

'Low and Slow'

Low Ratio, Slow Initiation of Ketogenic Diet In an Outpatient Canadian Setting - Safety and Tolerability -

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Disclaimers

Funding Source:

- Office of Dr. Heather Arthur
 - Chief Scientific Officer Hamilton Health Sciences
- Matthew's Friends Canada
 - medical advisory board member
 - board member

The ketogenic diet

- ***What is it?***
- A high fat diet, designed to mimic the metabolic effects of starvation, used in the management of epilepsy and related disorders

- ***Use only under medical supervision***

Efficacy of Ketogenic Therapies for Epilepsy Children and Adolescents

- 2016 Cochrane Review: 7 Randomised Controlled Trials
 - 427 children & adolescents
 - Ketogenic Diet for 3 months
 - Seizure freedom up to 55% in 4 : 1 KD group
 - Seizure reduction up to 85%
 - Modified Atkins Diet
 - Seizure freedom up to 10%
 - Seizure reduction up to 60%.
 - No studies evaluated effect on cognition or behaviour

What about Adults?

- Meta-analysis: 12 studies, 270 patients
 - Efficacy
 - All diets 42%
 - Classical Ketogenic Diet 52%
 - Modified Atkins Diet 34%
 - Compliance
 - - All diets 45%
 - - Classical Ketogenic Diet 38%
 - - Modified Atkins Diet 56%
 - - Main reason for discontinuation lack of efficacy

International consensus paper provides guidelines for clinicians

Optimal clinical management of children receiving the ketogenic diet: Recommendations of the International Ketogenic Diet Study Group

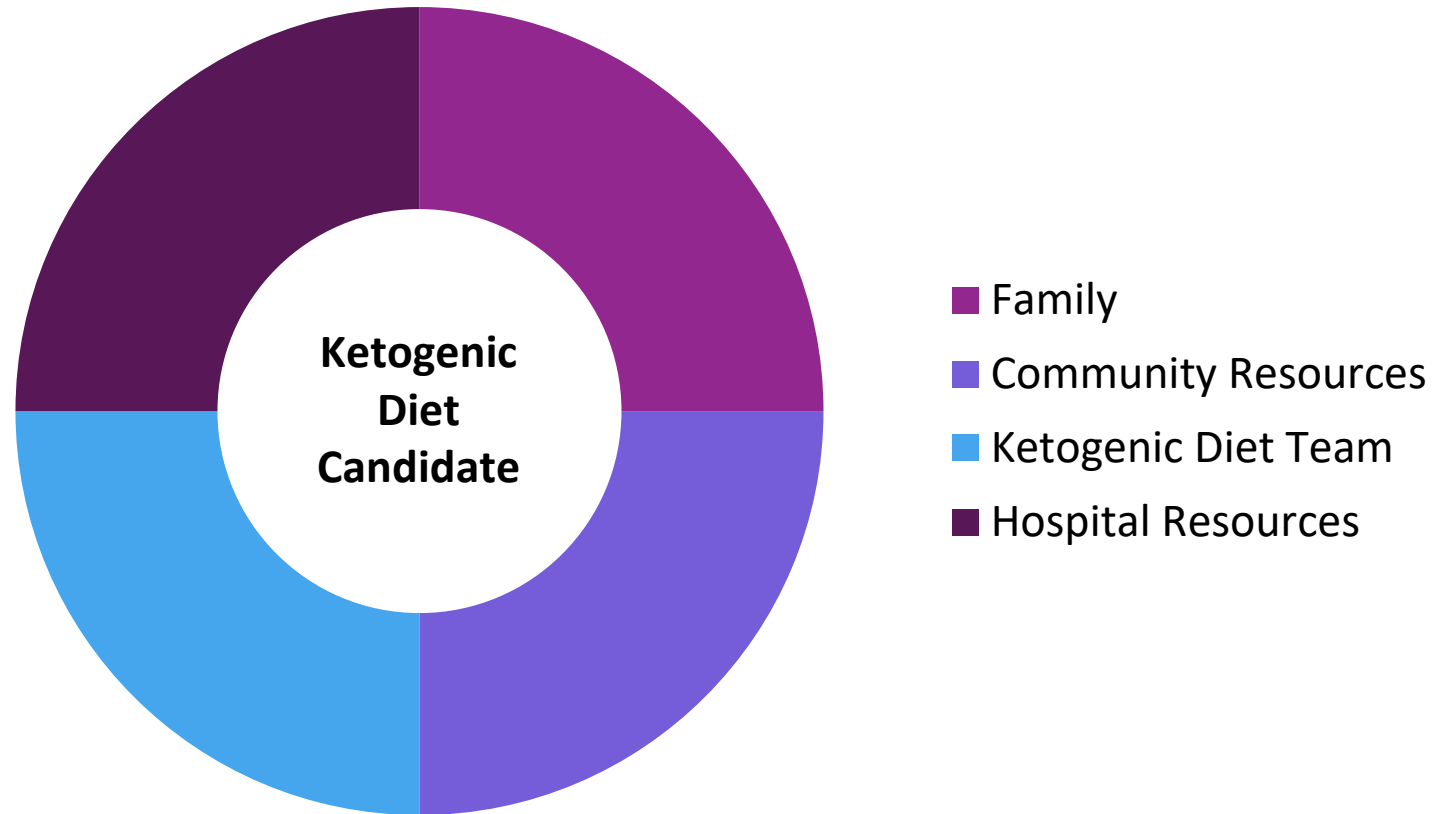
Authors:

Eric H. Kossoff, Beth A Zupec-Kania, Per E. Amark, Karen R. Ballaban-Gil, A.G. Christina Bergqvist, Robyn Blackford, Jeffrey R. Buchhalter, Roberto H. Caraballo, J. Helen Cross, Maria G. Dahlin, Elizabeth J. Donner, Joerg Klepper, Rana S. Jehle, Heung Dong Kim, Y.M. Christiana Liu, Judy Nation, Douglas Nordli, Jr., Heidi H. Pfeifer, Jong M. Rho, Carl E. Stafstrom, Elizabeth A. Thiele, Zahava Turner, Elaine C. Wirrell, James W. Wheless, Pierangelo Veggiotti, Eileen P.G. Vining and The Charlie Foundation, and the Practice committee of the Child Neurology Society

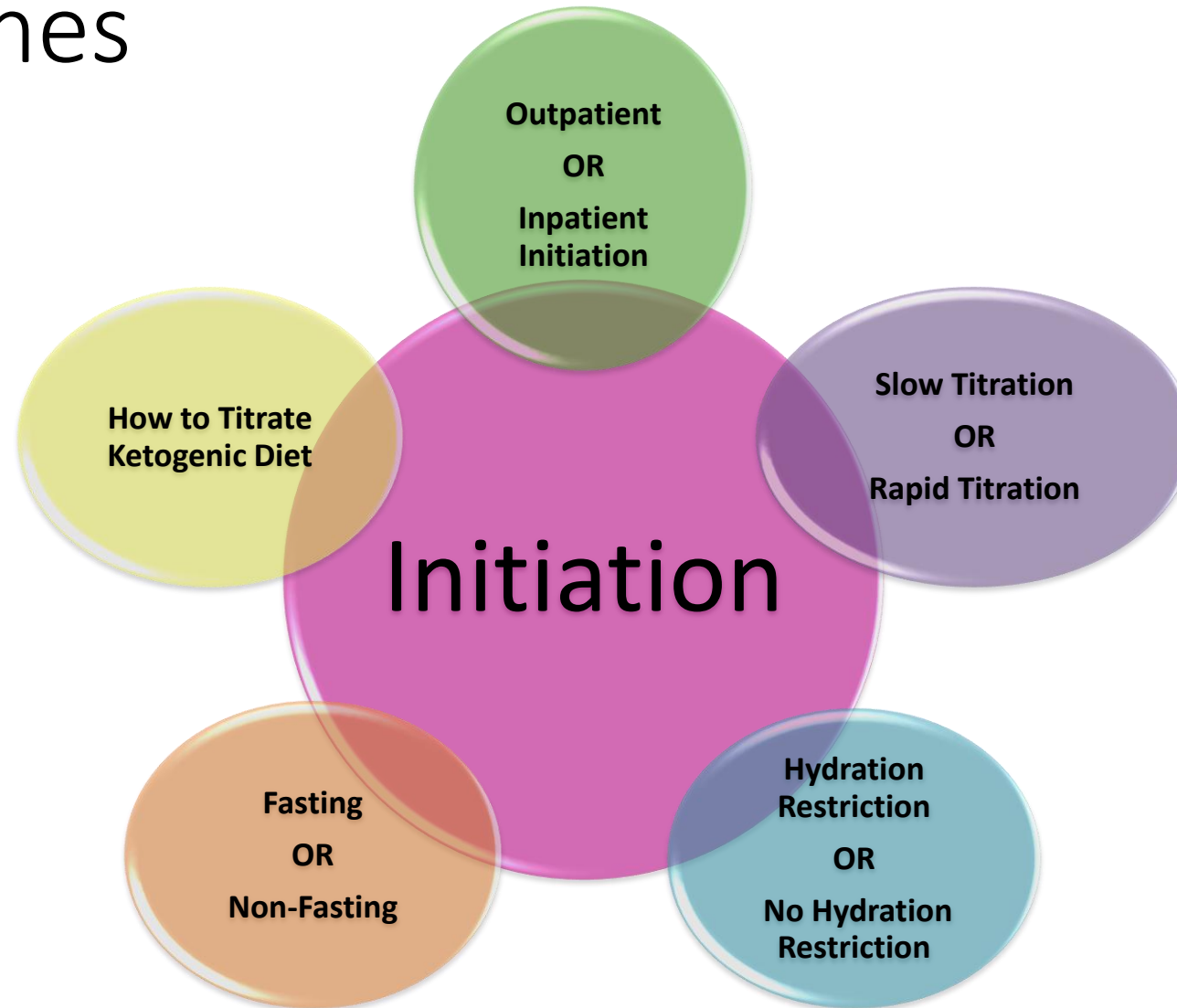
Recommendations for Pre-Ketogenic Diet Evaluation

- Teaching / Counselling before Initiation
- Nutrition Evaluation of current diet
- Eating Pattern (scheduled eating, grazing, eating schedule on school or work days)
- Anthropometric Data
- Laboratory Evaluation
- Investigations - as per your Ketogenic Diet Team
(eg. ECG, EEG, Ultrasound)
- What are your target endpoints of evaluation of efficacy?
- What are the patient and family's understanding of success of seizure control?
- Evaluation of social circumstances and supports in community
- Should you begin ketogenic diet therapy

Variables when considering Ketogenic Diet Initiation Method



Methods of initiation have a variety of approaches

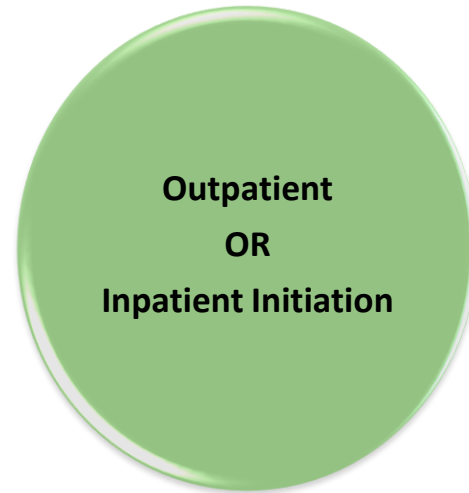


Low Ratio, Slow Outpatient Initiation

Overview of Rationale and History

Low Ratio, Slow Outpatient Initiation

Overview of Rationale and History



Inpatient Admissions for Initiations

2001 - Inpatient admission 5 day duration (Rapid Daily Titration)

- Day 1: +/- fasting or KD begins
 - Day 2: KD advanced in strength
 - Day 3: KD advanced in strength
 - Day 4: KD again advanced in strength
 - Day 5: KD adjusted and/or maintained and discharged home if stable
-
- Teaching of parents meal preparation and monitoring expectations
 - Daily bloodwork and monitoring for metabolic fluctuations
 - Once discharged home – RD would provide phone support and menu support intensely for approximately 4-6 weeks.

Challenges of Inpatient Initiations

Challenge to Keto Patient

- Rapid change to diet within days
- Diet may be more restrictive than perhaps necessary
- Side Effects of rapid initiation (hypoglycemia, acidosis, nausea, vomiting, diarrhea etc)

Challenge to the Keto Family

- Time away from work and home
- Learning within a hospital environment – unfamiliar kitchen facilities, distractions, limited foods compared to home

Challenges of Inpatient Initiations (cont)

Challenge to Hospital

- Bed availability
- Extended Length of Stay
- Cost of admission

Challenge to Registered Dietitian (RD)

- Less efficient use of time due to concurrent outpatient responsibilities
(eg. Clinic appointments, phone support, menu calculations)
- Over time hours

Outpatient
OR
Inpatient
Initiation

Outpatient or Inpatient Initiation

Outpatient Initiation	Inpatient Initiation
KD initiated while patient remains in the community (home or residential setting)	Admission to hospital for initiation
Appropriate for patient who is medically stable OR who cannot accommodate an inpatient admission	Appropriate for medically unstable or patients (eg. Status epilepticus) OR when deemed necessary by the ketogenic diet team
Medically stable and hospital bed not readily available	Resources available to manage acute Side effects for rapid titration include nausea, vomiting, acidosis, hypoglycemia
Use the foods of home/community environment to initiate KD	Use of hospital foods to begin initiation
Use in rapid and slow titrations of ketogenic diet initiation	Used traditionally for rapid titration of ketogenic diet initiation

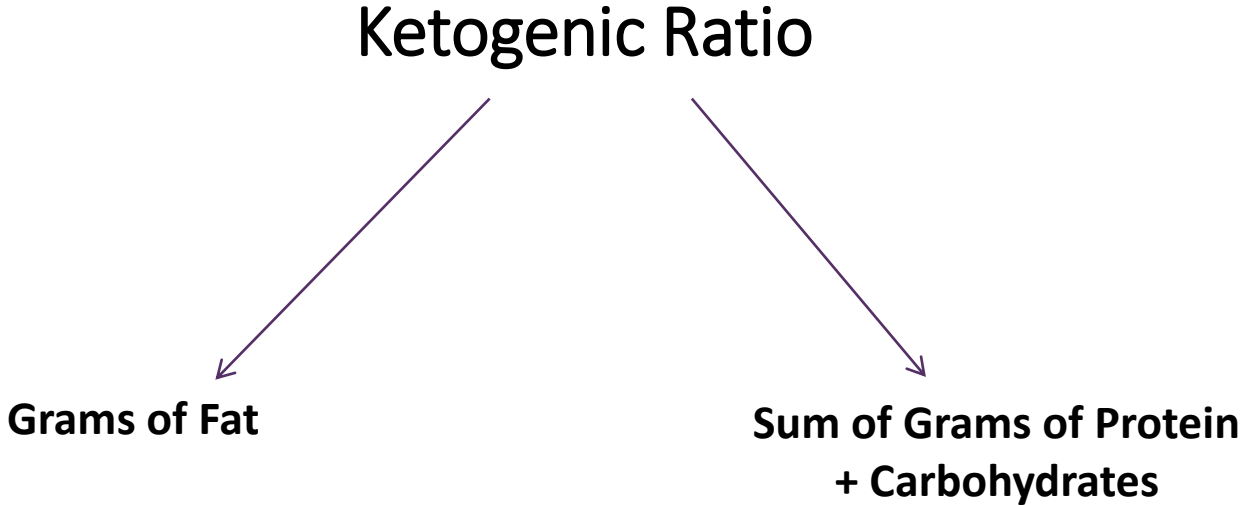
Low Ratio, Slow Outpatient Initiation

Overview of Rationale and History

How to Titrate Ketogenic Diet



Method 1 - Titrate Diet via Ketogenic Diet Ratios



Advance to predetermined goal ketogenic ratio - typically 3:1 or 4:1 ratio

How to Titrate
Ketogenic Diet

Method 1 - Titrate Diet via Ketogenic Diet Ratios



Ketogenic Ratio = grams of fat : sum of grams protein + carbohydrate

Method 1 - Titrate Diet via Ketogenic Diet Ratios

Difficult to compare the KD prescription when describing in ketogenic ratios.
Ratios do not adequately describe grams of protein and carbs.

Sample
Calculation:
4 year old boy
Wt: 15 kg
1200 kcal/day

KD Ratio	Fat grams	% kcal from fat	Protein grams	% kcal from protein	Carb Grams	% kcal from carbs
3 to 1	116 g	87%	14 g	4.7%	24.7 g	8.3%
3 to 1	116 g	87%	28 g	9.3%	10.6 g	3.5%

Method 2 - Titrate KD via % calories and/or grams of macronutrients

Diet STEP	% calories from fat	% calories from carbohydrate	% calories from protein	Grams of fat	Grams of carbohydrate	Grams of protein
Regular Diet	33%	53%	14%	44 g	159 g	42 g
STEP 1	60%	31%	9 %	80 g	93 g	27 g
STEP 2	70%	21 %	9 %	93 g	63 g	27 g
STEP 3	80%	11%	9 %	107 g	33 g	27 g

Comment:

more precise in the description of the ketogenic diet prescription to your patient and your medical team than ratios.

Method 3 - Set an initial goal of grams of carbohydrate/day

- Modified Atkins Diet – 10-20 g carbohydrate /day; encourage high fat intake
- Low Glycemic Index Diet – 40-60 g carbohydrate /day: encourage high fat intake

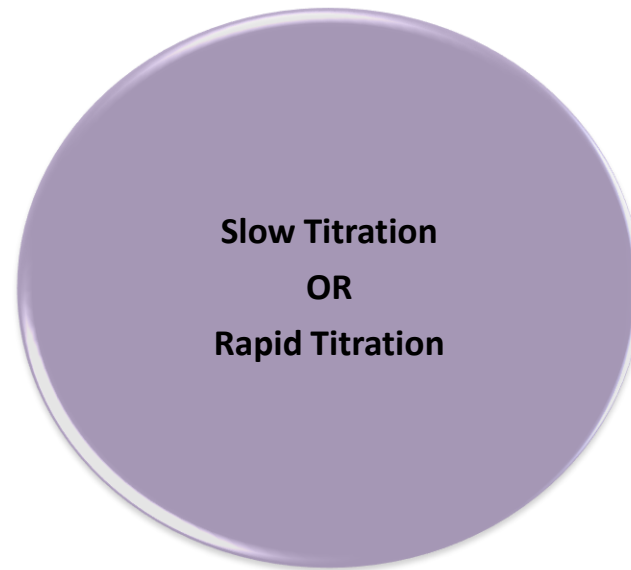
Method 4 - Titrate using menus and / or exchange lists

Examples

1. Custom menus for patient
 1. EKM
 2. KetoDietCalculator[®]
2. Fruit and Vegetable Exchange List (Classical Keto Diet)
3. Fat, Protein, Carbohydrate Food Exchange List
 1. MAD
 2. MCT KD
 3. Modified Ketogenic Diet (UK)
 4. Low and Slow Outpatient Method (Canada)
4. Glycemic Index Lists
 1. Low Glycemic Index Diet
 2. International Tables of GI Values Foster-Powell et al., 2002; Brand-Miller & Foster-Powell, 2007

Low Ratio, Slow Outpatient Initiation

Overview of Rationale and History



Challenge of Traditional Rapid Initiation

Advance to predetermined goal ketogenic prescription is over a period of hours or days

	Scenario #1	Scenario #2	Scenario #3	Scenario #4
Day 1:	1/3 strength	1:1 Keto ratio	60% kcal fat	Reduce to 20-60 g carbs
Day 2:	2/3 strength	2:1 Keto ratio	70% kcal fat	
Day 3:	Full strength	3:1 Keto ratio	80% kcal fat	
Day 4:	Observe	Maintain or advance to 4:1		
Day 5:	Discharge home	Discharge home		Encourage high fat intake

Challenge of Traditional Rapid Initiation (continued)

Issues

1. Through rapid advancement of ketogenic diet – is the least restrictive and effective ketogenic diet prescription being achieved?

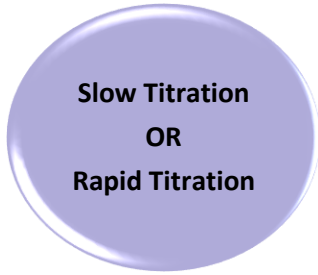
Is the ketogenic diet unnecessarily too restrictive?

2. Higher occurrence of metabolic fluctuations: hypoglycemia, acidosis



Slow Titration OR Rapid Titration

Slow Titration of KD	Rapid Titration of KD
Gradual reduction in carbohydrates and gradual increase in fat intake over weeks	Rapid reduction in carbohydrate and rapid increase in fat intake over a matter of days
<p>Advantage</p> <ol style="list-style-type: none">1. Minimize side effects of hypoglycemia, nausea vomiting, acidosis, hyper ketosis2. Does not need hospital admission to manage side effects3. Adjustment to new lifestyle is gradual for patient and family4. Longer window to monitor efficacy of KD prescription therefore avoiding unnecessary high restriction of KD5. Ketogenic Dietitian time is not as concentrated and permits more balance with other duties6. Patient or Family can gradually ease into new ketogenic diet lifestyle routine	<p>Advantage</p> <ol style="list-style-type: none">1. Achieve ketosis sooner2. May achieve seizure control sooner3. Management of acute medical side effects is4. Patient or family is very motivated and capable for that more rapid change in lifestyle <p>Source: Fabe, J. KetoCollege (2017) Initiation of Ketogenic Diet Lecture</p>



Slow Titration OR Rapid Titration

Slow Titration of KD	Rapid Titration of KD
Gradual reduction in carbohydrates and gradual increase in fat intake over weeks	Rapid reduction in carbohydrate and rapid increase in fat intake over a matter of days
Disadvantage 1. May take longer to see seizure control (but this remains to be determined) because achieving ketosis is more gradual	Disadvantage 1. KD prescription maybe higher (i.e. more restrictive) than necessary if not enough observation of each step is permitted. 2. Acute side effects of hypoglycemia, nausea, vomiting, acidosis 3. Adjustment to new lifestyle is fast

Evolution of the Low Ratio and Slow Initiation Outpatient Method

(Continued)

Is a fast necessary when
initiating the ketogenic diet?

Wirrell EC, Darwish HZ, Williams-Dyjur C,
et al. J Child Neurol. 2002;17:179-82.

Ketogenic diet: outpatient
initiation, without fluid, or
caloric restrictions.

Vaisleib, II, Buchhalter JR,
Zupanc ML. Pediatr Neurol.
2004;31:198-202.

Is hospitalization really
necessary during the
introduction of the
ketogenic diet?

Rizzutti S, Ramos AM, Muszkat M,
et al. J Child Neurol. 2007;22:33-7.

Evolution of the Low Ratio and Slow Initiation Outpatient Method

Inpatient Rapid Initiation Issues	Low Ratio, Slow Initiation Outpatient Method
<p>Inpatient admission for 5 days Hospital bed use</p>	<p>Outpatient admission 3 hour Clinic appointment to provide keto diet education prior to starting</p>
<p>Rapid titration of ketogenic diet prescription. Diet is adjusted every 18-24 hours.</p>	<p>Slower titration of ketogenic prescription. Diet is adjusted every 7-14 days.</p>
<p>Very brief window to observe if KD prescription (ratio) is effective</p>	<p>Longer window of observation to see if diet is effective</p>
<p>An arbitrary ratio (goal) is achieved</p>	<p>Titration of KD was by advancement of % kcal from fat, protein and carbohydrates AND Grams of fat, protein and carbohydrates Keto Ratio became the result not the goal</p>

Evolution of the Low Ratio and Slow Initiation Outpatient Method

Inpatient Rapid Initiation Issues	Low Ratio Slow Initiation Outpatient Method
Ketogenic Diet prescription may be too high	Goal is lowest ratio, least restrictive diet possible
Classic, MCT, MAD, LGIT - type of diet is started prior to initiation but can be adjusted as an outpatient	Principles of classic, MCT, MAD, LGIT – could be encompassed
Acute metabolic fluctuations	Less occurrence and less severe metabolic fluctuations (is this possible?)
Registered Dietitian – challenge to manage both inpatient and outpatient caseload concurrently	Registered Dietitian – works more primarily as an outpatient
Typical practice 1 initiation per month	Could more than 1 initiation occur per month (is this possible?)

Evolution of the Low Ratio and Slow Initiation Outpatient Method

2005

1st Initiation via Low Ratio and Slow Initiation at
McMaster Children's Hospital

2006



2018

85% of initiations is via the outpatient Low and Slow method

Low Ratio, Slow Outpatient Initiation Method



Ketogenic Diet Therapy: Low Ratio Slow Initiation in a Canadian outpatient setting – Safety and Tolerability

Author: Jennifer Fabe BSc.MSc.R.D.

Co-Authors: Brandon Meaney M.D., Gabriel M.Ronen M.D.

McMaster Children's Hospital, Hamilton Health Sciences, Hamilton, Ontario, Canada



Ketogenic Diet Therapy: Low Ratio Slow Initiation in a Canadian outpatient setting – Safety and Tolerability - 1 year followup

Author: Jennifer Fabe BSc.MSc.R.D.

Co-Authors: Gabriel M.Ronen M.D.

McMaster Children's Hospital, Hamilton Health Sciences, Hamilton, Ontario, Canada

Research proves successful diet initiation methods

2014 and 2016 – a retrospective review study (REB approval, 2016)

AIM: Evaluate safety and tolerability of the Low and Slow outpatient initiation method and secondarily on effectiveness of seizure control and finally sustainability

METHODS:

Retrospective chart review of the first 30 consecutive pediatric patients started on the Slow and Low Method at McMaster Children's Hospital

Pre-initiation, 1,3,6 and 12 month data during therapy was collected on:

KD Ratio	Acidosis	Blood Sugars	Ketones	% kcal fro macronutrients
Admissions	Medications	ECGs	Seizure Frequency	Grams of total fat, pro, carbs

METHODS

- Triple extraction of data from paper files and electronic medical records
- Hypoglycemia was defined as < 2.9 mmol/L
- Acidosis was measured by bicarbonate, pH level, or total CO₂ lab values. Acidosis was defined as 18.0 mmol/L or less
- Data was input into SPSS and analyzed using the Analyze-It Software
- Seizure frequency was analyzed via one-way ANOVA.

Author: Jennifer Fabe BSc.MSc.R.D.

Co-Authors: Brandon Meaney M.D., Gabriel M.Ronen M.D.

McMaster Children's Hospital, Hamilton Health Sciences, Hamilton, Ontario, Canada

	Pre Keto	1 Month	3 Months	6 Months	1 Year
Mean % kcal from fat (range %)	36.4 (58.5-89.0)	76.3 (61.0-90.0)	81.5 (61--90.0)	83 (72.8-90.0)	85 (77.9-90.0)
Mean % kcal from carbs	52 (14.5-20.0)	14.1 (1.7-16.7)	9.87 (3.0-16.7_	8.4 (3.2-16.6)	9.8 (1.5-16.5)
Mean Ratio	0.26	1.7	2.3	2.4	2.4

Blood Glucose, Blood Ketones and Urine Ketones

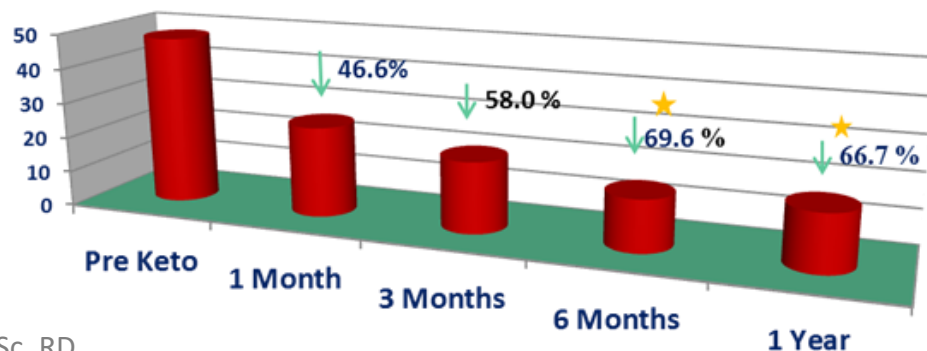
	1 Month		3 Months		6 Months	
	Mean	Range	Mean	Range	Mean	Range
Blood Glucose (mmol/L) ★	4.8	3.6-7.2	4.7	3.0-7.2	4.5	3.4-5.8
Blood Ketones (mmol/L)	2.9	0.5-5.2	3.6	1.4-5.9	3.6	0.6-6.2
Urine Ketones (mmol/L)	5.4	0.0-16.0	8.8	0.5-16	9.0	0.1-16

★ Hypoglycemia defined as 2.9 mmol/L that is requiring corrective action

Symptoms of Nausea, Vomiting and/or Lethargy

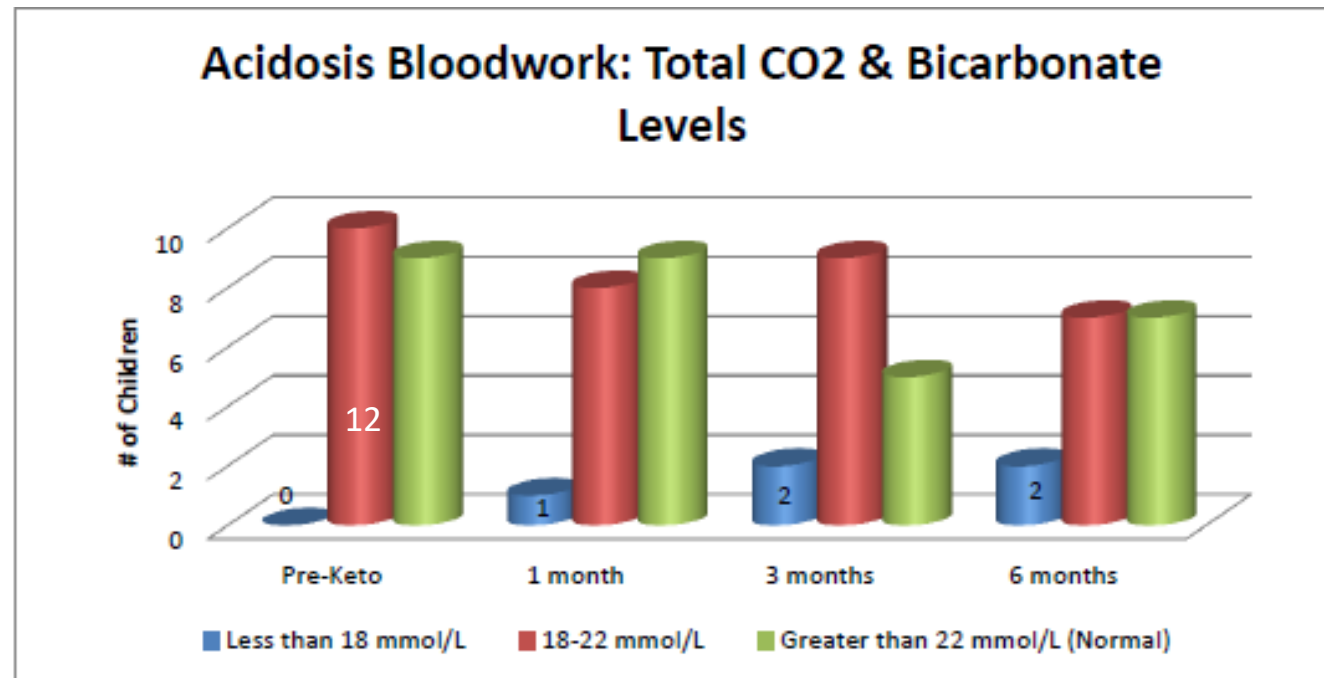
1 Month	3 Months	6 Months
0	1 (nausea)	1 Patient (nausea, vomiting, lethargy)

Mean number of Seizures at each time period



Results

Acidosis Measurements



Results

Symptoms of Nausea, Vomiting and/or Lethargy

1 Month	3 Months	6 Months
0	1 (nausea)	1 Patient (nausea, vomiting, lethargy)

Admissions to Emergency Department or Hospital for side effects related to initiation

1 Month	3 Months	6 Months
0	0	0

Review of ECG:

- ◆ Measured at 6 months with no concerns requiring change from usual monitoring

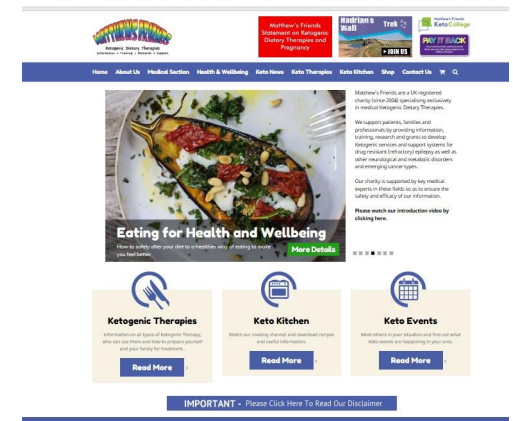
Overview of Low Ratio, Slow Initiation Outpatient Method

- **STEP 1 (Pre Keto):**

- All patients screened for inborn errors of metabolism that are contraindicated with the ketogenic diet
- Outpatient Teaching & Assessment with RD and Ketogenic Diet Team
- Pre-Ketogenic Diet History 5 days collected from family
- Ketogenic Bloodwork and Baseline ECG

- **STEP 2 (Pre Keto):**

- Pre- Keto Diet Analysis: determine average intake in grams and % calories from fat, protein and carbohydrates



TITRATION STEPS of the Low Ratio, Slow Initiation Overview

- 4 general titration steps
- Only 2 predetermined goals at the beginning of titration:
 1. Find the effective ketogenic diet prescription that is the least restrictive to support seizure control
 2. Calories to support acceptable growth % calories from fat is advanced with an effort to also calculate carb and protein to meet the patients needs and achieve palatability
- Keto Ratio is result NOT a goal
- NOT all titration steps are required if acceptable seizure control is achieved
- Duration of 4-8 weeks (= 1-2 months) of initiation
- After initiation phase – patient enters maintenance phase of Ketogenic Diet

Overview of Low Ratio, Slow Initiation Outpatient Method (continued)

TITRATION STEP 1

1. Determine energy requirements to support growth.
 2. Increase % kcal from fat by 20% or start at 60% kcal from fat whichever is appropriate.
- Protein meets minimum of DRI or pre-keto diet intake
 - Carbohydrate added to achieve goal calories

Keto Ratio is a result NOT a goal

Duration: 7-14 days

Home monitoring

- Daily cap blood sugars
- Daily urine ketones
- Weekly blood ketones
- Weekly Multistix[®]
- Bowel movements
- Seizure control

Local Lab Monitoring

- Acidosis bloodwork

Overview of Low Ratio, Slow Initiation Outpatient Method (continued)

TITRATION STEP 2

Advance % kcal from fat by 10-15%
(ie 70-75% kcal from fat)

- Protein meets minimum of DRI
- Calculate Fat and Carbohydrate grams to determine final decision of KD prescription
- Consider adding MCT oil

Keto Ratio is a result NOT a goal

Duration: 7-14 days
OR maintain at this step as if seizure control is acceptable & in agreement with your KD Team

Home monitoring

- Daily cap blood sugars
- Daily urine ketones
- Weekly blood ketones
- Weekly Multistix®
- Bowel movements
- Seizure control

Local Lab Monitoring

- Acidosis bloodwork

Overview of Low Ratio, Slow Initiation Outpatient Method (continued)

Continued

TITRATION STEP 3:

Advance % kcal from fat by 5-10% (ie 75-80% kcal from fat)

- Protein meets minimum of DRI
- Calculate Fat and Carbohydrate grams to determine final decision of KD prescription
- Consider adding or adjusting MCT oil

Keto Ratio is a result NOT a goal

Duration: 7-14 days

OR maintain at this step if seizure control is acceptable & in agreement with your KD Team

Home monitoring

- Daily cap blood sugars
- Daily urine ketones
- Weekly blood ketones
- Weekly Multistix[®]
- Bowel movements
- Seizure control

Local Lab Monitoring

- Acidosis bloodwork

Overview of Low Ratio, Slow Initiation Outpatient Method (continued)

Continued

TITRATION STEP 4:

Advance % kcal from fat by 5-10% (ie 80-90% kcal from fat)

- Protein meets minimum of DRI
- Calculate Fat and Carbohydrate grams to determine final decision of KD prescription
- Consider adding or adjusting MCT oil

Keto Ratio is a result NOT a goal

Continue to support and fine tune the diet

Home monitoring

- Daily cap blood sugars
- Daily urine ketones
- Weekly blood ketones
- Weekly Multistix®
- Bowel movements
- Seizure control

Local Lab Monitoring

- Acidosis bloodwork

Ketogenic Team Role/Involvement

- Decide calories for appropriate growth
- Decide protein and carbohydrate to support palatability and efficacy
- Registered Dietitian to create menus to best fit the KD prescription to optimize palatability
- Registered Dietitian provides weekly or biweekly monitoring and support via phone and email with caregivers
- Multidisciplinary Clinic Visit at 3 months, 6 months post initiation and every 6 months thereafter



Matthew's Friends
Statement on Ketogenic
Dietary Therapies and
Pregnancy



Eating for Health and Wellbeing

How to safely alter your diet to a healthier way of eating to make you feel better

[More Details](#)

Matthew's Friends are a UK registered charity (since 2004) specialising exclusively in medical Ketogenic Dietary Therapies.

We support patients, families and professionals by providing information, training, research and grants to develop Ketogenic services and support systems for drug resistant (refractory) epilepsy as well as other neurological and metabolic disorders and emerging cancer types.

Our charity is supported by key medical experts in these fields so as to ensure the safety and efficacy of our information.

Please watch our introduction video by clicking here.



Ketogenic Therapies

Information on all types of Ketogenic Therapy, who can use them and how to prepare yourself and your family for treatment..

[Read More](#)



Keto Kitchen

Watch our cooking channel and download recipes and useful information.

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Meet others in your situation and find out what Keto events are happening in your area.

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Jennifer Fabe, BSc, MSc, RD





Matthew's Friends
Statement on Ketogenic
Dietary Therapies and
Pregnancy



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Jennifer Fabe, BSc, MSc, RD

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Suggested Ketogenic Diet Protocol Overview of Steps (Example for Teaching only)

MEALS	Step 1	Step 2	Step 3
Fat Exchange	2 ½	3	4
Carbohydrate Exchange	12 ¼	8	5
Protein Exchange	1 ½	1 ½	1 ½
MCT oil	0.0 ml	3.5 ml	5.5 ml
Fluids (including water)	275	275	275

SNACKS	Step 1	Step 2	Step 3
Fat Exchange	0	1	1 1/3
Carbohydrate Exchange	6	4	2 ½
Protein Exchange	1 ½	1 ½	1 ½
MCT oil	0	0	0
Fluids (including water)	275	275	275

Meals & Snacks	Step 1	Step 2	Step 3
Duration of Step	1-2 weeks	1-2 weeks	1-2 weeks

Use Low Ratio, Slow
Outpatient - Food
Exchange Lists

CARBOHYDRATE, PROTEIN & FAT EXCHANGE LIST

Carbohydrate Choices (3.0 grams carbohydrates)				PASTA, RICE, AND NOODLES SUBSTITUTIONS			
FRUIT				BREADS SUBSTITUTIONS			
Item	Weight (grams)	Common Measure	Source	BREADS:			
Apple, with skin	Fat Choices			VEGETABLES			
Apple, dried	COCONUT PRODUCTS:			Broccoli, raw	70.0 g	190mL chopped or ¼ cup + 1Tbsp	CNF
Applesauce, unsweetened	Protein Choices			Broccoli, raw then steamed	76.8 g	207.6mL or ¾ cup + 2Tbsp chopped	CNF
Banana	FISH AND SHELLFISH			Brussels sprouts, cooked	63.0 g	95.5mL or 1/3 cup + 1 Tbsp or 3 brussels sprouts	CNF
Banana, dried	Cod, atlantic, cooked	41 g	CNF	Butternut squash, cooked	28.3 g	32.7mL or 2Tbsp cubes	CNF
Blackberries	Cod, pacific, cooked	50 g	CNF	Carrots, raw	41.7 g	77mL or 5Tbsp chopped 80.2mL or 1/3 cup slices	CNF
Blueberries, fresh	Lobster, cooked	50 g	CNF	NUTS, SEEDS, AND LEGUMES			
Blueberries, frozen unsweetened	Salmon, chinook, raw	30 g	CNF	NUTS:			
Cantaloupe	Salmon, chum, raw	40 g		Almonds	4 g	3 nuts	CNF
Grapes, green or red	Salmon, coho, raw	41 g		Brazil nuts	10 g	3 nuts	CNF
Honeydew melon	Salmon, pink, raw	35 g		Cashews	2 g	1 nut	CNF
Kiwi fruit, fresh	Salmon, sockeye, raw	31 g		Peanuts	9 g	10 nuts	CNF
Mandarin orange	Shrimp, steamed	42 g	About 8 medium shrimp	Pecans	8 g	4 nuts	CNF
	Sole fish sticks, High Liner brand, cooked	21.4 g		Pistachios	2 g	3.8mL	CNF
	Tilapia	36 g		Walnuts	5 g	11.8mL halves 9.8mL pieces 14.7mL ground	CNF
	Tuna, albacore, raw	30 g		NUT BUTTERS:			
	Tuna, albacore white, Starkist brand (in water)	43 g	½ of a 3 oz can (1.5oz)	raw (does not have to eat all)			
	EGG			or ½ cup + 1Tbsp chopped			
	Egg, raw, mixed well	50 g	50 mL	CNF			

COMBINATION FOODS EXCHANGE LIST

Item	Weight (grams)	Carbohydrate Exchanges	Protein Exchanges	Fat Exchanges	Source
CHEESE:					
Blue cheese	23.3 g	0	1	1	CNF
Brie	24.1 g	0	1	1	CNF
Camembert	25.2 g	0	1	1	CNF
Cheddar cheese	20.8 g	0	1	1	CNF
Colby	21.0 g	0	1	1	CNF
Clam	20.0 g	0	1	1	CNF
Comté cheese	35.2 g	0.5	1	1.5	CNF
Fontina	19.5 g	0	1	1	CNF
Goat cheese (chevre)	27.0 g	0	1	1	CNF
Gouda	20.0 g	0	1	1	CNF
Gruyère	16.8 g	0	1	1	CNF
Hamburger	24.9 g	0	1	1	CNF
Monterey	20.4 g	0	1	1	CNF
Mozzarella	20.6 g	0	1	0.5	CNF
Swiss	21.3 g	0	1	1	CNF
Stuffed	54.6 g	0.5	1	2.5	CNF
Swiss	19.5 g	0	1	1	CNF
Cottage (whole milk)	44.4 g	0	1	1	CNF
Swiss cheese (mild)	18.6 g	0	1	1	CNF
STORAGE CHEESE:					

Welcome to Matthew's Friends Keto Cooking Channel



Matthew's Friends

Keto Cooking Channel

#ketokitchen

0:03 / 1:57

CC HD YouTube



Jennifer Fabe, BSc, MSc, RD



Brief Case Study example of 'Low and Slow' Outpatient Initiation

4 year old boy, 15 kg and requires 1200 kcal/day to support growth

Myoclonic atonic epilepsy - 30 seizures weekly (GTC, atonic)



		Fat	Protein	Carbs	Ratio
Pre-Keto		46 g 33% kcal	43 g 14 % kcal	164 g 53%	0.22 to 1
Week 1	Titration 1	80 g 60% kcal	18 g 6% kcal	102 g 32.6%	0.66 to 1
Week 2 + 3	Titration 2	92.3 g 69.3%	28 g 9.3% kcal	64.3 g 21.4%	1.0 to 1
Week 4 + 5	Titration 3	102.8 g 77.1%	32 g 10.6% kcal	36.6 g 12.2% kcal	1.5 to 1 (85% Seizure Reduction)
Week 6	Sub Step to Titration 3	102.8 g 67.1% LCT 10.1% MCT	32 g 10.6% kcal	36.6 g 12.2% kcal	1.5 to 1 (Seizure Free)
1 year	Remained STEP 3	Same % kcal from fat, protein and carbs but increased kcal to support growth.			Seizure FREE

1 Hypoglycemic event

No Acidosis via repeated measurements

No nausea, vomiting or diarrhea

Urine Ketones 4-16 mmol/L

Usual sugars 3-4 mmol/L

Results

	Pre –Keto (n = 30)	1 Month (n = 30)	3 Months (n= 29)	6 Months (n = 27)	1 year (n = 26)
Mean % kcal from fat (range of %)	35.0% (22.0-44.0)	76.2 % (60.0-89.0)	81.5 % (61.0-90.0)	83.3 % (75.0-90.0)	81.4% (74.0-92.0)
Mean % kcal from carbs (range of %)	48.9% (38.0 – 62.4)	14.1% (4.0-28.0)	9.8 % (1.5 – 28.0)	8.4% (1.5 – 14.6)	9.8% (1.5-14.2)
Mean KD Ratio	0.2 to 1	1.8 to 1	2.3 to 1	2.45 to 1	2.46 to 1
% Seizure Frequency Reduction					
<50% Reduction		40.0 %	35.0 %	27.8%	23.1%
50-90% Reduction		50.0 %	35.0 %	39.0%	38.5%
>90% Reduction		10.0 % (1 seizure free)	30.0 % (3 seizure free)	33.0% (2 seizure free)	38.5% (4 seizure free)
Number of Antiseizure Medications	2.2		2.1		2.1

Conclusions

- Low Ratio, Slow Initiation Outpatient Method is a safe and well tolerated
- Longer time between each KD titration to observe efficacy allows time to determine lowest effective KD prescription
- Smaller Titrations of % kcal from fat and carbs is associated with good tolerability
- Seizure control efficacy is sustainable at 1 year
- Optimal seizure control is achievable and sustainable
- Ketogenic Ratios are a result NOT a goal.

GOAL: Least restrictive, sustainable, effective ketogenic diet prescription

Conclusions



Ketogenic Diet Therapy: Low Ratio Slow Initiation in a Canadian outpatient setting – Safety and Tolerability

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Ketogenic Diet Therapy: Low Ratio Slow Initiation in a Canadian outpatient setting – Safety and Tolerability - 1 year followup

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- Seizure Frequency reduction is reported within the 1st month of Initiation
- Seizure control appears to be similar to previous studies using rapid ketogenic diet initiation (Henderson et al, 2006, Neal) et al 2008)
- Results suggest seizure frequency reduction can be achieved with lower than traditional ketogenic ratios.
- Food Exchange Lists companioned with RD supervised meal plan is a useful tool to allow for more variability & independence in menu creation by the patient and family

GOAL: Least restrictive, sustainable, effective ketogenic diet prescription

Practical Advantages

- Allows child to adjust to new diet lifestyle at home at a slower pace
- Usual carb rich foods can be used in first steps of initiation to ease child into new lifestyle
- Parents may not need to take time off of work to initiate diet
- Describing KD using % of kcal or grams rather than ratios is more descriptive of prescription and provides a more clearer means of comparing
- Convenient for families that reside far from their KD centre
- Hospital cost of inpatient bed eliminated
- Initiation is not vulnerable to high bed occupancy facilities
- RD time more efficiently used
- RD can potentially initiate more patients
- 80% of starts at McMaster Children's Hospital in 2013 were via Low the Slow Outpatient Method
- Training of other Canadian Centres (3 to date)

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Questions?



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