Original article

Small spoon may be applied for effective weight management of youth with mild intellectual disabilities

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Abstract. The purpose of this study was to investigate the effect of spoon size on food intake in people with intellectual disabilities. Curry rice (400 g) was served with different-sized spoons: normal spoon (8.3 cc) or small spoon (4.1 cc). Subjects ate significantly more when test meal was served with a normal spoon (498.1 g) as compared to a small spoon (442.6 g) ($p < 0.05$). Subjects took significantly more in each spoonful when test meal was served with a normal spoon (14.2 g) as compared to a small spoon (7.4 g). Eating rate was significantly different between a normal spoon (73.2 g/min) and a small spoon (58.8 g/min) ($p < .05$). The results of this study suggests that small spoon may be applied for effective weight management of youth with mild intellectual disabilities.

Key words: intellectual disability, spoon size, food intake, environmental cues, obesity

Introduction

Obesity in people with intellectual disabilities (ID) is beginning to be accepted as a social problem, and obesity management programs for early detection and intervention of obesity problems have been developed and related studies have been reported (1). Obesity is known to be most influenced by dietary habits in the general population, and it has been reported that the regularity of diet, the choice of food, the type of intake, and the speed of eating are related to obesity (2). For that reason, various studies have been conducted on effective methods to prevent and treat obesity and attempts have been made to find new solutions to the reduction of food intake which research related to the external environmental factors as well as internal physiological factors have been attempted (3-5).

The external environment influencing the food intake is divided into the eating environment and the food environment. The eating environment is independent of the food, moreover it is related to eating atmospherics, eating effort, eating with other, eating distractions. On the other hand, the food environment is directly related to the provision of food, and includes food packaging, size of food package and portions, as well as salience of food, structure and variety of food assortments, stockpiling of food and shape of food plates, glasses and bowls (2, 6). More than 71% of caloric intake is done through dishes such as bowls, plates, and cups (7), so the size and shape of the dishes can affect the food intake by acting on the standard of food intake (8). The increase of spoon size has been reported to contribute to increase overall calorie intake. When ice cream was served, ice cream was increased by 56.8% compared to when a small bowl and a spoon are provided as small ones (9). Most people will be influenced by the size of the bowl or spoon when they themselves decide on the amount of food they serve. People who are given a large spoon are underestimating how much food they put on their own than those

with a relatively small spoon, and as a result, they consume larger quantities of food with larger spoons and consume 92% of their own food, eventually increasing their intake (10). Attempts have been made to reduce food intake and maintain and control weight through changes in environment, but these trials in individual with ID are limited. The purpose of this study was to investigate the effect of size of spoon on food intake in youth with mild ID.

Materials and methods

Subjects

Youth aged 15 to 21 years old would be recruited from a special school in South Korea. All subjects were diagnosed with mild ID (i.e., a performance IQ of 55–75) and had no other disabilities. Subject selection was primarily based on interested teachers who informally announced their willingness to cooperate with the study. Subjects were interviewed to ensure they met the following criteria: not using medication known to affect food intake or appetite); not athletes in training; not pregnant or lactating; non-smokers; free from food allergies; not dieting to gain or lose weight; and regularly eating three meals per day. Individuals who met these initial criteria visited the lab to complete additional exams, including the Eating Attitudes Test (11), which assesses attitude towards foods and eating, and the Zung Self-Rating Depression Scale (12), which measures depressive symptoms. Before commencing study, body weight and body composition were measured once in minimal clothing using the InBody 770 (Biospace Co., Seoul, Korea), height was measured by the DS-103 (Jenix Co., Seoul, Korea), and body mass index (BMI; kg/m^2) was calculated.

Procedures

The experiment used a within-subjects, repeated-measures design. Subjects visited the lab on 2 different days, separated by at least 1 week. Subjects were asked to keep their evening meals and activity levels as similar as possible on the days before each test day, and to refrain from consuming any food or energy-containing beverages three hours before the experiment. At the start of each test meal, subjects were seated in individual cubicles. They were not allowed to read or do work during the meal. Curry rice was served with different-sized spoons: normal spoon (1st week) or small spoon (2nd week). Figure 1 shows the picture of a normal spoon (8.3 cc) and a small spoon (4.1 cc) used in this experiment. Curry rice comprised 190 g of curry (Ottogi Co., Chungbuk, Korea) with 210 g cooked white rice. The curry rice contained 117.9 kcal, 22.2 g of total carbohydrates, 2.4 g of sugar, 2.7 g of protein, 2.0 g of total fat, 0.8 g of saturated fat, and 2.4 mg of cholesterol per 100 g. The conditions for each test meal were the same except spoon size. Subjects were instructed to consume as much of it as they would like, to the point of comfortable satiation. They were allowed to request for additional curry rice. During both conditions, investigators carefully monitored the subjects, prompting them to eat according to protocol. And the investigators counted the number of spoonful taken during each meal. Exact clock time of meal initiation and completion was recorded. The amount of the meal consumed was calculated by weighed differences before and after meal. The study was approved by the Ethical Committee for Human Experimentation of Jeonju University (jjIRB-170417-HR-2017-0510). Informed written consent was obtained from the

Figure 1. Picture of different-sized spoons.

subjects but the purpose of the study was not disclosed to them.

Visual analogue scale ratings for satiety and hunger

Subjective satiety and hunger were measured using a 100 mm VAS. Subjects completed the VAS four times on both days: before and after the meal, and hourly for two hours after the meal. They marked a cross on each scale of 0–100 mm for how full or hungry they felt. Meal palatability was also assessed with visual analogue scales at 1 min into each meal and after meal completion. These scales were anchored by statements "not at all" and "extremely."

Statistical analysis

Data were analyzed using SPSS Statistics 23 (IBM Corp., Armonk, NY, USA). Paired t-tests were used to compare the characteristics of subjects in the two portion size conditions. Results were presented as means ± standard error of the mean (SEM). Differences in means were considered significant at $p < 0.05$.

Results

Eighteen youth with mild ID were recruited and all completed the study (10 male, 8 female; mean age 17.9 years). Subjects had an average height and weight of 162.6 cm (male: 168.6 cm; female: 155.1 cm) and 62.2 kg (male: 68.7 kg; female: 54.1 kg), respectively. Subjects' characteristics are shown in Table 1. Ratings of taste pleasantness at the start of the lunch revealed no significant differences between the two test meals (data not shown).

Figure 2 shows the consumption volume, duration of the meal, number of spoonful, amount per spoonful and eating rate of test meal on different-sized spoons among subjects. Spoon size had significant effects on consumption volume in youth with mild ID; subjects ate significantly ($p < 0.05$) more when test meal was served with a normal spoon (498 g) as compared to a small spoon (442.6 g). Regardless of spoon size, subjects took similar time to eat test meal (normal spoon: 7.3 min vs. small spoon: 7.4 min, $p > 0.05$). Furthermore, subjects did not use significantly more spoonful when test meal served with a normal spoon as compared to a small spoon, although they ate more test meal provided with a normal spoon; subjects showed similar number of spoonful on two different-sized spoons (normal spoon; 42.4 vs. small spoon 46.2, $p > 0.05$). Subjects took significantly more in each spoonful when test meal was served with a normal spoon (14.2 g) as compared to a small spoon (7.4 g) ($p > 0.05$). Eating rate was significantly different between normal spoon (73.2 g/min) and small spoon (58.8 g/min) ($p < .05$).

Figure 3 presents the VAS results of subjective satiety and hunger rating of test meal on different-sized spoons among subjects. The initial ratings of satiety and hunger did not differ between 2 different-sized spoons. Although subjects ate more test meal served with a normal spoon as compared to a small spoon, there were no significant differences in satiety and

Table 1. Subjects' characteristics.

Category	Male (n=10)	Female (n=8)	Subjects Total (n=18)
Age (yrs)	17.8 ± 0.4	18.1 ± 0.5	17.9 ± 0.3
Height (cm)	168.6 ± 4.1	155.1 ± 1.6	162.6 ± 2.9
Weight (kg)	68.7 ± 6.5	54.1 ± 4.1	62.2 ± 4.3
BMI (kg/m2)	23.8 ± 1.6	22.6 ± 1.8	23.2 ± 1.2
Body fat mass (kg)	17.6 ± 3.7	18.7 ± 3.3	18.1 ± 2.5
% Body fat (%)	23.7 ± 2.9	32.9 ± 3.7	27.8 ± 2.5
Lean body mass (kg)	51.1 ± 3.5	35.5 ± 1.6	44. 1 ± 2.8

Values are means ± standard error of the mean (SEM). BMI; body mass index, body weight (kg)/[height (m)]^2.

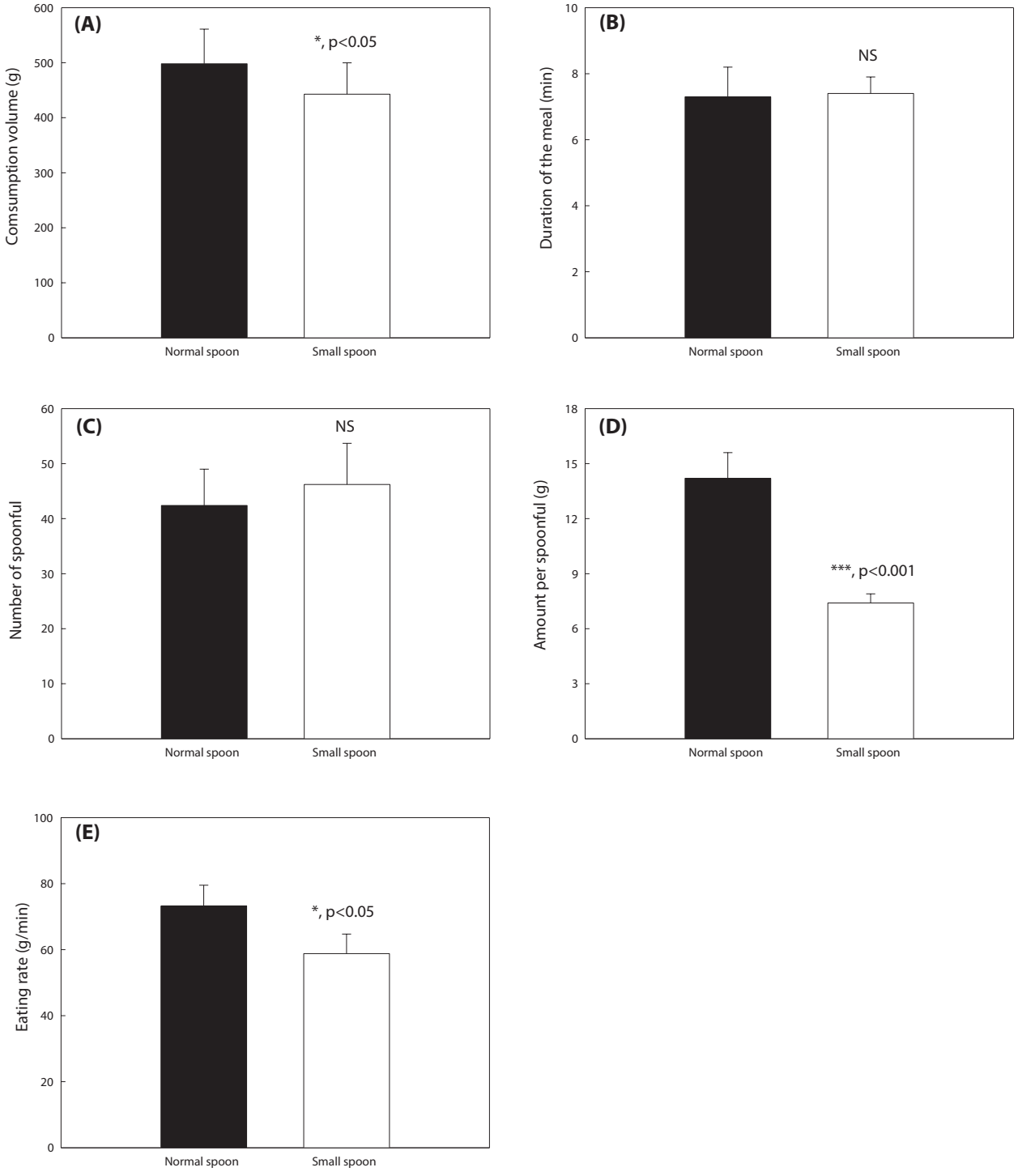

Figure 2. Consumption volume (A), eating rate (B), number of spoonful (C) and amount per spoonful (D) of test meal on different-sized spoons in youth with mild intellectual disabilities (ID). Values are means ± standard error of the mean (SEM).

Asterisk indicates a significant difference (*, $p < 0.05$; ***, $p < 0.001$) between two portion sizes by a paired t-test. NS: not significant.

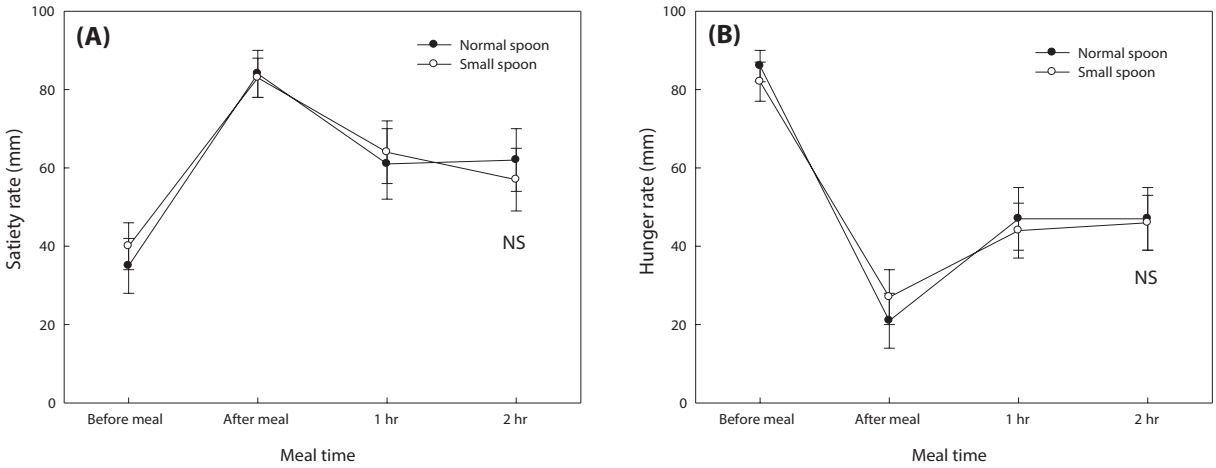

Figure 3. Satiety (A) and hunger (B) ratings of test meal on different-sized spoons in youth with mild intellectual disabilities (ID). Values are means ± standard error of the mean (SEM). NS: not significant.

hunger ratings across spoon sizes for 2hr after eating test meal.

Discussion

The effect of spoon size on the food intake in youth with mild ID was found to be significantly smaller than that of the normal spoon when the food was consumed with a small spoon. These findings are consistent with previous studies. Wansink et al. reported that the amount of ice cream consumed by the subjects increased to 14.5% when size of spoon of ice cream in a bowl was increased by 50%, even though the experiment was conducted on people who studied nutrition in the ice cream consumption test according to the size of the spoon in a bowl. It was reported that the intake increased by 56.8% when the size of the bowl was increased together with size of spoon of ice cream in bowl (9). In the study participated 24 adult women, results showed that the subjects using a small spoon ate less beef shank soup and lower total energy intake than using a normal spoon ($p < 0.01$) (13). Most people are influenced by the size of a bowl or spoon when determining the amount of food for one person. People who are given a large spoon tend to underestimate the amount of food in the spoon than those who are given a small spoon do. And as a result, they have larger spoons that contain more food and eventually increase food intake (14). The results of this study show that the effect of spoon size on amount of food intake is a possible intervention to reduce the caloric intake of youth with mild ID and is environment variable that can help weight control.

The duration of meal was not significant different between using normal spoon and small spoon. In a study of obese women, it was reported that eating time was the highest (54.9%) in less than 10 to 20 minutes, and that 26.3% of subjects were eating less than 10 minutes fast (15). The average body fat percentage and obesity were significantly higher in mealtimes (16). Especially, 87.5% of obese female students reported that the time required for meals was less than 20 minutes and there were significant differences with obese students (17). Although the use of small spoons in this study did not appear to affect duration of meal, given considering that short duration of meal was associated with obesity, the study on ways to increase duration of meal is needed in youth with mild ID.

There were no significant differences number of spoonful between using normal spoon and small spoon. On the other hand, amount of per spoonful was significant different between using normal spoon and small spoon. The results of this study are different from

the previous studies. In the previous study, the number of spoonful was increased due to compensatory psychology when small spoon was used (9). On the basis of the fact that food-holding devices, regardless of the amount they serve, can act as cues for actual ingestion as well as affect cognitive thinking, the youth with mild ID differently perceived the amount of food by spoon size. However, further study on how the amount of food perceived by people with ID vary according to the size of the meal tool and bowl and how it affects food intake is necessary.

In this study, the spoon size has a significant effect on the eating rate in youth with mild ID. In a Japanese study, eating rate was reported to be positively correlated with body mass index (BMI) (18). The higher the obesity rate, the faster the meal rate is reported (19). The results of this study, which showed that the use of small spoons slowed decrease of the eating rate, suggests that adjustment of the spoon size in future weight control programs may be a useful method.

Despite to the difference in amount of food intake, the ratings of satiety and hunger at initial and 2 hours after eating test meal did not differ between 2 different-sized spoons. There was a previous study comparing the food intake and satiety of 30 women when they were eating fast and when they were eating slowly (20). In this study, it was reported that the size of a small bite size increases the number of chewing, which increases the satiety by stimulating the physiological satiety signal, so that saturation does not show a significant difference even if a small amount is consumed. Fast eating rate are a major eating habit that causes you to eat large amounts of time until you feel satiety and also causes obesity.

In conclusion, in contrast to typically developing youth, youth with mild ID seem largely unaware of the changes in portion size in a laboratory setting. Youth with mild ID seem more likely to rely on internal physiological cues in determining the amount of food they eat rather than the external environmental cues on interpreting and judging visual information. The results of this study, which showed that the use of small spoon reduced amount of food intake, reduced amount per spoonful, and reduced eating rates, suggests that small spoon may be applied for effective weight management of youth with mild ID. This study was the first trial to investigate the effect of food environment on food consumption in youth with mild ID. Additional research is needed to evaluate the extent to which cognitive and perceptual factors related to portion size exert their effects on youth with mild ID.

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