

GUIDELINES FOR DIET CONTROL IN DIABETES MELLITUS —Importance of Food Exchange Lists and Perspectives for the Future—*

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Abstract: “Food Exchange List for Diet Therapy of Diabetes Mellitus” was proposed by the Japan Diabetes Society to meet the fundamental requirement of diet control in diabetes mellitus. They are (1) appropriate daily caloric intake, (2) diet with good nutritional balance, and, (3) appropriately divided meals taken at designated times. Foods are classified into six tables of four groups and seasonings. A unit, defined as 80kcal, common to all food groups has been created, and in each table the mean content of nutrients in one unit of the food is indicated. It is recommended, at each caloric intake level, to take definite respective units of food from each table; for example, when taking 1,600 kcal diet (20 units), 11, 1, 4, 1.4, 1, 1, and 0.6 units from Table 1 to 6 and seasonings, respectively. The recommended diets in the Food Exchange List are in good agreement with the composition of the daily diet of the average Japanese people, and are referred to as healthy food. As ready-to-eat food and cooked food have become popular, it may be necessary to revise Food Exchange List, taking them into consideration.

Key words: General rules for diet control;
Characteristics of a food exchange list;
Westernization of dietary habits

Introduction

It is well known that diet control and exercise constitute the basis of the treatment of diabetes mellitus. Diet control, in particular, is an essential approach to the treatment that should be observed by all diabetic patients. It is not rare for cases of non-insulin-dependent diabetes mellitus to improve solely as a result of diet control, without recourse to any medication. Even in cases of insulin-dependent diabetes mellitus, insulin therapy cannot exert its effects fully unless appropriate diet control is also practiced concomitantly.

To maximize the effects of diet control in the treatment of diabetes mellitus, the use of the “Food Exchange List for Diet Therapy of Diabetes Mellitus”,¹⁾

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edited by the Japan Diabetes Society, is recommended. This food exchange list is designed based on the following fundamental principles, to facilitate diet control by the patients in daily life:

- (1) should be simple and easy to use;
- (2) can be used by people with different dietary habits and environments;
- (3) should be useful when eating out; and
- (4) should be helpful in understanding the basic rules of a proper diet.

The "Handbook for guidance of diet therapy of diabetes mellitus based on the 'Food Exchange List'"²⁾ edited by the society is expected to be useful for medical staff wishing to instruct their patients on diet control.

This article introduces the contents of the handbook and discusses diet control for the treatment of diabetes mellitus.

Significance of Diet Control

Diet control in diabetes mellitus has the following two roles.

The first role is to supply adequate nutrition for the diabetic patients to lead their daily lives in the same way as healthy people. The amount of nutrition should be limited to the minimum necessary for maintaining the body weight at an appropriate level as well as leading the ordinary daily life. It is important to avoid excessive caloric intake. Since the amount of insulin required is reduced, the metabolism of glucose and other substances occurs smoothly, and the functions of the pancreatic B cells are preserved.

The second role is to supply nutrients in good balance for maintaining a healthy body. The three major types of nutrients, as well as vitamins and minerals, should be supplied in appropriate amounts. This results in smoother metabolism, and risk factors for complications such as hyperlipidemia and hypertension are corrected.

Diet with Appropriate Calorie Level

The appropriate daily caloric intake is that which is necessary for maintaining the body weight at or slightly below the ideal weight, while preventing obesity, and which allows the patients to lead their daily lives without any inconvenience. It is determined individually on the basis of the age, gender, height, body weight, and activity level of the patients. The daily caloric requirement for healthy people is calculated as the sum of that required for basal metabolism, metabolism associated with physical activity (activity metabolism), and specific dynamic action.³⁾ It remains to be confirmed whether the same equation applies for diabetic patients.

Accordingly, the following caloric intakes are recommended empirically per kg ideal body weight in adults on the basis of their requirement for basal metabolism: 25 to 30 kcal for light labor, 30 to 35 kcal for moderate labor; and 35 kcal or more for heavy labor.

Numerous methods have been recommended for calculation of the ideal body weight. In recent years, the body mass index (BMI; body weight (kg)/body height (m)²) has been proposed as an index for the body constitution. Since a BMI of 22

Table 1 Examples of the Proportion of Each Nutrient According to the Recommended Daily Units Indicated in "Food Exchange List for Diet Therapy of Diabetes Mellitus" Edited by the Japan Diabetes Society and the Ratio of Three Major Nutrients

Recommended daily units (recommended caloric intake)	Recommended daily units (recommended caloric intake)							Caloric ratio of the three major nutrients (%)		
	Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Seasoning	Carbohydrate	Protein	Fat
In the case of 15 units per day (1,200 kcal)	6	1	4	1.4	1	1	0.6	52	20	28
In the case of 18 units per day (1,400 kcal)	9	1	4	1.4	1	1	0.6	58	18	24
In the case of 20 units per day (1,600 kcal)	11	1	4	1.4	1	1	0.6	61	18	21
In the case of 23 units per day (1,800 kcal)	12	1	5	1.4	2	1	0.6	57	18	25

(Quoted from Reference 2)

is considered to be ideal, the ideal body weight (kg) is calculated as body height (m)² × 22.

The recommended caloric intake thus obtained is simply based on paper calculation, and should be reviewed whenever necessary while carefully following the changes in the blood glucose levels, lipid levels, and body weight.

Diet with Good Nutritional Balance

Once the appropriate caloric intake level is determined, attention should be directed to a good balance of nutrients.

1. Appropriate balance of the three major nutrients

Appropriate balance of the three major nutrients (carbohydrate, protein, and lipid) is of primary importance.

Carbohydrates are the source of energy for activities, and should represent 55 to 60% of the daily caloric intake.

Proteins are the raw materials for building the body, and should represent 15 to 20% of the daily caloric intake.

The intake of lipids should be limited to not more than 25% of the daily caloric intake. In recent years, the problem of excessive intake of fat has arisen.⁴⁾ Intake of animal fats rich in cholesterol and saturated fatty acids should be restricted.

The recommended diets in the food exchange list are almost perfectly in line with these guidelines (Table 1).²⁾ They are also in good agreement with the composition of the daily diet of the average Japanese people, that is, they are well-suited to the dietary habits of the Japanese people. Therefore, it allows the patients to naturally take daily diets. This is one of the reasons why diet for dia-

betic patients is often referred to as healthy diet.

2. Supply of vitamins and minerals in appropriate amounts

According to the food exchange list, diets allowing a daily caloric intake of 1,200 kcal contain the minimum necessary levels of vitamins, as well as minerals such as calcium and iron. When the daily caloric intake is lower, these nutrients may become insufficient. Therefore, it is important to ensure that an ideal balance of nutrients is maintained in the daily diet recommended.

3. Supply of dietary fiber

As people have come to eat less rice and more meat, the intake of dietary fiber has become insufficient. Dietary fiber delays the digestion and absorption of food and therefore helps to control the increase in blood glucose levels after meals and reduce the cholesterol levels. It also prevents constipation. Ideally, 20 to 25 g of dietary fiber should be consumed every day.

Characteristics of the “Food Exchange List for Diet Therapy of Diabetes Mellitus” Edited by the Japan Diabetes Society

While the use of this food exchange list often appears daunting, a good understanding of its basic principles would facilitate even complicated nutrition management.

The characteristics of this food exchange list can be summarized as follows:

(1) Foods are classified into six tables of four groups and seasonings depending on the composition of the major nutrients (Table 2). In addition, appendices have been attached.¹⁾

(2) A unit common to all food groups has been created. One unit is defined as 80 kcal, and the weight of food equivalent to one unit has been indicated.

(3) In each of the tables of every group, the mean content of nutrients in one unit of the food is indicated.

The “Food Exchange List” based on these characteristics was proposed for the first time by the Japan Diabetes Society.

Type of Diabetes Mellitus and Diet Control

The general rules of diet control are the same for insulin-dependent and non-insulin-dependent diabetes mellitus, however, emphasis is placed on different aspects of diet control in the two conditions.

1. Insulin-dependent diabetes mellitus

Insulin injections are essential in this condition. In order to prevent hypoglycemia and hyperglycemia, it is important to eat meals at designated times and to appropriately divide the daily food intake into several meals. For this purpose, it may be necessary to eat between meals, that is, in addition to breakfast, lunch, and supper. Particular attention is paid to the nutritional content of the meals, such as the amount of carbohydrates.

Table 2 Food Classification Table for Diabetes Mellitus

Mean content of nutrients per unit (80kcal)				
Food classification	Food type	Carbohydrate (g)	Protein (g)	Fat (g)
Group I: Foods mainly consisting of carbohydrate				
Table 1	Grain, potatoes, vegetables rich in carbohydrate and fruits, beans and peas (excluding soybeans)	18	2	0
Table 2	Fruits	20	0	0
Group II: Foods mainly consisting of protein				
Table 3	Seafood, meat, eggs and cheese, soybeans and soy products	0	9	5
Table 4	Milk and dairy products (excluding cheese)	6	4	5
Group III: Foods mainly consisting of fat				
Table 5	Lipids, fat-rich foods	0	0	9
Group IV: Foods mainly consisting of vitamins and minerals				
Table 6	Vegetables (excluding some vegetables rich in carbohydrate), seaweed, mushroom, and konnyaku	13	5	1
Seasonings	Miso, sugar, mirin, etc.			

(Quoted from Reference 1)

2. Non-insulin-dependent diabetes mellitus

Non-insulin-dependent diabetes mellitus develops as a result of a hereditary predisposition in association with environmental factors, such as overeating, obesity, and insufficient exercise. These factors not only induce, but also exacerbate this type of diabetes mellitus. Therefore, it is of fundamental importance for patients of non-insulin-dependent diabetes mellitus to avoid overeating and guard against obesity. A good nutritional balance of the diet is also important.

Diet Control in Special Cases

1. Diet control for diabetes mellitus in children

In both children with insulin-dependent and non-insulin-dependent diabetes mellitus, the basic principle of nutritional therapy is the provision of adequate calories and nutrients required for the normal growth of the children. For this purpose, consultation of "Nutritional Requirement for Japanese Boys and Girls" is recommended.

2. Diet control for diabetes mellitus associated with pregnancy

In cases of diabetes mellitus associated with pregnancy, the sum of calories

necessary for the mother and calories necessary for the generation and maintenance of the fetus and placenta, and for lactation, is regarded as the recommended daily caloric intake. The daily caloric intake of pregnant diabetic patients should be 150kcal higher, 350kcal higher, and 700kcal higher during the early stage of pregnancy, late stage of pregnancy, and lactation, respectively, as compared to the daily caloric intake of non-obese, non-pregnant diabetic women.

Monitoring of variations in the body weight is important. The daily caloric intake should be regulated so that the body weight does not increase by more than 6 to 8 kg during the course of pregnancy. For smooth blood glucose control, the total daily caloric intake should be divided in three or more meals.

3. Diet control for patients with diabetic nephropathy

Diabetic nephropathy can be divided into the following stages: the stage before development of nephropathy, early stage of nephropathy, early stage of overt nephropathy, late stage of overt nephropathy, stage of renal failure, and stage of dialysis. In each stage, appropriate restriction of protein, salt, potassium, and phosphorus is necessary.⁵⁾ Unlike in renal failure not associated with diabetes mellitus, correction of the abnormality of carbohydrate metabolism is important in patients with diabetes mellitus. Thus, it may be difficult to use the food exchange list designed for ordinary renal diseases, and the use of "Food Exchange List for Diabetic Nephropathy"⁶⁾ edited by the Japan Diabetes Society is recommended.

Conclusion — Perspectives for the Future —

Diet control for the treatment of diabetes mellitus is intended not to make the patients eat "special therapeutic diets", but to encourage them to eat "healthy food" that is also recommended for healthy people. For this purpose, it is important to make the patients understand well the importance of appropriate caloric intake and a good nutritional balance.

While evidence-based medicine has often been discussed in recent years, diet control in diabetes mellitus tends to have empirical aspects. Even if restricted diets are useful for controlling blood glucose, diet control for diabetes mellitus needs to be re-examined more scientifically from the global perspective of nutritional balance.

The "Food Exchange List" of the Japan Diabetes Society facilitates the practice of diet control by patients with diabetes mellitus. It is designed such that even patients without sufficient knowledge of nutrition can use it easily, and that patients can be guided in the same manner throughout Japan on the basis of the Food Exchange List. While the Food Exchange List is designed for people who cook meals by themselves, ready-to-eat food and cooked food have become popular in recent years, and have deeply penetrated into the daily dietary lives of the Japanese people. Under such circumstances, it may be necessary to revise the Food Exchange List taking this aspect into consideration.

While diet control established to date for diabetes mellitus has brought about enormous benefits, development of new dietary therapy that meets the contemporary needs is awaited.

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