HANDY GUIDE TO THE MCT DIET
(Medium Chain Triglyceride Diet)

Written by:

Emma Williams MBE – Founder/CEO

&

Val Aldridge – Ketogenic Dietetic Assistant

Approved by Elizabeth Neal RD PhD
Specialist Ketogenic and Research Dietitian
Matthew’s Friends Clinics
Background to the ketogenic diet

There are three main food groups from which the body is nourished:

- **Fats** – e.g. oil, butter, cream, mayonnaise and margarine.
- **Protein** – e.g. meat, fish, poultry, eggs, cheese and milk.
- **Carbohydrates** – e.g. bread, pasta, rice, potatoes, cereals, fruit, vegetables and sugar.

Carbohydrate is broken down (or metabolised) in the body to glucose and this gives the brain energy to function. The body will use glucose as its ‘fuel’ before anything else and usually carbohydrates will be used within a few hours of eating. By contrast, the role of fat is to store energy. If there is inadequate glucose available to fuel the body then it will use fat as an energy source instead of storing it. Fat from the food we eat will be used first; if this is inadequate then the body will start to use fat stores. Metabolising fat to use as energy takes longer than breaking down carbohydrate, which is why we feel fuller for longer after eating a high fat meal. Protein’s main function is to build up the body and maintain / replenish growth with any excess protein being metabolised into glucose.

With a 'normal' diet, we would eat larger amounts of carbohydrate and protein than we would fat. The ketogenic diet however turns this idea on its head by introducing a much higher level of fat than carbohydrate and protein. This type of very high fat, low carbohydrate diet was first described in the medical literature in 1921 as a treatment for epilepsy in children, following other reports of the beneficial effects of fasting on seizure control. The diet was designed to mimic the metabolic changes that occur in the body during starvation. The body will metabolise fat to use for its fuel instead of carbohydrates: muscles and other tissues progressively switch energy source from glucose to free fatty acids which are converted to ketone bodies (acetoacetate and β-hydroxybutyrate); these become the primary fuel source for the brain and other metabolically active tissues in the absence of adequate glucose supply.

This state of ketosis is characterized by rising levels of ketone bodies which can be measured by either urine dipstick or a pin prick blood test (similar to diabetes testing). It is being in ketosis that can stop seizures – although why this happens is still not fully understood and more research is needed.
So to summarize this simply and compare normal and ketogenic diets:

a) On a ‘normal' diet we eat mainly carbohydrates and protein, with some fat, any extra fat is stored.

b) On the ketogenic diet you eat mainly fats, with very little carbohydrate and enough protein to maintain growth.

c) The energy content (calories) of a ketogenic diet is controlled carefully and often slightly restricted.

d) When fat is used / burnt for energy (as fuel), ketones are produced which can be used as the primary energy source in place of glucose.

e) When the body is producing ketones, we know fat is being used for energy.

**Types of ketogenic diet**

Most naturally occurring fats are called triglycerides and usually they are Long Chain Triglyceride (LCT) which is provided from foods such as butter, oil and double cream. The classical ketogenic diet is very high in LCT fats and is based on a ratio of ketone producing foods in the diet (fat) to foods that reduce ketone production (carbohydrate and protein). A 'ketogenic' ratio of at least 3:1 is usually needed for maintenance of a good state of ketosis and optimal seizure control, although this varies between individuals and some will need a lower 2:1 ratio or a higher 4:1 ratio. In a 3:1 diet, 87% of the energy is provided by fat, in a 4:1 diet this increases to 90%. Fat is usually provided from food sources such as butter, mayonnaise, margarine, oil, cream, or a supplement that is available on medical prescription. Protein intake is based on minimum requirements for growth and is generally provided by a high-biological value source at each meal such as meat, fish, eggs or cheese. Carbohydrate is very restricted; starchy foods are not allowed, the main sources being a limited portion of vegetables or fruit.

A different type of fat with a shorter chain length is MCT (Medium Chain Triglyceride) fat. This also occurs naturally, the most abundant food source is coconut oil. The medium chain triglyceride (MCT) ketogenic diet was developed in the 1970s as an alternative to the classical diet. MCT is absorbed and transported more efficiently in the body than other types of fat and will yield more ketones per unit of dietary energy. These increased 'ketogenic' properties of MCT mean less total fat is needed on the MCT diet, allowing more protein and carbohydrate food sources to be included while still achieving a state of ketosis. This enables a wider range of foods to be included within the diet so it looks more like a ‘normal’ diet, for example allowing small amounts of bread, rice, pasta and potatoes. However, as with the classical ketogenic diet, the MCT diet will still involve strict dietary calculation and weighing of all foods.
The traditional MCT diet provided a higher amount of energy from MCT however it led to reports of gastro-intestinal problems in some children, and a modified version with less MCT was suggested. In practice a starting MCT level is now chosen that will allow good ketosis but avoid risk of side effects; this can be increased as needed and tolerated. MCT should be included in all meals and snacks; this is provided from an oil or emulsion, both available on medical prescription. The remaining energy in the MCT diet is provided from carbohydrate, protein and fat from foods. Larger portions of carbohydrate and protein will allow increased choice. A randomized controlled trial of both classical and MCT ketogenic diets was reported in 2008 and did not find either type of diet to be significantly better in terms of efficacy or tolerability, concluding both diets have their place in the treatment of childhood epilepsy.

MCT fat can also be used as a ‘supplement’ with other types of ketogenic diet to achieve a higher level of ketosis and/or allow more carbohydrates to be eaten.

**The MCT ketogenic diet**

"Calculation of a classical diet prescription is based on a ratio of long-chain fat to carbohydrate and protein, usually 3:1 or 4:1. Calculation of the MCT diet prescription is based on the percentages of energy provided from the medium chain fat (MCT), carbohydrate, protein and long-chain fat. The way these calculated prescriptions are translated into meals also differs in the two diets; the classical diet usually uses strict meal recipes, all in the correct ratio, whereas the MCT diet often employs exchanges, which can be more flexible, although ideally should be structured over the day to ensure the correct balance of MCT and long chain fat to carbohydrate and protein at each meal or snack. There has also been a tendency to be more relaxed with the calorie prescription on the MCT diet, although there is little literature evidence for this idea."

*Dr. Elizabeth Neal RD – Matthew’s Friends Paediatric & Research Dietitian*

The dietitian will calculate an individual MCT ketogenic diet prescription, based on energy and protein requirements. You will be required to complete a food diary normally for 3-5 days. Your dietitian will also need your weight and height details and will ask you about your level of activity. From this she will work out approximately how many calories you will need per day. Unfortunately this is not an exact science so there are times when calories may need to be adjusted after a short period on the diet. Whereas the classical diet works on a ‘ratio’, the MCT diet works on percentages – a percentage of the daily energy (calorie) intake must be MCT fat and this can be anything from 30% to 60% (these figures are not set in stone – but your dietitian will calculate the diet where she would like the MCT to start from). The diet will be started at a low MCT content and gradually built up to the level that best suits the individual without any side effects.
The dietitian will calculate all the necessary facts and figures for you and will make sure that this includes the correct amounts of MCT / LCT fat, protein, and carbohydrates which will then be divided into amounts for each meal and snack. From this prescription, the dietitian will then provide the necessary information to follow the diet – this could be by using the EKM (Electronic Ketogenic Manager) to work out recipes, or by the use of Exchange sheets where you have to choose from lists of fats, proteins and carbohydrates. MCT must be included with all meals and snacks. There are different sources of MCT supplement and they are all available to be prescribed by your doctor in the UK:

a) MCT Oil (Nutricia) – a clear oil which you can use as you would most other oils.
b) Liquigen (Nutricia) – this is a white emulsion liquid which can be used in cooking and can easily be mixed with milk/cream or flavoured as a milkshake drink. This is a 50% MCT preparation so if you require 20g of MCT per meal, you would need to use 40g of Liquigen.
c) Betaquik (Vitaflo) – again a white emulsion liquid and this is a 20% MCT preparation. It can be more tolerable to some patients because it has lower level of MCT oil contained in it, but it will mean you need to take more quantity to get the correct level of MCT for your prescription, e.g. If you require 20g of MCT per meal, you would need 100g of Betaquik.

Vitamin and mineral supplementation will also be needed with MCT ketogenic diets due to the restrictions; this will be prescribed by the dietitian after assessment of individual requirements and dietary provision. On-going diets will need careful fine-tuning to achieve optimal results.

Lowering the risk of side effects

There have been frequent reports of MCT causing tummy upsets, cramping and/or vomiting and this can be true if the level of MCT is set too high for the patient or they are not taking the MCT in balance with other foods. Over the years we have found that if you follow some simple steps then the risk of any tummy upsets can be drastically reduced if not eradicated altogether:

- When starting the MCT diet ALWAYS start on low amounts of MCT and build up.
- Spread the MCT supplement out throughout the day with each meal and snack which will produce the ketones steadily throughout the day.
• We would NOT recommend giving MCT on its own – this is when you are more likely to get tummy upsets and a higher risk of vomiting. This is especially true if MCT is given on its own before bed. If a bedtime ‘boost’ is needed then give it with LCT fat in something like milk or use it in a muffin/baked egg custard as a bedtime snack.

*MCT Cheese Muffins*

If a vomit does occur whilst on the MCT diet, we recommend using Bicarbonate of Soda to get rid of any stains and smells. It is one of the most effective methods we have found.

Even though this diet can sometimes have a reputation for causing diarrhoea, research has actually found that constipation can still be an issue and your dietitian will be able to help overcome these types of problems by advising you on the use of high fibre fruits and vegetables, increase of fluids or the appropriate preparation to alleviate constipation.

**How to use the MCT preparations**

The MCT oil can be much easier to use than a MCT emulsion as it will be a smaller quantity and easier to ‘lose’ in a meal. One of the most successful ways of using the MCT oil is in gravy with a small amount of chopped mushrooms, spring onions fried in the oil (which are optional if your carbohydrate allowance does not permit it) with water, a keto friendly stock cube and some herbs added to it: this makes great gravy to use with a variety of meals.

If you can’t use the oil and choose an emulsion preparation then a good way to make it palatable is in Diet Coke, it may sound and look unpleasant but it is probably the best way to hide the taste of MCT in
a drink. Another way of drinking an MCT emulsion is by mixing into milk/double cream with flavourings such as DaVinci Sugar Free Syrups or blended with berries as a smoothie or milkshake.

When frying with MCT oil remember it has a lower flash point than the regular oil we normally use in the kitchen – we recommend that you don’t use a high heat when frying with it as when it burns it can produce a rather unpleasant odour. If you are cooking with an MCT emulsion then again don’t fry it or heat it to boiling point, it will separate and smell unpleasant. We would recommend adding the MCT emulsion to any sauces at the end of their cooking. You can use both types of MCT preparation in muffin or cookie recipes.

The MCT emulsions are excellent to use for quiches, egg custards, omelettes, pancakes, waffles, and sauces. They also mix very well with double cream, for example, with added sweetener and flavouring to make an MCT ice cream or ice lollies. The ice cream can be added to Diet Coke to make an ice cream float. The emulsions can be added to sugar free jelly as a pudding or even some types of yogurts. MCT emulsion mixed with milk and/or double cream heated gently with some sweetener and cocoa powder and/or coffee makes a nice hot drink.

**MCT Chicken Korma**

The emulsions can be added to many everyday ingredients such as:

- Soups
- Milk/Cream to go over breakfast cereals
- Porridge
- Alpro soya desserts (dark chocolate flavour is recommended)
- Soft cheese such as Philadelphia (melted to make a really easy cheese sauce)
- Vinegar (to make a salad dressing)

Some easy MCT recipes can be downloaded from the Matthew’s Friends website and adapted by your own dietitian.

If you have any further suggestions on the use of MCT products in the MCT diet then please send them into us so we can include them in any updates to this ‘Handy Guide’.
Many of our MCT recipes have been developed in the Matthew’s Friends Ketokitchen by our Ketocook Mo. All have our ‘Tried and Tested’ stamp on them so you know that they work. All can be adapted to your own prescription by your dietitian.

Contact Details:
Matthew’s Friends
c/o Young Epilepsy
St. Piers Lane
Lingfield
Surrey RH7 6PW

Telephone: 01342 836571

E-mail: enq@matthewsfriends.org