

Nutritional Strategies for Managing Cardiovascular Disease in Adult Patients with Kidney Transplants

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Introduction

In 2006, over 17,000 kidney transplants were performed in the U.S. (1). Compared with dialysis, kidney transplantation improves patient survival and quality of life, and is the preferred treatment modality for suitable candidates with chronic kidney disease (CKD) Stage 5 (2).

Some of the benefits that follow a successful kidney transplant include correction or improvement of disturbances in carbohydrate, protein and lipid metabolism that negatively impact nutritional status in patients undergoing maintenance dialysis therapy (3). However, despite modest increases in graft survival rates during the last decade of the 20th century, kidney transplantation is not without risk (4). Increase in body weight of transplant recipients changes lipid metabolism and can contribute to development of post-transplant diabetes mellitus (5,6). Prevalence of hyperlipidemia in kidney transplant recipients is estimated at 80% to 90% and, together with obesity and post-transplant diabetes mellitus, increases the risk for cardiovascular disease and graft loss (7-9).

While immunosuppressive drugs have been linked with diabetes mellitus and hyperlipidemia in kidney transplant recipients, dietary intervention can play an important role in improving health outcomes in this population (6-8). This article will review nutritional strategies for managing cardiovascular disease in adult patients with kidney transplants.

Relationship of Obesity and Cardiovascular Disease in Kidney Transplant Recipients

Increase in energy intake following kidney transplant, resulting in weight gain of up to 10 kg within the first year post-transplant has been reported (5,10). However, overweight (body mass index or BMI 25-29.9 kg/m²) and obesity (BMI >30 kg/m²) are also common at the time of kidney transplantation, with the proportion of obese transplant recipients rising by 116% between 1987 and 2001 (11).

When kidney transplantation outcomes were compared in overweight patients and patients with BMI <25 kg/m², the overweight group had higher total cholesterol and triglyceride levels and lower overall survival rates (12). Furthermore, obesity in kidney transplant recipients has been identified as an important modifiable variable in predicting the incidence of cardiovascular events, including myocardial infarction, peripheral vascular disease and cerebrovascular accident (13).

Effects of Dietary Intervention on Body Mass Index and Hyperlipidemia in Kidney Transplant Recipients

The increasing incidence of obesity in kidney transplant recipients and the impact of overweight and obesity on cardiovascular events have resulted in interventions directed to improve patient outcomes in this population. Treatment of 68 obese kidney transplant recipients with modified immunosuppression, statins and an individualized hypocaloric-hypolipidemic meal plan over a 24-month period resulted in a significant decrease in BMI and improvement in lipid parameters (14).

In another study, 36 stable patients were followed for 5 years after kidney transplantation (15). Patients were instructed to consume 30-35 kcal/kg/day with lipids limited to ≤30% of total energy intake and polyunsaturated to saturated fat ratio >1. Cholesterol was limited to 300 mg/day, simple sugars were eliminated and patients were encouraged to exercise daily. After 5 years, mean cholesterol and triglycerides were normalized in most patients. Females had a significant increase in body weight over the first 2 years, followed by stabilization over

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the remaining 3 years. In males, body weight decreased during the first 3 months, increased to initial values at the sixth month and subsequently remained unchanged. Weight gain in females was attributed to dramatic increase in fat mass, while body composition in males remained close to baseline values. Limitations of this study included lack of systematic dietary assessment or consultation after the first year, and failure to measure patients' activity levels.

In a study designed to determine the effects of dietary intervention on obesity rates and cardiovascular risk factors in 86 kidney transplant recipients, outcomes were compared in patients who adhered to the dietary prescription (compliant group) and those who did not (control group) (16). The prescribed diet was based on

30 kcal/kg/day with 0.7 to 0.8 g protein/kg/day, salt intake less than 5 g/day and lipids limited to $\leq 30\%$ of total energy intake. Patients kept a 2-day diet diary every 2 months. Patients in the compliant group maintained or achieved adequate nutritional status, and avoided weight gain and changes in body composition. Most patients in the control group became overweight or obese. Findings from this study also indicated that controlling calorie, protein and lipid intake and encouraging physical activity had beneficial effects on lipid levels and lowered cardiovascular events.

In the general population, there is evidence that the Mediterranean diet decreases risk of death from cardiovascular disease (17,18). A modified version of the Mediterranean diet has also been found to improve lipid profiles in kidney transplant recipients without serious

Table 1

Summary of clinical studies investigating the effect of dietary intervention on body mass index (BMI) and hyperlipidemia in kidney transplant recipients.

| Study Subjects | Study duration | Interventions | Study Outcomes |
|---------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 68 obese kidney transplant recipients | 2 years | <ul style="list-style-type: none"> • Individualized hypocaloric-hypolipidemic meal plan • Modified immunosuppression • Statins | Significant decrease in BMI and improvement in lipid profile (14) |
| 36 stable kidney transplant recipients | 5 years | <ul style="list-style-type: none"> • 30-35 kcal/kg/day • Lipids $\leq 30\%$ total energy intake • Polyunsaturated to saturated fat ratio > 1 • $\leq 300\text{mg}$ cholesterol/day | Mean cholesterol and triglycerides normalized in most subjects. Femal subject experienced increased fat mass and initial weight gain (15) |
| 86 kidney transplant patients with stable graft function | 12 years | <ul style="list-style-type: none"> • 30 kcal/kg/day • Lipids $\leq 30\%$ total energy intake • 0.7-0.8g protein/kg/day • Salt $< 5\text{g/day}$ | Compliant patients showed: <ul style="list-style-type: none"> • absence of weight gain and changes in body composition • decrease in cardiovascular events (16) |
| 21 kidney transplant recipients following a modified Mediterranean diet and 16 on a low-fat diet isocaloric with the study diet | 6 months | <ul style="list-style-type: none"> • Daily energy intake: 47% low glycemic index carbohydrates; 15% protein; 38% fat (10% saturated, 22% monounsaturated, 6%polyunsaturated) • Cholesterol 165 ± 17 mg/day • Animal protein representing one-third total protein | Patients following the modified Mediterranean diet showed: <ul style="list-style-type: none"> • Continuous decline in total cholesterol and triglyceride levels • Significant decrease in LDL levels after 6 months (19,20) |



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pathologic dyslipidemia (19,20). This diet consisted of carbohydrates with low glycemic index (including cereals, rye bread, vegetables and noodles); olive oil and rapeseed oil; grains, flaxseed and nuts. Animal protein represented one-third of total protein. Carbohydrate accounted for 47% and protein comprised 15% of daily energy intake. The remaining 38% of energy intake was contributed by fatty acids (10% saturated, 22% monounsaturated and 6% polyunsaturated), and cholesterol was limited to 165±17 mg/day. Weekly menus were provided and dietary compliance was assessed monthly with 24-hour food diaries. When compared with patients in a control group consuming a low-lipid diet that was isocaloric with the study diet, patients consuming the modified Mediterranean diet showed a continuous decline in total cholesterol and triglyceride levels, and significantly lower low-density lipoprotein (LDL) levels after 6 months. No significant differences in body weight, body fat or BMI were noted in either group.

Recommendations for Managing Dyslipidemias and Cardiovascular Disease in Kidney Transplant Recipients

Clinical research studies on dietary interventions in kidney transplant recipients indicate that total cholesterol, LDL and triglyceride levels, and in some cases body weight, can be modified by limiting calorie intake and manipulating the amounts and types of carbohydrates, proteins and fatty acids consumed (14-16,19,20). Findings from these studies are summarized in Table 1. There is also evidence to suggest that incorporating exercise into the post-transplantation medical regimen can reduce hyperlipidemia and facilitate weight loss in patients who have received a kidney transplant (21).

In 2004, the Managing Dyslipidemias in Chronic Kidney Disease Work Group of the National Kidney Foundation Kidney Disease Outcomes Quality Initiative published recommendations for the management of dyslipidemias in kidney transplant patients (22). These clinical practice guidelines recommend the implementation of therapeutic lifestyle changes including diet, weight reduction and increased physical activity to treat triglycerides ≥500 mg/dL (≥ 5.65 mmol/L) and/or LDL 100-129 mg/dL (2.59-3.34 mmol/L). Recommendations include consulting with a dietitian with expertise in chronic kidney disease for dietary

Table 2

Overview of therapeutic lifestyle modifications for adult kidney transplant recipients (22)

Diet:

Total fat: 22-35% of total calories
Saturated fat: <7% of total calories
Polyunsaturated fat: ≤10% of total calories
Monounsaturated fat: ≤20% of total calories
Cholesterol: <200 mg per day
Carbohydrate: 50-60% of total calories
Improve blood sugar control
Focus on total calories; strive to maintain standard body weight
Balance overall caloric intake with energy needs
Body mass index 25-28 kg/m²

Physical activity:

Moderate activities of daily living
Moderate & routine physical activity:
• 3-4 times weekly; 20-30 minute intervals
• Important to Include 5 minute warm-up and cool-down
• Walking, swimming, supervised exercise; exercise within ability
• Include resistance exercise training

Habits:

Moderate alcohol intake;
limit one drink per day with physician approval
Cease smoking


management. Table 2 summarizes therapeutic lifestyle changes for adult kidney transplant recipients.

For the most part, treatment paradigms formulated by this Work Group reflect interventions that have promoted favorable outcomes in the clinical research studies described in this article. The Work Group also emphasized the need for controlled studies to define the importance of weight reduction and exercise in kidney transplant patients with dyslipidemias.

Conclusion

The high incidence of hyperlipidemia and resulting risk for cardiovascular disease require aggressive interventions to improve outcomes in the kidney transplant population. Renal nutrition professionals can play a key role in this process by providing medical nutrition therapy, as

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outlined in the NKF-K/DOQI clinical practice guidelines for managing dyslipidemias in kidney transplant patients (22). Studies directed to evaluate effects of nutrition intervention on patient outcomes have focused on the post-transplant phase. However, dialysis staff members can prepare kidney transplant candidates prior to the transplant event by providing education and behavior modification to address heart-healthy eating and weight management (23). 

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