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The impact of stopping high-energy oral nutritional supplements on eating behaviour and weight gain

Charlotte M Wright,[1] Anna Chillingworth[2]

[1]PEACH Unit, School of Medicine, MVLS College, University of Glasgow, Glasgow, UK
[2]Royal Hospital for Sick Children, Glasgow, UK

Correspondence to
Professor Charlotte M Wright, PEACH Unit, School of Medicine, MVLS College, University of Glasgow, QMH Tower, Yorkhill Hospitals, Glasgow G3 8SJ, UK; charlotte.wright@glasgow.ac.uk

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ABSTRACT

Background and aims Many children referred to a tertiary feeding clinic are already taking high-energy oral nutritional supplements (HEOS), but these often seem not clinically useful. We undertook a retrospective review of all children on HEOS at the time of referral to the clinic in order to describe their subsequent progress in terms of growth and feeding behaviour.

Results A total of 48 children were on HEOS at referral and withdrawal of HEOS was attempted in 38 children, aged median 3.0 years (range 0.7–10 years) who were taking volumes equivalent to 2/3 of total daily energy requirements. The children tended to be very short and slim (median height SD score (SDS) −2.0 (range −5.7 to 1.9); body mass index −2.0 (−5.1 to 1.9)). Half had normal neurodevelopment (ND) but 4 (11%) had learning disability and 4 (11%) severe ND problems. By last follow-up after 0.86 (0–2.9) years, 30 (79%) had stopped all feeds. Those who stopped had a mean (SD) change in weight of 0.08 (0.6) SDS (range −0.88 to +1.59). Five children (17%) showed significant catch-up weight gain after stopping feeds, of whom three had been referred for weight faltering and possible tube feeding. Improvement in feeding behaviour was documented in 76% (29).

Conclusions The use of HEOS in children suppresses appetite for solid food due to energy compensation. In some cases, HEOS may perpetuate or even cause weight faltering. It should not be assumed that failure to respond to HEOS is an indication for tube feeding.

What is already known on this topic?

- High-energy oral nutritional supplements (HEOS) are widely prescribed where there are concerns about slow weight gain, but have been little evaluated in childhood.
- Preschool children reduce intake at meals following a high-energy drink, so that HEOS are likely to suppress appetite while only slightly increasing net intake.
- Many children referred to a tertiary feeding clinic for management of eating behaviour problems or possible tube feeding were already taking HEOS.

What this study adds?

- It was possible to withdraw HEOS altogether in 2/3 of referrals with no adverse effect on weight gain and marked improvement in eating behaviour.
- A minority required progression to tube feeding, but a similar number showed accelerated weight gain once HEOS were withdrawn.

BACKGROUND

Growth faltering is a well-recognised problem in the paediatric population and can be a source of much anxiety for parents or carers. Children with an underlying illness or long-term conditions are more likely to experience growth faltering, and nutritional support can be essential to prevent long-term growth and developmental problems. High-energy oral nutritional supplements (sip feeds, HEOS) may allow sick infants to consume nutrient requirements in reduced volume and avoid tube feeding. However, beyond the age of 6–9 months solid feeding usually supplies a more energy-dense low-volume diet, and use of HEOS could delay the acquisition of oromotor skills by suppressing appetite for solid food.

Although widely used, HEOS have had little formal evaluation in childhood. We could identify only two trials in children published in peer reviewed journals. One trial described favourable short-term increases in weight and height for children taking HEOS aged >3 years in Taiwan and the Philippines.[1] However, a trial in the UK of HEOS use in children with cystic fibrosis did not show any difference in body mass index (BMI) in the treated group.[2]

The Glasgow Royal Hospital for Sick Children (RHSC), which provides tertiary care for the West of Scotland, set-up a feeding team in 2002 primarily to manage the withdrawal of artificial feeding. The team comprises a paediatric consultant, paediatric trainee, dietician, clinical psychologist and assistant psychologist, and its main role is to support feed reduction, help families deal with anxiety and to manage stressful mealtime interactions.

The team also see non-tube-fed children with medically complex feeding problems, as well as children with weight faltering where tube feeding is being considered. The team noticed that some children referred with eating behaviour problems were taking HEOS and their cessation led to improved eating behaviour and improved weight gain in some cases. As a result, the team began routinely reducing and stopping HEOS if this was felt to be appropriate after initial clinical assessment. It thus seemed advisable to undertake a review of all

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children where HEOS withdrawal was attempted to describe the overall impact of HEOS withdrawal on appetite and weight gain. We thus planned a review to:

1. identify the characteristics of children selected for HEOS withdrawal;
2. describe the success rate and length of time to HEOS cessation;
3. establish how commonly children showed rises (or falls) in weight centile following HEOS withdrawal.

METHOD

A retrospective case note review was performed. All children referred to the RHSC feeding clinic between 2002 and 2010 who were already on HEOS at time of referral were identified from the clinic database. As this was service evaluation, ethical approval was not required.

The team's general approach to assessment and management has been described elsewhere.[3–5] Families are seen initially for a 1 h, broad-ranging assessment undertaken by the multidisciplinary team consulting together. After this, action plans are agreed by negotiation with the family.

For this review, data were retrieved from the feeding clinic's clinical and growth databases as well as hospital notes. HEOS type and volume consumed were routinely recorded at each appointment. The impact of HEOS reduction on appetite was determined by review of the clinical notes, where parental reporting of appetite and intake of food was routinely recorded. Information on neurodevelopmental (ND) status was retrieved from referral information and the initial assessment. Follow-up data were collected until the end of January 2011. Successful withdrawal was defined as cessation of HEOS.

At each appointment, children are weighed naked or in light clothing using electronic scales and usually height or length is measured using a stadiometer. All these measurements were routinely entered into a growth database, where age and BMI were calculated (weight in kg/height in m^2) and converted to z scores compared with the UK (UK 1990) growth reference.[6] For each child, growth data closest to initiation of HEOS reduction, HEOS cessation and last follow-up were identified.

RESULTS

There were 48 children (median age 3.2 years, range 0.7–18 years) who were on high-energy oral supplements at referral (see flow chart, figure 1). Only a minority of children were referred specifically for HEOS reduction and about a third had been referred because of concerns about weight faltering or the possible need for tube feeding (table 1). Notes could not be traced for two. Eight children were deemed unsuitable for HEOS reduction because they lacked the capacity to feed orally and/or were considered to be significantly undernourished on the basis of slow growth trajectory and low-fat stores. Of these children, six had severe ND problems and five of these had progressed to tube feeding by the end of follow-up.

HEOS reduction was thus attempted in 38 children (median age 3.0 years, range 0.7–10 years). These children were less likely to have severe ND problems, though 22% had either severe ND problems or learning disability (table 1). Overall these children were very small and slim with a median height and BMI on the 2nd centile (table 2 and figure 2).

Median daily energy intake from supplements (recorded for 32/38) was 59 kcal/kg/day (range 13–96), which is equivalent to 2/3 of total requirements for a child at the age of 3 years. The strength of feed (where recorded) varied from 1 kcal/mL for 18 (56%) to 1.5 kcal/mL for 13 (40%). Eight children were taking more than one kind of HEOS. Only one child had been taking HEOS for <6 months and 19 (50%) had progressed onto HEOS from tube feeding.

HEOS reduction began at the first appointment for 24 (69%), of whom 4 stopped altogether, but 1 child waited nearly a year before beginning to reduce. By last follow-up a median (range) 0.86 (0–2.9) years later, 30 (79%) had stopped all feeds (figure 1).

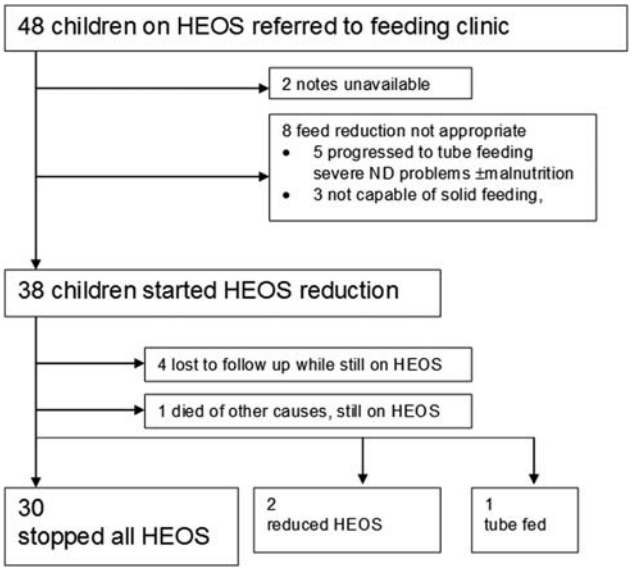

Figure 1 Flow chart of progress of audit subjects. HEOS, high-energy oral nutritional supplements; ND, neurodevelopment.

Table 1 Underlying conditions and reasons for referral of all referred and those in whom HEOS were reduced

Diagnosis	All referrals		HEOS reduction attempted	
Cerebral palsy	8	16.7%	3	7.9%
Learning disability or developmental delay	5	10.4%	5	13.2%
Ex premature infants	9	18.8%	8	21.1%
Complex cardiac	6	12.5%	6	15.8%
Chronic respiratory problems	3	6.3%	3	7.9%
Idiopathic weight faltering	6	12.5%	6	15.8%
Various other conditions	9	18.8%	7	18.4%
No information	2	4.2%		
Total	48		38	
Neurodevelopmental problems				
None	22	46.8%	20	52.6%
Mild–moderate	11	23.4%	10	26.4%
Severe	10	21.3%	4	10.5%
Learning disability	4	8.5%	4	10.5%
	47*		37	
Reason referred				
Reduce artificial feeding	10	20.8%	10	26.3%
Decrease parental anxiety	2	4.2%	1	2.6%
Improve feeding behaviour	18	37.5%	13	34.2%
Increase weight	11	22.9%	9	23.7%
Consider tube feeding	5	10.4%	3	7.9%
No information	2	4.2%	2	5.3%
Total	48		38	

*No information for one subject.
HEOS, high-energy oral nutritional supplements.

Table 2 Growth patterns in 30 children who stopped HEOS

	Age (years)	Weight SDS	Height SDS	BMI SDS
At first appointment				
Number	30	30	29	29
Mean (SD)	3.6 (2.6)	−2.72 (1.7)	−1.89 (1.7)	−1.89 (1.5)
Range	0.68 to 10.02	−6.57 to 1.02	−5.74 to 1.90	−5.08 to 0.55
At last follow–up				
Number	30	30	29	29
Mean (SD)	4.76 (2.8)	−2.69 (1.7)	−2.06 (1.7)	−1.67 (1.3)
Range	1.00 to 11.2	−6.48 to 0.31	−5.64 to 0.41	−4.33 to 0.95

	Age of reduction	Weight SD change	Number (%) fallen >0.67 SD	Risen >0.67 SD
Weight change from reduction to last follow-up				
Number	29	29	3 (10%)	5 (17.4%)
Mean (SD)	3.87 (2.6)	0.08 (0.6)		
Range	0.77 to 10.0	−0.88 to 1.59		

BMI, body mass index; HEOS, high-energy oral nutritional supplements; SDS, SD score.

Median time from first reduction to stopping was 6.4 months, with the longest taking 22 months. Half those who continued on HEOS disengaged from the clinic, in some cases reflecting resistance to reduce HEOS intake. One child with cerebral palsy was recognised to already be significantly underweight, but had a trial of HEOS reduction in the hope that his solid intake would increase; he showed no weight catch-up and was therefore commenced on tube feeding.

Improvement in feeding behaviour once HEOS were reduced was documented for 29 children: 26 (86%) of those who stopped and all 3 of those who remained on reduced HEOS.

Average height and BMI showed little change after feeds were reduced (table 2 and figure 2). Five children (17%) rose >1 centile spaces (0.67 SD) after stopping feeds, and these were slightly younger at referral, with mean (SD) age 1.8 (1.1) years compared with 4.2 (2.6) in the remainder (p=0.052). Of these children, all but one were initially below the 2nd centile (−2 SD) and the two who were exceptionally light also showed the largest gains (figure 3).

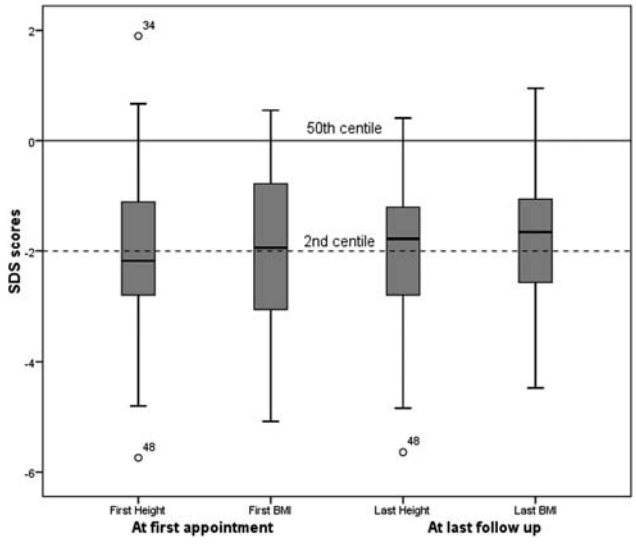

Figure 2 Box plot of height and body mass index (BMI) in children before high-energy oral nutritional supplements were reduced and at last follow-up. SDS, SD score.

Twelve children out of the total 38 had been referred because of concerns about weight faltering or the possible need for tube feeding. Ten of these progressed to normal diet and three of these showed catch-up weight gain of >1 centile space.

DISCUSSION

Tube feeding is an important tool in the management of sick infants and older children with severe neurodisability. However, while oral HEOS are widely perceived as being useful to provide additional energy and nutrients, there is little evidence of effectiveness. The one UK trial of their use found them to be ineffective.[2] One industry-sponsored trial did find short-term gains in weight and height but in a population where food poverty and moderate malnutrition may be more common.[1]

In our specialist feeding clinic, we found that a majority of those already on HEOS at referral had no clear need for them and that 80% could stop them with no adverse impact on growth or weight gain. The limitation of our data is that they are observational rather than trial data, with no control group, but the longitudinal nature of the analysis allows children to act as their own controls over the withdrawal process.

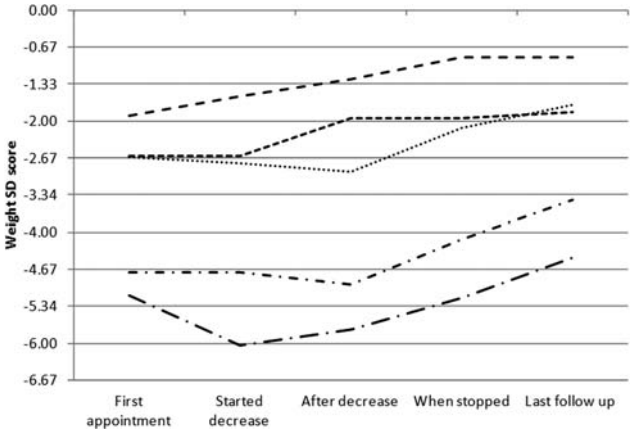

Figure 3 Weight gain patterns during high-energy oral nutritional supplements reduction in children who made overall gain of >1 weight centile space. Each data series represents one child's longitudinal data. SDS, SD score.

The children who were not deemed suitable for reduction were largely children with significant ND impairment and poor nutritional status who were in need of tube feeding. However, some remarkably tiny children who were being considered for tube feeding showed accelerated weight gain once HEOS were withdrawn.

We cannot determine the extent to which HEOS may have been helpful when first started, as we were not the original prescribers, though earlier growth data showed little evidence of accelerated weight gain on starting HEOS. Referrers often seemed unaware of this, and a significant proportion of the children were referred as weight faltering despite 'full' supplementation, when they were simply naturally short and/or slim and growing steadily.

A minority of children actually showed accelerated weight gain after stopping HEOS, suggesting that there may sometimes be oversuppression of appetite by HEOS. This may be because the high-energy liquid diet has prevented acquisition of solid feeding skills at the expected time in this relatively young subgroup.

Most children whose feeds were reduced showed improvement in eating behaviour. This is not surprising, given what is known about energy regulation in childhood. Healthy children have been shown to demonstrate short-term energy self-regulation, adjusting energy intake in response to high-energy drinks consumed before a meal and in the longer term.[7–9] Our earlier work has shown similar compensation in current and former tube-fed children.[10] Thus if children consume most of their daily energy requirements in liquid form, they are unlikely to show interest in solid foods, particularly if they are in fact naturally small, rather than weight faltering. Other studies have demonstrated that feeding behaviour problems are a common cause of a parental concern.[11] We did not formally collect data on the effect this feeding behaviour change had on parental quality of life, but it was clear in practice that many individual parents found their mealtime experiences transformed once HEOS were reduced. Our feeding team includes a psychologist who can support parents in making behavioural changes in relation to food, but in practice little formal psychological input was required once HEOS were withdrawn. In some cases, parents did need help dealing with their anxiety before they could contemplate withdrawing HEOS, and others withdrew from follow-up without attempting withdrawal.

It would be expected that HEOS could be helpful where a child is acutely undernourished and one experimental study has suggested that weight-faltering children may not show energy compensation, suggesting that HEOS could increase overall intake.[12] However, in the developing world, there is little evidence of lasting benefits from oral supplementation in moderate malnutrition.[13–15] Where a child can take sold foods, it seems unlikely that HEOS will be superior to simply giving more energy-rich solid foods and this may be why the one UK trial found no benefit from HEOS in children with cystic fibrosis.[2] HEOS may be used as a bridge from tube to oral feeding, as was the case in half the children in this series, but the risk of this approach is that there is then no incentive to acquire solid feeding skills and there may be no further progression to normal diet.[3] There is thus a need for rigorous trial evidence to quantify the benefits and consider the risks of HEOS in children capable of eating sold food.

While these findings arise from a specialist feeding clinic, we feel they have important wider implications. If HEOS are assumed to be effective, those children who do not 'respond'—either because they are not actually malnourished or because their appetite has been oversuppressed—may progress to tube feeding. Clinicians prescribing HEOS need to recognise and avoid this pitfall by observing their impact and stopping them promptly if they do not produce weight acceleration. These data also suggest that even in children with weight faltering on HEOS, a trial of withdrawal should be made before progressing to tube feeding, unless there is clear evidence of critical undernutrition. Clinicians and parents also need to be aware that HEOS prescribed for fussy feeding behaviours will reduce the child's appetite for solid food and are thus more likely to aggravate these behaviours than resolve them.

CONCLUSIONS

The use of HEOS in children who can eat and are not significantly malnourished is likely to produce food refusal due to energy compensation and in some cases may perpetuate or even cause weight faltering. There is a need for a more formal evaluation of the role of HEOS in childhood.

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Contributors CW conceived the idea for the study, performed further analyses and wrote the final draft. AC extracted the data from notes and databases with help from CW undertook the initial analysis and produced first draft of the manuscript. Both authors have seen and approved the final draft.

Competing interests None.

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