

# Research on Food and Medication for Type 2 Diabetes

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**Abstract.** Nowadays, diabetes is still a disease that is very difficult to cure, especially for type 2 diabetes, which does not have way to cure it yet. But it is still necessary to find ways to prevent and improve the conditions of patients. The author intends to discuss the treatment and improvement of diabetes from the aspects of diet and medicine. This paper is based on current papers and research from some scientists, and the paper's purpose is going to utilize the information that corresponds to the essay's topic. The result shows that diet and medicine can have different effects on the treatment of diabetes separately. Currently, the main treatment of type 2 diabetes is intervention. In the process of the treatment, food and diets are utilized to control the patient's blood sugar level. Medicine is used to prevent complications by adjusting the chemicals inside the human body and also controlling the blood sugar level.

**Keywords:** diet of diabetes, food therapy, medical care of diabetes, insulin, ketogenic diet

## 1. Introduction

Type 2 diabetes is a disease caused by the insufficient production of insulin in the body, leading to the increase in blood sugar. It is mainly caused by being overweight or the lack of exercise. Currently, there has been some research on the therapies and their aspects are looking for different foods and medicines that can be used in the treatment of diabetes to control blood sugar and prevent complications and side effects. Many studies have tested the exact effect of food and medical care in inhibiting the symptoms of diabetes and avoiding the side effects and complications of diabetes through experiments. This essay is based on some research and experiments aimed at using food and medicine to control the symptoms of diabetes. This essay explores the potential or current treatments to control diabetes, including three aspects: food, diet, and medicine. The treatments for type 2 diabetes are still not well developed, but there are still some current therapies that can relieve and control the symptoms and complications of diabetes. The therapies mentioned in the essay can be used in clinical treatments of patients. They would be beneficial to diabetic patients and reduce the anxiety of society towards diabetes. They can also be used as a clinical reference for the treatment of diabetes.

## 2. Diet therapy

Some foods and special diets can be used to deal with type 2 diabetes.

### 2.1. Ketogenic diet

Ketogenic diet can keep the blood sugar level and its fluctuation to a lower level by lowering the intake of monosaccharides, which can be converted from carbohydrates. Ketogenic diet changes the

source of energy from carbohydrates to ketone bodies, which reduces the pressure on the pancreas [1]. With the decline of blood sugar, the use of medicine will also decrease. The structure of a ketogenic diet includes:

- a. Net carbohydrate (except dietary fiber): less than 100g/d
- b. Protein: 1g/(kg·d)
- c. Lipid: The intake amount is decided by basal metabolic rate. It should be taken from food which is rich in  $\omega$ -3 or monounsaturated fatty acid.
- d. Dietary fiber: 30g per day, with 15g intake in the morning and 15g intake in the evening.
- e. Water: More than 2000 ml per day.
- f. Vitamin and trace element: to appropriate amount.
- g. Exercise: 10~40 minutes' anaerobic resistance exercise.

According to an experiment done by Bing Zhu et al. that uses ketogenic diet with physical exercise on mice shows that this therapy promotes the liver's utilization of glucose, increases hepatic glycogen synthesis and fatty acid oxidation. In turn, blood glucose and lipid levels were reduced, and there were no obvious side effects [2]. Ketogenic diet is not suitable for all patients of type 2 diabetes. If the patients have other serious diseases except diabetes, like diseases with vital organs (heart, lung, liver, kidney, etc.), ketogenic diet will make them worse [3].

## 2.2. *Vegetables, fruits and plants that are beneficial to diabetes treatment*

Some plants are also proven to be effective in the treatment of type 2 diabetes, like blackberry and bitter melon. Bitter melon is an example. It has been used as a food and hypoglycemic agent for hundreds of years. Figure 1 shows a recipe that researchers used in treating type-2 diabetes. Because of the bitter taste of bitter melon, it sometimes needs to be cooked specially to cover the bitter taste to make it easier for the patients to accept.

### A Bitter Melon Recipe

#### Ingredients

Bitter melon—1lb  
Salt—2 tsp  
Turmeric—1 tsp fresh minced or 1/2 tsp dried  
Mustard—1/2 tsp  
Red chili powder—1 tsp  
Asafoetida—3/4 tsp

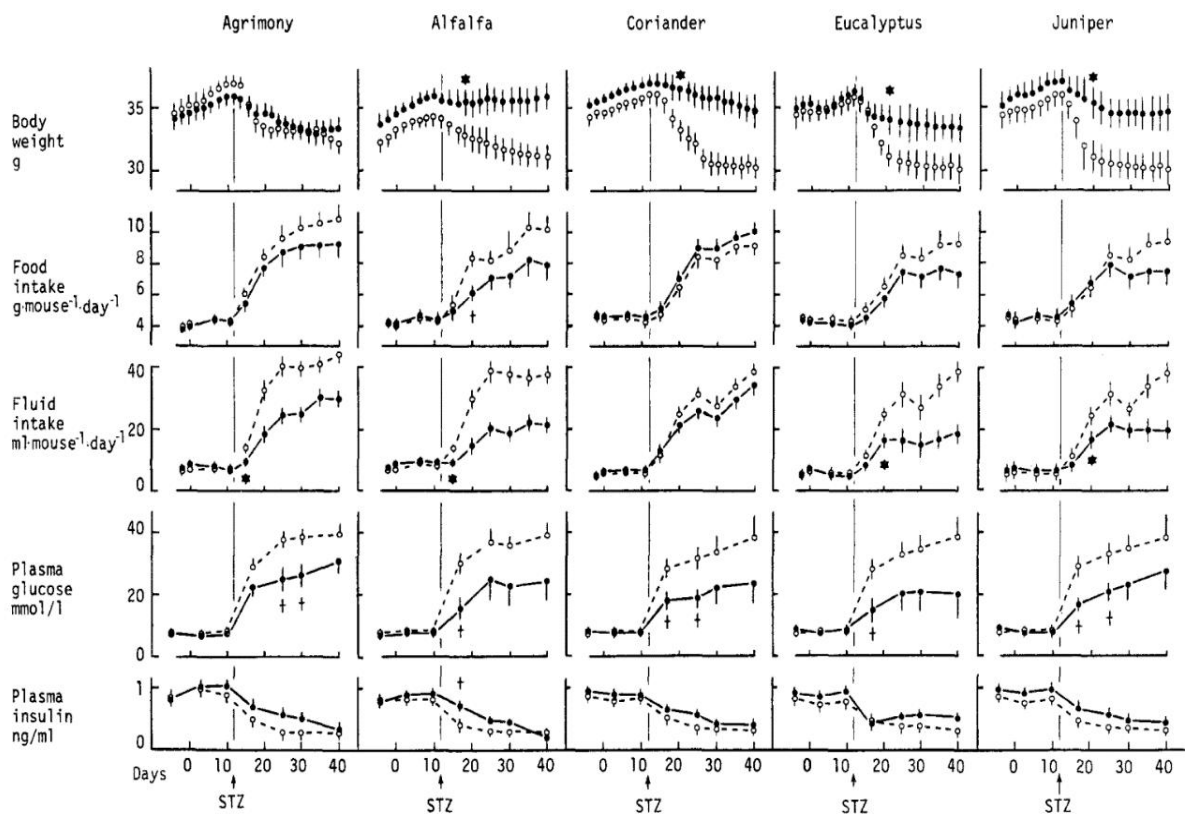
#### Preparation

Cut bitter melon into fine pieces. Add salt, turmeric powder, and let the mixture alone for 15 minutes. Heat 2 tsp of olive oil in a frying pan, add mustard seeds, and when the mixture pops, add 3/4 of a tsp of asafoetida. Squeeze the water out from the bitter melon and add it to the oil. Add red chili powder and fry well until fully cooked.

**Figure1.** Using the bitter melon to treat diabetes [4].

According to some animal studies, bitter melon can inhibit the absorption of glucose. That is because it contains an insulin-like polypeptide, promoting the utilization of glucose in the liver and increasing the secretion of pancreatic insulin. The production of beta-cells in the pancreas will also increase. However, there are no observations of a decrease in blood sugar levels. Another function of bitter melon in the treatment of diabetes is that it can reverse the irreversible changes in the kidneys, eyes, nerves, and blood vessels brought on by diabetes. Although there is not enough evidence to fully support it, more experiments will be conducted to show its accuracy [4]. According to Lihong Yang et al.'s experiment using bitter melon preparations to treat type 2 diabetes and hyperglycemia, the bitter melon preparation observably enhanced pancreatic  $\beta$ -cell function to glycemic load and reduced fasting blood glucose [5].

Some traditional antidiabetic plants are expected to help with the treatment of diabetes. The experiments done by S. K. Swanson-Flatt et al. are based on experiments on mice. Dried leaves of agrimony (*Agrimonia eupatoria*), alfalfa (*Medicago sativa*), blackberry (*Rubus fruticosus*), celandine (*Chelidonium majus*), eucalyptus (*Eucalyptus globulus*), lady's mantle (*Alchemilla vulgaris*), and lily of the valley (*Convallaria majalis*); seeds of coriander (*Coriandrum sativum*); dried berries of juniper (*Juniperus communis*); bulbs of garlic (*Allium sativum*) and roots of liquorice (*Glycyrrhiza glabra*) were studied in the experiments [6]. Figure 2 shows the results of the plants' effects.



**Figure 2.** Traditional plant treatments for diabetes [6].

According to the statistical results, blackberry, celandine, garlic, lady's mantle, lily of the valley and liquorice did not significantly affect basal plasma glucose and insulin concentrations in streptozotocin diabetic mice. The treatment including garlic and liquorice can reduce hyperphagia by about 15% and 20% respectively, and reduce the polydipsia by about 40% and 45% respectively in streptozotocin in diabetic mice. In the diabetic mice, the treatments of agrimony, alfalfa, coriander, eucalyptus and juniper consistently lowered mean values for basal plasma glucose concentrations. Alfalfa, coriander, eucalyptus and juniper reduced body weight loss in diabetic mice. For the control of blood sugar,

alfalfa, blackberry, coriander, and garlic were shown to be of some use. These plants can provide patients diagnosed with diabetes with some protection. They have great potential of being the material of the medicine to treat diabetes in the future [6].

Also, there are some things that need to be noted in making the diets of patients with diabetes. Firstly, patients should keep their BMI (Body Mass Index) in the proper range (18.5~24.9 based on the WHO standard). Secondly, the type of food needs to be noticed. Patients should eat more foods with crude fiber to promote gastrointestinal motility and control blood sugar. For vegetables, if their content of sugar is less than 3%, there is no limit to their intake. If their content of sugar is equal to 4%, their intake should be about 200g. Vegetables that are with content of sugar over 4% are not suitable for patients at all. Meals should be divided into five to six parts every day to control blood sugar after meals. The intake of fruits is also limited. They have many nutrients like vitamins, inorganic salt, and dietary fiber, but they also contain carbohydrates like fructose, which can quickly increase blood sugar. Thus, only patients with mild symptoms can eat some fruits that contain less sugar or lower sweetness, like strawberries, apples, and pears. The intake of fruit should be limited to between 150~200g, and fruits should be eaten between meals but not suitable to eat immediately after meals [7].

### 3. Medication

Aside from food, some medications have been shown to be effective in the treatment of type 2 diabetes. Insulin, one of the most important medicines in treating diabetes, has been used widely all over the world. Insulin has several different ways of administration. The first way is traditional injection, but it is not good for the long term of treatment since it can cause much pain and inconvenience, and while normal insulin's effect is slow, long-acting insulin can cause hypoglycemia because of its unstable drug release. The second way is oral preparation, but it met many difficulties. The three main difficulties are:

- a. Insulin can be inactivated by gastrointestinal digestive enzymes.
- b. Insulin has a high molecular weight, it is hard for it to pass through the intestinal absorption barrier.
- c. Insulin has a complicated interior structure, and any damage to its stability will inactivate it.

There are already some methods to achieve the goal, but this therapy still needs to be tested. It is very meaningful in reducing the pain and preventing complications. The third method is pulmonary drug delivery. By using this therapy, the drug can quickly reach the lungs. Because of the large superficial area, the drug can be absorbed quickly. This therapy can also avoid the damage to insulin's structure. Pulmonary drug delivery has come into the clinical trial stage. The fourth therapy is eye drops. This therapy can increase the absorption of special types of insulin, and it has a favorable exploitation foreground [8].

Insulin is very important in the therapy of diabetes, but the present insulin preparations still have some flaws that can cause the fluctuation of the patient's blood sugar. Insulin analogue is a medicine that can avoid the problem. Lispro, Aspart, and Glargine are the examples of insulin analogue, and they are made by using DNA recombination. Therapies involving using insulin analogues reasonably are still needed in the future [8].

IGT (Impaired glucose tolerance) is a step of type 2 diabetes development. The goal of medicine to deal with IGT is to prevent its development or even turn it into normal glucose tolerance. According to some experiments based on the efficiency of metformin, it shows a remarkable ability to prevent the transformation from IGT to type-2 diabetes. Compared to a similar medicine, phenformin, which can cause serious lactic acidosis, metformin can completely avoid this side effect, and it can reduce blood fat at the same time. Metformin has a milder effect on the decline of blood sugar and prevents the occurrence of hypoglycemia. Metformin has been used as a clinical drug for about sixty years, and its safety and efficiency have all been tested. Hence, metformin is a good medicine for preventing diabetes [9][10]. Another main type of medicine is sulfonylureas. The most widely used types of sulfonylureas are glyburide, gliclazide, glipizide, and gliquidone. The main effect of sulfonylureas is

to promote the secretion of insulin in the human body. The future development of sulfonylureas is that they should not only be able to promote the secretion of insulin but also improve insulin sensitivity [9].

The main effect of  $\alpha$ -glucosidase inhibitor is to inhibit  $\alpha$ -glucosidase, delay its hydrolysis and the production and absorption of glucose.  $\alpha$ -glucosidase inhibitor also has the ability to reduce blood fat and prevent diabetic chronic complications. It is now a medicine to reduce blood sugar after meals. Its main side effect is gastrointestinal reaction [9]. Non-sulfonylurea insulintropic has a different structure as sulfonylureas, but they are with similar mechanisms — they all promote islet- $\beta$  cells to secrete insulin. The difference between them is that the locations that they bind with islet- $\beta$  cells are different. Non-sulfonylurea insulintropic reduces the total contact of insulin and the fluctuation of glucose during meals. Thus, it can avoid the risk of hypoglycemia [9]. Insulin sensitizer is a medicine that can increase the utilization rate of the glucose in the surrounding tissues and reduce the output rate of liver to glucose. One medicine of this type is rosiglitazone. According to clinical experiments, insulin sensitizer can reduce the patient's blood sugar after meals and fasting blood sugar. This effect can maintain over 30 months [9].

#### 4. Conclusion

Many foods and medications have been shown to improve or prevent diabetes. For food, most of them are fruits and vegetables, like agrimony, alfalfa, coriander, eucalyptus, juniper, and bitter melon, which have special chemicals to help regulate the human body. Usually, the foods used in the therapy have been used for hundreds of years, and according to the experiments, they are actually of some use in controlling blood sugar. Some special diets, like the ketogenic diet, are also great tools to help treat diabetes by controlling blood sugar. Some of them have shown their stability and efficiency in controlling blood sugar and preventing complications, and some of them still need to be tested and improved to avoid side effects and improve their reliability. If the diet, food, and medicine can be used together, the effect can be stronger. There has already been much research about the treatments for diabetes, including food and medicine. They may be able to control diabetes, but more therapies are required to effectively treat diabetes. Apart from that, the thesis does not include its own experiments, so the further experiments will be based on using experiments to test the exact efficiency of these therapies in controlling diabetes.

#### Acknowledgement

Firstly, I would like to express my deepest gratitude to my professors and teachers, who provided me with valuable guidance and advice at every stage of the thesis. Furthermore, I would like to thank my parents and all my friends with all my gratitude for their encouragement during the process of writing this essay. Without their kind help, this essay would not have been done so smoothly and successfully. Thanks to all the people that helped me with my essay again!

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