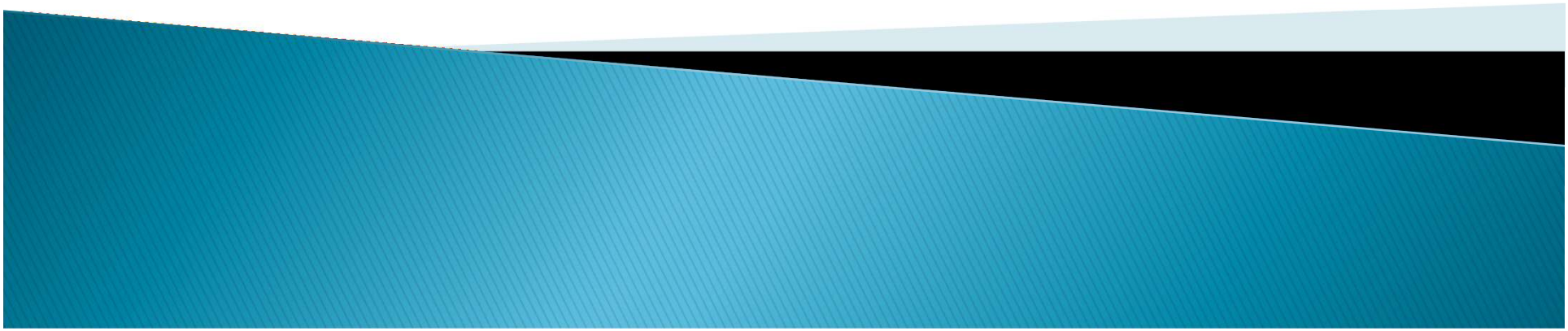
The Ketogenic and Modified Atkins Diet for the Treatment of Epilepsy

Yvette Mascareñas, MS, RD, LD
Carla M Fedor, RN, CDDN



What is the Ketogenic Diet?

- A high fat, low carbohydrate diet
- FDA approved treatment for Intractable Epilepsy
- Proven to be helpful for seizures that cannot be controlled with medication(s)

History

- Throughout history it has been recognized that if a person with epilepsy stops eating their seizures will generally stop
- 1910 – First scientific study on fasting is done in France
- 1921 – Dr. Wilder at the Mayo Clinic first used the Ketogenic Diet and it was widely used until effective medications were introduced
- 1980's – Dr. Freeman at John Hopkins Hospital revived the diet

How does it work?

- The body converts fat to energy instead of using carbohydrates
- Ketone bodies are produced as a by-product of fat metabolism
- “Keto” = ketone + “genic” = producing
- Ketones have anticonvulsant, sedative, and appetite suppression effects

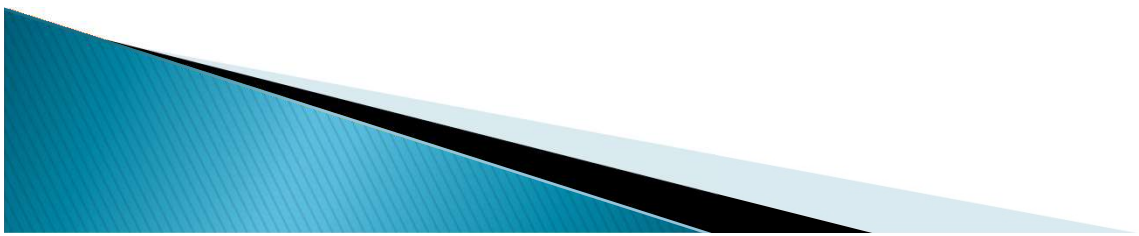
Description of the diet

- 90% of the total calories are provided from fat, therefore the meals are small due to the high fat content of the diet
- Remainder of calories are provided from protein and carbohydrate combined (protein intake is calculated using the DRI for age, to meet minimum recommended needs)
- Daily carbohydrate intake generally ranges between 2-5 grams per day.

Diet Ratios

Diet prescribed in ratios:

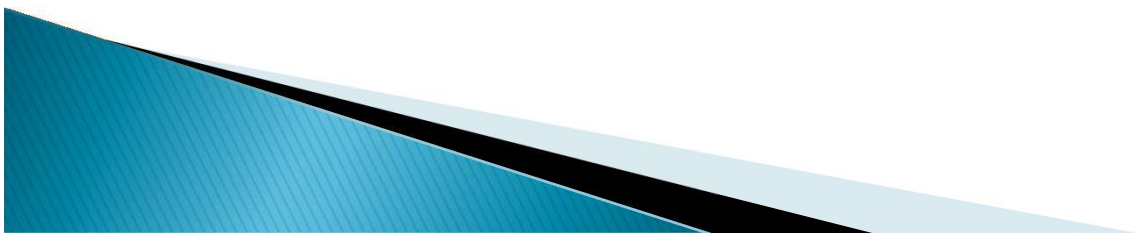
4:1, 3:1, 2:1, 1:1

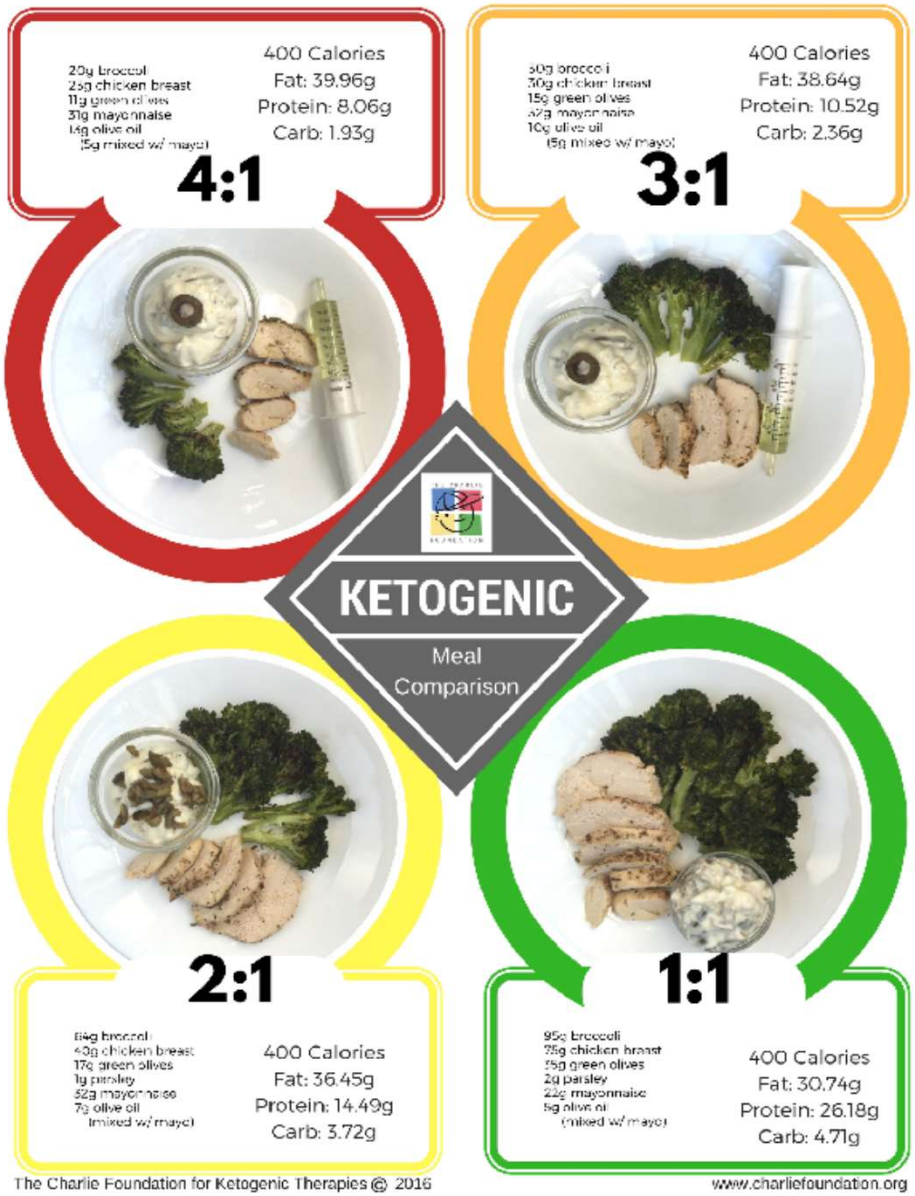


Diet Ratios

What do the numbers mean?

- Diet ratio is the dietary unit composition or building block of the diet
- It explains the composition of the diet
- For example – a 4 :1 diet consists of 4 grams of fat for every 1 gram of carbohydrate and protein combined




20g broccoli
25g chicken breast
11g green olives
31g mayonnaise
14g olive oil
(5g mixed w/ mayo)
400 Calories
Fat: 39.96g
Protein: 8.06g
Carb: 1.93g
4:1
30g broccoli
30g chicken breast
15g green olives
22g mayonnaise
10g olive oil
(5g mixed w/ mayo)
400 Calories
Fat: 38.64g
Protein: 10.52g
Carb: 2.36g
3:1
KETOGENIC
Meal
Comparison
84g broccoli
40g chicken breast
17g green olives
1g parsley
52g mayonnaise
7g olive oil
(mixed w/ mayo)
400 Calories
Fat: 36.45g
Protein: 14.49g
Carb: 3.72g
2:1
95g broccoli
75g chicken breast
15g green olives
2g parsley
22g mayonnaise
5g olive oil
(mixed w/ mayo)
400 Calories
Fat: 30.74g
Protein: 26.18g
Carb: 4.71g
1:1
The Charlie Foundation for Ketogenic Therapies © 2016
www.charliefoundation.org

Foods Groups

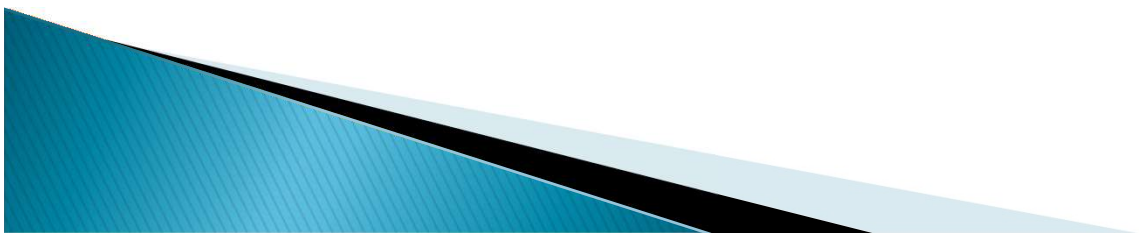
Four food groups of the Ketogenic Diet

- Protein: meat, fish, poultry, egg, or cheese
- Carbohydrate: fruits and vegetables
- Fat: butter, oil, margarine, cream cheese, sour cream, or mayonnaise
- 36% or 40% heavy whipping cream

Meal Plans

Solid food meal plans

- Meat/fish/poultry, fruit/vegetable, fat, cream
- Cheese, fruit/vegetable, fat, cream
- Egg, fruit/vegetable, fat, cream



Meal Plans

- Liquid Diet
  - Ketogenic tube feeding
    - Ross Carbohydrate Free (RCF) formula
      - Microlipid or Liquigen
      - Solcarb powder
      - Prescribed amount of water
    - Ketocal powder or liquid
      - Powder: 4:1 or 3:1 ratio
      - Liquid: 4:1 ratio, contains fiber, flavored or unflavored
      - Prescribed amount of water
    - Ketovie 4:1, 3:1, and Ketovie Peptide.

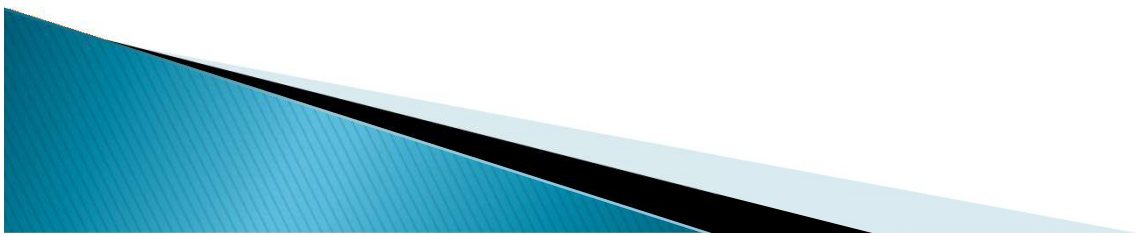
Other components of the diet

- Snack (1 of the following is allowed/day)
  - 2 lettuce leaves or ½ cup chopped lettuce (iceberg lettuce)
  - 1 walnut
  - 1 macadamia nut
  - 3 filberts
  - 3 black olives
  - 1 brazil nut
  - 1 butternut
  - 2 pecans
  - 1 tablespoon sour cream

- Free foods
  - Pepper or spices as desired
  - 1 diet, caffeine free soda per day
  - 1 piece of Trident sugarless gum per day
  - 1 frozen popsicle per day made by freezing sugar free Kool-Aid or Crystal lite
  - Weak decaffeinated coffee or tea
  - Sugar free Kool-Aid made with liquid sweetener
  - Extracts like pure vanilla, chocolate, coconut, maple (up to 15 drops each meal).
  - Artificial liquid sweeteners without calories such as Sweet 10 or Sweet-N-Low

Side Effects

- Hypoglycemia
- Constipation
- Slows growth/weight
- Hyperlipidemia
- Osteoporosis
- Hyperacidosis
- Kidney stones
- Pancreatitis



Hypoglycemia

- Can be a problem for active persons
- The family is taught the s x s
  - Mild – Irritable, pale, weak, drowsy, headache
  - Moderate – Confusion, tremors, sweaty, increased pulse, feel cold and clammy
  - Severe – Loss of consciousness
- Treatment – 30cc juice or regular soda
  - Could use teaspoon of sugar, ice cream, pudding
- Important to eat several small meals per day
  - 4-6 meals

Constipation

- It is seen in almost everyone on the diet
- Caused by decreased fiber in the diet
- Concurrent use of antiseizure medications
- Treatment
  - Smooth Move tea
  - SF MOM
  - Miralax

Slows Growth/Weight

- Weight loss
- Growth slowed due to decreased amount of protein
  - If consume < 80% of calories or daily protein
- Monitoring by dietitian essential

Hyperlipidemia

- Diet high in fats
- Familial predisposition
- Inability to metabolize fat efficiently
- Treatment
  - Adjust the diet
  - Carnitine

Osteoporosis

- Deficient in Calcium, Vitamin D, Magnesium, Phosphorous, Folic acid, and other trace vitamins and minerals
- Concurrent use of medications that interfere with Vitamin D absorption (Dilantin, Phenobarb, Tegretol)
- Many patients are non-weight bearing
- Treatment – all patients given calcium and vitamin D supplements

Hyperacidosis

- Ketones are acids and if they get too high they can cause hyperacidosis
- Ketone levels may be lower on MAD
- The body quickly compensates to correct its pH
- May occur when ill or dehydrated
- Treatment
  - Rehydrate
  - Adjust diet
  - May need to give Bicitra

Kidney Stones

- Caused by lack of fluids
- Meds
  - Topiramate
  - Zonisamide
- Symptoms
  - Back pain
  - Difficulty with urination
  - Blood in the urine
- Treatment
  - Insure adequate fluid intake
  - Bicitra

Pancreatitis

- Cause is due to the pancreas inability to handle the increase of fats

- Symptoms
  - Severe abdominal pain
  - Abdomen very tender to touch
  - Vomiting

- Treatment
  - Discontinue the diet
  - Can never be restarted

Pros and Cons

Pros

- More effective than medication in decreasing seizures
  - 75 % of patients will have 50% or more reduction
  - 27% of patients will have at 90% or more reduction
- Eliminate seizures in 10-15%
- Decrease medications
- Works well with infants and GT fed children

Cons

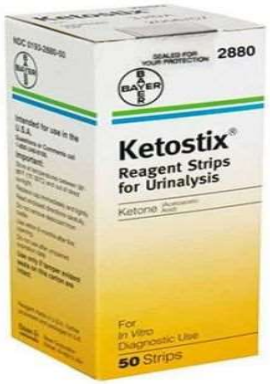
- Must weigh everything
- More difficult for adults
- Family lifestyle change
- Cultural lifestyle change
- Become bored with foods
- Tendency to “cheat”

Lifestyle Changes

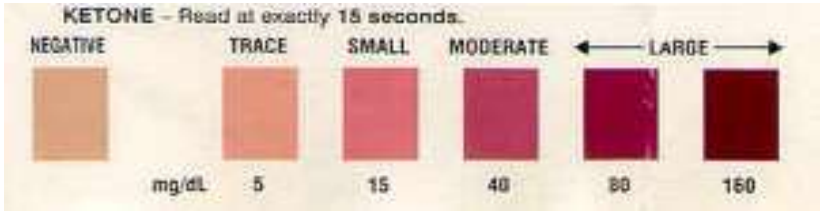
- Monitor everything that is put in mouth
  - Medications including IV fluids
  - Over the counter meds – cough syrups, pain meds
  - Toothpaste
  - Sunscreens and lotions
- Record dietary intake

Monitoring ketone levels

- Educate family on Ketostix
  - Urine collection
  - Reading Ketostix



- Daily for 7-10 days then as needed



Duration of diet therapy

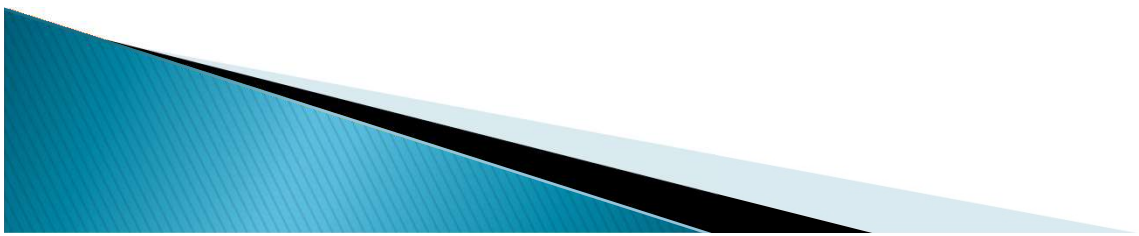
- 4:1 diet for 2 years until "seizure-free" w/o meds for 1 full year
- 3:1 diet for 6 months, if "seizure free"
- 2:1 diet for 6 months, if "seizure free"
- No concentrated sweets diet for 6 months post d/c of diet

Prior to clinic appointment

- RN discusses diet with team
- What are expectations
- Lifestyle change for most families
- Suggest decreasing carbohydrates
- 2-3 month commitment

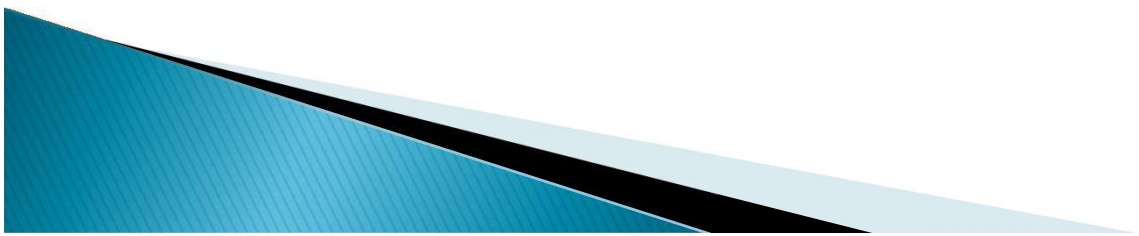
Preadmission

- Insurance Prior Authorization
  - Hospitalization–usually 3–5 days
  - Specialized Formula if needed
  - Medications – cannot contain carbohydrates
- Equipment
  - Scale
- Baseline lab work
- Education
  - *Everything* must be checked for carbohydrate content



Hospitalization

- Patients to arrive at 0900
  - Have been fasting since the night prior to admission
  - If they are not on the floor by 1000 – please call admitting
- Monitor blood sugar levels every 6 hours
  - Do not reach nadir until BS at ~ 40
  - Will usually rise again into 60's – 70's
- Monitor I & O and urine ketones
- Monitor for lethargy
- Monitor toleration of increased fats



How is the diet started?

- Patient is admitted for 3-5 days
- Diet is started by gradually increasing fat intake to the goal amount and by decreasing the carbohydrate intake
- Outpatient
  - High fat, low carbohydrate diet transitioned slowly and gradually over 2-3 months depending on the patients current diet (oral versus enteral fed)

How is the diet started inpatient?

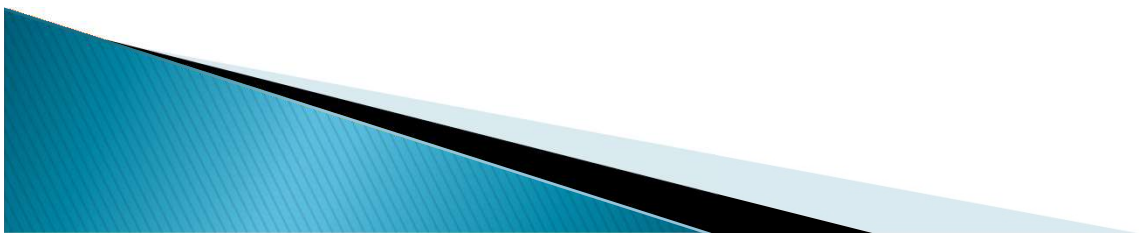
- Day 1: carbohydrate intake is decreased significantly and fat intake is provided as 30% of the total calories
- Day 2: carbohydrate intake remains at the amount provided on Day 1 and fat intake is provided as 60% of the total calories
- Day 3: carbohydrate intake remains at the amount provided on Day 1 and fat intake is provided as 90% of the total calories

Solid Food Diet

- Day 1 and Day 2: liquid diet, usually in the form of Ross Carbohydrate Free formula with Microlipid and Polycose powder; or Ketocal 4:1 or Ketocal 3:1 formula
  - Patient is offered 3 meals per 24 hours
  - Ideally meals should be offered on a schedule as the diet is utilized as a medication, and because a steady intake of glucose is required to maintain blood glucose levels
- Day 3: Start solid food meals

Formula Diet

- Day 1 Formula: provide 30% of calories from fat and decrease carbohydrate intake
- Day 2 Formula: provide 60% of calories from fat and decrease carbohydrate intake as prescribed for Day 1
- Day 3 (Goal Formula): provide 90% of calories from fat and decrease carbohydrate intake as prescribed for Day 1



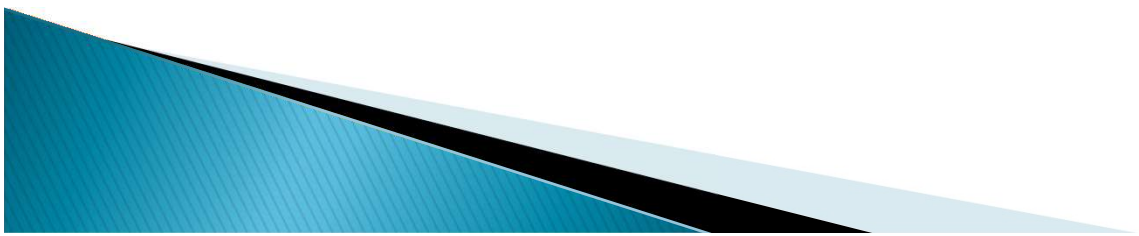
Education During the Admission

- Day 1: discuss with parents and patients progression of the diet over the course of the hospital stay

- Day 3: Meet with parents to provide instructions on preparation of formula and/or solid food meals.
  - How to recognize s/s of hypoglycemia
  - How to treat hypoglycemia
  - Review OTC medications that can be utilized with the diet

Monitoring During Initiation of the Diet

- Initial labs
- Monitor overall tolerance of diet (vomiting and/or diarrhea)
- Monitor blood glucose levels and urine ketones

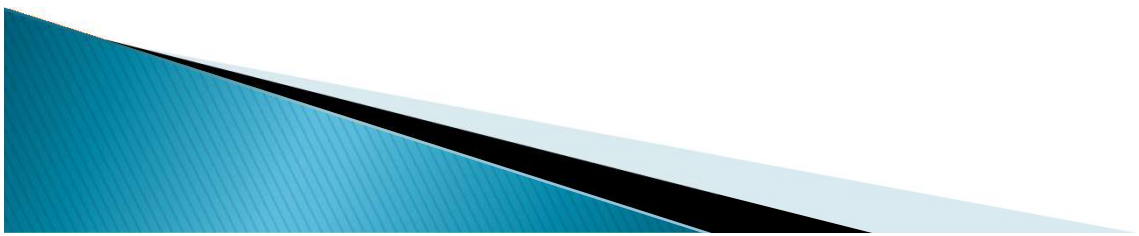


Lab Monitoring

- Baseline lab work prior to starting the diet
- Every 3-6 months the first year
- Every year the second year
- Ketogenic Diet Panel
  - CBC, Chem7, Lipid Panel, PO4, MG, Prealbumin, HFP, Vitamin D
  - Medication Levels

Ongoing Monitoring

- Follow up – 2 weeks after starting the diet
- Urine ketone testing at home as necessary
- Every 3 months thereafter in clinic
  - Weight/height check
  - Assess for side effects
  - Ongoing education
- Keto Panel

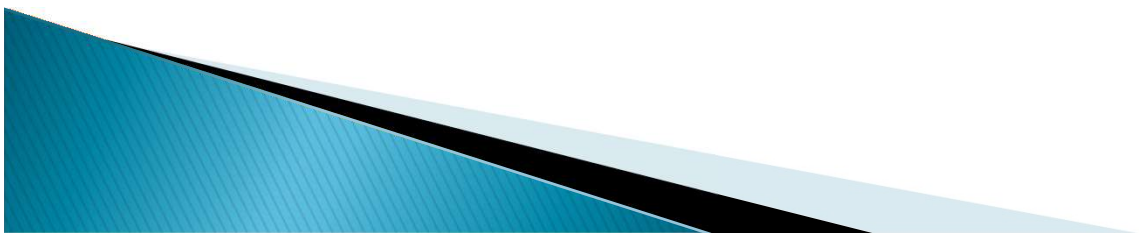


Ketogenic diet may also help

- Diabetes
- Amyotrophic lateral sclerosis (ALS)
- Alzheimer’s
- Parkinson's disease
- Some mitochondriopathies (carnitine deficiency)
- Glut 1 deficiency
- TBI (Strokes)
- Cancer (gliomas)
- Autism

Modified Atkins Diet

- Limited to ~ 20 grams carbs/day
  - ~ 65% of calories are provided from fat
- Modified refers to the lower carbohydrate limit compared to Atkins recommendations, with an emphasis on high fat foods
- Diet was created at Johns Hopkins to offer a less restrictive diet primarily for teenagers and adults
  - Easier diet for patients who eat by mouth

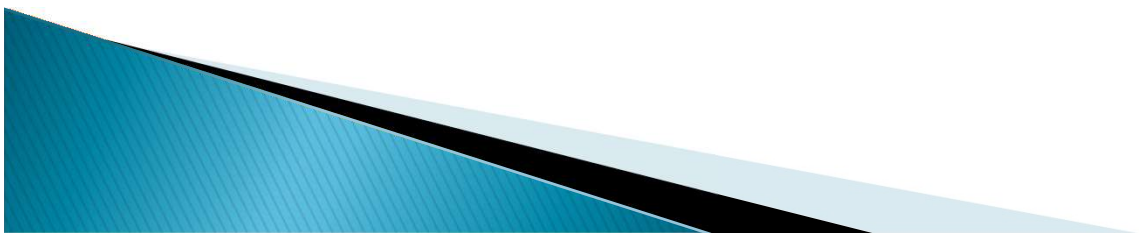


Modified Atkins Diet

- Usually 3 meals, 3 snacks
- Foods are measured, not weighed
  - Offers flexibility
  - Easier to be in social outings, restaurants
- Deficient in calcium, phosphorus, magnesium, zinc, folic acid. Vitamin and mineral supplements are recommended
- Monitored by team (MD, RN, RD)

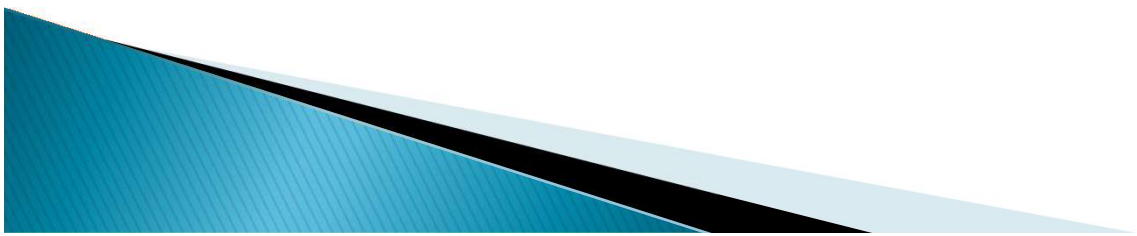
When is the diet used?

- As an introduction to a carbohydrate restricted diet or as a trial to see if patient will respond to dietary therapy
- To transition off the Classical Ketogenic Diet
- Families with limited time and resources
- Older children, teenagers, adults



Efficacy

- Efficacy
  - ~ 66 percent of children following the Modified Atkins Diet at Johns Hopkins had a 50% reduction in seizure activity
  - ~ 45% of patients who have trialed the diet will show improvement in seizure control



Lifestyle Changes

- Many cultures socialize around food/eating
  - Dining out
  - Special occasions – birthdays, holidays
- Family must be willing to monitor closely
- Easier if high carb foods not in house
- Cheating happens

Prior to clinic appointment

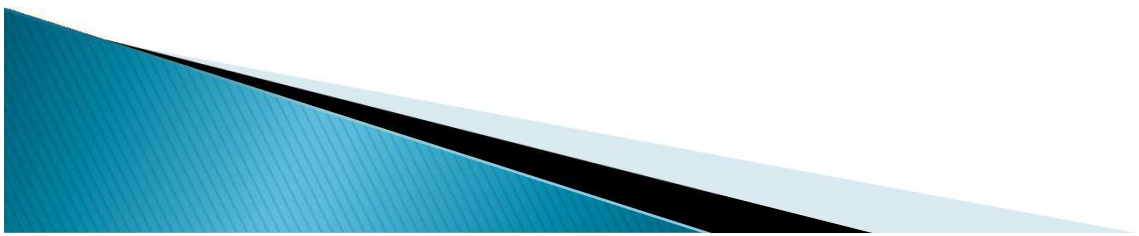
- RN discusses diet with team
- What are expectations
- Lifestyle change for most families
- Suggest decreasing carbohydrates
- 2-3 month commitment

RN Consultation

- RN provides general diet education on how to decrease carbohydrate and increase fat intake until the patient is seen in clinic
- Suggest ways to decrease carbohydrates; omit concentrated sweets, breads, pastas, dairy, limit fruits and starchy vegetables
- 2-3 month commitment

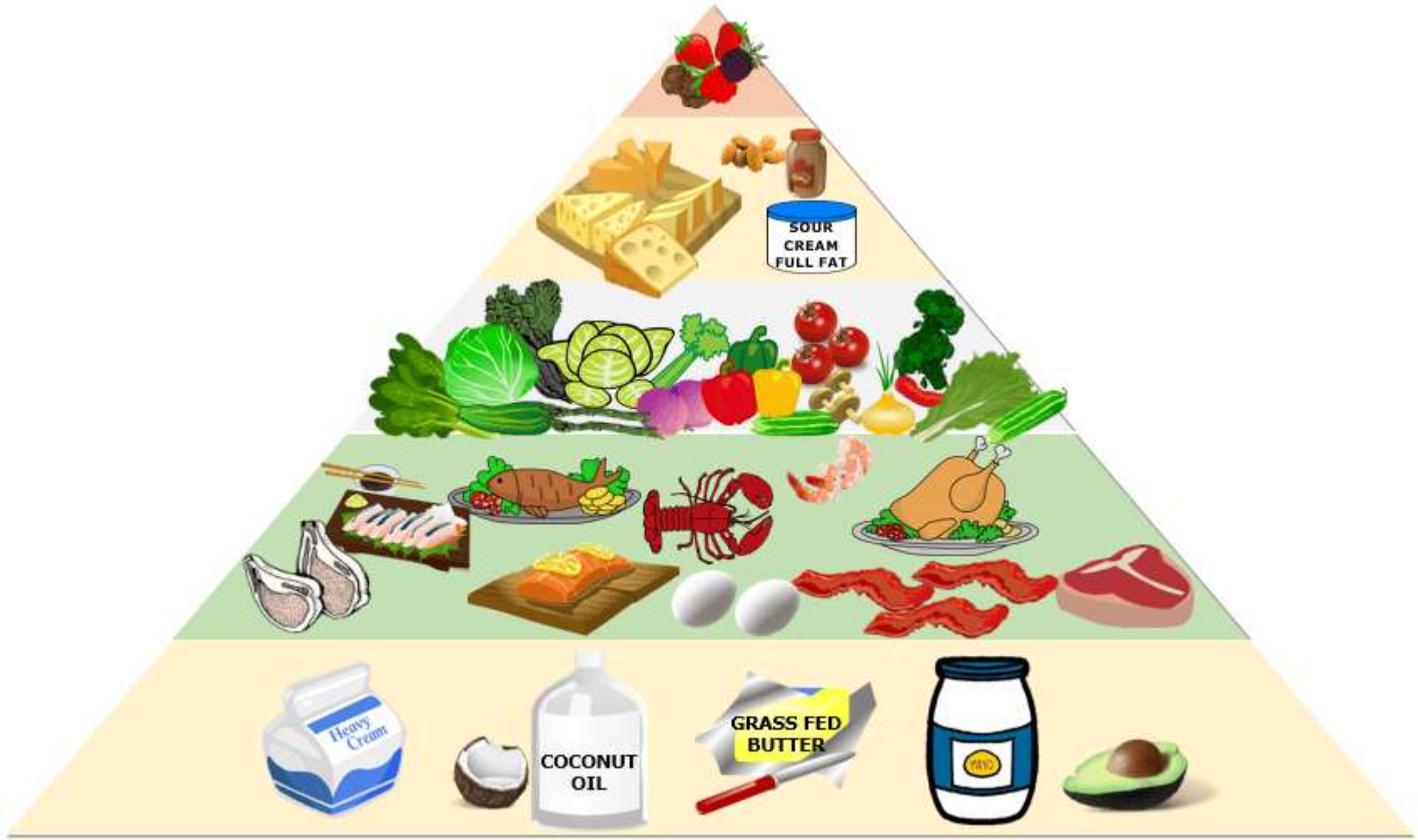
Modified Atkins Diet Education

- Detailed education about food groups
  - Fat is emphasized
    - Heavy cream, butter, oils, cream cheese, sour cream
  - Protein is not limited
    - Meat, chicken, fish, turkey, cheese, eggs, nut butters
  - Carbohydrates are limited to lower carbohydrate fruits and vegetables
    - Berries, olives, broccoli, peppers, cauliflower, celery, cucumber, mushrooms, romaine lettuce, spinach, zucchini, avocados, spaghetti squash



Reading Food Labels

- Educate primary caregiver(s) how to read food labels
  - School
  - Other family members
  - Friends
- Count “Total Carbohydrates”
- Pay attention to portion sizes
- Divide 20 grams of carbs throughout the day



Essential Keto/Keto Food Pyramid

Ongoing Monitoring

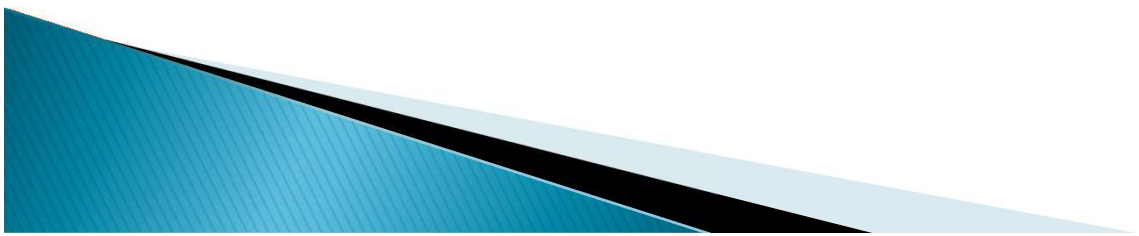
- Follow up: 4-6 weeks after starting the diet
- Urine ketone testing at home as necessary
- Every 3 months thereafter in clinic
  - Weight/height check
  - Assess for side effects
  - Ongoing education
    - Lots of phone calls and support for patients who are new to the diet
- Keto Panel

Sample menu for the Modified Atkins Diet

- Breakfast
  - Egg Scramble
    - 2 large eggs
    - 2 Tbsp heavy cream
    - 1 Tbsp butter
    - 1/4 cup feta cheese
    - 1/2 cup spinach
    - 1/2 cup mushrooms, chopped
- Lunch
  - Cobb Salad
    - 1 1/2 cups mixed greens
    - 1/2 cup avocado, sliced
    - 1 hard-boiled egg, sliced
    - 1 Tbsp finely chopped bacon
    - 1/4 cup blue cheese or cheddar cheese, shredded
    - 2 Tbsp olive oil
    - 1 Tbsp red wine vinegar

Sample menu for the Modified Atkins Diet

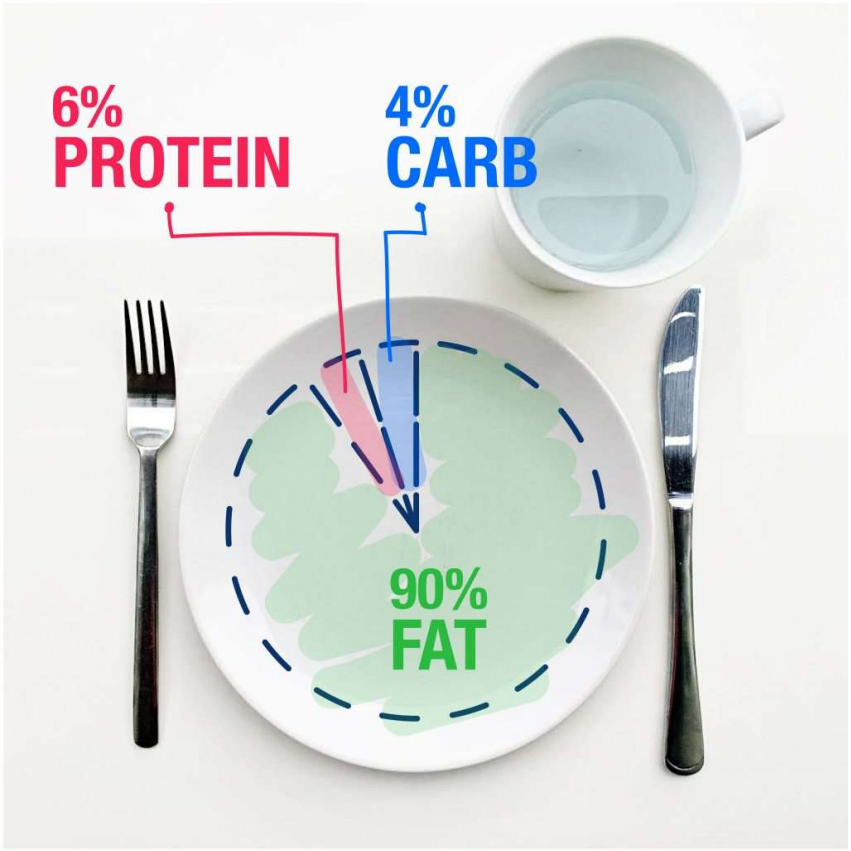
- Dinner
  - Chicken and Zucchini “Pasta”
    - 1 medium baked chicken breast
    - 1 cup sliced or spiraled zucchini
    - 1 Tbsp. olive oil
    - 2 Tbsp. pesto

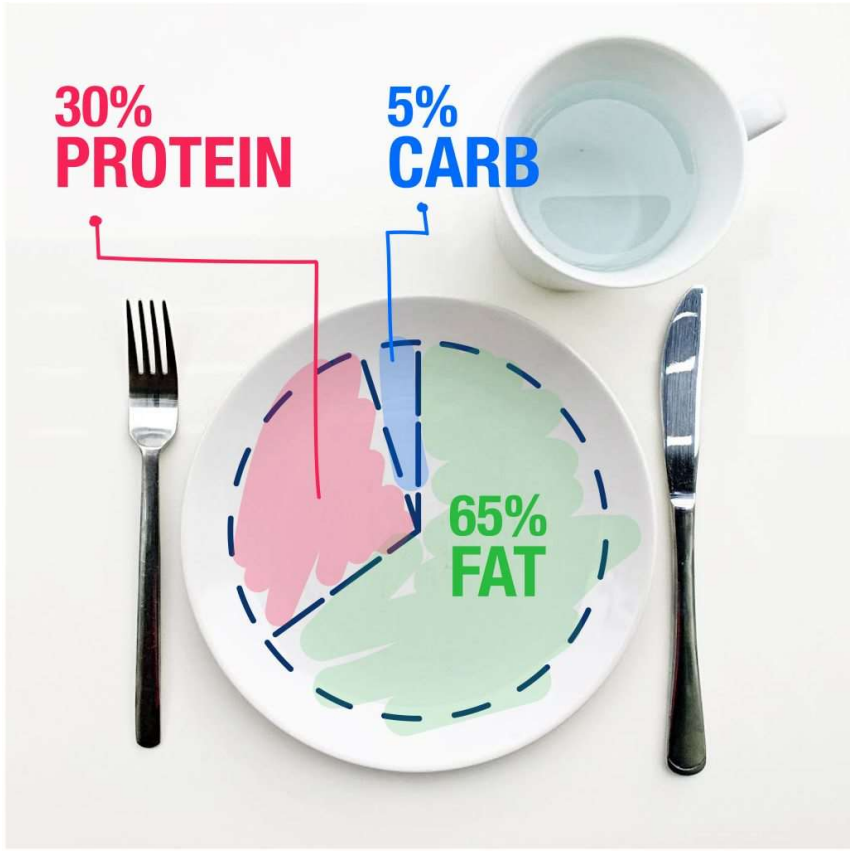


Sample Snack for the Modified Atkins Diet

- Snacks
  - Celery & Cream Cheese
  - 1 stalk of celery, sliced
  - 2 Tbsp full-fat cream cheese
  - Sugar-Free Gelatin, 1/2 cup

Classical Keto & MAD





Summary: Differences and Similarities

- Differences
  - Modified Atkins Diet
    - Protein not restricted
    - No gram scale required
    - More flexibility
    - Outpatient initiation
- Similarities
  - Classic Ketogenic Diet and Modified Atkins Diet
    - Carbohydrates are restricted
    - Fat is encouraged
    - Supplements are required
    - Both are effective with helping to manage seizures

Ketogenic Diet Program

- Jennifer Vickers, MD
- Yvette Mascarenas, MS, RD, LD
- Carla Fedor, RN, CDDN
- Jennifer Reed, RN
- Alfreda Begaye, MA
- Appointments: Call 505-925-2378