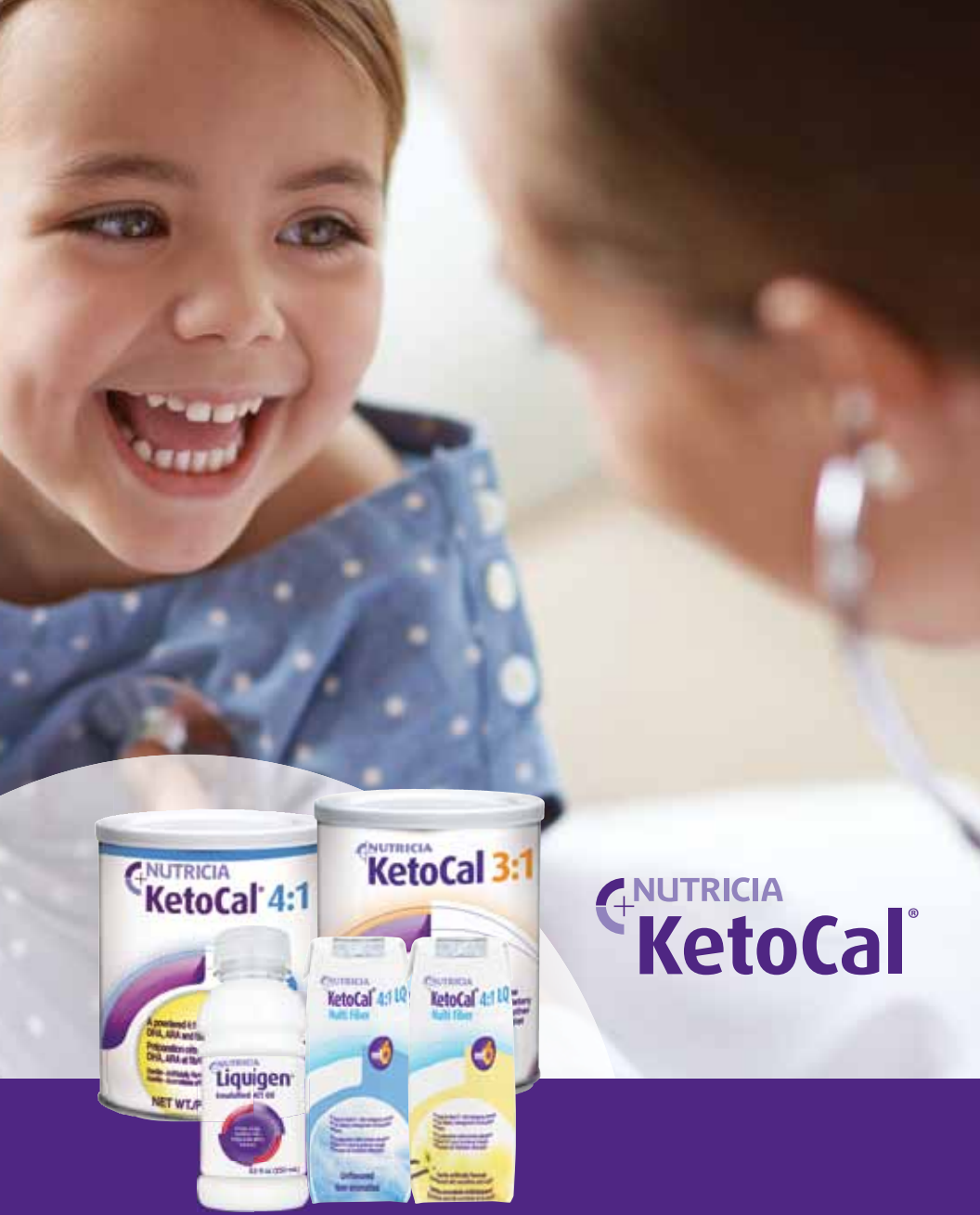

Initiation Guidelines for the **Ketogenic Diet** in Tube-fed Children with Refractory Epilepsy

Introduction

Epilepsy is the 4th most common neurological disorder in the United States. The World Health Organization estimates that worldwide, approximately 50 million people have epilepsy[1]. Many epilepsy patients will respond to pharmacologic treatment[2]. However, approximately 30 to 40% of patients will develop medically refractory epilepsy[3]. The ketogenic diet should be considered as an option after two anticonvulsants are used unsuccessfully[4]. The ketogenic diet is an established, well-tolerated and effective option for children with drug-resistant epilepsy[5,6,7].

Children with neurologic problems often have other co-morbid conditions, including an inability to tolerate oral feedings, which requires placement of a feeding tube. Such children are candidates for using the ketogenic diet by nasogastric or percutaneous endoscopic gastrostomy (PEG) feeding tube, provided contraindications are excluded.

Optimal management of the patient is best applied by a multidisciplinary team including e.g. a neurologist, dietitian, pediatrician, epilepsy nurse and pharmacist.

The following guidelines will cover the transition and monitoring of the ketogenic diet by tube during initiation, maintenance and discontinuation. The content is built upon opinions and experiences of expert dietitians and neurologists, who kindly gave feedback and practical insights on their best clinical practice. For steps in the clinical management, the special report 'Optimal Clinical Management of Children Receiving the Ketogenic Diet: Recommendations of the International Ketogenic Diet Study Group[8] was used as a basic approach.

Nutricia provides a range of medical foods for use in the ketogenic diet. The following guidelines are provided to help support healthcare professionals involved in the management of patients on the ketogenic diet. Practices may vary from clinic to clinic, and this booklet should serve as guidance only, not as strict protocol.

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Step one: Patient selection[8]

Choosing the appropriate patient to start on the ketogenic diet may help increase efficacy. Use the guidelines below to help evaluate patients for inclusion or exclusion of the ketogenic diet.

Indications for the Ketogenic Diet

Refractory epilepsy in children who have failed two or three anticonvulsant therapies, regardless of age or gender, and particularly in those with symptomatic generalized epilepsies[8].

Probable benefit (at least two known scientific publications)[8]

- Glucose transporter protein 1 (GLUT-1) deficiency
- Pyruvate dehydrogenase deficiency (PDHD)
- Myoclonic-astatic epilepsy (Doose Syndrome)
- Tuberous sclerosis complex
- Rett Syndrome
- Severe Myclonic epilepsy of infancy (Dravet Syndrome)
- Infantile spasms*
- Children receiving only formula (infants or enterally fed patients)

*** Infantile spasms are an indication for the ketogenic diet. KetoCal is indicated for children one year and older.**

Suggestion of benefit (one known case report or series)[8]

- Selected mitochondrial disorders
- Landau-Kleffner Syndrome
- Lafora body disease
- Subacute sclerosing panencephalitis (SSPE)

Contraindications of the Ketogenic Diet[8]

Absolute

- Carnitine deficiency (primary)
- Carnitine palmitoyltransferase (CPT) I or II deficiency
- Beta-oxidation defects
  - Medium-chain acyl dehydrogenase deficiency (MCAD)
  - Long-chain acyl dehydrogenase deficiency (LCAD)
  - Short-chain acyl dehydrogenase deficiency (SCAD)
  - Long-chain 3-hydroxyacyl-CoA deficieny
  - Medium-chain 3-hydroxyacyl-CoA deficiency
- Pyruvate carboxylase deficiency
- Porphyria

Relative

- Surgical focus identified by neuroimaging and video EEG monitoring
- Parent and/or caregiver non-compliance
- Inability to maintain adequate nutrition

Indications for enteral feeding by tube

- Poor or no acceptance of oral diet due to co-morbid conditions, including gastrointestinal and respiratory problems, spasticity, quadriparesis, dystonia and impaired cognition
- Impaired appetite and gastrointestinal function due to the use of anti-epileptic drugs (AED)
- Insufficient growth
- Poor compliance to oral diet
- Psychosocial factors in families preventing coping with oral ketogenic diet

Step two: Pre-diet evaluation and counseling[8]

The goals of pre-diet counseling are to identify seizure types and, most importantly, to define outcome measures, i.e. reduction in seizure frequency/severity and improvement in quality of life (QOL) that will make the ketogenic diet worthwhile.

For the application of enteral feeding at home, an assessment of adequate parental care and needs for support should take place.

Recommendations for baseline evaluation

Counseling

Classification of epilepsy

- Description of seizures: type and frequency
- Epilepsy syndrome
- Impairment description

Establish treatment goals

- Reduction in seizure frequency/severity
- QOL improvement
- Impairment improvement
- Optimal nutrition status, growth and development in children

Assess current medication

- In the initiation phase of the ketogenic diet, it is customary to keep the existing regimen of drugs in place.
- Check carbohydrate content of current medications, such as suspensions, generic and/or over the counter (OTC) medications
- In collaboration with the neurologist and medical team, make sure dosing of all medications, including anti-epileptic drugs, is appropriate for weight

Recommend family read parent-orientated ketogenic diet information

Evaluation and assessment

Perform a nutritional evaluation

- Assess baseline measurements on growth chart: weight, length, and head circumference for age, weight-for-length, and/or body mass index (BMI) for age
- Review child's GI status with caretaker: frequency of bowel movements, constipation, or diarrhea
- Assess feeding tube placement: nasogastric tube, gastrostomy, jejunostomy, or other feeding tube
- Request baseline laboratory assessment: may include but not limited to: vitamins A, E, and D, selenium, zinc, magnesium, and/or calcium

Nutritional assessment

Establish needs for energy, protein, fluids and micronutrients, based on:

- Nutritional need: Normal for age in children with normal activity and functioning
- Needs may be higher or low depending on individual circumstances
- Evaluate growth history: weight, height, BMI and activity level
- Evaluate current tube feeds
- Provide calorie, protein, fluid and micronutrient needs according to recommendations for age

Step two: Pre-diet evaluation and counseling (continued)[8]

Laboratory evaluation*

- Complete blood count with platelets
- Electrolytes to include serum bicarbonate, total protein, calcium, selenium, magnesium, zinc and phosphate
- Serum liver and kidney tests (including albumin, AST, ALT, blood urea nitrogen, creatinine)
- Fasting lipid profile
- Serum acylcarnitine profile
- Urinalysis
- Urine calcium and creatinine
- Urine organic acids
- Serum amino acids

Ancillary testing (optional)

- DEXA scan
- Renal ultrasound and nephrology consultation (if a history of kidney stones)
- EKG (electrocardiogram) if a history of heart disease
- MRI
- Cerebrospinal fluid (if no clear etiology for seizures has been identified)

*Check and follow your clinic guidelines

Step three: Introduction of the ketogenic diet[9]

The transition from standard enteral feeds to KetoCal tube feeds can take place in four to eight days. This can be adjusted to a shorter or longer period of time depending on clinic protocols and formula tolerance.

If a higher MCT content of feeds is desired, MCT oil can easily be added to KetoCal. Since Liquigen is an emulsified MCT oil, it mixes easily with KetoCal.

Transition from previous enteral feeding by tube to KetoCal

Phase	Time	Previous nutrition	KetoCal
1	1 – 2 days	75% energy	25% energy
2	1 – 2 days	50% energy	50% energy
3	1 – 2 days	25% energy	75% energy
4		0% energy	100% energy

Benefits of tube feeding with KetoCal

- Well tolerated
- Nutritionally complete
- Easy to prepare
- Consistency in ketosis
- Easy to administer to already enterally-fed children
- Better compliance than oral diet
- Can be given as a supplement to oral ketogenic food
- Simple for dietitians to calculate and prescribe
- Requires less education in meal preparation for families and caregivers

Step four: Evaluation and monitoring after initiation of the ketogenic diet[8]

The ketogenic diet should be provided for a minimum of three months prior to assessment of individual response and goal achievement.

Neurological checks

- Seizures: Seizure frequency and severity should be monitored daily by parents and reported back to clinician upon diet initiation, one month after initation and every three months thereafter, or based on clinic protocol.
- Efficacy of the diet: Although improvements may be seen sooner, efficacy of the diet should be evaluated after three months based on established goals such as seizure reduction, alertness, reduction in medication, etc.

Monitoring during the ketogenic diet

- Date
- Weight
- Length/height
- Tube and oral intake
- # seizures daily
- # seizures at night
- Severity of seizures
- Impairment changes
- Ketone and blood glucose levels
- Stool frequency and consistency
- Vomiting
- Behavior changes
- Alertness

Step five: Management of ketones, glucose and nutritionally-related side effects and illness[8,9]

Most side effects of the ketogenic diet are relatively mild and easily managed[10]. The overall risk of serious adverse events is low, and in most children the ketogenic diet does not need to be discontinued for these reasons[8].

Monitoring is usually performed on the basis of urinary ketones. Blood glucose and blood ketones may be used as well based on clinic protocol.

At initiation, the likelihood of hypoglycemia is small but must be monitored carefully.

Glucose and ketone measurements

	Goal level*	Frequency of measurement*
Ketones	• Urine: 3–4 + (8–16 mmol/L) with keto sticks • Blood: 2.5–5 mmol/L with ketone test • Blood ketone levels above 5 mmol/L should be monitored carefully for hyperketosis	• First 3 months: daily in the evening prior to feeding • After 3 months: follow clinic protocol (applies to both urine and blood ketones)
Glucose	• Blood glucose: above 45 mg/dL	• Consider checking blood glucose levels every 8 hours for first 48 hours, twice per day for a full 2 weeks, then once per day for the remainder of time on diet • Follow clinic protocols for low blood glucose levels on the ketogenic diet

* Follow your clinic's guidelines for goal ketone and blood glucose levels.

Step five: Management of ketones, glucose and nutritionally-related side effects and illness (continued)[8,9]

Managing blood ketones and glucose levels

Ketone/Glucose levels	Symptoms	Action required	Frequency of monitoring
Blood glucose ≤ 45 mg/dL and/or blood ketones > 6.5 mmol/L	None	None	Recheck every 30-60 minutes. Follow your clinic guidelines regarding blood and ketone monitoring and treatment.
Blood glucose ≤ 45 mg/dL and/or blood ketones > 6.5 mmol/L	Sweating, paleness, trembling	<10 kg bodyweight: 30 mL of 10% glucose solution or 30 mL apple/ orange juice >10 kg bodyweight: 60 mL of 10% glucose solution or 60 mL apple/orange juice	Recheck every 30-60 minutes. Follow your clinic guidelines regarding blood and ketone monitoring and treatment.
Blood glucose ≤ 45 mg/dL and/or blood ketones > 6.5 mmol/L	Diminished alertness	Seek medical attention. <10 kg bodyweight: 30 mL of 10% glucose solution IV >10 kg bodyweight: 50 mL of 10% glucose solution IV	Recheck every 30-60 minutes. Follow your clinic guidelines regarding blood and ketone monitoring and treatment.

Step five: Management of ketones, glucose and nutritionally-related side effects and illness (continued)[8,9]

Management of nutritionally-related side effects and disease[8,9]

Symptoms	Action required	Frequency of Monitoring
Vomiting, reflux and aspiration	Anti-reflux medication without carbohydrates; check location of tube	Daily
Constipation	Increase fiber content without carbohydrates; introduce laxatives; check total fluid intake	Daily
Weight loss	Increase calories by 5-10% or decrease ratio until desired weight gain is achieved	Once a week
High ketosis due to catabolism	Increase calories by 5-10% weekly until desired ketosis is achieved	Daily
Persistence of high ketosis	Lower ratio until desired ketosis is achieved; consider changing to KetoCal 3:1, adding Polycal or Complete Amino Acid Mix	Daily
Low ketones (≤1.5+)	• Check for hidden carbohydrates (medications, lotions etc.) • Check for possible non-adherence • Reduce energy content of enteral feeding by 25-50% for 24 h • Check enteral feeding preparations for possible errors • Increase ratio (if possible) • Add MCT oil or MCT fat emulsion such as Liquigen® • Start L-carnitine (as indicated) 20-150 mg/kg/day	Daily; Note that the effects of ratio adjustment may not be seen for a couple of days
Vomiting and/or diarrhea without fever	• Reduce bolus to smaller and more frequent portions per day • Extend the time rate on pump for bolus feedings or use a continuous drip	Daily
Vomiting and/ or diarrhea with fever (involvement of a health care provider required)	• Dilute the KetoCal enteral feeding with 50% water, max 24–48 hrs • In case of gastroenteritis: oral rehydration solution 24–48 hrs, calculated individually in addition to carbohydrate free fluid/water • Compensate for each vomiting/ diarrhea episode with 10 mL oral rehydration solution/kg bodyweight • Consider development of individual emergency protocol	Daily

Recommendations for follow-up clinic visits

Growth development and assessment

Young children are at greater risk for inadequate growth. The risk : benefit ratio should be continually evaluated.

Obtain height, weight, ideal weight for stature, growth velocity, BMI, when appropriate.

Review appropriateness of diet prescription.

Anthropometry	Age*	Action
Weight At start, during the first 3 months After the first 3 months	Infants <6 months Infants >6 months and children- Declining weight Infants <6 months Infants >6 months Children or adolescents	Once a week Once a month Once a week Once every two weeks Once every month Every two months
Length/height	Infants <6 months Infants >6 months Children or adolescents	Once a month Once every three months Once every six months
Head circumference	Infants	Once a month

* **Note: KetoCal is not intended for use in children less than 1 year of age.**

Assessment	Goals	Frequency/Action
Nutritional assessment	• Review appropriateness of diet prescription (calories, protein and fluid) • Review vitamin and mineral supplementation • Assess compliance to ketogenic diet	Every visit, at least every 3 months for the first year of the ketogenic diet Adjust diet if necessary to improve compliance and optimize management goals
Medical evaluation	• Efficacy of the diet (is the KD meeting parents' expectations?) • Medication reduction (if applicable) • Should the diet be continued?	Every visit, at least every 3 months for the first year of the ketogenic diet
Laboratory assessment	• Complete blood count with platelets • Electrolytes to include serum bicarbonate, total protein, 25-OH vitamin D, calcium, magnesium, zinc and phosphate, serum liver and kidney profile (including albumin, AST, ALT, blood urea nitrogen, creatinine) • Fasting lipid profile • Urinalysis • Urine calcium and creatinine • Anticonvulsant drug levels (if applicable)	Every visit, at least every 3 months for the first year of the ketogenic diet
Optional	• Serum β-hydroxybutyrate (BOH) level • Renal ultrasound • Bone mineral density (DEXA scan) • EEG	Every visit, at least every 3 months for the first year of the ketogenic diet (only repeated in case of deviated findings)
Medication	• Consider L-carnitine supplementation • Consider oral citrates to prevent kidney stones	Every visit, at least every 3 months for the first year of the ketogenic diet (only repeated in case of deviated findings)

Step 7: Ketogenic diet discontinuation[8,9]

Discontinuation

- Consideration should be given to discontinue the ketogenic diet:
  - after three months (if unsuccessful)
  - after two years (if successful)
  - based on diagnosis. Longer diet durations are necessary for GLUT-1 and PDHD and may be based on individual response
- During discontinuation, a gradual wean over 2-3 months is recommended, unless an urgent discontinuation is indicated.
- Reduce ratio weekly as tolerated: 4:1, 3:1, 2:1, 1:1, by adding glucose or mixing KetoCal with “normal” enteral feeding formula. Rate of decrease should be based on tolerance and seizure frequency.

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Products for the ketogenic diet

(For detailed product information, please visit www.MyKetoCal.com)

Product	Characteristics
KetoCal 3:1 	A nutritionally complete, powdered ketogenic formula in a 3:1 ratio (fat:carbohydrate + protein) for individuals over the age of one year. A medical food.
KetoCal 4:1 	A nutritionally complete, powdered ketogenic formula in a 4:1 ratio (fat:carbohydrate + protein) for individuals over one year of age. A medical food.
KetoCal 4:1 LQ 	A nutritionally complete, ready-to-feed ketogenic formula in a 4:1 ratio (fat:carbohydrate+protein) for individuals over one year of age. Available as unflavored or vanilla flavored. A medical food.
Liquigen 	An emulsified MCT oil. A creamy, palatable alternative to traditional MCT oil. Mixes easily with other liquids. Unflavored for oral or enteral use.
Complete Amino Acid Mix 	Balanced mixture of essential and non-essential amino acids. Indicated for conditions in which a nutritionally complete feed is not suitable or a modular approach is required.
Phlexy-Vits 	One 7 g packet supplies the majority of vitamins and minerals needed to meet the DRI of individuals 11 years and older. CHO content is 0.04 g/7 g sachet.
Polycal 	A powdered, concentrated source of energy based on maltodextrin.

Nutrition Information

The following nutrition information refers to the US versions of KetoCal products only.

KetoCal® 4:1 Powder

Nutrition Information:

Nutrients	Per 100 g	Per 100 kcal
Energy, kcal (kJ)	705 (2950)	100 (411)
Protein, g	14.4	2.0
Carbohydrate, g	8.2	1.2
Fiber, g	5.3	0.75
Soluble, g	3.2	0.45
Insoluble, g	2.1	0.30
Fat, g	69.2	9.8
Saturated, g	26.7	3.8
Monounsaturated, g	22.8	3.2
Polyunsaturated, g	19.7	2.8
Arachidonic Acid, mg	120	17.0
Docosahexaenoic Acid, mg	110	15.6
Vitamins		
Vitamin A, IU (mcg)	1232 (370)	175 (52.5)
Vitamin D, IU (mcg)	420 (10.5)	59.6 (1.5)
Vitamin E, IU (mg α TE)	15.9 (10.7)	2.3 (1.5)
Vitamin K, mg	0.031	0.0044
Thiamin, mg	0.89	0.13
Riboflavin, mg	0.70	0.10
Vitamin B6, mg	0.70	0.10
Vitamin B12, mg	0.0013	0.00018
Niacin, mg	4.9	0.70
Folic Acid, mg	0.116	0.0165
Pantothenic acid, mg	2.9	0.41
Biotin, mg	0.0191	0.0027
Vitamin C, mg	40.0	5.7
Choline, mg	320	45.5
Inositol, mg	19.1	2.7

Minerals, Trace Elements	Per 100 g	Per 100 kcal
Calcium, mg	700	99.3
Phosphorus, mg	420	59.6
Magnesium, mg	96.3	13.7
Iron, mg	7.0	0.99
Zinc, mg	3.6	0.51
Manganese, mg	0.83	0.12
Copper, mg	0.50	0.071
Iodine, mg	0.0862	0.0122
Molybdenum, mg	0.0287	0.0041
Chromium, mg	0.0148	0.0021
Selenium, mg	0.027	0.0038
Sodium, mg	481	68.2
Potassium, mg	771	109
Chloride, mg	726	103
L-Carnitine, mg	45.0	6.4
Taurine, mg	33.0	4.7

* Standard Dilution = 1 kcal/mL

Fiber is not included in calculating the ketogenic ratio

Ingredients:

Refined Vegetable Oils (Palm, Soy, High Oleic Sunflower), Casein (Milk), Soy Lecithin, Whey (Milk), Microcrystalline Cellulose, Chicory Root Inulin, Calcium Carbonate, Corn Syrup Solids, Fructooligosaccharide (FOS), Silicon Dioxide, Gum Arabic, Tripotassium Citrate, Potassium Chloride, Sodium Chloride, Calcium Phosphate Tribasic, High Amylose Corn Starch, Artificial Flavor (Vanilla), L-Arginine, L-Cystine, Choline Bitartrate, M. Alpina Oil*, C. Cohnii Oil**, Soy Fiber, L-Tryptophan, Magnesium Oxide, Sodium Caseinate (Milk), Sodium Ascorbate, L-Phenylalanine, Maltodextrin, L-Ascorbic Acid, L-Valine, L-Tyrosine, L-Carnitine, Taurine, Ferrous Sulfate, Mono- and Diglycerides, DL-alpha Tocopheryl Acetate, Sucralose§,M-Inositol, L-Histidine, Zinc Sulfate, Niacinamide, Calcium D-Pantothenate, Manganese Sulfate, Cupric Sulfate, Thiamine Chloride Hydrochloride, Pyridoxine Hydrochloride, Riboflavin, Vitamin A Acetate, Ascorbyl Palmitate, Mixed Tocopherols, Folic Acid, Potassium Iodide, Sodium Molybdate, Chromium Chloride, Sodium Selenite, Phylloquinone, D-Biotin, Cholecalciferol, Cyanocobalamin.

Contains: Milk, Soy

* A source of Arachidonic Acid (ARA)

** A source of Docosahexaenoic Acid (DHA)

§ Contains sucralose 14.2 mg/100 mL

KetoCal® 4:1 Liquid - Unflavored and Vanilla

Nutrition Information:

Nutrients	Per 100 mL	Per Tetra Pak (237 mL)
Calories	150	356
Protein, g	3.09	7.32
Carbohydrate, g	1.73	4.10
Fiber, g	1.12	2.65
Soluble, g	0.56	1.33
Insoluble, g	0.56	1.33
Fat, g	14.8	35.1
Saturates, g	2.2	5.2
Monounsaturates, g	8.3	19.7
Polyunsaturates, g	3.7	8.8
Linoleic Acid, mg	3228	7650
α-Linolenic Acid, mg	313	741
DHA, mg	55	131
ARA, mg	55	131
Vitamins		
Vitamin A, IU (mcg R.E.)	264 (79.2)	626 (188)
Vitamin D, IU (mcg)	92.0 (2.3)	220 (5.5)
Vitamin E, IU (mg α T.E.)	2.3 (1.5)	5.5 (3.6)
Vitamin K, mcg	5.6	13.3
Thiamine, mg	0.19	0.45
Riboflavin, mg	0.15	0.36
Vitamin B_6, mg	0.15	0.36
Vitamin B_{12}, mcg	0.17	0.40
Niacin, mg	1.5	3.6
Folic Acid, mcg	28.7	68.0
Pantothenic Acid, mg	0.62	1.5
Biotin, mcg	4.1	9.7
Vitamin C, mg	9.3	22.0
Choline, mg	51.5	122
Inositol, mg	4.1	9.7

Minerals, Trace Elements	Per 100 mL	Per Tetra Pak (237 mL)
Calcium, mg	88.4	210
Phosphorus, mg	88.4	210
Magnesium, mg	22.7	53.8
Iron, mg	1.5	3.6
Zinc, mg	1.2	2.8
Manganese, mg	0.18	0.43
Copper, mcg	120	284
Iodine, mcg	18.5	43.8
Molybdenum, mcg	6.2	14.7
Chromium, mcg	3.2	7.6
Selenium, mcg	7.1	16.8
Sodium, mg	103	244
Potassium, mg	165	391
Chloride, mg	155	367
L-Carnitine, mg	8.3	19.7
Taurine, mg	6.3	14.9

Fiber is not included in calculating the ketogenic ratio.

Ingredients:

Water, Refined Vegetable Oil (High Oleic Sunflower, Soy, Palm), Sodium Caseinate (Milk), Whey Protein Concentrate (Milk), Soy Fiber, Corn Starch, Inulin, CAEM (an Emulsifier), Dipotassium Phosphate, Gum Arabic, Calcium Chloride, M. Alpina Oil*, Magnesium Acetate, Potassium Chloride, C. Cohnii Oil**, Microcrystalline Cellulose, Fructooligosaccharide , L-Ascorbic Acid, Calcium Phosphate Monobasic, Mono and Diglycerides, Trisodium Citrate, Sodium Hydroxide, Choline Chloride, L-Cystine, Calcium Phosphate Dibasic, Propylene Glycol Alginate, Ferrous Lactate, L-Carnitine, Taurine, M-Inositol, L-Tryptophan, Zinc Sulfate, DL-Alpha Tocopheryl Acetate, Soy Lecithin, Niacinamide, Calcium D-Pantothenate, Manganese Sulfate, Ascorbyl Palmitate, Cupric Sulfate, Thiamine Chloride Hydrochloride, Pyridoxine Hydrochloride, Riboflavin, Vitamin A Acetate, Mixed Tocopherols, DL-Alpha Tocopherol, Folic Acid, Potassium Iodide, Chromium Chloride, Sodium Selenite, Sodium Molybdate, Phylloquinone, D-Biotin, Vitamin D_3, Cyanocobalamin.

Unflavored version also contains: Sugar.

Vanilla flavored version also contains: Artificial Flavor, Sugar, Artificial Sweetener: Sucralose, Sodium Hydroxide, Choline Chloride.

*A Source of Arachidonic Acid (ARA)

**A Source of Docosahexaenoic Acid (DHA)

KetoCal® 3:1 Powder

Nutrition Information:

Nutrients	Per 100 g	Per 100 kcal*
Calories	699	100
Protein, g	15.3	2.2
Carbohydrate, g	7.2	1.0
Fat, g	67.7	9.7
Linoleic Acid, mg	12700	1817
α-Linolenic Acid, mg	1481	212
DHA, mg	116	16.6
AHA, mg	116	16.6
Vitamins		
Vitamin A, IU (mcg RE)	1748 (525)	250 (75.1)
Vitamin D, IU (mcg)	508 (12.7)	72.7 (1.8)
Vitamin E, IU (mg α TE)	11.8 (7.9)	1.7 (1.1)
Vitamin K, mcg	55.9	8.0
Thiamine, mg	0.89	0.13
Riboflavin, mg	0.70	0.10
Vitamin B_6, mg	0.70	0.10
Vitamin B_{12}, mcg	1.4	0.20
Niacin, mcg	4900	701
Folic Acid, mcg	140	20
Pantothenic Acid, mg	2.8	0.40
Biotin, mcg	13.9	2.0
Vitamin C, mg	84.0	12.0
Choline, mg	180	25.8
Inositol, mg	153	21.9

Minerals	Per 100 g	Per 100 kcal*
Calcium, mg	760	109
Phosphorus, mg	510	73.0
Magnesium, mg	95.0	13.6
Iron, mg	10.9	1.6
Zinc, mg	7.4	1.1
Manganese, mcg	570	81.5
Copper, mcg	760	109
Iodine, mcg	124	17.7
Molybdenum, mcg	31.3	4.5
Chromium, mcg	26.2	3.7
Selenium, mcg	18.9	2.7
Sodium, mg	287	41.0
Potassium, mg	900	129
Chloride, mg	440	62.9
L-Carnitine, mg	50.0	7.2
Taurine, mg	48.0	6.9

Ingredients:

Refined Vegetable Oils (Palm, Soy, Sunflower), Milk Protein (Casein, Whey), Lactose (Milk), Tricalcium Phosphate, Tripotassium Citrate, Corn Syrup Solids, Potassium Chloride, Calcium Phosphate Dibasic, Magnesium Acetate, Choline Bitartrate, L-Cystine, M. Alpina Oil*, C. Cohnii Oil**, L-Tryptophan, M-Inositol, Ferrous Sulfate, Sodium Caseinate (Milk), Sodium Chloride, Sodium Ascorbate, L-Ascorbic Acid, L-Carnitine, Taurine, Mono and Diglycerides, Zinc Sulfate, DL-alpha Tocopheryl Acetate, Niacinamide, Soy Lecithin, Calcium D-Pantothenate, Cupric Sulfate, Manganese Sulfate, Thiamine Chloride Hydrochloride, Pyridoxine Hydrochloride, Riboflavin, Vitamin A Acetate, Potassium Iodide, Folic Acid, Ascorbyl Palmitate, Mixed Tocopherols, Chromium Chloride, Sodium Molybdate, Phylloquinone, Sodium Selenite, D-Biotin, Vitamin D_3, Cyanocobalamin.

*A Source of Arachidonic Acid (ARA)

**A Source of Docosahexaenoic Acid (DHA)

Complete Amino Acid Mix

Nutrition Information:

Nutrients	Per 100 g
Calories	328
Protein Equivalent, g	82
Fat, g	None
Carbohydrate, g	None
Amino Acids, g	
L-Alanine	3.5
L-Arginine	7.66
L-Aspartic Acid	6.39
L-Cystine	2.4
L-Glutamic Acid	8.17
Glycine	6.0
L-Histidine	4.38

Nutrients	Per 100 g
L-Isoleucine	5.95
L-Leucine	10.22
L-Lysine	7.55
L-Methionine	1.65
L-Phenylalanine	4.5
L-Proline	7.0
L-Serine	4.29
L-Threonine	5.0
L-Tryptophan	2.0
L-Tyrosine	4.3
L-Valine	6.5
L-Glutamine	0.7

Ingredients:

L-Lysine L-Glutamate, L-Leucine, L-Arginine, L-Proline, L-Valine, L-Aspartic Acid, Glycine, L-Isoleucine, L-Threonine, L-Phenylalanine, L-Histidine, L-Serine, L-Tyrosine, L-Alanine, L-Cystine, L-Tryptophan, L-Methionine, L-Glutamine, L-Glutamic Acid.

Liquigen

Nutrition Information:

Nutrients	Per 100 mL	Per 250 mL
Calories	450	1125
Protein Equivalent, g	None	None
Carbohydrate, g	None	None
Fat, g	50	125
Saturated, g	47.1	118
MCT, g	45.4	114
MCT %	96.4	

Minerals	Per 100 mL	Per 250 mL
Calcium, mg	0.30	0.75
Sodium, mg	5.0	12.5
Potassium, mg	0.10	0.25
Chloride, mg	0.10	0.25

Ingredients:

Refined Vegetable Oil (Medium Chain Triglycerides (Palm Kernel and/or Coconut Oil)), Water, Citric Acid Esters of Mono and Diglycerides (Emulsifier), Mono and Diglycerides (Emulsifier), Citric Acid.

Phlexy Vits

Nutrition Information:

Nutrients	Per 7 g packet
Calories	0.2
Protein, g	0.02
Fat, g	None
Carbohydrate, g	0.04
Vitamins	
Vitamin A, IU (mcg R.E.)	2664 (800)
Vitamin D, IU (mcg)	400 (10)
Vitamin E, IU (mg α T.E.)	13.5 (9)
Vitamin K, mcg	70
Thiamin, mg	1.2
Riboflavin, mg	1.4
Vitamin B6, mg	1.6
Vitamin B12, mcg	5
Niacin, mg	20
Folic Acid, mcg	700
Pantothenic Acid, mg	5

Nutrients	Per 7 g packet
Biotin, mcg	150
Vitamin C, mg	50
Minerals	
Calcium, mg	1000
Phosphorus, mg	775
Magnesium, mg	300
Iron, mg	15.1
Zinc, mg	11.1
Manganese, mg	1.5
Copper, mcg	1505
Iodine, mcg	150
Molybdenum, mcg	70
Chromium, mcg	30
Selenium, mcg	75
Sodium, mg	8.8
Potassium, mg	<1.4
Chloride, mg	<0.35

Ingredients:

Calcium Phosphate Dibasic, Magnesium Acetate, Guar Gum, L-Ascorbic Acid, Ferrous Sulfate, Dextrose, Zinc Sulfate, Nicotinamide, DL-Alpha Tocopheryl Acetate, Copper Gluconate, Calcium D-Pantothenate, Manganese Sulfate, Pyridoxine Hydrochloride, Thiamin Mononitrate, Riboflavin, Vitamin A Acetate, Folic Acid, Potassium Iodide, Sodium Molybdate, Sodium Selenite, D-Biotin, Chromium Chloride, Phylloquinone, Vitamin D3, Cyanocobalamin.

Polycal

Nutrition Information:

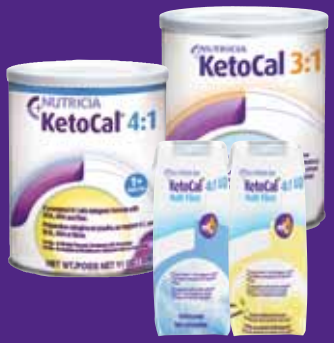
Nutrients	Per 100 g
Calories	384
Carbohydrate, g	96.0
Protein, g	0

Nutrients	Per 100 g
Fat, g	0
Minerals	
Sodium, mg	2.0

Ingredients:

Maltodextrin.

Notes:



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