



**Kaiser Permanente
Los Angeles Medical Center Center**

Initiation of Diets: Inpatient & Outpatient

**Epilepsy & Brain Mapping Program,
Huntington Memorial Hospital, Pasadena CA**

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History of KD initiation



Early Initiation
(Wilder1921)
Fasting Protocol
(Livingston 1954; 1972; Freeman et al 1996)
Gradual Non-fasting Protocol
(Bergqvist et al 2005)

Early Initiation

(Wilder1921)

Fasting Protocol

(Livingston 1954; 1972; Freeman et al 1996)

Gradual Non-fasting Protocol

(Bergqvist et al 2005)

Early Fasting Protocol

(Livingston 1954; 1972; Freeman et al 1996).

24-48 hour Fast

Fluid Restriction

4:1 Ratio

1/3 calories First
Day

2/3 calories
Second Day

Full Calories
Three Day

Pre-diet Assessment

- Screen for inborn errors of metabolism
- Screen for diet contraindications
- Keto Blood Work
- Diet History/Diet Analysis
- Reduce carbohydrates from medications and supplements



Non-Fasting Initiation Protocols

(Wirrell EC et al. J Child Neuro 2002 Mar 17(3):179-82.)

3-5 Day Admission

No Fluid Restriction

Calculated
Meals

Eggnog or Keto
Shake

Goal Ratio and
Calories
Reached

Parent
Education

Initiation Orders

- Pre-diet labs (If not done prior)
- Vital signs q shift (during waking hours)
- Weight & Height upon admission; daily weights
- Urine ketones and Urine Specific gravity q void
- Accuchecks q 2 hours if infants, after 24 hrs q 4 hrs
- if no hypoglycemia
- Accuchecks q 4 hours if > 1 years old
- Labs:
 - Day 2: Electrolytes & Fasting Blood Sugar
 - Day 3: Electrolytes, Fasting Blood Sugar, Fasting Lipid Panel, BHB
- Seizure precautions

KD Prescription

Day 1

- Ketogenic Shake @2.0:1 ratio offered six times per day with goal calories and fluids

Day 2

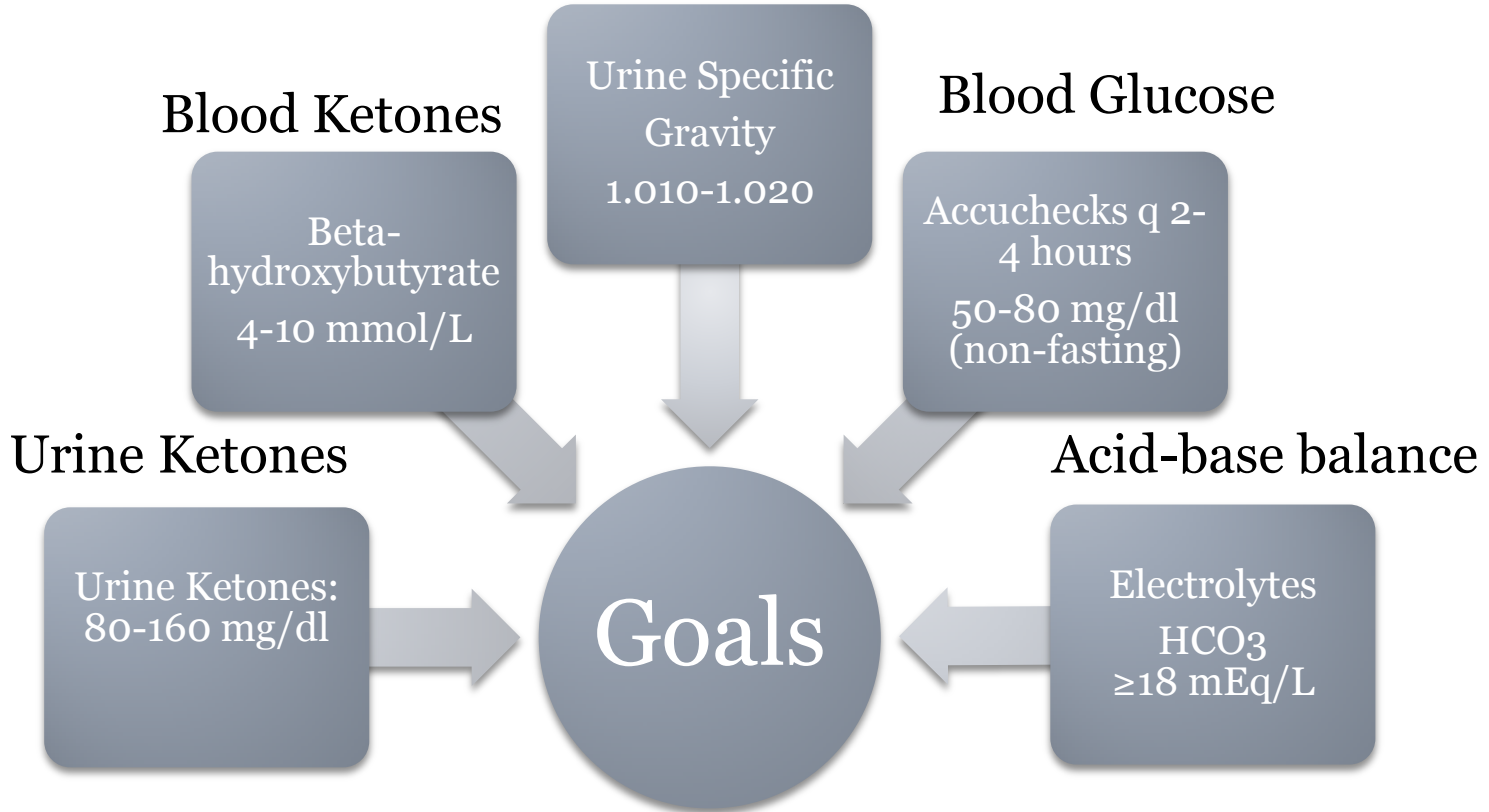
- 3 meals & bedtime snack @ 3.0:1 ratio with goal calories and fluids

Day 3

- Arbitrary goal ratio is reached. Discharge after lunch if normoglycemia and diet tolerance established and urinary ketones are positive

Monitoring KD Initiation

Hydration



Treating Diet Intolerance: Nausea and Emesis

Correct Hypoglycemia

Correct acidosis

Correct excessive ketosis

Give six (6) small feedings

Separate medication and meal time

Prevention of Dehydration

Adhere to fluid
schedule

Maintain Urine
Specific Gravity
1.010 -1.020

If dehydration occurs, $USG \geq 1.030$

- Give IV bolus of .9NS if needed

Monitor Blood Ketone Levels

Freeman JM. J Child Neuro 2000;15 (12):787-90

Betahydroxybutyrate(BHB)

- Levels 4-10 mmol/L
- Monitor during initiation and outpatient clinic

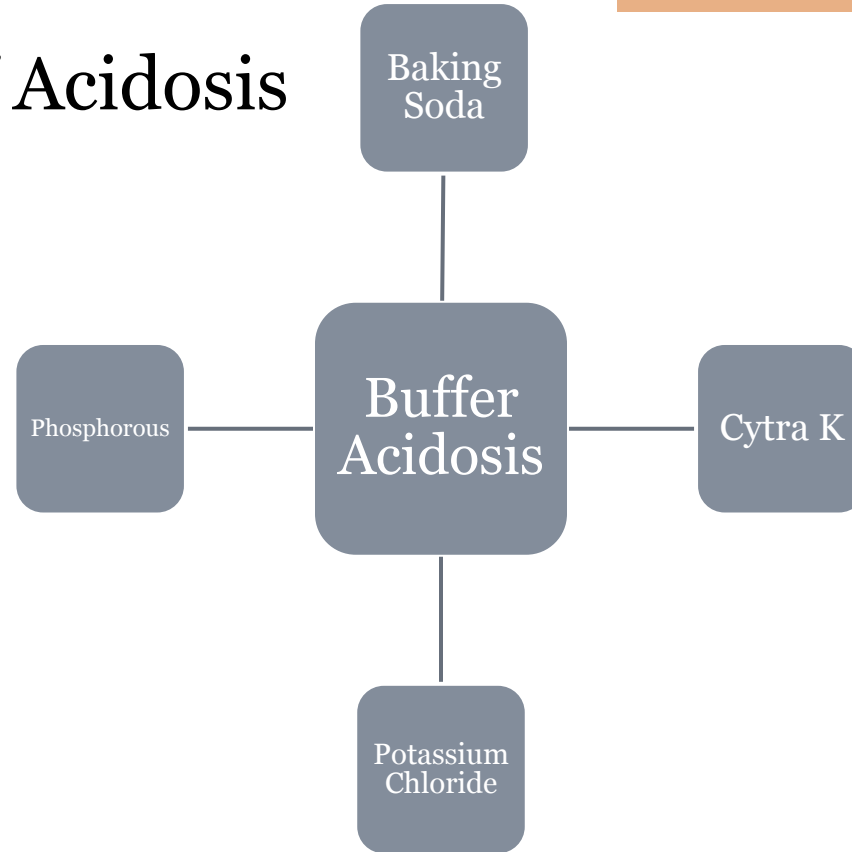
Useful in assessing dietary compliance/tolerance for fine tuning the diet

- Diet intolerance, acidosis, dehydration may occur with levels >6 mmol/L.

Treatment for excessive ketosis

- Increase fluids and/or give 15 ml of apple juice. May need to lower ratio.

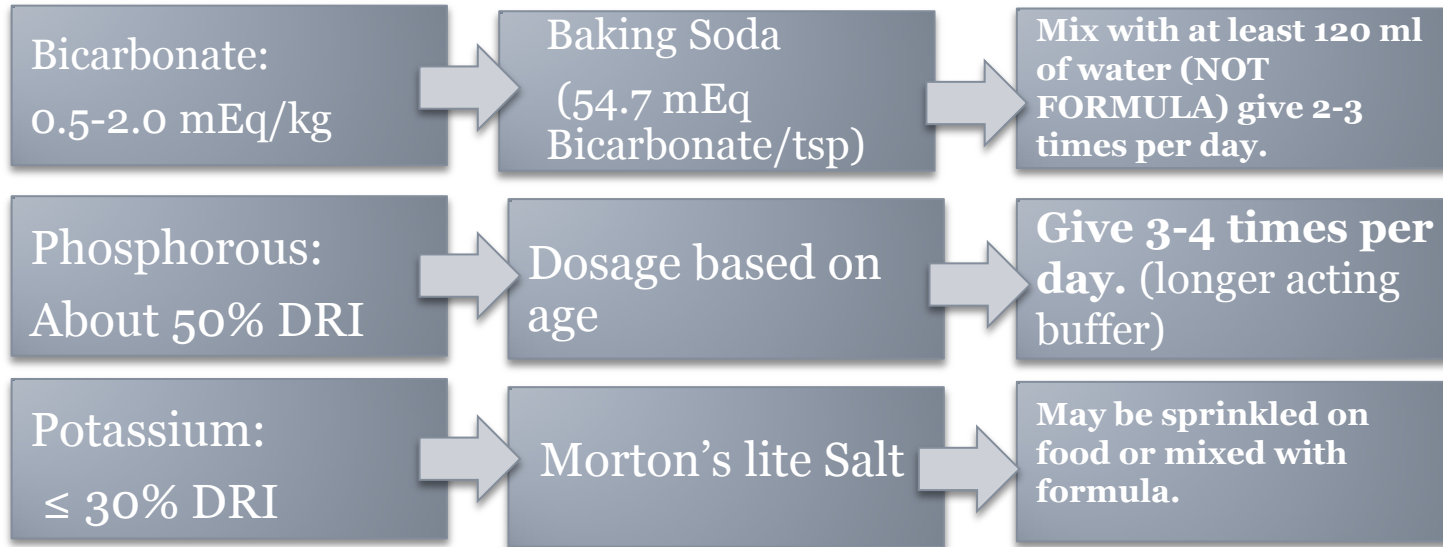
Treatment of Acidosis



Give 100% Maintenance Fluids plus up to 20% more

Treatment of Acidosis

Give 100% Maintenance Fluids plus up to 20% more



Outpatient Initiation Protocol



Duration 3-4 weeks

Start at 0.5:1 or
1.0:1 Ratio

Advance ratio
every week

Start with
Goal
Calories

No Fluid
Restricti
on

Labs obtained
after one week
of 2:1 Ratio

Ratio not
advance if
seizure control
is achieved.

Outpatient KD Training

Food Preparation
(Weighing techniques)

Ketodietcalculator™

Monitoring
Ketones/hypoglycemia

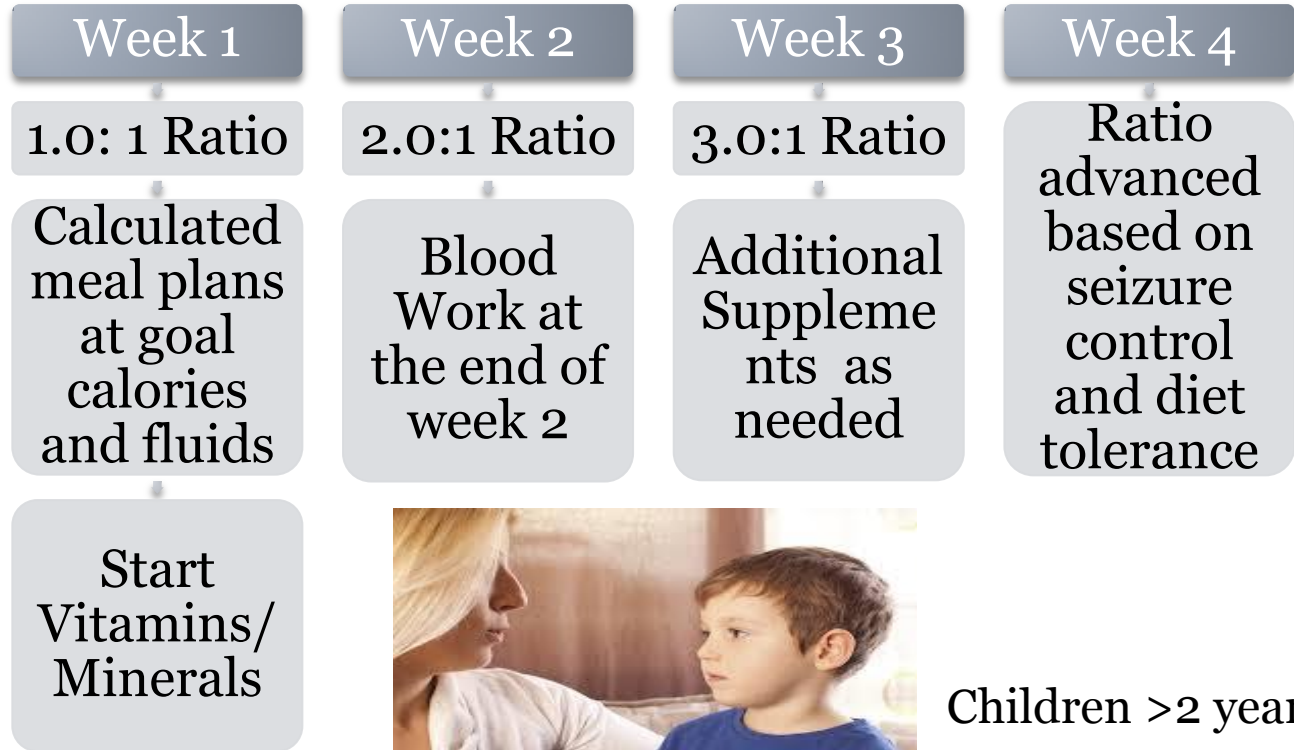
Vitamins/Minerals

Sick
days

Fluids

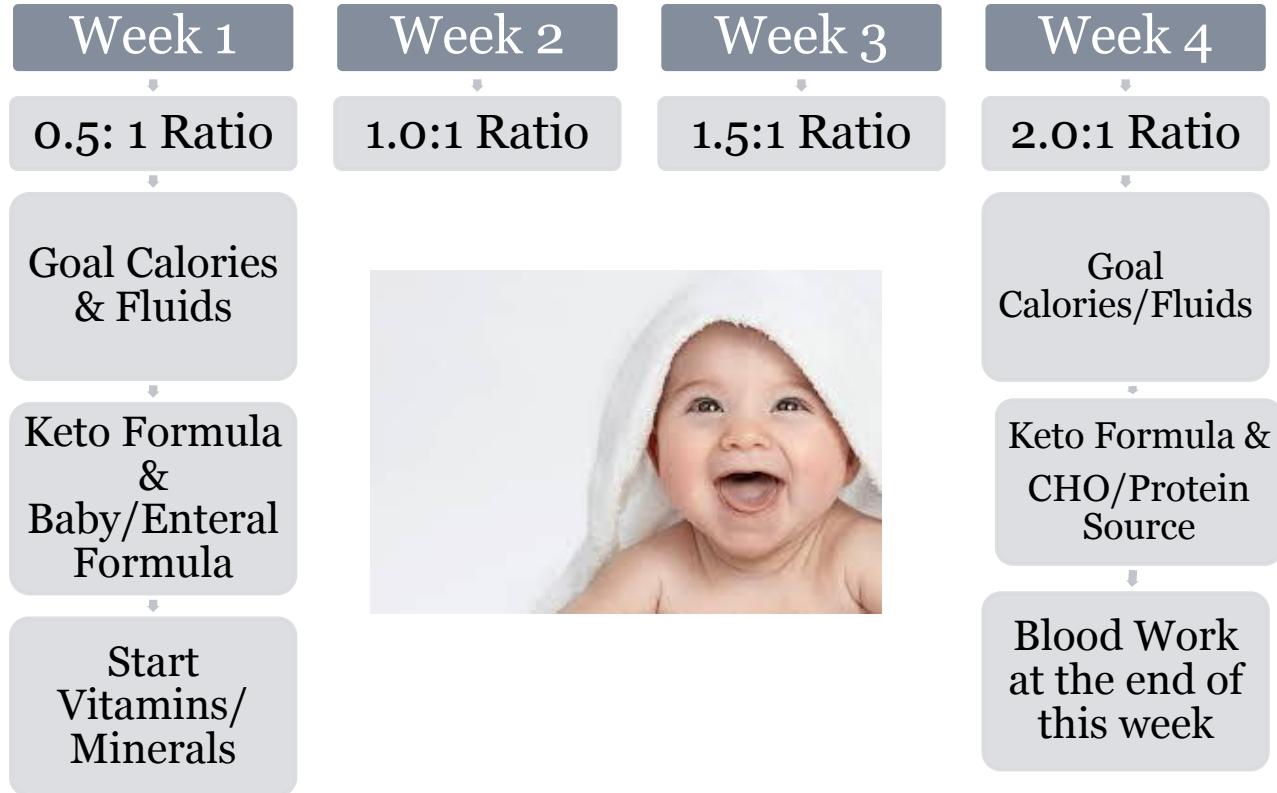


Outpatient Initiation: (Low and Slow method)



Children >2 years old

Initiation Diet: Infant/ Toddlers & Enteral Fed Patients



Outpatient Monitoring

Daily

- Urine Ketones 1-2 times per day for one month
- Bowel Movement
- Seizure Log

Week

- Blood Work after one week of 2:1 Ratio
- Phone or Office Visit RD and/or Nurse
- Weekly weight

Month

- Office follow up in one-month then every 3 mths
- Blood Work after first month & every 3 mths thereafter for first year



Advantages for Dietitian and Patient

Dietitian	Patient/Family
More than one initiation per month	Longer diet adjustment
Better time management	More variety of food options
Develop more palatable meals	Home environment
KD education prior to initiation	Parents work schedule not altered



Case Study

10 year old female with medical history of Epilepsy (>20 seizure per day), Cerebral Palsy, Gastrostomy Tube

Baseline Weight and Height

- Weight 46 lbs (20.865 kg)
- Percentile: 10-50% Weight for Age
 - Based on CP Group 5 for girls 2-20 years old
- Height 114.3 cm (45 in)
- Percentile: 10-50% Height for Age
 - Based on CP Group for girls 2-20 years old

Diet History

- Formula: Boost Kids Essential 1.5
- Regimen: Continues feeding full strength at 60 ml per hour for 15.5 hours per day
- Total Calories: 950 kcals per day
- Total fluids per day 1008 ml of free water
- Supplements:
 - 50 mg Vitamin B6 per day
 - D-Vi-Sol 1 ml per day

Estimated Nutritional Needs

- **1080** calories per day (50 kcals/kg BW)
- **21-25** grams Protein per day (1.0-1.2 g Pro/kg BW)
- Recommended fluids: 1500 plus 20 (wt-20)mL/day = **1518 mL** : Source; Holiday-Segar Method

Initiation of KD (STEP 1)

- 240 ml of Boost Kids Essentials
- 474 ml of KetoCal Liquid 4:1 Ratio
- 240 ml of water
- Run at 60 ml per hour for 18 hours
- Flush 120 ml (4 oz) of water after formula finishes
- 20-30 ml of water for medication
- Continue for 1 week if tolerated

Provide 1052 kcals, 1400 ml Fluids, 1:1 Ratio 81.98 g FAT, 29.74 g Pro, 48.67 CHO

Initiation of KD (STEP 2)

- 160 ml of Boost Essential for Kids 1.5
- 570 ml of KetoCal 4:1 Ratio LQ
- 360 ml of Water
- Run pump at 60 ml for 18 hours
- Flush 120 ml of water after formula finishes
- 20-30 ml of water for medication
- Continue for 1 week if tolerated

1080 kcals, 1400 ml fluids 1.5:1 Ratio, 92.37 g FAT, 27.8 gPro, 34.37 g CHO

Supplements started on (STEP 2)

- 1/2 tablet of Centrum Multivitamin per day.
- 1 tablet of Nature Made 600mg Calcium and 400 IU Vitamin D
- 50 mg Vitamin B6 1 tablet per day
- 2 ml of Levocarnitine three times per day.
- 1/4 teaspoon of Morton's Lite Salt per day (mix into the formula)

Initiation of KD (STEP3)

- 100ml of Boost Essential for Kids 1.5
- 630 ml of KetoCal 4:1 Ratio LQ
- 360 ml of Water
- Run pump at 60 ml for 18 hours
- Flush 120 ml of water after formula finishes
- 20-30 ml of water for medication
- Continue for 1 week if tolerated

1078 kcals, 1400 ml fluids 2.0:1 Ratio, 98.12 g FAT, 25.8 g Pro, 23.14 g CHO

Assessment & Labs one week after 2:1 Ratio

- KD follow up labs unremarkable
- BHB 3.08 mmol/L
- 50% improvement in seizures less than 10 years per day
- Lipid Panel WNL
- Liver Function WNL

Fine-tuning KD (STEP 4)

- 76 ml Prune Juice Sunsweet Light
- 707 ml KetoCal 4:1 LQ
- 300 ml Water
- Run pump at 60 ml for 18 hours
- Flush 120 ml of water after formula finishes
- 20-30 ml of water for medication
- Continue for 1 week if tolerated

1078 kcals, 1400 ml fluids 3.0:1 Ratio, 104.71 g FAT, 22.16 g Pro, 12.52 g CHO

Conclusion

Inpatient Initiation	Outpatient Initiation
Most Common Method	Evolving New Method
3-5 days admission	3-4 weeks initiation
Rapid transition to ketosis	Slower transition to ketosis
Use an arbitrary goal ratio which may be too high	Seizure control can be achieved with lowest ratio
Diet adjustments every 18-24 hours	Diet adjustments 7-14 days
Limited food available in the hospital	Variety of foods available at home
Acute metabolic fluctuations may occur	Less occurrence and severity of metabolic fluctuations