

The Role of Nutrition and Dietary Patterns in Managing Type 2 Diabetes

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Abstract. Nowadays, type 2 diabetes(T2D) has become one of the most popular chronic diseases around the world. Then, most people who have an unhealthy diet have a higher chance of getting T2D. Most studies focus on the medical methods to treat chronic diseases like T2D, such as taking tablets or injecting insulin. However, the dietary pattern should be the primary important factor that may be firstly taken into account. In this paper, it mainly discusses the relationship between T2D and nutrition. Eventually, the paper claims that people with T2D need low carbohydrates, USFAs, fiber, vitamin C, vitamin D, and plant protein as their major nutrition. In addition, the Mediterranean diet and the dietary approaches to stop hypertension are the two main diets, which include that nutrition and suitable for T2D patients, this paper aims to remind people to realize the importance of a balanced diet and how to avoid T2D. In the future, more and more studies should pay attention to the connection of T2D and T2D because a balanced diet plays an essential role in people's daily lives. Finally, the issue of dealing with T2D still exists so researchers may focus on the genetical factors that affect T2D and discover more different dietary patterns.

Keywords: Type 2 diabetes; nutrition; mediterranean diet; dietary approaches to stop hypertension; balanced diet.

1. Introduction

In 2001, the incidence of type 2 diabetes (T2D) increased about 5.5%. In 2008, the incidence of T2D was 9.7%, and in 2010 was 11.6% in China [1]. China has the highest incidence of T2D. T2D is characterized by impaired insulin secretion from pancreatic β -cells and/or reduced response of target tissues to insulin. Many people suffer from the T2D so they be gain to pay attention to their dietary and nutrition. The main reasons that cause these kinds of chronic diseases are the lack of nutrition or healthy diets [2].

Some data suppose that an increased risk for developing T2D is associated with overweight and obesity, abdominal obesity, physical inactivity and maternal diabetes. Then, incidence of T2D will have lots of very serious consequences. For example, it is easy to cause non-traumatic blindness and renal failure, which are really harmful and dangerous to human beings. Moreover, some pathogenesis may occur when somebody has T2D, such as heart disease, stroke and blindness [3]. There are lots of factors causing this type of disease. Mother with overweight or obesity has really high chance that baby will have T2D. Genetic inheritance and aging growth are uncontrollable factors, so studies focus on the controllable factors that are food dietary and nutrition. Macro-nutrition and micro-nutrition are both essential for health. To be more specific, saturated fats and trans fats may both increase the risk of incidence of T2D. In the contrast, polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids can help us reduce the risk [3]. Similarly, over-intake of sugar may also cause T2D. More intake of fiber and fish contributes a lower chance of incidence of T2D. Studies over past 2 decades have provided some information on the nutrition and T2D.

Despite its long clinical success, T2D has a number of problems in human beings. However, these rapid changes are having a serious effect on people's health. Although extensive research has been carried out on how to deal with nutrition and T2D, no single study exists which the relationship between nutrition and T2D. One study shows that dietary structure and glycemic load food exchange methods can effectively control blood glucose in elderly patients with T2D. And also, it can control the body mass index in a effective way, which is really essential for human to keep body healthy.

2. Macro nutrition

2.1. Carbohydrate

Studies show that there is a strong relationship between macronutrition and T2D. This section reviews the interaction between macronutrition and T2D. Some recent researches illustrate that carbohydrates could directly influence T2D and cause serious consequences. Firstly, carbohydrate plays an essential role in humans. For example, during digestion, carbohydrates that consist of more than one sugar get broken down into their monosaccharides by digestive enzymes, and then get directly absorbed causing a glycaemic response. The body uses glucose directly as energy source in muscle, brain and other cells. However, carbohydrate is also the main factor that causes blood sugar to increase. Recent research has demonstrated that major problems of T2D are not enough insulin being secreted and poorly responding to insulin by cells. For those patients, their body cannot adjust glucose well so higher blood sugar level will lead to disorder of the circulatory, nervous and immune systems. In addition, the study shows that adjusting nutrition and energy intake is the relatively best method to treat people who have T2D. There is a type of diet called the Low Carbohydrate Diet (LCD) [4]. To be more specific, reducing the proportion of carbohydrates can effectively control blood sugar. Moreover, some evidence shows that LDC can increase the diversity of the gut microbiota of patients. A variety of gut microbiota develops mutually beneficial relationships with their hosts. More often than not, they regulate the gut movement and secretion, decomposition of macromolecular complex polysaccharides in food, involved in the camp digestion and absorption of nutrients [5]. For patient, to increase the diversity of gut microbiota can better treat T2D.

2.2. Fat

Obesity is a major risk of developing T2D because fat as the energy source in human body can also affect T2D because much fat intake may influence the sensitivity of insulin. To be more specific, cross-sectional studies that use the clamp technique to measure insulin sensitivity and FA composition in skeletal muscle show a direct relation between the proportion of long-chain PUFA and insulin action [6]. In contrast, more saturated the muscle membrane, the more insulin resistance the individual. Toxicity damages some specific tissues. For example, in pancreas it leads to beta-cell dysfunction, reducing insulin production and in the liver, it causes insulin resistance, leading to increased glucose production, which can both contribute T2D. Controlling the intake of fat is the simplest way that could effectively reduce the risk of T2D. In addition, taken together, the evidence suggests that replacing saturated fats and trans fatty acids with unsaturated fats has beneficial effects on insulin sensitivity and is likely to reduce risk of T2D [7,8].

2.3. Protein

Protein has a minimal impact on blood sugar levels. Protein can stimulate the release of glucagon, a hormone that can raise blood glucose levels by stimulating the liver to release stored glucose. However, in most people with type 2 diabetes, this effect is relatively modest compared to the effect of carbohydrates. Furthermore, protein can help humans away from being overweight and obese to a large extent. A convincing example is given by the research, high-protein diets can increase the feeling of fullness, which may help with weight management. Weight loss can improve insulin sensitivity and reduce blood sugar level. Totally, there is a potential connection between protein and T2D. To be more specific, plant protein has a positive effect in regulating the metabolism of lipid. For example, many studies show soybean protein and oat protein can adjust the gut microbiota, which is essential for T2D patient's health. Plant protein contains lower level of the branched chain amino acids (BCAA) leucine, isoleucine and valine and of the sulphur amino acid methionine as compared with animal protein [9]. Lower levels of methionine increase the generation of hydrogen sulphide, which was reported to improve the metabolic function of adipose tissue, liver and β cells [10]. In addition, the amino acids arginine and asparagine are elevated in plants proteins [11]. and arginine may improve insulin sensitivity by increasing microvascular function via nitric oxide production [12].

3. Micronutrition

3.1. Vitamin

Different types of vitamins play different roles in treating T2D. Overall, this paper aims to study about 3 main types of vitamins that affect T2D in different ways. Vitamin D and C are the most popular micronutrients in people daily lives and also could be bought easily. Study shows that vitamin D is essential for the proper functioning of insulin receptors. Adequate levels of vitamin D can improve insulin sensitivity, which helps lower blood glucose levels. Some studies suggest that low vitamin D levels are associated with an increased risk of developing T2D. Moreover, vitamin D has anti-inflammatory properties, which may help reduce the chronic low-grade inflammation commonly seen in individuals with T2D. Vitamin C has antioxidant properties and can reduce blood sugar levels. To be more specific, vitamin C acts as an antioxidant, protecting the body from oxidative stress, which is elevated in T2D and contributes to complications like heart disease and nerve damage. Some studies show that vitamin B7 (Biotin) is involved in the metabolism of carbohydrates, fat and proteins. In addition, biotin supplementation may help improve blood glucose control in people with T2D, particularly when combined with chromium. To summarize, a well-balanced diet that ensures adequate intake of essential vitamins, possibly supplemented under medical guidance, can help individuals with T2D better manage their condition and reduce the risk of complications.

3.2. Fiber

The study shows that dietary fiber can treat and adjust the disorder of gut microbiota in order to control blood glucose. For the specific patient who has T2D, gut microbiota is very important for them. Much research choose intervention of dietary as studying method to because through changing the dietary patterns, the impact on patients is obvious. According to the research, T2D patients have gut microbiota disorder and the number of probiotics in the gut decreasing, which means the amount of opportunistic pathogen goes up [13]. However, more dietary fiber could be contained in the diet, diabetic patients could have a balanced intestinal flora. To be more specific, dietary fiber can provide a platform for *Bifidobacterium bifidum* to anaerobic glycolysis. Anaerobic glycolysis can reduce the pH level of gut [14]. In conclusion, dietary fiber has a certain hypoglycemic effect. Adequate intake of dietary fiber is beneficial to the diabetic patients.

4. The application of nutrition

According to the recent researches, many chronic diseases are related to the dietary pattern in people's daily lives. Especially, some people who are overweight or with obesity due to unhealthy diet often easily have chronic diseases like T2D. In addition, the daily diet should contain a variety of nutrition, included both macro and micro nutrition. Some studies highly discuss about two main dietary patterns, which aim to treating chronic diseases, such as Mediterranean diet (MD) and the dietary approaches to stop hypertension (DASH).

Firstly, MD was found in the mediterranean area in the middle of 20 century due to local customs [15]. This type of dietary pattern is beneficial to T2D because it contains less red meat, lower sugar food, lower saturated fat intake and even taking olive oil as the major oil, instead of pork oil or rap oil. Olive oil contains mostly monosaturated fat, which can help people protect against harmful inflammation and manage their blood sugar well, aiming to reduce the risk of T2D [16]. Moreover, olive oil may help arteries remove rest of cholesterol and keep the blood vessels clean in order to avoiding some cardiovascular diseases (CVDs). CVDs may be caused by T2D, which is one of the diabetic chronic complications. Olive oil is taken as the major fat source in MD dietary patterns, and also MD recommends patients have more fiber, vitamins and other active substance intake meanwhile some appropriate fish and seafood intake is necessary because it provides unsaturated fat acid, which is beneficial to T2D [17]. Some studies suggest that MD is enable to reduce oxidative stress, low-density lipoprotein cholesterol and inflammation, and meanwhile regulating the insulin sensitivity

and immunity response. Animal protein contains more saturated fatty acid, which could easily cause blood fat level to increase. However, MD usually contains plant protein because it is a vegetable diet, including the rich of fiber and omega-3 fatty acids and lower animal protein.

Some researches show that DASH contains fruit, vegetables and low-fat products, which suggests the minimally processed and the freshest food in order to decrease the sodium intake. Over-sodium may harm to heart, eventually causing CVDs. In addition, this impact may aggravate the burden of the heart of T2D patients. Some evidence supports that DASH could reduce the risk of obesity and T2D, which brings lots of benefits to T2D. For example, it can positively affect triacylglycerol, blood sugar, insulin resistance and even low-density lipoprotein cholesterol [18-20]. For somebody who has multi-chronic diseases, DASH could be the best and most suitable dietary pattern because it can help reduce blood pressure so studies highly recommend DASH to some patients for long-term eating. Up to now, there are four types of evaluating methods of DASH, include of Dixon's diet index, Millen's diet index, Fung's diet index and Günther's diet index [21]. Research compares these four-diet index and gives the conclusion that confirming DASH diet could better help people reduce the risk of chronic diseases.

5. Conclusion

To sum up, the paper suggests that there is a strong relationship between the T2D and nutrition. Nutrition is the primary factor that could directly affect T2D, so people should pay attention to their dietary patterns in order to have a balanced diet. In most cases, people usually have a lack of nutrition and some harmful habits, which contribute to T2D. According to this paper, low carbohydrates, unsaturated fatty acids, plant protein, vitamin C and fiber are necessary for people with T2D or reduce the risk of T2D. To be specific, this paper concludes how different nutrition treat to and affect T2D, which also mentions two of the dietary patterns like MD and DASH. Studies highly recommend people with T2D confirming these two dietary patterns. As the incidence of T2D increases nowadays, the cure of T2D has become a popular clinical issue around the world. However, the factors lead to chronic diseases not only caused by patients themselves, but also some food producers make over-processed food products like high-calorie, high-fat, or containing too much animal protein that all can result in the risk of T2D. This paper just mentions the relationship between nutrition and T2D, in fact, genetic factors cause T2D which is also a problem. T2D also has some serious pathogenesis so more studies should focus on how to treat pathogenesis and prevention of them. The way of coping with some of the pathogenesis should be searched deeply and how to tackle the root of T2D may be focused on in the future.

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