Meta Analysis: Relationship between Obesity and Dental Caries in Children

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ABSTRACT

Background: Caries is an oral disease that often affects children around the world. The oral disease is related to several etiological factors with indicators of nutritional status, such as obesity and malnutrition. Studies linking overweight/obesity and caries experience in children have proved contradictory so far, the results including positive association, no association and inverse association. Therefore, this study aims to estimate the relationship between obesity and caries in children based on the results of several previous studies.

Subjects and Method: This was a systematic study and meta-analysis. The search for articles was carried out by considering the eligibility criteria determined using the PICO model. The study population was children aged 6-15 years old with an intervention in the form of obesity, normoweight comparison and caries outcome. This article was collected for 3 weeks. The keywords to search for articles were as follows: "obesity" OR "overweight" AND "dental caries" AND "children". The articles included in this study are full text articles with a cross sectional research design from 2012 to 2022. Articles were collected using the PRISMA flow chart. Articles were analyzed using the Review Manager 5.3 application.

Results: A total of 9 articles contained in this study, including 3 articles from Brazil which is the continent of South America, 2 articles from Mexico which is the continent of North America, 1 article from Nigeria which is the African continent, 2 articles from China and 1 article from Arabia which is the continent of Asia. The results showed that obesity can reduce the incidence of dental caries in children by 0.82 times higher compared to children with normal weight (aOR= 0.82; 95% CI= 0.45 to 1.52; p= 0.540)

Conclusion: Meta-analyses show that overweight and obese children have a lower risk of developing early childhood caries.

Keywords: Obesity, Overweight, Caries Dental, Children

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BACKGROUND

Child obesity, overweight and malnutrition are public health challenges in this century. Nutrition is necessary for the normal growth and development of children and adolescents. The relationship between nutrition or diet and many systemic diseases during childhood and its relationship to

oral health, has been extensively investigated by many researchers.

Caries and gingivitis are oral diseases that often affect children worldwide. Both oral diseases are related to several etiological factors with indicators of nutritional status, such as obesity and malnutrition. These factors include dietary habits, socio-economic determinants, and the presence of dental biofilm (Barbosa et al, 2021)

Caries is a common oral disease in children, affecting all socio-economic strata. However, the prevalence in socioeconomic groups varies in other countries. The study by Henshaw reported that caries prevalence was higher among children of higher socioeconomic class than lower class in most developing countries, and this was attributed to dietary factors. Studies also show that the prevalence of caries among children in developing countries varies with biological and environmental factors such as gender, birth rank, socioeconomic status, parents, oral health status, oral health practices and fluoride levels in water (Chukwumah, 2012).

Research in Brazil show that socio-economic factors and perinatal events are important determinants of oral health status in children (Junior, et al 2014). Various studies have reported an association between caries and obesity, showing that children with obesity experience more caries than children in the normal weight group. In the study of Hayden et al (2013) as cited in an article by Perez (2020) showed a meta-analysis on this relationship, concluding that there is evidence of an association between obesity and dental caries in permanent teeth in industrialized countries. However, a study conducted on obese children in Kuwait revealed a lower prevalence of caries, whereas a study conducted on schoolchildren in Brazil found no

association between caries and being overweight or obese (Perez et al, 2020)

Studies that linked overweight/ obesity and caries experience in children aged 6-12 years old have proved contradictory so far, the results including positive association, no association and inverse association. A recent systematic review of the literature demonstrated the lack of significant differences in the prevalence of caries between abnormal and normal in underweight children and adolescents in both teeth. Therefore, it is important to investigate the confounding factors associated between caries and body mass index (Guare et al, 2019).

The results of a study in Guangzhou, China showed that children who are at risk of being overweight and obese generally had lower rates of caries experience than other normal weight children (Liang et al, 2016). Based on the results of previous studies on dental and oral health problems, especially caries in children with obesity, the researchers were interested in studying the relationship between obesity and caries. The data obtained were analyzed using a systematic review and meta-analysis in an effort to obtain a comprehensive understanding.

The purpose of this study was to determine the relationship between obesity and caries in children.

SUBJECTS AND METHOD

1. Study Design

This study used a meta-analysis study design. This study was conducted by searching, examining, identifying and selecting secondary data from previous observational studies in the period of 2012-2022. Data from clinical trials conducted worldwide with different locations. The data was searched from several databases including Pubmed and Google Scholar. The keywords used in the search were "obesity"

OR "overweight" AND "caries dental" AND "children". The duration of the study search was carried out for 3 weeks. This study followed the eight-step guideline of systematic review and meta-analysis adapted from the PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-analyses).

2. Inclusion Criteria

In this study, the inclusion criteria were full text articles which were an observational study, original articles in English, using a cross sectional study design, study subjects were children aged 6-15 years old. Articles published in 2012-2022.

3. Exclusion Criteria

Articles published before 2012 and articles published in languages other than English.

4. Operational Definition of Variable

In formulating the problem, the researchers used PICO. The population in this study were children aged around 6-13 years old. The intervention was obesity. Obesity is a medical condition that is described as being overweight in the form of fat which is characterized by a BMI of 30. The compa-

rison in this study was not obese or normal weight. The outcome in this study was caries or cavities.

5. Study Instrument

Assessment of article quality was carried out using the Critical Appraisal Checklist for Cross-sectional Study (CEBMa, 2019).

6. Data Analysis

The data were analyzed by using the Review Manager application (RevMan 5.3). The results of data analysis in the form of effect sizes and study heterogeneity. The results of the meta-analysis data processing were presented in forest plots and funnel plots.

RESULTS

The process of searching for articles through the database can be seen in Figure 1. There were 633 articles identified from the database, after the article deletion process, 308 articles were issued and 187 of them met the requirements for a full text review. Articles were excluded for several reasons, therefore, 9 articles were included in the synthesis study and meta-analysis.
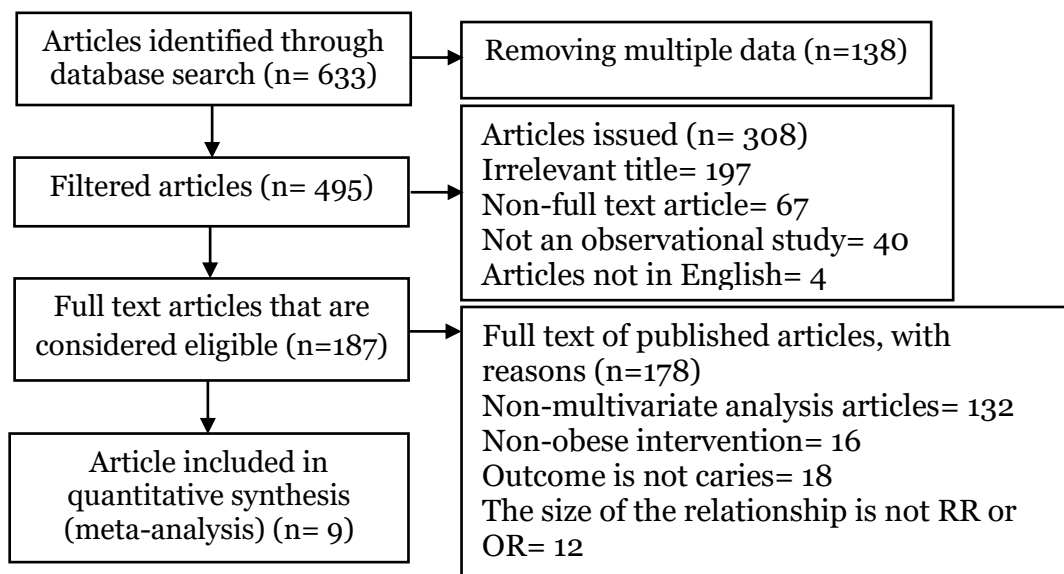
Articles identified through database search (n= 633) → Removing multiple data (n=138)

Filtered articles (n= 495) → Articles issued (n= 308)
Irrelevant title= 197
Non-full text article= 67
Not an observational study= 40
Articles not in English= 4

Full text articles that are considered eligible (n=187) → Full text of published articles, with reasons (n=178)
Non-multivariate analysis articles= 132
Non-obese intervention= 16
Outcome is not caries= 18
The size of the relationship is not RR or OR= 12

Article included in quantitative synthesis (meta-analysis) (n= 9)

Figure 1. PRISMA flow Chart

Table 1. Assessment of study quality published by the Critical Appraisal Skills Program (CASP)

No	Indicators	Barbosa et al. (2021)	Chukwumah et al. (2012)	Garcia et al. (2020)	Guare et al. (2019)	Junior et al. (2014)	Liang et al. (2016)	Perez et al. (2020)	Ravi et al. (2021)	Yao et al. (2014)
1	Does the study address clearly focused questions/problems?	1	1	1	1	1	1	1	1	1
2	Is the study method (study design) suitable to answer study questions?	1	1	1	1	1	1	1	1	1
3	Is the subject selection method clearly explained?	1	1	1	1	1	1	1	1	1
4	Is the sampling method free of bias (selection)?	1	1	1	1	1	1	1	1	1
5	Is the study sample taken representative of the designated?	1	1	1	1	1	1	1	1	1
6	Is the sample size based on pre-study considerations?	0	0	1	1	1	1	1	0	0
7	Is a satisfactory response rate achieved?	1	1	1	1	1	1	1	1	1
8	Is the research instrument valid and reliable?	1	1	1	1	1	1	1	1	1
9	Is statistical significance assessed?	1	1	1	1	1	1	1	1	1
10	Is a confidence interval given for the main outcome?	1	1	1	1	1	1	1	1	1
11	Have confounding factors been taken into account?	0	0	1	1	0	1	1	1	0
12	Are the results applicable to your research?	1	1	1	1	1	1	1	1	1
	Total	**10**	**10**	**12**	**12**	**11**	**12**	**12**	**11**	**10**

Note:
2: Yes; 1: Can't Tell; 0: No

Table 2. Summary of primary research related to alcohol consumption and cardiovascular disease

No	Author (year)	Country	Study Design	Sample	P Population	I Intervention	C Comparison	O Outcome	aOR (95%CI)
1	Barbosa et al. (2021)	Brazil	Cross Sectional	353	Children aged 8-11 years old	Obese	Normoweight	Caries	0.42 (0.15 to 1.00)
2	Perez et al. (2020)	Mexico	Cross Sectional	522	Children aged 8-12 years old	Obesity	Normoweight	Dental Caries	0.53 (0.31 to 0.89)
3	Guare et al. (2019)	Brazil	Cross Sectional	91	Children aged 6-11 years old	Overweight	Normoweight	Caries	0.61 (0.15 to 2.49)
4	Chukwumah et al. (2012)	Nigeria	Cross Sectional	210	Children aged 7-15 years old	Obesity	Normoweight	Dental Caries	0.64 (0.05 to 8.61)
5	Liang et al. (2016)	China	Cross Sectional	32,461	Children aged 7-9 years old	Obesity	Normoweight	Dental Caries	0.66 (0.59 to 0.74)
6	Yao et al. (2014)	China	Cross Sectional	67,956	Children aged 5-14 years old	Obesity	Normoweight	Dental Caries	2.09 (1.92 to 2.18)
7	Garcia et al. (2020)	Mexico	Cross Sectional	600	Children aged 8-12 years old	Obesity	Normoweight	Dental Caries	0.53 (0.31 to 0.89)
8	Ravi et al. (2021)	Saudi Arabia	Cross Sectional	302	Children aged 6-14 years old	Obese	Normoweight	Dental Caries	0.30 (0.16 to 0.57)
9	Junior et al. (2014)	Brazil	Cross Sectional	320	Children aged 3-4 years old	Obesity	Normoweight	Caries	6.24 (3.06 to 12.72)

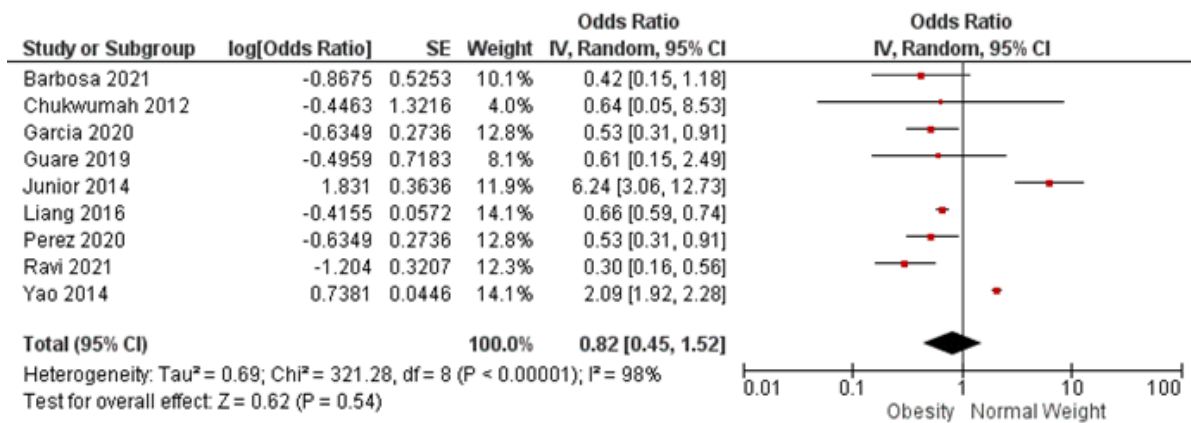**Figure 2. Map of study area**

Figure 3. Forest plot of the relationship between obesity and dental caries in children
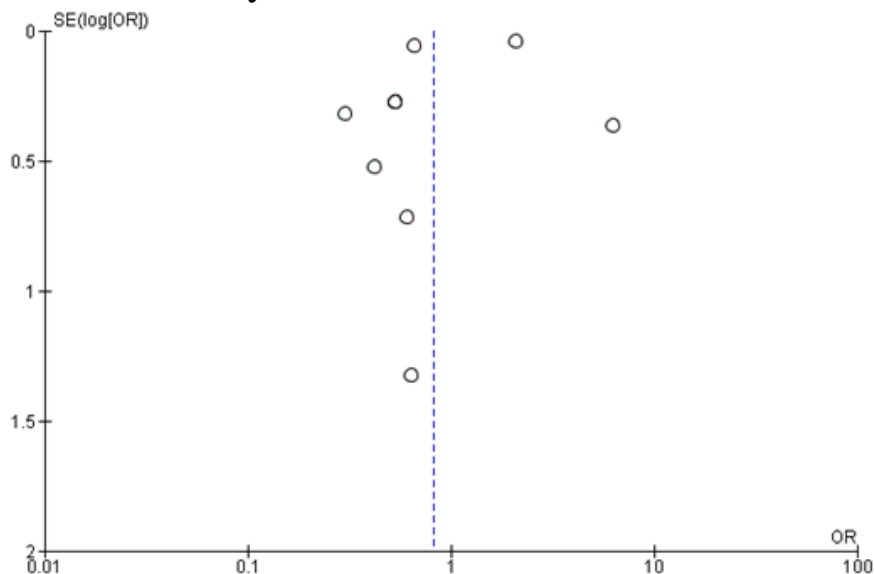

Figure 4. Funnel plot of the relationship between obesity and dental caries in children

The results from the forest plot (Figure 3) showed that obesity can reduce the incidence of caries in children by 0.82 times compared with normal weight children (aOR 0.82; 95% CI 0.45 to 1.52; with p= 0.54). The heterogeneity of the study data showed I²= 98%, so that the distribution of the data was heterogeneous (random effect model).

The funnel plot (Figure 4) showed a publication bias indicated by the symmetrical distribution of right and left plots, where there were 6 plots on the left (over-estimated), and 2 plots on the right.

DISCUSSION

This study is a systematic review and meta-analysis about the relationship between obesity and caries in children. This systematic review and meta-analysis study used research that controls for confounding factors which can be seen from the inclusion requirements of the study, namely using multivariate analysis and the reported statistical results are adjusted odd ratio (aOR).

The combined results of the relationship between obesity and caries in children were processed using the RevMan 5.3 application, while the results of a systematic review and meta-analysis of this study were presented in the form of forest plots and funnel plots.

The results of a meta-analysis of cross-sectional studies showed that obesity can reduce the incidence of caries in children by 0.82 times compared with children with normal weight (aOR= 0.82; 95% CI= 0.45 to 1.52; p= 0.54).

This study is strengthened by Yang et al (2015) which stated that there is a relationship between obesity and caries in children. Several investigators found that thin children had a statistically higher caries prevalence than normal weight children. They assume that thin children are picky eaters and the types of food they consume are unhealthy so that it does not increase their appetite and cause underweight and increase the risk of caries. In addition, the feeling of pain and discomfort from untreated caries prevents children from eating and leads to underweight (Norberg et al., 2012).

Dubois et al. (2007) mentioned that the results of this systematic review showed that there is a relationship between overweight/ obesity and caries, but the strength of the association should be interpreted with caution due to the heterogeneity of the studies. Thus, all dental and oral health workers can provide education, prevention and treatment to pediatric patients who are underweight about the risk of caries.

AUTHOR CONTRIBUTION
All authors have a role in selecting topics, tracking, collecting data, reviewing study documents, and analyzing data

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CONFLICT OF INTEREST
There was no conflict of interest in this study

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