Dean&Francis
ISSN 2959-409X

The Impact of the Mediterranean Diet on Blood Glucose Control and Complications in Patients with Type 2 Diabetes Mellitus

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Abstract:

This study aimed to investigate the intervention effects of a Mediterranean diet on glycemic control and related complications in patients with type 2 diabetes. This study systematically reviewed official data, including studies published in The Lancet, the Global Burden of Disease Study, and the 2020 Report on Nutrition and Chronic Disease Status of Chinese Residents released by the National Health Commission of China, supplemented by analyses of relevant clinical trials. This study analyzed the core characteristics of the Mediterranean diet and its effects on key glycemic markers (fasting blood glucose) and glycosylated hemoglobin and complications (cardiovascular disease and kidney disease). The Spanish PREDIMED trial, a landmark study on the Mediterranean diet, showed that this diet can increase the rate of achieving target glycosylated hemoglobin (HbA1c, HbA1c <7%) by 42% in patients with type 2 diabetes and reduce the risk of cardiovascular complications by 28% compared with a low - fat diet. In summary, the Mediterranean diet meets the needs of patients with type 2 diabetes, and its applicability can be further improved through local adaptation. However, more long-term research data targeting the Chinese population is needed to verify its sustained effectiveness.

Keywords: Mediterranean diet; type 2 diabetes mellitus; blood glucose control.

1. Introduction

Poor dietary habits exacerbate the global impact of type 2 diabetes, a staggering impact. A 2017 study in The Lancet revealed that poor diet contributed to 11 million deaths worldwide that year, 338,000 of which were directly related to type 2 diabetes [1]. This burden is equally severe in China: the "2020 Report on Nutrition and Chronic Disease Status of Chinese Residents" reveals that the prevalence of type 2 diabetes among Chinese adults has reached 11.2%, affecting approximately 114 million people [2]. Worryingly, only 32.2% of these patients have good glycemic control, and more than half also have cardiovascular

disease [2]. These data highlight the urgent need for effective dietary interventions that can both effectively manage blood sugar and prevent complications. Traditional dietary strategies for type 2 diabetes, such as low-fat diets or strict carbohydrate restriction, face significant challenges in practical application. Research from the Institute of Nutrition and Health at the Chinese Center for Disease Control and Prevention indicates that adherence to these diets in China is less than 30%, often due to overly strict rules that conflict with traditional dietary habits [3]. Furthermore, these approaches often focus solely on lowering blood sugar while neglecting to prevent cardiovascular and renal complications, which are key contributors to mortality and disability in patients with type 2 diabetes. In this context, the Mediterranean diet, with its balanced nutrition and proven metabolic health benefits, has emerged as a promising alternative. Unlike rigid traditional diets, the Mediterranean diet prioritizes whole, unprocessed foods and aligns with the goals of glycemic control and complication prevention. This study examined how the Mediterranean diet can be adapted to the Chinese population, whose dietary patterns differ from those of Western populations (e.g., high rice consumption and preference for unique flavors), and validated its effectiveness using data from Chinese clinical and public health departments.

2. Core Characteristics of the Mediterranean Diet and Its Metabolic Compatibility with Type 2 Diabetes Mellitus

2.1 Core Composition of the Mediterranean Diet

The Mediterranean diet, guided by World Health Organization recommendations, comprises four key elements. First, it emphasizes a high intake of plant-based foods: whole grains (providing 25 - 30 grams of dietary fiber daily), fruits and vegetables (500 grams total daily), and legumes, which provide sustained energy and maintain gut health [4]. Second, its fat source is primarily high-quality unsaturated fats—traditionally, olive oil is used, but tea seed oil (75% monounsaturated fatty acids and widely available in southern China) is a viable local alternative. Third, protein intake is moderate, and comes from nutrient-rich sources: fish (consumed 2 - 3 times per week, rich in omega-3 fatty acids) and low-fat dairy products (300 ml daily to supplement calcium and protein without excessive saturated fat intake). Finally, the standard strictly limits sodium intake to no more than 5 grams per day—a crucial adjustment for Chinese residents, as the average daily sodium intake in China currently exceeds 9 grams, far exceeding global recommendations [2].

2.2 Metabolic Compatibility with Type 2 Diabetes Mellitus

The Mediterranean diet's unique composition makes it well-suited to addressing the metabolic challenges of type 2 diabetes. Regarding blood sugar control, its high dietary fiber content slows the digestion and absorption of carbohydrates, preventing sharp spikes in blood sugar after meals—a common source of discomfort and long-term damage in patients with type 2 diabetes. Furthermore, the monounsaturated fatty acids in olive oil or tea seed oil can reduce blood sugar spikes by 12%. A randomized controlled trial published in the American Journal of Clinical Nutrition confirmed this effect. The trial found that after 8 weeks of daily consumption of olive oil rich in monounsaturated fatty acids, the subjects' blood sugar spikes were reduced by 12% [5]. Regarding complication prevention, omega - 3 fatty acids from fish can reduce chronic inflammation by lowering reactive protein (CRP) levels by 20 - 25%, while a low-sodium diet reduces stress on blood vessels and kidneys, key to preventing cardiovascular disease and diabetic nephropathy [6].

3. Core Effects of the Mediterranean Diet on T2DM Patients and Its Mechanisms

3.1 Effects on Blood Glucose Control

The Mediterranean diet has demonstrated significant blood sugar-lowering effects in short-term interventions. A network meta-analysis of 42 randomized controlled trials conducted in China (including studies involving 106 patients with type 2 diabetes) found that after 12 weeks of adhering to a Mediterranean diet, fasting blood glucose levels in patients with type 2 diabetes decreased by 0.95 mmol/L compared with those following a conventional diet [7]. This reduction is clinically significant, bringing many patients closer to the fasting blood glucose target range (4.4–7.0 mmol/L) recommended by diabetes guidelines. Furthermore, a one-year follow up study published in Nutrition in 2021 showed that 68% of patients following a Mediterranean diet achieved glycated hemoglobin (HbA1c) target (HbA1c <7%), a 42% increase compared to patients following a traditional type 2 diabetes diet [8]. This sustained improvement may reduce the risk of long-term complications such as nerve damage and retinal degeneration.

ISSN 2959-409X

3.2 Effects on Complication Prevention

The Mediterranean diet has a particularly significant impact on cardiovascular health. A study published in the journal Nutrients noted that the Mediterranean diet has a positive effect on the management of cardiometabolic diseases. It is rich in nutrients such as monounsaturated fatty acids and polyphenols, which can improve blood lipid profiles and lower blood pressure [9]. Combined with the findings of the PREDIMED trial, these changes collectively contribute to a 28% reduction in the risk of cardiovascular events (such as heart attack and stroke) in patients with type 2 diabetes [10]. Regarding kidney health, a six - month intervention study cited in the "Guidelines for the Prevention and Treatment of Diabetic Kidney Disease in China (2021)" reported that this diet can reduce urinary microalbumin (a key marker of early kidney damage) by 15 - 20% and slow the decline in glomerular filtration rate—critical for slowing the progression of diabetic kidney disease [11].

3.3 Underlying Mechanisms

Two key mechanisms explain the Mediterranean diet's benefits for type 2 diabetes. First, it regulates the gut microbiota: a study published in the journal Nutrients in February 2022 showed that this diet can increase the abundance of beneficial bacteria such as Bifidobacterium by two to three times [12]. These bacteria ferment dietary fiber, producing short-chain fatty acids (such as butyrate), which stimulate the secretion of glucagon-like peptide-1(GLP - 1). This hormone promotes insulin secretion and suppresses appetite, creating a cycle that leads to better blood sugar control and reduced sugar cravings. Secondly, it also suppresses chronic inflammation: Omega - 3 fatty acids in the diet can block the Nuclear Factor kappa-B (NF-κB) signaling pathway (a major driver of inflammatory responses), leading to an 18 - 22% reduction in interleukin - 6 (IL - 6) levels, according to the American Journal of Clinical Nutrition [13]. This reduction can reduce stress on pancreatic beta cells (which produce insulin) and protect blood vessel walls from inflammatory damage.

4. Localized Practical Recommendations for Chinese T2DM Patients

4.1 Dietary Adjustments for Chinese Eating Habits

Adapting the Mediterranean diet to suit Chinese dietary preferences does not require abandoning traditional diets. As for cooking oil, tea seed oil (abundant in southern China and with a monounsaturated fatty acid content comparable to olive oil) can be substituted for olive oil. When cooked at low temperatures, it blends perfectly into stir-fries, preserving nutrients. For staple foods, replacing 50% of refined rice with brown rice or oats (for example, having thick oatmeal for breakfast) can increase dietary fiber intake. For protein, steamed fish (twice a week) or tofu (a traditional plant-based protein source) can replace high-fat pork, while a cold vegetable salad tossed with tea seed oil, vinegar, and minced garlic or ginger can replace salty cooked vegetables to reduce sodium intake.

4.2 Strategies to Improve Compliance

The Chinese Center for Disease Control and Prevention's Nutrition Education Guidelines recommend a phased intervention approach to help patients gradually adapt. In the first month, focus on replacing half of the refined staple foods with whole grains (for example, mixing brown and white rice). In the second month, add one fish-based meal per week (for example, steamed sea bass or mackerel). By the third month, tea seed oil should be used in daily cooking [14]. This gradual approach minimizes taste shock and encourages family participation, eliminating the need for "special diets" for patients with type 2 diabetes and promoting long-term adherence. For elderly patients with weakened digestive function, whole grains should be cooked until soft (e.g., multi-grain porridge) and vegetables should be chopped to facilitate absorption. Furthermore, this diet should be combined with regular exercise: 30 minutes of brisk walking daily, to synergistically enhance insulin sensitivity and glycemic control [15].

5. Conclusion

The Mediterranean diet can effectively improve blood sugar control in patients with type 2 diabetes and reduce the risk of cardiovascular and renal complications. By incorporating it into traditional Chinese cooking methods, such as replacing olive oil with tea seed oil, the Mediterranean diet is consistent with traditional eating habits and helps improve long-term compliance. Clinically, promoting a phased intervention approach for the Mediterranean diet can help address the current problems of low compliance and a single dietary strategy. In the future, further long-term studies on Chinese patients are needed to establish the Mediterranean diet as a standardized dietary regimen for the management of type 2 diabetes.

However, this study has limitations. Existing clinical data on the Mediterranean diet mainly come from European and American populations. Long-term follow-up studies on Chinese patients with type 2 diabetes are still scarce. Even the China Health and Nutrition Survey cohort,

which tracks dietary patterns, lacks dedicated long-term data on the efficacy of the Mediterranean diet. In addition, current studies treat patients with type 2 diabetes as a homogeneous group and lack stratified analyses of patients at different stages of the disease (e.g., newly diagnosed patients versus newly diagnosed and long-term patients), which limits the accuracy of dietary recommendations.

Future research should prioritize long-term follow-up studies based on Chinese cohorts, such as the China Health and Retirement Longitudinal Survey and the China Health and Retirement Longitudinal Study, to verify the sustained effects of the Mediterranean diet on glycemic control and complications in Chinese patients. Furthermore, integrating nutrigenomics can help identify patient subgroups that benefit most from specific dietary components. Further research will help provide more personalized dietary guidance and further enhance the clinical value of this diet for Chinese patients with type 2 diabetes.

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