

Diabetes mellitus and life-style — for the primary prevention of diabetes mellitus: the role of diet

Ryoko Hagura*

The Institute for Diabetes Care and Research, Asahi Life Foundation, 1-6-1 Marunouchi Chiyoda-ku, Tokyo 100-0005, Japan

Diet treatment for diabetes requires restriction of the food amount (energy intake). It is desirable that patients have a proper relative consumption of the three main nutrients (proteins, carbohydrates, fats) and also habitually take low-energy foods such as vegetables, mushrooms and seaweeds, etc. as often as possible in each meal. Therefore, we can replace the expression 'a diet for diabetes' with 'a diet for healthy living'. By showing a clinical case of an obese diabetic patient, who succeeded to reduce their body weight, HbA_{1c} and oral agents through diet treatment, and finally could go on diet treatment only, the importance of diet therapy can be emphasized. Furthermore, the estimation index was examined to evaluate how accurately diabetic patients could estimate food energy. According to this study, a large amount of food on the plate leads most patients to underestimate the amount of real energy, and patients are apt to eat too much compared with having smaller amounts of food on the plate. By analyzing questionnaires on the diet therapy of approximately 3000 diabetics, it has been shown that the majority of patients at our hospital recognize that diet therapy is the most important factor in the treatment of diabetes. Interestingly, patients who ate all the food served showed a significantly higher body mass index compared with those who left served food.

Diabetes: Diet therapy: Estimation index

The basic treatment of diabetes is the diet

The diet for a diabetic is a diet for healthy living

Diet treatment for diabetes does not require a special prescribed eating plan. There are no restricted foods for diabetics, but a remarkable feature is that the diet restricts the amount of food (the energy intake). It is necessary to reduce high-energy foods such as fatty foods and increase low-energy foods (e.g. vegetables, seaweeds, mushrooms and glucomannan, etc.) to control hunger. A diabetic diet is actually a diet for those who want to live longer and healthier. Therefore, we can replace the expression 'a diet for diabetes' with 'a diet for healthy living'.

The diet is the most important and basic treatment of diabetes. Anyone who has been diagnosed with diabetes must follow this treatment. However, diabetics usually do not have any symptoms or are even unaware of diabetes itself. Moreover, patients have to struggle with their appetite, which is exasperated, when glycemic control is poor. These factors make diet treatment more difficult.

The fundamentals of the diet treatment for diabetic patients

To start the diet treatment for diabetics, they should understand the meaning of diet treatment and then follow the fundamental rules. The fundamentals of diet treatment for diabetes are as follows:

- (1) an appropriate amount of energy intake per day;
- (2) proper amounts of the three main nutrients (proteins, carbohydrates and fats);
- (3) proper intake of vitamins and minerals;
- (4) regular eating times;
- (5) effort to maintain the above basic rules life-long.

The fundamentals for diet treatment are (1), (2) and (3). In addition to these, (4) and (5) are also very important for following diet treatment. Especially concerning (5), for a certain period (for example, when patients are admitted to the hospital or during pregnancy), diet can be easier to control. However, they must still continue the diet

Abbreviations: BMI, body mass index; EI, Estimation index.

* **Corresponding author:** Ryoko Hagura, tel 81 3 3201 6781, fax 81 3 3201 6881, email hagura@jms.jeton.ne.jp

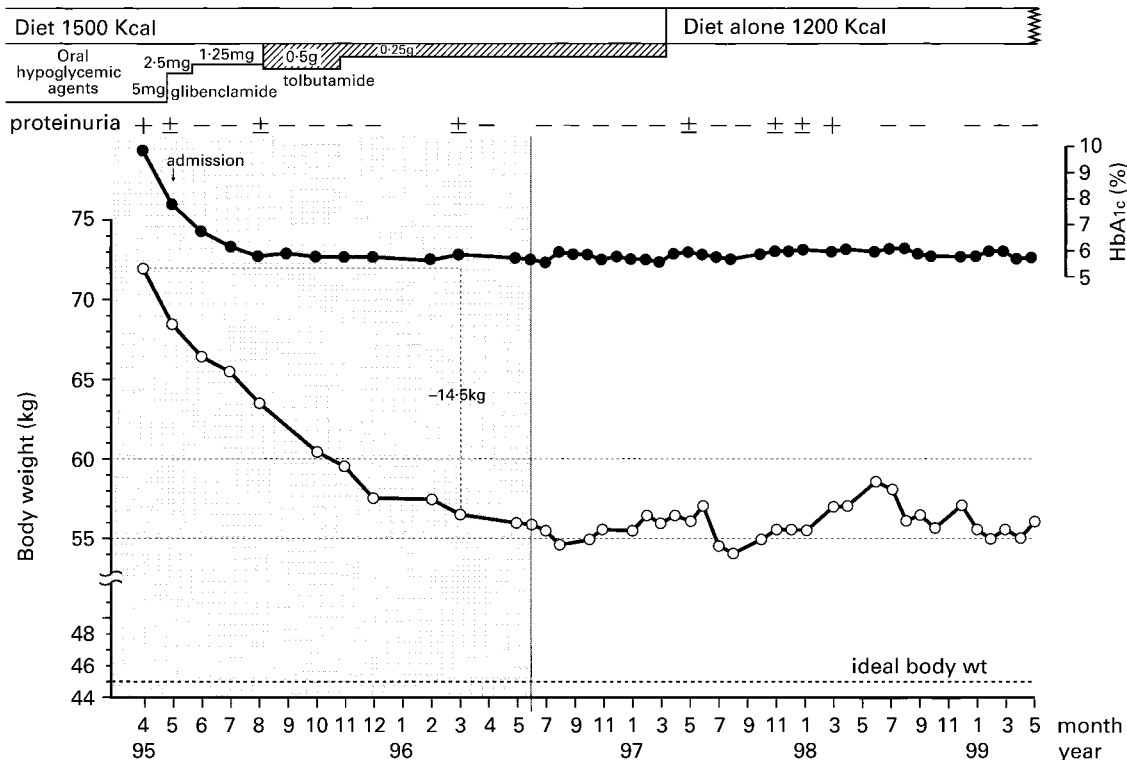


Fig. 1. The clinical course of an obese diabetic patient (T.S. female, age: 66 years old). The patient learned the correct diet therapy during admission for diabetes education. As a result, her HbA_{1c} and body weight decreased significantly. Finally, she stopped taking oral hypoglycemic agents, and controlled her diabetes by diet alone.

treatment by themselves for their lifetime without exceptions. This is why diet treatment is considered to be difficult in practice.

However, it would become easier for patients to practice diet treatment if they were well educated about diabetes and really understood the importance of diet in the treatment of diabetes. For this reason, education should play an important part.

Striking effect of diet treatment for diabetes learned from an actual case

Figure 1 illustrates the case of a patient who markedly reduced her body weight and improved diabetic metabolism significantly. As a result, oral agent therapy was discontinued and diet treatment alone revealed good metabolic control thereafter. This case shows the importance and effectiveness of diet in the treatment of diabetes.

The patient was a 66-year-old female who was diagnosed with diabetes at the age of 59 years old, and was advised to reduce weight, but she did not. Her maximum body weight was 90 kg (body mass index (BMI) = 39.1). From the age of 60, oral hypoglycemic agent was prescribed. At the age of 64, she visited our hospital for the first time. Her weight was 72 kg (BMI = 31.3), HbA_{1c} was 9.8% and fasting blood glucose was 206 mg/dl. She was immediately admitted to our hospital and learned intensively about diabetes following our diabetes education program for two weeks. During this admission, she reduced her body weight

by 2 kg and the amount of oral agent was reduced. HbA_{1c} fell from 9.8 to 5.7% over a 4-month period as an out-patient, and she kept HbA_{1c} close to 5% until now. She reduced her body weight by 14.5 kg over the next year. The amount of hypoglycemic agent prescribed was reduced further to the minimum amount of the weakest agent. After one year on this regimen, she was finally treated by diet only.

It is remarkable in this case that she could improve diabetic metabolism significantly despite remaining relatively obese. This shows the result of strictly following diet treatment. Patients can improve metabolism by maintaining a proper diet, even before normalizing their body weight. It is important that many type 2 diabetics can be treated with diet alone. The sooner patients start diet treatment, the greater the possibility of success. Thus, for type 2 diabetes many cases have shown remarkable improvement in metabolism by strict adherence to diet treatment.

The ability to estimate the energy of food for diabetic patients

The 'Japanese Food Exchange Lists for Diabetic Therapy' (Japan Diabetes Society, 1993) were published for the convenience of diet treatment from which diabetics can estimate the amount of energy of food for themselves. The basis of diet treatment lies in the ability to estimate the energy content (unit) of food for diabetics. One unit contains 80 kcal. For several years, we have been planning

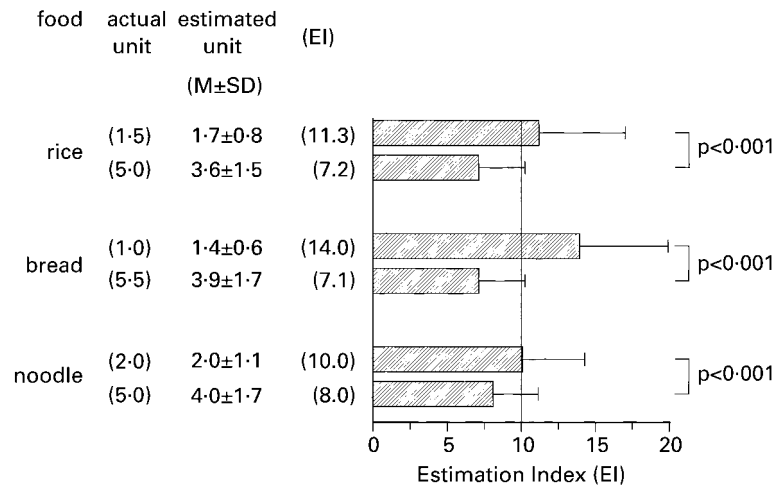


Fig. 2. Comparison of estimated energy units for different amounts of rice, bread and noodles, as estimated by diabetic patients ($N = 448$). One unit is equal to 80 kcal according to the food exchange list of Japan Diabetes Society.

an index for estimation and trying to evaluate how accurately patients can estimate energy of food. Estimation index (EI) is calculated as follows: $EI = \text{estimated energy unit}/\text{actual unit} \times 10$. An index of 10 is a correct estimation, EIs lower than 9 are underestimations, EIs between 9 and 11.9 are proper estimations, and EIs above 12 are overestimations. We judge 10 ± 1 as inappropriate and recognize an EI as good when 'overestimated', because diet therapy can be safer when they overestimate. When we analyzed the ability of diabetics to evaluate the energy units of various foods, only 30 % of patients estimated properly, 20 % overestimated, and 50 % underestimated. This suggested, therefore, that they have a tendency to eat too much. The most interesting point is that for the same kind of food, when served in small quantities, most patients can estimate it accurately or overestimate it, but when served as a large quantity, they are apt to underestimate, see Fig. 2 (Hagura, 1997). They estimated 1.5 unit for 1.7 unit ($EI = 11.3$) when served a small quantity of rice, but they underestimated 5.0 unit for 4.0 unit ($EI = 7.2$) when served a large quantity of rice. There was a similar tendency for bread and noodles. The index may be supposed to be low when foods are served in large portions even if they are similar foods. Too much food on the dish leads people to underestimate the real energy content. Underestimation leads diabetics to overeat, so attention must be given to this matter. Therefore, in diabetes therapy, we should control diet in detail for better diabetes treatment by taking into consideration the patients' ability to estimate energy contents, eating tendency and habits, etc.

Patient's understanding and awareness for diet treatment

When following diet treatment, patients must first of all restrict the total amount of food intake, study the food exchange lists, estimate the calorie units of each food, decrease alcohol consumption and study the restriction of

eating out and so on. In addition, diabetics must endure a degree of mental stress because they must tolerate hunger.

Once the patient has been diagnosed with diabetes, they are requested to start a good life-style and adhere to the restriction of food intake. The following are findings (Hagura, 2000) of a questionnaire completed by 3000 patients who regularly visited our outpatients department, about their understanding and awareness of diabetes. According to this questionnaire, 82 % of patients agreed that diet was most important for diabetes therapy, and only 7 % answered that exercise was important. However, when compared according to the type of diabetes, most type 2 patients thought that diet was most important for treatment, and 68 % of type 1 patients thought that not only was insulin treatment most important as a matter of course, but that diet was also almost equally important.

Diabetics really admit the importance of diet

Regarding the questionnaire about the food exchange lists, 92 % of all patients own this book. Eighty-two per cent of patients reported that it was useful, and 31 % had difficulty in studying the book. During long-term follow-up at the outpatient clinic, diabetics sometimes got very severe advice from their doctors. When some were cautioned against eating too much or when some were given the caution about being overweight, 49 % of the former and 54 % of the latter thought 'I will do my best for the next time!' In the outpatient clinic, patients were sometimes scolded like a child, or sometimes praised. Seventy-three per cent of patients had been scolded, and 86 % had been praised. Sixty-seven per cent of the former thought in a positive way for next meeting or appointment, and 45 % of the latter thought in a positive way to continue.

In the diet therapy of diabetes, drinking alcohol and eating out are the factors to cause the patients to have poor control. In the survey of alcohol drinking, 22 % of males and 65 % of females never drank alcoholic beverages.

While taking alcohol beverages, half of males could stop within a limitation, and only 9 % of males could not. Eleven per cent of the patients abstained from drinking alcohol after recommendation by the doctor, 40 % of the patients were permitted a certain limit of alcohol consumption. In the patients who had been restricted, the first ranking of (30 %) their feelings was 'lonely' and the second (29 %), which was very close to the first, was 'fortunate to be able to abstain'. The majority of the patients had experience of eating out and only 4 % of the patients never ate out. Twenty-eight per cent of the patients ate all the food served at the restaurant, 38 % of them said that the reason to eat all the dish was 'because it was delicious', 25 % answered that the reason was 'because it was wasteful to leave food'. From these findings, we could learn that eating out would become a serious problem in the diet treatment of diabetes. Regarding eating out, we compared 802 cases (28 %) who ate all the food served with 2090 cases (72 %) who left something or ate an appropriate amount. The former had a BMI of 23.1 ± 3.16 , and the latter had a BMI of 22.3 ± 3.08 . The difference is significant ($P < 0.01$).

The role of diet in the primary prevention of diabetes

The WHO (Report of a WHO Study Group, 1994) classifies diabetic prevention into three levels: primary, secondary and tertiary. Primary prevention includes activities that prevent diabetes from developing. Secondary prevention includes activities such as early detection of diabetes, prompt and effective management of diabetes, and also measures to halt its progression. Tertiary prevention includes all measures undertaken to prevent complications and physical disabilities due to diabetes. Diet is important at any of these levels of prevention. The target subjects of primary prevention are people who do not have diabetes. In other words, by teaching the right habit of eating and life-style, we must try to prevent the development of diabetes. This should be publicized, and must also be taught as social education. More attention should be paid to the problems that have high-risk for diabetes. The following are suggestions for the education of diet life-style and enlightening activity that would be effective to the public.

Generally, we can teach the following items. This can be very useful for prevention of not only diabetes but also atherogenic disorders:

- avoid overeating;
- reduce excess body weight;
- ensure your nutrition at each meal is well-balanced, especially avoid fatty foods and consume more vegetables, seaweed and mushrooms;
- keep to a regular eating time.

It is our intention to send the above-stated guidance to

everyone through the mass media and so on. We should not only treat diabetics, but also take effective means to prevent diabetics. Thus, it is desirable to specifically target the group whose risk for diabetes is high, such as those whose family members have diabetes, those who are obese, those who have delivered a large baby, those whose glycosuria is positive, those whose blood glucose has increased and so on.

The intervention study for IGT in China (Pan *et al.* 1997) for six years indicated that positive diet restriction and exercise significantly reduced the rate of progression to diabetes. We compared the patient group that was educated to adhere to diet with the other group without any education and practice, and obtained the following results:

- (1) Percentages of patients with FBG above 140 mg/dl after six years were 16.2 % and 41.4 % in the educated and non-educated groups, respectively.
- (2) Percentages of patients with greater than 200 mg/dl of 2 h postprandial blood glucose were 43.8 % in the former and 67.7 % in the latter.

These findings indicate that diabetes was significantly prevented in the educated group. A similar study has already been reported from Sweden (Eriksson & Lindgarde, 1991).

These studies suggest that it is important to intervene before development of diabetes and to adhere to a proper diet. It follows that not only letting IGT alone but also teaching about diet lowers the incidence of the development of diabetes. This is true not only for diabetes, but also for the prevention of atherogenic disorders and is an important issue that contributes to build up a national health strategy.

References

- Eriksson KF & Lindgarde F (1991) Prevention of type-2 (non-insulin-dependent) diabetes mellitus by diet and physical exercise. The 6-year Malmö feasibility study. *Diabetologia* **34**, 891–898.
- Hagura R (1997) Prescription of Diet, *Progress in Diabetes Care and Education '97*: pp. 53–57. Shindan-to-Chiryō Co. Ltd., Tokyo (in Japanese).
- Hagura R (2000) Guide for self-control. *Journal of the Japan Diabetes Society* **43**, 25–27 (in Japanese).
- Japan Diabetes Society (1993) *Japanese Food Exchange Lists for Diabetic Therapy*, 5th ed. Bunkodo, Tokyo: Japan Diabetes Association.
- Pan X, Li G, Hu Y, Wang J, Yang W, An Z, Hu ZL, Lin J, Xiao J, Cao H, Liu P, Jiang X, Jiang Y, Wang J, Zheng H & Zhang H (1997) Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and diabetes study. *Diabetes Care* **20**, 537–544.
- Report of a WHO Study Group (1994) *Prevention of Diabetes Mellitus*. WHO Technical Series 844, Geneva: WHO.