

UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
FACULDADE DE ODONTOLOGIA

ARIEL GOULART RUP

**OBESIDADE E MUDANÇA DE PESO NÃO SÃO FATORES DE RISCO PARA
CÁRIE CORONÁRIA E RADICULAR: ESTUDO PROSPECTIVO DE 4 ANOS**

Porto Alegre

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Trabalho de Conclusão de Curso apresentado ao Curso de Graduação em Odontologia da Faculdade de Odontologia da Universidade Federal do Rio Grande do Sul, como requisito parcial para obtenção do título de Cirurgião-Dentista.

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Porto Alegre, 12 de julho de 2019

Marisa Maltz

Universidade Federal do Rio Grande do Sul

Juliana Balbinot Hilgert

Universidade Federal do Rio Grande do Sul

Roger Keller Celeste

Universidade Federal do Rio Grande do Sul

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“Não é na ciência que está à felicidade,
mas na aquisição da ciência.”

Edgar Allan Poe

RESUMO

Objetivo: Avaliar a associação entre sobrepeso e obesidade com cárie coronária e radicular em adultos do sul do Brasil. *Materiais e Métodos:* Este estudo prospectivo de coorte reavaliou após 4 anos de seguimento (2016-2017), quatrocentos e quatorze indivíduos (35,78% dos 1023 sujeitos elegíveis avaliados no exame inicial - 2011-2012) residentes em Porto Alegre. Entrevistas utilizando questionário estruturado foram realizadas para registrar variáveis sociodemográficas, hábitos de higiene bucal, auto percepção da saúde bucal, acesso a serviços odontológicos, histórico médico e fatores comportamentais. Oito examinadores treinados e calibrados realizaram exame bucal domiciliar avaliando cárie coronária, cárie radicular e recessão gengival (Kappa intra e inter-examinador para cárie coronária e radicular $\geq 0,82$; Kappa ponderado para recessão gengival intra e inter-examinador variou entre 0,87-0,92). Altura e peso foram coletados para calcular o índice de massa corporal. Análise multivariada para incidência de cárie utilizou modelos de Poisson e modelos de regressão binomial negativa para incremento de dentes com novas lesões cariosas. (taxa de incidência [IIR] / intervalo de confiança [IC 95%]) de cárie coronária e radicular. *Resultados:* Em relação à mudança de peso ao longo do tempo, 18,0% dos indivíduos foram classificados como normais, 9,8% perderam peso, 34,4% permaneceram ou ficaram com sobrepeso e 37,7% permaneceram ou se tornaram obesos. Entre as variáveis de exposição avaliadas, apenas o tabagismo e o IMC basal foram associados à mudança de peso ao longo do tempo. Não houve diferença significativa na incidência de cárie coronária e radicular de acordo com o IMC basal. A porcentagem de indivíduos com incidência de cárie coronária foi de aproximadamente 45% entre todas as categorias de IMC. Também não houve diferenças significativas na média de incremento de CPOD e CPOS de acordo com o IMC basal. Indivíduos classificados com IMC normal durante todo estudo tiveram porcentagem de incidência de cárie coronária de 39,4%. Para as outras três categorias de mudança de peso, a incidência variou entre 43,5% (obeso), 49,2% (sobrepeso) e 44,4% (perda de peso) sem diferenças significativas entre a categoria em relação ao IMC normal. Da mesma forma, não houve diferenças significativas entre as categorias de mudança de peso na média de incremento de CPOD/S. Análise multivariada não encontrou associações estatisticamente significativas entre as categorias mudança de peso e a incidência de cárie coronária, nem entre o incremento de dentes com cárie coronária. Ausência de associações estatisticamente significativas também em relação à cárie radicular. *Conclusões:* Adultos com sobrepeso e obesos não devem ser considerados com maior risco para a cárie.

Palavras-chave: Cárie dentária. Cárie radicular. Alteração do peso corporal. Obesidade. Epidemiologia.

ABSTRACT

Objective: To assess the association between overweight and obesity and coronal and root caries among south Brazilian adults. *Methods:* This prospective cohort study (2016-2017) reassessed after 4 years of follow-up four hundred and fourteen individuals (35.78% of the 1023 eligible subjects assessed in the initial exam- 2011-2012) living in Porto Alegre. Interviews were conducted using a structured questionnaire containing questions regarding socio-demographic variables, oral hygiene habits, self-perceived oral health, access to dental services, medical history, and behavioral factors. Eight trained and calibrated examiners performed the domiciliary oral exam evaluating coronary caries, root caries and gingival recession (Kappa intra and inter-examiner for coronary and root caries ≥ 0.82 ; Kappa weighted for intra and inter-examiner gingival recession ranged from 0, 87-0.92). Height and weight were collected to calculate the body mass index. Multivariable negative binomial (number of teeth) and Poisson (incidence) regression analysis models were applied (incidence rate ratio [IRR]/ confidence interval [95% CI]) of coronal and root caries. *Results:* Regarding weight change over time, 18.0% of the individuals were classified as normal, 9.8% had lost weight, 34.4% remained or became overweight and 37.7% remained or became obese. Among the exposure variables evaluated, only smoking and baseline BMI were associated with weight change over time. There was no significant difference in the incidence of coronal caries according to baseline BMI. The percentage of individuals with incident coronal caries was approximately 45% among all BMI categories. There were also no significant differences in the mean increment of DMFT and DMFS according to baseline BMI. The percentage of individuals having incident coronal caries was 39.4% among those classified as normal weight both at baseline and follow-up. For the other three categories of weight change, incidence varied among 43.5% (obese), 49.2% (overweight) and 44.4% (lost weight) without significant differences between the normal weight category. Similarly, there were no significant differences among categories of weight change in mean DMFT/S increment. There were no significant associations between weight change and coronal caries incidence, nor between increment of teeth with coronal caries. Absence of significant associations was also found regarding root caries. *Conclusions:* Overweight and obese adults should not be considered as at higher risk for dental caries.

Keywords: Dental Caries. Root Caries. Body Weight Changes. Obesity. Epidemiology.

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LISTA DE ABREVIATURAS E SIGLAS

BMI – Body Mass Index

DMFT – Decayed, Missing, FilledTeeth

DMFS – Decayed, Missing. FilledSurfaces

IMC – Índice de Massa Corporal

OMS – Organização Mundial da Saúde

WHO – World Health Organization

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1 REVISÃO DE LITERATURA

Atualmente mais de cinquenta por cento dos brasileiros maiores de 18 anos estão com sobrepeso [Índice de Massa Corporal (IMC) ≥ 25] (GLOBAL HEALTH OBSERVATORY, 2016). O excesso de peso pode ser considerado uma epidemia do século, uma doença de característica não comunicável, de grande abrangência na população e considerado um problema de saúde pública para países desenvolvidos e em desenvolvimento (CABALLERO, 2007; WORLD HEALTH ORGANIZATION, 2000). Tem se mostrado fator de risco para desenvolvimento de diversas outras co-morbidades, como diabetes, distúrbios músculo esqueléticos e até mesmo câncer (WORLD HEALTH ORGANIZATION, 2018).

As doenças que afetam a cavidade bucal compartilham de muitos fatores de risco em comum com doenças crônicas, desses fatores, que tem sido explorado, é a dieta (SHEIHAM, 2005). Uma dieta rica em consumo de carboidratos fermentáveis, como a sacarose, é um fator determinante para o estabelecimento da doença cárie (GUSTAFSSON *et al.*, 1954) e desenvolvimento de novas lesões pelo favorecimento do crescimento de uma microbiota cariogênica (VÅGSTRAND; BIRKHED, 2007). Dieta rica em carboidrato tem sido relacionada também ao favorecimento do ganho de peso (MOZAFFARIAN *et al.*, 2011).

As evidências de que indivíduos com sobrepeso e obesidade possuem um risco aumento para desenvolvimento de novas lesões de cárie são bastante heterogêneas. Ao observar estudos transversais e longitudinais envolvendo crianças e adolescentes, as conclusões apresentadas são totalmente discrepantes entre si. Alguns relatam uma associação positiva entre o IMC e o desenvolvimento de lesões de cárie (ALM *et al.*, 2008; GERDIN *et al.*, 2008; HAYDEN *et al.*, 2013; HONNE *et al.*, 2012), existem relatos de associação inversa entre os desfechos (FERNÁNDEZ *et al.*, 2017; KOPYCKA-KEDZIERAWSKI *et al.*, 2008; NARKSAWAT *et al.*, 2009), assim como alguns autores não encontram associação entre as duas doenças (ALVES *et al.*, 2013; LI *et al.*, 2017; MACEK; MITOLA, 2006; SADEGHI *et al.*, 2011; WU *et al.*, 2013).

A literatura é vasta em estudos abordando indivíduos jovens, entretanto são escassos os dados transversais em adultos e idosos relacionando sobrepeso e obesidade com a doença cárie. Não há estudo longitudinal sobre esta associação nestas faixas etárias. Dados transversais de base populacional em populações orientais (coreanos) demonstram não encontrar associação entre obesidade e cárie (KIM; KIM, 2017), ou relatam uma associação inversa, observando um decréscimo do número de lesões com aumentos do IMC (SONG *et al.*, 2017). Em indivíduos do Arábia Saudita, estudos utilizando amostras de conveniência,

também apresentam resultados conflitantes: um encontra associação positiva (ALSWAT *et al.*, 2016), outro não encontram essa associação (IDREES *et al.*, 2017). Chala *et al.*(2017), em um estudo populacional em indivíduos marroquinos, relatam que a obesidade e o baixo peso são indicadores de risco para desenvolvimento da cárie. No continente Africano, estudo com adultos Egípcios, relata que consumo de açúcar e IMC estão relacionados ao aumento do número de lesões (ABBASS *et al.*, 2019). Estudo envolvendo a população latino-americana, observou idosos no interior do Rio Grande do Sul e encontrou que obesos têm maior número de dentes perdidos, podendo haver então associação entre as condições (DE MARCHI *et al.* 2012;HILGERT *et al.*, 2009).

Indiferente da faixa etária observada nos estudos a direção e natureza da correlação é bastante controversa, uma vez que alguns estudos observam as diferentes tipos de correlação entre os dois desfechos não ajustando a análise para variáveis de confundimento, enquanto outros encontram apenas após a realização dos ajustes. Além de que as variáveis de ajustes também se alteram entre as publicações, isto poderia ser o motivo pelo qual os autores diferem em seus achados.

Devido aos resultados controversos de estudos transversais, trabalhos de acompanhamento são necessários para elucidar a existência ou não de associação entre a obesidade e a cárie dentária em adultos.

2 OBJETIVOS

2.1 Objetivo geral

Identificar se a obesidade é fator de risco para a cárie dentária em adultos e idosos.

2.2 Objetivos Específicos

- a) Determinar a associação entre incidência de modificação de IMC normal para sobrepeso e persistência do sobrepeso com a incidência e incremento de incremento de superfícies e dentes com lesões de cárie coronária e radicular;;
- b) Determinar a associação entre incidência e permanência de obesidade e incidência e incremento de superfícies e dentes com lesões de cárie coronária e radicular;
- c) Determinar associação entre a perda de peso com incidência e incremento de cárie coronária e radicular.

3 ARTIGO

Obesity and weight change are not risk factors for coronal and root caries: prospective 4-years study.

Abstract

Objective: To assess the association between overweight and obesity and coronal and root caries among south Brazilian adults. *Methods:* This prospective cohort study (2016-2017) reassessed after 4 years of follow-up four hundred and fourteen individuals (35.78% of the 1023 eligible subjects assessed in the initial exam - 2011-2012) living in Porto Alegre. Interviews were conducted using a structured questionnaire containing questions regarding socio-demographic variables, oral hygiene habits, self-perceived oral health, access to dental services, medical history, and behavioral factors. Eight trained and calibrated examiners performed the domiciliary oral exam evaluating coronary caries, root caries and gingival recession (Kappa intra and inter-examiner for coronary and root caries ≥ 0.82 ; Kappa weighted for intra and inter-examiner gingival recession ranged from 0.87-0.92). Height and weight were collected to calculate the body mass index. Multivariable negative binomial (number of teeth) and Poisson (incidence) regression analysis models were applied (incidence rate ratio [IRR]/ confidence interval [95% CI]) of coronal and root caries. *Results:* Regarding weight change over time, 18.0% of the individuals were classified as normal, 9.8% had lost weight, 34.4% remained or became overweight and 37.7% remained or became obese. Among the exposure variables evaluated, only smoking and baseline BMI were associated with weight change over time. There was no significant difference in the incidence of coronal caries according to baseline BMI. The percentage of individuals with incident coronal caries was approximately 45% among all BMI categories. There were also no significant differences in the mean increment of DMFT and DMFS according to baseline BMI. The percentage of individuals having incident coronal caries was 39.4% among those classified as normal weight both at baseline and follow-up. For the other three categories of weight change, incidence varied among 43.5% (obese), 49.2% (overweight) and 44.4% (lost weight) without significant differences between the normal weight category. Similarly, there were no significant differences among categories of weight change in mean DMFT/S increment. There were no significant associations between weight change and coronal caries incidence, nor between increment of teeth with coronal caries. Absence of significant associations was also found regarding root caries. *Conclusions:* Overweight and obese adults should not be considered as at higher risk for dental caries.

Introduction

Overweight and obesity are risk factors for many non-communicable diseases such as cardiovascular diseases, diabetes, musculoskeletal disorders and some cancer¹. Both these non-communicable diseases and obesity, largely prevalent in the population, has been related to the high intake of ultra-processed food, rich in sugar content, in big portion size, summed up the sedentary lifestyle, thus causing energy imbalance between calories consumed and calories expended^{2,3}. It has been suggested that obesity and caries share a common risk factor, the unbalanced diet marked by a rich sugar intake, which can stimulate the growth of cariogenic bacteria and favor the development of carious lesions⁴.

The relationship between BMI and dental caries is inconclusive. A clear association between overweight and obesity with dental caries among children and adolescents is not established both in cross-sectional and longitudinal studies. Some studies show a positive association⁵⁻⁸, some a negative association⁹⁻¹¹ and others no relation at all¹²⁻¹⁶. Therefore, overweight and obesity cannot be considered a risk factor for dental caries in children and adolescents.

The relation between obesity and dental caries in adults and elderly has been studied only in crossover studies. Studies show conflicting results, some observed a positive association^{17,18}, some inverse association¹⁹, and some no association^{20,21}. These studies preclude determining clear risk factors due to their cross-sectional design. Further longitudinal studies are necessary to elucidate the association between overweight/obesity and tooth decay.

Therefore, the aim of this longitudinal study was to assess the association between overweight and obesity and coronal and root caries among adults aged 35 years and older from Porto Alegre, South Brazil.

Materials and methods

This population-based prospective cohort study was designed by the Caries-Perio Collaboration group from the Federal University of Rio Grande do Sul, Brazil. A representative sample of adults 35 years and older was drawn between June 2011 and June 2012. Detailed information regarding the sampling strategy at baseline was previously published²²⁻²⁴. In brief, a multistage probability sampling strategy was applied. The city was divided in 86 neighborhoods comprising the primary sampling units (PSU) that were stratified in low and high income. The second stage consisted on a random selection of sectors proportional to the total number of sectors in each PSU. The third stage consisted of selecting

households consecutively according to the sector starting point until the sector sample size was reached. The number of individuals to be selected within each sector was estimated based on the proportional distribution of the sample size.

A total of 1,225 individuals participated in the baseline examination (Figure 1). Among those, 1,023 (83.5%) were dentate and therefore eligible for the follow-up examination, which was conducted between January 2016 and March 2017. The mean time spent (and standard deviation) between baseline and follow-up examinations was 4.2 ± 0.5 years.

Data collection

Interviews were conducted using a structured questionnaire containing questions regarding socio-demographic variables, oral hygiene habits, self-perceived oral health, access to dental services, medical history, and behavioral factors. Clinical examinations were conducted inside the household using a medical headlight and a bendable chair.

Coronal and root caries were assessed using the World Health Organization criteria [DMFT-WHO]²⁵. Anthropometric data was collected with the participants wearing light clothes and no shoes to calculate the body mass index [BMI] (weight [kg]/height [m]²). Weight was obtained using a 150 kg mechanical scale. Height was measured to the nearest full centimeter using an inelastic metric tape.

All permanent fully erupted teeth were examined using a manual periodontal probe (PCP10-SE, Hu-Friedy Mfg. Co. Inc., Chicago, IL, USA). Gingival recession (GR) was assessed at four sites per tooth at mesiobuccal, mid-buccal, distobuccal and mid-lingual surfaces. GR was defined as the distance from the cement-enamel junction (CEJ) to the free gingival margin. If the CEJ was located apical to the gingival margin, this assessment was given a negative sign.

Reproducibility

The reliability of the questionnaire was evaluated in the baseline examination using the test-retest approach in 50 participants. A set of key questions was used to assess the reproducibility of the questionnaire, and Kappa coefficients ranged from 0.91 to 0.99.

Intra and inter-examiner reproducibility of caries and GR was assessed before the start of the study with duplicate measures conducted in a total of 16 patients. During the fieldwork, 42 participants allowed to perform the duplicate measurements.

One examiner conducted all the clinical caries examinations at baseline. This examiner calibrated other three examiners that conducted the follow-up examinations. Baseline intra-examiner reliability revealed Kappa values of ≥ 0.82 for coronal caries, ≥ 0.90 for root caries, and the inter-examiner values were ≥ 0.84 (coronal) and ≥ 0.96 (root). During the study, Kappa values for intra- and inter-examiner reproducibility were ≥ 0.82 .

Five examiners conducted the gingival recession examinations. Intra and inter-examiner reliability for GR revealed weighted (± 1 mm) Kappa values range from 0.87 and 0.92.

Outcomes

Incidence of coronal and root caries was the primary outcome of this study. For coronal caries, incidence was defined as the presence of at least one new caries lesion/decayed/ filling or missing tooth (DMFT index). For root caries, an individual was considered as an incident case when presenting at least one tooth with a new caries lesion/decayed, and/or one new filling (DFT index).

In addition, caries increment was also estimated, as follows: (a) for coronal caries, the number of teeth [DMFT] or surfaces [DMFS] presenting new decayed, missing, or filled tooth/surface; (b) for root caries, the number of teeth [DFT] or surfaces [DFS] presenting at new decayed or filled tooth/surface.

Exposures

The main exposure of this study was the obesity status, which was evaluated using two variables. Firstly, the baseline BMI was calculated and used to classify individuals into normal weight (≥ 18.5 and < 25.0 kg/m²), overweight (≥ 25.0 and < 30.0 kg/m²), or obese (≥ 30 kg/m²)²⁵. Secondly, weight change was defined combining the BMI statuses at baseline and at the follow-up examination, as follows:

- Normal: individuals that had normal weight at both baseline and follow-up;
- Weight loss: individuals that were classified as overweight or obese at baseline and became normal weight at the follow-up examination and individuals that were obese at baseline and became overweight at follow-up;
- Overweight: individuals that were overweight at both baseline and follow-up and individuals that had normal weight and became overweight;
- Obese: individuals that were obese at both baseline and follow-up and individuals that were overweight or had normal weight and became obese.

Age was categorized into three categories 35-49, 50-59, ≥ 60 years old. Socioeconomic status was categorized using cut-off points adapted from the CCEB classification²⁶ that considers the amount of consumer goods and the educational level of the head of the family as follows: low (≤ 20 points), middle (21-26 points) and high (≥ 27 points). Educational level was defined according to years of education into low (≤ 8 years), middle (9-11 years) and high (≥ 12 years). The total number of packs of cigarettes consumed in a lifetime (pack years) was calculated for each individual by multiplying the number of cigarettes consumed per day by the years of habit and dividing by 20. Smoking exposure was categorized into never-smokers (0 pack years), light-moderate smokers (< 20 pack years) and heavy smokers (≥ 20 pack years). Dental care was determined by the access to dental services and defined as irregular (no dental visit or visits only for emergencies) and regular (visits for prevention with a frequency of ≥ 1 time/year over the 4 years of follow-up). Tooth brushing frequency was categorized into never, or ≤ 1 time/day and ≥ 2 times/day. Interproximal/proximal cleaning frequency was dichotomized into < 1 time/day and ≥ 1 time/day.

Ethical aspects

The study protocol was reviewed and obtained ethical approval from the Research Ethics Committee, Federal University of Rio Grande do Sul, Porto Alegre, Brazil (19794/11). Prior to the interview, all patients read and signed a consent form.

Statistical analyses

Pair-wise comparisons of crude estimates were carried out using the chi-square test for categorical variables and the Wald test for continuous variables. The model building followed the strategy described by Hosmer and Lemeshow²⁷, which considers confounding and interactions. Age, gender, socioeconomic status and frequency of interproximal cleaning were associated with coronal caries; thus, the models were always adjusted for these variables. In regard to root caries, models were adjusted for smoking exposure and a number of teeth with gingival recession ≥ 1 mm. All models were fitted using a robust variance estimator.

When the incidence of caries (an individual with at least one increment of coronal and root caries) was the outcome, Poisson models were applied. When the outcome was increment of teeth with new carious lesions, an excess of zeros was observed, and then negative binomial regression models were applied.

The individual was the unit of analysis. The significance level was set at 5%. Data analyses were performed using a statistical package (Stata 14 for Macintosh, STATA Corp., College Station, USA).

Results

The characteristics of the study sample according to weight change over the follow-up period are described in Table 1. Most of the individuals were female (64.5%) and had more than 45 years of age. Overall, 42.1% and 39% of the individuals were from low socioeconomic and educational levels respectively. The majority of the participants had smoked over lifetime (51.4%). Most of them reported having regular access to dental services, 60.4% (n = 221), brushing teeth ≥ 2 times/day and performing interproximal cleaning ≥ 1 times/day. At baseline, the percentage of normal weight, overweight and obese individuals was 23.8%, 41.5% and 31.7%, respectively. In regard to weight change over time, 18.0% of the individuals were classified as normal, 9.8% had lost weight, 34.4% remained or became overweight and 37.7% remained or became obese. Among the exposure variables evaluated, only smoking and baseline BMI were associated with weight change over time.

There was no significant difference in the incidence of coronal caries according to baseline BMI (Table 2). The percentage of individuals presenting incident coronal caries was approximately 45% among all BMI categories. There were also no significant differences in the mean DMFT and DMFS according to baseline BMI. The percentage of individuals having incident coronal caries was 39.4% among those classified as normal weight both at baseline and follow-up. For the other three categories of weight change, incidence varied among 43.5% (obese), 49.2% (overweight) and 44.4% (lost weight) without significant differences between the normal weight category. Mean DMFT was approximately 1 tooth for all categories of weight change without significant differences between them. Similarly, there were no significant differences between categories of weight change in the mean DMFS.

Table 3 shows multiple models for the association between caries and obese status. There were no significant associations between weight change and coronal caries incidence, nor between increment of teeth with coronal caries. Absence of significant associations was also found regarding root caries.

Discussion

The current longitudinal study investigate if overweight and obesity is a risk factor for dental caries since these diseases share a common risk factor: sugar consumption. However, there were no statistically significant associations between baseline BMI, nor between weight change, and coronary caries and root caries. Therefore, overweight and obesity was not a risk factor to dental caries in the studied population.

To the best of our knowledge, this is the first study that associated obesity and dental caries in a longitudinal study. The strength of this study is the association between the change of weight or obesity status to caries incidence and increment in adults.

The behaviors and habits appear to be the key factors to weight change. Keeping a stable BMI or the long-term changes in its status are the results of behavior patterns that occur over time, being the reflection of a more balanced lifestyle with more exposure to physical activity, or an unbalanced lifestyle with unhealthy dietary habits^{28,29}. It is reasonable that overweight, obesity and dental caries have a common risk factor, once they are dietary-habits-related diseases, associated with diet rich in carbohydrate. However, it is also plausible to suggest that overweight and obesity may be associated with other types of diet, not only to the consumption of a carbohydrates rich diet²⁹.

The lack of association between obesity and dental caries observed in previous cross-sectional studies of adults and elderly¹⁹⁻²¹ and in the present longitudinal study, contradict the concept of common risk factors. The fact that sugar is involved in the caries etiology is irrefutable, however, there is some controversial on its role on obesity development. Sun and Empie³⁰ examined, in cross-sectional studies, the relationship between sugar-sweetened beverage intake and incidence of obesity in adults, using data from the two USDA Continuing Surveys of Food Intakes by Individuals (CSFII 1989–1991 and 1994–1998) and the three CDC National Health and Nutrition Examination (1988–1994, 1999–2000, and 2001–2002). They did not find an association between sugar-sweetened beverage intake and incidence of obesity (OR, 1,109-1.003; $p=0.0831-0.1742$). A systematic review published in 2014 concluded that it is not clear how sugar-sweetened beverages contribute to caloric intake and to obesity, irrespective of the age group studied³¹. The high-fat diet could explain, at least in part, obesity. Enes and Slater²⁹, in a longitudinal study of Brazilian adolescents, provide evidence that fatty foods consumption is related to longitudinal changes in body fatness, plausibility is the high energy density in the fatty foods associated with its low nutrient contents.

This longitudinal study on body mass and dental caries confirm previous evidence of no association between obesity and coronal/root caries in adult and elderly population observed in some cross-sectional studies.

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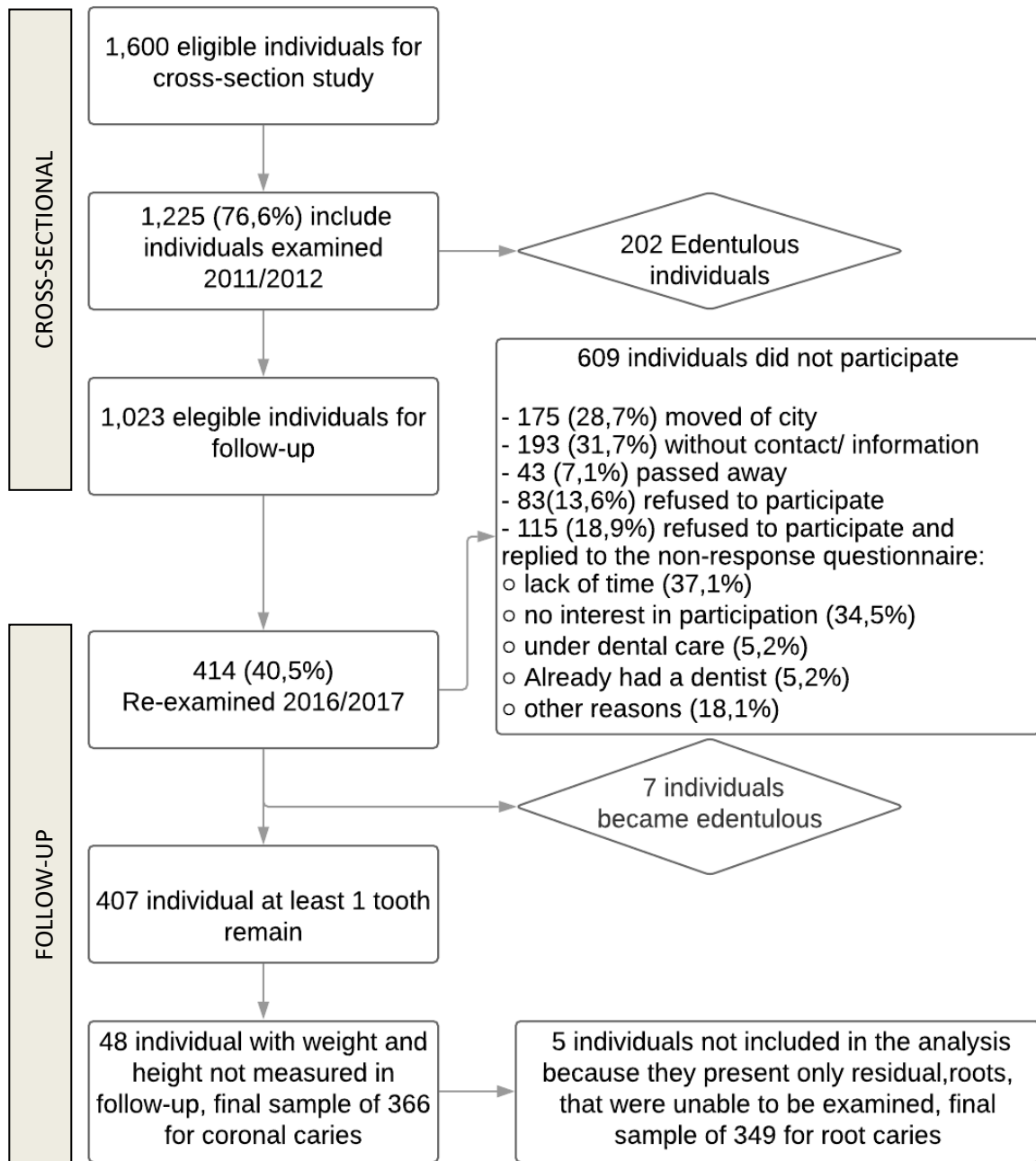


Figure 1.Flowchart of sampling strategy and response rate (PSU = primary sampling unit).

Table 1. Study sample characteristics (number of individuals and percentage) according to weight change over the follow-up period.

Variables		Whole sample	Weight change over time				p
			Normal	Weight loss	Overweight	Obese	
Sex	Female	236 (64.5)	26 (20.0)	10 (07.7)	54 (41.5)	40 (30.8)	0.08
	Male	130 (35.5)	40 (17.0)	26 (11.0)	72 (30.5)	98 (41.5)	
Age, years	35-44	73 (20.0)	13 (17.8)	03 (04.1)	26 (35.6)	31 (42.5)	0.31
	45-59	193 (52.7)	31 (16.1)	19 (09.8)	68 (35.2)	75 (38.9)	
	≥60	100 (27.3)	22 (22.0)	14 (14.0)	32 (32.0)	32 (32.0)	
Socioeconomic status	Low	154 (42.1)	30 (19.5)	16 (10.4)	48 (31.2)	60 (39.0)	0.94
	Middle	121 (33.1)	22 (18.2)	11 (09.1)	43 (35.5)	45 (37.2)	
	High	91 (24.9)	14 (15.4)	09 (09.9)	35 (38.5)	33 (36.3)	
Educational level	Low	143 (39.0)	27 (18.9)	14 (09.8)	55 (38.5)	47 (32.9)	0.45
	Middle	150 (41.0)	26 (17.3)	17 (11.3)	51 (34.0)	56 (37.3)	
	High	73 (20.0)	13 (17.8)	05 (06.9)	20 (27.4)	35 (48.0)	
Smoking exposure	Never smoking	178 (48.6)	23 (12.9)	13 (7.30)	73 (41.0)	69 (38.8)	0.01
	Moderate	97 (26.5)	19 (19.6)	12 (12.4)	35 (36.1)	31 (32.0)	
	Heavy	91 (24.9)	24 (26.4)	11 (12.1)	18 (19.8)	38 (41.8)	
Dental care	None/irregular	145 (39.6)	24 (16.6)	13 (09.0)	51 (35.2)	57 (39.3)	0.88
	Regular	221 (60.4)	42 (19.0)	23 (10.4)	75 (33.9)	81 (36.7)	
Tooth brushing frequency	Never	39 (10.7)	5 (12.8)	1 (2.6)	16 (41.0)	17 (43.6)	0.10
	≤1 time/day	124 (33.9)	17 (13.7)	13 (10.5)	38 (30.7)	56 (45.2)	
	≥2 time/day	203 (55.5)	44 (21.7)	22 (10.8)	72 (35.5)	65 (32.0)	
Proximal cleaning	<1 time/day	109 (29.8)	26 (23.9)	12 (11.0)	29 (26.6)	42 (38.5)	0.12
	≥1 time/day	257 (70.2)	40 (15.6)	24 (9.3)	97 (37.7)	96 (37.4)	
Baseline BMI	Normal	98 (23.8)	66 (67.4)	00 (00.0)	28 (28.6)	04 (4.0)	<0.001
	Overweight	152 (41.5)	0 (00.0)	13 (08.5)	98 (64.5)	41 (27.0)	
	Obese	116 (31.7)	0 (00.0)	23 (19.8)	00 (00.0)	93 (80.2)	
Total		366 (100)	66 (18.0)	36 (9.8)	126 (34.4)	138 (37.7)	

*p value = chi-square test

Table 2. Coronal and root caries incidence (percentage of individuals), mean and standard error DMFT/DFT and DMFS/DFS according to baseline BMI and weight change over time.

CORONAL CARIES							
	Incidence (n/%)		p	Increment			
	0	≥1		Mean DMFT		Mean DMFS	
				mean (SE)	p	mean (SE)	p
<i>Baseline BMI</i>							
Normal	55 (56.1)	43 (43.9)		1.3 (0.2)		6.1 (1.2)	
Overweight	83 (54.6)	69 (45.4)	0.82	1.1 (0.1)	0.53	5.9 (0.7)	0.90
Obese	64 (55.2)	52 (44.8)	0.89	1.2 (0.2)	0.85	5.3 (0.9)	0.60
<i>State of obesity at follow up</i>							
Normal	40 (60.6)	26 (39.4)		1.1 (0.2)		5.38 (1.1)	
Overweight	64 (50.8)	62 (49.2)	0.19	1.1 (0.1)	0.99	5.44 (0.6)	0.96
Obese	78 (56.5)	60 (43.5)	0.78	1.2 (0.2)	0.59	5.71 (0.9)	0.82
Lost weight	20 (55.6)	16 (44.4)	0.62	1.4 (0.4)	0.47	7.56 (2.6)	0.44
ROOT CARIES							
	Incidence (n/%)		p	Increment			
	0	≥1		Mean DFT		Mean DFS	
				mean (SE)	p	mean (SE)	p
<i>Baseline BMI</i>							
Normal	66 (69.5)	29 (30.5)		0.62 (0.1)		1.07 (0.2)	
Over Weight	114 (76.5)	35 (23.5)	0.23	0.48 (0.1)	0.34	0.91 (0.2)	0.53
Obese	84 (73.0)	31 (27.0)	0.57	0.43 (0.1)	0.18	0.91 (0.1)	0.49
<i>State of obesity at follow up</i>							
Normal	42 (66.7)	21 (33.3)		0.65 (0.1)		1.22 (0.3)	
Overweight	96 (77.4)	28 (22.6)	0.13	0.44 (0.1)	0.21	0.74 (0.1)	0.10
Obese	98 (71.5)	39 (28.5)	0.50	0.48 (0.1)	0.28	0.85 (0.1)	0.21
Lost weight	28 (80.0)	07 (20.0)	0.14	0.54 (0.3)	0.73	1.60 (0.5)	0.53

*p-values from Wald test.

Table 3. Multiple models for the association between coronal and root caries incidence and increment with state of weigh tat follow up.

		CORONAL CARIES[†]		
		IRR	95%CI	p
<i>Incidence*</i>				
	Normal	1.00		
	Loss weight	1.21	0.76 – 1.94	0.42
	Overweight	1.30	0.92 – 1.84	0.14
	Obese	1.16	0.82 – 1.65	0.40
<i>Increment of teeth**</i>				
	Normal	1.00		
	Loss weight	1.53	0.74 – 3.17	0.25
	Overweight	1.03	0.65 – 1.62	0.90
	Obese	1.21	0.74 – 1.96	0.45
		ROOT CARIES^{††}		
		IRR	95%CI	p
<i>Incidence*</i>				
	Normal	1.00		
	Loss weight	0.63	0.30 – 1.24	0.24
	Overweight	0.76	0.47 – 1.23	0.27
	Obese	0.94	0.60 – 1.47	0.78
<i>Increment of teeth**</i>				
	Normal	1.00		
	Loss weight	0.81	0.32 – 2.05	0.66
	Overweight	0.74	0.40 – 1.35	0.33
	Obese	0.82	0.48 – 1.29	0.46

*Poisson regression; **Negative binomial regression; †Adjusted for age, gender, socioeconomic status and frequency of interproximal cleaning.; ††Adjusted for smoking and number of teeth with gingival recession

4 CONSIDERAÇÕES FINAIS

Nosso trabalho investigou se o excesso de peso (sobrepeso e obesidade) poderiam ser fatores de risco para desenvolvimento de novas lesões de cárie. Não observamos diferenças estatisticamente significativas entre o IMC basal e mudança de peso com incidência e incremento de cárie coronária e cárie radicular. Podemos, assim, inferir que o sobrepeso e obesidade não são fatores de risco para a cárie dentária em população de adultos e idosos.

O excesso de peso, a obesidade e a cárie dentária poderiam ter um fator de risco comum, por serem doenças relacionadas aos hábitos alimentares (GUSTAFSSON *et al.*, 1954; MOZAFFARIAN *et al.*, 2011). No entanto, é plausível sugerir que o sobrepeso e a obesidade também podem estar associados a outros tipos de dieta, não apenas ao consumo de uma dieta rica em carboidratos. A falta de associação entre obesidade, cárie dentária e dieta rica em açúcar foram observadas em estudos anteriores, contradizendo o conceito de fatores de risco comuns. O fato de que o açúcar está envolvido na etiologia da cárie é irrefutável, entretanto, há algumas controvérsias sobre o seu papel no desenvolvimento da obesidade. Sun e Empie em (2007) em um estudo transversal que examinou a relação entre o consumo de bebidas açucaradas e a incidência de obesidade em adultos, usando dados de base populacional de adultos americanos, não encontrou associação entre o consumo de bebidas açucaradas e a incidência de obesidade. Uma revisão sistemática publicada em 2014 concluiu que não está claro como as bebidas adoçadas com açúcar contribuem para a ingestão calórica e para a obesidade, independente da faixa etária (TRUMBO; RIVERS, 2014).

Assim, uma dieta rica em gordura poderia explicar, pelo menos em parte, a obesidade. Enes e Slater (2013), em um estudo longitudinal com adolescentes brasileiros, fornecem evidências de que o consumo de alimentos gordurosos está relacionado a mudanças longitudinais na gordura corporal, sendo plausível pela alta densidade energética nos alimentos gordurosos, associada ao baixo teor de nutrientes.

Este estudo longitudinal sobre mudança de peso e cárie dentária confirmou evidências anteriores da não associação entre obesidade e cárie coronária / radicular em adultos e idosos observada em estudos transversais.

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