

# A low carbohydrate diet effective in the treatment of obese or diabetic patients with chronic kidney disease

## Abstract

**Aim:** Diet of Hope Institute specializes in the treatment of obesity, diabetes, hypertension, and metabolic syndrome. In 2011, a patient being treated at our clinic improved estimated glomerular filtration rate (eGFR) from 46 to 80. The patient was obese, hypertensive and diabetic. She lost 10% of her body weight and was able to stop her diabetic and blood pressure medications. This finding prompted the Institute to collect data regarding the frequency of kidney disease in the clinic's patient population and evaluate its response to our disease management program which emphasizes a low carbohydrate and normal protein diet.

**Methods:** Of five hundred consecutive patients referred to the program, thirty-three patients (6.6%) carried the diagnosis of chronic kidney disease as established by their nephrologist. These patients were supervised for an average of 6.3 months during 2013 and 2014 and data were collected at that time. Statistical analysis was subsequently performed in January 2015. Carbohydrates were restricted to berries and non-starchy vegetables. Daily protein intake was calculated at 0.5 gm per pound of body weight up to a maximum of 120 gm.

**Results:** In a population of thirty-three patients diagnosed with chronic kidney disease, eGFR increased by an average of 25.5%, serum creatinine decreased by an average of 13.7% and blood urea nitrogen (BUN) decreased by an average of 9.1%. Average weight loss was 23.8 pounds or 10.2% of body weight.

**Conclusion:** A low carbohydrate and normal protein diet can be effective in improving renal function in obese, hypertensive, and diabetic patients.

**Keywords:** diabetes, obesity, hypertension, chronic kidney disease, low carbohydrate

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**Abbreviations:** BUN, blood urea nitrogen; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HbA1c, glycated hemoglobin; Y/O, years old; Avg, average; BP, blood pressure; DM, diabetes mellitus; F, female; eGFR, estimated glomerular filtration rate; M, male; PTs, patients; HT, hypertension; Meds, medications; PO, oral; PTs, patients

## Introduction

Two-thirds of the U.S. population is obese or overweight.<sup>1</sup> The obesity epidemic created the diabetes epidemic. As physicians, we have an ever increasing armamentarium of expensive medications for the treatment of obesity and diabetes. None of the medications affect the underlying cause of these conditions. The use of insulin frequently causes weight gain.

The incidence of chronic kidney disease (CKD) has been increasing along with the epidemic of obesity and diabetes. Chronic kidney disease has been divided into five stages based on the level of eGFR. Several methods exist to calculate eGFR. Most frequently, it is calculated from serum creatinine, age, gender, and race. BUN is not included in the calculation.

Stage 1: Kidney damage with normal kidney function eGFR 90 or above

Stage 2: Kidney damage with mild loss of kidney function eGFR 89 to 60

Stage 3: Mild to moderate loss of kidney function eGFR 59 to 30

Stage 4: Severe loss of kidney function eGFR 29 to 15

Stage 5: Kidney failure eGFR less than 15

Of the thirty-three patients in our study, twenty-eight were diagnosed with CKD stage 3 and five were diagnosed with CKD stage 4. None of the patients had symptoms related to their kidney disease. Their kidney problems were discovered by routine blood testing. The major causes of chronic kidney disease are diabetes and hypertension.<sup>2</sup> The Diet of Hope program improves these conditions by providing good nutrition, changing lifestyle, treating addiction, teaching portion control, and providing accountability. The program is medically supervised. A previously published study reported the success of the Diet of Hope program in thirty-eight patients with documented coronary artery disease.<sup>3</sup> In the last five years, over 6,000 patients have been referred to the program by the local medical community. Forty-nine physicians and nurse practitioners have become patients in the program. Medicare and most insurance programs have accepted the program.

In 2011, a patient being treated at the Diet of Hope Institute improved her eGFR from 46 to 80. This finding prompted the Institute

to collect data regarding the frequency of kidney disease in the clinic's patient population and evaluate its response to our disease management program, which emphasizes a low carbohydrate and normal protein diet.

## Methods and materials

### Population

Thirty-three patients diagnosed with chronic kidney disease and treated for obesity, diabetes, hypertension, and metabolic syndrome participated in the Diet of Hope program. They received extensive counseling and education. These patients were supervised for an average of 6.3 months during 2013 and 2014 and data were collected at that time. Statistical analysis was subsequently performed in January 2015.

### Measures

Carbohydrates were restricted to approximately 50 gm of berries and non-starchy vegetables. Daily protein intake was calculated as 0.5 gm per pound of body weight, slightly above the minimum requirement of 0.36 gm per pound of body weight. Recent studies suggest that elderly patients may need a higher amount of protein to prevent sarcopenia and osteoporosis.<sup>4</sup> Protein also provides satiety. Low carbohydrate diets are often mischaracterized as high protein diets. Our program provides a normal amount of protein.

As the patients started the program, all regular insulin was stopped and long-acting insulin was reduced at night time. All sulfonylureas were discontinued. Within 24 hours of starting the program, blood sugars often dropped dramatically. Most diuretics were stopped. Eliminating refined carbohydrates produced a spontaneous diuresis which potentially could have lowered blood pressure too much. Gemfibrosil and all fibrates were discontinued. Elevated triglycerides were often related to excessive consumption of carbohydrates. The program was well tolerated with patient satisfaction at 98%.

### Statistical analysis

The patients' average age was determined, along with the average number of months they were supervised on the program. Then, the patients were sorted by each diagnosed medical condition to determine the percentage of patients existing in each category. For each relevant category (weight loss, eGFR, creatinine, BUN, blood pressure, and HbA1c), the difference between the starting value measured at induction into the program and the value obtained after an average of 6.3 months on the program was calculated. Additionally, the average change and percent change for each category were calculated. By tracking medication changes throughout the course of the program, statistics concerning the frequency of reducing and discontinuing various medications were calculated.

All patient blood work analyzed in the study was performed by their treating nephrologists as part of their regular evaluation. Statistical analysis was performed ensuring patient anonymity and confidentiality.

## Results (Tables I - 2)

Average time supervised was 6.3 months (range: 1.5 to 26.5 months). Out of thirty-three patients, eGFR increased by an average of 10.8 or 25.5%; serum creatinine decreased by an average of 0.20 mg/dL or 13.7%; BUN decreased by an average of 2.6 mg/dL or 9.1%. (On a high protein diet BUN frequently increases). Average age was 69.7 years

(range: 58 to 85 y/o). Average weight loss was 23.8 pounds or 10.2% of body weight. In the five patients diagnosed with CKD stage 4, eGFR increased by an average of 6.2 or 25% and serum creatinine decreased by an average of 0.16 mg/dL or 7.3%.

**Table 1** Demographic Characteristic of the Study Population and Changes in Relevant Measured Categories after an Average of 6.3 months on the Diet

	Avg	Range
Age of Patient	69.7y/o	56 to 85y/o
Months on Diet	6.3mos	1.5 to 26.5mos
	# of PTs	% of PTs
Number of Patients	33	27% (M), 73% (F)
CKD 3	28	84.80%
CKD 4	5	15.20%
DM	17	51.50%
Obese	29	87.90%
Overweight	4	12.10%
Hypertension	33	100.00%
	Avg Change	% Change
Weight Loss	23.8 lbs	10.20%
eGFR	*10.8	*25.5%
Creatinine	0.20mg/dL	13.70%
BUN	2.6mg/dL	9.10%
Systolic BP	3.6mmHg	2.80%
Diastolic BP	1.5mmHg	2.00%
HbA1c (DM)	1.06%	13.90%

**Note** \*, indicates increase; Avg, average; BP, blood pressure; BUN, blood urea nitrogen; CKD, chronic kidney disease; DM; diabetes mellitus; F, female; eGFR, estimated glomerular filtration rate; HbA1c, glycated hemoglobin; M, male; PTs, patients

**Table 2** Descriptive Statistics Concerning Medication Changes after an Average of 6.3 months on the Diet

	# of PTs	% of Pts
PTs on HT Meds (initial)	33	100% of total
Off	18	54.50%
Reduced	10	30.30%
Off/Reduced	28	84.80%
PTs on DM PO Meds Only (initial)	8	24.2% of total
Off	5	62.50%
Reduced	2	25.00%
Off/Reduced	7	87.50%
PTs on Insulin (initial)	9	27.3% of total
Off	6	66.70%
Reduced	3	33.30%
Off/Reduced	9	100.00%

DM, diabetes mellitus; HT, hypertension; Meds, medications; PO, oral; PTs, patients

All thirty-three of the patients were hypertensive. Eighteen patients discontinued hypertensive medications and ten reduced hypertensive medications. Even after these significant medication reductions, average systolic blood pressure decreased by 3.6mmHg and average diastolic blood pressure decreased by 1.5mmHg.

Seventeen patients were diabetic. Eight of these patients were on oral diabetic medications. Five patients discontinued oral diabetic medications and two reduced oral diabetic medications. Nine patients were diabetics on insulin. Six of these patients discontinued insulin and three reduced insulin. Even after reducing oral diabetic medications and insulin substantially among these seventeen patients, average HbA1c decreased by 1.06%.

## Discussion

Data from the National Kidney Foundation (2014) suggest that 43.8% of kidney failures are related to diabetes and 26.8% are related to hypertension. Cost of care for patients on dialysis is thirty-one billion dollars per year. In the year 2011, approximately 228, 924 people with kidney failure related to diabetes were living on dialysis.

Data from the Diabetes Association (2013) showed that 29.1million people were diabetic (9.3% of the adult population) and 78million were pre-diabetic. In seniors, the incidence of diabetes was 25.9% and the incidence of hypertension was 71%. Successful treatment of diabetes, hypertension, and obesity reduces the incidence and severity of kidney disease, resulting in decreased costs associated with the management of the disease.

All of our patients were hypertensive; they were also either obese or overweight. Seventeen patients were diabetic. Kidney disease in our patients was most likely related to these medical issues. Their nephrologists could not find any specific cause for their disease. We believe that improving the risk factors for kidney disease helped improve kidney function.

The improvement of renal function could also be related to weight loss and possibly to the effect of a low carbohydrate ketogenic diet.<sup>5,6</sup> Weight loss generates multiple health benefits including reduction of blood pressure, blood glucose, and inflammation, as well as improvement of the lipid profile.<sup>7</sup> A two year randomized study addressed the long-term effects of the low carbohydrate, low fat and Mediterranean diets on renal function.<sup>8</sup> Participants with CKD stage 3 improved eGFR by 10% on the low carbohydrate diet, compared to 6% on the Mediterranean diet and 5.4% on the low fat diet. The improvement of eGFR was significantly associated with weight loss, fasting insulin levels and blood pressure. No association was found with age or diabetic status. Another study involving diabetic mice with induced renal disease reversed their diabetic nephropathy with a low carbohydrate ketogenic diet. The ketone 3-beta-hydroxybutyric acid (3-OHB) was thought to protect the kidneys from the oxidative stress of glucose.<sup>9</sup>

Pharmacological treatment of diabetes with insulin has substantial limitations. Based on the results of the Accord and Advance studies, aiming at an HbA1c of 7% in diabetics on insulin is now official policy.<sup>10,11</sup> An HbA1c of 7% corresponds to an average blood sugar level of 154mg/dL, implying the patient remains exposed to diabetic complications. A recent study from Veterans hospitals suggests that treating elderly patients with insulin in addition to metformin might be harmful.<sup>12</sup> No long term studies showing benefits with newer diabetic medications exist.

All patients with chronic kidney disease did well on the Diet of Hope program because medical supervision was constant and ongoing. Patients were taught principles of good nutrition and how to control portion size. All simple carbohydrates, especially sugar, were eliminated from their diets. They were treated behaviorally for addiction issues while learning new lifestyle management techniques. They were also held accountable by medical professionals. Those patients who were diabetic and hypertensive often needed reductions of medications in the first week resulting in major savings for the patients.

## Limitations

The major limiting factor of the study was the relative short follow up of only 6.3months. Most dietary interventions can be successful short term. We expect our patients to follow the program long term. Chronic kidney disease is a very motivating factor.

The average age of our patients was 69.7years (range: 56years to 85years). We do not yet know if the program is also helpful in younger patients with similar kidney problems. Further study would be beneficial.

## Conclusion

Diabetes, hypertension and obesity are the main predisposing factors for chronic renal failure. These risk factors can be successfully controlled with a low carbohydrate and normal protein diet. Improving the risk factors for chronic renal disease with diet alone improves kidney function and allows for reduction of medications.

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## Conflict of interest

Author declares that there is no conflict of interest.

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