Relationship between Obesity and Oral Health Behavior in Primary and Junior High School Students: A Cross-sectional Study

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Abstract

It has been reported that people who brush their teeth frequently might be more health-conscious and maintain healthier lifestyle habits. The relationship between obesity and oral health behavior in childhood is unknown, however. The aim of the present study was to fill this gap by investigating obesity and factors associated with oral health behavior in Japanese primary and junior high school students. A total of 475 primary school students (fifth-grade, age 10–11 years) and 408 junior high school students (first-grade, age 12–13 years) were included. All the participants underwent a regular health check-up and completed a self-reported questionnaire. The data thus obtained were subjected to multiple logistic regression analyses to identify the relationship between obesity and factors associated with oral health behavior. In primary school students, a dislike of physical activity was the only factor showing a significant association with obesity (p<0.05). In addition, however, tooth brushing <2 times per day and a lack of regular clinical dental care showed a significant association with obesity in junior school students (p<0.05). The present results suggest a significant association between regular clinical dental care and tooth brushing and obesity in junior school students.

Key words: Regular dental attendance — Childhood obesity — Tooth brushing — Health behavior

Introduction

Childhood obesity has increased worldwide, and this phenomenon is assumed to be associated with increased risk of diabetes mellitus6. Moreover, childhood obesity has been reported to be predictive of obesity in early adulthood11. Therefore, preventing obesity in
childhood should be encouraged\(^5\).

Several studies have reported a relationship between obesity and dental caries\(^{12,18,19,28}\). Some systematic reviews, on the other hand, have identified no significant association between obesity and dental caries in childhood\(^7,10\). It is still reasonable to suppose, however, that obesity and dental caries might share several risk factors, such as dietary habits. One previous study identified many associations between interactive genetic and non-genetic factors and obesity\(^6\). Interestingly, both tooth brushing\(^2,14\) and regular clinical dental care\(^1\) have been associated with dental caries in childhood, and several studies have reported a relationship between obesity and the former\(^4,17\) or latter factor in adults\(^11\). This suggests that oral health behavior is associated with obesity in childhood. In addition, one study found that people who brushed their teeth frequently might be more health-conscious and maintain healthier lifestyle habits than those who did not\(^9\). Therefore, we hypothesized that tooth brushing and regular clinical dental care, which represent oral health behavior, were associated with obesity. The aim of the present study was to explore the potential relationship between obesity and oral health behavior in primary and junior high school students.

### Materials and Methods

#### 1. Participants

The study participants were recruited from 21 public schools in Ichikawa city, Chiba, Japan, where health and dental check-ups and self-reported questionnaire surveys were regularly conducted. The results from 9 primary schools (762 fifth-grade students) and 5 junior high schools (713 first-grade students) were made available for the study. These grades were selected because significant weight gain is observed at these ages. In addition, it was assumed that the environment, which might affect oral health behavior, differed between primary and junior high school. After excluding potential participants on whom the relevant data were unavailable, 475 fifth-grade primary school students (age: 10–11 years) and 408 first-grade junior high school students (12–13 years) were included in the analyses. All the students and their parents or caregivers provided written informed consent for participation, and the study protocol was approved by the Ethical Committee of Tokyo Dental College (approval number: 657).

#### 2. Questionnaire

All the participants answered a self-administered questionnaire. Table 1 lists the ques-

| Items                                      | Category                        |
|--------------------------------------------|---------------------------------|
| Preference regarding physical activity     | Like or Dislike                 |
| “Do you like physical activity?”           |                                 |
| Physical activity habits                   | Yes or No                       |
| “Do you exercise regularly?”               |                                 |
| Eating snacks                              | Daily or Not daily              |
| “How often do you eat snacks?”             |                                 |
| Frequency of tooth brushing                | <2 or ≥2                        |
| “How many times do you brush your teeth per day?” | |
| Regular clinical dental care               | Yes or No                       |
| “Do you have regular dental check-ups?”    |                                 |

Table 1 List of self-reported questionnaire components.
 Questionnaire items and categories used. Questionnaire items addressing factors associated with obesity solicited information on physical activity habits, preferences regarding physical activity, and eating habits. Items addressing factors associated with oral health behavior solicited information on matters such as frequency of tooth brushing and regular clinical dental care.

3. Physical examination

Waist circumference (WC) was measured at the umbilical point during a physical examination performed by members of the Ichikawa Medical Association. Obesity was defined as a WC ≥75 cm in primary school students and WC ≥80 cm in junior high school students, based on criteria established by the Ministry of Health, Welfare, and Labor of Japan.\(^1\)

4. Statistical analyses

Descriptive statistical analyses were performed to evaluate the characteristics of the study population. A chi-squared test (or Fisher’s exact test for cases with <5 cells in the contingency table) was used to determine the distribution of the participants in terms of factors associated with obesity. Multiple logistic regression analyses were performed separately for primary and junior high school students to identify the relationship between obesity and oral health behavior. For these analyses, the dependent variable was the presence or absence of obesity. After adjustment for sex, physical activity habits, preferences regarding physical activity, and eating habits, frequency of tooth brushing and regular clinical dental care were used as the independent variables. All multiple logistic regression analyses were developed using the forced entry method. The data were analyzed using SPSS Version 22.0 (SPSS Japan, Inc., Tokyo, Japan), with a significance level of 5%.

|                        | Primary school students |               | Junior high school students |               |
|------------------------|-------------------------|---------------|-----------------------------|---------------|
|                        | Non-obese (WC <75 cm)  | Obese (WC ≥75 cm) | Non-obese (WC <80 cm) | Obese (WC ≥80 cm) |
|                        | n   | %  | n   | %  | p    | n   | %  | n   | %  | p    |
| Sex                    |     |    |     |    |      |     |    |     |    |      |
| Male                   | 217 | 49.2 | 17  | 51.5 | 0.708 | 205 | 54.2 | 15  | 60.0 | 0.68 |
| Female                 | 224 | 50.8 | 16  | 48.5 | 173  | 45.8 | 10  | 40.0 |
| Preference regarding physical activity | Like | 400 | 90.7 | 26  | 78.8 | 0.064 | 312 | 82.5 | 14  | 56.0 | 0.003 |
|                        | Dislike | 41  | 9.3  | 7   | 21.2 | 66  | 17.5 | 11  | 44.0 |
| Physical activity habits | Yes | 384 | 87.1 | 30  | 90.9 | 0.785 | 325 | 86.0 | 20  | 80.0 | 0.382 |
|                        | No     | 57  | 12.9 | 3   | 9.1  | 53  | 14.0 | 3   | 20.0 |
| Snacking habit         | Not daily | 388 | 88.0 | 29  | 87.9 | 1   | 354 | 93.7 | 23  | 92.0 | 0.671 |
|                        | Daily  | 53  | 12.0 | 4   | 12.1 | 24  | 6.3  | 2   | 8.0  |
| Tooth brushing frequency (times per day) | <2   | 74  | 16.8 | 9   | 27.3 | 0.126 | 70  | 18.5 | 11  | 44.0 | 0.002 |
|                        | ≥2     | 367 | 83.2 | 24  | 72.7 | 308 | 81.5 | 14  | 56.0 |
| Regular clinical dental care | No | 280 | 63.5 | 17  | 51.5 | 0.17 | 250 | 66.1 | 23  | 92.0 | 0.007 |
|                        | Yes    | 161 | 36.5 | 16  | 48.5 | 128 | 33.9 | 2   | 8.0  |

WC: waist circumference
Results

Among primary and junior high school students, 33 (6.9%) and 25 (6.2%), respectively, met the definition of obesity. Table 2 lists the characteristics of the primary school and junior high school students. No significant association was found between any factor and obesity in primary school students. In junior high school students, the prevalence of obesity was significantly higher among students who reported a dislike of physical activity, those who brushed their teeth <2 times per day, and those who did not receive regular clinical dental care (p<0.05).

Table 3 presents the results of multiple logistic regression analyses of both primary and junior high school students, with obesity as the dependent variable. In both analyses, an association was observed between dislike of physical activity and increased risk of obesity, with an odds ratio (OR) of 3.24 (95% confidence interval [CI], 1.22–8.58) among primary school students, and 3.91 (95% CI: 1.51–10.13) among junior high school students. In addition, junior high school students who brushed their teeth <2 times per day (OR: 2.91, 95% CI: 1.22–6.93) and did not receive regular clinical dental care (OR: 5.26, 95% CI: 1.20–23.09) were more likely to be obese.

Discussion

The results of the present analyses revealed associations between obesity and oral health behavior or other related factors in primary school and junior high school students. Among the former, only a dislike of physical activity showed a significant association with obesity. Although this factor also showed a significant association with obesity among junior high school students, a low frequency of tooth brushing and lack of regular clinical dental care were also identified as significant factors in this population.

Some studies have also reported a relationship between obesity and tooth brushing in adulthood. For example, Ekuni et al. reported a lower frequency of tooth brushing in overweight individuals than in those who were either under- or normal weight. Few studies have addressed the relationship...
between obesity and tooth brushing in childhood, however. Tooth brushing can be regarded as positive health behavior. Therefore, people with lower frequency of tooth brushing might have low awareness of healthy life. In addition, based on the aforementioned study by Ekuni et al., it was assumed that children with good oral hygiene habits would have positive health behavior, with a concomitant decrease in risk of obesity. The results of the present study, which aimed to elucidate this relationship, suggest that the association between obesity and tooth brushing emerges during the junior high school period.

Although few studies have addressed the relationship between obesity and regular clinical dental care, Koletsi-Kounari et al. reported that obese and physically inactive individuals were less likely to regularly visit a dental clinic, and some studies have reported a correlation between physical activity and regular clinical dental care among adults. For example, Scheutz and Heidmann reported that individuals who lacked an exercise habit were more likely to receive irregular dental care. Again, the present findings suggest that the relationship between obesity and regular dental attendance also emerges during the junior high school period. It should further be noted that although several studies have reported the effectiveness of school-based physical activity interventions for preventing obesity, these programs do not address oral health. The present results suggest that dental health in the context of school-based physical activity intervention is associated with obesity.

As noted above, the observed associations between factors associated with oral health behavior and obesity tended to emerge during the junior high school period, which is attributable to the physical and mental changes that occur during adolescence. Several studies have investigated the relationship between quality of life (QoL) and these physical and mental changes. For example, Raphael et al. reported a negative association between age and QoL in a study of 160 Canadian adolescents, and Wang et al. noted that children increasingly gained control over their health and development during the transition to adolescence. The latter study also found that Japanese adolescents tended to feel that they did not require care from a physician. These findings suggest that children may be poorly aware of health-related factors, as they tend to experience few health problems. This suggests that parental influence plays a role in the development of desirable oral health behavior in primary school students, but that this influence weakens as children begin to gain independence during the junior high school period. This may explain the relationship between obesity and undesirable oral health behaviors observed in the junior high school period in the present study.

Regarding the definition of obesity in the present study, several indicators of obesity have been used previously in pediatric populations, including the BMI, WC, and waist-to-height ratio (WHtR). However, the BMI has the disadvantage of not allowing fat to be distinguished from muscle or body fat. Additionally, Sung et al. reported that, in children, the WC is a more convenient method of central fat estimation than the WHtR. Taken together, this indicates that the WC is a reasonable indicator of pediatric obesity.

Unsurprisingly, the present results indicated an association between preference regarding physical activity and obesity, as have several previous studies. For example, Shan et al. reported a significant association between physical inactivity and obesity in a cross-sectional study of 21,198 children aged 2–18 years. However, the present analysis found no relationship between obesity and physical activity habits. It should be noted that the Japan Sports Agency reported that approximately 90% of primary and junior high school students nationwide participated in physical activity. Therefore, physical activity habits might not be associated with obesity in the Japanese pediatric population.

This study had several limitations. For example, it was not possible to investigate the
relationship between socio-economic factors and childhood obesity, even though previous reports have found a link between the two.\textsuperscript{6,13} Additionally, the study participants were not selected randomly, which may have led to selection bias. The results may not, therefore, be representative of all primary and junior high schools in Japan. Moreover, the students self-answered the questionnaires, which may have led to some errors, and the measurement of WC was obtained by several examiners, which increases the risk of measurement bias. Finally, this study featured a cross-sectional design. Therefore, further research is required to demonstrate a causal relationship between oral health behaviors and obesity.

Conclusion

A significant association was observed between obesity and oral health behavior among junior high school, but not primary school, students. This suggests that improving oral health behavior, including by means of tooth brushing instruction during the junior school period, might lead to positive health behavior, which would decrease the risk of obesity. The results of the present study may help elucidate the relationship between obesity and health behavior, although further research is needed.

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