

Diet Therapy Using a Small Rice Bowl among Japanese Men with Diabetes: A Randomized Controlled Trial

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Background: This study aimed to investigate the effectiveness at 1 and 3 months of using a smaller rice bowl for diet therapy among Japanese men with type 2 diabetes.

Methods: A parallel-group randomized controlled trial was conducted at a medical clinic in Japan. The participants were men with type 2 diabetes mellitus, aged 20–80 years, with glycosylated hemoglobin <8.5%, and who ate rice one or more times per day at home. The intervention group (36 men) received a small rice bowl from which to eat the usual diet therapy, and the control group (38 men) received only the usual diet therapy.

Results: The changes in weight and body mass index among the intervention group at 1 month were significantly higher than those in the control group. There were no significant differences between the two groups at 3 months.

Conclusion: The effects of using a small rice bowl were minor and short-term.

Key words: Bowl size, Nudge, Diabetes mellitus, Randomized controlled trial, Diet therapy

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INTRODUCTION

Recently, the concept of nudge,¹ for improving health behaviors, has received considerable attention. One such nudge for promoting a healthy diet is changing the size of the plate. When served on a relatively large plate, the quantity of food appears smaller than it would if it were served on a smaller plate.

While one previous study observed a significant association between a bigger plate and higher meal energy intake,² others noted no such significant association.³⁻⁵ Some reviews have also reported that participant characteristics (sex, nationality, and weight status), type of serving dish (plate or bowl), place of experiment (laboratory or real world), and food type (snack or main meal) influence the relationship between dish size and food consumption.⁶⁻⁸ Moreover,

most previous studies were conducted in laboratories.²⁻⁵ Only one study conducted in a real-life setting reported that a small rice bowl effectively controlled the body weight of type 2 diabetes patients at 2 weeks; however, the long-term effect was not investigated.⁹ Considering the inconsistencies in previous findings, the effect of dish size on food consumption must be confirmed based on food type.

Therefore, this study investigated the effectiveness of using a smaller rice bowl for 1 and 3 months of diet therapy among Japanese men with type 2 diabetes. As rice contributes most of the total daily energy intake among Japanese people,¹⁰ the present study focused on the size of the rice bowl. The study was limited to men because a previous study reported that an increase in food package size affected men more strongly than women.⁷ Additionally, the rate of diabetes is higher among men than women in Japan.¹⁰

METHODS

Participants and recruitment

Our methods were informed by the guidelines of the Consolidated Standards of Reporting Trials.¹¹ Medical doctors recruited participants at a medical clinic in Aichi, Japan, from June 2019 to April 2020. Eligible participants and the exclusion criteria are shown in Fig. 1.

Procedure

Participants who signed the consent form answered a questionnaire. Then, they were assigned randomly to an intervention or control group in a parallel-group (1:1) randomized controlled trial involving dietitians and staff in a clinic. Those assigned to the intervention group received a small rice bowl (diameter, 10.7 cm; height, 5.0 cm) and the usual diet therapy, which specified rice in-

take. Those assigned to the control group received only the usual diet therapy.

Measures

At baseline, the participants answered questionnaires on demographic characteristics, rice intake, and diabetes diet-related quality of life (DDQOL).¹² At 1 month and 3 months later, they answered questionnaires on the amount of rice that they were instructed to consume, the DDQOL related directly to diet therapy, and their intention to continue the diet therapy. The staff collected medical data at the first clinic visit or on the day of questionnaire completion.

Sample size

The sample size was calculated using G power 3.1.9.2 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) for t-tests

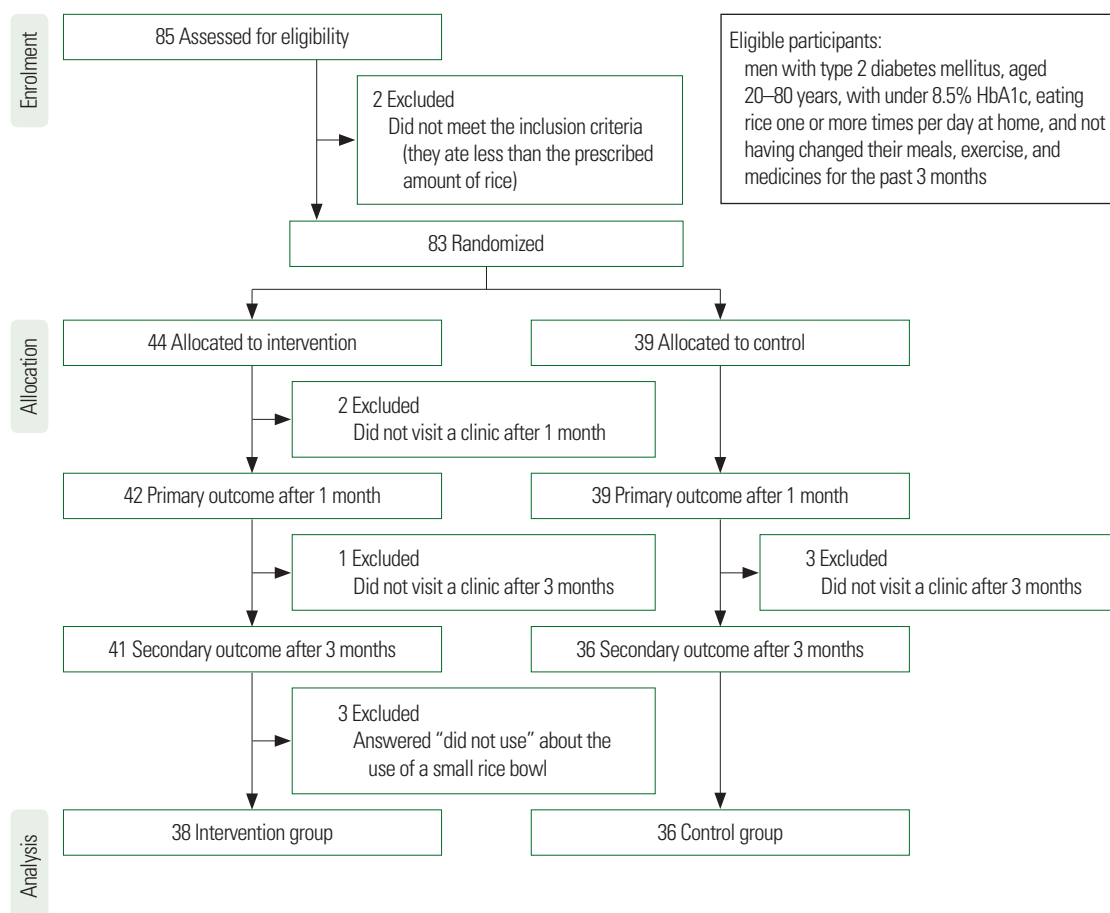


Figure 1. Consolidated Standards of Reporting Trials flow diagram of the number of participants at each stage of the study. Exclusion criteria are (1) eating lesser amount of rice than the amount prescribed, (2) using a smaller size of rice bowl than that used in this study, (3) limiting the intake of protein, and (4) those determined unfit for this study by the doctors because of reduced cognitive ability and other factors. HbA1c, glycosylated hemoglobin.

between the control and intervention groups. Participant recruitment began in June 2019 and was complicated by the coronavirus disease 2019 (COVID-19) pandemic. Thus, recruitment was terminated in April 2020, with 85 recruited participants (control group, 40 men; intervention group, 45 men). Calculation indicated that 70 participants (35 in each group) exhibited a power greater than 0.50 and an effect size of 0.5.

Data analysis

All analyses were conducted using IBM SPSS ver. 26.0 for Windows (IBM Corp., Armonk, NY, USA). Statistical significance was set at $P < 0.050$.

Ethical considerations

This study was conducted according to the Declaration of Helsinki guidelines, and all procedures involving study participants were approved by the University of Nagano's Research Ethics Board (authorization no. E18-5). Written informed consent was obtained from all participants and patients. The study protocol was registered with

the University Hospital Medical Information Network (UMIN)—Clinical Trials Registry (registered no. UMIN000036627).

RESULTS

Participant characteristics

In all, 85 participants were recruited. Fig. 1 shows the flow diagram of the number of participants at each stage of the study. The median (25th–75th percentiles) age of the participants was 54 years (47–60). There were no significant differences in participant characteristics, medical data, and DDQOL between the control and intervention groups at baseline.

Comparison of medical data and DDQOL between baseline and after 1 and 3 months

Table 1 shows the medical data and DDQOL of the intervention and control groups at baseline and after 1 and 3 months. The results show significantly different changes in weight and BMI at 1 month.

Table 1. Comparison of medical data and DDQOL of the control and intervention groups

Variable	Baseline	At 1 month	P^*	At 3 months	P^*
Control group (n=36)					
Weight (kg)	76.3 (66.3–84.0)	76.8 (66.8–84.3)	0.022	77.0 (66.7–84.0)	0.177
Height (cm)	170.8 (165.0–174.1)				
BMI (kg/m ²)	26.4 (23.6–28.6)	26.4 (23.8–28.7)	0.024	26.2 (24.0–28.7)	0.172
HbA1c (%)	6.7 (6.2–6.9)	6.7 (6.2–6.9)	0.324	6.7 (6.2–7.0)	0.223
SBP (mmHg)	123 (117–133)	127 (114–134)	0.844	123 (115–138)	0.731
DBP (mmHg)	78 (70–86)	76 (68–83)	0.309	77 (70–86)	0.806
Satisfaction with diet	16 (15–16)	15 (14–16)	0.215	16 (14–16)	0.548
Burden of diet therapy	22 (20–25)	23 (20–26)	0.466	24 (20–27)	0.154
Perceived merits of diet therapy	17 (16–19)	18 (16–19)	0.107	18 (16–20)	0.077
Intervention group (n=38)					
Weight (kg)	74.9 (64.7–83.1)	74.1 (64.4–82.5)	0.030 [†]	74.6 (65.1–83.3)	0.711
Height (cm)	168.0 (165.0–175.0)				
BMI (kg/m ²)	26.1 (22.8–28.3)	25.8 (23.0–28.1)	0.041 [†]	26.0 (23.0–28.2)	0.788
HbA1c (%)	6.6 (6.3–7.0)	6.6 (6.4–7.1)	0.597	6.6 (6.4–7.0)	0.059
SBP (mmHg)	125 (113–134)	127 (120–136)	0.050	127 (118–138)	0.085
DBP (mmHg)	74 (67–79)	76 (70–83)	0.106 [†]	75 (70–82)	0.065
Satisfaction with diet	16 (15–16)	16 (14–16)	0.359	16 (14–16)	0.029
Burden of diet therapy	23 (21–25)	24 (21–27)	0.020	24 (19–27)	0.716
Perceived merits of diet therapy	18 (16–19)	17 (16–19)	0.670	18 (16–19)	0.505

Values are presented as median (interquartile range).

*Wilcoxon matched paired signed-rank test was used to compare medical data and DDQOL between baseline and after 1 and 3 months within each group; [†] $P < 0.05$ on Mann-Whitney U -test for comparison of changes of medical data and DDQOL from baseline to 1 and 3 months between groups.

DDQOL, diabetes diet-related quality of life scale; BMI, body mass index; HbA1c, glycosylated hemoglobin; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Comparison of diet therapy compliance and continuance intention

At 3 months later, the positive response rate of “Mostly maintained the amount of rice” in the intervention group ($n = 17$, 45%) was significantly higher than that in the control group ($n = 7$, 19%). The response rate of “strongly agree” regarding continuance intention in the intervention group ($n = 10$, 26%) was slightly higher than that in the control group ($n = 2$, 6%), but the difference was not significant.

DISCUSSION

This study investigated the effectiveness of using a smaller rice bowl for 1 month and 3 months of diet therapy in real-life settings in Japanese men with type 2 diabetes. The differences in the changes in weight and BMI were significant at 1 month but not at 3 months.

In other words, the effect of a small rice bowl on participant body measures was short-term, lasting less than 3 months. A previous study on Korean women observed the effect of a small rice bowl after only 2 weeks.⁹ This short duration of effect of nudges could be attributed to habituation that the repeated presentation of a stimulus might cause a decrease in the reaction to that stimulus, a theory formalized by several studies.^{13,14} The advantages of the intervention in our study were the simplicity and labor- and cost-effectiveness. Future studies should extend the research period to examine long-term effects and combine the use of a small rice bowl with other interventions for sustained effectiveness.

CONFLICTS OF INTEREST

Takahiro Tosaki received lecture fees from Novo Nordisk, Sanofi, MSD, Eli Lilly, Sumitomo Dainippon Pharma, and Takeda. No other potential conflicts of interest relevant to this article were reported.

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AUTHOR CONTRIBUTIONS

Study concept and design: all authors; acquisition of data: SS and TT; analysis and interpretation of data: MS; drafting of the manuscript: MS; critical revision of the manuscript: SS and TT; statistical analysis: MS; obtained funding: MS; administrative, technical, or material support: SS and TT; and study supervision: MS and TT.

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