Failure to thrive

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Abstract

Despite being commonly used, the term failure to thrive (FTT) has no consistent definition. In its broadest sense, FTT refers to poor growth in infants and young children. Although FTT defies attempts at a strict definition and its effect on future growth and development remains unclear, the assessment of growth remains a central part of routine clinical practice and health professionals are frequently required to assess a child who is thought to be growing poorly. This review describes the comprehensive and multidisciplinary clinical assessment that is required to identify specific underlying causes including illnesses and adverse social and other environmental factors. Most children with suspected FTT will be normal children who are constitutionally small or have slow growth and only reassurance is required. For those with underlying causes, careful clinical assessment informs appropriate management, which usually requires multidisciplinary input.

Keywords failure to thrive; weight faltering; growth faltering; undernutrition

Introduction

Concerns regarding undernutrition and poor growth in children have a long history. Holt's first edition of *The Diseases of Infancy and Childhood* in 1897 referred to an infant who 'ceased to thrive' and the term 'fail to thrive' appeared in the 10th edition of the textbook in 1933.[1] The term became established early in the 20th century when poor growth in infants and young children was common as a consequence of a high burden of infection and socioeconomic disadvantage.

Usage of the term 'failure to thrive' (FTT) persists in affluent societies today despite the dramatic improvements in children's health and well-being. The most common usage of FTT is for infants and young children with poor growth and associated undernutrition but FTT is also used more broadly for poor growth regardless of the underlying cause.[2,3] The terms 'weight faltering' or 'growth faltering' are now often preferred to avoid the inference that 'failure' refers to the care being provided for the child.[3] The term 'protein energy malnutrition' refers to nutritional deprivation among children in developing countries.[2] Although sadly still prevalent in the developing world,[4] marasmus and kwashiorkor – the severe forms of malnutrition – are now rare in industrialised countries.

Despite the routine practice of growth monitoring in children living in more prosperous societies, a concise definition of FTT remains elusive and its relevance to a child's future health and development is unclear. In this review, we describe our clinical practice in children who are referred with suspected FTT. In the clinical assessment we aim to identify the small proportion of children with underlying disease, social or other environmental factors that result in growth faltering. Some of these children will have associated nutritional deficiencies. We ascribe the final diagnosis of FTT to those children in whom we identify underlying causes of poor growth. The rationale is that interventions that address these underlying causes improve both growth and the future well-being of the child. This review does not address obesity, which may now be the predominant manifestation of poor nutrition in children in industrialised countries.[5]

Definition

The World Health Organization recommended in 1985 that FTT should be defined solely on anthropometrical parameters[6] but several authors have highlighted the absence of a concise and universally accepted definition for FTT.[5,7] The essential problem is that normal growth cannot be determined reliably for any individual child and, therefore, it is not possible to identify impaired growth. A particular problem is accounting for patterns of growth variation in normal infants confounding the diagnosis of growth faltering.[7] Clearly, dynamic measures are critical and include conditional weight gain, which describes the phenomenon of regression to the mean, with small infants tending to move upwards through the centiles and large infants tending to cross downwards.[8] In practice, a broad range of different anthropometric indicators are employed to identify FTT (Table 1).

Despite the large number of criteria and the apparent sophistication of some, broad definitions relying on clinical judgement remain in common usage: 'Failure to thrive is a description applied to children whose current weight or rate of weight gain is significantly below that of other children of similar age and sex'.[9]

Incidence and prevalence

Although FTT is acknowledged to be a common problem, reported incidence rates vary widely depending on the criteria used. This was well-illustrated in a large cohort of Danish infants with varying socioeconomic status and living in a suburban environment. FTT was identified in anything between 0.5 and 5.0% depending on which of the first six criteria in Table 1 were used; it was 14.7% for infants 2–6 months and 20.6% for those 6–11 months for the seventh criteria (weight falling more than equal to 2 major centiles from birth).[2]

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Commonly used anthropometric criteria for failure to thrive

- Weight <75% of median weight for chronological age (Gomez criterion)
- Weight <80% of median weight for length (Waterlow criterion)
- Body mass index for chronological age <5th centile
- Weight for chronological age <5th centile
- Length for chronological age <5th centile
- Conditional weight gain = lowest 5%, adjusted for regression towards the mean from birth until weight within the given age group using 5% thrive lines produced by the Child Growth Foundation
- Weight deceleration crossing >2 major centile lines (using 5, 10, 25, 50, 75, 90 and 95 centile lines) from birth until weight within the given age group

Adapted with permission from Olsen EM *et al*, 2007.[2]

Table 1

Aetiology

Understanding of the main causes of FTT has changed in recent years. FTT was classically conceptualised as either 'organic' or 'non-organic'. Organic FTT refers to growth faltering due to an underlying disorder that interferes with nutrient intake, absorption, metabolism, or excretion or that increases energy requirements. All organ systems are represented and almost any chronic medical condition in a young child may manifest as poor growth. Classical examples are cystic fibrosis, coeliac disease and congenital heart disease. FTT can be the initial and only presentation of such underlying diseases and a careful and considered investigation for underlying causes, guided by the clinical assessment, is an essential part of evaluation (see below). However, it should be remembered that underlying illness in children with slow growth is uncommon: in 3 separate population based studies, an underlying organic disease was found in 5% or less of children with FTT.[3]

'Non-organic FTT' refers to growth faltering resulting from adverse environmental influences such as neglect, poor feeding and stimulus deprivation. Synonymous terms include 'psychosocial FTT' and 'maternal deprivation syndrome'. However, the importance of socioeconomic factors in causing FTT is thought to have been overstated in the past. Both the Avon Longitudinal Study of Parents and Children (ALSPAC) looking at a large number of infants in South West England[3] and a community-based study in Newcastle in northern England[10] failed to identify markers of social deprivation or neglect as important causes.

Rather than the traditional 'organic' versus 'non-organic' classification, there is now greater awareness that multiple factors contribute to poor growth even where a major single underlying cause is identified. A simple example might be coeliac disease where the main cause of impaired growth is malabsorption. However, the condition also makes a child miserable and apathetic resulting in feeding difficulties which, together with the knock-on adverse affect on the mother–child interaction, compromise nutrient intake and further impair growth. The ALSPAC study highlighted feeding difficulties as being associated with slower growth in infancy.[4] However, the cause of feeding problems remains unclear and includes possible disease factors (such as subtle neurological impairment) and environmental factors (such as prolonged breastfeeding and the success of weaning). Where underlying disease or adverse environmental factors are suspected to impair growth, the probability that such factors are causal is increased by the finding of clinical or laboratory markers of micronutrient deficiency.

In addition to the above clinical scenarios, normal constitutionally small children are the most numerous[3] but the most troublesome group to identify reliably as the diagnosis is one of exclusion. The child is small but appears healthy. Weight and height lie on similar centiles and simple investigations (see below) do not identify any significant abnormalities.

Clinical evaluation

The infant or young child is usually referred because of concerns regarding weight gain. A careful and complete clinical assessment is vital in identifying possible underlying illness, markers of adverse environmental influences and the interaction between the main carer and the child. A thoughtful clinical evaluation also avoids a pointless 'fishing expedition' where multiple, ill-considered investigations may throw-up spurious results and risk confirming in the carer's mind that there must be a problem. Some key points in the clinical history are listed in Table 2.

In addition to a careful general examination and review of all systems that is essential in all children, clinical examination has three specific goals. The first is to ensure an accurate assessment of growth and nutritional status. Make accurate and repeatable measurements of weight, height and head circumference and plot them carefully on centile charts. Measurement of skin-fold thicknesses assesses the adequacy of subcutaneous fat. Previous measurements from the child's health records are essential in providing a dynamic picture and assessing growth velocity. Look out for thin extremities, a narrow face, prominent ribs, and wasted buttocks due to loss of subcutaneous fat and reduced muscle mass and also common signs of micronutrient deficiency, such as pallor and angular stomatitis.

Secondly, identify any underlying disease or associated conditions. Search carefully for general signs of underlying disease, such as clubbing and dysmorphic features (e.g. Turner's syndrome). Review each of the major systems and assess neurodevelopmental status. A critical element of the assessment is the observation of feeding when the infant/child is hungry, which provides an invaluable opportunity to assess both the mechanics of feeding, the child's developmental stage as well as the carer–child interaction (Table 3).[11] The recent ALSPAC study highlighted the significant association between feeding difficulties reported by carers and slow growth.[3] A small percent of the 'picky eaters' have anxiety disorders and a few have autistic spectrum disorder.[11]

Thirdly, identify signs of neglect or abuse and assess behaviour. Is there evidence of poor hygiene? Is the child either less responsive than expected (avoidance of eye contact, expressionless face, hypotonia) or, alternatively, does he or she seek affection to a greater level than normal?

Remember that a comprehensive clinical assessment usually requires input from other health professionals such as dieticians,

Clinical history in assessing failure to thrive

Feeding history from birth and current mode of feeding and nutrient intake	Breastfeeding • maternal diet • use of alcohol, diuretics and other drugs that affect milk production and let down Formula feeding • preparation • volume consumed • feeding technique Older children • frequency and nutritional adequacy of meals and snacks • excessive intake of squash and fruit juices • feeding behaviours: feeding battles, parental attitudes and eating habits, coercive practices
Pregnancy and birth history	• Illness or drugs during pregnancy • Prematurity, small for gestational age • Apgar scores and other markers of birth asphyxia
Development	Document age at which major milestones achieved
Past medical history for markers of an underlying medical condition, neglect or abuse	• Recurrent infections • Vomiting and regurgitation • Diarrhoea • Milk intolerance • Injuries • Accidents
Family history	• Assess genetic target growth from stature and growth of parents, siblings and grandparents • Calculate mid-parental height
Social history	• Marital stress • Maternal depression • Young or single parent • Domestic violence • Parental employment and economic well-being • Parental substance abuse

Table 2

Observation of feeding in the context of feeding milestones

Breastfeeding	• Is the infant latching-on and sucking well? • Is the let-down of milk adequate (assess by asking the mother to express a small amount to check flow)? Newborns cannot approximate lips tightly around the sucking surface (the areola of the breast or the teat of the bottle) so milk leaks out at the corners of the mouth and the infant has 'wind'.
Bottle-feeding	• Does the infant have a strong and adequate coordination of suck and swallow? After the first few days of life, complete approximation of lips to the sucking surface reduces 'wind'.
Spoon feeding and self-feeding	• Is the evidence that the child assists with feeding or self-feeds at an appropriate developmental stage? *6–12 months* – beginning of chewing together with ability to hold object enabling self-feeding. The fingers go into the food, and much is spilt, accidentally or deliberately *15 months* – early attempts to feed by spoon
General	• Are there inappropriate practices such as prolonged attempts at winding or discontinuing feeding when the infant is still hungry? • Does the caregiver recognise the child's cues and child's responsiveness? • Does the caregiver demonstrate appropriate warmth and behaviour toward the child?

Table 3

speech and language therapists to assess oro-motor abilities, health visitors and general practitioners. A home visit might reveal obvious dietary and feeding issues and this input alone often results in improvement.[10]

Laboratory investigations

Rather than a comprehensive list of laboratory tests, investigations must be guided by the findings of the clinical assessment. In our practice, we undertake some basic investigations in most children as part of our routine assessment (Table 4). In addition, it is wise to review the newborn metabolic screen for a young infant who is not growing adequately. In a minority of children, further investigations are based on a specific diagnostic hypothesis arising from the clinical assessment.

In- or out-patient assessment?

Hospitalisation is rarely required and is only indicated for children with acute malnutrition, if outpatient assessment has been inconclusive or where the safety of the child is a concern.[12] The children's ward provides a controlled environment to assess dietary intake, feeding techniques and the carer–child interaction. It allows timely input from important ancillary healthcare staff, including dieticians, play therapists and nurses.[1] In cases of frank neglect, appropriate feeding on the ward can demonstrate that the child gains weight. However, the risks of

Usual basic laboratory investigations in failure to thrive

Sample	Investigation	Significance of abnormality
Blood	Full blood count differential, ferritin	Anaemia, iron deficiency
	Urea, creatinine, glucose, calcium, phosphate, bicarbonate	Renal disease, metabolic disease
	Liver function tests and albumin	Liver disease, protein deficiency or loss
	CRP, ESR, platelets	Inflammation
	Total immunoglobulins and IgA anti-transglutaminase antibodies if weaned	Coeliac disease
	Thyroid function tests	Thyroid disease
	Chromosome analysis in girls	Turner's syndrome
Urine	Urinalysis (protein and blood)	Urinary tract infection and renal disease
	MSU for microscopy and culture	

CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; MSU, mid-stream urine.

Table 4

exposure to infections and disruption of home routines should be considered.[10]

Management

The management of FTT is multidisciplinary. A systematic approach that draws on the skills of many different health professionals, with leadership from either hospital or community-based paediatricians, will be more effective and more supportive of parents for whom FTT is often a cause of great distress. In most children, the initial assessment will not identify underlying causes of poor growth and the diagnosis by exclusion of a constitutionally small child is made. Such children are likely to remain small but weight and height should increase at a normal velocity (parallel to growth centiles). Our usual practice is to follow-up these children at about 3 months after the initial assessment to confirm this expected growth trajectory, to check for any new symptoms or signs and provide further reassurance to the carers. Opportunity should be given to carers to discuss their concerns at any time. If subsequent growth is not as expected or new features have developed, then this should prompt a thorough re-evaluation with a repeat of the procedures listed above.

Where underlying diseases that are likely to have impaired growth are identified, management aims to address these specific causes while simultaneously providing nutritional and feeding interventions with input from both paediatric dieticians and speech and language therapists. In some cases, aggressive nutritional intervention with comprehensive protein, caloric and micronutrient supplementation given by nasogastric or gastrostomy tubes may be required to correct existing nutritional deficiencies and provide on-going dietary supplementation.

Sub-optimal feeding practices especially regarding breastfeeding and appropriate weaning are common and often respond well to simple advice and support from health visitors, breastfeeding co-ordinators and community paediatric nurses in the primary care setting. In one study, one in five children showed improvement in their growth pattern immediately after dietary advice.[10] In toddlers, food intake could be enhanced by offering familiar food that is appropriate in texture and portion size and in a social feeding environment.[11]

Prognosis

Early childhood is a critical period for growth and development and both carers and health professionals worry about FTT as a cause of future short stature, adverse behavioural problems and cognitive deficiencies.[2] A systematic review of prognostic studies of FTT found that on average children will be lighter, shorter and score less well on measures of psychomotor development than their peers although the authors commented on the paucity of high quality studies.[13] In particular, size at follow-up did not take into account parental size. The data on intellectual consequences of FTT are conflicting with some authors reporting only a marginal deficit in average IQ[13,14] and others more significant deficits.[15] Identifying causal relationships is difficult and it is possible that FTT is a contributing or associated factor to adverse outcomes.[13] However, this data implies that to enable timely intervention to prevent any deleterious long-term consequences, cases of FTT will have to be identified early in infancy.[14]

Future directions

It is clear that perceptions of the causes and outcomes of FTT have changed markedly in recent years. Some authors even question the continued validity of this diagnosis, especially given the absence of a concise and universally-accepted definition.[5] However, concerned carers will continue to seek the advice of health professionals regarding apparent poor growth in young children. There are two main priorities for future research. First, how can we identify with confidence the normal, constitutionally small child in whom no interventions are required other than reassurance? Second, what parameters can we measure that are associated with future adverse outcomes and that are amenable to intervention? Both of these questions can only be answered by cohort studies with long-term follow-up into adulthood. ◆

REFERENCES

1 Schwartz ID. Failure to thrive: an old nemesis in the new millennium. *Pediatr Rev* 2000; **21:** 257–64.

2 Olsen EM, Petersen J, Skovgaard AM, Weile B, Jorgensen T, Wright CM. Failure to thrive: the prevalence and concurrence of anthropometric criteria in a general infant population. *Arch Dis Child* 2007; **92:** 109–14.

3 Emond A, Drewett R, Blair P, Emmett P. Postnatal factors associated with failure to thrive in term infants in the Avon Longitudinal Study of Parents and Children. *Arch Dis Child* 2007; **92:** 115–9.

4 Black RE, Allen LH, Bhutta ZA, et al. Maternal and Child Undernutrition Study Group. Maternal and child undernutrition:

global and regional exposures and health consequences. *Lancet* 2008; **371:** 243–60.
5 Hughes I. Confusing terminology attempts to define the undefinable. *Arch Dis Child* 2007; **92:** 97–8.
6 In: Drotar D, ed. New directions in failure to thrive – implications for research and practice. New York: Plenum Press, 1985.
7 Spencer NJ. Failure to think about failure to thrive. *Arch Dis Child* 2007; **92:** 95–6.
8 Olsen EM. Failure to thrive: still a problem of definition. *Clin Pediatr* 2006; **45:** 1–6.
9 Med*linePlus Medic*al Dictionary, Bethesda (MD): National Library of Medicine (US) updated 9/28/2007. Failure to thrive. Available from: http://www.nlm.nih.gov/medlineplus/ency/article/000991.htm#Definition
10 Wright CM. Identification and management of failure to thrive: a community perspective. *Arch Dis Child* 2000; **82:** 5–9.
11 Gahagan S. Failure to thrive: a consequence of undernutrition. *Pediatr Rev* 2006; **27:** e1–1.
12 Krugman SD, Dubowitz H. Failure to thrive. *Am Fam Physician* 2003; **68:** 879–84.
13 Rudolf MCJ, Logan S. What is the long term outcome for children who fail to thrive? A systematic review. *Arch Dis Child* 2005; **90:** 925–31.
14 Emond AM, Blair PS, Emmett PM, Drewett RF. Weight faltering in infancy and IQ levels at 8 years in the Avon Longitudinal Study of Parents and Children. *Pediatrics* 2007; **120:** e1051–8.
15 Corbett SS, Drewett RF. To what extent is failure to thrive in infancy associated with poorer cognitive development? A review and meta-analysis. *J Child Psychol Psychiatry* 2004; **45:** 641–54.

Practice points

- The term FTT is used very broadly but has no strict definition or clear outcomes
- Comprehensive evaluation of FTT should be undertaken to identify or rule out underlying disease and environmental factors
- Most infants and young children with suspected FTT will be normal, constitutionally small children
- Our practice is to diagnose FTT in those children in whom we identify underlying disease and/or environmental factors. Some of these children have associated nutritional deficiencies
- Large, long-term cohort studies are required to investigate the effects of FTT on future growth, behaviour and cognitive development