Guidelines for practical implementation of the ketogenic diet for dietary management of epilepsy and neurometabolic disease

PART 1
These dietary management guidelines:

- Are intended for use as a general aid to implementing the very high fat, low carbohydrate, adequate protein ketogenic diet (KD) in children aged over 1 year, adolescents and adults diagnosed with drug resistant epilepsy or an inherited neurometabolic disorder, for example, Glut-1 Deficiency Syndrome (Glut-1 DS) or Pyruvate Dehydrogenase Deficiency (PDHD), where its use is indicated and evidence based.
- Focus primarily on the dietetic application of the KD, not the clinical management associated with its use.
- Do not relate to the particular challenge of KD implementation in infants i.e. those under 12 months of age. Further guidance from more specialist resources should be sought for this group.

These dietary management guidelines are:

- Only to be used by qualified healthcare professionals.
- Not for use by patients or their parents or carers.
- For general information only and must not be used as a substitute for professional medical advice or treatment.

The information in these guidelines, although accurate and based on current best practice in the UK at the time of publication, is subject to change as use of the KD evolves.

It is the sole responsibility of the Multi-Disciplinary clinical Team (MDT), i.e. a dedicated ‘keto-team’, to ensure patients managed on the KD are suitable to undergo this form of dietary therapy and they undertake and implement all the assessments, procedures, investigations and monitoring required in accordance with locally agreed procedures specific to the intervention.

We advise that you read these guidelines in conjunction with your local and national protocols and general recommendations for the use of the KD in the dietary management of drug resistant epilepsy and neurometabolic disease.

* N.B. The term ‘keto-team’ is a generic description for those healthcare professionals (for example, dietitians, clinicians, nurses) involved in the implementation, follow-up and care of patients on a KD.

Recommended general references for the practical implementation of the KD


N.B. All other references are located in Part 3
1.0 The Ketogenic Diet (KD)
### Overview of the KD

#### Comparison of a typical human diet with the KD

Figure 1 represents the relative proportions of energy from macronutrients typically consumed in the human diet. Intake of a high proportion of carbohydrate in comparison to fat and protein combined results in the production and utilisation of glucose as the major source of fuel for the body when sufficient food is eaten.

In comparison, macronutrient distribution and content is manipulated in the KD so energy from fat significantly predominates over that from carbohydrate and protein combined (Figure 2).

The very high fat content of the KD produces ketones from dietary fatty acids which are used as the main energy source instead of glucose from carbohydrates i.e. the KD is designed to be 'keto-genic' - ketone generating. Provided carbohydrate is restricted, adequate protein included and sufficient fat consumed to meet individual energy requirements, glucose release from muscle and organ breakdown is minimised, in favour of ketone production (Hartman and Rho 2012).

![Figure 1: Typical human diet](image1)

![Figure 2: Ketogenic Diet](image2)

#### History and development of the KD

The response of the body to fasting and starvation is a ‘metabolic shift’ from the production and usage of glucose predominantly from dietary carbohydrates to ketones generated from fat stored in adipose tissue (Figure 3).

Following observations dating back to the 5th century BC by Hippocrates that fasting led to seizure reduction, the KD was designed in the 1920’s to replicate this metabolic process (Wilder 1921, Talbot et al 1927, Talbot 1930).

The KD proved efficacious in the management of epilepsy in children and adults. It was widely used prior to the development of anti-epileptic drugs (AED’s) in the late 1930’s. Then, seen as complex in comparison, its use declined until the early 1990’s when interest in the application of the KD began to re-emerge as an adjunct or alternative to medication (Cross 2013).

#### Metabolic overview of the KD

![Figure 3: Fasting and starvation](image3)

In the liver, beta oxidation of fatty acids produces acetyl-CoA, for conversion to ketones - ketogenesis.

Ketones are transported to organs and tissues via the bloodstream and absorbed into cells. Here they are converted back into acetyl-CoA and then enter the Kreb’s cycle for oxidation in the mitochondria to energy.

N.B. the degree of ketosis achieved via the KD is an individual response to an individual dietary regime. It does not always correlate with successful seizure control or other improvements in well being - both high and low ketone levels can produce equally good results (Hartman and Rho 2012).
There are 5 versions of the KD in clinical use worldwide

**Classical CKD**

**Medium Chain Triglyceride MCTKD**

**Low Glycaemic Index Treatment LGIT**

**Modified Atkins MAD**

**Modified Ketogenic MKD**

Although there are slight differences in the proportions of macronutrients and how each version is calculated and applied, all are very high in fat, low in carbohydrate, provide adequate protein and are designed to achieve ketosis.

Choice and application of the versions of the KD varies by country, keto-team, clinician or dietitian, and is usually based on factors such as history, experience and familiarity of use.

The CKD and MCTKD are the traditional versions of the KD. However over the past decade, development of the 'modified' versions - the MAD, LGIT and MKD - has enabled less prescriptive, more flexible and accessible methods for implementation of the KD whilst still retaining its original efficacy.

The use and application of the KD is evolving to incorporate the different approaches, features and attributes of each of the versions to optimally meet individual requirements and lifestyle (Neal 2012, Wood 2015).

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**The KD has proven efficacy in the dietary management of**

- **Drug resistant epilepsy** - 25 - 30% of all patients with epilepsy fail to respond adequately to AED's (Martin et al 2016). In addition to lack of seizure reduction and control, side effects from medication can contribute towards a poor quality of life.

  Studies on the use of the KD in such cases in children and adults show that approximately 50 - 60% will have a 50% or more reduction in seizures, and in those in whom it is beneficial, 15% will become seizure free (Kossoff 2012).

  The exact mechanism (or mechanisms) by which the KD can be successful in the dietary management of drug resistant epilepsy has yet to be fully elucidated. However, the consumption of a high proportion of daily energy requirements from fat combined with a low intake of carbohydrate appears crucial. It is likely the benefits of the KD, which in addition to control of epileptic symptoms may include, for example, improvements in cognition, sleep, developmental progress and well-being, are due to more than ketosis alone.

- **Inherited neurometabolic disease e.g. Glut-1 DS** - a genetic defect in primary glucose transport via the Glut-1 transporter enzyme across the blood brain barrier reduces its availability as a fuel source within the brain, resulting in seizures, complex movement disorders and global developmental delay. A range of phenotypes from mild to severe are exhibited and the condition is diagnosed from infancy through to adulthood (Pearson et al 2013).

  Glut-1 DS was first described in 1991 by De Vivo and colleagues. This coincided with renewed interest in the KD and its application. The KD is now central to the effective management of Glut-1 DS as the ketones generated are able to enter the brain directly to provide an alternative and efficient energy supply. This promotes brain growth and development in infancy and early childhood, and facilitates more normal neuronal function and symptom control (Klepper 2012).

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**The KD now and in the future**

Renewed interest and use of the KD, together with associated clinical and scientific research, has been gathering momentum up to the present day and looks set to continue into the future (Cross 2013). It has further established the efficacy of the KD in the dietary management of drug resistant epilepsy and neurometabolic diseases and revealed its potential application in cancer and other neurological conditions (Paoli et al 2013).
2.0 The KD in more detail

2.1 Foods used in the KD.

2.2 Comparison of the 5 versions of KD and considerations.
**Food items usually included in the KD**

(always check local product availability, product ingredients and keto-team policy)

- Water and sugar free fluids e.g. carbonated drinks, cordials, squash, herbal teas, coffee.
- Unsweetened soya, coconut or almond milk
- Salt, pepper, carbohydrate-free flavourings, stocks and essences.
- Sweeteners - liquid, powder or tablets, e.g., sucralose, saccharin, stevia - always check labels as some brands contain carbohydrate.
- Fresh and dried herbs and spices.
- N.B. carbohydrate content may be counted in some versions of the KD.

**Other foods that can be incorporated into the KD in measured amounts**

Foods, such as bread, milk, yogurt, pasta and rice, fruit and vegetables can be incorporated into the KD by calculation and weighing or by the use of the Choices system (Part 2). This means that in addition to extending the range and choice of foods, favourite or familiar items can be included as part of meals, snacks and as ingredients in recipes. Although portion sizes will be much smaller than typically eaten in a normal diet, even tiny quantities can aid acceptability, palatability and long term compliance with a KD.

**Foods very high in carbohydrate are avoided in a KD**

- **Foods high in natural or added sugars** e.g. sweets (candies) and chocolate, dried fruit, fruit juices, fizzy drinks and cordials containing sugars, jams, honey, ice cream.
- **Foods high in starch with or without natural or added sugars** e.g. potato chips (french fries) and crisps, cakes, biscuits, puddings, pies and pastry products.

For further details, refer to the ‘Links to useful KD resources’ section in Part 3 of these guidelines, and to the Vitaflo patient resource website https://www.myketogenicdiet.com.
### Key practical references for the specified version of the KD

**History**

- **CKD**: Magrath and Neal 2012, Fitzsimmons and Sewell 2015
- **LGIT**: Developed by Huttenlocher et al. (1971) as a modification of the CKD, using medium chain triglyceride (MCT) oil to replace a proportion of long chain triglycerides (LCT) and take advantage of the greater ketogenic potential of the medium chain fatty acids (MCFAs). (C8 (octanoic) and C10 (decanoic).)
- **MKD**: Fitzsimmons and Sewell 2015, Wood 2016

### Key points

**Traditional**

- A ratio expresses the proportion of fat to protein plus carbohydrate combined. E.g. a 4 to 1 CKD indicates for every 4g of fat there is 1g of protein and carbohydrate combined.
- Although the higher ratios of 4 to 1 and 3 to 1 are potentially the most ketogenic, a lower ratio of 2 to 1 may be as efficacious for seizure reduction (Neal 2012), Janek (2012).
- Once individual daily energy and protein requirements (which form the basis of the dietary prescription and calculation) are determined, the target ratio is chosen.
- The amounts of fat, protein and carbohydrate in grams required are calculated, then divided up evenly into meals and snacks so the ketogenic ratio is the same over the day.

**Modified**

- In comparison to the CKD, the MCTKD permits:
  - Proportionally more carbohydrate and protein to be included
  - Less total fat
  - Enhanced palatability.
- The percentage of total daily energy for LCT, MCT, protein and carbohydrate is used to express macronutrient distribution. 45-70% of energy from MCT is likely to achieve macronutrient distribution 45-50% of energy from LCT, 30-35% of energy from protein and the remaining energy is carbohydrate.
- Individual energy requirements are determined, % contribution from each macronutrient chosen and used to calculate daily amounts of fat (LCT and MCT), protein and carbohydrate in grams, then converted intoChoices (Part 2) and used to construct meals and snacks.

### Comparisons of approximate proportions of dietary energy from fat, protein and carbohydrate

- **Traditional**: Approximately 1.6 to 1.
- **Modified**: Approximately 1 to 1.
## Comparison of the 5 versions of the KD and considerations - macro and micronutrients

### Fat - LCT

- Proportionally, intakes of saturates, mono or polyunsaturates will predominate depending on the particular high fat foods most frequently consumed.
- Prudent inclusion of a variety of sources of LCT from both animals and plants, provides a more balanced mixture of all three types of fatty acids in the context of cardiovascular and metabolic health.

### Fat - MCT

- Once established on diet, MCT can be introduced and used to ‘boost’ ketone production without needing to increase the ketogenic ratio.
- Pure coconut oil consists predominantly of C12. Although it can be classed as a MCFA, C8 and C10 are considered to have the greater ketogenic potential (Bergen et al 1966, Marten et al 2006).
- C8 and C10 are predominant in the MCT oils and emulsions available for clinical use and in any version of the KD these products can be consumed directly, in combination with:
  - For further information, refer to Vitaflo’s ‘Guidelines of use for MCT and betaquik in the Ketogenic Diet.’

### Essential fatty acids (EFA) - omegas 3 and 6

- The ratio of omegas 6 to 3 EFA can be above recommendations.
- Use of different LCT sources provides balance, together with inclusion of small amounts of vegetable oils (e.g. walnut, flaxseed, linseed) and foods (oily fish, fortified eggs, seeds, nuts and green vegetables) naturally high in omega-3 fatty acids.
- EFA’s are not present in MCT and intakes can be low. Although some will be provided via LCT, inclusion of oil and food sources of omega 3 is advised, as per CKD.

### Protein

- For all versions of the KD sufficient protein and essential amino acids must be included to ensure adequate intakes.
- To ensure high ratios diet with low energy requirements.

### Carbohydrate

- Daily carbohydrate intake is influenced by protein and energy needs and diet ratio. E.g. on a higher protein, lower energy, 3 to 1 or 4 to 1 ratio CKD there is less carbohydrate compared to a lower protein, higher energy 2 to 1 ratio. This may influence acceptability and compliance as it affects palatability.
- The quantity of carbohydrate permitted is more generous than the CKD which helps with palatability.

### Micronutrients

- Micronutrient content is inherently low and/or inadequate in all versions of the KD. A comprehensive, daily supplement is advised, or as per keto-team policy.

### Fat - MCT

- MCT is consumed regularly throughout the day e.g. at each meal and bedtime to ensure a steady supply of ketones are generated.

### Carbohydrate

- Very restrictive. Depending on age, 10, 15 or 20g per day initially. After 1 to 3 months this may be increased up to 25g per day if the MAD proves efficacious (Kossoff et al 2015).

### Protein

- A free choice of protein food(s) can be made but moderate intakes are advised, i.e., normal sized portions.
- If eaten to excess, protein foods, due to their high palatability, may replace those providing fat and compromise ketosis.

### Carbohydrate

- Very restrictive but typically a slightly more generous allowance compared to the MAD, especially at diet initiation, e.g. 30–40g per day. Carbohydrate may be adjusted by increasing or decreasing incrementally depending on efficacy.

### Micronutrients

- A comprehensive, daily supplement is advised, or as per keto-team policy.

### Notes

- N.B. The MCFAs C8 and C10 are saturated. However, evidence suggests they have potentially beneficial health effects in comparison to saturated fatty acids with longer chains (Bhavsar & St-Onge 2015).
The patient (non-infant) journey on the KD
3.0 The patient (non-infant) journey on the KD

Drug resistant epilepsy  Neurometabolic disease e.g. Glut-1 DS

Referral to 'keto-team'

Pre-KD nutritional and diet related clinical evaluation

KD inappropriate - discuss further management

KD suitable

Anthropometric and dietetic assessments
KD version chosen and planned to meet individual patient nutritional requirements

Education of patient and / or carers

Implementation of KD for 3 month trial

KD SUCCESSFUL

Regular clinical monitoring and follow-up
Ongoing dietetic review & adjustment of KD to meet individual nutritional patient needs

Glut-1 DS - continue with KD

Drug resistant epilepsy – continue KD for up to 2 years, then consider trial of weaning off and return to normal diet

Seizure control maintained/and/or controlled with medication – continue normal diet

Seizures return and are not controlled with medication – consider resumption of KD

KD unsuccessful
Discontinue KD

Compliance issues, adverse side effects or reduction in efficacy, despite fine tuning on an individual patient basis

Based on Kossoff et al 2009.
4.0 Pre-KD Assessment

4.1 Before starting a KD

4.2 Diet related clinical assessments

4.3 Baseline anthropometric and dietetic assessments

4.4 Choosing a version of the KD
4.1. Before starting a KD

The KD is complex and not without implications for patients and their carers.
It can have side effects.

Before any patient is started on a KD, ensure the following has taken place:

- Discussion between the patient and/or carers and the keto-team about the KD and what it involves.
- Careful assessment and appropriate management of relevant pre-existing clinical issues.
- Prior planning and education for the patient and/or carers and all those involved in their wider care e.g. extended family, teachers, respite staff.
- A commitment has been obtained from the patient and/or their carers and all parties involved that the KD will be tried for at least 3 months. This is the recommended trial period to determine efficacy (Kossoff et al 2009).

Ongoing support for patients on a KD from an experienced keto-team is recommended, and that is easily accessed by them and/or carers on their behalf.

4.2. Diet related clinical assessment

<table>
<thead>
<tr>
<th>Does your patient currently have this?</th>
<th>To consider...</th>
<th>Action BEFORE starting KD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal disorder(s)</td>
<td>GOR may be aggravated by a high fat diet (Kang et al 2004). BUT...</td>
<td>Mandatory assessment by specialist feeding and/or gastroenterology team.</td>
</tr>
<tr>
<td></td>
<td>...including MCT in a KD can lower total fat intake (Neal 2012) and promote gastric emptying (Beckers et al 1992).</td>
<td>Implement recommended strategies and interventions before starting a KD.</td>
</tr>
<tr>
<td>Physical feeding problems</td>
<td>The KD has a soft, semi solid texture due to its high fat content. This consistency can be well suited to those with feeding difficulties.</td>
<td>Ensure they are successful prior to starting the KD.</td>
</tr>
<tr>
<td>Oro-motor impairment causing:</td>
<td>If a frequent meal and snack pattern is normally followed throughout the day due to feeding issues, its continuation will help with achieving and maintaining ketosis on a KD.</td>
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<tr>
<td>• Difficulties with chewing, biting &amp; swallowing.</td>
<td>The high energy density of fat means that relative to a normal diet, ketogenic meals and snacks are much smaller in size.</td>
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<tr>
<td>• Increased aspiration risk.</td>
<td>This reduction in volume may help those who struggle to consume adequate food by facilitating quicker and more efficient feeding and an improved nutritional intake.</td>
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<tr>
<td>• Prolonged feeding times.</td>
<td>The restricted range of foods permissible on the KD may suit fussy eaters.</td>
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<tr>
<td>Behavioural feeding problems</td>
<td>Personal &amp; family food preferences can be incorporated into the KD and may aid compliance and acceptance.</td>
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<tr>
<td>e.g. food refusal, food avoidance,</td>
<td></td>
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<tr>
<td>selective or faddy eater.</td>
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</tbody>
</table>

N.B. If any of these issues continue or develop once on the KD, refer for specialist assessment and advice.
<table>
<thead>
<tr>
<th>Action BEFORE starting a KD</th>
<th>Relevance to the KD</th>
<th>Does your patient currently have this?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advise on using KD compatible foods that are relatively low in carbohydrate yet high in fibre to promote natural laxation e.g. seeds (e.g., flax, chia), berry fruits, avocados and certain vegetables, e.g. spinach, mushrooms, broccoli and cauliflower (see Part 3).</td>
<td>Constipation may affect seizure control (Moezi et al 2015). Fibre intakes are low on the KD due to restricted carbohydrate intakes. Fluid - see below.</td>
<td>Constipation due to immobility, low fibre content of usual diet and/or poor fluid intake</td>
</tr>
<tr>
<td>Advise on, and achieve, appropriate and safe fluid intake.</td>
<td>Low fluid intake is linked to acidosis, constipation and renal stones. Foods high in fat, which comprise such a significant proportion of energy intake, are low in moisture and those that typically contribute water in a normal diet e.g. vegetables and fruits are restricted on a KD, thus inherent fluid content is low.</td>
<td>Inadequate fluid intake due to poor/unsafe swallow Habitual low fluid intake</td>
</tr>
<tr>
<td>Start pre-KD micronutrient supplementation.</td>
<td>The predominant intake of fat, inherently low in micronutrients, combined with restrictive food choices on the KD, increases the risk of nutritional deficiencies, especially long term.</td>
<td>Nutritional deficiency on pre-KD screening e.g. anaemia, hypovitaminosis D</td>
</tr>
<tr>
<td>Ensure the correct diagnosis has been made and that food exclusion is actually required.</td>
<td>All versions of the KD can be given as an exclusion diet, or to meet individual or family dietary choices using preferred and permitted foods.</td>
<td>Food allergies e.g. milk, egg. Food intolerance e.g. lactose, wheat. Coeliac disease</td>
</tr>
<tr>
<td>Correct any deficiencies resulting from food restrictions with appropriate macro and/or micronutrient supplementation.</td>
<td>N.B. Due to the restriction of carbohydrate, quantities of protein foods used in a vegan KD (especially a CKD) e.g. nuts, lentils, beans, soya and quorn, may not provide adequate intakes of the individual essential amino acids needed for normal growth, development and maintenance of body tissues.</td>
<td>Food restrictions, self imposed or cultural e.g. vegetarian, vegan, halal, kosher</td>
</tr>
<tr>
<td>See Part 3.</td>
<td>Ketogenic feeds can be calculated and prepared from commercially available products designed for the KD, or on a modular basis using these and/or locally sourced ingredients.</td>
<td>On full or partial enteral feeding (oral or via a feeding tube)</td>
</tr>
</tbody>
</table>

**Expectations**

 Patients &/or carers need to be motivated and have decided they definitely want to embark on a KD.

The KD doesn't always work, although for some individuals improvements in seizure management and quality of life may be better than anticipated.

As part of the assessment and pre KD preparation process, realistic goals for dietary management and clinical outcomes should be discussed and agreed between the keto-team and patient and/or carers.
4.3. Anthropometric and dietetic assessments

Anthropometric and dietetic assessments aid choice of the most suitable version of the KD for your patient and its implementation. Once established on diet, this initial information acts as a reference point for on-going follow-up.

**Anthropometric assessment**

**Children and adolescents**

- **Weight (kg)**
- **Height (cm)**
- If aged between 1 and 2 years - head circumference (cm)

Optional - calculate Body Mass Index (BMI).
Plot on growth chart along with any historical growth data.
N.B. Children’s growth velocity and expected weight gain may slow on the KD (Nation et al 2014).

**Overweight pre KD**  Some initial weight loss may be beneficial for initiation and maintenance of ketosis at the start of a KD. In children, aim for stabilisation of weight over time to allow for growth once on the KD.

**Underweight pre KD**  Advise on increasing energy intake by adding extra fat into the current diet - both to promote weight gain and to get used to eating more before formally starting the KD.

**Adults**

- **Weight (kg)**
- **Height (m)**

Calculate BMI = \[
\frac{\text{weight in kg}}{\text{height in metres}^2}
\]

**Ongoing anthropometric and dietetic assessment**

- Once on the KD, regular assessment is important for monitoring children’s growth and for those with pre-existing compromised nutritional status, feeding problems and/or impaired mobility and activity levels, to help ensure dietary intake is appropriate.
- If the KD proves efficacious, reduction in the frequency and duration of seizures can significantly impact energy requirements. Likewise, changes in mobility due to progress in development of ambulatory skills and ability will alter individual needs which may increase or decrease over time and be reflected in nutritional status.
- Refer to local policies and keto-team for advice, and Part 2 for specific guidance on the implementation and follow-up of each version of the KD.
Identifies

- Specific details of foods and drinks consumed i.e. those avoided and restricted; textures (important for those with feeding problems), preferred food combinations, flavours, presentations, portion sizes.
- Usual eating and drinking intake, habits and patterns.
- How foods and drinks are prepared, and by whom.
- Sources and availability of foods, eating venues e.g. home and institutions (school, college, respite care), takeaways, cafés, restaurants.

Action points when planning a KD

Include familiar and favourite foods and drinks where possible to aid compliance.

If eating habits are irregular, advise that a consistent daily meal and snack pattern is established pre-KD as this will aid maintenance of ketosis.

Aim to normalise fluid intakes as

- too little is linked to side effects (Part 3)
- or
- if excessive - especially in young children - this may decrease appetite and food intake, affecting the ability to consume the KD properly and achieve ketosis.

Educate and provide information to all involved in preparing foods, drinks and feeding the patient. This is vital prior to starting a KD.

Give information and advice on making correct food and drink choices when eating out and away from home.

Dietetic assessment tools e.g.

- 3-4 day diet diary filled in by the patient and/or carer
- Verbal diet history (previous 24 hours and/or longer retrospective period)
- and/or
- Food frequency questionnaire

For the CKD and MCTKD, detailed and specific information about current nutritional status and usual diet enables estimation of actual daily energy needs (which may differ from those recommended for age) and calculation of quantities of macronutrients for meals and snacks (Fitzimmons and Sewell 2015).

In comparison, for the modified versions of the KD - MAD, LGIT or MKD - pre-diet evaluation may be less formal. Before starting a MAD, a diet history is not typically taken nor body weight noted for adults, as energy intake is not fixed. Encouragement to consume sufficient permitted foods, especially those high in fat, is given in order to satisfy appetite (Kossoff et al 2016).

However, for these versions of the KD, prior insight into usual food intake and eating habits, ability and preferences is prudent, as is anthropometry for children. This information facilitates practical guidance to be given by the keto-team and can help achieve greater success in diet implementation and efficacy (Fitzsimmons 2012).
### 4.4. Which version of the KD might suit your patient?

**Traditional Versions**

<table>
<thead>
<tr>
<th>Are they one who....?</th>
<th>Suggestion</th>
<th>To consider</th>
</tr>
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<tbody>
<tr>
<td>Is a younger child.</td>
<td>CKD</td>
<td>Labour intensive - all foods need weighing and measuring and all meals and snacks need calculating. Lots of fat, very little carbohydrate and protein; meals look small.</td>
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<tr>
<td>Would prefer a structured format and detailed, precise instructions to follow.</td>
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<tr>
<td>Has a poor appetite, can be a fussy or slow eater or self restricts; prefers small meals.</td>
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<tr>
<td>Needs an enteral feed taken orally or via a feeding tube.</td>
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<tr>
<td>Is of any age (children, adolescent and adults).</td>
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<tr>
<td>Would prefer a structured format and detailed, precise instructions to follow.</td>
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<tr>
<td>Likes carbohydrate and protein foods.</td>
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<td>Needs more protein than achieved from a CKD.</td>
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<tr>
<td>Is willing to use the <strong>Choices</strong> system for fat, carbohydrate and protein.</td>
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<tr>
<td>Needs an enteral feed taken orally or via a feeding tube.</td>
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**Modified Versions**

<table>
<thead>
<tr>
<th>Are they one who....?</th>
<th>Suggestion</th>
<th>To consider</th>
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<tbody>
<tr>
<td>Is an older child, adolescent or adult. Needs a less restrictive diet than a CKD or MCTKD i.e. less weighing of foods and more flexibility with food choices and quantities.</td>
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<tr>
<td>They and/or their carers can cope with a less structured KD.</td>
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<td>Eats out or is away from home regularly.</td>
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<td>Wants 'normal sized' and 'normal looking' meals.</td>
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<tr>
<td>Willing to use the <strong>Choices</strong> system for fat and carbohydrate to assist with meal planning and portion sizes from the outset or as an aid to compliance (see Part 2).</td>
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<tr>
<td>LGIT</td>
<td>40 - 60g carbohydrate (including fibre) each day from foods with a GI &lt; 50.</td>
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<tr>
<td>MAD</td>
<td>Very restrictive carbohydrate intake at first.</td>
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<tr>
<td>MKD</td>
<td>Has the potential to be the most 'tailored' to the patient's nutritional and lifestyle requirements by incorporating elements of the other 4 versions of the KD</td>
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**LGIT, MAD, MKD**

- **High fat and strict low carbohydrate intakes are still required.**
- **Level of ketosis achievable may be inadequate for very young children with neurometabolic disease, e.g. Glut-1 DS. The CKD or MCTKD may be preferable.**