 1997;11(2):203-209.
- Borges CM, Cascaes AM, Fischer TK, Boing AF, Peres MA, Peres KG. Dor nos dentes e gengivas e fatores associados em adolescentes brasileiros: análise do inquérito nacional de saúde bucal SB- Brasil 2002-2003. *Cad Saude Publica*. 2008;24(8):1825-1834.
- Brasil sorridente [Internet]. Brasília: Brasil Sorridente é o maior programa de saúde bucal do mundo; [citado 2018 out 12]. Disponível em: <http://www.brasil.gov.br/noticias/saude/2013/10/brasil-sorridente-e-o-maior-programa-de-saude-bucal-do-mundo>
- Buff CG, Ramos E, Souza FIS, Sarni ROS. Frequência de síndrome metabólica em crianças e adolescentes com sobrepeso e obesidade. *Rev Paul Pediatr*. 2007;25(3):221-6.
- Bulgareli JV, Faria ET, Cortellazzi KL, Guerra LM, Meneghim MC, Ambrosano GMB, Frias AC, Pereira AC.

- Fatores que influenciam o impacto da saúde bucal nas atividades diárias de adolescentes, adultos e idosos. *RevSaude Publica*. 2018;52:44-52.
- CeschiniFI, Miranda MLJ, Andrade EL, Oliveira LC, Araújo TL, Matsudo VR, Figueira Junior AJ. Nível de atividade física em adolescentes brasileiros determinado pelo Questionário Internacional de Atividade Física (IPAQ). *R. bras. Ci. e Mov*. 2016;24(4):199-212.
- Ditmyer M, Dounis G, Mobley C, Schwarz E. Inequalities of caries experience in Nevada youth expressed by DMFT index vs. Significant Caries Index (SiC) over time. *BMC Oral Health*. 2011; 11:12. DOI: 10.1186/1472-6831-11-12.
- EGestorAB.<https://egestorab.saude.gov.br/paginas/acessoPublico/relatorios/relHistoricoCoberturaSB.xhtml>.
- Ely, HC; Abegg, C; Pattussi, MP. Redução da cárie dentária em adolescentes: distribuição temporal e espacial em 36 municípios do Sul do Brasil 2003 e 2011. Dental caries reduction among adolescents: temporal and spatial distribution in 36 Southern Brazilian municipalities, 2003 and 2011. *Epidemiol. Serv. Saúde, Brasília* 23(3):421-434, jul-set 2014. doi: 10.5123/S1679-49742014000300005.
- Fernández JR, Redden DT, Pietrobelli A, Allison DB. Waist circumference percentiles in nationally representative samples of African-American, European-American, and Mexican-American children and adolescents. *J Pediatr*. 2004;145(4):439-44.
- Frazão, P. Epidemiology of dental caries: when structure and context matter*. *Braz Oral Res.*, (São Paulo) 2012;26(SpecIss 1):108-14.
- Freire MCM, Reis SCGB, Figueiredo N, Peres KG, Moreira RS, Antunes JLF. Determinantes individuais e contextuais da cárie em crianças brasileiras de 12 anos em 2010. *RevSaude Publica*. 2013;47 Supl 3:40-49.
- Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem*. 1972;18(6):499-502.
- Gibilini C, Esmeriz CEC, Volpato LF, Meneghim ZMAP, Silva DD, Sousa MLR. Acesso a serviços odontológicos e auto percepção em saúde bucal em adolescentes, adultos e idosos. *Arquivos em odontologia*. 2010;46(4):213-223.
- Instituto Brasileiro de Geografia e Estatística (IBGE) [Internet]. Montes Claros: IBGE. [citado 2018 out 12]. Disponível: [IBGE/Brasil/MinasGerais/Montesclaros](https://ibge.gov.br/brasil/brasilia/mg/montes-claros/panorama). Disponível em: <https://cidades.ibge.gov.br/brasil/mg/montes-claros/panorama>.
- Kopycka-Kedzierawski DT, Auinger P, Billings RJ, Weitzman M. Caries status and overweight in 2- to 18-year-old US children: findings from national surveys. *Community Dent Oral Epidemiol*. 2008;36(2):157-167.
- Lundegren N, Axtelius B, Hakansson J, Akerman S. Dental treatment need among 20 to 25-year-old Swedes: discrepancy between subjective and objective need. *Acta OdontolScand*. 2004;62(2):91-96.
- Mello T, Antunes J, Waldman E, Ramos E, Relvas M, Barros H. Prevalence and severity of dental caries in schoolchildren of Porto, Portugal. *Community Dent Health*. 2008;25(2):119-125.
- Ministério da Saúde (MS). Fundação Nacional de Saúde. Manual de Fluoretação da Água Para Consumo Humano, Brasília,2012.
- Ministério da Saúde (MS). Secretaria de atenção à saúde. Secretaria de vigilância em saúde. Departamento de atenção básica. Coordenação geral de saúde bucal. Projeto SB Brasil 2003 - Condições de saúde bucal da população brasileira 2002-2003: resultados principais. Brasília: MS; 2004.
- Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. Departamento de atenção básica. Coordenação geral de saúde bucal. Projeto SB Brasil 2010:Pesquisa Nacional de Saúde Bucal: resultados principais. Brasília: MS; 2012.
- Moura SMS, Oliveira IM, Leite CMC, Conde Júnior AM. Dieta e Cárie Dental em Escolares de 10 a 14 Anos na Cidade de Picos, Piauí. *J Health Sci*. 2016;18(1):14-18.
- Norton APMAP. Relação entre fatores de risco cardiovascular e saúde dentária em crianças de 6 a 13 anos [tese]. Faculdade de medicina dentária: Universidade do Porto; 2013.
- Oliveira SS. Associação entre fatores sociodemográficos e saúde bucal em crianças e adolescentes de 3 a 15 anos[dissertação]. Ribeirão Preto: Mestrado em Ciências odontológicas; 2015.
- Pereira A, Guedes AD, Verreschi ITN, Santos RD, Martinez TLR. A obesidade e sua associação com os demais fatores de risco cardiovascular em escolares de Itapetininga, Brasil. *ArqBrasCardiol*. 2009;93(3):253-260.
- Pontigo-Loyola AP, Medina-Solis CE, Borges-Yañez SA, Patiño-Marín N, Islas-Márquez A, Maupome G. Prevalence and severity of dental caries in adolescents aged 12 and 15 living in communities with various fluoride concentrations. *J Public Health Dent*. 2007;67(1):8-13.
- Porcelli ICS, Braga MP, Corsi NM, Poli-Frederico RC, Maciel SM. Prevalência da cárie dentária e sua relação com as condições nutricionais entre escolares de um município do sul do Brasil. *ClipeOdonto*.2016;8(1):2-9.
- Ravens-Sieberer U, Auquier P, Erhart M, Gosch A, Rajmil L, Bruil J, Power M, Duer W, Cloetta B, Czemy L, Mazur J, Czimbalmos A, Tountas Y, Hagquist C, Kilroe J. The KIDSCREEN-27 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Qual Life Res*. 2007;16(8):1347-1356.
- Ravens-Sieberer U. The KIDSCREEN Group Europe. The KIDSCREEN Questionnaires – Quality of Life Questionnaires for Children and Adolescents Handbook. Lengerich, Germany: Pabst Science Publishers; 2006.
- Rihs LB, Sousa MLR, Cypriano S, Abdalla NM. Desigualdades na distribuição de cárie dentária em adolescentes de Indaiatuba (SP), 2004. *Cien. Saude Colet*. 2010;15(8):2173-2180.
- Santos DR. III Diretrizes brasileiras sobre dislipidemias e diretrizes de Prevenção da Aterosclerose da Sociedade Brasileira de Cardiologia. *ArqBrasCardiol*. 2001;77 Supl. 3:1-48.
- Silva AER, Menezes AMB, Demarco FF, Vargas-Ferreira F, Peres MA. Obesityand dental caries: systematicreview. *RevSaude Publica*. 2013;47(4):799-812.
- Silva AF, Velo MMAC, Pereira AC. Importância da reprodutibilidade dos métodos para diagnóstico em odontologia. *RFO UPF*. 2016;21(1):115-120.
- Silva BCC, Camargos BM, Fujii JB, Dias EP, Soares MMS. Prevalência de deficiência e insuficiência de vitamina D e sua correlação com PTH, marcadores de remodelação óssea e densidade mineral óssea, em pacientes ambulatoriais. *ArqBrasEndocrinolMetab*. 2008;52(3):482-488.

- Silva MFCS. Prevalência e fatores associados à cárie dentária e ataque elevado de cárie em adolescentes da região nordeste do Brasil [monografia]. Recife: Residência Multiprofissional em Saúde Coletiva, Fundação Oswaldo Cruz; 2013.
- Silveira MF, Freire RS, Nepomuceno MO, Martins AMEBL, Marcopito LF. Cárie dentária e fatores associados entre adolescentes no norte do estado de Minas Gerais, Brasil: uma análise hierarquizada. *CienSaude Colet*. 2015;20(11):3351-3364.
- Sousa, MLR; Meirelles, MPMR; Tôrres, LHN; Frias, AC. Cárie dentária e necessidades de tratamento em adolescentes paulistas. Dental caries and treatment needs in adolescents from the state of São Paulo, Brazil. *Rev Saúde Pública* 2013;47(Supl 3):50-8. DOI:10.1590/S0034-8910.2013047004340.
- Stunkard AJ, Sorensen T, Schulsinger F. Use of the Danish Adoption Register for the study of obesity and thinness. In: Kety SS, Rowland LP, Sidman RL, Matthysse SW. *The genetics of neurological and psychiatric disorders*. New York: Raven Press; 1983. p. 115-20.
- Vale, EB; Mendes, ACG; Moreira, RS. Autopercepção da saúde bucal entre adultos na região Nordeste do Brasil. Auto percepção de lasalud bucal entre adultos enlaregiónNoreste de Brasil. *Rev. Saúde Pública* 47(Supl3) Dez 2013 <https://doi.org/10.1590/S0034-8910.2013047004893>
- Vinholes DB, Assunção MCF, Neutzling MB. Frequência de hábitos saudáveis de alimentação medidos a partir dos 10 Passos da Alimentação Saudável do Ministério da Saúde: Pelotas, Rio Grande do Sul, Brasil. *CadSaude Publica*. 2009;25(4):791-799.
- World Health Organization (WHO). Oral health surveys: basic methods. Design of an oral health survey. 5th ed. São Paulo; 2013. p.14-21
- Ximenes RCC, Colares V, Bertulino T, Couto GBL. Versão brasileira do “BITE” para uso em adolescentes. *ArqBras Psicol*. 2011;63(1):52-63.
- Yévenes IL, Zillmann GG, Muñoz MA, Araya VM, Coronado VL, Manríquez UJ, Werlinger FC, Maass PW, Quintana RB. Caries and obesity in 6 year-old schoolchildren from the Metropolitan region (MR) of Santiago, Chile. *Rev OdontoCienc*. 2012;27(2):121-126.
- Zardeto CGDC. Prevalência de cárie dentária em adolescentes residentes no município de São Paulo: indicadores de risco e gravidade [Tese]. São Paulo: Faculdade de Odontologia da USP; 2004.
