Research on Interaction Design of Diabetes Diet Health Based on GL Food Exchange Serving

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Abstract. Research on the application of food exchange serving based on the concept of glycemic load (GL) in the treatment of diabetes diet, the use of computer technology to compile a set of software for diabetic diet catering, and the use of interaction design thinking and methods to establish an interaction design for diabetic diet health. On the basis of literature research, through the user journey map, interaction flowchart and relevant stakeholder analysis methods, a logical table of the food exchange portion method of the concept of glycemic load (GL) is proposed. Using interaction design strategies, the GL concept of food exchange method is realized. Based on the concept of GL, the food exchange method is proposed, taking diet therapy as interaction scenario, integrating the visualization of diet medical information, eliminating information asymmetry, and improving the awareness of diabetic diet therapy so as to form a healthy diet.

1. Introduction
Diabetes, as the top 1 chronic disease in the world, has been receiving widespread attention in the medical community. In recent years, the living standards of domestic residents in my country have been continuously improved, the incidence of diabetes has been increasing, and the age of diabetes has been declining. In the medical treatment of diabetes, dietary structure is the most basic method for treating diabetic patients. However, in practice, the self-control effect of diet of type 2 diabetes patients and food have great difficulties in understanding prevention, and the comparison of compliance low. In the current dietary treatment plan, most of the treatments are theoretically strong. In practice, due to the large differences in the individualization of dietary habits, the hospital fails to provide a detailed diet plan for diabetic patients. The food exchange method is to balance the intake of various nutrients and energy according to the needs of human functions. A reasonable diet is an important measure to control or reduce the symptoms of diabetic patients.

2. Research Background: Diabetes and Food Exchange Serving
Diabetes is a very complex, chronic and incurable chronic disease. There are many reasons for the onset of diabetes. Its main clinical manifestation is that blood glucose exceeds normal values. Diabetes can cause a variety of complications after serious illness. Long-term illness and lack of scientific management can cause failure of the eyes, skin, internal organs, blood vessels and other parts. In severe cases, it can cause disability or critical illness. According to a study published by the Journal of the American Medical Association (JAMA), the national survey data in 2010 showed that the prevalence of diabetes among Chinese adults reached 11.6%, of which 50.1% of adults were in pre-diabetes. Therefore, diabetes has become a chronic disease that seriously affects the health of our
people. Preventing and controlling diabetes is a major health problem to be solved in our country. At present, there are five main aspects of comprehensive treatment of diabetes: diet therapy, exercise therapy, drug therapy, health promotion education and blood glucose monitoring. Among them, diet therapy is the most basic of comprehensive treatment of diabetes, so patients need long-term treatment and strict implementation.

The food exchange serving is currently an internationally common diet control plan, first proposed by the American Diabetes Association (ADA), which is mainly based on the patient's activity, age, weight and height, so as to calculate its energy and three macroscopic The daily requirement of nutrients, calculate the number of food portions, and distribute it to various types of food and three meals a day in a certain proportion. The core of the food exchange serving is to control the total calories and “portions” of food, but the food exchange portion method does not take into account the effect of the total amount of carbohydrates contained in the food on blood sugar. Therefore, in 1997, Harmer University Salmeron et al. proposed the concept of GL [1], and introduced the food exchange portion method based on the concept of GL. Its essential feature is that the traditional food exchange portion method is endowed with the concept of GL. Under the premise of balanced nutrition, taking into account the impact of food sugar production on the blood sugar of diabetic patients, from the carbohydrate aspect, the traditional food exchange serving cannot distinguish the equivalent food in the exchange table [2].

3. Design Method and Process

3.1. Focus Interview

The initial survey mainly focused on telephone and field interviews. The main interviewers were eligible diabetic persons in relatives or friends’ families. When asking patients, they focused on asking how to obtain information and whether they knew about dietary treatment.

Interview profile:

Through communication with patients and field research, this study summarizes the problems of diabetic patients in diet therapy: the diet plan lacks reference, the patient does not know how to choose food suitable for diabetic patients; the patient does not arrange diet for himself under the guidance of the doctor. The main reason is the lack of reasonable diet knowledge; the choice of diet is small, and the taste is difficult to meet; according to the doctor’s diet, the facilities and conditions at home are not allowed.

Through in-depth research on target users, we found that the current situation of diabetes patients in self-health diet management, management process encountered many problems and potential needs, this survey can find common characteristics from diabetic patients, so as to find problems and then solve problems and provide strong guidance for subsequent design.

3.2. Design Concept Put Forward

Taking the "Clinical Nutrition" food exchange method [3] as the most basic reference, and according to the dietary habits of the Chinese people, there are situations in the population that do not eat dairy products and fruits. In order to ensure the nutrition and energy supply, this study divides the food into Four categories: cereals, vegetables, meat, eggs, milk, and fats. Each part of various foods in the same category is important, but the heat generated is 90kCal. Similar foods can be exchanged. Patients can calculate and determine the total calories they need every day based on actual physical information and physical labor intensity. Since the basic food exchange method does not take into account the effect of food carbohydrates on blood sugar, the International Blood Sugar Index and Blood Sugar Load Table compiled by Foster-Powell et al. [4] and domestic Sun et al. [5] 2006 The data of the food exchange system based on glycemic load GL published in 2014 is used for the secondary classification of food, and the two concepts are merged with each other, and then the food exchange method: similar foods provide similar energy, which can be equivalent according to the patient's dietary preferences exchange. Based on the concept of GL, the food exchange portion method is basically the same as the
traditional food exchange portion method. Only when the food is selected again in the last step, the patient is required to refer to the GL value of each food. The following is the specific operation process:

(1) Calculate the ideal weight according to the height of the patient, and evaluate the current weight situation.
- Standard weight (kg) = height (cm) - 105
- Ideal weight = standard weight ± 10%
- Obese weight = 20% above standard weight
- Weight loss: 20% below standard weight

(2) According to the patient’s weight and manual labor, determine the number of calories per kilogram of body weight, as shown in table 1.

| Weight loss  | Bed    | Light work | Moderate work | Heavy work |
|-------------|--------|------------|---------------|------------|
| Normal      | 25-20  | 35         | 40            | 40-45      |
| Obesity     | 15     | 20-25      | 30            | 35         |

(3) According to the determined energy supply coefficient, the product of the ideal weight and the total daily calories required by the patient; total calories (kcal) = ideal weight × number of calories required per kg of body weight (kg/kg/day)

(4) Estimate the number of foods: According to the total daily calories required, find out the total number of daily exchanges of food intake from the food exchange framework table of different calories, and distribute them in proportion to each meal and 4 categories of food; As shown in table 2.

| Energy (kcal) | Staple food | Vegetables | Meat, Egg and Milk | Fat | Total |
|---------------|-------------|------------|--------------------|-----|-------|
| 1200          | 7           | 1          | 5                  | 1.5 | 14.5  |
| 1400          | 9           | 1          | 5                  | 1.5 | 16.5  |
| 1600          | 9           | 2          | 6                  | 1.5 | 18.5  |
| 1800          | 11          | 2          | 6                  | 2   | 21    |
| 2000          | 13          | 2          | 6.5                | 2   | 23.5  |
| 2200          | 15          | 2          | 6.5                | 2   | 25.5  |
| 2400          | 17          | 2          | 7                  |      | 28    |

(5) Select food according to GL value: Refer to the “Food Exchange Form Based on GL Concept” compiled by the researchers, and choose according to the GL value of each food. In the same category, choose more foods with lower GL values.

4. Research on Interaction Design Based on GL Food Exchange Serving
This article improves the current lack of professional knowledge and guidance in the treatment of healthy diets by diabetics through research on the introduction of service design based on blood sugar load (GL) food exchange serving, and improves the self-awareness and self-management of diabetic patients. The role of diabetic patients in services has changed from "users" to "health seekers; and the visualization of patient language information.

4.1. Diabetes Healthy Eating Behavior and Demand Analysis
Through the investigation of the target population in the early stage, we found that diabetics self-regulate at home. Due to the lack of knowledge about diabetes diet, it is difficult to develop a healthy diet without professional guidance. They can only rely on relatively online information for relevant
knowledge. Understand that at the same time, due to the special nature of the diabetes diet, it is difficult to get correct guidance in the actual implementation process. Through the analysis of patient behavior to establish a typical character. Build a user experience chart around the persona of the sick patient, based on the information provided by the diabetic patient in life, and summarize many issues that affect the patient's choice of ingredients during the cooking process. The user behavior model is mainly for the analysis of the dietary stage of diabetes. The dietary stage is divided into four aspects: what to eat, grocery shopping, weighing, and cooking. Each aspect will produce different problems, and record formal and non-standard. Formal touch point. Through the analysis of behavior, we put forward related design methods of interaction design as shown in figure 1.

Figure 1. Schematic illustration of eating behavior of diabetic patients.

4.2. Interactive Flow Chart of Diabetes Healthy Diet
According to the above survey, we have summarized the interactive flow chart of diabetes diet health. As shown in figure 2, the flow chart clearly describes the relationship between the function of diabetes diet management and the stakeholders involved in an intuitive way. The diabetes diet service system includes two forms of patient home management and supermarket self-service order delivery. Stakeholders participating in the system include professionals, supermarket staff and couriers. Different arrows represent information flow, capital flow and material flow respectively, and are used to represent the way characters interact.

In the flowchart, diabetic patients can get the most scientific, authoritative and most comprehensive dietary guidance through the mobile phone terminal when they carry out dietary health management at home. The diabetic dietary service system develops a dietary exchange method for diabetes by medical professionals in diabetes. It is delivered to patients through a virtual platform, which not only saves communication costs, but also meets the needs of patients for inquiries anytime and anywhere. At the same time, when we match the good ingredients according to our own preferences, we can place an order through the mobile phone to the supermarket. The supermarket staff will pack the
patients with a specific amount according to the matched ingredients of the patient, and then a courier will deliver the goods to your door. With the ingredients in hand, we can proceed to the final step of cooking. By integrating the problems presented by the diabetic patients’ cooking process, using computer technology to achieve information sharing before sharing, as well as ways to combine online and offline, to better meet the needs of patients in the management of chronic processes, thereby improving diabetes patient self-management level.

![Figure 2. Schematic illustration of diabetes healthy diet management interactive.](image)

**4.3. Information Visualization of Diabetes Healthy Diet**

Since the most basic food exchange portion method does not take into account the food’s glycemic load index, we add the concept of GL to the last step of the traditional food interactive portion method. Since the basic feature of the food exchange serving method is “serving”, the glycemic load index of each food and each gram of food is different. Therefore, this study is based on the “International Glucose Index and Glucose Load Table” and relevant domestic data. The “Food Exchange Form Based on the GL Concept” for daily consumption is shown in figure 3. In this study, computer technology will be used to calculate the two combined recipes of food exchange method and glycemic load value into the diabetes healthy diet management service system, which is more convenient and quicker to apply to practice. GL = the glycemic index of something’s food x the actual amount of carbohydrates (g)/100 of the food, combined with the “parts” of the food exchange portion method, which not only takes into account the “quality” of carbohydrates contained in the food, but also takes into account the effect of total carbohydrates in food on blood sugar [6-7].

The GL concept food exchange table is based on the daily foods that people often eat, and according to the number of portions of the exchange portion method, the blood sugar load index of each food (100g as an example) is calculated. This allows patients to conduct secondary screening of food based on GL. While ensuring daily calories, we try to choose foods with low blood sugar load for exchange.

**4.4. Design of “Suppressing Sugar” APP for Diabetic Diet**

Diabetes treatment requires long-term adherence to follow-up treatment, and clinical observation is generally not recommended for diabetic patients. The main method is home self-health management. Therefore, how patients obtain effective dietary treatment from professionals is a very critical step. Due to the lack of professional guidance, patients have information asymmetry, which makes self-management less effective. In order to better explain the design strategy, the demand points were extracted from the roles of different patients and typical scenes in the early stage, and converted into the content and function modules provided by the interactive system, and an attempt was made to design a GL-based food exchange serving method Mobile platform for health management-“Suppressing Sugar” APP. Mobile platform prototype is shown in figure 4.
Through the previous research on the food exchange portion method, glycemic index and glycemic load, the related concepts were established through computer technology to establish a service system, and then realized through the mobile phone APP. This APP is mainly to visualize the data, and improve the diet management of diabetic patients through the guidance of professional personnel and accurate calculation. The four main functions of the mobile APP, recipe matching, store, discover and mine. Among them, the recipe matching is the core function. When we first use the APP, we need to register through the mobile phone, fill in personal information to facilitate the calculation of the subsequent recipe matching, and then enter the home page. The home page is a place where a lot of information is gathered. Through the home page we can get the popular science of expert knowledge and tips for inhibiting sugar. Enter the recipe matching function page, through the registration information we can calculate the total calories you want in a day, if the information is filled in incorrectly, you can click “Edit” to modify the information, and we will also calculate breakfast, lunch and according to the total amount you want For the specific number of dinners, click on staple foods, vegetables, fats, fish and eggs to jump to the next page. When you click on the food selection function, the entire page will display relevant personal information, and the navigation bar on the left will display each type of food. To subdivide the glycemic index, in the range of 0-100, choosing a food with a lower glycemic load is good for your health. Therefore, when choosing food, try to choose between low and high glycemic load. When we want to choose one When planting food, click the “+” or “−” button to select the number of servings. If all foods with a large amount of blood sugar load appear during the selection process, the system will give a reminder to remind the user to pay attention to the blood sugar load of the food. Through the design of anti-sugar health service system, more
visual information is created, constantly providing patients with accurate diet information, improving the patient’s self-management, and controlling the patient’s condition and mood.

5. Summary
In the current diabetes treatment methods, healthy diet is the most important basic measure for the treatment of diabetes, and the key to diet therapy is effective diet education. The American Diabetes Association emphasizes in the diabetes diet guidelines that the dietary health treatment of diabetes patients needs to be based on diabetes itself. Determining the physical condition requires a differentiated and personalized design [5]. Based on the reference to relevant scientific theories, this study found the shortcomings of the current food exchange method for diabetic patients, actively explored the research points of related theories to combine, and designed a healthy diet therapy service system for diabetic patients through computer technology. The software not only guarantees the reasonable combination of different types of food and the energy conversion between each other, but also the patients can choose according to their own tastes and preferences within a certain range. The system is easy to use, highly compliant and operable. It can better help diabetic patients to control blood sugar and reduce blood lipids. Since this study only calculated more common foods in the food exchange portion table based on the concept of GL, it did not meet the patients' daily diet mix. The purpose of this study is to help patients use the same amount of food exchange principles in their diet through the use of mobile apps Change the recipe to ensure the diversity of diet. I hope to make some exploration through the diabetes diet treatment program.

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