Improvement of Dietary Habits in Patients with Impaired Glucose Tolerance : Effects of Group Education on Self-Management

Short Communication

Improvement of Dietary Habits in Patients with Impaired Glucose Tolerance: Effects of Group Education on Self-Management

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1 Introduction

In Japan, the Ministry of Health, Labor and Welfare has promoted a health promotion policy called Health Japan 21. This policy has increased the amount of information that people obtain on health and nutrition within the community and also at their work place. However, despite this policy there has been a shift in the opposite direction for several health indicators, one of which is the increase of life-style diseases, including the metabolic syndrome and diabetes that has occurred in middle-aged and elderly people. From 2008 onwards, methods of efficient self-management training will be required in public health programs, and all health insurance organizations will be responsible for educating and improving the medical characteristics of patients with the metabolic syndrome or other health problems. One of the goals of this policy is to decrease by 25% the number of patients with life-style diseases such as the metabolic syndrome, diabetes and borderline cases by 2015. Previous studies have examined and reported on the effectiveness of several programs for diabetes education [1,2]. Sudo et al. [2] used a meta-analysis to examine the effectiveness of educational interventions and showed that diet and exercise interventions were the most effective for improving glycemic control in patients with type 2 diabetes. On the other hand, recent research has emphasized that health care providers need to adopt a more patient-centered counseling style [3,4]. In this regard, Credock [5] states that as increased knowledge does not necessarily lead to changes in behavior, diabetes education should be seen as a collaboration between equals, designed to help patients make informed decisions about self-management. Using this strategy, patients identify life-style problems by themselves and set goals to improve their behavior leading ultimately to the ability to self-manage their life-styles.

This paper describes a patient-centered diet program that we introduced and a subsequent study of the effects of group education on self-management. This education program had the aim of improving the dietary habits in patients with impaired glucose tolerance.

2 Subjects and Methods

2.1 Subjects

The study protocol was approved by the Ethics Committee of the School of Comprehensive Rehabilitation at Osaka Prefecture University and informed consent was obtained from all the patients. People were recruited for the program if they were diagnosed with impaired glucose tolerance (glycated hemoglobin A1c (HbA1c) $\geq 5.5\%$ to $< 6.1\%$) in a public health check in Habikino city (Osaka, Japan) in 2006. The participants were 52 adults who agreed to take part in the study program, with the final study group consisting of 46 people (mean age 63.6 $\pm$ 4.7 yr, 9 men and 37 women) excluding 6 individuals who withdrew from the program. The contents of this program consisted of exercise, oral management and diet, with the dietary program being especially emphasized. The exercise program was performed once a month for 6 months. The participants were also encouraged to walk every day.

2.2 Diet program

The diet program was performed once a month for 6 months from April to September in 2007. The diet program was based on group dynamics. The participants were divided into 5 groups with 10 or 11 people in each group and a registered dietician and public health nurse were assigned to each group as advisers. Before the program started, we educated the registered dieticians and public health nurses on interactive support and advised

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them how to make a participant-centered group function correctly. The lectures were designed so that the participants could understand them easily and make changes to their behavior accordingly such as "Eat the vegetables fast in the meal" or "Eat slowly". In order that the participants could have positive learning experiences, the program included games and a quiz. A self-check sheet and check sheet for measuring body weight were distributed to the participants. Participants checked whether they had been successful or had failed their goals using the self-check sheet, and they also recorded their body weight and waist circumference using the body weight check sheet every day. Each group dynamic session lasted for approximately 1-2 hours. In the sessions, the participants made intermediate goals for themselves by thinking about practical things that they could use to change in their diet and daily exercise habits. In addition, they encouraged each other to achieve the goals. During the program, the participants cooked and ate a menu designed to prevent diabetes and also ate a lunch box with a menu provided by a dietitian. Self-monitoring of blood glucose was also carried out before and 2 hours after eating respectively. The participants recorded the details of their usual meals and took pictures of these meals 3 days before and after each intervention. The meal records were analyzed using Eiyokun (Kenpakusha, Japan).

2.3 Outcome measures

The indices measured before and after intervention included body height and weight, body mass index (BMI), waist circumference and the following laboratory data: fasting blood glucose (FBG), HbA1c, total cholesterol (Total-Ch), low density lipoprotein cholesterol (LDL-Ch), high density lipoprotein cholesterol (HDL-Ch) and triglyceride (TG). The laboratory analyses were carried out by an external bio-clinical laboratory.

We also examined dietary restraint before and after intervention using the restraint scale of The Dutch Eating

Behavior Questionnaire (DEBQ)[6]. The DEBQ consists of 33 items and contains three scales for measuring 'emotional eating' (13 items), with the scale for overeating in response to emotions corresponding to the psychosomatic theory of Bruch[7]. 'External eating' (10 items) was a scale of eating in response to food-related stimuli, regardless of the internal states of hunger and satiety, and corresponded to the externality theory of Schachter & Rodin[8]. 'Restrained eating' (10 items) was a scale of attempts to refrain from eating and corresponded to the restrained eating theory of Herman & Polivy[9]. These subscales have been reported to have high internal consistency, factorial validity, and Pearson and item-total correlation coefficients[6]. The response alternatives were: 'Never' = 1, 'Seldom' = 2, 'Sometimes' = 3, 'Often' = 4, 'Very often' = 5.

2.4 Statistical analysis

Data were expressed as means $\pm$ SD. The statistical analyses were performed using SPSS version 14.0 (SPSS Inc., USA). Differences in the laboratory and dietary data before and after the intervention were determined using paired-t tests. Differences in DEBQ scores were determined by factor analysis (principal component, varimax rotation), while differences between factor scores before and after intervention were determined using paired-t tests. A p-value of less than 0.05 was considered statistically significant.

3 Results

Table 1 shows BMI, waist circumference and laboratory data before and after intervention. Over the study period, significant decreases ($p<0.001$) were observed for BMI (23.6 ± 3.5 kg/m^2 vs 22.5 ± 3.3 kg/m^2), waist circumference (88.3 ± 10.9 cm vs 83.7 ± 10.4 cm) and HbA1c ($5.8\pm0.4\%$ vs $5.4\pm0.2\%$). FBG, Total-Ch, LDL-Ch and TG were also decreased significantly (FBG, TG; $p<0.01$, Total-Ch, LDL-Ch; $p<0.001$).

The changes in nutrition intake before and after intervention are summarized in Table 2. Total energy

Table 1 Changes in BMI and laboratory data before and after intervention

| | Intervention | | p-value |
	Before	After	
BMI (kg/m^2)	23.6±3.5	22.5±3.3	0.000**
Waist circumference (cm)	88.3±10.9	83.7±10.4	0.000**
FBG (mg/dl)	100±9	96±10	0.009*
HbA1c (%)	5.8±0.4	5.4±0.2	0.000**
Total-Ch (mg./dl)	234±29	220±32	0.000**
LDL-Ch (mg/dl)	142±28	126±28	0.000**
HDL-Ch (mg/dl)	70±19	68±16	0.090
TG (mg/dl)	144±83	112±53	0.001*

Data are expressed as means±SD.
Before intervention vs after intervention; *$p<0.01$, **$p<0.001$

Table 2 Changes in nutrition intake and food group intake before and after intervention

| | Intervention | | p-value |
	Before	After	
Nutrition intake			
Energy (kcal)	2009±352	1776±374	0.000**
Protein (g)	83.1±12.8	78.7±15.9	0.096
Lipid (g)	60.2±12.8	53.3±16.1	0.003*
Carbohydrate (g)	273.6±50.8	242.7±58.8	0.000**
Dietary fiber (g)	18.0±3.7	19.2±5.3	0.134
Salt (g)	11.6±2.1	10.4±2.5	0.002*
Food group intake			
Cereals (g)	409±102	323±92	0.000**
Seeds (g)	4.0±6.9	2.5±3.1	0.180
Potatoes (g)	45±37	47±42	0.700
Sugars (g)	14±10	11±8	0.173
Oils (g)	16±10	14±9	0.219
Beans (g)	79±54	98±66	0.083
Fruites (g)	134±82	143±88	0.529
Green and yellow vegetables (g)	127±56	234±100	0.000**
Vegetables (g)	170±55	229±83	0.000**
Mushrooms (g)	17±16	16±19	0.680
Seaweed (g)	16±15	18±24	0.510
Fish (g)	107±38	35±43	0.146
Meat (g)	60±31	66±37	0.146
Egg (g)	52±29	36±22	0.000**
Milk and milk products (g)	135±106	137±97	0.857

Data are expressed as means±SD.
Before intervention vs after intervention; *$p<0.01$, **$p<0.001$

Table 3 Factors and factor loadings for DEBQ items

| Items | Factor | | |
	I (Emotional eating)	II (External eating)	III (Restrained eating)
30. Do you have the desire to eat when you are depressed or discouraged?	0.93	0.18	0.02
20. Do you have a desire to eat when things are going against you or when things have gone wrong?	0.88	0.24	0.02
15. Do you have the desire to eat when you are disappointed?	0.87	0.26	0.20
14. Do you have a desire to eat when you are cross?	0.82	0.32	0.01
21. Do you have a desire to eat when you are feeling lonely?	0.79	0.18	−0.18
4. Do you get the desire to eat when you are anxious, worried or tense?	0.76	0.11	−0.18
8. Do you have a desire to eat when somebody lets you down?	0.75	0.31	0.11
16. Do you have a desire to eat when you are frightened?	0.71	0.13	−0.16
28. Do you have a desire to eat when you are expecting something unpleasant to happen?	0.68	0.12	−0.34
22. Do you have a desire to eat when you are emotionally upset?	0.66	0.03	−0.33
18. Do you eat more than usual when you see others eating?	0.36	0.34	−0.19
2. If you have something delicious, do you eat it straight away?	−0.04	0.79	−0.13
10. If you see or smell something delicious, do you have the desire to eat it?	0.22	0.77	0.12
12. If food tastes good to you, do you eat more than usual?	0.19	0.75	0.04
7. If food smells and looks good to you, do you eat more than usual?	0.31	0.69	0.07
31. If you walk past a restaurant or café, do you have the desire to buy something delicious?	0.15	0.65	−0.12
5. How often do you try not to eat between meals because you are watching your weight?	−0.26	−0.63	0.34
6. When you are preparing a meal, are you inclined to eat something?	0.26	0.55	0.21
9. If you see others eating, do you also have the desire to eat?	−0.01	0.52	−0.10
24. If you walk past a confectionery, do you have the desire to buy something delicious?	0.24	0.51	−0.11
32. Can you resist eating delicious food?	0.17	0.36	−0.14
33. If you have put on weight, do you eat less than you usually do?	−0.19	0.07	0.86
23. Do you take into account your weight with what you eat?	−0.02	0.11	0.78
17. Do you deliberately eat less in order not to become heavier?	−0.19	−0.11	0.77
29. Do you deliberately eat foods that are slimming?	−0.02	−0.11	0.72
13. When you have eaten too much, do you eat less than usual the following day?	−0.17	−0.08	0.58
1. How often do you refuse food or drink offered because you are concerned about your weight?	0.12	−0.25	0.57
α coefficient	0.94	0.74	0.88

intake decreased significantly from 2009±352 kcal before intervention to 1776±374 kcal after intervention ($p<0.001$). The intake of lipid (60.2±12.8 g vs 53.3±16.1 g; $p<0.01$), carbohydrate (273.6±50.8 g vs 242.7±58.8 g; $p<0.001$) and salt (11.6±2.1 g vs 10.4±2.5 g; $p<0.01$) also decreased significantly after intervention. The intake of cereals (409±102 g vs 323±92 g) and eggs (52±29 g vs 36±22 g) also decreased significantly after intervention (both $p<0.001$), whereas the intake of green and yellow vegetables (127±56 g vs 234±100 g) and vegetables (170±55 g vs 229±83 g) increased significantly (both $p<0.001$).

Factors and factor loadings for the DEBQ items are shown in Table 3. Some of the factor loading items with values <0.35 were excluded. The following three items in the original 'emotional eating' scale were excluded: 'Do you have the desire to eat when you are irritated?' (item 11), 'Do you have a desire to eat when you are bored or restless?' (item 26) and 'Do you have the desire to eat when you have nothing to do?' (item 27). In the original 'restrained eating' scales, the following three items were excluded: 'Do you watch exactly what you eat?' (item 3), 'Do you try to eat less at meal times than you would like eat?' (item 19) and 'How often in the evenings do you try
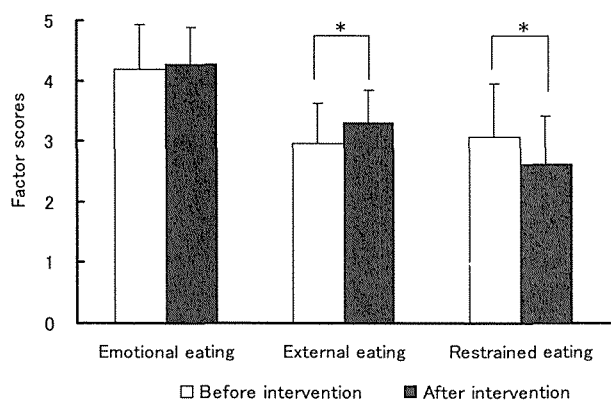
Fig. 1 Comparison of factor scores in the DEBQ questionnarie before and after intervention.
The white bars show the factor scores before intervention and the black bars the factor scores after intervention. 'External eating' and 'restrained eating' were improvement significantly after intervention. *p<0.05
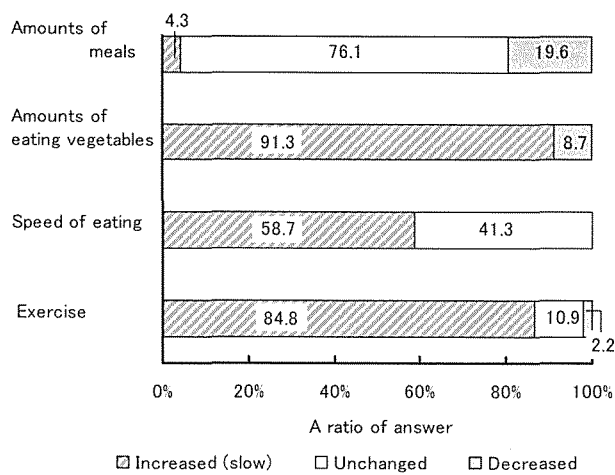

Fig. 2 Results of questionnaire survey after the intervention.
The striped bars show the percentage that increased (slow), the white bars the percentage that remained unchanged, and the gray bars the percentage that decreased.

not to eat because you are watching your weight?' (item 25). These results confirmed the factorial integrity of the DEBQ, with 26 of the 33 original items having appropriately significant loading. Factor 1 (emotional eating) accounted for 35% of the variance, factor 2 (restrained eating) 12% and factor 3 (external eating) 15%. Computation of the internal consistency of the data showed an alpha coefficient of 0.84 for the DEBQ total score. The subscale alpha values were 'emotional eating' 0.94, 'external eating' 0.74 and 'restrained eating' 0.88, with these values indicating adequate internal consistency. The factor scores were expressed as the mean scores of each item in each factor. 'Emotional eating' and 'external eating' are associated with an improvement in high factor scores, whereas 'restrained eating' is indicated by an improvement in low factor scores. Significant differences were found for the 'external eating' and 'restrained eating' scales (both

$p<0.05$) after intervention in the study (Fig. 1).

The results of the questionnaire survey on changes in dietary and exercise habits after the intervention are shown in Fig. 2. The prevalence of participants who answered that the amounts of their meals had decreased was 19.6%, while 76.1% reported no change. An increase in the amount of vegetables consumed was reported by 91.3% of participants, eating slowly by 58.7% and an increase in exercise by 84.8%.

4 Discussion

We often experience that it is difficult to motivate individuals to change their lifestyle, especially their diet. Self-management of dietary habits is therefore most important. In order to achieve this objective, we consider it is necessary to define dietary problems and then set appropriate goals and behavior aimed at changing dietary habits. In our diet program, self-management group

education was emphasized. In addition, this education was supplemented with lectures on awareness of present dietary habits and management of life using self-check and body weight check sheets every day.

Laboratory data improved significantly after this intervention. The data indicated these improvements were related to a decrease in total energy with a decrease in the intake of cereals and an increase in the intake of vegetables. Participants understood the suitable amount of meals in the dietary program and we also repeated a lecture concerning eating order such as having vegetable dishes first, followed by other dishes, with cereals at the end. Excessive intake of cereals was prevented by adopting this order of eating. In the lecture, we also recommended to choose foods with a low glycemic index (GI) such as rice with barley, and bread made of whole wheat flour. The GI of these foods was low compared with polished rice and white bread. Participants understood how to choose food and better ways to eat, and were able to achieve their objectives. As a consequence of this program, participants were aware of their dietary habits. These results were reflected in the questionnaire survey after the intervention. The amount of meals unchanged or decreased, the amount of vegetables eaten increased, while eating speed became slower. Furthermore, participants understood the appropriate amounts of food required for individuals and realized the importance of diet. We surveyed psychological factors using DEBQ before and after intervention. The scales for 'external eating' and 'restrained eating' improved significantly. The improvement in 'external eating' which represented eating elicited by external stimuli and 'restrained eating' which reflected a tendency to diet with the aim of losing weight indicated that the participants were able to control their eating behavior.

Self-management behavior of diet consists of a process of purchasing food, cooking and eating behavior. Throughout this program, we recognized that dietary behavior and psychology of the participants changed. The improvement in life-style suggested that group dynamics had been influenced strongly by individual effort. A characteristic of these group dynamics was the interactive support between participants and the advisers, with the participants encouraging each other to achieve their goals. Gregoire et al. [10] reported that supporting people with illnesses so that they understood their experiences has been shown to be effective in several studies. Sharing of experiences with others gave the participants reassurance, helped alleviate anxiety, and led to a more positive outlook on life. In our program, the participants were able to form companionships, which promoted encouragement and the motivation required to change their life-style. Participants gained confidence and the ability to self-manage their life-style by identifying dietary problems by themselves, setting goals, and making behavioral change in dietary habits.

In conclusion, this study indicated that group education on self-management can be effective for patients with impaired glucose tolerance and improving the dietary habits of these people.

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