



*Do NOT undertake any kind of Ketogenic diet without Medical Supervision from a properly trained keto team especially if you are taking Anti-Epileptic Medication as well. Matthews Friends cannot be held responsible if you do not heed this warning and your health could seriously be at risk*

## **TYPES OF KETOGENIC DIET.**

*This document has been edited and approved by the following members of our Matthews Friends Medical Board:*

*Liz Neal – Paediatric Research Dietitian*

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*‘The ketogenic diet, a high fat diet designed to mimic starvation, has been used for the treatment of epilepsy for over eighty years. Although used widely initially, use became less widespread with the development of antiepileptic drugs, but with the awareness that medication may not work, and indeed the profile of their possible side effects, use of the diet has again become prominent. Many of the children with seizures resistant to medication may benefit from the ketogenic diet.*

*The diet originally used was the ‘Classical’ diet, where the primary fat source is long chain triglycerides (LCT) and the diet is calculated on the basis of fat to carbohydrate ratio. Later the medium chain triglyceride (MCT) diet was developed in an attempt to ease implementation and improve tolerability. Evidence from studies suggest that the diet is effective reporting improvement in up to 60% of a drug resistant population, independent of seizure type or age of child. Only one study to date has compared the two ways of giving the diet and shown no difference. Side effects appear minimal and children require monitoring of growth and for renal stones.’*

*Helen Cross - Reader and Honorary Consultant in Paediatric Neurology*

So, to make matters even more confusing for us parents/carers – there is more than one version of the Ketogenic Diet and different centres can use different versions of it. The two main questions for us as parents are:

### **WHICH IS THE BEST? WHICH ONE IS GOING TO SAVE MY CHILD?**

**ANSWER: They all could.**

Below you will find basic details of the 3 main types of the Ketogenic Diet. More information can be found in our medical board section of this site. But before we tackle the ketogenic diet, just a quick recap on....

### **A 'Normal' diet!**

There are 3 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, fruit, vegetables and sugar.

We get our energy (or calories) from eating these foods and most of us eat a lot of carbohydrate – if you are anything like me then quite a bit of it will be in the form of sugar! Some of us try to reduce our fat intake as fat contains more calories than carbohydrates and protein and as we all know there is the continuous 'healthy eating campaign' going on where we are all encouraged to eat as many fruit and vegetables as possible but must at least have '5 a day'.

Carbohydrate when broken down (metabolised) in the body produces glucose and it is this glucose that gives the brain its energy to function. The body will use glucose as its 'fuel' before anything else. Carbohydrates are metabolised by the body quickly and usually carbohydrates will be used within a few hours of eating, which is why we eat them so frequently.

By contrast, the role of fats are to store energy. If there is not enough glucose available to energise the body then instead of the body storing the intake of fat as it would try to do normally, the body will use the fat as its energy source. It will use the fat from the food we eat first and foremost but if the body still doesn't get enough energy from that, then it will start to use any fat stores we have on/in our body. Metabolising fat to use as energy takes a lot longer than breaking down carbohydrate, which is why we feel a lot fuller for a lot longer after eating a high fat meal as opposed to eating a bucket load of lettuce (to feel 'full' on lettuce, you would probably have to eat the entire crop of Cornwall, if you didn't pass out with the boredom first!)

Proteins main function is to build up the body and maintain/replenish growth with any excess being metabolised into glucose as well.

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, much higher level of fat than carbohydrate and protein. You also have to restrict how much food is taken in to ‘mimic’ starvation in the body by reducing its chance to produce its primary energy source - glucose.

The body then has to metabolise the fat to use for its energy instead of carbohydrates, fats are broken down to what is called ‘free fatty acids’, but these cannot pass into the brain to be used as an energy source, however, another product of fat metabolism, ketone bodies, can pass into the brain and these become the primary brain energy source in the absence of glucose.

You can measure the level of ketosis the body is in very easily by either a dipstick/urine test or a pin prick blood test (similar to diabetes testing).

So to summarise this simply and compare normal v Ketogenic diets:

- a) On a ‘normal’ diet we eat mainly carbohydrates and protein, with some fat and any extra fat is stored!
- b) On the Ketogenic diet our kids eat mainly fats, with very little carbohydrate and just enough protein to maintain growth and the calories are restricted.
- c) When fat is used/burnt for energy, ketones are produced which can be used as the primary energy source in place of glucose.
- d) When the body is producing ketones, we know fat is being used for energy.

It is being in this state of ketosis that can stop seizures – although why this happens is still not fully understood and more research is needed.

So let us have a look at the 3 types of diet.....

### **The Classical Ketogenic Diet.**

This is probably the most well known version of the Ketogenic Diet and definitely the one that has been used the most, especially in America, so more data is available for this form of the diet. The basics of this diet are:

Low Carbohydrate (CHO)  
Adequate protein  
High Fat  
Calorie Restricted

Some US centres recommend controlling fluid intake as well. This doesn’t appear to be true of the UK centres generally but some of them MAY use this as a fine-tuning technique.

Below you will find details of how the Classical Ketogenic Diet is calculated and it has been based on the information given by Liz Neal (our Medical Board dietitian from Great Ormond Street Hospital – you will find her original presentation on this subject under the Conference Presentation 2005 heading). Some UK centres MAY do things slightly differently but we are using the GOSH details here as an example for you. Remember though, each child is an individual and every diet will have to be tailored for that particular child – none of the diets is a ‘one fits all’ type of diet.

### ***Initiating the Classical Diet:***

- a) *Establish energy prescription.*** (i.e. how many calories your child will need per day).

You will probably be asked to keep a record of what your child eats for about 3 days. Your dietitian will also need your child's weight and height details and she will ask you about your child's level of activity. From this she will work out approximately how many calories your child 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.

- b) *Establish protein requirements.***

Depending on the age and sex of your child there is a recommended daily allowance for protein in the form of grams per kg of weight, your dietitian will have all these facts and figures and will use these to calculate the right amount of protein for your individual child.

- c) *Choose ketogenic ratio - generally 4:1, and use to calculate fat, protein and CHO allowance over the whole day.***

This is where your dietitian will calculate the diet for your child. She will work out how much fat, carbohydrate and protein your child needs in a day and she will calculate the diet and meal plan based on those needs.

If you would like to see an example of the calculations – you can either find these in the medical presentations on this website OR you can find them in The Ketogenic Diet book (Freeman, Kossoff, Freeman and Kelly, 4<sup>th</sup> Edition).

- d) *Divide into required number of meals/snacks.***

Usually this is 3 meals a day maybe with a snack for school and another before bed (this could be in the form of a milky drink) – but you and your dietitian will discuss your child's needs in greater detail. Some children don't have any snacks and some children have 4 smaller meals calculated for them throughout the day – it can be flexible.

- e) *Work out meal ideas.***

You and your dietitian will discuss your child's likes and dislikes and work out meal plans, which you will be able to follow at home.

Some dietitians will give you set meal plans, with set amounts of foods that you will need to weigh out for your child and in the beginning of the diet this is obviously a very good way of doing things because it eases you and your child into things.

As you get more familiar with the diet, you might want to talk to your dietitian about getting the EKM Ketogenic Calculator – so you are able to make up your own meals from foods that you use everyday. This is something you will need to discuss with your dietitian and you can find out more information about this meal planner on the EKM Section on this website.

***f) Consider necessary supplements.***

This diet is not nutritionally sufficient on its own and it HAS to be supplemented with vitamins and minerals. Your dietitian will give you details of the supplements that will need to be taken and will also monitor these supplements as your child grows.

***g) Medications.***

Your dietitian will look at the medications that your child is currently taking and make sure that they are exchanged (if necessary) to carb free versions.

However, with regard to the dose of medication that your child is taking - this always needs to be discussed with your child's neurologist and **NO CHANGES WHATSOEVER** must be made without full discussion with the neurologist.

You may have also read that this diet is the one that is favoured the most and is the one that is deemed to work more efficiently. I would actually reserve judgement on that last particular statement. We certainly do know a lot more about the Classical diet, that much is true, as it is the one that has been used the most and other versions of the diet have come under some criticism especially when it comes to tolerability – but with the trial results soon to be released from Great Ormond Street, I certainly would not dismiss other versions of the diet and the future may hold a different story – so watch this space.

Which leads us on to the next version of the diet.....

***The MCT Diet (Medium Chain Triglycerides)***

*“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”*

*Liz Neal – Paediatric Research Dietitian*

Most naturally occurring fats are called triglycerides and usually they are Long Chain Triglycerides which take longer to metabolise than carbohydrate and protein as we have already covered earlier. MCT fats also occur naturally, the most abundant source is coconut oil and MCT oil is refined from coconut oil. This type of oil is different because it is metabolised in a different way than LCT fats and a lot quicker too and because of this it produces a lot more ketones. It looks like an ordinary clear oil, although its flashpoint temperature is a lot lower than the LCT oils we normally use in the kitchen – so don't try deep fat frying with the stuff!

The rationale for the MCT diet is that because the MCT oil is more "ketogenic", it is possible to increase the levels of carbohydrate and protein, and still achieve the basic objective of the diet which is the body going into ketosis. The increase in carbohydrates and protein enables a wider range of foods within the diet, and so makes it more "palatable" although we at MF feel that all versions of the diet can be palatable.

Because this oil produces a lot of ketones quicker than LCT fats – this oil is used as a 'supplement' with this version of the Ketogenic diet and it therefore allows more carbohydrates and calories to be eaten whilst still achieving 'ketosis' and hopefully the beneficial effects of that ketosis.

MCT oil MUST be consumed with every meal or snack. Drinking oil is not a wonderful prospect and would put a lot of children off (not surprisingly!) but there is a different, more pleasant way of consuming the necessary MCT oil at each meal and this is in the form of a white liquid 'emulsion' type drink called liquigen (see SHS Ketogenic Products Section on the site) which is virtually flavourless but can be 'jazzed up' with carbohydrate free flavourings (see Recommended Products section on the site) – this turns it into a 'milkshake' type drink and is a very easy way for your child to consume and digest the necessary fat that is required with this type of diet.

### ***Calculating the MCT Ketogenic Diet.***

Once again this information has been taken from Liz Neal's presentation and can be found in the same place, mentioned earlier.

#### ***a) Establish energy prescription***

This is the same method as the classical diet. Some centres allow more calories than the Classical diet, although there is little literature evidence for this.

***b) Choose starting level of MCT in the diet.***

Now 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 dietician will calculate the diet where she would like the MCT to start from).

In the early days of the MCT diet, the percentage of MCT given was high, about 60% and at this level more tolerance issues would occur – children would suffer from stomach cramps, diarrhea and vomiting and THIS is why the MCT diet use to have such a bad name and wasn't used very much.

When the early use of the MCT diet resulted in a lot of intolerance and gave children side effects – Ruby Schwartz developed a more tolerable version of the MCT diet, which is The John Radcliffe version. This version uses 30% of energy from MCT fats with an extra 30% of energy from LCT fats.

*“The John Radcliffe diet is a combination of the classical and MCT diet. When I started my research MCT alone was not well tolerated whereas the classical diet was tolerated. I tried combining the 2 to see if I could get the flexibility of the MCT diet with the tolerability of the classical diet and came up with the MCT diet using both MCT oil and long chain saturated fats”*

*Ruby Schwartz - Consultant Paediatrician*

When Liz Neal started doing the clinical trial at GOSH comparing the two versions of the diet and their efficacy, she started her levels of MCT about half way between the original 60% MCT diet, and the modified 30% energy MCT diet. This reduced the tolerance issues tremendously, but allowed good ketosis and was a flexible approach combining the 2 forms of MCT diet. At Matthews Friends we very much believe that the MCT is a successful version of the diet that can give very good results – after all we have many families that have proved this!

***c) Calculate daily amounts of MCT fat (either in oil or liquigen), other fat, protein and Carbohydrate (CHO)***

Once again we have given examples below, but this is your dietitian's part of things, and she will calculate all the necessary facts and figures for your child and will make sure that your child gets the correct amounts of MCT Fat, protein, and carbohydrates.

With the original MCT diet the daily energy (calorie) allowances would be calculated as follows:

60% of the calories coming from MCT fat, 10% protein, 19% CHO, 11% fat in foods/LCT fats OR 60% energy MCT and 40% as 100kcal food exchanges.

To balance need for good ketosis with need for tolerance, 40-50% MCT fat proved a good starting point, as discussed above.

Therefore 40%/50% of the calories come from MCT fat, 10% Protein (OR increase the protein if the 10% doesn't cover the recommended daily allowance), 15% to 19% Carbohydrate and the remaining is made up from LCT fats.

*Then continue as you would per the classical diet above.*

One thing that has cropped up on the MF forum regarding the MCT version of the diet is that this diet could possibly be better for older children – but this hasn't been proved medically, it has just been discussed amongst some parents for whom the MCT has helped their older children because there is more quantity of food and more flexibility.

If you have any questions on the above then please don't hesitate to contact us or post your questions in our forum

Also please read the Medical Board Section of this site. Questions to our medical board should be sent to [emma@matthewsfriends.org](mailto:emma@matthewsfriends.org)