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Brief Research Report

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The Association of Weight Status with Dental Caries and Trachoma Among School Children in Cities of Changsha and Shenzhen, China

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ABSTRACT

Dental caries and trachoma are two common diseases among children in developing countries. To examine whether weight status is associated with these two diseases, we used data from two screening surveys conducted in Changsha and Shenzhen, two cities in China. The screening surveys were part of a case-control study examining risk factors related to childhood obesity. Approximately 5,900 children (3,794 from Changsha and 2,193 from Shenzhen) participated in the screening survey in which weight and height were measured. Decayed or filled tooth counts (primary dentition) and trachoma infection status were obtained from school general health examination records (SGER). After excluding those who had missing information on weight, height, and SGER, a total of 4,073 (2,185 boys and 1,888 girls) aged 5-9 years old were included in the analysis. Body mass index (BMI) was calculated as weight (kg) divided by height (m^2) and standardized for age and sex, then converted to a BMI *z*-score. Using BMI *z*-score, subjects were categorized into 4 groups as underweight (<-2), normal weight (~1.03), overweight (~1.64), or obese (>1.64). Overall, approximately 5.5% of children (6.2% girls and 4.6% boys) were underweight and 18% (11% girls and 23% boys) were overweight or obese. Comparing normal weight to underweight, overweight and obese subjects, after adjusting for age, gender, grade, and city of survey, the odds ratios (OR, [95% CI]) for dental caries were 1.12 (0.84-1.49), 0.70 (0.56-0.86), and 0.62 (0.48-0.79), (*p* for trends <0.001) while the ORs for trachoma were 1.65 (0.94-2.89), 0.90 (0.52-1.57), and 1.92 (1.20 -3.06). This suggests that weight status is associated with dental caries and trachoma among these Chinese children. Further study is warranted to explore the underlying mechanism(s).

KEY WORDS: Childhood obesity; Dental caries; Trachoma; Epidemiological study.

INTRODUCTION

The global accelerated increase in obesity among children and adolescents is alarming.[1] Dental caries and trachoma are two common diseases among children in developing countries as well as among children from economically disadvantaged rural and aboriginal areas.[2-7] Information regarding the relationship between obesity and these two diseases of childhood is inconclusive or scarce. For dental caries, some studies showed a positive relationship,[8-10] but others show no relationship[11-14] or even an inverse relationship.[15,16] Our search turned up no study having examined the relationship between childhood obesity and trachoma. Since the prevalence of childhood obesity is on the rise and both dental caries and trachoma are prevalent among Chinese children, it is worth understanding whether and what relationship might exist between obesity and these two diseases when we keep intervention in mind.

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METHODS

Survey Method and Participants

The data used in this analysis came from a survey conducted between March and June, 2005 in the cities of Changsha and Shenzhen, China(Footnote 1). A two-stage cluster sampling method was used in the survey: in stage one, one out of nine districts in the city of Changsha and one out of ten districts in the city of Shenzhen were randomly selected; in stage two, 10 out of 62 elementary schools from the chosen district of the city of Changsha and 5 of 45 elementary schools from the chosen district of the city of Shenzhen were randomly selected for the survey. A combined total of 5,987 children aged 5-9 years were surveyed at the time as they underwent a school health screening examination. After cleaning the dataset for missing information, a total of 4,073 children (2,185 boys and 1,888 girls) were included in this analysis.

Measurements Related to Obesity Status

Weight and height were measured using a portable stadiometer and weight scale with each participant wearing light clothing without shoes. Body mass index (BMI) were calculated as weight (kg) divided by height (m^2) and converted to an age and sex specific BMI *z*-score. Using BMI *z*-score, subjects were categorized as either underweight (≤-2), normal weight (~1.03), overweight (~1.64), of obese (≥1.64), which correspond to the ≤5th, ~85th, ~95th, and ≥95th age and sex-specific percentiles.[17]

Examination of Dental Caries and Trachoma

Information on dental caries and trachoma was obtained from a school health screening examination conducted by dentists and eye specialists. Oral health examination from schools in the city of Shenzhen recorded decayed (d), missing (m) and filled (f) teeth (t) for primary and permanent dentition; while the health examination at schools in the city of Changsha only recorded a positive finding of dental caries. Therefore, in this analysis, dental caries was defined as positive if either the health examination records showed 'yes' for students from the city of Changsha or dft>0 for primary dentition and dmft>0 for permanent dentition for students from the city of Shenzhen. Trachoma was assessed using the simplified grading scheme proposed by the World Health Organization (WHO),[18] and recorded as 'yes' in the health examination records when positive.

Statistical Analysis

Data was analyzed using SAS 9.4 with significance level set at two-sided α=0.05. A *t*-test was used to compare the mean level of continuous variables and a Chi-square test was used to compare the distribution of category variables. A multiple logistic regression model was used to evaluate the association between dental caries and trachoma with weight status. Covariates controlled in the analysis were age (year), sex (1-male, 0-female), grade (1~4), and city (1-Changsha, 2-Shenzhen).

RESULTS AND DISCUSSION

Overall, 717 children (17.6%) were categorized as overweight (9.8%) or obese (7.8%). 48.4% (1,973) of children had dental caries and 4.7% (192) screened positive for trachoma. There was no gender difference in age, survey location, or the proportion of positive dental records and incidence of trachoma. However, the distribution of grades, and mean BMI distribution varied by gender (Table 1).

Table 1: Characteristics of 4,073 Children by Gender.

	Girls	Boys
N	1,888	2,185
Age (yr, mean (SD))	7.5 (0.9)	7.5 (0.9)
Grade (%)		
1	17.7	19.9 **
2	35.8	36.8
3	35.9	35.4
4	10.7	7.8
City from (%)		
Changsha	47.3	46.1
Shenzhen	52.7	53.9
BMI (kg/m^2, mean (SD))	15.5 (2.1)	16.4 (2.6)***
Weight status^ (%)		
Underweight	6.3	4.5***
Normal weight	82.3	72.6
Overweight	7.9	11.4
Obese	3.6	11.4
Dental Caries (%)	46.3	53.7
Trachoma (%)	5.2	4.2

^based on BMI *z*-score. Underweight: BMI *z*-score <-2, Normal weight: -2<BMI *z*-score<1.03,
Overweight: 1.03<BMI *z*-score<1.96, Obese: BMI *z*-score >1.96
**p<0.001, ***p<0.0001

Univariate analysis found that the proportion of dental caries in underweight, normal weight, overweight, and obese groups was 51.6%, 50.0%, 41.3%, and 39.8% (p<0.01) respectively, with trachoma frequencies by weight category of 6.9%, 3.4%, 3.7%, and 7.5% (p=0.02).

Multiple logistic regression used normal weight as comparator group, adjusting for age, gender, grade, and survey location. For dental caries by weight category, our model found odds ratios (OR, [95% CI]) of 1.12 (0.84, 1.49), 0.70 (0.56, 0.86), and 0.62 (0.48, 0.79), (p-value for trends <0.001) (Figure 1a) corresponding to underweight, overweight, and obese; for trachoma the respective ORs (95% CI) were 1.65 (0.94, 2.89), 0.90 (0.52, 1.57), and 1.92 (1.20, 3.06) (p-value for trends=0.19) (Figure 1b).

1. At the time these surveys were conducted there was no requirement for a research ethics review.

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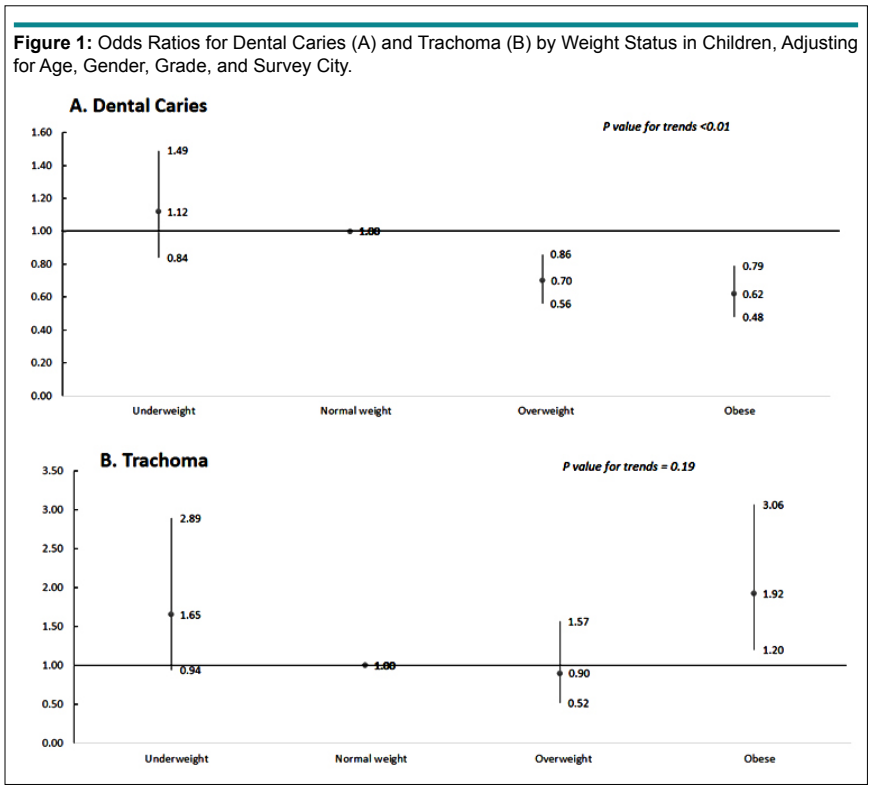

Figure 1: Odds Ratios for Dental Caries (A) and Trachoma (B) by Weight Status in Children, Adjusting for Age, Gender, Grade, and Survey City.

With economic progress and modernization in China the prevalence of obesity in Chinese children has increased dramatically over the past two decades.[19,20] Although, there is no information on the trends of dental caries among Chinese children, population-based cross-sectional studies suggest that the prevalence of dental caries is high among Chinese children with significant geographical variation.[21,22] While the prevalence of blindness caused by trachoma is happily on the decline, it remains endemic, nonetheless, among school children, particularly in rural areas.[23-26] Prevalence rates for obesity, dental caries, and trachoma in this study are comparable to those from other national metropolis samples. In the current study, we observed a negative association between weight status and the odds of dental caries and a "U" shaped relationship between weight status and the odds of trachoma.

Although, this is not the first study to find a negative relationship between weight status and dental caries we believe this to be the first report of a "U" shaped relationship between weight status and trachoma. The underlying mechanism that accounts for this remains uncertain. It is biologically quite plausible that childhood obesity could correlate with dental caries since they share risk factors, e.g., too much free sugar intake,[27] though the evidence to support such a hypothesis is weak and inconclusive. The relationship between weight status and dental caries among children may be more complicated than we think. The aforementioned studies[8-16] are to some extent contradictory which suggests that each may only be seeing part of the bigger picture. The pathogenic mechanism for the link between underweight status and dental caries may well differ from that for overweight/obese children and finding a common solution may be improbable. In the case of trachoma, some increased risk was observed in children who were underweight as well as for those categorized as obese, though the difference only reached significance for the obese. Why there should be such an association and by what biological mechanism is not at all clear.

The main limitations of this study include 1) the data originate from cross-sectional surveys, which cannot determine causality; 2) there was no information on family socio-economic status which would be an important risk factor in the study of childhood obesity, dental caries, and trachoma; and 3) no sampling weight information was available since the number of students in the excluded clusters is unknown. Although, the sampling probability for individual students is indeterminate, we have no reason to think that the sample in the study was not representative of the population since the sampling method ensured representativeness by region; furthermore, results are based on the analysis of a very large sample of carefully scrutinized anthropometric measurements.

CONCLUSION

In conclusion, given the fact that the childhood obesity is a growing problem in China, and that dental caries and trachoma are still endemic health concerns among children, more studies are needed to examine the complex relationships between weight status oral health and trachoma among children.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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