

UPDATE

Association between obesity and dental caries in children and adolescents. Review.

Asociación entre obesidad y caries dental en niños y adolescentes. Revisión.

Associação entre obesidade e cárie dentária em crianças e adolescentes. Revisão.

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Abstract

Obesity and dental caries share common and modifiable risk factors: diet and lifestyle. **Objective.** Identify and analyze the available literature on the possible association between obesity and dental caries in children and adolescents. **Method.** The researchers conducted a review of the literature in Spanish, English, and Portuguese using Pubmed, SciELO, Latindex, and Cochrane (obesity AND body mass index AND caries AND children OR adolescents). **Results.** 115 articles were identified, and 28 articles were included after full-text analysis (21 cross-sectional studies, 4 longitudinal studies, 3 systematic reviews). Four cross-sectional studies and one longitudinal study demonstrated the association between obesity and the presence of caries. **Conclusions.** The studies analyzed on the association between obesity and caries report inconsistent results. The multifactorial origin of the pathologies analyzed can contribute to rejecting the hypothesis of the association of both pathologies from the excessive consumption of carbohydrates and fermentable sugars.

Keywords: obesity, tooth decay, biofilm, body mass, adolescence.

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Resumen

obesidad y caries dental comparten factores de riesgo comunes y modificables: dieta y estilo de vida. **Objetivo.** Identificar y analizar la literatura disponible sobre la posible asociación entre obesidad y caries dental en niños y adolescentes. **Método.** Dos investigadoras realizaron una revisión de la literatura en idiomas español, inglés y portugués utilizando Pubmed, SciELO, Latindex y Cochrane (obesidad AND índice de masa corporal AND caries AND niños OR adolescentes). **Resultados.** Se identificaron 115 artículos y fueron incluidos 28 luego del análisis a texto completo (21 estudios transversales, 4 longitudinales, 3 revisiones sistemáticas). Cuatro estudios transversales y uno longitudinal mostraron asociación entre obesidad y presencia de caries. **Conclusiones.** Los estudios analizados sobre asociación entre obesidad y caries presentan resultados inconsistentes. El origen multifactorial de las patologías analizadas puede contribuir a rechazar la hipótesis de asociación de ambas patologías a partir del consumo excesivo de carbohidratos y azúcares fermentables.

Palabras clave: Obesidad, Caries dental, Biofilm, Masa corporal, Adolescencia.

Resumo

A obesidade e a cárie dentária compartilham fatores de risco comuns e modificáveis: dieta e estilo de vida.

Objetivo: Identificar e analisar a literatura disponível sobre a possível associação entre obesidade e cárie dentária em crianças e adolescentes.

Método: Dois pesquisadoras realizaram uma revisão da literatura em espanhol, inglês e português usando Pubmed, SciELO, Latindex e Cochrane (obesidade E índice de massa corporal E cárie E crianças ou adolescentes).

Resultados: 115 artigos foram identificados e 28 foram incluídos após análise do texto completo (21 estudos transversais, 4 estudos longitudinais, 3 revisões sistemáticas). Quatro estudos transversais e um longitudinal demonstraram a associação entre obesidade e presença de cárie.

Conclusões: Os estudos analisados sobre a associação entre obesidade e cárie apresentam resultados inconsistentes. A origem multifatorial das patologias analisadas pode contribuir para rejeitar a hipótese de associação entre elas a partir do consumo excessivo de carboidratos e açúcares fermentescíveis.

Palavras-chave: Obesidade, Cárie Dentária, Biofilme, Massa Corporal, Adolescência.

Introduction

Chronic noncommunicable diseases (NCDs) are conditions of long duration and usually slow progression, resulting from the combination of genetic, physiological, environmental, and behavioral factors. NCDs are the world's leading cause of morbidity and mortality (WHO, 2018).⁽¹⁾ They are related to genetic disposition and age. The risk factors contributing to these

diseases include poor nutrition, physical inactivity, smoking and alcohol consumption, high blood pressure, high cholesterol levels, overweight, and obesity.⁽¹⁾

Obesity and overweight are systemic alterations associated with excess body fat⁽²⁾ and risk factors for NCDs. According to the 2017 WHO report,⁽³⁾ the prevalence of obesity has increased 5 times in the last 10 years worldwide, from 10 to 50% in children aged 5 to 19 years, regardless

of sex.⁽⁴⁾ Latin America shows significant variation in the figures reported. In Uruguay, 3 out of 10 adolescents aged 13–15 are overweight or obese, according to the 2019 Ministry of Public Health report.⁽⁵⁾ Given its impact on health, this disease can be considered a public health problem in Uruguay.⁽⁵⁾

Obesity has a complex multifactorial etiology; it can be influenced by psychological factors,⁽⁶⁾ environmental conditions,^(7,8) genetic factors,⁽⁹⁾ a sedentary lifestyle, and behavioral factors.⁽¹⁰⁾ Children and adolescents are more exposed to an obesogenic environment in industrialized societies. Ready-prepared and instant foods come in large portions, are high in calories, and less expensive than fruits or vegetables.⁽¹¹⁾

Dental caries is a dynamic, multifactorial, complex, noncommunicable, biofilm-mediated, diet-modulated disease that results in a net loss of minerals from dental hard tissues.⁽¹²⁾ It involves high costs associated with treatment and significantly impacts the quality of life.⁽¹³⁾ Like obesity, caries is determined by biological, behavioral, psychosocial, and environmental factors.^(8,9) Excess sugar consumption is a common risk factor for obesity and dental caries.⁽¹³⁾ The WHO has developed guidelines to reduce the prevalence of NCDs, including the recommendation to reduce free sugar consumption to lower caries prevalence.⁽¹⁴⁾

Historically, various studies have evaluated the association between obesity/overweight and dental caries, with varying results. The great challenge is to systematically understand and consider the potential confounding factors (eating habits and socio-economic status) and modifying effects (age, oral hygiene, fluoride use).^(8,9) Obesity and dental caries share common risk factors: diet and lifestyle, among others. In addition, obesity is recognized as a metabolic risk factor for developing different systemic diseases. However, its impact on oral health has not been well studied.⁽⁸⁾ Obesity is highly prevalent in Uruguay in children and adolescents. Therefore, this review aims to iden-

tify and analyze the available literature on the potential association between obesity and dental caries in children and adolescents.

Method

In 2022, we conducted a review of the scientific literature published between 2012 and 2022 in PubMed, SciELO, Latindex, and Cochrane, in English, Spanish, and Portuguese, to identify articles with information about the association between obesity and dental caries in children and adolescents (ages 6 to 18).

The search strategy was developed for Medline via PubMed and adapted to be used in the other databases, including controlled vocabulary and free terms. The descriptors used were “Obesity (OR body mass index) AND caries AND children AND adolescence.” Two reviewers (FR and YI) independently identified the publications and selected them by title and abstract. They then read through the articles for the final selection. In case of disagreement, two external reviewers (LA and MCLJ) familiar with the review methodology provided their opinion.

Results

The search strategy resulted in 115 articles (113 from PubMed and 2 from Scielo), of which 48 articles were discarded due to repetition and 28 after analyzing the titles. Six articles were discarded after reading the abstracts and 5 after full reading, resulting in 28 articles being included in the review (Fig. 1).

Table 1 describes the 28 studies that met the inclusion criteria and were analyzed at full text. The following were included: 21 cross-sectional studies (5 from Europe, 11 from Asia, 4 from America and 1 from Oceania), 4 longitudinal studies (2 from America, 1 from Europe, and 1 from Asia), and 3 systematic reviews (2 from Europe and 1 from Oceania). The articles included in systematic reviews were excluded from this study.

Of the 21 cross-sectional studies, 4 showed an association between obesity and caries lesions (Saudi Arabia, Italy, China, and India), while only 1 of the longitudinal studies found such a connection (Hong Kong). The reviews included did not have meta-analyses. Hooley et al. (2012)⁽⁶⁾ included 49 articles in their review, of which 17 articles showed an association between obesity and dental caries, 23 studies reported

no association, and 9 presented an inverse relationship. Furthermore, in 2013, Gonzalez Munoz⁽¹⁵⁾ included 37 articles in their review, of which 19 articles showed an association, and 18 did not. The review conducted by Paisi⁽¹⁶⁾ included 88 papers; 26 reported an association, 43 did not, and 19 reported an inverse association between dental caries and obesity.

Fig.1. Flowchart. Literature review on the association between obesity and dental caries 2012/2022.

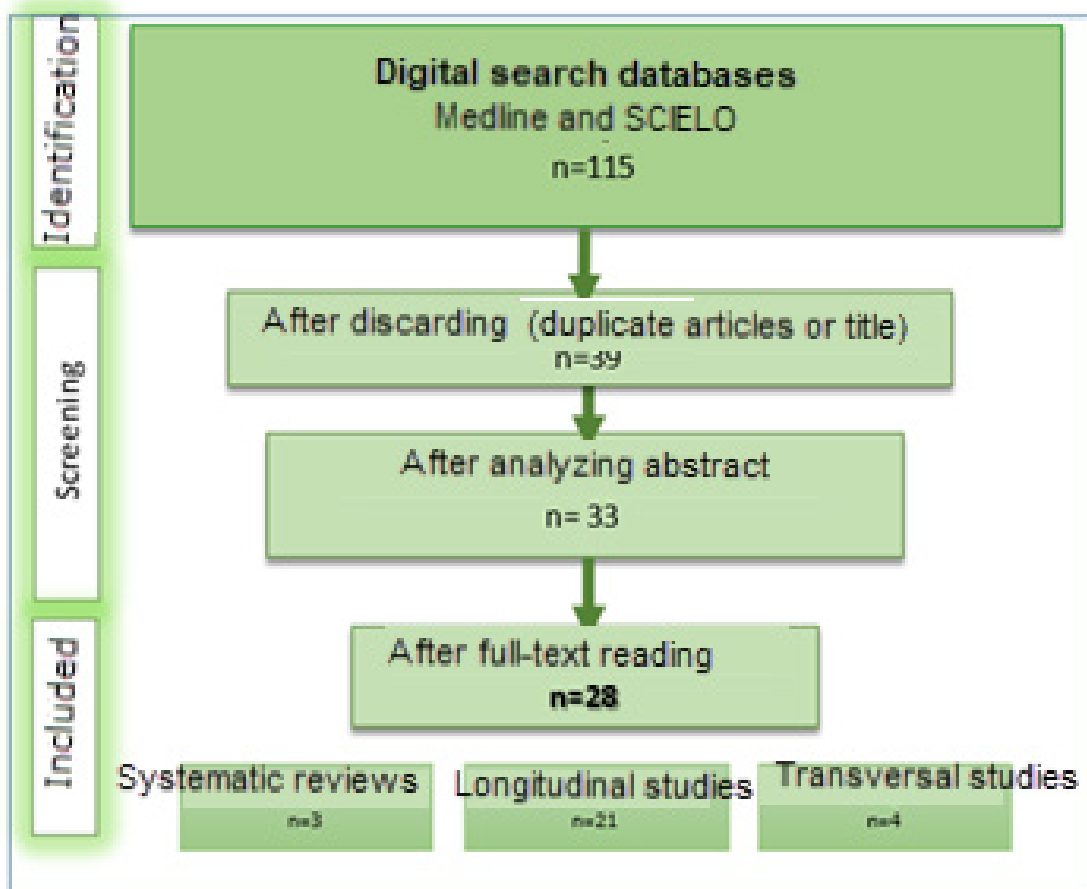


Table 1. Literature review on the association between obesity and dental caries 2012/2022

AUTHOR YEAR COUNTRY	TYPE OF STUDY	AGE (N)	INDEX CARIES	OBESITY*.	RESULTS
CAGETTI MG.et al. ⁽³⁹⁾ 2021 INDIA	TRANSVERSAL	6-14 (1474)	DMFT dmft	BMI (WHO) IOTF**	No association found
MILITI A et al. ⁽³⁸⁾ 2020 ITALY	TRANSVERSAL	6-16 (127)	DMFT	BMI (WHO) CDC ***	No association found
AL-ANSARI A.et al. ⁽¹⁹⁾ 2020 SAUDI ARABIA	TRANSVERSAL	12-15 (258)	DMFT	BMI (WHO) IOTF**	There is an association between obesity and tooth decay in Saudi Arabian males. RR= 2.33 (IC95%=1.07-5.04)
AL-ANSARI A,et al. ⁽²⁶⁾ 2019 SAUDI ARABIA	TRANSVERSAL Multicenter	12 (117coun-tries)	DMFT	BMI (WHO)	No association found
GUARÉ R O et al. ⁽³⁶⁾ 2019 BRAZIL	TRANSVERSAL	6-12 (91)	ICDAS	BMI (WHO) CDC ***	No association found
LARA-CAPI C.et al. ⁽²⁰⁾ 2018 ITALY	TRANSVERSAL	12-15 (464)	ICDAS	BMI (WHO) IOTF**	There is an association between overweight and the spread of caries in rural adolescents. RR= 1.78 (IC95%1.08-2.91)
KARKI S.et al. ⁽²⁴⁾ 2018 INDIA / FINLAND	TRANSVERSAL	5-15 (1135)	DMFT Dmft	BMI (WHO) IOTF**	NO association found at age 12
CHOUDHARY R. et al. ⁽²⁹⁾ 2017 INDIA	TRANSVERSAL	12-15 (1500)	DMFT	BMI (WHO) IOTF**	No association found
KHADRI FA et al. ⁽²⁵⁾ 2017 ARAB EMIRATES	TRANSVERSAL	11-17 (803)	DMFT	BMI (WHO) IOTF**	No association found
KUMAR S.et al. ⁽²⁷⁾ 2017 AUSTRALIA	TRANSVERSAL	11-14 (1092)	DMFT	BMI (WHO) IAP*****	No association found
QUADRI MF.et al. ⁽⁴⁰⁾ 2017 SAUDI ARABIA	TRANSVERSAL	6-15 (360)	DMFT dmft	BMI (WHO) CDC ***	No association found
LI W. et al. ⁽²²⁾ 2017 CHINA	TRANSVERSAL	7-17 (111792)	DMFT	BMI (WHO) IOTF**	No association found
KOTTAYI S et al. ⁽³⁰⁾ 2016 INDIA	TRANSVERSAL	12-15 (2000)	DMFT	BMI (WHO) IOTF**	No association found
DA SILVA AB. et al. ⁽¹⁰⁾ 2016 BRAZIL	TRANSVERSAL	3-15 (237)	DMFT dmft	BMI (WHO) CDC ***	No association found

AUTHOR YEAR COUNTRY	TYPE OF STUDY	AGE (N)	INDEX CARIES	OBESITY*.	RESULTS
MARKOVIC D.et al. ⁽²⁸⁾ 2015 SERBIA	TRANSVERSAL	6-18 (422)	DMFT dmft	BMI (WHO) CDC***	No association found
YAO et al. ⁽²¹⁾ 2014 CHINA	TRANSVERSAL	5-14 (67956)	DMFT	BMI (WHO) IOTF**	There is an association between BMI and CARIES OR= 1.908 (IC95%=1.75-2.079)
BICA I.et al. ⁽¹⁸⁾ 2014 PORTUGAL	TRANSVERSAL	11-17 (661)	DMFT	BMI (WHO) CDC***	No association found
TONG HJ.et al. ⁽³¹⁾ 2014 UNITED KINGDOM	TRANSVERSAL	7-15 (64)	DMFT	BMI (WHO) CDC***	No association found
FREITAS AR.et al. ⁽³²⁾ 2014 BRAZIL	TRANSVERSAL	12 (202)	DMFT	BMI (WHO) CDC***	No association found
ALVES LS. et al. ⁽³³⁾ 2013 BRAZIL	TRANSVERSAL	12 (1528)	DMFT	BMI (WHO)	No association found
SAKEENABI B.et al. ⁽⁷⁾ 2012 INDIA	TRANSVERSAL	6-13 (1550)	DMFT Ceo-d	BMI - WHO CDC***	There is an association between BMI and CARIES OR=3.6 (IC95%=2.5-4.32)
LOCK NC.et al. ⁽³⁷⁾ 2019 BRAZIL	LONGITUDINAL	12 (801)	DMFT DMFS	BMI (WHO) CDC***	No association found
HALL-SCULLIN EP. et al. ⁽³⁴⁾ 2018 UNITED KINGDOM	LONGITUDINAL	7-16 (2958)	DMFT dmft	BMI (WHO) UK90 SCORE	No association found
LI W.et al. ⁽²³⁾ 2017 HONG KONG	LONGITUDINAL	12 (282)	DMFT	BMI (WHO) IOTF**	There is an association between BMI and CARIES. OR 1.135 (IC95%=1.01- 1.28)
CHIU SH.et al. ⁽³⁵⁾ 2012 UNITED STATES	LONGITUDINAL	2-17 (157)	DMFT	BMI (WHO) CDC***	No association found
PAISI M. et al. ⁽¹⁶⁾ 2019 UNITED KINGDOM	SYSTEMATIC REVIEW	<18 (84)	DMFT	BMI (WHO) CDC*** IOTF**	Association exists=26 item No association found=43 items Inverse association -19 items
GONZÁLEZ MUÑOZ et al. ⁽¹⁵⁾ 2013 SPAIN	SYSTEMATIC REVIEW	0-18 (37)	DMFT dmft ICDAS	BMI (WHO)	Association exists=19 items No association found= 18 articles
HOOLEY M. et al. ⁽⁶⁾ 2012 AUSTRALIA	SYSTEMATIC REVIEW	8-18 (48)	DMFT dmft	BMI - WHO	Association exists=17 items No association found= 23 articles Inverse association=9 items

BMI Body mass index calculated according to WHO criteria: kg/m² // **IOTF =International Obesity Force // **IOTF =International Obesity Force

CDC= Center for Disease Control // *IAP Indian Academy of Paediatrics ∞ ECOG= European Childhood Obesity Group

Discussion

This review was conducted to find scientific evidence on the association between obesity and dental caries. The results were not consistent. The limitations found were associated with the type of study, most of which were transversal studies. This makes it impossible to establish a causal link. Other limitations seen in the search were the heterogeneity in the age range, the variability in the obesity subgroups, how caries lesions were recorded (caries lesions in initial stages were excluded), and finally, the systematization of lesion diagnosis. A positive factor to highlight is the universal use of the obesity and dental caries indexes used, always following WHO criteria. Childhood obesity is considered a public health problem worldwide. In Latin America, overweight/obesity affects 42.5 million children aged between 0 and 19, which makes it necessary to analyze its determinants and complications and develop action lines to solve it.⁽¹⁷⁾ The dramatic change in the world economy, globalization, and the resulting change in lifestyle have affected the prevalence of obesity and caries and their association pattern.^(16,17)

Lifestyle changes influence people's health. More than ever, processed foods, high carbohydrate consumption, and greater use of technology to the detriment of physical activity mark an increase in obesity prevalence in families.⁽¹⁷⁾ Various authors related obesity to family history of obesity and lack of exercise as the most relevant factors.^(18,19) Furthermore, parents' education level is a common risk factor for obesity and caries.⁽²⁰⁾ Diet determines the increased prevalence of obesity and caries, particularly the increased consumption of fermentable carbohydrates and the high consumption of free sugar.⁽¹⁶⁾ Therefore, the association suggesting that diet affects both diseases differently is well established.

Five studies have reported an association between obesity and dental caries.^(7,19-22,24) They describe the role of diet as a determinant in

obesity and caries due to high consumption of sugar and carbohydrates. Likewise, these studies related eating habits to the socio-economic status and geographic place of residence of the families, finding a statistically significant association with dental caries severity.⁽¹⁹⁻²¹⁾ The articles analyzed report that eating habits are the factors that contribute most to obesity and caries. However, it is necessary to reflect on the multifactorial nature of both diseases and how the causal factors interact in each situation. The literature usually includes the analysis of snack consumption in children and adolescents. Snacking between meals does not provide conclusive information on the total calories consumed or the consumption pattern.^(7,22)

The studies that found no association between obesity and dental caries clearly showed that untreated caries was common in individuals who did not brush frequently, and consumed sweet bakery products or sweets and tea with sugar frequently.⁽²³⁻²⁶⁾ As for socio-economic status and caries risk, the authors stated that those with high socio-economic status and overweight had a lower risk of developing dental caries.^(27,28) Similar results were found by Choudhary et al.,⁽²⁹⁾ Kottayi et al.,⁽³⁰⁾ Tong et al.,⁽³¹⁾ Freitas et al.,⁽³²⁾ Alves et al.,⁽³³⁾ Hall-Schullin et al.,⁽³⁴⁾ and Chiu et al.⁽³⁵⁾

The inverse relationship between obesity and dental caries (obesity and fewer carious lesions) was associated with consuming high-fat foods that favor obesity.^(36,37) Militi⁽³⁸⁾ highlighted decreased DMFT with increasing weight and age. One theory that explains the connection between low weight and caries is that untreated carious lesions affect masticatory ability, a major predictor of caries risk.⁽³⁸⁾ Weight gain was observed in the children who received treatment.⁽¹⁶⁾

In summary, our review found that there are still inconsistencies on the association between obesity and dental caries. The number of studies with negative results is greater.^(10,18,22,24-40) Higher BMI, age, high socio-economic status,

higher frequency of daily intakes, lack of physical activity, low frequency of brushing, and consumption of sugary drinks were identified as significant risk factors for caries in the studies analyzed in this review. On the other hand, authors such as Cagetti (2021)⁽³⁹⁾ report an association between low weight and caries, as well as Quadri et al.(2017),⁽⁴⁰⁾ who describe dental caries as a predicted independent variable for low weight.

Conclusions

The analysis of the studies on the association between obesity and caries shows inconsistent results. The multifactorial origin of the pathologies included in the study could partly explain the diversity of the results reported by the researchers. Further research is needed on the factors influencing a potential association between BMI and dental caries.

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The authors declare no conflict of interest.

Authorship contribution:

1. Conception and design of study
2. Acquisition of data
3. Data analysis
4. Discussion of results
5. Drafting of the manuscript
6. Approval of the final version of the manuscript

MFR has contributed in 1, 2, 3, 4, 5 y 6.

YI has contributed in 2, 3, y 6.

MCLJ has contributed in 1, 3, 4, 5 y 6.

LAL has contributed in 1, 3, 4, 5 y 6.

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