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Self-reports of eating quickly are related to a decreased number of chews until first swallow, total number of chews, and total duration of chewing in young people

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ABSTRACT

Objective: The validity of a self-questionnaire about eating quickly remains unclear. If a significant relationship between subjective and objective methods to evaluate eating quickly can be confirmed, then the subjective method can be widely and reliably used in many fields. This study investigated relationships between subjective and objective methods to evaluate eating quickly and also numerically characterized the kinesis of eating quickly in young people.

Design: One hundred and thirteen students (44 males and 69 females; mean age 22.8 ± 2.0 years) were selected. All subjects completed written questionnaires, and number of chews until first swallow, total duration of chewing, number of chews, chewing rate and bite size were measured using test products (a Japanese cracker and rice ball).

Results: Both male and female subjects who reported eating quickly showed a significantly lower number of chews until first swallow (Japanese cracker), a lower number of chews overall (rice ball), and a shorter total duration of chewing (rice ball) than other subjects. There was no difference in chewing rate between subjects who ate quickly or not.

Conclusions: These findings suggest that using test products, self-reports of eating quickly are related to a decreased number of chews until first swallow, total number of chews, and total duration of chewing, but not chewing rate, and that a self-reported questionnaire to evaluate eating rate is valid in young people.

1. Introduction

Obesity and being overweight are important risk factors for lifestyle-related diseases including type 2 diabetes, cardiovascular disease, hypertension, and cancer.[1,2] Obesity is affected by eating behaviours. Eating quickly has been associated with increased total energy intake,[3] decreased satiety,[4] and insulin resistance[5] and leads to obesity.[6–12] Therefore, accurate information on eating quickly is required for health care workers so that they can provide guidance to patients.

Subjective methods are commonly used to evaluate eating quickly in epidemiological studies.[5–7,10,11] Some methods use four qualitative categories to compare speed of eating with

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Abbreviations: ICC, intra-class correlation coefficient; BMI, body mass index.

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somebody else: slow, normal, fast, and very fast.[11] In other studies, the eating speed is self-reported according to one of five qualitative categories: very slow, relatively slow, medium, relatively fast, and very fast.[5,10] Sasaki et al. examined the validity of these rating categories in a preliminary survey using the eating speed as reported by a close friend as the standard.[6] In that study, they asked subjects to categorize the eating speed of three close friends and the percentage of agreement was reasonably good (75.3%), with a moderate kappa statistic. However, although only one study reported high levels of agreement between self- and friend-reported eating speed,[6] the validity of a self-questionnaire about eating quickly remains unclear. In addition, there is little information whether eating quickly reflects chewing rate or total number of chews.

Various methods have been proposed to evaluate eating speed objectively, such as measurements based on electromyographic activity,[13,14] jaw movements,[15] observers,[14,16,17] and a portable chewing counter.[18,19] These objective methods have validity, but are not suitable for daily use in terms of cost and time of measurement, especially for epidemiological studies. Furthermore, placement of electromyographic device or portable chewing counter on the face disturbs the natural eating situation, which can impact results.

If a significant relationship between subjective and objective methods to evaluate eating quickly can be confirmed, then the subjective method can be widely and reliably used in many fields. In the present study, we hypothesized that self-reported eating quickly might be related to chewing rate or total number of chews determined by objective methods. Therefore, the aim of this study was to investigate the relationship between subjective and objective methods to evaluate eating quickly and to numerically characterize the kinesis of eating quickly. We selected young people for participation in this study because they have less systemic diseases and removable dentures or missing teeth compared with elderly people; these advantages may help in interpreting the results and avoiding invisible biases.

2. Materials and methods

2.1. Study sample

We enrolled 114 young adults (44 male and 70 female students at Okayama University; aged 22.8 ± 2.0 (mean $\pm$ SD) years). The study was conducted from October 2010 to March 2011. The study was approved by the Ethics Committee of Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences. After obtaining written informed consent, subjects completed written questionnaires regarding personal health, eating quickly, and other variables described below. We excluded 1 subject who was under dietary restrictions. Finally, data from 113 healthy students (44 males, 69 females) were analysed.

2.2. Questionnaire

A dentist (D.E.) interviewed the students. Subjective eating speed compared with another person was reported according to one of five qualitative categories: very slow, relatively slow, medium, relatively fast, and very fast.[5–7,10] We combined fast and very fast responses into a single category, that is, the ''Eating quickly'' group.[10,20] The other respondents were categorized as the ''Not eating quickly'' group. Because food preferences may affect eating speed,[16] subjects were asked if they liked Japanese crackers (''*Senbei*''; Kameda Seika Co., Ltd., Niigata, Japan) and rice balls (''*Sake Onigiri*''; Shinobu Foods Products Co., Ltd., Osaka, Japan) used in the study; answers were given in a yes/no form. A visual analogue scale was used to investigate degree of hunger. The scale allowed for a single subjective score between 0 (not hungry) and 100 (hungriest). The number of teeth present and presence of oral pain including a pain caused by temporomandibular joint were self-reported.

To investigate the reliability of the questionnaire, subjective eating speed was reported by the same self-reported questionnaire again after 2 months in all subjects.

2.3. Experimental procedure

The test products were commercially available Japanese crackers (2.9 g) and rice balls (100 g).[19] After subjects were allowed to eat as usual ad libitum, they were told to slice a cracker in half and to eat it in one bite. Based on visual observation of jaw movements, the dentist (D.E. or N.T.) counted the number of times the subjects chewed while eating the cracker. Subjects were instructed to raise their hand to indicate when they had swallowed the first piece of cracker, and the number of chews from the start of eating to the first swallow was recorded by the dentist. The total number of chews until the entire cracker was swallowed was also recorded.

Next, subjects ate a rice ball, and the total duration of chewing, number of chews, and number of bites until the entire rice ball was swallowed were counted. Chewing rate (cycle/s) and bite size (=100/total number of bites) (g/bite) were calculated.[16]

In a preliminary study, the intra-class correlation coefficient (ICC) was used to measure the inter-class-reliability. The ICC for the inter-observer reliability was calculated from assessments between two examiners and it was 0.99 (95% confidence interval: 0.973–0.998) for the number of chew until the entire cracker. In comparison of the self-reported number of chew until the entire cracker by subject with the number of that by the observer, the ICC was 0.99 (95% confidence interval: 0.988–0.999).

2.4. Evaluation of body mass index (BMI)

Based on self-reported weight and height, BMI was computed as weight in kilograms divided by square height in metres.[21] BMI $\geq$ 23 was considered as overweight.[22,23]

2.5. Statistical analysis

All data were analysed using SPSS 15.0 J for Windows (SPSS Japan, Tokyo, Japan). The differences in parameters among the five eating speed groups (i.e., very slow, relatively slow, medium, relatively fast and very fast) were analysed by