



Original / *Obesidad*

## The relationship between dental caries and obesity among primary school children aged 5 to 14 years

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### Abstract

**Background:** Previous study revealed that the link between dental caries and obesity has been controversial. The purpose of this research is to investigate the association between dental caries and obesity among primary school children in Wannan area, China.

**Methods:** A cross-sectional study was designed to collect the routine health screening data for primary school children aged 5-14 years in Wannan area, China. Overweight and obesity status were determined using the International Obesity Task Force standard (IOTF) BMI cut-off points. Caries status was recorded based on WHO recommendations.

**Results:** Our results revealed that the overall caries prevalence of the subjects was 44.9%, Maximum number of caries affected children belonged to underweight and normal group, followed by overweight, and the least number was obesity. These differences were statistically significant (chi-square test,  $P < 0.001$ ). Children with obesity were 1.908 times (OR = 1.908; CI95% = 1.750, 2.079) more likely have caries than children with underweight or health weight. Overweight children were 1.547 times (OR = 1.547; CI95% = 1.479, 1.618) more likely to have caries than children with underweight or health weight. After adjusted the gender and age, a statistically significant association was also observed between body mass index categories and caries.

**Conclusions:** Obesity may have a significant effect on caries prevalence of primary school children in Wannan area, China. The importance of obesity should not only be emphasized with respect to general diseases but also with regard to carious lesions.

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Key words: *Dental caries. Primary school children. Obesity. Overweight. China.*

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### LA RELACIÓN ENTRE CARIES DENTAL Y OBESIDAD EN LOS NIÑOS DE ESCUELA PRIMARIA CON EDADES ENTRE 5 Y 14 AÑOS

#### Resumen

**Antecedentes:** Un estudio previo reveló que la asociación entre la caries dental y la obesidad es controvertida. El propósito de esta investigación fue investigar la asociación entre la caries dental y la obesidad en niños de escuela primaria en el área de Wannan, China.

**Métodos:** Se diseñó un estudio transversal para recoger los datos del chequeo rutinario de salud de los niños de escolarización primaria con edades de 5-14 en el área de Wannan, China. Se determinó el estado de sobrepeso y obesidad utilizando los puntos de corte estándar del IMC del Grupo de Trabajo Internacional en Obesidad (GTIO). El estado de las caries se registró de acuerdo con las recomendaciones de la OMS.

**Resultados:** Nuestros resultados revelaron que la prevalencia global de caries en los sujetos fue del 44,9%. El máximo número de niños afectados por las caries estaba en los grupos normal y con peso bajo, seguido por el grupo con sobrepeso y por último en el grupo de obesidad. Estas diferencias fueron estadísticamente significativas (test Chi-cuadrado,  $P < 0,001$ ). Los niños con obesidad fueron 1.908 veces (OR = 1,908; IC 95% = 1,750, 2,079) más probable tener la caries que los niños con bajo peso o de peso de salud. Los niños con sobrepeso tenían una probabilidad 1,547 veces superior (OR = 1,547; IC al 95% = 1,479, 1,618) de tener caries dental que los niños con un peso bajo o normal. Tras ajustar por sexo y edad, también se observó una asociación estadísticamente significativa entre el índice de masa corporal y la caries.

**Conclusiones:** La obesidad puede tener un efecto significativo sobre la prevalencia de caries en niños en escolarización primaria en el área de Wannan, China. No sólo se debería poner el énfasis de la importancia de la obesidad en relación con las enfermedades generales sino también en relación con las lesiones cariales.

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Palabras clave: *Caries dental. Niños de escuela primaria. Obesidad. Sobrepeso. China.*

## Introduction

Dental caries and obesity constitute important health problems worldwide and have been associated with a great number of negative health outcomes<sup>1,3</sup>. Dental caries is a chronic disease which can affect us at any age. If untreated, it can lead to pain and discomfort and finally loss of teeth. Dental caries has a multifactor etiology. The risk of dental caries can be evaluated by analyzing and integrating several causative factors such as fluoride, microbial plaque, diet, bacterial and salivary activity, and social and life style related behavioral factors<sup>4,5</sup>.

In recent decades, the prevalence of obesity risen steeply world wide<sup>6,7</sup>. Obesity is associated with breast cancer<sup>8</sup>, asthma<sup>9,10</sup>, diabetes mellitus<sup>11,12</sup>, hypertension<sup>13</sup>, coronary artery disease<sup>14</sup>, and dental caries<sup>15-17</sup>. Previous study showed that the prevalence of obesity in Chinese children and adolescents was considered to be still relatively low<sup>18</sup>. However, research recently found that rapid increasing of both obesity and overweight, in both urban and rural areas would arouse special attention<sup>19,20</sup>.

However, there have been little studies documented in literature in this part of China assessing the prevalence of dental caries in relation to obesity. Thus, cross-sectional study was designed to assess the prevalence of dental caries in relation to obesity in 5- 14 year-old school children in Wannan area, China.

## Methods

### *Subjects and Methods*

#### Participants

A population-based cross-sectional study was conducted among primary school children for routine health screening from 2009 to 2013. A total of 67956 subjects (36,664 male and 31,292 female) aged 5-14 years were recruited in this study. All subjects agreed to provide their personal information regarding the purpose and the procedures of our study. This study was approved by local ethics committee.

#### *Anthropometric measurements*

Height was measured to the nearest 0.1 cm with a standard stadiometer following study protocols, and weight in kilograms was measured in light clothing to the nearest 0.1 kg on an electronic scales. All anthropometric data were collected by trained staff and supervised by the school nurse. BMI was computed using the following standard equation:  $BMI = \text{Weight in kg} / \text{height squared in meter}$ .

## *Definitions*

Overweight and obesity were defined using the International Obesity Task Force standard (IOTF) body mass index cut-off points established for children<sup>21</sup>. These cut-off points are based on health related adult definitions of overweight ( $\geq 25 \text{ kg/m}^2$ ) and obesity ( $\geq 30 \text{ kg/m}^2$ ) but are adjusted to specific age and sex categories for children<sup>21</sup>. Caries status was recorded based on WHO recommendations<sup>22</sup>. A single trained and calibrated examiner performed comprehensive clinical examination with the assistance of one recorder. Children were made to sit on the chair and examination was conducted under bright daylight.

## *Ethical consideration*

All respondents agreed to take part in this study. According to local and international guidelines on ethics considerations in research involving human participants, this study was approved by local ethics committee.

## *Statistical analysis*

Excel software was performed to describe the characteristics of study population. The difference in caries prevalence of children according to year, age, grade and body mass index categories was tested using chi-square test. Relationships between year, grade, body mass index categories and dependent variable dental caries were assessed using multivariate logistic regression. Adjusted odds ratios (OR) and their 95% confidence intervals (CI) were calculated. In evaluating the association, we adjusted for the following confounders: gender and age. A line graph was drawn for caries prevalence of boys and girls among children by age and year. A value of  $P < 0.05$  was considered statistically significant.

## Results

A total of 67,956 subjects (36,664 male and 31,292 female) aged 5-14 years were recruited in this study.

The characteristics of study population are shown in table I.

Caries prevalence of children according to year, age, grade and body mass index categories are shown in table II. The overall caries prevalence of the subjects was 44.9%, caries prevalence of boys and girls are showed in figure 1 and figure 2. Maximum number of caries affected children belonged to underweight and normal group, followed by overweight, and the least number was obesity. These differences were statistically significant (chi-square test,  $P < 0.001$ ).

**Table I**  
*Characteristics of study population*

Variable	Male		Female		Total	
	n	%	n	%		
Year	2009	9054	24.7	7778	24.9	16832
	2010	9166	25.0	7814	25.0	16980
	2011	9248	25.2	7870	25.2	17118
	2012	9196	25.1	7830	25.0	17026
Age years	5	13	0.0	34	0.1	47
	6	3116	8.5	3082	9.8	6168
	7	5561	15.2	4855	15.5	10416
	8	5855	16.0	4901	15.7	10756
	9	6111	16.7	5317	17.0	11428
	10	6267	17.1	5443	17.4	11710
	11	6571	17.9	5489	17.5	12060
	12	2934	8.0	2021	6.5	4955
	13	204	0.6	125	0.4	329
	14	32	0.1	25	0.1	57
Grade	one	5541	15.1	4828	15.4	10369
	two	5724	15.6	4836	15.5	10560
	three	5916	16.1	4982	15.9	10898
	four	6172	16.8	5291	16.9	11463
	five	6472	17.7	5530	17.7	12002
	six	6839	18.7	5825	18.6	12664
Caries	Yes	16307	55.5	14196	54.6	30503
	No	20357	44.5	17096	45.4	37453
Body mass index categories	Underweight or health weight	28265	77.1	27536	88.0	55801
	overweight	6485	17.7	3180	10.2	9665
	obesity	1914	5.2	576	1.8	2490

Table III provide unadjusted and adjusted ORs of dental caries by year, grade and body mass index categories. Subjects recruited in 2009, 2010 and 2011 had less likely to have caries than subjects conducted in 2012, the OR (95%CI) was 0.44, 0.871 and 0.996, respectively. Children from low grade have more likely have caries than children from high grade. Children with obesity were 1.908 times (OR =1.908; CI 95% = 1.750, 2.079) more likely have caries than children with underweight or health weight. Overweight children were 1.547 times (OR = 1.547; CI95% = 1.479, 1.618) more likely have caries than children with underweight or health weight. After adjusted the gender and age, a statistically significant association also observed between year, grade, body mass index categories and caries.

## Discussion

The main objective of the present study was to determine the prevalence of dental caries in relation to obesity of 5-14 year-old school children of Wannan area, China. Our study found high caries prevalence

(44.9%), a statistically significant association was observed between obesity and caries. Similar results were obtained in a systematic review and meta-analysis conducted by Hayedn et al.<sup>23</sup> showed that, overall, there was a significant relationship between childhood obesity and dental caries. However, this relationship between dental decay and BMI was not significant for the study by Pinto et al<sup>24</sup>. Kopycka-Kedzierawski et al.<sup>25</sup> even found an inverse association between BMI and caries experience: overweight children were less likely to have caries experience than normal weight children aged 6-11 years. The possible explanation was that both obesity and dental caries are multifactorial in aetiology and various genetic and environmental factors have an impact on them. Another possible reason was that high sugar intake is risk factor common to both obesity and dental caries<sup>26</sup>. The role of high sugar intake in the prevalence of obesity and dental caries should be further researched.

Recent evidence suggests that the nutrition transition is accelerating and the outcome of this trend is a rapid increase in obesity and chronic diseases<sup>27</sup>. Lifestyle transition and socio-economic improvement have con-

**Table II**  
The prevalence of caries for children according to year, age, grade and body mass index categories

Variable	Caries free		Caries		p
	n	%	n	%	
Year	2009	11459	68.1	5373	0.00
	2010	9024	53.1	7956	
	2011	8510	49.7	8608	
	2012	8460	49.7	8566	
	Total	37453	55.1	30503	
Age years	5	29	61.7	18	0.00
	6	3249	52.4	2949	
	7	4958	47.6	5458	
	8	4839	45.0	5917	
	9	5341	46.7	6087	
	10	6428	54.9	5282	
	11	8498	70.5	3562	
	12	3809	76.9	1146	
	13	259	78.7	70	
14	43	75.4	14	24.6	
Grade	one	5308	51.2	5061	0.00
	two	4780	45.3	5780	
	three	4911	45.1	5987	
	four	5614	49.0	5849	
	five	7276	60.6	4726	
	six	9564	75.5	3100	
Body mass index categories	Underweight or health weight	29604	53.1	26197	0.00
	overweight	6148	63.6	3517	
	obesity	1701	68.3	789	

#P for linear-by-linear association.

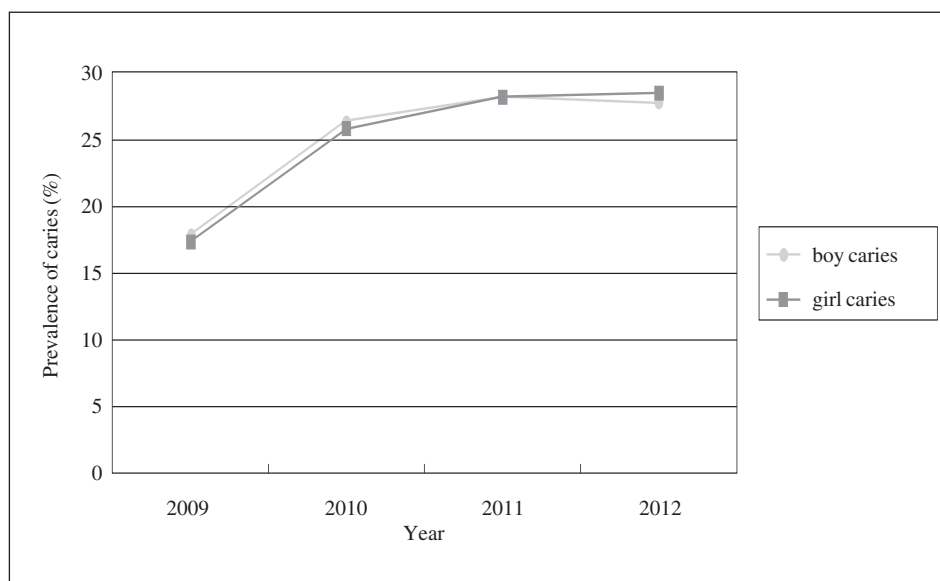


Fig. 1.—The prevalence of caries for children by year.

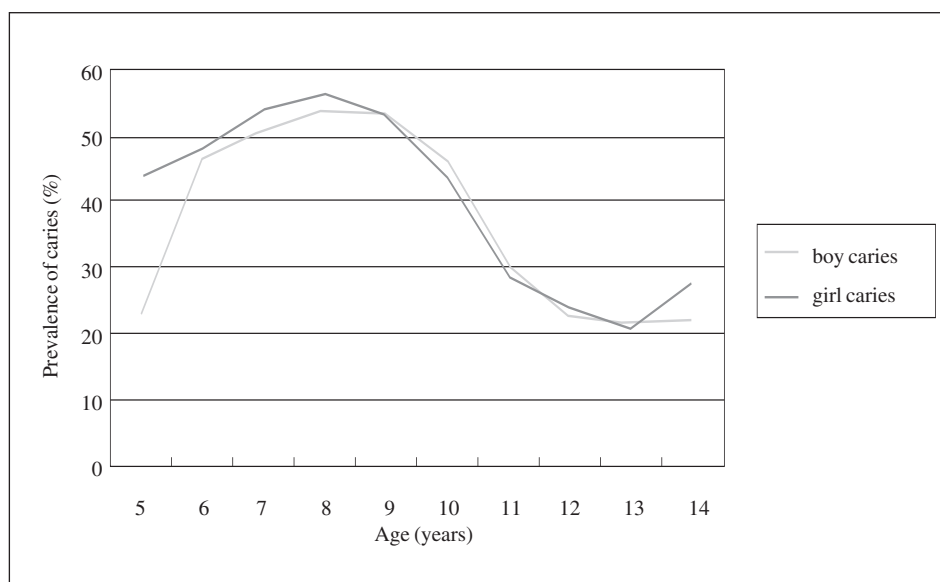


Fig. 2.—The prevalence of caries for children by age.

**Table III**  
The results of association between year, grade, and body mass index categories and dependent variable dental caries

Variable		Unadjusted OR (95% CI)	P	Adjusted OR (95%CI) <sup>#</sup>	P
Year	2009	0.440 (0.420,0.460)	0.000	0.446 (0.426,0.466)	0.000
	2010	0.871 (0.834,0.910)	0.000	0.893 (0.855,0.933)	0.000
	2011	0.996 (0.954,1.041)	0.873	1.000 (0.958,1.045)	0.992
	2012	1		1	
Grade	one	2.948 (2.785,3.120)	0.000	1.979 (1.707,2.295)	0.000
	two	3.823 (3.613,4.046)	0.000	2.688 (2.377,3.041)	0.000
	three	3.927 (3.712,4.154)	0.000	2.914 (2.639,3.218)	0.000
	four	3.310 (3.132,3.499)	0.000	2.705 (2.503,2.924)	0.000
	five	2.022 (1.913,2.137)	0.000	1.829 (1.720,1.945)	0.000
	six	1		1	
Body mass index categories	Obesity	1.908 (1.750,2.079)	0.000	2.092 (1.917,2.184)	0.000
	Overweight	1.547 (1.479,1.618)	0.000	1.515 (1.448,1.586)	0.000
	Underweight or health weight	1		1	

\*Adjusted for gender, age.

tributed enormously to the escalating problem in developing countries<sup>28</sup>. Especially, lifestyle<sup>29</sup> and food variety<sup>30</sup> may have an influence on obesity. Thus, the eating pattern among overweight or obese children may be a common risk factor in overweight children and dental caries. Lack of oral health education and less physical training to primary school children may also be linked to high obesity and dental caries prevalence.

### Conclusions

Obesity may have a significant effect on caries prevalence of primary school children in Wannan area,

China. The importance of obesity should not only be emphasized with respect to general diseases but also with regard to carious lesions.

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## Conflict of Interest

None declared.

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