An approach to 'failure to thrive'

BACKGROUND Infants commonly present with failure to thrive. Psychosocial and nutritional causes are commonly responsible, but significant organic pathology requires exclusion in all children with failure to thrive.

OBJECTIVE This article discusses an approach to the assessment of infants presenting with failure to thrive, together with information on management and available resources.

DISCUSSION Close liaison between those involved in the management of infants presenting with failure to thrive – including family, maternal child health nurse, family doctor and paediatrician – should usually allow for appropriate intervention to correct the failure to thrive.

Growth measurement and the use of growth charts form a basic but essential part of health monitoring for all children. The measurement of an infant's head circumference, weight and length is routinely performed at birth, and then on an intermittent basis throughout the rest of childhood; most frequently in the first 6–12 months of life. Divergence from the standard growth curve may occur at any time point, in any of the growth parameters, and in either direction. When such a deviation from the standard curve occurs, a careful assessment is required to determine the aetiology.

Failure to thrive (FTT) is a term generally used to describe an infant or child whose current weight or rate of weight gain is significantly below that expected of similar children of the same sex, age and ethnicity. It usually describes infants in whom linear growth and head circumference are either not affected, or are affected to a lesser degree than weight. More exact definitions, based upon precise weight percentile, rate of weight gain or weight loss, or changes in other parameters exist, but are no more useful than the above definition. They usually refer to weight being below the 3rd centile or dropping two major percentile lines over time.

Failure to thrive is a common problem, usually recognised within the first 1–2 years of life, but may present at any time in childhood. It is not a final diagnosis but a description of a physical state; therefore a cause for the FTT must always be sought (although often a significant underlying physical cause is not recognised). Long term sequelae involving all areas of growth, behaviour and development may be seen in children suffering from FTT. A number of excellent reviews on the assessment of FTT exist.[1–3]

Philip Bergman
MBBS, FRACP, is a paediatric endocrinologist, Diabetes Ambulatory Care Service, Monash Medical Centre, Clayton, Victoria.
philip.bergman@southernhealth.org.au

Justin Graham
MBBS, is General Paediatrics Fellow, Department of Paediatrics, Monash Medical Centre, Clayton, Victoria.

Diagnosis

The differential diagnosis of FTT is highly influenced by geographic setting, with a significantly different likelihood of diagnoses in different parts of the world – FTT in the setting of refugee health and third world medicine is beyond the scope of this article. The same basic approach however, is useful in all contexts – identifying organic causes, nonorganic causes, and normal variants of growth. It is important to note that there may be significant overlap between these diagnostic groups.

The first consideration in an infant presenting with presumed FTT is identifying normal variants of growth. Within this group lie four main patterns (*Table 1*):

- infants who have small parents and are growing to their genetic potential
- infants with constitutional delay in growth
- infants born prematurely who are growing below their age matched peers, and
- infants with postnatal 'catch down' growth.

Those infants born of small parents may be small from birth and will grow along their low percentile line for both weight and height (sometimes falling below their weight percentile for short periods of time). This raises significant concerns at the time, because they are already at the lower end of normal (see *Case study*). Those infants with constitutional delay in growth represent a group of children whose body growth (often noticed as delayed length or height rather than weight) is delayed by months or years when compared to their peers of the same age. This is best identified by bone age assessment (although this test is at its most unreliable in the first 12 months of life). There is often a family history of constitutional delay in parents or other siblings. Premature neonates will often grow below but parallel to the normal growth curve, but when corrected for gestation their growth parameters will usually fall within the normal range.

The final group of normal infants are those who are larger than expected at birth (eg. macrosomic infants of mothers with gestational diabetes) and postnatally experience a period of 'catch down' growth. Catch down growth – as opposed to 'catch up growth' shown by growth restricted babies who cross percentiles upward into the normal range – crosses percentiles downward. This diagnosis is best made in retrospect after other causes have been excluded and the infant has been shown to have steadied out in their growth to follow a lower growth percentile line (see *Case study*).

Most pathological explanations for failure to thrive can be broken up into one of the following groups:

- inadequate food intake
- inability to properly utilise ingested nutrients due to reduced absorption or digestion of nutrients or excessive loss of nutrients, and
- excessive utilisation of energy.

Various causes are summarised in *Table 2*.

Failure of food intake underlies most cases of FTT and includes nearly all episodes due to nonorganic causes. It may be due to lack of available food, lack of knowledge about infant feeding, maternal depression (postnatal or otherwise), or specific dietary beliefs that limit foodstuffs offered to the infant. It often hinges on the parent-child interaction: the problem may be the parent not offering enough food, the child refusing to take enough food, or a combination of both (see *Case study*). There may be specific organic issues in the infant which limit feeding, including oro-motor dysfunction, anatomical abnormalities such as cleft palate, or concurrent illnesses in the child such as cardiovascular abnormalities.

Failure of utilisation is generally due to gastrointestinal causes resulting in poor digestion,

Table 1. Normal variants of growth presenting as FTT

	Genetic short stature	Ex-premature infant	Constitutional	'Catch down' growth
Birth weight	Low to normal	Normal if corrected for gestation	Low to normal	Above expected
Parental percentiles	Low	Normal	Normal	Normal
Progress along percentiles	Low percentile but does not cross percentiles	Low if uncorrected but follow percentile curves, may show catch up to normal range	May be an initial fall in first 6 months and then follow percentiles	Initial fall in 6–12 months and then follow percentiles

reduced absorption, or excessive losses. Recognised causes include gastro-oesophageal reflux, malabsorption, maldigestion or other causes of vomiting and diarrhoea. The age of the child may hold clues to the diagnosis, eg. coeliac disease doesn't usually cause problems until after the introduction of gluten containing solids, so fall off in growth is usually observed from 4–8 months of age. An earlier fall off in growth in association with gastrointestinal symptoms would suggest other causes such as gastro-oesophageal reflux, allergic colitis or cystic fibrosis related pancreatic disease.

Increased requirements occur in those infants who have a higher metabolic rate due to chronic illness. Some of these conditions may also contribute to the FTT by other mechanisms listed above, including cystic fibrosis which can cause maldigestion through pancreatic enzyme deficiency, reduced intake due to chronic infection, and increased requirement due to chronic infection or liver disease. Most forms of chronic disease in childhood are associated with increased metabolic rate, highlighting the need for a thorough history and examination.

History and examination

The first issues requiring assessment are the specific worries of the concerned adult, be they parent, guardian, health nurse, or midwife. While nutritional and psychosocial causes are the more common causes of FTT in developed countries, it is important to rule out the less common major organic problems before focussing on nutritional and psychosocial areas. This can usually be achieved during history taking, which should include a nutritional history detailing what is eaten, how often it is eaten, and what behaviours occur around mealtimes. Input from a dietician at this stage often helps make an exact assessment of current and future nutritional requirements. A thorough psychosocial history is mandatory including assessment of pregnancy history, parental mental health, intellectual capacity and social circumstances. Particular care needs to be undertaken to elicit this information while maintaining the family's trust, and usually requires more than one session. Finally, history of recurrent infections, vomiting, diarrhoea, or respiratory symptoms including chronic cough, shortness of breath and snoring should be sought.

Case study – Jake

Jake, aged 4 months, presents with poor weight gain since birth. He was born at term by normal delivery following a pregnancy complicated by maternal gestational diabetes. His birth weight was 4.9 kg, length 52.5 cm. He is fully breastfed and apart from initial oral thrush has been well with no physical symptoms. Having been above the 97th centile at birth for weight, he was on the 90th by 2 months, 75th by 3 months, and now is just below the 50th centile. His length is also just below the 50th centile. Other history and examination is normal, and initial investigations and paediatric review are also normal. Over the next 3 months he remains well and his weight and length remain just below the 50th centile. At age 1 year, a presumptive diagnosis of 'catch down' growth followed by now normal growth is made.

Table 2. Pathological causes of FTT[4,6]

Inadequate food intake
- Lack of appetite
  - chronic illness or anaemia
  - psychosocial disorder
- Food not available
  - type or volume of food not appropriate
  - feeding technique, parental-infant interaction problems
  - withholding of food

Reduced absorption or digestion of nutrients
- Pancreatic insufficiency: cystic fibrosis
- Loss or damage to villous surface: inflammation, coeliac disease

Excessive loss of nutrients
- Vomiting
  - gastro-intestinal: gastro-oesophageal reflux, obstructions
  - central nervous system causes: increased intracranial pressure, drugs
  - systemic illness: urinary tract infection or other infection, metabolic disorders
- Malabsorption/diarrhoea
  - coeliac disease, inflammatory bowel disease, pancreatic insufficiency (eg. cystic fibrosis), colitis (eg. allergic)
- Renal losses
  - renal failure/renal tubular acidosis
  - diabetes mellitus or diabetes insipidus

Inability to properly utilise ingested nutrients
- Chromosomal or genetic abnormality
- Metabolic disorder
- Endocrine disorder

Excessive utilisation of energy
- Chronic illness, eg. cardiac disease, liver failure, renal failure, endocrine disorders, infections, anaemia

An accurate assessment of growth requires the evaluation of current and past parameters including height or length, weight, and head circumference. Occasionally further assessments are performed such as mid upper arm circumference, various skin fold thicknesses, body proportions (ie. upper and lower segments and arm span) and, if indicated, pubertal assessment. Weight assessment is best done either bare or minimally clad, with the amount of clothing recorded in the weight record to allow for accurate future comparison. Length is usually performed up until the child is 1–2 years of age, after which a height measurement using a stadiometer is more accurate. These growth parameters are then required to be plotted on an age, sex, and where available, disease and race specific chart. Comparison can then be made to any previous growth parameter. If babies are born prematurely, a correction for prematurity is usually helpful until between the second and third year of life, at which time delays of only a few months become negligible.

Case study – Jenny

Jenny, aged 6 months, is seen due to parental concerns of poor growth. She is the first born child to parents from southeast Asia whose heights are on the 1st and 3rd centiles respectively. Her birth weight was 2.9 kg, length 46 cm. She was breastfed until 3 months of age, and is now on a standard cow's milk based formula. Solid food was introduced at 4 months of age. Her current growth parameters of 63 cm and 6.2 kg sit just below the 3rd centile for her age. She is otherwise well with no physical symptoms and her examination is normal. A diagnosis of familial small stature is made and on further 2 monthly clinical reviews over the next 6 months she remains well and continues to follow just below the 3rd centile for length and weight.

Case study – Jill

Jill presented at 4.5 months of age with failure to thrive and irritability. She was born at 41 weeks gestation following a normal pregnancy and a labour complicated by obstruction and an emergency caesarean section after 30 hours. Her parameters were normal with a birth weight of 3.5 kg, length 49 cm. Her mother, Jackie, had difficulty in establishing breastfeeding and developed mastitis at 4 weeks after birth. Jill developed irritability from the second week of life that increased over the next 2 months; settling over the past 2 months. At the time of presentation Jill is fully breastfed, feeding up to 10 times per day with a maximum of 2.5 hours between feeds overnight. Jackie presents with a lowered mood, fatigue, constipation and episodic headache. Jill appears wasted and has a weight of 5.2 kg (5th centile), length 61 cm (25th centile) but has no other physical signs or symptoms. Urinalysis, stool examination and blood screening tests are normal in Jill. Jackie is diagnosed with postnatal depression. Careful attention to the postnatal depression and mother-baby attachment including a stay in a mother-baby unit sees a significant improvement in Jackie's mood and interactions paralleled by increasing gains in Jill's weight and length.

Further examination beyond growth parameters should include a thorough general physical examination including inspection for any physical signs of neglect or abuse, dysmorphic features, skin rashes, examination of the mouth for the presence of a cleft palate and quality of sucking movements, and observation of feeding if possible (including observation of mother-infant interaction). The chest may reveal signs of chronic respiratory or cardiac disease. The abdomen may be distended due to malabsorption, or there may be organomegaly. Wasting of the buttocks may be seen, indicating general muscle wastage.

Investigations

Investigations should be guided by the history and examination. Infants who are either unwell or have significant positive physical findings will require immediate investigation and consideration of paediatric referral, while those who are generally well – with no positive findings – may require no immediate

Table 3. Investigations for FTT

Blood tests
Urea and electrolytes/creatinine
Full blood examination/erythrocyte sedimentation rate
Liver function
Calcium/phosphate
Immunoglobulins
Coeliac screen (and total IgA if not already done)
Thyroid function
Blood glucose
Iron studies
Stool sample
Stool microscopy and culture
Fat globules and fatty acid crystals
Urine sample
Urine microscopy and culture
Other tests (only if clinically indicated)
Urine for organic and amino acids (metabolic screen)
Karyotype
Allergy investigations: RAST, skin prick test
Sweat test
Gastroscopy

Case study – Josh

Josh presents at 11 months of age with a history of poor weight gain over the past 4–5 months and a fall in weight over the past 2 weeks. He was born at term by normal delivery following an uncomplicated pregnancy with normal birth parameters of 3.4 kg and 49 cm. He was breastfed until 7 months of age, then weaned to a standard cow's milk based follow on formula. Solid food was introduced at 5 months of age. At 3 months of age he had mild bronchiolitis for 1 week and at 8 months of age had 4 days of diarrhoea, which has now settled. At the time of presentation he has no physical symptoms, including normal bowel actions. Clinical review shows normal examination except for slight reduction in muscle bulk in his buttocks. Investigations include normal urine and stool examination, normal renal, liver and thyroid function, normal calcium, full blood examination, and ESR. His coeliac screen showed an abnormal anti-endomysial antibody level and elevated anti-gliadin antibodies. He proceeded to endoscopy that confirmed coeliac disease, and following instigation of a gluten free diet at just under 1 year of age, his weight started to increase again.

investigations. In those requiring investigation, full blood examination, erythrocyte sedimentation rate (ESR), electrolytes including urea, creatinine, calcium and magnesium, and urine for culture and urinalysis are helpful as an initial group of screening tests (*Table 3*). If there are specific concerns raised in the history, other investigations may be indicated (*Table 3*). In children where significant doubt persists and tests have been unhelpful, paediatric review and sometimes a period of hospitalisation for a trial of observed feeding and further investigation may be helpful.

Treatment

Treatment for infants with FTT is separated into a number of distinct sections.[4] Addressing identified issues of attachment and other psychosocial issues is crucial and often requires input from a multidisciplinary team. The management of any underlying cause also needs to occur, such as institution of a gluten free diet for coeliac disease (*see Case study*), diuretics for heart failure, or pancreatic enzyme replacement and antibiotics for cystic fibrosis. Nutritional rehabilitation by means of increased caloric intake is often best supervised with input from an experienced dietician, allowing for exact caloric requirements to be calculated, such as by formulae based upon current and ideal weight and usual calories required for age.[4] Vitamin and mineral supplementation is also sometimes required, usually guided by specific testing of these levels. In severely malnourished infants and children, specialist care is recommended to supervise cautious re-feeding in order to avoid the re-feeding syndrome which may result in electrolyte disturbance and circulatory compromise.[4,5]

Even when the child's growth parameters return to normal, it is vital that he or she remains under long term surveillance for growth and cognitive development. If the child is judged to be at risk, state and territory legislation on mandatory reporting must be followed.

Resources

- Growth charts – CDC USA: www.cdc.gov/growthcharts/
- Australasian Paediatric Endocrine Group: www.racp.edu.au/apeg/
- Dietitians Association of Australia: www.daa.asn.au/
- The Gut Foundation: www.gut.nsw.edu.au/
- Australian Breastfeeding Association: www.breastfeeding.asn.au/

Conflict of interest: none declared.

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Email: afp@racgp.org.au

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ERRATUM

The figures in case 2 and case 3 of the article 'Atypical facial pain' by Geoffrey Quail (*AFP* August) were incorrectly labeled. The correct version is available at: www.racgp.org.au/document.asp?id=17780

AFP aplogises for any confusion this error may have caused.