

Ketogenic dietary therapy for Enteral Tube Feeding



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Use of an enteral feeding tube to provide all or part of a prescribed ketogenic dietary therapy is indicated in situations where oral intake is not possible. It may also be used to supplement an inadequate oral intake resulting from physical or behavioural eating problems. A ketogenic feed can be used for existing tube fed patients who are to be initiated on ketogenic dietary therapy, or for patients already established on ketogenic dietary therapy who require tube feeding. This may be due to a change in a patient's ability to swallow or acute illness where they may not be able to eat sufficiently. The most common feeding route is directly to the stomach via a nasogastric tube (NGT) (short term use, only) or a gastrostomy/PEG, through the stomach wall (for longer term use), however it is also possible to feed below the stomach directly into the duodenum or jejunum.

Prior to commencing a ketogenic diet via a tube, a full nutritional evaluation must be carried out by the dietitian. This will include assessment of current and past growth, current nutritional intake and route of feeding, bowel function, scope for inclusion of oral feeds and whether swallow has been recently assessed by a speech and language therapist, and review of baseline ketogenic blood biochemistry results. Consideration of nutritional requirements will then enable the dietitian to calculate and advise on an appropriate ketogenic feeding plan.

Ketogenic feeds tend to be devised using the classical ketogenic ratio* system; a mathematical tool used to determine the fat, protein and carbohydrate proportions in ketogenic diets.

*The ketogenic ratio = fat ÷ [carbohydrate + protein combined]

KetoCal (Nutricia), K.Flo (VitaFlo) and KetoVie (Cambrooke) are currently the only ketogenic feed ranges available on prescription in the UK and Ireland. KetoCal is available in a range of formulations with different age groups; as a liquid formulation at 4:1 ratio (age >1 year) and 2.5:1 ratio (for adolescents & adults) and as a powder formulation at 3:1 ratio (can be used from birth) and 4:1 ratio (age >1 year). K.Flo is available in a 4:1 liquid (age >3 years) only. KetoVie is available in a 4:1 liquid (age >3 years) only. The fat composition of these feeds does vary with some only containing long chain triglycerides (LCT) and others a combination with medium chain triglyceride (MCT). These formulae commonly require adjustment of the protein, fat or carbohydrate composition to match the individual ketogenic diet prescription and need regular adjustment along the way based on growth, symptom changes and biochemical monitoring. Fluid is an essential consideration for those following a ketogenic diet and should be considered within a feeding plan.

If there are food allergies, it is possible to devise ketogenic feeds using individual protein, fat and carbohydrate modules, with appropriate vitamin, mineral and trace element supplementation. Blended food diet that is liquidised to pass through gastrostomy tubes is also a possibility for some patients.

Transition from a traditional feed to a ketogenic feeding regime is generally achieved using a stepwise approach over a few days as tolerated. This can be implemented by either introducing the ketogenic feed as a percentage of the existing feed or introducing full ketogenic feeds at a reduced ketogenic ratio. Ketogenic feeds can be given as separate units (bolus feeds) or via a pump over a longer time (continuous feeds), depending on the requirements of the individual and may need adjustments to the feed schedule to improve

tolerance and optimise seizure control. Any feed given directly into the jejunum should always be delivered via a pump over a longer time.

Studies have shown that there is good efficacy and tolerability of ketogenic dietary therapy when provided by the enteral route (1, 2). Calculating the prescription of a ketogenic feed can be simpler for the dietitian and requires less education for families or patients. Due to ease of delivery, ketosis can be easily achieved and errors are less common. However, where possible, oral ability should not be compromised and regimes enabling a combination of enteral feeding and oral meals to suit the capacity and capabilities of the individual are a practical possibility too.

Possible side effects of ketogenic enteral feeding are like those seen within an oral ketogenic diet; however particular consideration should be given to the risk of abdominal problems such as constipation and worsening of any pre-existing gastro-oesophageal reflux. The diet should be monitored in the same way as one taken orally. This will include home measuring of ketone levels in blood or urine, regular weight / height checks, seizure symptom tracking and regular clinic visits for assessment which will also include biochemical monitoring.

References:

1. Kossoff, E.H., McGrogan, J.R. & Freeman, J.M. (2004) Benefits of an all-liquid ketogenic diet. *Epilepsia*, 45, 1163.
2. Hosain, S.A., La Vega-Talbott, M. & Solomon, G.E. (2005) Ketogenic diet in paediatric epilepsy patients with gastrostomy feeding. *Paediatr Neurol*, 32, 81-3.