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FALTERING GROWTH

Jacqueline Lowdon
Paediatric Dietitian
Manchester
Children's Hospital

Faltering growth is a common problem in paediatrics and more so during infancy than any other stage in life, due to programmed growth rates and thus higher nutritional requirements. It is a problem with many untoward effects. Divergences in growth, particularly reduced growth, have been associated with an increased risk of disabilities and diseases, in the short and long term.

Recent studies show that children who faltered with growth in infancy are lighter and shorter at school age with adverse intellectual outcomes (1,2,3,4) and had a higher prevalence of feeding problems. Nutrition is also critical during adolescence, another period of rapid growth.

WHAT IS FALTERING GROWTH?

It is regarded as an indicator of physical and/or psychosocial problems in early childhood and is associated with subsequent growth delay and cognitive deficiencies. Although its concept is used widely, no consensus exists regarding its specific definition. Therefore, it has been used to cover a broad range of different anthropometric indicators, usually based on centile charts for weight or height. The indicators studied by Olsen et al (5,6) include:

- weight <75 percent of the median weight for chronological age (Gomez);
- weight <80 percent of the median weight for length (Waterlow);
- body mass index for chronological age <5th centile;
- weight for chronological age <5th centile;
- length for chronological age <5th centile;
- weight deceleration crossing more than two major centile lines;
- centile lines used: 5, 10, 25, 50, 75, 90, 95 from birth until weight within a given age group;
- conditional weight gain=lowest 5.0 percent, adjusted for regression towards the mean weight from birth until the weight gained within the given age group.

Therefore, the definition of faltering growth and its risk factors depend on the anthropometric definition used.

MAIN CAUSES OF FALTERING GROWTH

Several reasons exist, both disease-related and other. Obtaining the correct diagnosis is crucial, ensuring the correct treatment. Causes of disease-related faltering growth in children are multifactorial:

- decreased dietary intake, e.g. anorexia, difficulties in swallowing;
- increased nutritional requirements, e.g. metabolic response to disease;
- increased nutritional losses, e.g. maldigestion, malabsorption.

However, only five percent of children with faltering growth have an underlying medical condition (7). The most common cause of growth failure however, is an inadequate intake, particularly of energy and protein, but also micro-nutrients (8,9,10), e.g. zinc. Failure to grow with no known

Presently team leader for Critical Care and Burns, Jacqueline previously specialised in gastroenterology and cystic fibrosis. Although her career to date has focused on the acute sector, Jacqueline has a great interest in paediatric public health.

organic cause is likely to be attributed to a lower intake due to poor appetite regulation, sensory hypersensitivity, delayed introduction to solid foods, fear of new foods (neophobia) and/or oral-motor dysfunction. In fact, it is now widely accepted that undernutrition is the primary cause of poor growth in infancy (11).

MANAGEMENT OF FALTERING GROWTH IN CLINICAL PRACTICE

Nutritional assessment and long-term management is essential in clinical practice. Evidence for nutritional support is increasing, e.g. in congenital heart disease, impaired weight gain has been shown to predict the risk of late death after surgery (12); in children with active Crohn's disease, nutritional therapy is as effective as corticosteroids in improving intestinal inflammation and maintaining a more sustained clinical remission (13,14,15).

Assessments should include dietary, feeding and oral motor function and should involve the MDT, potentially incorporating, paediatrician, GP, paediatric dietitian, speech and language therapist, paediatric nurse, health visitor, social worker, clinical psychologist.

The initial nutritional approach depends on the degree and type of undernutrition:

- adapted (normal plasma albumin or marasmus) or
- disadapted (reduced plasma albumin or Kwashiorkor).

In adapted undernutrition, the gut mucosal function is relatively normal, so the child's intake can be progressed to high levels (>200kcal/kg/day). In disadapted undernutrition, the gut mucosa is atrophied and gut function limited. With hypoalbuminaemia, there is intra-vascular volume contraction and whole-body depletion of K and P, which contribute to 'refeeding syndrome'. To avoid refeeding syndrome, initially feed at levels that are only 10 to 20 percent above the resting metabolic rate. Once diuresis occurs, the gut mucosa and intestinal function recovers enough to progressively increase intakes up to the high levels used for adapted undernourished children.

The targets for catch-up growth depend on body composition depletions, with regard to lean and fat mass and the rate of repletion (16). There are several guidelines on calculating requirements.

A practical way of estimating catch-up requirements, is to decide on the composition of the new tissue to be laid down during refeeding. Using Atwater figures, 1.0g of fat would require 9.0kcal/g; if it is assumed that lean tissue contained 25 percent protein, then lean tissue would require 1kcal/g. Therefore, if the catch-up growth desired involved 40 percent fat and 60 percent lean mass, then the energy cost of the catch-up would be (0.4 x 9.0)+(0.6 x 1.0) = 4.2kcal/g of catchup growth. If the desired rate of catch-up growth is 20g/kg/day, this would mean an additional 4.2 x 20 = 84kcal/kg/day above normal daily energy requirements.

Protein requirements can also be determined similarly, to replete depleted lean body mass (LBM), as it contains 20 to 25 percent protein. The metabolic efficiency of dietary protein is around 70 percent; therefore, to deposit 1.0g new lean tissue (which equals 0.25g protein), 0.25/0.7=0.36g protein should be ingested. If the target weight gain is 10g/kg/day (with 60 percent lean and 40 percent fat tissue), 10 x 0.6=6g lean tissue should be accreted per kg per day. This would require an additional protein intake of 6.0 x 0.36=2.2g protein per kg per day, or a total protein intake of 1.5+2.2=3.7g/kg/day (17).

Many children with chronic conditions have reduced activity, so if estimated average requirement is used, it may overestimate their requirements.

Another formula for predicting energy requirements for catch-up growth in infants and young children has been suggested (18):

$$\text{kcal/kg} = 120 \times \frac{\text{ideal weight for height (kg)}}{\text{actual weight (kg)}}$$

The importance of ensuring adequate protein to energy ratio has been well reported. In healthy children, seven to 12 percent of energy is required to come from protein. To support catch-up growth, the percentage of energy form protein should be about nine percent (care should be taken in renal insufficiency).

Initial energy needs for catch-up growth may be estimated by using ideal body weight for height, or energy per kg actual body weight plus 10 to 50 percent (19). The protein requirements of wasted infants and children are estimated to be between 9.0 to 11.5 percent of the total energy, depending on the rate and composition of weight gain required (20, 16). Infants and children who are stunted and/or who have increased needs e.g. infection, inflammation, increased losses, may require a higher percentage of energy from protein (19, 21).

Methods to achieve these requirements will take a variety of forms, including food fortification, behavioural management and prescribed supplements, as well enteral tube feeding.

CONCLUSION

Monitoring growth is an essential tool for assessing the health and well-being of children at all ages and whatever the clinical situation. Faltering growth can have severe consequences for health development, behaviour and school performance. For those at risk and those already identified, nutritional treatment should be initiated as early as possible to prevent adverse outcomes. Nutritional management will depend on its severity and cause. Ongoing assessment and longitudinal follow up will both be essential components in the prevention and treatment of faltering growth.

For article references please email: info@networkhealthgroup.co.uk

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Questions relating to: *Faltering growth*
Type your answers below and then **print for your records.** Alternatively print and complete answers by hand.

Q.1	What is faltering growth?
A	
Q.2	Describe three anthropometric indicators studied by Olsen et al.
A	
Q.3	Give three main multifactorial causes of disease related faltering growth.
A	
Q.4	What is the most common cause of growth failure?
A	
Q.5	What should a nutritional assessment include?
A	
Q.6	Which members of the MDT may be involved in the assessment of children with faltering growth?
A	
Q.7	Describe the two main types of undernutrition.
A	
Q.8	What is the practical way of estimating nutritional catch-up requirements giving an example based on Atwater figures for 1.0g of fat?
A	
Q.9	What is the formula for predicting energy requirements for catch-up growth as suggested by Maclean et al?
A	
Q.10	How would you estimate energy needs for catch-up growth?
A	

Please type extra notes here . . .