

# A 36 Year Old Male's Weight Loss Using Multiple Cycles of a Ketogenic Feeding Tube Diet Over 2 Years: A Case Report

## Abstract

**Introduction:** The purpose of this patient study was to report the effects of multiple 10 day ketogenic feeding tube diet cycles to achieve long term, sustained weight loss.

**Case report:** Over 26 months, a 36 year old male patient was treated for obesity using intermittent 10 day cycles of a ketogenic feeding tube diet from November 2012 through January 2015. During each diet cycle the patient was evaluated every 2 to 3 days in the clinic for weight, vitals, urine ketones, tolerance of diet and side effects. On initial and each diet cycle the patient was evaluated by the physician for physical and mental health, blood chemistries and body composition by DEXA. The diet consisted of a 10 day continuous feeding of a zero carbohydrate, protein, vitamin and fat formula delivered through a nasogastric tube by a feeding pump. In between diet intervals, the patient was advised to follow a low carbohydrate diet consisting of <20 grams of total carbohydrates per day without strict medical follow up.

**Discussion:** Over 26 months, 9 diet cycles were completed. Diet cycles were performed at random intervals at the patient's request. The average duration was 9 days per diet cycle. There was an average weight loss of 18.7 lbs (8.5 kg) per diet cycle with an average of 2.5 kg/m<sup>2</sup> reduction in BMI. Nutritional ketosis was achieved each diet cycle with average ketones of 124 mg/dL per urinalysis. The patient tolerated the diet well with minimal reported side effects. The patient was unable to maintain weight loss during intervals between diet cycles. The cumulative weight loss of 9 diet cycles was 167.9 lbs (76.3 kg), but with the patient's weight gain between cycles he had a net weight loss of 7 lbs (3.2 kg).

**Conclusion:** The ketogenic feeding tube diet produces effective weight loss during the 10 day diet cycle and continues to be effective for weight loss with repeated cycles; however weight regain is inevitable without an effective ongoing lifestyle modification program. Long term weight loss using the ketogenic feeding tube diet may be effective with implementation of sustainable lifestyle and dietary behavior changes. Medications or weight loss surgery may be utilized in addition to the ketogenic feeding tube diet to achieve long term weight management. More clinical studies are warranted.

**Keywords:** KE Diet; Feeding tube diet; ketogenic diet; KEN, NEC, Rapid weight loss preoperatively; Nutritional ketosis

**Abbreviations:** Lbs: Pounds; mg/dL: Milligrams Per Deciliter; kg/m<sup>2</sup>: kilograms Per Square Meter; BMI: Body Mass Index; DEXA: Dual Energy X-ray Absorptiometry; BMC: Body Mass Composition

## Introduction

Obesity was recognized as a disease by the American Medical Association in 2013 and subsequently medical providers need to find more successful methods to assist their patients in achieving long term sustained weight loss [1]. Multiple cycles of ketogenic enteral nutrition has been shown to induce rapid weight loss and is well tolerated [2]. Obesity among all racial groups in the United States is associated with multiple acquired comorbid conditions including type 2 diabetes, hypertension, dyslipidemia, cardiovascular disease, coronary heart disease and stroke [3]. With a diagnosis of Obesity Class III (BMI ≥ 40 kg/m<sup>2</sup>) as stated

on the ASBP Obesity Algorithm 2014-2015, the patient in this case study is at an extremely high risk for multiple comorbid conditions associated with obesity.

The ketogenic feeding tube diet is a new, short term, quick weight loss program aimed at individuals wishing to jump-start a long-term weight loss program or for weight loss prior to bariatric surgery. It is a physician supervised diet without drugs or surgery. The diet formula is a low calorie, zero carbohydrate, high protein and moderate fat diet which forces the body into a state of nutritional ketosis whereby the main mechanism of weight loss is burning stored fat for energy. The average diet cycle is 10 days. The purpose of this case study was to examine the effects of using multiple 10 day ketogenic feeding tube diet cycles to achieve long term, sustained weight loss.

## Case Report

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## Case Presentation

The patient in this study is an unmarried, Caucasian male, marketing executive. He does not smoke or drink and consumes 3 caffeinated beverages daily. He takes no prescription medications. He presented to our weight loss clinic for obesity management after refusing bariatric surgery. He has a family history of diabetes, heart disease, stroke, thyroid disease, cancer and high blood pressure. The patient was found to have no significant medical history except for obesity. He was in good general health with a diagnosis of Obesity III and found to be an appropriate candidate for the ketogenic feeding tube diet.

The study span was 26 months, beginning in November 2012, at which time the patient was 36 year old, 6 feet 1 inch (73 inches) tall, weighed 417 pounds (189.5 kg) and had a BMI of 55 kg/m<sup>2</sup>. The study ended in January 2015, at which time the patient was 39 years old, weighed 410 lbs (186.4 kg) and had a BMI of 54.1 kg/m<sup>2</sup>.

Nine cycles of the ketogenic feeding tube diet were completed over a 26 month period. During each diet cycle the patient was evaluated every 2 to 3 days in the clinic for weight, vitals, urine ketones, tolerance of the diet and side effects, including but not limited to diarrhea, cramping and hunger. During each diet cycle the patient was evaluated by the physician for physical and mental health, blood chemistries and body composition by DEXA (GE Lunar Prodigy Primo™ v.107) when appropriate. The DEXA body composition scan has a weight limit of 350 pounds (160 kg), therefore the patient could only complete one body mass composition scan at the end of diet cycle six.

The ketogenic feeding tube diet consisted of a 10 day continuous feeding of a zero carbohydrate, protein, vitamin, mineral and fat formula delivered through a nasogastric tube by a feeding pump. The patient's daily protein and fat intake was determined by the physician and adjusted throughout the course of the diet when applicable to improve tolerability. While on the diet, the patient was not allowed to consume anything except the feeding formula, water, black coffee, home brewed tea, or up to 1 beef bouillon cube dissolved in water per day. While on the diet the patient was provided with weight loss coaching and support to develop a better relationship with food. He was provided the tools to implement behavioral changes, which could help him develop a long term weight management lifestyle. During the time span between diet intervals, the patient was advised to follow a low carbohydrate, ketogenic diet consisting of <20 grams of carbohydrate a day.

Diet cycle #1 the patient completed 9 days and lost 23.7 pounds with a BMI reduction of 3.1 kg/m<sup>2</sup>, a final urinary ketosis level of 150 mg/dL with hunger and cramping at end of diet only. Starting weight 417 lbs, ending weight 393.3 lbs. Patient did not qualify for DEXA.

Diet cycle #2 the patient completed 6 days and lost 13.2 pounds with a BMI reduction of 1.7 kg/m<sup>2</sup>, a final urinary ketosis level of 150 mg/dL with no hunger or other side effects. Starting weight 402.8 lbs, ending weight 389.6 lbs. Patient did not qualify for DEXA.

Diet cycle #3 the patient completed 9 days and lost 22.6 pounds with a BMI reduction of 3 kg/m<sup>2</sup>, a final urinary ketosis level of

150 mg/dL with mild hunger or other side effects. Starting weight 389.6 lbs, ending weight 367 lbs. Patient did not qualify for DEXA.

Diet cycle #4 the patient completed 8 days and lost 23 pounds with a BMI reduction of 3.1 kg/m<sup>2</sup>, a final urinary ketosis level of 150 mg/dL with mild hunger but no other side effects. Starting weight 389.6 lbs, ending weight 367 lbs. Patient did not qualify for DEXA.

Diet cycle #5 the patient completed 9 days and lost 18.8 pounds with a BMI reduction of 2.5 kg/m<sup>2</sup>, a final urinary ketosis level of 150 mg/dL with no hunger or other side effects. Starting weight 365.4 lbs, ending weight 346.6 lbs. Patient refused DEXA.

Diet cycle #6 the patient completed 9 days and lost 12 pounds with a BMI reduction of 1.6 kg/m<sup>2</sup>, a final urinary ketosis level of 150 mg/dL with mild hunger but no other side effects. Starting weight 356 lbs, ending weight 344 lbs. DEXA scan showed 48.0% body fat, 58.3% android fat, 48.6% gynoid fat, 329.2 lbs total body mass, 320.7 lbs tissue, 154.1 lbs fat, 166.6 lbs lean, 8.5 lbs BMC and 175.1 lbs fat free.

Diet cycle #7 the patient completed 9 days and lost 22 pounds with a BMI reduction of 2.9 kg/m<sup>2</sup>, a final urinary ketosis level of 150 mg/dL with no hunger or other side effects. Starting weight 387.8 lbs, ending weight 365.8 lbs. Patient did not qualify for DEXA.

Diet cycle #8 the patient completed 10 days and lost 13.6 pounds with a BMI reduction of 1.8 kg/m<sup>2</sup>, a final urinary ketosis level of 15 mg/dL with no hunger or other side effects. Starting weight 384 lbs, ending weight 370.4 lbs. Patient did not qualify for DEXA. Patient removed tube by himself on day 10 and came into the office on day 11 for follow up. Final urine ketones are inconclusive because patient reported eating food.

Diet cycle #9 the patient completed 11 days and lost 19 pounds with a BMI reduction of 2.5 kg/m<sup>2</sup>, a final urinary ketosis level of 50 mg/dL with mild hunger but no other side effects. Starting weight 429 lbs, ending weight 410 lbs. Patient did not qualify for DEXA. Final urine ketones suggest patient may have consumed food while on diet (Table 1 & 2) (Figure 1-4).

**Table 1:** Diet cycle by start and end.

Diet Cycle Number	Ketones Start mg/dL	Ketones End mg/dL
1	0	150
2	15	150
3	0	150
4	0	150
5	15	150
6	0	150
7	50	150
8	0	15*
9	0	50**

\*Patient pulled NG tube day before office visit and admitted to consuming regular food

\*\*Patient denied eating but reports hunger

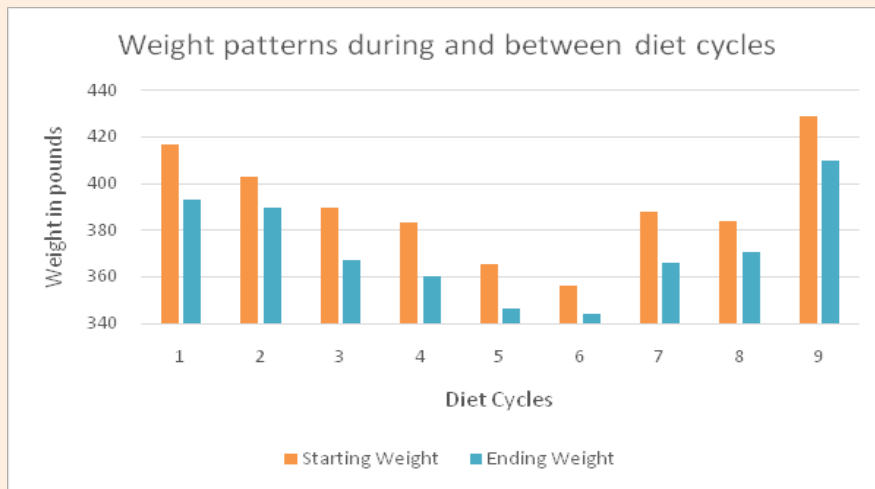


Figure 1: Weight patterns during and between diet cycles.

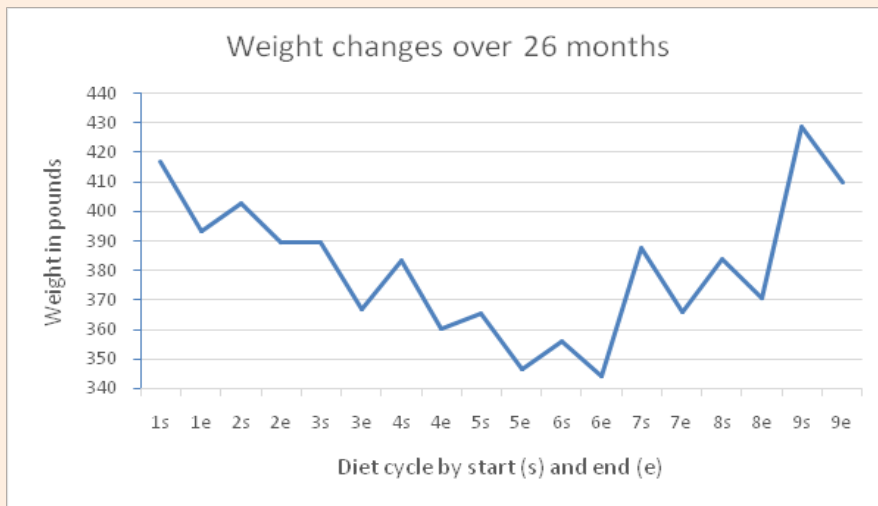


Figure 2: Weight changes over 26 months.

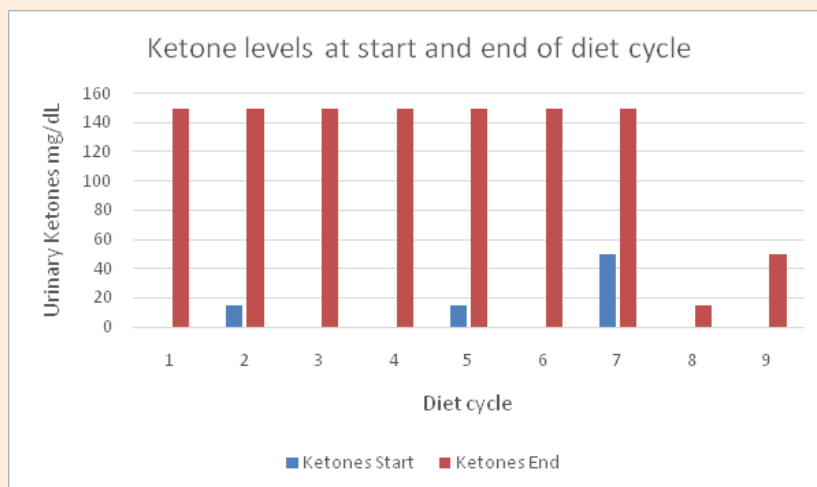


Figure 3: Ketone levels at start and end of diet cycle.

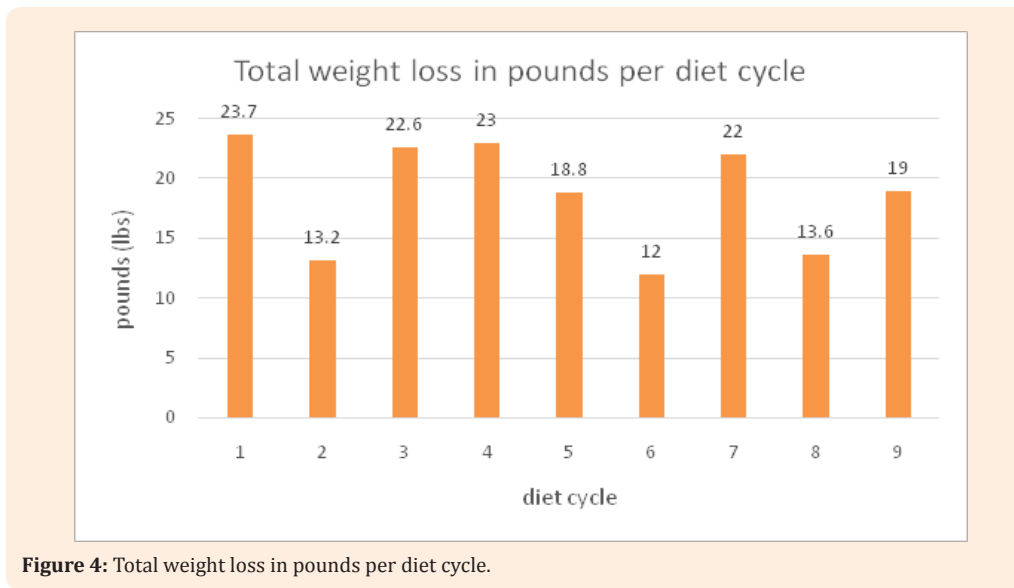


Figure 4: Total weight loss in pounds per diet cycle.

Table 2: Diet cycle vs weight loss.

Cycle #	Total weight loss (pounds)
1	23.7
2	13.2
3	22.6
4	23
5	18.8
6	12
7	22
8	13.6
9	19

### Discussion

Ketogenic diets have long been known to produce weight loss by forcing the body into a state of nutritional ketosis. This is accomplished by reducing the total carbohydrate content to less than 50 grams per day, however at times it must be reduced to less than 20 grams per day. The ketogenic feeding tube diet is essentially devoid of carbohydrates and produces intense nutritional ketosis which often suppresses hunger completely and produces weight loss of approximately 0.5 to 1 kilogram per day [4,5] while preserving FFM [3]. This patient completed 9 ketogenic feeding tube diet cycles over 26 consecutive months. The patient averaged 9 days per diet cycle and the diet intervals were scheduled at his convenience. Average weight loss per diet cycle was 18.7 lbs (8.5 kg) with an average of 2.5 kg/m<sup>2</sup> reduction in BMI.

Nutritional ketosis was achieved each diet cycle with an average final urine ketone measure of 124 mg/dL per urinalysis. The patient was in a low ketotic state at the beginning of diet cycle 2 and 5. The patient was in a moderate state of ketosis at the start of diet cycle 7. The patient was not in ketosis at the

start of diet cycle 1, 3, 4, 6, 8 or 9. The final level of ketosis does not appear to be related to the starting ketosis level. Nutritional ketosis occurs when the body burns fat for energy and as the fat is metabolized, ketone bodies are produced and excreted. Nutritional ketosis is important in the ketogenic feeding tube diet because this nutritional state helps prevent hunger. Ketosis levels were measured using urine ketone strips and classified on a scale of 0 mg/dL to 150 mg/dL.

The patient tolerated the diet well with minimal reported side effects. Monitored diet side effects include headache, diarrhea, abdominal cramps and hunger. Headache and abdominal cramps were reported subjectively as yes or no answers. Diarrhea was subjectively measured as having a liquid bowel movement 4 or more times a day. Hunger was subjectively measured on a scale of 0 to 4 with 0 = no hunger, 1 = mild hunger, 2 = moderate hunger, 3 = severe hunger and 4 = excessive hunger.

The patient was unable to maintain weight loss in-between diet cycles and did not follow a low carbohydrate ketogenic diet as directed by physician. The cumulative weight loss of 9 diet cycles was 167.9 lbs, but the patient's weight gain between cycles allotted a sustained total weight loss of 7 lbs. This case report clearly exemplifies what is already known to obesity medicine specialists and bariatric surgeons, namely that to achieve sustained weight loss, patients need to follow on going lifestyle modification programs, often in a comprehensive weight loss clinic, which includes bariatric surgeons, obesity medicine specialists, registered dietitians, psychologists and exercise physiologists.

### Conclusion

The ketogenic feeding tube diet produces effective weight loss during the 10 day diet cycles and continues to be effective for weight loss with repeated cycles; however weight regain is inevitable without strong patient motivation and an ongoing lifestyle modification program. Long term weight loss using the

ketogenic feeding tube diet may be achievable with sustainable lifestyle and dietary behavior changes, medications, weight loss surgery or a combination of all. Further clinical studies are warranted in this area and to determine which combinations are best.

### **Acknowledgement**

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