

Dental Caries in Relation to Obesity in Children: A Systematic Review and Meta-analysis

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Abstract

Background: Globally, almost 43 million children below five years of age carry excess body weight, 17% of adolescence and children are presently obese. The prevalence of obesity is about 40-60% because high diet calories in obese children lead to dental caries and teeth problems. **Aim:** This work aims to determine the relationship between dental caries with obesity in children. **Materials and Methods:** A systematic search was performed over different medical databases to identify Dentistry studies, which studied the outcome of Caries group versus Caries-free group of obese children. Using the meta-analysis process, either with fixed or random-effects models, we conducted a meta-analysis on the prevalence of obesity as a primary outcome, and on low socioeconomic standard as a secondary outcome. **Results:** Seven studies were identified involving 6886 patients, 3062 in the Caries group, and 3824 in the Caries-free group. The meta-analysis process revealed a highly significant increase in obesity and low socioeconomic standard in the Caries group compared to the Caries-free group ($p < 0.05$ respectively). **Conclusion:** To conclude, obesity and dental caries has become increasingly prevalent challenges to public health. Research results in the relationship between obesity and dental caries in children have been mixed and inconclusive.

Keywords: Dental caries; Obesity; Children

Introduction

Dental caries is one of the global health issues in both industrialized and developing communities. But dental caries prevalence and prevalence are more reported in developing countries. Dental caries is an age-associated disease involving approximately 60–90% of schoolchildren. Caries is an outcome of numerous interplaying factors such as cultural, social, and political factors, which in turn rule the individual behaviors and commitment to preventive oral hygiene measures. ^[1]

Childhood obesity has emerged as a worldwide health problem and is related to precursors of adult illnesses which include cardiovascular disorder and type II diabetes. Globally, almost 43 million children below five years of age carry excess body weight, 17% of adolescence and children are presently obese. The increasing hazard of obesity for younger humans is of particular concern due to the fact studies have suggested that childhood obesity predicts adult obesity. ^[2]

Obesity and overweight and are serious public health problems in children. The incidence of obesity increased worldwide in all ages and socio-economic groups. The prevalence of obesity is about 40-60%. because high diet calories in obese children lead to dental caries and teeth problems. ^[3]

Regular dental attendance has been one of the key recommendations of dental specialists. Longitudinal research found that regular dental attendance is linked with better oral health outcomes even after adjusting for the effect of social status. Limitations to dental attendance are thought to be one

mechanism through which children in low-income families develop a higher incidence of dental caries than those living in high-income households. In addition to the early detection and treatment of dental disorder, preventive dental attendance has been considered an opportunity for the provision of fluoride varnish treatments in addition to increasing awareness of dental and general health problems. ^[4]

This work aims to determine the relationship between dental caries with obesity in children.

Literature Review

Our review came following the (PRISMA) statement guidelines. ^[5]

Study eligibility

The included studies should be in English, a journal published article, and a human study describing dental caries children. The excluded studies were non-English or animal studies or describing adult patients.

Study identification

Basic searching was done over the PubMed, Cochrane library,

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and Google scholar using the following keywords: Dental caries, Obesity, Children.

Data extraction and synthesis

RCTs, clinical trials, and comparative studies, which studied the outcome of Caries group versus Caries-free group of children with dental caries, will be reviewed. Outcome measures included, obesity (body mass index BMI>30) (as a primary outcome), and low socioeconomic standard (as a secondary outcome).

Study selection

We found 280 records, 223 excluded based on title and abstract review; 57 articles are searched for eligibility by full-text review; 20 articles cannot be accessed; 19 studies were reviews and case reports; 11 were not describing the desired outcome; leaving 7 studies that met all inclusion criteria.

Statistical methodology

The pooling of data, Proportions (%), Odds Ratios (ORs), Standard Mean Differences (SMDs), with 95% confidence intervals (CI) were done, using MedCalc ver. 18.11.3 (MedCalc, Belgium). According to heterogeneity across trials using the I²-statistics; a fixed-effects model or random-effects model were used in the meta-analysis process.

Results

The included studies published between 2007 and 2020. Regarding the type of included studies, 5 studies (out of 7 studies) were cross-sectional and 2 studies were retrospective [Table 1].^[6-12]

Regarding patients' characteristics, the total number of patients in all the included studies was 6886 patients, with 3062 patients

in the Caries group, and 3824 patients in Caries-free group [Table 1].

The mean age of all patients was (8.5 years) [Table 1].

A meta-analysis study was done on 7 studies that described and compared the 2 different groups of patients; with an overall number of patients (N=6886) [Table 2].^[6-12]

Each outcome was measured by:

Odds Ratio (OR)

- For obesity.
- For low socioeconomic standards.

Concerning the primary outcome measure, we found 7 studies reported the prevalence of obesity with a total number of patients (N=6886). I² (inconsistency) was 92% with a highly significant Q test for heterogeneity (p<0.0001), so random-effects model was carried out; with overall OR=2.12 (95% CI=1.167 to 3.872).

Using the random-effects model, the meta-analysis process revealed a significant increase in obesity in the Caries group compared to the Caries-free group (p=0.014) [Figure 1].

Concerning the secondary outcome measure, we found 4 studies reported low socioeconomic standards with a total number of patients (N=2966).

I² (inconsistency) was 0% with a non-significant Q test for heterogeneity (p>0.05), so fixed-effects model was carried out; with overall OR=1.46 (95% CI=1.24 to 1.73).

Using the fixed-effects model, the meta-analysis process revealed a highly significant increase in low socioeconomic standards in the Caries group compared to the Caries-free group (p<0.001) [Figure 2].

Table 1: Patients and study characteristics.

S. No	Authors	Type of study	Number of patients			Age (Average years)
			Total	Caries group	Caries-free group	
1	Sadeghi et al. ^[6]	Cross-sectional	633	432	201	9
2	Oliveira et al. ^[7]	Cross-sectional	1016	238	778	3
3	Vázquez-Nava et al. ^[8]	Cross-sectional	1074	266	808	4.5
4	Sakeenabi et al. ^[9]	Retrospective	1550	448	1102	10
5	Mangukia et al. ^[10]	Cross-sectional	400	306	94	10
6	Hall-Scullin et al. ^[11]	Retrospective	2213	718	1495	14
7	Pérez et al. ^[12]	Cross-sectional	522	417	105	9.5

#Studies arranged via publication year.

Table 2: Summary of outcome measures in all studies.

S. No	Authors	Primary outcome (Obesity)		Secondary outcome (Low socio-economic standard)	
		Caries group	Caries-free group	Caries group	Caries-free group
		1	Sadeghi et al. ^[6]	107	15
2	Oliveira et al. ^[7]	10	8	79	204
3	Vázquez-Nava et al. ^[8]	90	282	---	---
4	Sakeenabi et al. ^[9]	39	77	266	550
5	Mangukia et al. ^[10]	6	1	64	9
6	Hall-Scullin et al. ^[11]	376	342	---	---
7	Pérez et al. ^[12]	78	14	100	22

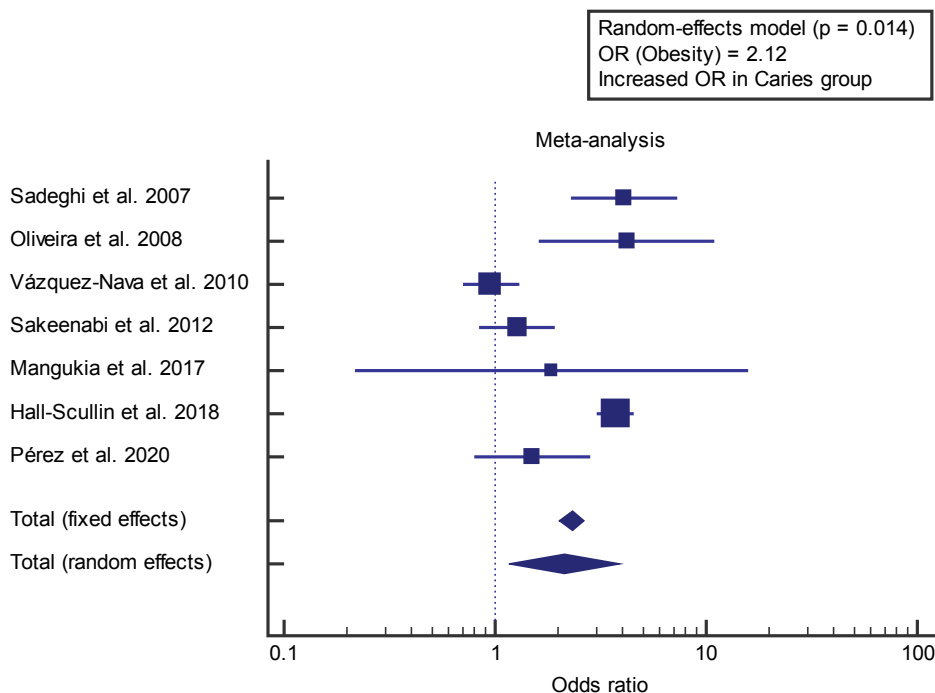


Figure 1: Forest plot demonstrating (Obesity).

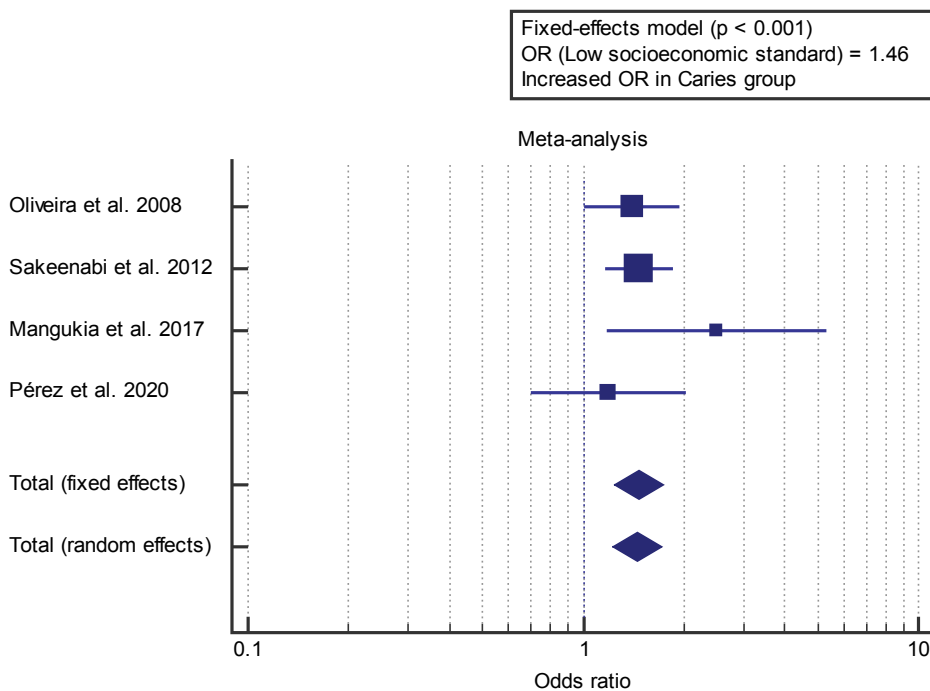


Figure 2: Forest plot demonstrating (Low socio-economic standard).

Discussion

This work aims to determine the relationship between dental caries with obesity in children. The included studies published between 2007 and 2020. Regarding the type of included studies, 5 studies (out of 7 studies) were cross-sectional and 2 studies were retrospective. Regarding patients' characteristics, the total number of patients in all the included studies was 6886 patients, with 3062 patients in the Caries group, and 3824 patients in Caries-free group. The mean age of all patients was (8.5 years). A meta-analysis study was done on 7 studies that described and

compared the 2 different groups of patients; with an overall number of patients (N=6886).

Concerning the primary outcome measure, we found 7 studies reported prevalence of obesity with a total number of patients (N=6886). Using the random-effects model, the meta-analysis process revealed a significant increase in obesity in Caries group compared to Caries-free group ($p=0.014$), which came in agreement with Manohar et al.,^[13] Hayden et al.,^[2] Shen et al.^[14] and Soares et al.^[15]

Manohar et al. reported that a random outcomes model meta-

analyses had been applied. Nine studies have been included in this review. Children with overweight and obesity had significantly better dental caries experience in comparison with youngsters with normal weight (n=6). The pooled estimates showed that differences in caries experience among the two groups became statistically significant. [13]

Hayden et al. reported that generally, a significant relationship among childhood obesity and dental caries (effect size=0.104, P=0.049) was found. While analyzed by dentition type (primary as opposed to permanent), there has been a non-significant association of obesity and dental caries in primary and permanent dentitions, but on accounting only for standardized definitions for evaluation of child obesity the usage of frame mass index, a strong significant relationship was evident in children with permanent dentitions. [2]

Shen et al. reported that children with a prevalence of intense caries had higher odds for prevalence thinness (OR: 4.08 ;). The baseline incidence of severe caries was no longer significantly associated with prevalence thinness. Individuals with severe caries at baseline had higher odds for prevalence overweight (OR: 2.33). [14]

Soares et al. reported that overall of 285 children (96.0%) participated via to the end of the study. Dropouts were due to a lack of cooperation on the part of children during the evaluations and were distributed as follows: 5 from the underweight institution, 4 from the ideal weight group, and 3 from the overweight/obesity group. No significant variations amongst groups had been observed concerning the child's age, child's sex, mother's schooling, MP masticatory performance period, or ST swallowing threshold period. Widespread variations between groups were observed concerning monthly household income, the number of teeth with cavitated dental caries, the X50 of MP, and the ST. Inside the easy linear regression evaluation, the following independent variables were significantly related to BMI: monthly household income (β =zero.281), mother's schooling (β =0.192), number of cavitated teeth (β =0.126), MP (β =0.169), ST (β =; 95% CI: 0.134 to 0.413), number of chewing cycles until reaching the ST (β =-0.123) and ST duration (β =-0.121). In the very last more than one regression model, BMI was influenced by monthly family income, the number of teeth with cavitated dental caries (β =-0.180), and the ST (β =0.304). [15]

On the other side, our study came in disagreement with Kumar et al. [16] Kumar et al. reported that a total of 1,092 subjects returned questionnaires and were clinically examined (giving a response rate of 85%). There were no tremendous differences in caries incidence and experience across the categories of BMI. But, caries incidence and experience in obese children were 24.8% and 0.69 ± 1.51 , respectively, even as the corresponding values in normal-weight kids were 35% and 0.85 ± 1.50 , respectively. Among children of high-SES families, obese children had about 71% fewer caries than did people who were normal weight, incidence rate ratio (IRR). [16]

Concerning the secondary outcome measure, we found 4 studies

reported low socioeconomic standards with a total number of patients (N=2966).

Using the fixed-effects model, the meta-analysis process revealed a highly significant increase in low socioeconomic standard in Caries group compared to Caries-free group ($p < 0.001$), which came in agreement with Engelmann et al., [17] Eid, Khattab, and Elheeny, [1] Manohar et al., [13] Chi, Luu, and Chu [18] and Cianetti et al. [19]

Engelmann et al. reported that the variables income, parents' educational level showed a significant association with the incidence of dental caries and untreated dental caries. Considering the family income, the gradient in the prevalence of the ailment was observed. For example, children belonging to the 3rd tertile of the sample, representing the richest, and those belonging to the second tertile, representing the middle level, presented a 50% (OR 0.50) and 39% (OR 0.61) respectively lower chance to have untreated dental caries when compared to the 1st tertile, which involved the poorest children. [17]

Eid, Khattab, and Elheeny reported that Poisson regression analysis demonstrates that early children whom their mothers with a lower level of education and of low socioeconomic status have been 1.41 and 1.27 times respectively had higher severity of dental caries scores while as compared with their peers. [1]

Manohar et al. reported that low levels of parental income and education have been identified to be associated with both conditions in the sample population. Children with obese and weight problems are more vulnerable to dental caries. Low levels of parental income and education influence the relationship between the two situations. [13]

Chi, Luu, and Chu reported that studies reported conflicting findings regarding obesity risk and type of school (private versus public school). Other studies reported the following factors (potential proxies for socioeconomic status) as being associated with childhood obesity that is additionally a hazard factor for dental caries. [18]

Cianetti et al. reported that a pattern of 231 children (mean age 8.1 years, SD 2.6; 127 males, 104 females) became recruited. One hundred and sixty-three (70.46%) children in observe had caries. Caries presence in children was higher in children where the mothers' socio-economic level was decreased (OR=6.1), in children where the fathers' socioeconomic degree become decrease (OR=2.9) and in children with decrease family income (OR=9.9). [19]

Conclusion

To conclude, obesity and dental caries have become increasingly prevalent challenges to public health. Research results in the relationship between obesity and dental caries in children have been mixed and inconclusive.

Competing Interests

The authors declare that they have no competing interests. All the listed authors contributed significantly to the conception and

design of study, acquisition, analysis, and interpretation of data and drafting of the manuscript, to justify authorship.

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