



# A clinical trial of a ketogenic diet as treatment of Parkinson's disease

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## Background

People with Parkinson's disease have decreased levels of CNS adenosine (1). Ketosis can increase adenosine levels. We hypothesized that a ketogenic diet might have neuroprotective or symptomatic benefit for people with Parkinson's disease.

The only previously reported trial of ketogenic diet for Parkinson's disease was of 5 patients on a 90% fat diet for 4 weeks. (2)

We report a phase I feasibility study of maintaining people with Parkinson's on a ketogenic diet.



## Methods

13 people with Hoehn-Yahr stage 2 or 3 Parkinson's disease ate a ketogenic diet (intended fat content 80%) for 12 weeks.

Exclusionary criteria were hyperlipidemia (controlled lipids by medical therapy not excluded), coronary artery disease, congestive heart failure, diabetes mellitus, cancer other than basal cell skin cancers, kidney stones or gallstones, childhood inborn error of metabolism, or any possibility of pregnancy.

The patients received weekly dietary counseling at the National College of Natural Medicine (see Poster 35.19 for details). Dietary adherence was confirmed by monitoring beta-hydroxybutyrate levels.

Twelve of the thirteen patients were taking dopaminergic drugs. Doses of these drugs were held constant during the twelve week trial.

Outcomes measures included the UPDRS, PDQ 39. Mini Best, Timed Up and Go, and Freezing of Gait score. Patient symptoms and lab tests were used to monitor toxicity.

The trial was approved by the Legacy Health IRB.

## Results

1 patient worsened and terminated the trial after 4 weeks; re-challenge confirmed his intolerance of the diet.

12 patients completed the trial. For these 12 patients UPDRS showed a trend to improvement; the sum of UPDRS tremor items showed a significant improvement (baseline - 4.6, week 12 - 2.8, p=0.04); and 6 patients had clinically significant improvements in UPDRS. For a 360 degree turn, turn time and total steps showed statistically significant improvement. PDQ39 showed no significant change.

The Table below shows the change in total UPDRS score for each patient. Week 0 is the score before starting the diet. Week 12 is the score at the end of the twelfth week on the diet. On the UPDRS, a low score is better, so a negative value for change indicates that the patient has improved on the diet.

UPDRS	Week 0	Week 12	Change
Patient 1	27	12	-15
Patient 2	99	40	-59
Patient 3	57	30	-protein 27
Patient 4	29	20	-9
Patient 5	36	47	11
Patient 6	35	22	-13
Patient 7	71	51	-20
Patient 8	32	28	-4
Patient 9	42	48	6
Patient 10	25	28	3
Patient 11	31	38	7
Patient 12	47	50	3

The three patients with the best improvement in UPDRS score were enthusiastic about their response to the diet and also showed improvement in the UPDRS when tested at the end of week 4 and week 8 of the diet.

Two patients who did not have an improvement in UPDRS also had a subjective sense that they had improved on the diet. Some of the patients whose UPDRS score improved did not believe that they had improved on the diet.

Adverse symptoms [constipation (2), worse motor fluctuations (4), nausea, fatigue, leg aches, dizziness, sleepiness, decreased mental clarity, atrial fibrillation] were mild. Mean weight loss was 12.3 lbs; mean increase in LDL cholesterol was 33 mg/dl.

## Conclusions

This was a short duration, small, and uncontrolled trial of ketogenic diet treatment of Parkinson's disease but is the longest and largest such trial reported to date.

With one exception, patients were able to adhere to the diet and complete the trial. One half of those completing the trial had a clinically significant improvement in UPDRS with a suggestion that tremor was the most responsive motor symptom.

The trial was not designed to investigate any neuroprotective effect of the diet.

We plan a longer and larger treatment trial of a fat rich diet for people with Parkinson's disease, first screening for responders with one month of a ketogenic diet and then maintaining responders long term on a modified Atkins Diet.

## References

- (1) Bosion D "Adenosine as a neuromodulator in neurological diseases." *Curr Opin Pharmacol* 2008; 8:2-7
- (2) Van Italie et al "Treatment of Parkinson disease with diet-induced hyperketonemia: A feasibility stud" *Neurology* 2005; 4:728-30

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