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Title Page

Blended foods for tube-fed children – a safe and realistic option? A Rapid Review of the evidence.

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Key Words

Blended Diet, gastrostomy, children, young people, enteral, rapid review.

Abstract

With the growing number of children and young people with complex care needs or life limiting conditions, alternative routes for nutrition have been established (such as gastrostomy feeding). The conditions of children and young people who require such feeding are diverse but could relate to problems with swallowing (dysphagia), digestive disorders or neurological/muscular disorders. However, the use of a blended diet as an alternative to prescribed formula feeds for children fed via a gastrostomy is a contentious issue for clinicians and researchers. From a rapid review of the literature, we identify that current evidence falls into three categories: (1) those who feel that the use of a blended diet is unsafe and substandard; (2) those who see benefits of such a diet as an alternative in particular circumstances (for example, to reduce constipation); (3) and those who see merit in the blended diet yet are cautious to proclaim potential benefits due to the lack of clinical research in the area. The review suggests that there may be some benefits to the use of blended diets, although concerns around safety, nutrition and practical issues remain.

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What is known:

- Current national guidelines call for the use of commercial formula to be used over blended food wherever possible.
- There are risks which should be minded when considering using a blended diet, particularly with regards to infection control.
- The desire to nurture and feed is taken away from parents whose children are fed via gastrostomy.

What this review adds:

- There is some evidence of benefits as a blended diet could improve some symptoms of diarrhoea and/or vomiting, and give families control of the development of their child.
- Recent research has suggested that there are concerns over the suitability of blended diet when using new tube equipment, and that such diets are nutritionally variable and imprecise.
- Further high quality, empirical studies are required to understand the benefits, impact and outcomes of blended diets and the experiences of the children and families who use them.

Introduction

This article presents the findings from a rapid review of the available peer-reviewed literature which considers a blended diet^a for children as an alternative to standardised commercial feeds. This is against the backdrop of increasing anecdotal evidence that families are choosing such a diet for their children and finding it beneficial. Health professionals' responses however have been mixed. Most notably the statements from the British Dietetic Association who does not endorse the practice of using blended diets, although guidance

^a We will use the term 'blended diet' throughout to refer to the use of blended food administered through an enteral tube. This is food consisting at least in part of normal solid food or dairy products usually prepared in the home, which is blended to produce a fine puree or liquid and used through the enteral tube. Alternative phrases such as blenderized, liquidised and homebrew have been used.

has been issued^b and some manufacturers of gastrostomy buttons, such as Vygon™, have stated that their equipment can be used for blended diet¹.

Medical practitioners and dieticians support the use of nutritional formula feeds as they contain precise measures of the calories, macronutrients and micronutrients that the child is receiving². Subsequently these feeds are seen to be easily quantifiable, convenient, portable, pasteurised and balanced. Families using nutritional feeds are provided with packaged feeds, a specific time schedule, and a prescribed number of ounces per feeding. However, many families have reported that this approach focuses only on the medical nature of nutrition and increases the separation of the child from the family meal and the feeding relationship that families value².

Although the use of blended diets via gastrostomy are receiving growing support in international literature as an alternative to nutritional formula feeds, their effects have not been well studied or evaluated in the UK. There is an urgent need to address this issue to overcome the risk of families trialling the diet for themselves in the absence of any professional guidance or literature. Importantly, families who have been informed about the potential benefits of a blended diet approach have helped to generate and drive interest, making the push to recognised blended diets user led. It is often the issue of choice that families hold on to, as they chose how to feed their own child. It is hoped that this literature review will highlight key considerations of a blended diet to carers, dieticians and family members.

Aims

The overall aim of this paper will be to review the literature in order to explore research opinion on whether blended diet is a valid alternative to commercial formula for children who are enterally fed via a gastrostomy. There were no limitations put on how this was qualified and included articles explored and reported medical, nutritional and social outcomes and experiences.

^b See: https://www.bda.uk.com/improvinghealth/healthprofessionals/liquidised_feeds

Method

A rapid review method was employed using systematic principles. These will be detailed throughout the following section.

The Supplementary Table on the following page summarises the studies which were included in the review. Figure 1 highlight the methodological approach and the inclusion and exclusion criteria in greater detail.

Search Strategy

See Appendix A for Protocol.

Key databases were searched including PubMed, MEDLINE, CINAHL, PsychINFO and Google Scholar. Searches took place between August and December 2014 and detailed searches were saved. The searches and extractions were verified by additional reviewers.

Inclusion/Exclusion Criteria

Results included peer reviewed journals only where research outcomes are presented.

Inclusion criteria:

- Studies needed to be published in English due to the time-constraints of the review.
- Studies had to explore a blended diet as a real alternative to commercial formula feeds.
- Studies that examined blended diets and gastrostomy care for adults were included if findings were easily transferable to children and young people^c with gastrostomies.
- To be included, studies needed to focus on gastrostomy and consider blended diets as a type of feed. This is important because although there are few studies specifically exploring blended diets, there are studies which consider a blended diet while examining commercial formulas.
- Studies that considered blended diets as an alternative to commercial formula feeds were included.

Studies which did not focus on original research (e.g. literature reviews) were excluded as were articles which were solely theoretical in nature (e.g. did not report outcomes).

^c Children and Young People are aged 0-25 for the purpose of this review.

Data extraction and critical appraisal

A data extraction sheet was used to record the critical appraisal of the selected studies. Data extracted included topic, study design, methodology, outcomes and author's conclusions, limitations and reasons for exclusion if applicable. Throughout the process checking and verification took place by at least an additional two members of the team.

Reporting

Information from the dataset was synthesised into a coherent narrative to address the aims and objectives of the review. Themes were extracted from the data pertaining to experiences and perspectives around the use of blended diets with children and young people with a gastrostomy. These themes were synthesised into a narrative presentation. Although studies often use phrases such as tube-feeding and enteral feeding, and this is reflected in reporting, we are focussing upon feeding via gastrostomy as this is more practically viable.

[INSERT SUPPLEMENTARY TABLE]

Results

Eighteen articles were included in the review and are summarised in the Supplementary Table. Through synthesis of the themes this review explores the current literature on blended diet with regards to: the range of conditions that blended diet is used for; the nutrition value of a blended diet; the impact of a blended diet upon family and issues of choice; difficulties and risks associated with homemade blended diets; and the benefits of homemade blended diets against the shortcomings of formula feeds.

Range of Conditions

Pentuik et al³ explored the possible benefits of a blended diet for children after fundoplication surgery. It was hypothesized that a blended diet may reduce gagging and retching which have been associated with using commercial formula. Another study which focused upon a specific condition was a Croatian study conducted by Kolacek et al⁴. The authors tested whether a modular diet would improve chronic diarrhea in infants less than 1 year of age.

Other studies have explored a wider population of those who require enteral feeding. The participants of Daveluy et al⁵ included those with digestive disorders, neurological and muscular disorders and malignancy. A Polish study conducted by Klek et al⁶ included a significant population of young people (39 were aged 17 or younger) and included a sample of those with neuromuscular swallowing disorders, cancer-related dysphagia and cystic fibrosis.

Nutritional value of blended diets

In general, studies did not specify the recipes of blended diets beyond stating it was home cooked food. Others studies involved recipes tailored to the child's health and the family's traditional foods². However, actual recipes were documented and tested by two studies. Firstly, Kolacek et al⁴ tested a modular diet comprising of boiled mince chicken meat, sunflower oil emulsion, sucrose and cornflower and then compared this to Pregomin formula. Borghi et al⁷ tested several recipes:

- 1- Beef/Chicken with legumes
- 2- As above with: cooked beans, green leaves and eggs
- 3- As above with cow's milk and oils (vegetable, soya bean, corn)

Pentuik et al³ provided a sample menu which could be modified; this included strained meats, plums/bananas, strained pears/applesauce, strained squash/sweet potatoes, infant cereals, oil, yoghurt, corn-starch/sugar, formula/milk. This resulted in 25oz providing 942 calories.

The nutrient composition of feeds prepared from normal food stuffs depends on the nutrient compositions of the foods used⁸. As a result such feeds are variable in their content. Furthermore, these compositions can vary according to the geographical source of the food, the season and stage of maturity when the food was harvested, food processing methods, storage conditions, and cooking methods. Schuitema⁹ argued that it is difficult to meet a patient's nutritional needs using a homemade liquid diet since it will have a much lower calorie density than prescribed feeds and require much larger volume. Older studies¹⁰ also highlighted the inaccuracy of the calorie count for blended food. Novak et al² also adds that when families attempt to produce blended diets on their own the result is quite often inadequate fluid, protein and nutrient intake for the child. It is recommended that with children who have high energy needs such as those with hypertonia, a high calorie formula could be added to their blended feed recipe. Schuitema⁹ suggests that patients' intake of blenderized diets should be carefully monitored along with any outputs (e.g. urine; faeces), weight changes and symptoms. Recent research has suggested however that variation in diet is key to a healthy gut. Claesson et al¹¹ have suggested that the reliance on a single formula may lead to an impoverishment of microbial diversity in the enteric flora, although a formula feed is theoretically nutritionally adequate. It is concluded that use of a single formula could contribute to long-term ill health in the elderly.

Although not exploring the blended diet as such, research has also suggested that commercial formula has links to obesity. Use of blended diet may be more advantageous in this respect¹².

Family impact and Choice

Families reported that preparing blended diets gives them more control in their children's growth and feeding and allowed them to nurture children with a gastrostomy with food that they would give to orally fed children².

Novak et al² suggests that paediatricians should support and encourage families to use blenderized feeds with their children, although this should be guided by professionals. Families question whether one formula, one diet or one recipe could provide all the nutrition needed to maximise health and growth for children with gastrostomy¹³. This sense of

empowerment and taking ownership of care is important to consider with regards to gastrostomy feeding as there is a strong instinct to nurture and to feed children¹⁴. Although studies have not been conducted on the blended diet, research has shown that gastrostomy feeding leads parents to feel like they are no longer nurturing their child¹⁵.

Difficulties and risks associated with homemade blended diets

Studies have highlighted the persistent and negative symptoms associated with the continuous use of commercial nutritional feeds including constipation, diarrhoea, reflux, retching and gut failure associated with both the child and the family's quality of life¹⁶. However, clinical risks associated to the use of blended diets have also been identified in the literature. Importantly, current NICE guidelines state that wherever possible pre-packaged commercial formulas should be used over any enteral feeds that have to be prepared. Such preparation has risk of infection and contamination¹⁷.

The inside diameter of fine bore tubes is small (2–3 mm) and they can easily block because of coagulation of proteins and minerals¹⁸. Feeds therefore need to be non-viscous and free of particles that could block the tube. However, the mean viscosity of blended feeds prepared for the 21 samples in the study by Sullivan et al⁸, was reported to be more than 43 times higher than typical commercial formulas. Consequently, it was felt that some of these samples would not flow easily through nasogastric or nasoenteric feeding tubes and could occlude these tubes. To prevent tube occlusion from a high viscosity formula, rapid feeding by bolus method or the use of large bore feeding tubes was recommended. Sullivan et al⁸ concluded that these methods of feeding were poorly tolerated compared to continuous feeding through a small bore feeding tube. Recent research conducted by Mundi et al¹⁹ has found that homemade blenderised recipes require more force to push through when using the new ENFit adapter which could have implications for using a blended diet with malnourished patients.

When a child starts receiving a blended diet a food intolerance is often unmasked. It is recommended that a child should have had a period of gastrointestinal stability and absence of other major health changes before the blended diet is introduced².

Schuitema⁹ presents a comprehensive list of rules and recommendations to minimise risks when using a blenderized liquid food diet. The list includes the avoidance of mixing additional fibres with liquid diets so that the mixture does not thicken and clog tubes. It is also recommended that in order to prevent bacterial contamination the real food for liquid

diets should be pasteurised. Tubes should be rinsed every 4 hours and homemade feeds should always be enterally administered.

Additionally, Novak² presents essential criteria to help to determine when a blended real food diet can be safely and competently used. This consists of the following points; when child is medically stable and has treated reflux; when appropriate weight or caloric intake is obtained; when motivated care providers with appropriate kitchen facilities are available; when a gastrostomy tube is at least 14 French; when the gastrostomy site is well healed with no infection.

Benefits of homemade blended diets and shortcomings of formulas

Although outside of our inclusion criteria a recent study has indicated that healthcare professionals report positive experiences when using a blended diet²⁰, and there is some evidence highlighting clinical improvements from a blended diet in an American study³. Here a total of 33 children with mean age of 34 months were given a pureed by gastrostomy tube (PBGT) diet in an attempt to improve symptoms, nutrition and hydration. Findings showed that 73% had at least a 50% reduction in symptoms after 2-6 months, no child had worse symptoms and over 50% had increased enteral intake. Similarly, Novak et al² reported a greater volume tolerance and improvements in reflux and constipation when switching from commercial formula to blenderized tube feeding.

If a child has a medical plan allowing them to eventually undergo a transition from tube feeding to oral feeding then blended diets are also thought to facilitate this process by introducing meal planning and by priming the gastrointestinal system².

Conclusion

The limited evidence suggests that a blended diet via gastrostomy might be effective for improving the food intake of those with chronic diarrhoea and those after fundoplication surgery. There is emerging evidence that a blended diet is being used by families who feel it is more effective than formula feeding, yet the evidence base is not established. There is a suggestion however that a blended diet has a wider social benefit, improving the relationship between child and parent and allowing families to become involved with tube-feeding.

This review will help to provide vital guidance for families and professionals in knowing the benefits and risks of using real food blended diets via gastrostomy as an alternative to formula feeds. Findings can also be used to inform policy, practice and further research into safely trialling and evaluating the blended diet with gastrostomy-fed children and young

people and their families. There is also potential for longer term benefits from this review that extend beyond those that are reported, which include empowering families to be together for family mealtimes and improve food sharing which families value so much.

More robust research is now needed to explore the risks, benefits, impact and outcomes of blended diets and the experiences of the children and families who use them. The use of blended diet via gastrostomy is becoming increasingly popular. A stronger evidence base would inform professionals as they advise families, and inform development of standardised guidance to support safe, evidence-based practice.

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INSERT FIGURE 1