KETOGENIC FEEDS: INNOVATION OVER THE YEARS

Here we look at the changing development of ketogenic feeds for the dietary management of drug-resistant epilepsy.

Madeleine Rowan, Clinical Research Manager, Nutricia, on behalf of BSNA

British Specialist Nutrition Association Ltd
bsna

Epilepsy is a common neurological disorder, affecting over 70 million people globally, and is characterised by recurrent seizures.[1] Seizures are a result of abnormal, excessive or synchronous neuronal activity in the brain.[2] Epilepsy affects people of all demographics, but is more prevalent in very young children. First-line treatment of epileptic seizures is through one or more antiseizure medications.[1] However, around one-third of patients do not respond to antiseizure medications and many suffer significant drug-related side effects.[3,4] The ketogenic diet (KD) has been found to be highly efficacious in helping to reduce or stop seizures in these patients.[5-13]

MANAGEMENT OF DRUG-RESISTANT EPILEPSY WITH KETOGENIC DIET THERAPY

Ketogenic diet therapy (KDT) has been around since the 1920s as an alternative treatment option for epilepsy. The classical ketogenic diet is based on a dietary ratio of grams of fat to grams of carbohydrate plus protein of 3:1 or 4:1. While the exact mechanism of KDT in epilepsy is still unknown, the beneficial action is thought to be due to the high-fat and restricted carbohydrate diet mimicking the biochemical response to starvation, when ketone bodies become the main fuel for the brain.[14,15]

There are some common modifications to KDT, such as the medium-chain triglyceride KDT, in which most of the fat in the diet is provided as medium-chain triglycerides, which yield more ketones per kilocalorie of energy than long-chain triglycerides.[16] There is also the modified ketogenic diet (MKD), which is less restrictive than the classical ketogenic diet, as there is no restriction on protein. All therapeutic diets should be carefully planned with a multidisciplinary care team, including a dietitian with specialised knowledge.

NICE Guideline NG217, Epilepsies in children, young people and adults, states that a ketogenic diet under the guidance of a tertiary epilepsy specialist could be considered in people with certain childhood-onset epilepsy syndromes or drug-resistant epilepsy if other treatments have been unsuccessful.[17] A prescribed ketogenic diet must be carefully planned by healthcare professionals with dietetic expertise, as there are many considerations to ensure the patient receives all the nutrients they require within the limits of the diet. Access to KDT is currently limited, as only 26 hospitals are offering KD services across the UK as of August 2024.[18]

INNOVATION

The ketogenic diet is known to be difficult to achieve and maintain due to its restrictive nature. The use of Foods for Special Medical Purposes (FSMPs) has revolutionised the management of the ketogenic diet for individuals with epilepsy.

REFERENCES

Please visit: www.NHDmag.co.uk/article-references.html

Many patients with epilepsy suffer from a range of mental and physical comorbidities and are often partially or fully enterally tube-fed.[19,20] For these patients, suitably formulated ketogenic medical foods are essential to ensure they can safely receive KDT.

Historically, patients were managed using modular feeds. This meant a specialist healthcare professional (HCP) would diligently plan a mix of separate carbohydrate, protein, fat, vitamin and mineral products. This was onerous on the HCP and difficult to adjust for community-based patients, resulting in increased risk of inaccurate calculations for both macronutrients (essential for maintaining ketosis) and micronutrients (essential for maintaining proper nourishment).

In the early 2000s, the first ketogenic formula was created specifically to meet the nutritional needs of patients on KDT. This powder product was a 4:1 ratio of fat to carbohydrate and protein and could be made up easily by HCPs or carers into the required volume, and was suitable for children over one year old. This formula also had adequate levels of vitamins and minerals and so was suitable as a sole source of nutrition for children aged 1-10.

The first clinical trial found that when patients switched from modular feeds to getting 100% of their intake from the ketogenic formula, all patients maintained ketosis and 13% had a reduction in the number of seizures per week.[21] Furthermore, carers found the product convenient and easier to use than modular feeds. Several clinical trials have since confirmed the efficacy of a 4:1 powder in children and adults.[22-26]

Since the first powder ketogenic formula, innovations have developed further, with powders in new ratios of macronutrients being created to support HCPs and patients on different adaptations of KDT, for example, carbohydrate to fat and protein ratios of 3:1 and 2.5:1.

Ketogenic medical foods in liquid and ready-to-eat food formats have also been innovated, offering greater choice for orally-fed patients and greater convenience for all patients by reducing the burden of making up powder products. These products can be consumed as a supplement, a sole source of nutrition or as a key ingredient in homemade meals and snacks. The variety of ketogenic medical foods currently available on the market allows HCPs to tailor KDT to specific patient requirements and preferences.[27]

Products specifically designed for the KDT remove barriers to trying the diet therapy, such as modular feeds or stringent meal planning.[28] These innovative products can be quickly adopted into the diet with HCP guidance and can have positive impacts on the patient within weeks.[21-26] Kossoff (2011) reported that the daily use of an FSMP ketogenic formula during the first month of KDT 'appeared to improve efficacy for the treatment of intractable childhood epilepsy'.[28] Furthermore, a 2025 scoping review of facilitators and barriers to starting and staying on the ketogenic diet for children with epilepsy included the use of ketogenic-specific formulas/products as a facilitator to maintenance of KDT.[29]

PATIENT STORY

At six months of age, Tia was diagnosed with infantile spasms, which can cause severe brain injury.[30] She was started on an antiseizure medication, but her seizures didn't improve very much. Over two years, Tia was moved onto the next medication and then the next, with minimal improvement in her seizures. By this point, Tia was having hundreds of seizures every day. The more she had, her risk of dying from a seizure increased. Tia's mum, Chloe, says, 'I don't think she would be here today if we hadn't tried the [ketogenic] diet.'

It was when her seizures were at their worst that Tia began a prescribed KD, using FSMP formulas and products specifically designed to support the introduction and maintenance of KDT. The first thing that Tia's mum remembers after starting KDT was Tia beginning to laugh again, something she had completely stopped doing. After six weeks of KDT Tia had her first seizure-free day. Tia has now had several years seizure-free.

Chloe concludes, 'Tia has now got a second chance. She is now happy and this is all because of the ketogenic diet. It's also given me a chance to have another shot at being a proper mum, because previously I felt like a carer rather than a mum with a daughter. Now we're like best friends and we get to do things together and it's all because of the diet.'

About the British Specialist Nutrition Association

BSNA is the trade association representing manufacturers of products designed to meet the particular nutritional needs of individuals; including specialist products for infants and young children (including infant formula, follow-on formula, young child formula and complementary foods), medical nutrition products for diseases, disorders and medical conditions, including oral nutritional supplements, enteral tube feeding and parenteral nutrition, as well as companies who aseptically compound chemotherapy, parenteral nutrition and Central Intravenous Additive Services (CIVAS).