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The Impact of a Low Energy Partially Hydrolysed Enteral Formula on Feeding Experiences in Children Tube Fed with Neuro-Disabilities: *Multicentre Retrospective Study**

Background and Aims: To monitor the effectiveness of a low energy 100% whey-based partially hydrolysed enteral formula on weight management and feed tolerance in tube fed children with a neuro-disability.

Introduction

Children with complex neuro-disabilities are unable to meet all **their nutritional requirements orally** and may require a **feeding tube**. Children tube fed with neuro-disabilities and low mobility can become **overweight** due to **reduced energy requirements**[1]. Efforts are needed to **protect severely disabled children** from **overfeeding** and to **help families** of children with neuro-disabilities to manage their child's weight.[2]

Any attempt to dilute the existing feeds to **reduce the calorie intake** to a level commensurate with the energy expenditure of a child with a disability is likely to have **an adverse impact on micronutrient and protein intake.**[3]

Additionally, feed tolerance is generally worse in children with neuro-disabilities, associated with:[4]

- **Comorbidities** including **epilepsy**
- **Posture and tone disorders**
- **Medications used for the treatment** of these co-morbidities can further exacerbate gastrointestinal symptoms

The clinical nutrition industry has **responded to this need** and developed **enteral formulas that are low in energy but nutritionally adequate for protein and micronutrients, essential** for **developing children** who are reliant on enteral formula to **supply a major proportion of their intake.**[3]

Materials and Methods

A Retrospective, Multicentre Trial

This is a retrospective, multicentre study conducted across two National Health Service Trusts in UK: one **tertiary centre** and one **district general community hospital**. Data were collected by **paediatric dietitians** from **dietetic and medical records.**

17 children from **1 to 17 years old**

Enteral feeding accounted for at least **80%** of their total energy requirements

At least **1 month** trial on a **low energy partially hydrolysed enteral formula**

Clinical dietetic documentation on feeding tolerance was measured as:

- Either improved
- No change, or worsened and on **key markers of tolerance** (gastro-oesophageal reflux, retching/gagging, vomiting, and stool consistency)
- Stool consistency was assessed with the **Bristol Stool scale**

Common feed related symptoms associated with neuro-disabilities include:[5]

- **Constipation** was defined as **Rome IV Criteria**, less than three defecations a week, and painful, hard stools[6]
- **Diarrhoea** was defined as more than **one loose stool a day** lasting longer than **7 days**[7]
- **Reflux** was defined as **parental observation** of the **passage of gastric contents into the oesophagus** causing regurgitation
- **Nutrition status** (weight for age and height for age) was **assessed using Z-scores**[8]
- **Moderate overweight** was identified if **Z-scores were between +2 and +3 standard deviation** (SD)
- **Severe overweight** was identified if the **Z-scores were above +3** (SD)[9]
- **Moderate underweight** was identified if **z-scores were between -2 and -3**
- **Energy requirements** were calculated on **reduced activity at 80%** of estimated average requirements[10]

*Graeme O'Connor., et al. "The Impact of a Low Energy Partially Hydrolysed Enteral Formula on Feeding Experiences in Children Tube Fed with Neuro-Disabilities: National Multicentre Retrospective Study". EC Nutrition 18.5 (2023): 10-19.

Results

The **most frequently recorded neuro-disability** of children who had switched to the new enteral formula was **cerebral palsy, 8 of 17 children (48%). 94% of the children had gastrostomy feeding tube**.

Characteristics

Feed formulas prior to switch included: whole protein (1kcal/ml – 41%), hydrolysed protein (1kcal/ ml – 41%) and amino acid based (18%) based on mean feed volume (ml) excluding water boluses (IQR).

Benefits

- The baseline mean **weight** and **BMI Z-scores** were bordering the **moderate overweight**. After **one month** switching to a low energy partially hydrolysed formula both **weight** and **BMI Z-scores decreased**.
- **80% children** reported an **improvement in one feeding intolerance symptom** after feed was switched.
- **81% of children** had **feeding regimens simplified** after switching to low energy formula.
- Hydration regimen **simplified** by **reducing the need for additional water boluses**.
- The simplification of feeding plans included: **easier to physically transfer child, reduced risk of pressure sores and increased physical activity**.

Clinical Outcome

35%	35%	11%	82%	64%	12%	64%	76%
Hydration regimen – Less water boluses	Feed preparation – removed additional supplements	Switch from powder to 'Ready to Hang' formula	Easier to move/ transfer patient, n (%)	Weight gain slowed/ stabilise	Weight reduction	Perceived reduced risk of pressure sores, n (%)	Reduced feeding preparation increased time for physical activities/ play, n (%)

Discussion

The study reported that **76% of families** felt they had **more time** to dedicate to **physical activity/play** after switching to the low energy partially hydrolysed formula, which was largely attributed to simplifying children's feeding regimen.

Unnecessarily complex feeding regimes were prescribed prior to formula switch

- Challenges meeting **essential micro-nutrients requirements** while **reducing total energy intake** to avoid overfeeding.
- Overly complicated **feeding plans add further complexity** on the already busy lives of parents caring for children with neuro-disabilities.
- Common practice observed included dilution or significant reduction in total feed volumes, leading to need to add:
  - hydration solutions to meet electrolytes deficiencies,
  - **multivitamins** to account for the loss from the **feed volume reduction/dilution**.

Summary

Children with neuro-disabilities who have low energy expenditure coupled with feed intolerances **may benefit from a low energy 100% whey-based hydrolysed enteral formula** to **minimise risk of excessive weight gain, further compromising mobility**. Additionally, implementing a low energy hydrolysed 'ready to feed' formula may **beneficially impact health economic outcomes** by **simplifying the feeding regimens – eliminating the need for additional fluid, electrolytes** and **multivitamins**, thereby, **reducing time** and **financial cost attributed to feeding**.

1. Neter JE., *et al.* "The prevalence of overweight and obesity and its determinants in children with and without disabilities". *The Journal of Pediatrics* 158.5 (2011): 735-739. **2.** Lip SZL., *et al.* "Prevalence of under and over weight in children with neurodisability, using body composition measures". *European Journal of Clinical Nutrition* 72.10 (2018): 1451-1454. **3.** Vernon-Roberts A., *et al.* "Gastrostomy feeding in cerebral palsy: enough and no more". *Developmental Medicine and Child Neurology* 52.12 (2010): 1099-1105. **4.** Hauer J. "Feeding Intolerance in Children with Severe Impairment of the Central Nervous System: Strategies for Treatment and Pre-vention". *Children* 5.1 (2017). **5.** Batra A., *et al.* "Feeding children with neurodisability: challenges and practicalities". *Archives of Disease in Childhood* 107.11 (2022): 967-972. **6.** Russo M., *et al.* "Functional Chronic Constipation: Rome III Criteria Versus Rome IV Criteria". *Journal of Neurogastroenterology and Motility* 25.1 (2019): 123-128. **7.** Giannattasio A., *et al.* "Management of children with prolonged diarrhea". *F1000Research* (2016): 5. **8.** Cole TJ. "The development of growth references and growth charts". *Annals of Human Biology* 39.5 (2012): 382-394. **9.** WHO Child Growth Standards based on length/height, weight and age". Acta Paediatrica 450 (2006): 76-85. **10.** SACN. Dietary Reference Values for Energy The Scientific Advisory Committee on Nutrition report on the DRVs for energy 2 (2011).