NUTRICIA
LIFE-TRANSFORMING NUTRITION

Infatrini and Infatrini Peptisorb

Evidence Booklet

IMPORTANT NOTICE: Infatrini and Infatrini Peptisorb are foods for special medical purposes. They must be used under medical supervision. Infatrini is used for the dietary management of disease related malnutrition and growth failure in infants and young children. It is suitable as a sole source of nutrition for infants from birth and young children up to 18 months of age (or 9kg). Infatrini Peptisorb is used for the dietary management of disease related malnutrition and growth failure in infants and young children with malabsorption and/or maldigestion. It is suitable as a sole source of nutrition under 1 year of age and as a supplement for young children. Refer to labels for details.

FOR HEALTHCARE PROFESSIONAL USE ONLY

Accurate at time of publication: December 2023
CL2234

Contents

Infatrini

Infatrini Peptisorb

Abbreviations

cEB: cumulative energy balance

cNB: cumulative nitrogen balance

EF: formula supplemented with energy

ENDF: energy-nutrient dense formula

FG: faltering growth

HEIF: high energy infant formula

MCT: medium-chain triglycerides

NO: nitric oxide

PICU pediatric intensive care unit

PRI: population reference intake

RTU: ready to use

SIF: standard infant formula

SPE(Phe): splanchnic phenylalanine extraction

SPIF: standard powder infant formula

WbPBalance: whole body protein balance

WbPBreakdown: whole body protein breakdown

WbPSynthesis: whole body protein synthesis

WFA: weight-for-age

***stands for:** statistical significant p values

Medical evidence summary

Infatrini

2006	**Evans S, *et al.*** J Hum Nutr Diet	• Well tolerated in infants with growth faltering <12months • A gradual introduction may be beneficial for infants <12 weeks
2007	**Clarke SE, *et al.*** J Hum Nutr Diet	• Well tolerated • Supports nutrient intake and catch-up growth • Is the preferred option over a supplemented infant formula to support infants with FG
2009	**van Waardenburg DA, *et al.*** Clinical Nutrition	• Well tolerated • Improves energy and nutrient intake vs a SIF
2011	**de Betue CT, *et al.*** Arch Dis Child	• Promotes protein anabolism in the first days after admission vs a SIF • Increased energy & protein intakes are preferable in critically ill infants vs standard intakes
2013	**de Betue CT, *et al.*** Am J Clin Nutr	• Increases arginine availability, nitric oxide and protein synthesis vs a SIF
2013	**Marino LV, *et al.*** e-SPEN Journal	• Taking into account all the hidden costs, ready to use ENDF is more economical vs a fortified powder formula
2017	**Cui Y, *et al.*** Chin J Clin Nutr	• Supports catch up growth • Improves nutritional intake • Well tolerated
2018	**Cui Y, *et al.*** JPEN	• Well tolerated • Faster realisation of nutritional objectives • Achieves positive nitrogen balance sooner (D2 vs D5)
2019	**Zhang H, *et al.*** Nurs Crit Care	• Increases energy intake and reduces the weight loss versus a SIF • Gradual introduction over 3 days may support tolerance
2019	**Eveleens RD, *et al.*** J Hum Nutr Diet	• Well tolerated and supports weight gain in infants with a prolonged PICU stay
2020	**Scheeffer V, *et al.*** JPEN	• Well tolerated and improved weight gain vs a SIF • Potential reduction in length of stay and on duration of antibiotic use
2021	**Zhou H-M, *et al.*** Chin J Contemp Pediatr	• Supports catch up growth • Improves nutritional intake • Well tolerated
2022	**Goday PS, *et al.*** J Parenter Enteral Nutr	• Supports catch up growth • Improves nutritional intake • Well tolerated

Infatrini Peptisorb

2018	**Smith C, *et al.*** Clin Nutr	• Well tolerated • Excellent compliance • Improves energy intake • Supports catch-up growth in a heterogenous group of infants with complex medical needs and FG
2019	**Marino LV, *et al.*** J Hum Nutr Diet	• Well tolerated • Improves weight gain and achievement of nutritional goals • Minimal feeding interruptions due to feeding intolerance

Therapeutic Area

- Faltering Growth
- Congenitial Heart
- Malabsorption/ Maldigestion
- Critically ill

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

Evans S, *et al.* J Hum Nutr Diet 2006; 19: 191-7.

PURPOSE

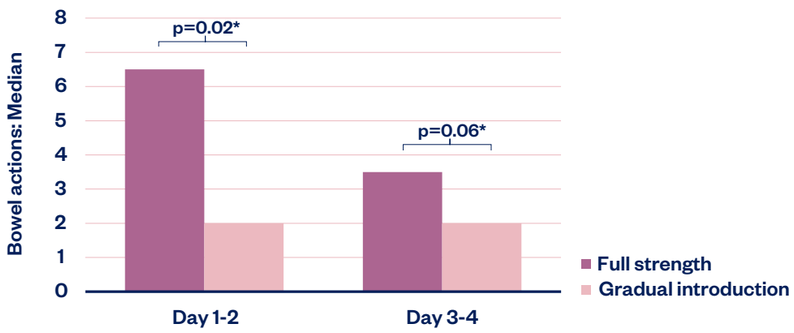
To assess whether an energy-nutrient dense (1kcal/mL) infant formula (ENDF), intended for the nutritional management of infants with faltering growth can be well tolerated at full strength from day 1 versus a gradual introduction.

DESIGN

Thirty infants with a median age of 14.5 weeks were recruited in the study. Inclusion criteria included the age indication (0-12months) and a diagnosis of faltering growth in order for them to be eligible for receiving an ENDF. The infants were assigned at random to either full-strength ENDF from day 1 (n=18) or diluted ENDF which gradually increased to reach full strength by day 3 (n=12). Daily records of volume of feed consumed as well as bowel movements and vomiting episodes were kept for 14 days. Anthropometric measurements (including weight, length, head circumference and mid-upper arm circumference) were taken at baseline and after 14 days.

OUTCOMES

Higher numbers of bowel movements were observed on days 1 and 2 for the group who received the ENDF at full strength versus the gradual introduction group (p=0.02). Additionally, subjects younger than 12 weeks experienced more bowel movements on days 1 & 2 with ENDF at full strength (p=0.04). Finally, there was a correlation between higher total energy intake (kcal/kg) and more frequent bowel movements for days 1-4 (p=0.01). No statistically significant differences between the two groups were seen for growth or vomiting.



CONCLUSIONS

Administering ENDF at full strength from day 1 to infants with faltering growth was found to be generally well tolerated. Infants younger than 12 weeks of age could potentially benefit from a gradual introduction of ENDF to avoid more frequent bowel movements.

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

Clarke SE, *et al.* J Hum Nutr Diet 2007; 20: 329-39.

PURPOSE

Infants with faltering growth are commonly managed by supplementing routine infant formula with added energy. This approach increases energy density but negatively impacts the protein: energy ratio. It further increases the risks of mixing errors in preparing the feeding and of microbial contamination. This trial aimed to evaluate the effectiveness of an ENDF compared to a standard formula supplemented with energy (EF) in infants with growth faltering.

DESIGN

Forty-nine infants with growth faltering were randomised in this open, parallel study that lasted 6 weeks. The test group received ENDF (1 kcal/mL) and the control group received EF (1 kcal/mL). Measures collected included anthropometrics, laboratory values, formula intake, and stool and emesis frequencies.

OUTCOMES

Compared to the EF group, protein intake for the ENDF group was 42% higher, and vitamin and mineral intakes were 15-40% higher. There were no significant differences in feeding volumes, energy intake and in tolerance. Blood urea levels in the EF group dropped by 50% during the trial, indicative of a non-optimal protein: energy ratio. The ENDF group maintained normal blood urea levels, higher urine potassium levels, and did not experience a significant drop in *z*-score for length, as was seen in EF group.

	ENDF group (n=26) (n=14 boys) (n=12 girls)*	EF group (n=23) (n=12 boys) (n=11 girls)*	Difference between groups**
Median change in length z-score			
Both sexes (range) ♀♂	-0.18 (-1.7 to 1.2)	-0.28 (-1.3 to 2.1)	0.3
p-value	0.24	0.01	
Boys sexes (range) ♂	-0.16 (-0.9 to 1.2)	-0.80 (-1.2 to -0.3)	0.02
p-value	0.42	0.002	
Girls sexes (range) ♀	-0.24 (-1.7 to 1.0)	-0.17 (-1.3 to 2.1)	0.52
p-value	0.27	0.77	

*Wilcoxon signed rank test for differences within ENDF group and within EF group.
**Mann-Whitney test for differences between ENDF and EF groups.

CONCLUSIONS

An infant formula enriched in protein and energy that provides appropriate levels of micronutrients where available, should be favored for infants with faltering growth over the practice of adding energy to standard infant formula.

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

van Waardenburg DA, *et al.* Clin Nutr 2009; 28; 249-55.

PURPOSE

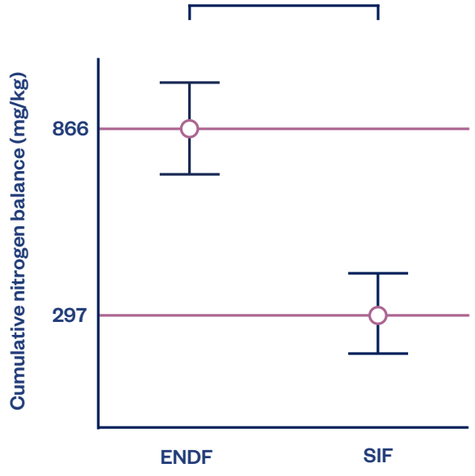
Nutritional support improves outcome in critically ill infants but is impeded by fluid restriction, gastric intolerance and feeding interruptions. ENDF infant formulas may help to achieve nutritional targets earlier during admission and promote anabolism.

DESIGN

Randomised controlled design. Infants with respiratory failure due to RSV-bronchiolitis received an ENDF (n=8) or a or a SIF (n=10) for 5 days after admission. Primary outcome: nutrient delivery, energy and nitrogen balance and plasma amino acid concentrations. Secondary outcome: tolerance and safety.

OUTCOMES

Nutrient intakes were higher in ENDF infants and met population reference intake (PRI) on day 3-5. In SIF infants PRI was met on day 5 only. Cumulative nitrogen balance (cNB) and energy balance (cEB) were higher in ENDF infants compared to SIF infants (cNB: 866 ± 113 vs. 296 ± 71 mg/kg; cEB: 151 ± 31 and 26 ± 17 kcal/kg, both p<0.01). Essential amino acid levels were higher in ENDF infants but within reference limits whereas below these limits in SIF infants. Both formulas were well tolerated.



CONCLUSIONS

Early administration of a protein and energy-enriched formula in critically ill infants is well tolerated, promotes a more adequate nutrient intake and improves energy and nitrogen balance without adverse effects.

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

de Betue CT, *et al.* Arch Dis Child 2011; 96: 817-22.

PURPOSE

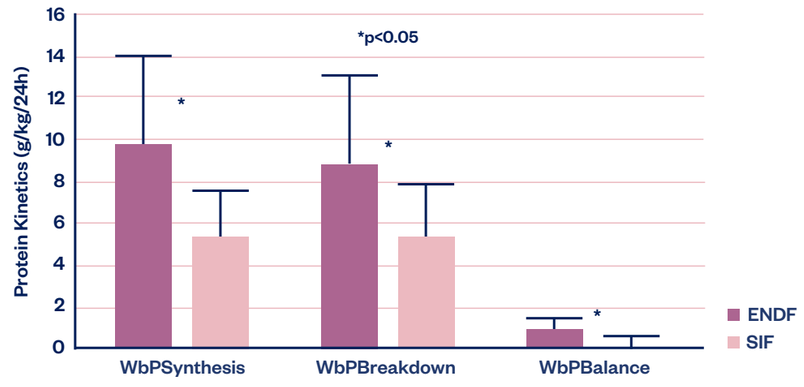
The preservation of nutritional status and growth is an important aim in critically ill infants, but difficult to achieve due to the metabolic stress response and inadequate nutritional intake leading to negative protein balance. This study investigated whether increasing protein and energy intakes can promote anabolism. The primary outcome was whole body protein balance, and the secondary outcome was first pass splanchnic phenylalanine extraction (SPE(Phe)).

DESIGN

A double-blind randomised controlled trial. Infants (n=18) admitted to the pediatric intensive care unit with respiratory failure due to viral bronchiolitis were randomised to continuous enteral feeding with an ENDF (n=8; 3.1 ± 0.3 g protein/kg/24 h, 119 ± 25 kcal/kg/24 h) or a SIF (n=10; 1.7 ± 0.2 g protein/kg/24 h, 84 ± 15 kcal/kg/24 h; equivalent to recommended intakes for healthy infants <6 months). A combined intravenous-enteral phenylalanine stable isotope protocol was used on day 5 after admission to determine whole body protein metabolism and SPE(Phe).

OUTCOMES

Protein balance was significantly higher with ENDF than with SIF (ENDF: 0.73 ± 0.5 vs SIF: 0.02 ± 0.6 g/kg/24 h) resulting from significantly increased protein synthesis (ENDF: 9.6 ± 4.4, SIF: 5.2 ± 2.3 g/kg/24 h), despite significantly increased protein breakdown (ENDF: 8.9 ± 4.3, SIF: 5.2 ± 2.6 g/kg/24 h). SPE(Phe) was not statistically different between the two groups (ENDF: 39.8 ± 18.3%,SIF: 52.4 ± 13.6%).



CONCLUSIONS

Increasing protein and energy intakes promotes protein anabolism in critically ill infants in the first days after admission. Since this is an important target of nutritional support, increased protein and energy intakes should be preferred above standard intakes in these infants.

Arginine appearance and nitric oxide synthesis in critically ill infants can be increased with a protein-energy–enriched enteral formula

de Betue CT, *et al.* Am J Clin Nutr 2013; 98(4); 907-16.

PURPOSE

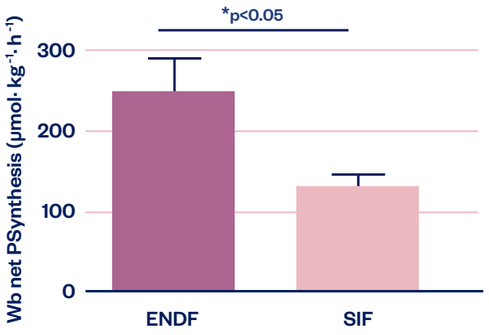
The amino acid arginine is required for protein synthesis and the production of nitric oxide (NO), an important signalling molecule. It is conditionally essential in critical illness, as arginine production does not meet requirements in states of increased metabolic requirements, e.g. severe inflammation. The present study explored if an ENDF, which contains more arginine than a SIF due to the increased protein content, can increase arginine appearance and NO synthesis.

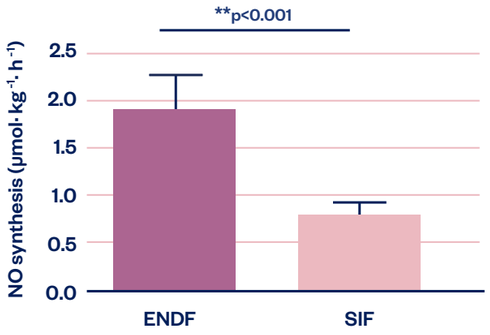
DESIGN

Patients were randomly assigned to receive either the ENDF (Infatrini) or SIF (Nutrilon 1) for 5 days. A 2 hour stable isotope protocol was used to measure arginine kinetics and metabolism. Phenylalanine and tyrosine tracers were used to assess whole body protein synthesis.

OUTCOMES

The stable isotope tracer protocol was conducted in 18 patients (n=8 ENDF, n=10 SIF). Both formulas were well tolerated. Energy, protein and arginine intakes were significantly higher in the ENDF group. Arginine appearance and NO synthesis was found to be significantly higher with the ENDF group compared to the SIF group (p=0.003). Whole body protein synthesis and net whole body protein synthesis (whole body protein synthesis – whole body protein breakdown) were also significantly higher in the ENDF group (figure 1).





CONCLUSIONS

This study demonstrates that arginine availability can be increased in critically ill infants with the use of ENDF. In addition to increased arginine appearance and NO synthesis, the ENDF increased protein turnover, synthesis and breakdown, achieving an anabolic state in these infants despite severe acute illness.

Cost comparison between powdered versus energy dense infant formula for undernourished children in a hospital setting

Marino LV, *et al.* ESPEN J 2013;8; e145-9.

PURPOSE

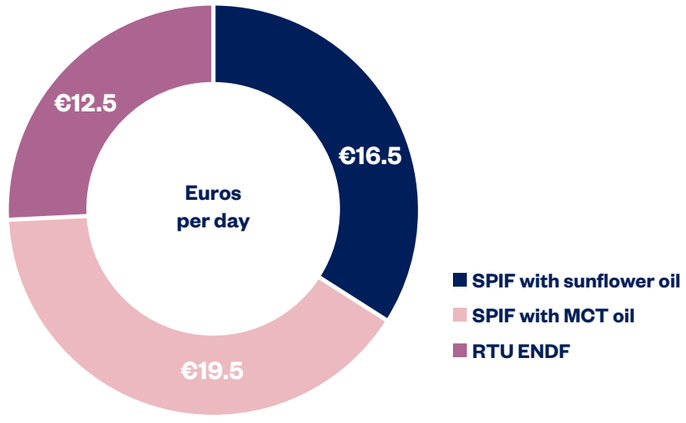
In 2005 a range of ready to use infant formulae (RTU) were launched in South Africa. Previously standard powder infant formulae (SPIF) were fortified with different modules (i.e MCT oil, sunflower) to increase energy. This raised a debate in regards to costs associated to these 2 feeding protocols. This study aimed to analyze the full costs for both models of feeding to allow comparison.

DESIGN

This study retrospectively analyzed patient data from undernourished infants, <12months of age, initially admitted to Red Cross War Memorial Children Hospital, Cape Town, South Africa between 2007-08. The total costs related to the annual use of energy dense RTU infant formulae were analyzed and compared to an energy fortified SPIF.

OUTCOMES

Taking into acount all the relevant costs related to the preparation and delivery of a powdered feed the total related costs were i) RTU ENDF 12.51 Euros/day ii) fortified SPIF with sunflower oil 16.52 Euros/day iii) fortified SPIF with MCT oil 19.61 Euros/day.



CONCLUSIONS

Hidden costs should be considered in the use of fortified SPIF. In order to make a conscious decision in healthcare systems in regards to what to feed undernourished infants, all the costs need to be taken into account.

Effect of high-calorie formula on postoperative growth catch-up of infants with congenital heart disease and malnutrition

Cui Y, *et al*. Chinese Journal of Clinical Nutrition, 2017, Vol. 25(3).

PURPOSE

Malnutrition and growth faltering are common in infants with congenital heart disease (CHD). Malnutrition in these infants not only delays growth and development but also affects clinical outcomes. This study aims to investigate the efficacy and safety of Energy Nutrient Dense Formula (ENDF) on postoperative growth catch-up in infants with CHD and malnutrition.

DESIGN

Randomised controlled design. Infants ≤ 6 months old with CHD requiring surgery and a weight for age Z Score (WAZ) ≤-2 randomly received an ENDF (n=50) or standard infant formula (SIF; n=51) after surgery for a period of 3 months. Growth, nutritional status, GI tolerance and cardiac function were recorded at 5 time points up to 3 months after surgery and all infants followed up for 6 months post-surgery.

OUTCOMES

Mean fluid intake was not different between groups (p>0.05) however the ENDF group achieved significantly higher energy intake (437.24 ± 6.68 KJ vs. 312.43 ± 86.22 KJ; p<0.001). A significantly higher proportion of the ENDF group demonstrated catch up growth, with improvements in both weight and height. Additionally the ENDF group increased body mass prior to discharge (0.067 ± 0.384 kg) whereas body weight in the control group decreased (-0.125 ± 0.425 kg) with the difference between groups being statistically significant (p=0.015).

	1 month after surgery			3 months after surgery		
	ENDF group (n=50)	**Control group (n=51)**		**ENDF group (n=50)**	**Control group (n=51)**	
Body mass (kg)	5.46 ± 1.36	4.80 ± 1.01	p=0.008	6.78 ± 1.42	5.72 ± 1.01	p=<0.001
WAZ	-2.79 ± 1.28	5.46 ± 1.36	p=<0.001	-1.60 ± 1.17	-3.10 ± 1.40	p=<0.001
Proportion of WAZ >-2 (%)	25.0% (11/2)	4.9% (3/51)	p=0.0011	64.1% (25/39)	15.7% (8/51)	p=<0.001
WHZ	-2.47 ± 1.43	-3.62 ± 1.77	p=0.001	-0.86 ± 1.31	-2.59 ± 2.13	p=<0.001

There were no significant differences in tolerance or GI adverse events, demonstrating that both ENDF and the control formula were well tolerated. Cardiac function recovered well following surgery in both groups.

CONCLUSIONS

Preoperative malnutrition and growth retardation are common in infants with congenital heart disease, often displayed as significantly lower height and body mass than children of the same age without congenital heart disease. The study demonstrates that ENDF is well tolerated and successfully improves nutritional intake and promotes catch up growth in infants with congenital heart disease requiring surgery.

Effects and tolerance of protein and energy-enriched formula in infants following congenital heart surgery: a randomised controlled trial

Cui Y, *et al.* JPEN J Parenter Enteral Nutr 2018; 42: 196-204.

PURPOSE

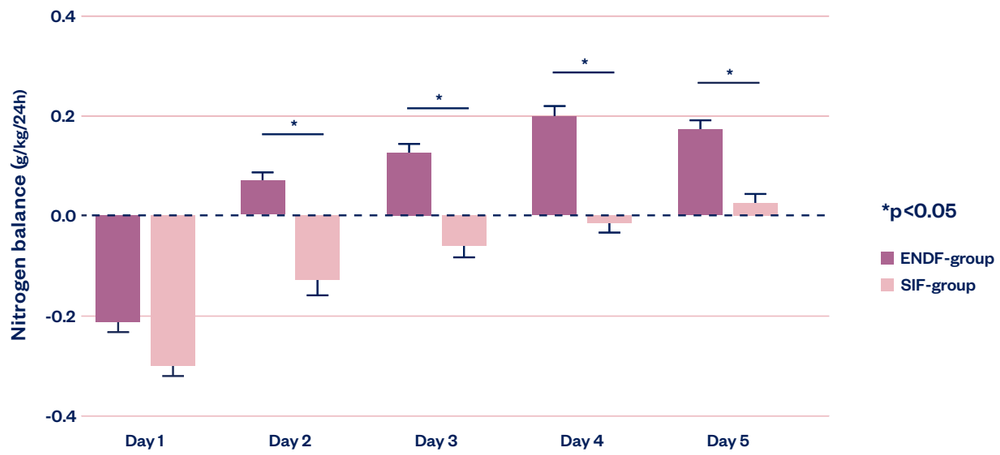
For infants undergoing surgery for congenital heart defects, nutrition support is a critical component for positive outcomes. ENDF may help meet nutrient recommendations and support healing from surgery. However, tolerance and impacts of increased energy and protein delivery for this population has not been well researched. This trial aimed to study the tolerance and nutritional response to ENDF compared to a standard formula (SIF) in infants for 5 days following surgery for congenital heart defects.

DESIGN

Infants (n=50) were randomised to receive either a test formula (ENDF, n=26) or control formula (SIF, n=24). Tolerance and daily volume intakes were recorded. Plasma levels of amino acids were measured, and cumulative nitrogen balance (cNB) and cumulative energy balance (cEB) were calculated.

OUTCOMES

ENDF group had significantly higher intake of nutrients after day 1, with all subjects in this group meeting adequate nutrient intakes by day 2. Positive cNB was met in the ENDF group from day 2: the SIF group did not achieve this until day 5. Many essential amino acid concentrations increased more significantly in ENDF group. ENDF group did not experience significantly higher incidences of adverse events, with one exception for tolerable diarrhea (hazard ratio with multivariate adjustment, 3.16; 95% confidence interval, 1.24-8.01).



CONCLUSIONS

In the immediate days following surgery for congenital heart defects in infants, administering ENDF early was tolerated equally as well as SIF. ENDF administration was also effective in meeting adequate nutrient intakes sooner and achieving positive nitrogen balance sooner.

High-energy nutrition in pediatric cardiac critical care patients: a randomised controlled trial

Zhang H, *et al*. Nurs Crit Care 2019; 24: [Epub ahead of print].

PURPOSE

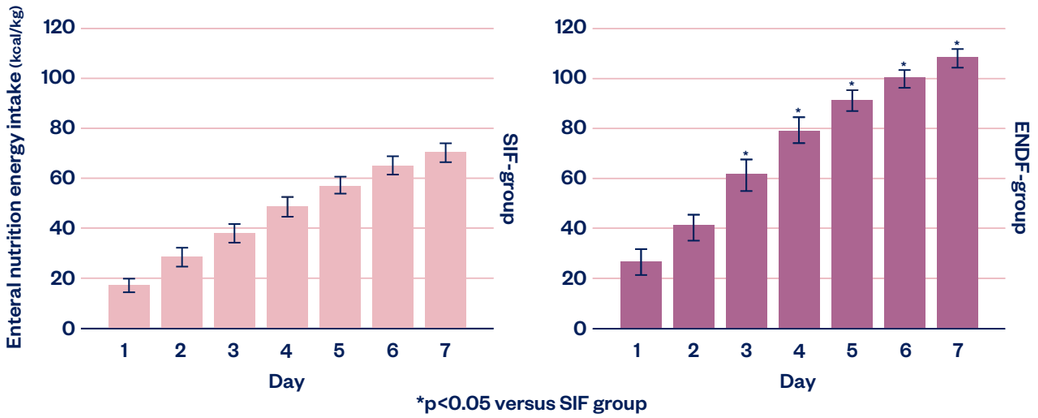
Recent evidence has shown that ENDF can support infants after cardiac surgery by providing higher energy intake than other feeding options while having less cardiopulmonary impact. However, there is scarce evidence of the effect of ENDF on weight gain and feeding tolerance. This study compared the use of the ENDF versus the use of a SIF in infants following surgery for congenital heart disease to assess weight gain and digestive tolerance.

DESIGN

Infants who underwent cardiac surgery <1 year of age were eligible for this randomised controlled study. Infants were divided into 2 groups, the intervention (ENDF, n=32, 100 kcal/100mL) or the control group (SIF, n=32, 67kcal/100mL) for the duration of 7 days. Weight gain and feeding intolerance (resulting from vomiting, abdominal distention, feeding volume decrease or no increase, gastric residual volume (GRV) >one third of the previous feed, diarrhea) were set as the primary outcomes. Energy intake and various measurements (e.g. prealbumin, duration of mechanical ventilation, length of stay in cardiac intensive care unit, hospital length of stay, number of participants with necrotizing enterocolitis) were secondary outcomes.

OUTCOMES

Fifty-nine infants completed the study with a median age at recruitment of 60 days (35-120 days). No statistically significant differences were reported for baseline characteristics. Infants receiving ENDF (n=30 completed) experienced overall less weight loss compared to those receiving SIF (n=29 completed) [-16g (95%CI -74,42) vs -181g (95%CI: -264,-99)]. The control group did not present with any gastrointestinal problems, however, the intervention group reported abdominal distention (n=1), elevated GRV (n=2) and diarrhea (n=1). The energy intake increased in both groups; the increase in the intervention group was significantly higher compared to the control group by day 3 ($p<0.05$). No statistically significant differences were observed for all other secondary measurements between the two groups except prealbumin, which gradually increased in the ENDF group and declined in the control group.



CONCLUSIONS

Feeding infants after cardiac surgery with ENDF can increase their energy intake and minimize weight loss compared to SIF. Gastrointestinal symptoms increased initially, but this can be managed by medication and feeding progression and energy intake were not compromised.

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

Eveleens RD, *et al.* J Hum Nutr Diet 2019; 32; 3-10.

PURPOSE

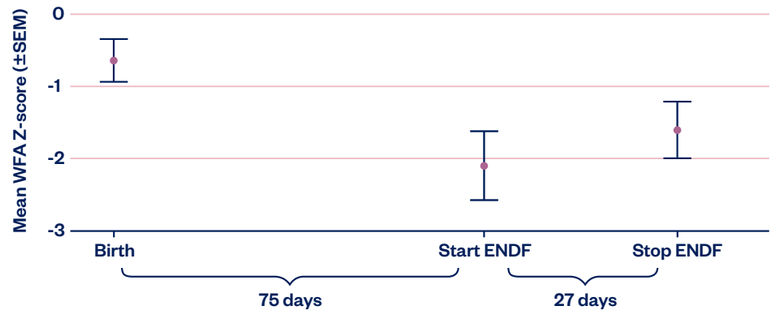
To achieve nutritional intake goals in critically ill infants is difficult. The use of an ENDF is one way to to reduce nutritional losses, since the use of standard infant formula for this patient group provides inadequate nutrient levels. The present study aimed to assess weight gain and gastrointestinal events in infants with an extended pediatric intensive care unit (PICU) stay while they were receiving ENDF for an extended period.

DESIGN

Retrospective data from infants who were admitted to PICU between 2007-2017 (Erasmus Medical Center, Rotterdam, The Netherlands) were analyzed including demographics, nutritional intakes and the duration of ENDF use. Part of the inclusion criteria were the specific age of the infants (not younger than 37 post-menstrual weeks and not older than 12 months), an extended PICU stay (>=14days) as well as a minimum of 14 days feeding with ENDF. Breast milk was the preferred feeding choice, but when breast milk was not available, ENDF was started at the discretion of the clinician. Weight-for-age (WFA) *z*-scores were calculated at the start and at the end of ENDF use and compared to birth WFA *z*-scores. Variables such as gastric residual volume, vomiting, constipation and diarrhea were assessed as markers of feeding intolerance.

OUTCOMES

Seventy infants met the inclusion criteria of the study. Overall, the median use of ENDF was 30 days (IQR: 21–54) and median PICU duration was 50 (IQR: 35–83) days. Post-cardiac surgery, respiratory, cardiac and neurological conditions were the main reasons for admission. Mean WFA *z*-score significantly increased during ENDF use (0.48, SD 1.10, $p<0.001$). Further analysis revealed that lower WFA *z*-scores when starting ENDF were associated with greater increases in WFA *z*-score following ENDF use. The number of infants with a WFA *z*-score <-2 had decreased from 33 (47%) to 23 (33%) after the use of ENDF. Overall, 93% of infants gained weight and 71% of infants showed an increased WFA *z*-score. Only 5 infants had constipation and 3 infants were treated for vomiting.



Weight-for-age (WFA) z-scores over time (n = 70). Energy-nutrient dense formula (ENDF).

CONCLUSIONS

The use of ENDF was overall well tolerated and significantly supported growth markers (weight gain & WFA z-scores) of a vulnerable patient group of critically-ill infants, for an extended PICU stay.

Tolerability and effects of the use of energy-enriched infant formula after congenital heart surgery: a randomised controlled trial

Scheeffer VA, *et al.* JPEN J Parenter Enteral Nutr 2020; 44(2); 348-54.

PURPOSE

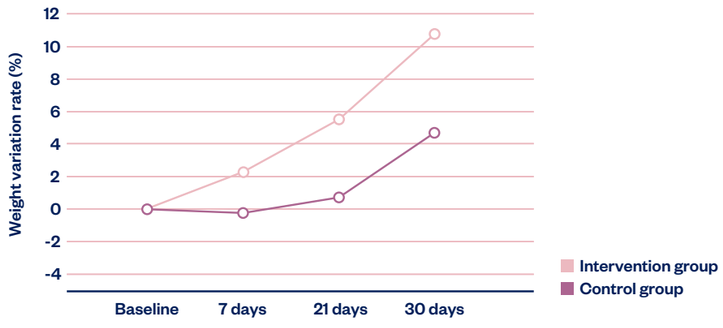
Children with congenital heart disease (CHD) frequently experience undernutrition, which can negatively impact outcomes after surgery. Increased energy intake following CHD surgery has been linked with improved outcomes. This trial evaluated the impacts of using an ENDF compared to standard infant formulae (SIF) during the 30 days following surgery for CHD.

DESIGN

Children undergoing surgery for CHD in a tertiary care hospital in southern Brazil between March and December in 2017 were eligible for this randomised controlled trial. Subjects in the test group were fed with ENDF (1 kcal/mL), and those in the control group were fed with a SIF (0.67 kcal/mL). The individual responsible for anthropometric measurements was blind to each subjects' random group assignment.

OUTCOMES

Fifty-nine patients were randomised: 29 to the test (ENDF group) and 30 to the control (SIF group). No statistically significant differences were seen between groups following randomization regarding gender, age, anthropometry or surgical risk classification. After intervention, the ENDF group demonstrated significantly higher weight-for-age *z*-score and weight gain variation rate compared to the SIF group. Similar frequency of general GI side effects was seen between groups, although diarrhea was more frequent in the ENDF group. Findings for the ENDF group included less frequent use of antibiotics (p=0.047) and a trend toward shorter hospital length of stay vs the SIF group.



CONCLUSIONS

This trial found that use of ENDF is well tolerated by children following surgery for CHD while also supporting weight gain. Potential impacts seen on reducing length of hospital stay and use of antibiotics in this trial could be confirmed in future trials with larger sample sizes.

Effect of high-energy density formula on postoperative growth catch-up in children with cyanotic congenital heart disease: a prospective randomised controlled study

Zhou Hong-Mei, *et al.* Chin J Contemp Pediatr, 2021, Vol.23(1).

PURPOSE

Cyanotic CHD has a significant impact on infants and children due to its complex condition and long surgical time, however despite nutritional status being critical for their growth, development, immunity and postoperative clinical outcomes infants with CHD often present with varying degrees of malnutrition. This study investigated the effect of an Energy Nutrient Dense Feed (ENDF) on postoperative catch-up growth in infants with CHD.

DESIGN

Randomised controlled design. Infants ≤ 6 months old with CHD requiring surgery randomly received an ENDF (n=50) or standard infant formula (SIF; n=50) after surgery for a period of 6 months. Growth, nutritional status and cardiac function were recorded for 6 months following surgery.

OUTCOMES

The ENDF group had significantly less incidence of malnutrition (18% vs 36%; p<0.05) and significantly improved growth trajectories at the end of the intervention. No GI intolerance occurred in either group. Cardiac function improved in both groups following surgery.

Group		HAZ						WAZ						WHZ					
		No. of subjects	Pre-op	Postoperative extubation	Post-op 1 month	Post-op 3 months	Post-op 6 months	No. of subjects	Pre-op	Postoperative extubation	Post-op 1 month	Post-op 3 months	Post-op 6 months	No. of subjects	Pre-op	Postoperative extubation	Post-op 1 month	Post-op 3 months	Post-op 6 months
Control (x ± s)	malnourished	9	-2.6 ± 0.5	-2.7 ± 0.5	-2.7 ± 0.6	-2.7 ± 0.6	-2.6 ± 0.6	20	-3.7 ± 1.2	-3.7 ± 1.2	-3.8 ± 1.3	-3.4 ± 1.1	-2.8 ± 0.9	19	3.1 ± 1.4	-3.2 ± 1.3	-3.2 ± 1.4	-3.1 ± 1.1	-2.8 ± 1.1
	not malnourished	41	-1.2 ± 0.7	-1.2 ± 0.8	-1.3 ± 0.6	-1.2 ± 0.7	-1.1 ± 0.8	30	-1.3 ± 0.7	-1.3 ± 0.7	-1.4 ± 0.6	-1.1 ± 0.8	-0.9 ± 0.9	31	-1.2 ± 0.7	-1.3 ± 0.6	-1.3 ± 0.7	-1.1 ± 0.8	-1.0 ± 0.9
ENDF (x ± s)	malnourished	10	-2.4 ± 0.3	-2.5 ± 0.4	-2.5 ± 0.6	-2.4 ± 0.5a	-2.2 ± 0.4a	21	-3.9 ± 1.1	-3.9 ± 0.9	-4.1 ± 1.1	-3.1 ± 1.2a	-1.8 ± 1.1a	20	-3.9 ± 1.3	-3.9 ± 0.7	-4.0 ± 0.6	-3.5 ± 0.6	-2.2 ± 0.8a
	not malnourished	40	-1.0 ± 0.8	-1.1 ± 0.7	-1.1 ± 0.9	-1.1 ± 0.9	-1.0 ± | 1.0	29	-1.2 ± 0.7	-1.3 ± 0.7	-1.3 ± 0.6	-1.0 ± 0.9	-0.6 ± 1.0	30	-1.2 ± 0.8	-1.2 ± 0.7	-1.1 ± 0.9	-1.1 ± 0.9	-0.7 ± 0.9
Proportion with < -2 change in (%)	Control	50	9 (18)		9 (18)	8 (16)	8 (16)		20 (40)		19 (38)	18 (36)	10 (20)b		19 (38)		19 (38)	13 (26)	15 (30)
	ENDF	50	10 (20)		10 (20)	9 (18)	7 (14)		21 (42)		20 (40)	12 (24)	4 (8) a, b		20 (40)		19 (38)	12 (24)	8 (16) b

[LAZ] length-for-age z-score; [WAZ] weight-for-age z-score; [WLZ] weight-for-length z-score.
(a) Comparison with the control group, p<0.05; (b) comparison with the preoperative status in the same group, p<0.05.

CONCLUSIONS

Postoperative use of ENDF is a safe and well tolerated intervention that can improve nutritional status and promote effective catch-up growth in infants with cyanotic CHD.

Energy- and protein-enriched formula improves weight gain in infants with malnutrition due to cardiac and noncardiac etiologies

Goday P.S, *et al*. J Parenter Enteral Nutr, 2022, Vol 46(6).

PURPOSE

To promote catch-up growth in infants with growth failure nutrients supply exceeding the requirements of healthy infants is required. This study aimed to assess safety, tolerability, and improvement in weight gain with an Energy Nutrient Dense Formula (ENDF) in infants with poor growth.

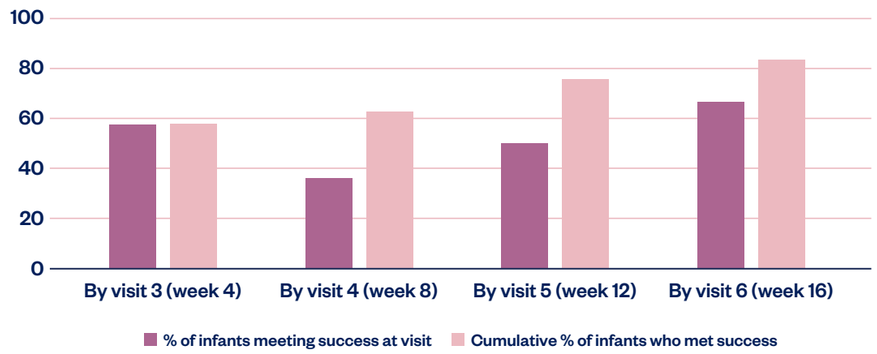
DESIGN

Prospective, open-label, single-arm growth, safety, and tolerance study conducted across six sites in the United States. 26 infants aged 1–8 months with poor growth received ENDF for 16 weeks. Improvement in weight, as measured by change in weight-for age z-score (WAZ) and weight gain velocity (g/d) ≥ median for age was measured as the primary outcome. Improvement in other anthropometric z-scores, formula tolerance, and safety were also recorded.

OUTCOMES

Mean daily energy intake was 123 ± 32 kcal/kg bw, with >90% of energy coming from ENDF. Weight gain velocity exceeded the median for 83% (20 of 24) of infants at ≥1 time point and 67% (16 of 24) of infants for the overall study period. Mean ± SD WAZ significantly improved from baseline to 16 wks (−2.92 ± 1.04 to −2.01 ± 1.12; p=0.0001). In addition Z-scores for weight-for-length and head circumference (p=0.0001) and for length-for-age (p=0.003) improved significantly at 16 weeks.

Proportion of infants meeting weight gain velocity targets



Weight gain velocity target = greater than or equal to WHO growth standards median weight gain velocity for age).

Compared with baseline, stool consistency was different at 2, 4, and 16 weeks (p<0.05), with no significant differences in tolerance.

CONCLUSIONS

ENDF is safe, well tolerated, and improves growth and weight gain in infants with poor growth.

Improved growth, tolerance and intake with an extensively hydrolised peptide feed in infants with complex disease

Smith C, *et al.* Clin Nutr 2018; 37(3); 1005-12.

PURPOSE

The inability to tolerate whole protein feeds is commonly observed in severe malabsorption. In infants with complex medical diagnoses, malabsorption and maldigestion may result in faltering growth, requiring nutrition support with specialized enteral feeds. Historically, such patients were managed with powdered peptide formulae requiring adaption to meet patient's specific nutritional needs. This study examines the use of a ready to feed, peptide-based ENDF with medium chain triglyceride (MCT) in infants with complex, multiple system diseases and assesses the efficacy and acceptability of the feed in this challenging patient group.

DESIGN

This multi-center, single arm intervention study monitored 18 infants receiving a ready to use, peptide-based ENDF (1kcal/ml, Infatrini Peptisorb) for 28 days. Primary outcome was gastro-intestinal tolerance and secondary outcomes included compliance, safety, nutritional intake and growth. Historic weights were used to calculate growth rates in the period prior to the introduction of the feed.

OUTCOMES

All 18 patients received the ready to feed, peptide-based ENDF for the duration and remained on the feed following conclusion of the study. Tolerance was good with moderate or severe vomiting occurring in 6 infants before administration of the study feed (day 1) to 0 infants at day 28. Moderate or severe diarrhea decreased from 4 infants (day 1) to 1 infant (moderate diarrhea, day 28). The majority of parents/carers reported tolerance as better (50%) or the same (44%) as with their infant's previous feed regimen. Compliance was excellent at 94% ± 12.6. Energy intake/kg body weight significantly increased (+23 ± 42kcal/kg, p=0.037). Weight (0.61 ± 0.31 kg, p=0.0001), length (1.89 ± 1.77cm, p=0.0001) and head circumference (1.33 ± 1.29cm, p=0.001) all significantly increased as well as weight for length ($p<0.05$) and weight-for-age ($p<0.05$) *z*-scores. The majority of infants (61%) also demonstrated increased growth velocity.

CONCLUSIONS

This heterogenous group of infants with complex, multiple medical conditions and evidence of faltering growth demonstrated good tolerance and compliance with a ready to feed, peptide-based ENDF. In this study weight, but also length and head circumference, significantly increased with many infants demonstrating increased growth rate and signs of catch-up growth.

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

Marino LV, *et al.* J Hum Nutr Diet 2019; 8: [Epub ahead of print].

PURPOSE

The feeding of critically ill children is complex and tailored to each phase of illness and recovery. Furthermore, fluid restrictions and medical procedures often prevent children receiving all of their prescribed feeds, while the metabolism of nutrients may be affected by disease and its consequences. Diarrhoea, vomiting and abdominal distension while receiving a standard formula may indicate the need for a peptide-based feed. The purpose of this study was to assess feasibility, tolerance and achievement of nutritional goals in critically ill infants fed with a peptide-based ENDF.

DESIGN

A retrospective observational study was carried out in two PICUs in Southampton, UK (PICU1) and Rotterdam, The Netherlands (PICU2) in infants with length of stay ≥7 days receiving a peptide-based ENDF (Infatrini Peptisorb). Gastrointestinal tolerance was evaluated based on gastric residual volumes (GRV), vomiting, constipation and prescribed diarrhoea medications (PICU2 only).

OUTCOMES

Fifty-three patients met the inclusion criteria of the study and were included in the analysis. Inclusion criteria included age of infants (not older than 12 months) and a minimum PICU stay of 7 days. Post-cardiac surgery, respiratory disease and sepsis were the main reasons for admission. Median energy intake in PICU1 was 68 (IQR: 47–92) and PICU2 was 90 (63–124) kcal kg-1. In PICU1 feeding was withheld for perceived feed intolerance in only 1 infant on 2 occasions; none of the infants presented with constipation problems, while vomiting occurred in 11 infants with a median of 2 episodes per day (IQR: 1-5). In PICU2 feeding was withheld in 2 infants on 2 occasions for perceived intolerance; 1 infant presented with constipation, while vomiting occurred in 23 infants with a median of 0.3 episodes per day (IQR: 0-1.2). Median intakes (%REE) across admission are shown in table. In both PICUs there was a positive change in weight-for-age z-scores in the infants that had weights taken (median change 1.2 z-scores PICU1, 0.4 z-scores PICU2).

	Disease phase	Day of ENDF formula intake	Energy intake %REE median (IQR)
PICU 1	Acute	Days 1-5	61% (10-112%)
	Stable	Days 6-10	118% (85-168%)
	Recovery	Days 11-21	135% (98-184%)
PICU 2	Acute	Days 1-5	152% (74-229%)
	Stable	Days 6-10	209% (141-276%)
	Recovery	Days 11-21	213% (155-262%)

CONCLUSIONS

These results indicate that the use of peptide-based ENDF in critically ill infants is feasible and well tolerated. Despite a few interruptions as a result of feeding intolerance, patients receiving peptide ENDF demonstrated positive changes in weight-for-age z scores and nutritional goals were achieved which has not been accomplished in a number of other studies in PICU populations.

Notes

Notes

Infatrini and Infatrini Peptisorb

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