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Abstracts Evidence

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The Infatrini range for every infant with faltering growth

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- **Complete nutrition** with sufficient energy, protein and micronutrients[1]
- **Low osmolarity** for better tolerance[2]
- Supported by clinical evidence to show **catch up growth**[3]
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- **Different sizes:** powder in 400 g tin / ready-to-use in 125 and 200 ml bottles or 500 ml OpTri bottle.

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Infatrini is a food for special medical purposes for the dietary management of disease related malnutrition and growth failure and/or malabsorption and/or maldigestion. Use under medical supervision after considering all nutritional options, including breastfeeding. For use from birth to 18 months or up to a weight of 9 kg.

1. Braegger C et al JPGN. 2010; 51: 101-122. 2. Sutphen JL & Dillard VL. Gastroenterology. 1989; 97 (3). 601-604. 3. Clarke SE et al. J Hum Nutr Diet. 2007; 20: 329-39.

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Should high-energy infant formula be given at full strength from its first day of usage?

Evans, et al. J Hum Nutr Diet 2006;19:191-7.
Dietetic Department, Birmingham Children's Hospital, Birmingham, UK.

Introduction

In this study the feeding tolerance of a high-energy (1 kcal/ml) infant formula (HEIF[1]) for infants with faltering growth, weighing 2,5-8 kg, when administered at full strength from day 1 compared with stepwise introduction is evaluated.

Methods

Infants (n=30, aged 2-43 weeks) from a supraregional children's hospital requiring a high-energy formula for faltering growth were randomly allocated to receive either a 1 kcal/ml ready to feed infant formula at full strength from day 1 or the same formula in diluted form, graded to full strength over 3 days. Bowel actions, vomits and volume of feed taken were recorded daily for 2 weeks. At recruitment and after 2 weeks, weight, length, head circumference and mid-upper arm circumference were recorded.

Results

The number of bowel actions in the first 2 days was significantly higher for the full strength group than for the stepwise group (p=0.02); younger infants (<12 weeks) had more bowel actions over the first 2 days on the HEIF at full strength (Spearman's correlation =-0,5; p=0.04); and infants with a total higher energy intake (kJ/kg) had more frequent bowel actions over the first 4 days (Spearman's correlation =0,48; p=0.01). There was no significant difference between groups for growth or vomiting.

A significantly higher number of bowel actions in the first 2 days was observed for the full strength group compared to the stepwise group (p=0,02). Furthermore, there was a correlation between age and bowel action; younger infants (<12 weeks) had more bowel actions over the first 2 days on the HEIF at full strength (Spearman's correlation =-0,5; p=0,04). Also, a correlation was seen between energy intake and bowel action; infants with a total higher energy intake (kJ/kg) had more frequent bowel actions over the first 4 days (Spearman's correlation =0,48; p=0.01). All but one infant gained weight and no significant difference was observed between groups for growth or vomiting.

Conclusions

Infatrini was generally well tolerated in infants <12 months with faltering growth even when administered at full strength from day 1. For younger infants (<12 weeks of age) however, a graded introduction is beneficial, in order to avoid increased bowel frequency.

1. HEIF = Infatrini

Randomised comparison of a nutrient-dense formula with an energy-supplemented formula for infants with faltering growth

Clarke, et al. J Hum Nutr Diet 2007;20:329-39.
Dietetic Department, Birmingham Children's Hospital, Birmingham, UK.

Introduction

Catch-up growth requires an increase in all nutrients. Different methods are used to supplement standard infant formula only with energy for infants with faltering growth. This increases energy density but reduces the percentage of energy derived from protein. Moreover, it increases risks of microbial contamination and errors in feed preparation. In this study the effectiveness of a nutrient-dense formula high in energy and protein (NDF[2]) is compared with an energy-supplemented formula (ESF) in infants with faltering growth.

Methods

49 infants with faltering growth were randomised in an open, parallel, randomised study to receive a ready to feed NDF (4,2 kJ/ml) or an energy-supplemented formula ESF (4,2 kJ/ml) for 6 weeks. Food intake, anthropometry, biochemistry, stool and vomit frequency were collected.

Results

The NDF group provided 10,4% energy from protein compared to only 5,5% in the ESF. There were comparable results between groups in tolerance, feed volumes or energy intakes. The infants in the NDF group (n=26) received 42% more protein and 15-40% more vitamins and minerals. In the ESF group (n=23), blood urea concentration reduced by 50% over the trial period, suggesting a suboptimal protein:energy ratio in the ESF feed. The NDF group managed to retain a normal mean blood urea concentration. Also a higher urinary potassium concentration was seen and the NDF group did not have the significant fall in length z-score seen in the ESF group.

Conclusions

Increasing the energy content and increasing protein and micronutrients should be practiced in infants with faltering growth instead of only increasing the energy content.

Median change in length z-score

	Infarini (NDF)	Supplemented formula (ESF)	Difference (P value)
Both sexes (range) P-value	-0.18 (-1.7 to 1.2) 0.24	-0.28 (-1.3 to 2.1) 0.01	0.30
Boys (range) P-value	-0.16 (0.9 to 1.2) 0.42	-0.80 (-1.2 to -0.3) 0.002	0.02
Girls (range) P-value	-0.24 (-1.7 to 1.0) 0.27	-0.17 (-1.3 to 2.1) 0.77	0.52

2. NDF = Infatrini

Critically ill infants benefit from early administration of protein and energy-enriched formula: a randomised controlled trial

Van Waardenburg, et al. Clin Nutr 2009;28:249-55.
Department of Pediatrics, Maastricht University Medical Centre, Maastricht, The Netherlands.

Introduction

Nutritional support is an important aspect of the clinical management of pediatric intensive care patients. It improves outcomes in physiologic stability. Sufficient nutrient intake is impeded by fluid restriction, gastric intolerance and feeding interruptions. To achieve nutritional targets earlier during admission and a positive nitrogen balance, protein and energy-enriched infant formulas may be helpful.

Methods

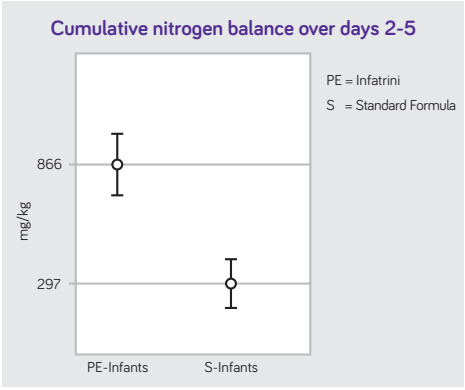
This randomised controlled study involved infants with respiratory failure due to RSV-bronchiolitis admitted to hospital.
The infants were randomised to receive a protein- and energy enriched formula (PE[3]-formula , n=8) or a standard formula (S[4]-formula[3], n=10). The study duration was 5 days after admission and the primary outcomes, nutrient delivery, energy and nitrogen balance and plasma amino acid concentrations. Secondary outcomes were tolerance and safety.

Results

Results showed that the PE fed infants achieved population reference intake (PRI) on day 3-5 whilst S-fed infant PRI was met on day 5 only. Nutrient intakes were higher in PE fed infants and so were cumulative nitrogen balance (cNB) and energy balance (cEB) compared to S-infants (cNB: 866+/-113 vs. 296+/-71 mg/kg; cEB: 151+/-31 and 26+/-17 kcal/kg, both P<0.01). In both groups formulas were well tolerated. Significantly higher concentrations of several essential amino acids, especially the branched chain amino acids were found in the PE-group. In the infants receiving S-formula, the essential amino acid levels were below reference limits.

Conclusions

The use of a protein and energy formula in critically ill infants early at administration promotes a higher and more adequate nutrient delivery and improves energy and nitrogen balance and is well tolerated.



3. PE = Infatrini 4. S = Nutrilon 1

Increased protein-energy intake promotes anabolism in critically ill infants with viral bronchiolitis: a double-blind randomised controlled trial

De Betue, et al. Arch Dis Child. 2011;96:817-22.
Department of Pediatrics, Maastricht University Medical Centre, Maastricht, The Netherlands.

Introduction
Critical illness in children is associated with increased protein breakdown, negative protein balance and adverse clinical outcome. Metabolic stress response and inadequate nutritional intake impede the preservation of nutritional status and growth. In this study the effect of increased protein and energy intake on anabolism is investigated. Primary outcome measures were whole body protein balance. Secondary outcomes included first pass splanchnic phenylalanine extraction (SPE) to assess protein synthesis.

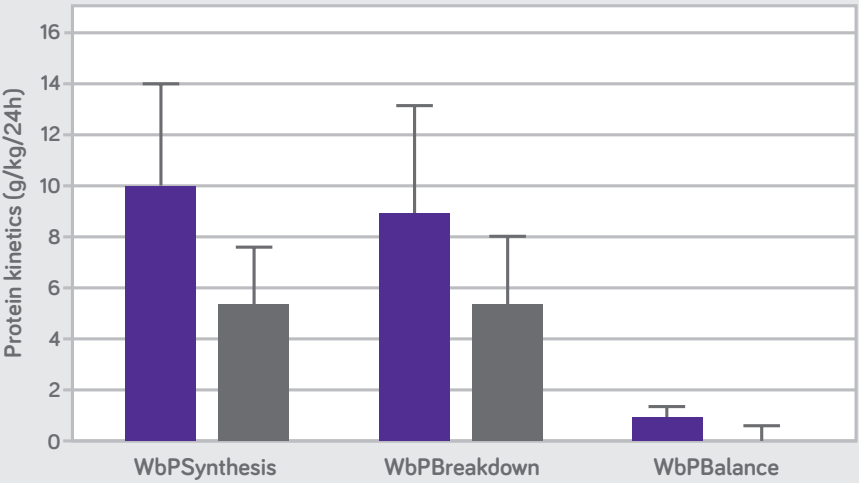
Methods
In this double-blind randomised controlled trial, infants admitted to the paediatric intensive care unit with respiratory failure due to viral bronchiolitis (n=18) received either a continuous enteral feeding with protein and energy enriched formula (PE[5]-formula) (n=8; 3.1±0,3g protein/kg/24 h, 119±25 kcal/kg/24 h) or a standard formula (S[6]-formula) (n=10; 1.7±0,2g protein/kg/24h, 84±15 kcal/kg/24 h. The ranges of energy and protein intakes covered recommended intakes for healthy infants <6 months. Whole body protein metabolism and SPE was determined using a combined intravenous-enteral phenylalanine stable isotope protocol on day 5 after admission.

Results
Despite significantly increased protein breakdown in both groups (PE-formula: 8,9±4,3; S-formula: 5,2±2,6g/kg/24h), infants in the PE-formula group managed to increase their protein synthesis significantly (PE-formula: 9,6±4,4; S-formula: 5,2±2,3g/kg/24h). As a result of this, protein balance was significantly higher in infants with PE-formula compared to S-formula (PE-formula: 0,73±0,5 vs S-formula: 0,02±0,6g/kg/24h). The two groups showed comparable results in SPE (PE-formula: 39,8±18,3%, S-formula: 52,4±13,6%).

Conclusions
Protein anabolism in critically ill infants can be achieved in the first days after admission by increasing protein and energy intakes above reference levels. As the preservation of nutritional status and growth is an important aim in critically ill infants, increased protein and energy intakes should be preferred above standard intakes in these infants.

5. PE = Infatrini 6. S = Nutrilon 1

Rates of protein kinetics (g/kg/24h) in both study groups on day 5



Data are presented as mean ±SD. $p<0.05$. PE-group, protein and energy enriched formula fed group; S-group, standard formula fed group; WbPB, whole body protein breakdown; WbPBal, whole body protein balance; WbPS whole body protein synthesis. WbPS and WbPB were significantly higher in the PE-group than in the S-group. Consequently, a positive WbPBal was achieved in the PE-group, with was significantly higher than in the S-group.

Weight improvement with the use of protein and energy enriched nutritional formula in infants with a prolonged PICU stay

Eveleens, et al. J Hum Nutr & Diet. 2019;32(1):3-10
Department of Pediatrics and Paediatric Surgery, Erasmus University Medical Centre- Sophia Children's Hospital, Rotterdam, The Netherlands.

Background:
In critically ill infants it is difficult to reach an optimal nutritional intake. This study was designed to describe the feasibility of the use of protein and energy-enriched[7] (PE) formula on weight achievement and gastrointestinal symptoms in infants admitted to the paediatric intensive care unit (PICU). Infants received PE-formula for a prolonged period (≥ 14 days).

Methods:
Records from infants admitted to a multidisciplinary PICU and using PE-formula daily for at least 2 weeks were analyzed retrospectively. Changes in nutritional status were determined as the difference between weight-for-age (WFA) Z-scores at start and end of PE-formula use. Tolerance was determined by evaluating gastrointestinal symptoms, including gastric residual volume, constipation and vomiting.

Results:
70 infants with a median [interquartile range (IQR)] age of 76 (30–182) days, with a the PICU duration of 50 (35–83) days were included. PE-formula was used for 30 (21–54) days. Predominant admission diagnoses were post-cardiac surgery, respiratory and cardiac diagnosis. Results showed a significant increase of the mean (SD) WFA Z-score of 0.48 (1.10) (P< 0.001) and a median (IQR) weight gain of 5.80 (3.28–9.04) g/kg/day. In the majority of the infants, an improvement of WFA Z-score was achieved and, overall, PE-formula was well tolerated. The maximum 24-h gastric residual volume was 8.1 mL (IQR = 2.2–14.3) for each 1 kg in bodyweight. 3 infants (4%) were treated for diarrhea and 3 infants were treated for vomiting.

Conclusions:
The majority of critically ill infants receiving protein and energy-enriched formula for a prolonged period gained weight and had an increase in WFA Z-score during PICU admission. Furthermore, signs of gastrointestinal intolerance were sparse during PE-formula use.

7. PE = Infatrini

Peptide nutrient-energy dense enteral feeding in critically ill infants: an observational study

Marino, et al. J Hum Nutr Diet. 2019;32(3):400-408
Department of Dietetics and Speech & Language Therapy, University of Southampton, Southampton, UK

Background:
In critically ill infants, enteral feeding is challenging as fluid restriction, procedural interruption and perceived enteral feeding tolerance complicate intake. Target intakes are often not achieved. The use of a peptide nutrient-energy dense enteral feed[8] (PEF) may improve tolerance and therefore improve nutritional intake and minimize feeding interruptions as a result of gastrointestinal symptoms. The aim of this observational study was to characterize the use of a PEF amongst critically ill infants in two paediatric intensive care units (PICUs).

Methods:
Critically ill infants aged <12 months and with a PICU length of stay (LOS) ≥ 7 days of two paediatric intensive care unit (PICU's) were included in this retrospective study. Their medical records were reviewed on achievement of nutritional targets during the time receiving PEF. Gastrointestinal symptoms, including gastric residual volume, constipation and vomiting, were evaluated as tolerance parameters.

Results:
See table.

Conclusions:
Peptide nutrient-energy dense feeding in infants in two different PICU's with different population and feeding indications is feasible, well tolerated and nutritional targets are met. There may be a role for the use of peptide nutrient-energy dense feed in critically ill infants who are difficult to feed as a result of feeding intolerance and gastrointestinal symptoms. However, with this study design, it is not possible to draw any conclusions regarding the benefit of peptide nutrient-energy dense enteral feed (PEF) over standard polymeric protein-energy dense feed (PE) in critically ill children.

Patient demographics and feeding characteristics of 53 included infants

	PICU 1) (n=25)	PICU 2 (n=28)
Gender, male (%)	17 (43%)	13 (46%)
Age on admission, median	2,6 months	
Weigth on admission	3,9 kg	4,7 kg
Energy intake (interquatile range)	68 (47–92) kcal/kg	90 (63–124) kcal/kg
Protein intake (interquatile range)	1.7 (1.1–2.4) g/kg	2.5 (1.6–3.2) g/kg
Feeding withheld because of feeding intolerance	2 occasions (4%) for 2,5 h	n=2 (7%) for 19,5 h
Gastric residual mean (SD) volumes	3,5 (5.4) ml/kg	16,9 (15.6) ml/kg

8. PEF = Infatrini Peptisorb

Decision tree tubefeed

<18 MONTHS (0-9 KG)

TOLERANCE ISSUES?

- YES
  - 
    Infatrini Peptisorb
- NO
  - 
    Infatrini 125 ml, 200 ml, 500 ml & 400 g

> 1 YEAR (8-20 KG)

ENERGY REQUIREMENTS?

- LOW (0,75 KCAL/ML)
  - with fibres
    - 
      Nutrini Low Energy Multi Fibre
- NORMAL (1,0 KCAL/ML)
  - TOLERANCE ISSUES?
    - YES
      - 
        Nutrini Peptisorb
    - NO
      - with or without fibres
        - 
          Nutrini (Multi Fibre)
- HIGH (1,5 KCAL/ML)
  - TOLERANCE ISSUES?
    - YES
      - 
        Nutrini Peptisorb Energy
    - NO
      - with or without fibres
        - 
          Nutrini Energy (Multi Fibre)

> 7 YEARS (21 À 45 KG)

ENERGY REQUIREMENTS?

- NORMAL (1,0 KCAL/ML)
  - with or without fibres
    - 
      NutriniMax (Multi Fibre)
- HIGH (1,5 KCAL/ML)
  - with or without fibres
    - 
      NutriniMax Energy (Multi Fibre)

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Case studies

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Faltering Growth and Behavioural Feeding Difficulties Following Acute Gastroenteritis

Dr Rosan Meyer, Paediatric Dietitian, London

Clinical Presentation

A 9 month old baby girl (Baby N) was referred to the dietitian for faltering growth reportedly resulting from behavioural feeding difficulties.

History

The history reported by the parents revealed she was born at full term at a weight of 3.48 kg (50th centile) with a length of 51 cm (> 50th centile).
She was exclusively breastfed until 4 months of age when a top-up cow's milk formula was introduced. Baby N was not that keen on the bottle, however with perseverance she accepted 200 ml of formula every night in addition to her breast milk. At 20 weeks of age complementary foods were introduced, following the UK Department of Health guidelines[1], which reportedly went well. At this stage she was receiving only 1 breast feed per day at night and the rest of the nutrients came from the infant formula. Growth continued along the birth centiles.

At 7 months she however became unwell with acute diarrhoea and vomiting, which lasted 10 days. During the acute period she only wanted breast milk and had some rehydration fluid prescribed by the GP. She lost 700 g during this illness and dropped 1 centile in weight; however her length continued to track along the birth centile. Mum was extremely concerned about this weight drop and started to feed her every 2 hours, which was recommended by granny, with either infant formula or some solids, aiming to increase the catch-up weight gain.

Baby N refused the majority of feeds offered, by sealing her mouth and pushing the spoon away. Mealtimes became extended (45-60 min), with her protesting to sit in the high chair and requiring significant distraction to get her to eat any food. Although food intake was low, they still managed to get her to drink 500 ml of formula. A follow-up weight indicated that her weight had dropped further, now to 2 centiles from her previous weight 8 weeks before. The length measurement also indicated 1 centile drop.

The dietitian identified the cycle of events that have led to the feeding difficulty which results in the faltering growth (Figure 1) and identified areas that needed to be addressed to improve the situation. This included the following:

1. Ensuring sufficient energy and protein as recommended by the WHO/FAO/UNO guidelines on catch-up growth[2]
2. Provision of vitamins and minerals that are essential for growth and development[3]
3. Improving feeding routine at home

It was recommended that instead of standard infant formula, an energy dense infant formula (i.e. Infatrini, Nutricia) should be used and the aim volume for the family was set at 500 ml per day (23 kcal/kg additional), in addition to the breast feed at night. This provided an 23 kcal/kg/day, 0.6/kg/day additional protein at an optimal of energy from protein at 10.3%.[2] A multivitamin and mineral supplement was also commenced to provide her with sufficient vitamin D, zinc and iron as well as other micronutrients to support catch-up.[3, 5] Advice on mealtimes was given.

Within 4 weeks of following this regime, weight gain had increased from the 9th to 25th centile. Although Baby N still consumed smaller volumes, she now happily sat in the high chair and would open her mouth for a couple of spoons before wanting to self-feed.

There are many lessons to be learnt from this case study. The first is the occurrence of "behavioural feeding difficulties" in young infants, which according to Rommel et al.[6] is more frequently observed in children > 2 year age and below this age mostly has an organic causes. Five common triggers have been found identified for the development of feeding difficulties, which include:[7,8]

1 Size – i.e. faltering growth
2 Transitioning – i.e. transitioning from puree to lumpy food
3 Organic disease – i.e. chronic or acute illness
4 Mechanistic feeding – i.e. feeding at specific intervals irrespective of hunger or satiety
5 Post traumatic – i.e. a severe event, including choking, anaphylactic reaction

The second lesson is that feeding difficulties often have a medical cause, that may not be chronic, but acts as a trigger.[7] In this case, a common childhood illness (trigger 2), led to growth faltering (trigger 1) which in turn caused a change in feeding practice (trigger 4) and the only way Baby N could signal that this was going against her normal hunger/satiety and also her normal development was to refuse the feeds/food which then in turn became her normal routine.

The last lesson to be learnt is ensuring nutritional adequacy through a simple measure like changing to an energy dense formula, which does not only promote weight gain, but has the added benefit of reducing the anxiety as parents do not need to aim for the same volume as with a standard formula and they know that their child is still receiving sufficient energy, protein at the correct level.

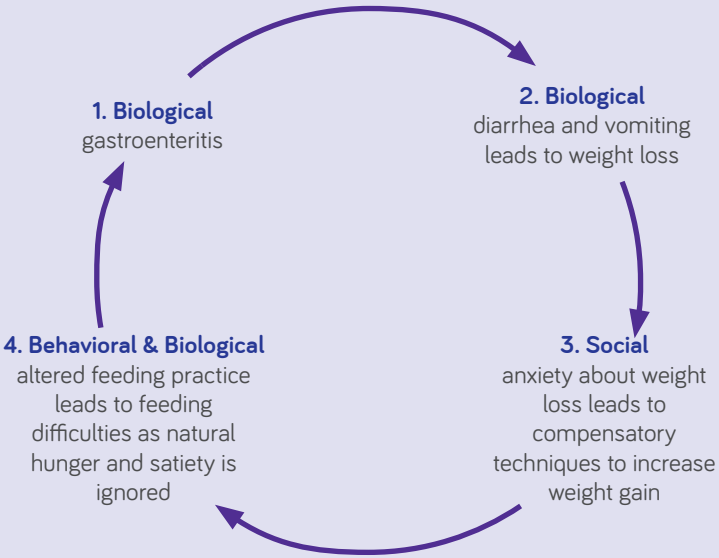

Figure 1: Cycle of biological, social and behavioural events that have led to feeding difficulties and faltering growth

Reference list

1. Department of Health. (2003). Infant feeding recommendation. Available from: http://webarchive.nationalarchives.gov.uk/20120503221049/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4097197
2. Joint WHO/FAO/UNU Expert Consultation. Protein and Amino Acid Requirements in Human Nutrition. World Health Organisation; 2007. Report No.: 935. 1-265 p.
3. Golden MH. Proposed recommended nutrient densities for moderately malnourished children. Food Nutr Bull. 2009; 30 (3 Suppl): S267-S342.
4. Meyer R, Rommel N, Van OL, Fleming C, Dziubak R, Shah N. Feeding difficulties in children with food protein induced gastrointestinal allergies. J Gastroenterol. Hepatol. 2014 29(10):1764-9.
5. Doherty CP, Crofton PM, Sarkar MA, Shakur MS, Wade JC, Kelnar CJ, Elmlinger MW, Ranke MB, Cutting WA. Malnutrition, zinc supplementation and catch-up growth: changes in insulinlike growth factor I, its binding proteins, bone formation and collagen turnover. Clin. Endocrinol. (Oxf) 2002; 57 (3) :391-9.
6. Rommel N, De Meyer A, Feenstra L, Veereman-Wauters G. The Complexity of Feeding Problems in 700Infants and Young Children Presenting to a Tertiary Care Institution. JPGN 2003; 37: 75-84.
7. Levy Y, Levy A, Zangen T, Kornfeld L, Dalal I, Samuel E, Boaz M, Ben DN, Dunitz M, Levine A. Diagnostic clues for identification of nonorganic vs organic causes of food refusal and poor feeding. JPGN 2009 Mar; 48 (3): 355-62.
8. Levine A, Bachar L, Tsangen Z, Mizrachi A, Levy A, Dalal I, Kornfeld L, Levy Y, Zadik Z, Turner Z, et al. Screening Criteria for Diagnosis of Infantile Feeding Disorders as a Cause of Poor Feeding or Food Refusal. JPEN 2011; (52): 563-8.

Faltering growth, GOR and feeding difficulties following severe bronchiolitis and laryngomalacia

Jessica Schram BSc
Senior Paediatric Dietitian, The National Children's Hospital, Tallaght, Dublin, Ireland

Background Information

Baby J was admitted to Tallaght Hospital at 15+4 weeks old with severe bronchiolitis, difficulty feeding and hypotonia. He was born at term by emergency c-section with a birth weight of 2.98 kg (9-25th centile). He had one previous hospital admission at 3 weeks old with stridor. He was diagnosed with laryngomalacia at this time. He was born to a settled traveller family and has one older brother aged 2 years.

Reason for referral

Baby J was referred to the dietetic department during his hospital admission due to poor feeding and faltering growth. On admission he measured 4.85 kg (0.4th centile), 60 cm (9th centile), and had a head circumference of 39.5 cm (9th centile). Baby J was bottle fed from birth on a standard infant formula and there had been no formula changes. During his admission, he was noted to be very slow to feed and had a variable intake from 2-4oz per feed. He had some drooling during feeding and intermittent vomiting. Bowel motions were normal.

Physical examination and investigations

On physical examination Baby J had muscle wasting, loss of subcutaneous fat stores and low central tone. He underwent extensive investigations during his admission including a CT brain, sweat test, metabolics and chromosomal testing, which all returned normal findings. He was diagnosed with feeding difficulties, gastro-oesophageal reflux (GOR) and faltering growth on a background of severe bronchiolitis and laryngomalacia, and poor central tone secondary to poor nutrition. He was assessed by the speech and language therapist who noted a poor lip seal and a risk of aspiration on clear fluids. She advised on improved positioning during feeding and the addition of a thickener to his formula. He was commenced on ranitidine for his GOR.

Dietetic Management

Baby J was commenced on Infatrini on his initial dietetic assessment at 15+5 weeks old. Over the next 7 days, volumes taken per feed ranged from 40-70 ml, totalling 380-420 ml (78-86 ml/kg) of formula daily. He gained 155g that week. As Baby J was slow to feed and unable to achieve the desired intake of Infatrini orally (600 ml initially), a nasogastric (NG) tube was placed to top up to 100 ml Infatrini x 6 feeds. Once he was achieving adequate intake of Infatrini with the help of NG top-ups, Baby J's average weekly weight gain increased to 230 g. In total, he required NG top-up's for a 3 week period. During Baby J's admission weaning was commenced (at 19 weeks old) and he tolerated solids well. The NG tube was removed at 20 weeks old at which time Baby J weighed 5.74 kg (2nd centile) and measured 64 cm in length (25th centile). He was discharged home 1 week later following a 6 week admission with a weight of 5.97 kg, representing a total weight gain of 1.12 kg on Infatrini. His parents were advised to continue 500-600 ml Infatrini/day and to continue to progress with weaning.

Follow-up plan

Baby J returned to the dietetic outpatient department 2 weeks later aged 23 weeks for review. He weighed 6.38 kg (2-9th centile) and measured 65 cm in length (25th centile). He continued to be reviewed regularly in the outpatient department for weight monitoring,

and was also advised on a high protein high calorie meal plan once weaning was fully established. Baby J continued to show good catch up growth, muscle tone improved, and all developmental milestones were achieved. Infatrini was discontinued at 8 months of age when Baby J weighed 7.6 kg (9-25th centile) and measured 69.5 cm in length (25-50th centile). He was reviewed twice more to ensure his weight had not faltered on transition back to a standard infant formula.

Discussion

Laryngomalacia is a congenital softening of the tissues of the larynx. For most infants it is not a serious condition but some infants can experience symptoms including feeding difficulties, gastro-oesophageal reflux and poor weight gain. In this case, Baby J's existing feeding difficulties were exacerbated by bronchiolitis, a viral lower respiratory tract infection which generally affects infants under 12 months of age. This, combined with possible increased energy expenditure due to the increased respiratory effort, contributed to Baby J's growth faltering. Infatrini helped maintain adequate weight gain and achieve timely catch-up growth.

A case of non-specific poor tolerance to a whole protein nutrient dense formula in congenital heart disease

Chris Smith
Senior Paediatric Dietitian, Royal Alexandra Children's Hospital, Brighton, UK

Birth–diagnosis

Dottie was born at term by emergency caesarean section secondary to foetal distress. She had undergone normal ultrasound imaging at 20 weeks with no abnormality detected. Her birth weight was good (3.48 kg, 50th centile), there were no immediate concerns and she was discharged on exclusive breastfeeding. Dottie was admitted to hospital age 3 weeks with concerns related to feeding, including tiredness with feeds, poor volumes taken and noticeable tachypnoea. She struggled with breastfeeding and weight gain had been poor (3.49 kg, 25th centile). She underwent investigation which identified a large inlet muscular ventricular septal defect, posterior deviation of the outlet septum and a small aortic valve (5 mm). The ventricles were balanced, but there was increased pulmonary blood flow with dilated main and branch pulmonary arteries. Dottie remained in hospital for a week of observation and once daily diuretics. Infatrini was introduced as a top-up via nasogastric tube (NGT) to supplement breastfeeding. A breastfeeding specialist confirmed an uncoordinated and weak suck. Advice was given to the mother to optimise feeding, particularly surrounding positioning. She was discharged with a small weight gain, but weight overall had fallen to the 9th centile. Age 2 months. Since starting Infatrini, Dottie's mum had noticed a slightly increased stool frequency (additional 1-2 stools/day) and the stools were noticeably looser. Volumes of feed taken were inconsistent, but on average were <110 mls/kg/day. Feeding times were prolonged (in excess of 60 mins) and breastfeeding had been stopped. Mild reflux symptoms were reported, with inconsistent frequency. Dottie's weight had continued to drop and she was now on the 2nd centile. The decision was made to swap to Infatrini Peptisorb in view of lower than expected weight gain for volume, changes in stool pattern and parental concerns of non-specific "poor tolerance". In the following weeks, her weight gain pattern stabilised on the 2nd centile, but did not significantly improve. However, the family reported more successful feeding times and her stools were firmer. Her surgery was planned for 1 month later.

Age 3 months

Surgery was undertaken at 3 months. Her weight was now tracking the 2nd centile, but she remained underweight in proportion to her head circumference and length (50th centile). Surgery was unremarkable and successful. Discharge weight was 200 g below admission weight and Dottie was discharged with her NGT in place as she had failed to re-establish oral feeds.

Age 4 months

On review, the family reported good re-establishment of regular feeding pattern, but some feed avoidance behaviours remained. Weight had increased to pre-surgery admission weight and centile position (2nd centile). The NGT was repeatedly dislodging, but replacement was becoming distressing for Dottie and despite alternating nostrils the skin around her nose was breaking down. The decision was made to trial oral feeds only. At this stage the volume of Infatrini Peptisorb tolerated was 90-120 mls/kg/day.

Age 5 months

Weaning began around 5 months. This was the family's first child, so the process was discussed by the Dietetic team. In view of her history of bottle aversive behaviours (feeds were still taking over an hour), a joint dietetic and speech and language therapist appointment was arranged. Feeding strategies to promote oral progress were recommended, including messy play and education for the family on positive mealtime outcomes.
Dottie was also seen for routine cardiac review. Echocardiography confirmed a stable VSD patch with no residual shunt, no outflow tract obstruction, normal left ventricular size and function, and a patent aortic arch. The cardiology conclusion was that she had done very well following her surgery and now had a functionally normal circulation. Diuretics were stopped and follow up review was arranged for 6 months' time.

Age 6 months

Weaning was slow to progress. However, it was identified that mum's expectation of a portion of food was quite unrealistic. Further education for the family on weaning foods and expectations was provided. Feed intake was stable and feeding times, reflux symptoms and stool output were all acceptable. These factors combined successfully contributed to an improved weight, now on the 9th centile.

Age 9 months

Dottie had made some progress and was more accepting of bottle feeds and textures. She remained behind with some feeding skills for age (however, this was consistent with a child with early medical intervention), but positive steps with growth were evident. Family anxiety levels were settling coinciding with her weight pattern improvements. Fortification of weaning foods (advised around 7 months) appeared to be associated with a slight increase in weight gain velocity and weight was now >25th centile. This was close to other anthropometric markers on the 50th centile.

Age 11 months

Review showed Dottie's weight gain was very good and she had caught up to her proportional centile (50th). She remained in the early stages of texture acceptance, but variety of foods within her range was very good. The decision was made to discontinue Infatrini Peptisorb and introduce standard infant formula. A telephone review and community weight was organised for 6 weeks later to ensure her growth pattern was maintained

Learning Points

1. Non-specific poor tolerance of a high energy formula in very young children can present an issue in conditions where promotion of weight gain and growth is a priority. Using formulas with characteristics that may have some theoretical tolerance benefits (i.e. hydrolysed proteins, high MCT content) represent another option for Dietitians to support vulnerable groups.

2. Weaning can be a stressful time for new parents and supporting families of cardiac infants is important, especially since these infants are widely recognised to have difficulty feeding. However, weaning is a vital part of ongoing nutritional management. It is therefore essential to communicate with families on topics such as expectations of growth, recovery times and sufficient oral intake.

3. Catch-up growth following early under nutrition and subsequently evolving feeding difficulties can be challenging to manage, and delays in growth recovery are not uncommon. Ongoing support and monitoring is vital especially when using nutrient dense formulas where care is required not to cease too soon or continue feeding for too long.

A case of intolerance to a whole protein formula in a very low birth weight infant

Eilis Shields, Dietitian, Northern Health & Social Care Trust, Northern Ireland

Baby S was born preterm at 30 weeks gestation weighing 1.45 kg (VLBW) by emergency caesarean section with small secundum Atrial Septum Defect (ASD). She spent her first 3 months on continuous positive airway pressure (CPAP) in the neonatal unit. She did not feed well from birth and had periods of requiring nasogastric tube feeding. This was complicated with episodes of vomiting and gastro-oesophageal reflux and therefore weight gain was very poor. During her admission she was changed to a 1.0 kcal/ml nutrient dense whole protein infant formula to improve weight gain and was discharged home on this feed.

At 6 months, she was admitted to the district general hospital with a history of decreased feeding. She was not gaining weight which on admission was 4.3 kg, 0.4th centile (corrected age of sixteen weeks). Her feeds had reduced dramatically to 90 ml/kg/day which caused great anxiety for her parents. She was diagnosed with bronchiolitis.

She was given a trial of an amino acid formula for a number of days. This was changed from continuous to bolus feeding, but there was no improvement in achieving her nutritional requirements or tolerance. Baby S was unable to achieve the target volume of 640 ml/day due to the persistent vomiting. She continued to lose weight on the amino acid formula.

Following discussions with the multidisciplinary team, it was agreed to commence a trial of Infatrini Peptisorb, a ready to use nutritionally complete 1 kcal/ml semi elemental formula, to promote weight gain and improve tolerance. She was initially commenced on a bolus of 115 ml x 5/day, but vomiting continued. It was changed to 50 ml/hr x 6 hours of continuous feeds twice a day and her vomiting stopped quickly.[8]

Baby S is now 9 months old (corrected age of 6.5 months) and her regimen of Infatrini Peptisorb has increased gradually to 117 ml/kg/day (666 kcals and 17.3 g protein) via her nasogastric feeding. She is now also spoon feeding well on stage one family foods 3 times a day and is now gaining weight (100 g/week) and gradually moving closer to the 0.4th m centile. She is having regular reviews to optimise her nutritional status.

Mum is pleased with her progress as she is now gaining weight and is more settled on Infatrini Peptisorb compared to previous feeds. Her vomiting has reduced and she appears to tolerate her new feeding pattern.

Feed intolerance following surgery for intestinal failure

Chris Smith, Dietitian, Royal Alexandra Children's Hospital, Brighton, UK

Baby J was born at 24 weeks gestation with a number of conditions involving the respiratory and gastrointestinal systems. He was born with metabolic bone disease and he suffered from intestinal failure at birth which was resected. This resulted in some malabsorption and also led to severe faltering growth. Initially he was started on a pre-term discharge formula — Nutrilon Nenatal 1 but due to poor tolerance he then commenced on an amino acid formula. However these formulas increased the stoma output and therefore baby J gained little weight on these feeds. At 10 months old, James was started on Nutrilon Pepti MCT and this provided him with 60% of his requirements orally. He also ate solid food and his gastrointestinal tolerance was noted to improve.

At 11 months of age, baby J was started on Infatrini Peptisorb (1.0 kcal/ml) whilst at home. His weight at this stage was 5.69 kg and length 61.1 cm — both of which were on the 0.4th centile. Infatrini Peptisorb was commenced with the aim to improve growth and provide 600 kcal/day (105 kcal/kg) providing him with 87% of his requirements in addition to solid food. He tolerated 450 ml out of the 600 ml prescribed after 2 weeks, and this was greater than the previous feed he was given. The dietitian was happy with this amount as it was 8% higher than Baby J's calculated energy requirements. Weight was taken after 2 weeks and 0.17 kg was gained (5.86 kg) and 0.9 cm gained in length (62 cm), however these remained within the 0.4th centiles.

Baby J's parents and dietitian found Infatrini Peptisorb easy and convenient to use as well as noting improved tolerance to this feed.

Poor weight gain

Grainne Mallon
Senior Paediatric Dietitian, The National Children's Hospital, Tallaght, Dublin, Ireland

Baby S was born at 41/40 by elective caesarian section with a birth weight of 4.4 kg (C98th), but at 6 weeks of age, remained at her birth weight (now C25 – 50th).

At 26 weeks of age Baby S was referred by the Public Health Nurse (PHN) due to concerns over poor weight gain. Her weight was 6.0 kg (C9th) and length was 66 cm (C50th). At 29 weeks of age Baby S was seen by the paediatrician and dietitian in the out-patient department. The growth faltering assessment included FBC, U&E, LFT, serum immunoglobulins, coeliac antibodies, sweat test, urinalysis and stool examination – all of which were negative. There was no family history of note and Baby S was reported to be a healthy infant with only a recent course of antibiotics for a urinary tract infection. She was noted to have poor subcutaneous fat stores and a history of poor bottle feeding was reported by the parents. All developmental milestones were being achieved.

Dietary Assessment

At 29 weeks weight was 6.12 kg (C2 – 9th), length was 66.5 cm (C50th) and head circumference was 42 cm (C25 – 50th). Feeding history was discussed; Baby S was breastfed for 1 week, then formula fed Nutrilon 1 for 3 months. She only took small amounts of formula at feeds and always struggled to meet fluid requirements so was changed to an alternative first formula. Due to ongoing difficulties taking adequate amounts of formula, solids were introduced at 41/2 months. Baby S managed solids well but amounts taken at meals remained small. On assessment, a typical day consisted of 3 small meals and 4 x 120 ml formula. Dietary analysis revealed suboptimal energy and protein intake.

Management

Initial advice given was to fortify solids, increase protein to 2 meals and concentrate formula from 13.5% to 18% (i.e. 90 kcals and 1.8 g protein per 100 ml). Follow up was arranged for 2 months time. At 38 weeks weight was 6.5 kg (falling to C2nd) and length was 70 cm (C50th). Weight had increased 380 g in 9 weeks or approximately 42 g/week which was less than expected weight gain of 50 – 75 g/week. Some increase in solids was noted but formula intake remained poor between 300 - 400 ml per day and it was reported that Baby S did not like the taste of the concentrated feed. As her overall diet remained low in energy and her weight centile had fallen further, Baby S was commenced on Infatrini. The change to a high energy infant formula was well tolerated, with Baby S taking on average of 500 ml Infatrini per day, in addition to 3 meals and 1 – 2 small snacks. Advice on managing mealtimes was also given to parents. An improved rate of weight gain was noted (between 70 – 80 g/week) and parents reported less anxiety regarding Baby S's intake on days when her appetite was reduced. Baby S continued to be followed up every 2 months in out-patient clinic. The table on the right shows growth measures recorded at these visits. When Baby S was 13 months old, she was being offered 3 meals plus 2 – 3 small snacks per day and drinking between 300 – 400 ml Infatrini. Despite her parents' consistency with a mealtime routine and employing behaviour management strategies, Baby S was reported as having good and bad days with food intake. Even on good days Baby S's appetite remained small. At this review Baby S was changed to Nutrini-Drink Multi Fibre (neutral flavour). She had no problems with the change in high energy supplement and took 300 ml per day in addition to 3 fortified meals and snacks in between.

At 17 months Baby S's weight centile had improved from C2 – 9th to C9th and a decision to stop Fortini Multi Fibre was made.

Baby S's weight remained above the 9th centile at 19 months and she was discharged from the dietetic out-patient department.

Discussion

Assessment of infants with faltering growth is a common referral to paediatric dietetic out-patient clinics. In the majority of cases the cause is non organic.

However all children referred for nutrition assessment should be seen by a paediatrician/GP to rule out a medical cause. This case is an example of a baby who experienced growth faltering secondary to inadequate intake which was due to persistently small intakes of both formula and then solids being consumed. Use of a high calorie infant formula (Infatrini) and high energy oral nutritional supplement (NutriniDrink Multi Fibre) were necessary to help prevent further falling of weight centiles and to achieve catch up weight gain.

Summary of growth measurements

Age	Weight	Length
29 weeks / 6 1/2 months	6.12 kg (C 2 - 9th)	66,5 cm (C 50th)
38 weeks / 8 1/2 months*	6.5 kg (C 2nd)	70 cm (C 50th)
45 weeks / 10 months	7.0 kg (C 2 - 9th)	-
49 weeks / 11 months	7.31 kg (C 2 - 9th)	-
13 months**	7.45 kg (C 2 - 9th)	74.5 cm (C 50th)
15 months	8.05 kg (C 9th)	77 cm (C 50th)
17 months	8.45 kg (C 9th)	79 cm (C 50th)
19 months	8.96 kg (C 9th)	81 cm (C 50th)

A case of intolerance to a whole protein feed in a child with multiple cardiac and respiratory issues

Sara MacDonald,
Dietitian, Great Ormond Street Hospital for Children NHS Trust, London, UK

Baby T was born at term with multiple heart and respiratory conditions, including a ventral septal defect, left atrial isomerism, pulmonary stenosis, double outlet right ventricle, laryngomalacia and had been intubated periodically since birth with continuous positive airway pressure (CPAP) respiratory support. He also had a malrotation of the gut, undergoing Ladd's correction in the Paediatric Intensive Care Unit (PICU). He had fed poorly since birth, and tube feeding had been complicated by persistent vomiting, gastro-oesophageal reflux and loose stools.

His birth weight was 3.2 kg (25th centile), but by 1 month of age it had dropped to the 0.4th centile (3.58 kg). Enteral feeding via nasogastric (NG) or nasojejunal (NJ) tube was repeatedly attempted and an energy dense whole protein feed had been trialled. However, baby T had rarely been able to achieve his target nutritional prescription of 570 kcal/ day, due to being fluid restricted, having watery stools, vomiting and generally, poor feed tolerance.

It was felt that due to his severe tolerance problems a ready to use extensively hydrolysed feed was indicated. Infatrini Peptisorb was commenced when baby T was 2 months of age (weight 4.1 kg between 2nd and 0.4th centiles), with an initial prescription of 432 kcal/day (105 kcal/kg) allowed. The feed was given continuously over 24 hours via a NG tube

Improvements were seen in terms of stool consistency shortly after the feed was changed. However, vomiting continued to be a problem and NJ feeding was trialled for a short time during the feed trial.

The prescription of Infatrini Peptisorb increased to 558 kcal/day when he was 3 months of age; his weight had improved to 4.97 kg (2nd centile). He no longer required CPAP at this point and was transferred from PICU to the cardiac unit.

Baby T's tolerance of Infatrini Peptisorb improved compared to his previous feed. His family felt that Infatrini Peptisorb was convenient to use and even said they preferred this to the previous feed.

Baby T continued to receive Infatrini Peptisorb whilst his persistent vomiting remained under investigation.

Feeding intolerance in a child with cystic fibrosis and multiple gastro-intestinal disease

Hilary Colgan,
Dietitian, Our Lady's Children's Hospita!, Crumlin, Dublin, Ireland

Baby K was bom at 37 weeks gestation and her birth weight was 3.08 kg (25th centile). She presented with meconium ileus and peritonitis, and a loop Ileostomy was fashioned on day 1 with a further laparotomy on day 3 for mucous fistula formation. Baby K was subsequently diagnosed with cystic fibrosis. Feeding was commenced immediately following her operation and as no expressed breast milk was available, she was initially fed standard whole protein infant formula as tropic feeding with Parenteral Nutrition (PN) support.

Baby K's necrotic bowel was left insitu as some gut motility was observed intra-operatively, however the remaining functioning gut available was limited, so a diagnosis of short gut syndrome was evident.

As her PN was weaned with oral and nasogastric volumes increasing, her stoma losses escalated. She was changed to Nutrilon Pepti MCT. Due to weight loss, poor feed tolerance and positive stool reducing substances, PN was reintroduced and the concentration of Nutrilon Pepti MCT was decreased, with additional protein and MCT/LCT added. This was done in an effort to reduce the carbohydrate load to the gut. Again baby K had poor tolerance with very elevated stool losses, and remained positive for reducing substances. She was changed to a modular feed and remained reliant on this, in conjunction with PN for a period of 6 weeks.

Her weight increased from 3.69 kg (0.4-2nd centile) to 5.8 kg (25-50th centile) over this period. The aim of increasing carbohydrate and MCT concentrations within her modular feed was to achieve a composition similar to Infatrini Peptisorb. Baby K was transitioned from her modular feed to this energy dense semi elemental formula. Her PN was also discontinued at this time. Baby K continued to achieve good weight status and had excellent tolerance to Infatrini Peptisorb. She had her loop ileostomy reversed and was discharged on full Infatrini Peptisorb feeds. She has been maintained on this and her weight gain has been excellent. Her parents are very satisfied with her progress and tolerance to Infatrini Peptisorb.

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You might still have questions after having read this booklet. Do not hesitate to contact the dieticians of Nutricia Medische Voedings-service. They can also support your patient with complying to the advised nutritional care.

This is a team of specifically trained dieticians, who can support you with your nutritional advice.

Please contact them with your general questions about malnutrition in children, but also with your questions about Nutricia's medical nutrition and medical devices, such as Infatrini, Nutrini, Flocare and metabolic products. The Nutricia Medische Voedings-service is happy to provide, amongst others, practical tips about the usage of the products, information about availability, assortment and reimbursement.

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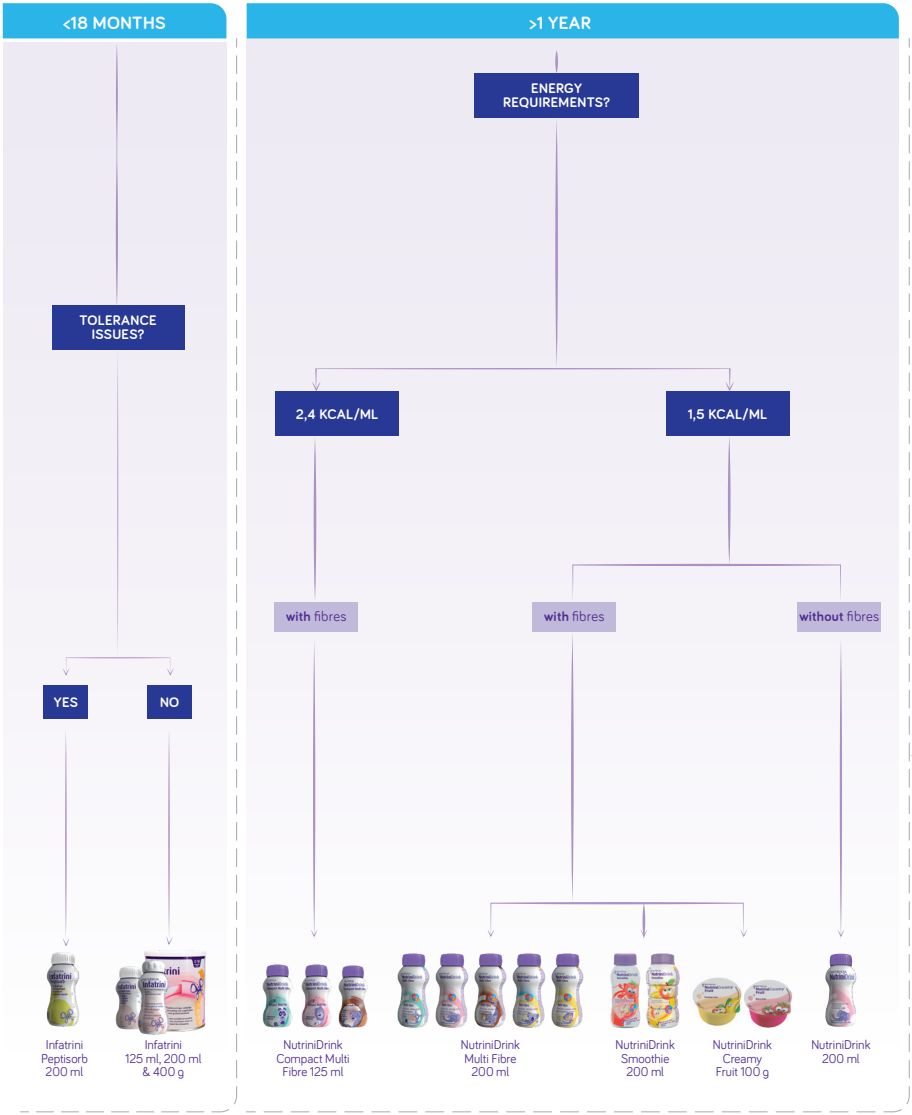

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