



# A Low-Carbohydrate Diabetes Prevention Program for Adults with Prediabetes: A Mixed Methods Pilot Study

Dina H. Griauzde MD, MSc<sup>1,2</sup>; Tahoor Ansari MPH<sup>2</sup>; Kaitlyn J. Patterson BS<sup>2</sup>; Patti Bihn BSN, RN<sup>3</sup>; Samuel Shopinski MMS<sup>3</sup>; Caroline Richardson MD<sup>2</sup>; Laura R. Saslow PhD<sup>2</sup>  
<sup>1</sup>VA Ann Arbor Healthcare System, <sup>2</sup>University of Michigan, <sup>3</sup>National Kidney Foundation of Michigan

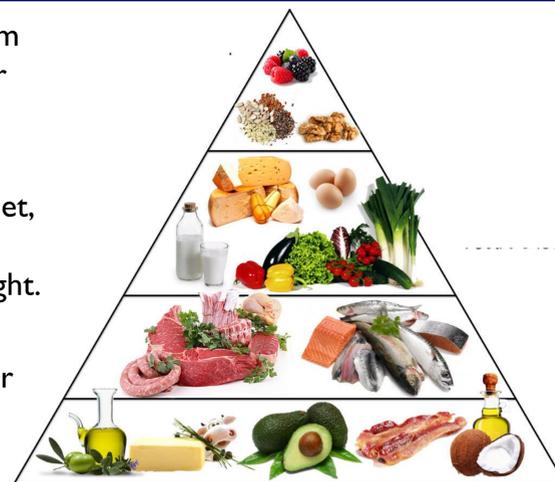


## OBJECTIVES

- To evaluate feasibility and acceptability of a Low-Carbohydrate Diabetes Prevention Program (LC-DPP) among adults w/ prediabetes
- To estimate weight loss from a LC-DPP

## BACKGROUND

- The CDC's National Diabetes Prevention Program (NDPP) is the prevailing public health strategy for type 2 diabetes prevention
- The NDPP teaches a low-fat, calorie-restricted diet, and many NDPP participants do not achieve clinically-significant weight loss of  $\geq 5\%$  body weight.
- Low-carbohydrate diets may be more effective for weight loss among individuals with prediabetes (carbohydrate-insulin hypothesis)



Low-carbohydrate food pyramid

## METHODS

**Design:** single-arm pilot study with mixed methods evaluation

**Inclusion criteria:** BMI  $\geq 25$  kg/m<sup>2</sup> and prediabetes (HbA1c 5.7-6.4%)

**Intervention:**

- Adapted DPP dietary content to teach participants to follow a low-carb (<25 g net carb/day) rather than a low-fat/calorie-restricted diet
- 16 weekly sessions (**core**); 6 bi-monthly/monthly sessions (**maintenance**)
- Community partnership with National Kidney Foundation of Michigan

**Quantitative Measures:**

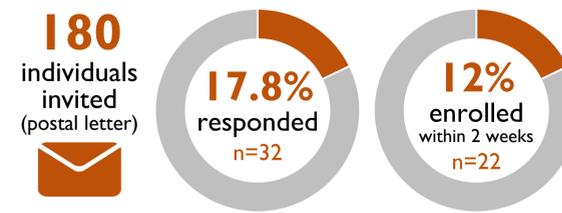
- Feasibility (rate of recruitment)
- Acceptability (session attendance)
- Change in weight
- Change in HbA1c

**Qualitative Measures:**

Semi-structured interviews at 6 months (n=13) and 12 months (n=12)

## RESULTS

### Recruitment



22 participants

### Baseline characteristics (n=21)

Mean age in years (SD)	58.9 (11.0)
Female, n (%)	9 (42.9%)
White, n (%)	18 (85.7%)
Education > HS, n (%)	17 (85.0%)
Married / partnered, n (%)	15 (71.4%)

### 6- and 12-month outcomes

Outcomes (mean (SD) or N(%))	6 months	12 months
Core days attended	10.3 (4.5)	NA
Maintenance days attended	NA	3.4 (2.7)
Weight change (kg)	-4.3 (4.9)	- 4.9 (5.8)
% weight change	-4.5 (5.0)	-5.9 (7.1)
$\geq 5\%$ weight loss	10 (45.5)	9 (42.8)
$\geq 7\%$ weight loss	6 (27.3)	8 (36.4)
$\geq 10\%$ weight loss	4 (18.2)	6 (27.3)
HbA1c change*	-0.1 (0.2)	-0.2 (0.2)

\*n=18 at 6 months and n=19 at 12 months

### Side Effects and Adverse Events

- No significant differences in side effects (e.g., constipation, diarrhea, headache)
- Ischemic stroke (n=1)

### Key Themes

#### Facilitators of adhering to a low-carb meal plan

**Highly effective for weight loss**

"...it's the **best diet I have ever been on**, and I've been on a lot...it seems **effortless**, it just seems like [the weight] is melting off..."  
- Female, -14.5 kg (18.2% body weight) at 12 months

**Decreased hunger and cravings**

"I like the fact that I'm **not craving food** and thinking about food all the time."  
- Female, -8.63 kg (9.5% body weight) at 12 months

#### Barriers of adhering to a low-carb meal plan

**It's hard to give up carbs**

"The **hardest thing is avoiding food that I like** or love, like breads and mashed potatoes and potato chips and pasta and going out to dinner and having a nice, big juicy hamburger on a nice bun."  
- Male, -3.6 kg (3.6% body weight) at 12 months

**Concerns about dietary fat**

"For years and years and years, I've heard eating red meats, cheeses, and nuts, and low carbohydrate foods...is **not good for your coronary system, your heart**. And now, it seems, like the whole thing is reversed. That's the only thing that bothers me."  
- Male, 2.2 kg (2.3% body weight) at 12 months

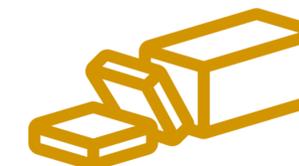
## CONCLUSIONS AND NEXT STEPS



A Low-Carbohydrate Diabetes Prevention Program (LC-DPP) is **feasible and acceptable**.



**Greater weight loss** than historical controls in low-fat DPPs (5.9% v. 4.2%).



**Uncertainty about dietary fat** and disease risk is a challenge to implementation.



**Comparative effectiveness** trial of low-carb vs. low-fat DPP

### Acknowledgements

Michigan Nutritional Obesity Research Center

National Kidney Foundation of Michigan

# A Low-Carbohydrate Diabetes Prevention Program for Adults with Prediabetes: A Mixed Methods Pilot Study

Dina H. Griauzde MD, MSc<sup>1,2</sup>; Tahoorah Ansari MPH<sup>2</sup>; Kaitlyn J. Patterson BS<sup>2</sup>; Patti Bihn BSN, RN<sup>3</sup>; Samuel Shopinski MMS<sup>3</sup>; Caroline Richardson MD<sup>2</sup>; Laura R. Saslow PhD<sup>2</sup>; <sup>1</sup> VA Ann Arbor Healthcare System, <sup>2</sup> University of Michigan, <sup>3</sup> National Kidney Foundation of Michigan



22 participants

## Baseline characteristics (n=21)

Mean age in years (SD)	58.9 (11.0)
Female, n (%)	9 (42.9%)
White, n (%)	18 (85.7%)
Education > HS, n (%)	17 (85.0%)
Married / partnered, n (%)	15 (71.4%)

## Side Effects and Adverse Events

- No significant differences in side effects (e.g., constipation, diarrhea, headache)
- Ischemic stroke (n=1)

Decreased hunger and cravings

“I like the fact that I’m not craving food and thinking about food all the time.”  
– Female, -8.63 kg (9.5% body weight) at 12 months

## Barriers of adhering to a low-carb meal plan

It’s hard to give up carbs

“The hardest thing is avoiding food that I like or love, like breads and mashed potatoes and potato chips and pasta and going out to dinner and having a nice, big juicy hamburger on a nice bun.”  
– Male, -3.6 kg (3.6% body weight) at 12 months

Concerns about dietary fat

“For years and years and years, I’ve heard eating red meats, cheeses, and nuts, and low carbohydrate foods...is not good for your coronary system, your heart. And now, it seems, like the whole thing is reversed. That’s the only thing that bothers me.”  
– Male, 2.2 kg (2.3% body weight) at 12 months

## METHODS

**Design:** single-arm pilot study with mixed methods evaluation

**Inclusion criteria:** BMI ≥ 25 kg/m<sup>2</sup> and prediabetes (HbA1c 5.7-6.4%)

### Intervention:

- Adapted DPP dietary content to teach participants to follow a low-carb (<25 g net carb/day) rather than a low-fat/calorie-restricted diet
- 16 weekly sessions (**core**); 6 bi-monthly/monthly sessions (**maintenance**)
- Community partnership with National Kidney Foundation of Michigan

### Quantitative Measures:

- Feasibility (rate of recruitment)
- Acceptability (session attendance)
- Change in weight
- Change in HbA1c

### Qualitative Measures:

Semi-structured interviews at 6 months (n=13) and 12 months (n=12)



A Low-Carbohydrate Diabetes Prevention Program (LC-DPP) is **feasible and acceptable.**



**Greater weight loss** than historical controls in low-fat DPPs (5.9% v. 4.2%).

**Uncertainty about dietary fat** and disease risk is a challenge to implementation.



**Comparative effectiveness** trial of low-carb vs. low-fat DPP