Does diet really matter? Part II: Hyperlipidemia, hypertension and renal disease

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Abstract

The evidence is clear that diet, or the preferred term medical nutrition therapy (MNT), does make a difference. Long touted as the cornerstone of diabetes care, research clearly supports the role of nutrition (when delivered by a trained professional such as a registered dietitian) to improve outcomes in diabetes care. In this series of two articles we explore the evidence behind the nutrition recommendations made by major health organizations. The focus of the first article is on the science behind the effectiveness of MNT for glycemic control and weight reduction. The second article examines MNT guidelines for the comorbidities of diabetes including hyperlipidemia, hypertension and renal disease.

Lipids can improve due to a variety of MNT interventions. The initial approach in all MNT therapies should be to take steps to improve glycemic control (usually achieved through carbohydrate consistency). In addition, LDL reduction can be achieved through decreased saturated and *trans*-fat intake as well as increasing soluble fibers. There is also evidence reporting the benefits of certain monounsaturated and polyunsaturated fatty acids, including additional omega-3 fatty acids. Effective dietary interventions for hypertension include weight reduction and lower sodium intake. For renal disease, in addition to glycemic and hypertension control, protein restriction may be recommended

Key words:
Diabetes, diet, medical nutrition therapy (MNT), hyperlipidemia, hypertension, diabetic nephropathy

Introduction

In the United States, medical nutrition therapy (MNT) is essential to all aspects of diabetes care: prevention, management of existing diabetes and reducing the risks of complications. Clinical evidence continues to accumulate demonstrating MNT's effectiveness and affirming that diet does indeed matter.

This article is the second part in a two-part series reviewing the evidence that MNT is an effective diabetes management strategy. Part I reviewed the role of MNT in weight management and glycemic control. Here, we examine the role of MNT in hyperlipidemia, hypertension and renal disease.

Hyperlipidemia

People with diabetes are at a three- to fourfold increased risk for cardiovascular disease (CVD). To that end, it is recommended that adults with diabetes aim to keep their LDL cholesterol levels below 100 mg/dl (2.6 mmol/l) and if there is a history of cardiac disease, a more aggressive LDL goal of less than 70 mg/dl (1.8 mmol/l) is recommended. For moderate dyslipidemia, MNT can be extremely effective in reducing total and LDL cholesterol levels. The National Cholesterol Education Program–Adult Treatment Panel III (NCEP ATP III) guidelines offer a set of 'therapeutic lifestyle change' (TLC) recommendations based on clinical evidence of their lipid-lowering effectiveness. *Table I* illustrates the similarity in recommendations between the American Diabetes Association and the NCEP ATP III [2, 3]. In addition, the Evidence Analysis Library of the American Dietetic Association has recently published a set of evidence-based nutrition guidelines that nearly mirror these recommendations. Those recommendations that received a 'strong' rating based on the evidence review are also shown in *Table I* [1, 4]. All of these guidelines emphasize the importance of reducing saturated fat and *trans*-fat, and increasing fiber and plant stanols.

Clinical outcome expectations are important when assessing the effectiveness of an MNT intervention. Based on the evidence, estimates have been made for the expected LDL-lowering effect of different interventions. For example, a meal plan low in saturated fat and *trans*-fat can lower

Table I: *Daily nutritional recommendations for hyperlipidemia and CVD.*

Nutrient	American Dietetic Association [1]	American Diabetes Association [2]	NCEP ATP III TLC diet [3]
Saturated fat and *trans*-fat	<7% of calories as saturated fat or *trans*-fat	<7% of calories as saturated fat Minimize *trans*-fats	<7% of calories as saturated fat
Polyunsaturated fat (PUFA)			<10% of calories as PUFA
Monounsaturated fat (MUFA)			<20% of calories as MUFA
Total fat	25–35% of total calories		25–35% of total calories
Cholesterol	<200 mg	<200 mg	<200 mg
Total fiber	25–30 g	14 g fiber (total and soluble) per 100 kcal	20–30 g
Soluble fiber	7–13 g		10–25 g
Protein		15–20% of calories if renal function is normal	15% of calories
Plant stanols/sterols	2–3 g	2 g	2 g

LDL cholesterol by up to 16%. Interestingly, the NCEP ATP III report estimates that a cumulative LDL-lowering effect of 20–30% could be achieved if all therapeutic options are combined (*Table II*) [3]. As a result of this cumulative LDL response, MNT has the potential to produce LDL reductions comparable to those achieved with standard doses of statin drugs. However, clinicians should have realistic expectations of exactly what LDL cholesterol changes might be expected from dietary changes and which have the most impact. This can help prevent unwarranted delays in prescribing lipid-lowering medications.

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The NCEP ATP III guidelines also recommend frequent follow-up visits to evaluate and support lifestyle changes. After an initial MNT education session, a second visit 4–6 weeks later is recommended to evaluate the LDL response. If the goal is not achieved, nutrition therapy should be intensified if the patient is willing, and the patient should be re-evaluated after a further 6 weeks.

Fat intake

In the past decade, much attention has been given to *trans*-fats. A *trans*-fatty acid is one that starts out unsaturated (such as a polyunsaturated or monounsaturated oil) but then is modified or 'hydrogenated' by the food industry to create an oil that resembles a saturated fat. These *trans*-fats usually have a higher melting point (making them more suitable for baking) and a longer shelf life. Along with saturated fats, *trans*-fats are the principal dietary determinants of plasma LDL cholesterol. In the United States, the amount of *trans*-fats in a product must be listed on the nutrition facts panel of a food label. Many communities, including New York City, have started to ban the use of *trans*-fats in restaurant foods.

The polyunsaturated fats known as omega-3 fatty acids are essential parts of a balanced diet. Marine life and plants are the two sources of these fatty acids. Marine sources provide eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), while plant sources such as flaxseed and nuts are rich in α-linolenic acid. The average American consumes about 160 mg/day of omega-3 fatty acids, with plants being the primary source. There is limited evidence that omega-3 fatty acids from plant sources offer the same cardioprotective benefits as marine sources. Recommended marine sources are cold-water oily fish such as salmon, herring, mackerel and sardines. A number of studies have demonstrated the effectiveness of omega-3 fats in reducing the risks of CVD and particularly decreasing triglycerides, thus prompting both the American Diabetes Association and the American Heart Association to recommend two or more servings of fish per week (with the

Table II: *Approximate and cumulative LDL cholesterol reduction with MNT.*

Dietary component	Dietary change	Approximate LDL reduction
Saturated fat	<7% of calories	8–10%
Dietary cholesterol	<200 mg/day	3–5%
Weight reduction	Lose 4.5 kg	5–8%
Soluble fiber	7–13 g/day	3–5%
Stanols/sterols	2–3 g/day	6–15%
Cumulative estimate		20–30%

exception of commercially fried fish fillets) for an approximate intake of 1000 mg omega-3 fats per day. The American Dietetic Association recommends considering supplementation with 1 g EPA and DHA for individuals who do not eat these food sources. [1, 4, 5]. For those with high triglycerides, a higher dose (2–4 g) is recommended under a physician's care [6, 7].

Fiber intake

The evidence from the American Dietetic Association's review of fiber, with special emphasis on soluble fiber sources and plant sterol and stanol ester-enriched foods, is considered strong [1, 4, 5]. Sources of soluble fibers include legumes and pulses, oats, barley and many fruits and vegetables, particularly citrus fruits and Brussels sprouts. The goal is to aim for 25–30 g/day (with 7–13 g soluble fiber). Sterols are a group of naturally occurring compounds that are part of all animal and plant cell membranes. Hydrogenating the sterol molecule forms stanols that are found less abundantly in nature. This type of hydrogenation does not form *trans*-fats. The recommended daily intake of plant stanols or sterols is 2–3 g/day. This amount can lower LDL cholesterol levels by between 7% and 15%. While sterols are found in many commonly consumed foods (fruit, vegetables, nuts, seeds, legumes, vegetable oils), in order to achieve a therapeutic intake it is generally necessary to consume foods enriched with sterols or stanols. In the United States, several different food companies add sterols to margarine-type spreads, low fat cheeses, orange juice, whole grain breads and cereal bars. Two to three servings of these enriched foods are recommended per day.

Other dietary modifications

Other nutritional modifications are associated with lipid-lowering effects, but the evidence is not strong enough for their inclusion in the general recommendations summarized in *Table I* and *Table II*. The American Dietetic Association's evidence-based nutrition guidelines give the following recommendations a 'fair' rating in terms of the amount of evidence to support them, but they may be considered as options for certain patients [1, 4, 5]:

— Soy protein (26–50 g/day) in place of animal protein can reduce total cholesterol by up to 20% and LDL cholesterol by 4–24%.
— Nuts (50–100 g/day) can reduce total cholesterol by 4–21% and LDL cholesterol by 6–29%, provided that they are included as part of the patient's daily calorie intake.
— Alcohol consumption of up to one drink per day for women and up to two drinks per day for men may be incorporated into the diet for those who already drink and have no contraindications. There is no evidence to suggest that one type of alcohol is better than another. However, there is also no evidence to suggest that someone should drink alcohol if they do not already do so.

Hypertension

Hypertension affects nearly one in three adults in the United States. MNT can have a significant impact on reducing blood pressure. Guidelines for prevention and management of hypertension recommend lifestyle modifications including weight loss, adoption of the Dietary Approaches to Stop Hypertension (DASH) eating plan, dietary sodium reduction, physical activity, and moderation of alcohol intake [2, 8, 9]. The effect of each of these elements in reducing systolic blood pressure is usually additive (*Table III*). These lifestyle modifications may be used to replace or enhance the efficacy of antihypertensive medications. For example, the results of one study showed that a DASH eating plan,

Table III: *Lifestyle modifications to manage hypertension [8, 9].*

Modification	Recommendation	Approximate reduction in systolic blood pressure
Reduce weight	Maintain a normal body weight (18.5–24.9 kg/m^2)	5–20 mmHg per 10 kg weight loss
Adopt DASH eating plan	Consume a diet rich in fruit, vegetables and low fat dairy products, with reduced total and saturated fat content	8–14 mmHg
Reduce dietary sodium	Reduce dietary sodium intake to ≤2300 mg/day If treatment goals are not achieved, reduce further to 1600 mg/day	2–8 mmHg
Increase physical activity	Engage in regular aerobic exercise such as brisk walking at least 30 min/day on most days of the week	4–9 mmHg
Moderate alcohol consumption	Men: no more than 2 drinks/day (e.g. 700 ml beer, 300 ml wine or 90 ml 80-proof whisky) Women: no more than 1 drink/day	2–4 mmHg

combined with reduced sodium intake (1600 mg/day), was comparable to single drug therapy for hypertension management [10].

DASH eating plan

The DASH eating plan encourages increased intake of fruit, vegetables, whole grains and low fat dairy products, and thus is richer in those nutrients associated with lowering blood pressure, namely potassium, magnesium, calcium and fiber. The American Dietetic Association's Evidence Analysis Library found the data were 'strong' to recommend at least 5–10 servings of fruit and vegetables per day [4, 8]. Despite the effectiveness of dietary interventions to lower blood pressure, recent research reveals that the dietary profile of adults with hypertension in the United States has a low accordance with the DASH eating plan. In addition, the dietary quality of adults with hypertension has deteriorated since the introduction of the DASH diet, thus necessitating the importance of ongoing nutrition support [11].

Other dietary modifications

Other nutritional modifications are associated with reducing blood pressure, but the evidence is not strong enough to include them in the general recommendations summarized in *Table III*. The American Dietetic Association's evidence-based nutrition guidelines give the following recommendations a 'fair' rating in terms of the amount of evidence to support them, but they may be considered as options for certain patients [4, 5, 8]:

— Recommend eating adequate food sources of potassium as part of nutrition therapy, because low consumption is associated with increased blood pressure.
— The effect of calcium as a single nutrient on blood pressure is unclear, but dietary patterns with calcium lower than the recommended levels (i.e. lower than dietary reference intakes) may be associated with elevated blood pressure.
— Monitoring of blood pressure is advised for those consuming caffeine. Acute intake does appear to increase blood pressure, but the effects of chronic intake are unclear.

Diabetic nephropathy

Diabetic nephropathy can occur in people who have had diabetes for a long time. One of the main factors responsible for nephropathy is hyperglycemia. The risk of nephropathy is also increased by hypertension, family history of nephropathy, and smoking. Diabetic nephropathy is more likely to occur in men and in those with type 1 diabetes [12].

Protein intake

Several studies, including the Modification of Diet in Renal Disease study [13], indicate that the progression of nephropathy may be slowed by decreasing protein intake. In patients with microalbuminuria (30–299 mg/24 h), a decrease in protein consumption to 0.8–1.0 g protein/kg per day may reduce the urinary albumin excretion rate and glomerular filtration rate. In patients with macroalbuminuria (≥300 mg/24 h), decreasing protein intake to 0.8 g/kg per day (which is the recommended dietary allowance

for adult men and women) may slow the decline in renal function [2]. There is no good evidence that lowering protein intake below 0.8 g/kg per day provides additional benefit; in fact, lowering protein below this amount may actually increase the risk for malnutrition. The importance of high-quality sources of protein, such as lean meat, poultry, fish, eggs, milk and soy products, should be emphasized. Vegetarian meal plans can be used in those with nephropathy as long as careful attention is given to the nutritional quality of the meal plan, as well as to serum levels of phosphorus and potassium [14].

Other dietary modifications

Other nutritional issues may need to be addressed when nephropathy is present. Decreasing protein intake leads to a decrease in calorie and micronutrient intake. Unless the patient is overweight, additional calories can be provided by increasing fat intake; however, saturated fat and *trans*-fat should be limited. A general multivitamin (without minerals) is recommended. For blood pressure control, sodium intake should be limited to less than 2300 mg/day; the DASH diet may be prescribed; and weight loss may be indicated in overweight or obese individuals. Additional dietary modifications may be necessary if nephropathy progresses [15].

Because adherence to a lower protein meal plan can be challenging and can significantly impact lifestyle, ongoing psychological and behavioral support should be provided to patients with nephropathy [16].

A collaborative relationship between the patient, the physician and the dietitian to set meaningful goals results in the best outcomes

Summary

MNT is the cornerstone of treatment for diabetes care, particularly with regard to glycemic and weight control (as described in part I on page 48) and in the prevention and treatment of complications. Careful monitoring of food intake and an understanding of the meal plan along with laboratory values to assess progress towards goals is essential.

A collaborative relationship between the patient, the physician and the dietitian to set meaningful goals results in the best outcomes.

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