Fortnightly Review

Failure to thrive

Harvey Marcovitch

"Failure to thrive" is a descriptive term, not a diagnosis. There is no clear agreement on definition; one commonly used is, "when his or her rate of growth fails to meet the potential expected for a child of that age."[1] As it is difficult to predict potential, such a definition might initially include many normal children of short stature. Illingworth added to the definition evidence of lassitude, loss of energy and joie de vivre.[2]

A major paediatric textbook includes "signs of developmental retardation and of physical and emotional deprivation such as apathy, poor hygiene, intense eye contact with people and withdrawing behaviour as well as disorders of oral intake which may be manifested as anorexia, voracious appetite or pica."[3] This description attempts to combine some of the characteristics of psychosocial deprivation with those of eating disorder and poor growth. Any combination may be present in an individual child.

Summary points

- Failure to thrive may be the end point of any combination of a nutritional disorder, poor growth, and psychosocial deprivation
- Normal short children do not need investigation. The clues might be very low birth weight, low mid-parental height, normal growth velocity, and no observable illness
- Growth charts are an essential part of child health surveillance but need careful interpretation. It is not axiomatic that a healthy child should grow along a particular centile line
- Hospital admission is rarely necessary and may be counterproductive. Day attendance, for investigation and observation of child-parent interaction, may be more valuable

Screening

General practitioners and health visitors have a key role in detecting infants who may be failing to thrive. Such infants might be screened from a population if their weight falls below an arbitrary point, perhaps three standard deviations below the mean or possibly the third[4] or 10th[5] centile for the population concerned. Referral by the health visitor to the general practitioner or by the general practitioner to a paediatric clinic is initiated more commonly when early growth velocity appears to be poor as evidenced by "falling through the centiles."[6]

Diagnosis

Box 1 lists the differential diagnoses in children who may be failing to thrive.

NORMAL CHILDREN OF SHORT STATURE

Pointers in the case of a normal child of short stature may include any of the following: low birth weight, particularly under 1000 g[7]; extreme prematurity; low mid-parental height (box 2)[8]; slight build of siblings or other close relatives; normal growth velocity; no lack of energy or responsiveness; observed normal interaction with parent(s) and doctor; no symptoms or signs of poor intake, malabsorption, or excess output. Such a child may need to be seen two or three times over a few months to confirm the initial impression. No laboratory investigation is necessary in the absence of symptoms, except as part of serendipitous surveillance—for example, for anaemia or urinary tract infection.

Parents often alter the child's diet but there is little rationale behind this. Often they believe their child to be food intolerant or allergic, but this is highly unlikely in the absence of gastrointestinal symptoms, and there is no evidence that changing infant formulas is likely to make any difference.

IDIOSYNCRACIES OF NORMAL GROWTH PATTERN

There are many confounding factors in the normal growth pattern. For example, the maximum weight centile achieved between 4 and 8 weeks is a better predictor of the centile at 12 months than is the birthweight centile.[9] This may be because birth weight is determined less by genetic endowment than by maternal weight, parity, smoking, and alcohol consumption. "Catch up" weight is common in the first few weeks in light for dates babies.

There is also a phenomenon of "catch down" weight. A baby may grow along its birth centile for three or four months and then have a period of low velocity growth during which it crosses one or more centile lines.[10] Careful diagnostic assessment is necessary and possibly referral. Often by the time this is achieved the infant is growing with apparently normal velocity along a lower centile line. It is not clear whether this pattern represents a normal variant (or switch between

The Horton General Hospital NHS Trust, Banbury, Oxfordshire OX16 9AL
Harvey Marcovitch, *consultant paediatrician*

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Box 1—Differential diagnoses in children who may be failing to thrive

- Normal child of short stature
- Idiosyncratic growth pattern
- Breast feeding failure
- Formula feed errors
- Non-organic failure to thrive
- Severe developmental delay
- Chronic infection (urinary tract, lung)
- Gastrointestinal disorders
- Metabolic disease
- Congenital heart disease

Box 2—How to use mid-parental heights to calculate growth potential[6]

(1) Plot parents' heights at adult end of centile chart
(2) Add 12·5 cm when plotting mother's height on male child's chart, and deduct 12·5 cm when plotting father's height on female child's chart
(3) Parents tend to overestimate own height, so measure if possible
(4) Take midpoint and define range of ±8·5 cm
(5) Upper and lower limits of this range are broadly representative of child's likely achievable 10th and 90th centiles

an intrauterine and genetic growth pattern) or should be taken as indicative of the child being part of a population vulnerable to failure to thrive (fig 1).[9 11]

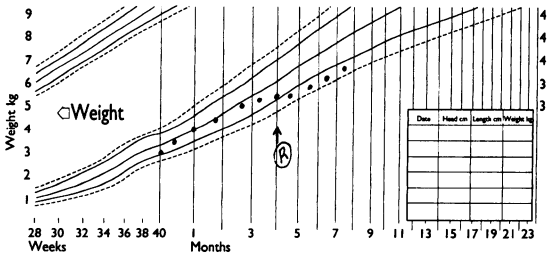


FIG 1—*Portion of Tanner and Whitehouse's growth assessment chart[8] of girl infant apparently failing to thrive. R=Referral to paediatric clinic. (Courtesy of Castlemead Publications, Welwyn Garden City, Hertfordshire)*

TRUE FAILURE TO THRIVE

Once it is decided that a child does not lie in the above categories an attempt should be made at diagnosis in physical, psychological, emotional, social, and family terms. Infants will then broadly be categorised as having "organic" or "non-organic" failure to thrive. There may, of course, be elements of both.

The history must include an account of the infant's health, feeding habits, behaviour, and activity. It must also be directed to discover details of the family's social and financial circumstances, parental attitudes to the conception and pregnancy, maternal ill health, parent-child separation, and the parents' own experiences of childhood. In other words, the doctor should gently seek out evidence for settings predisposing to child abuse or neglect.[12]

Differentiating organic and non-organic failure to thrive

Many workers have made attempts at differentiating organic and non-organic failure to thrive. Usually these have been based on inpatient studies, which may be biased by admission criteria such as (in the United States) availability of state funded inpatient but not outpatient care. Homer and Ludwig admitted 82 such infants and suggested the following breakdown: psychosocial only (family stress, dysfunction, neglect) 34 cases (41%); organic and psychosocial 19 (22%); organic only 21 (26%) (table); iatrogenic (allergy diets) 3 (4%); undiagnosed 5 (6%).[13]

Berwick *et al* investigated 122 children with failure to thrive and suggested a social or environmental cause in 39 (32%) and an organic diagnosis in 38 (31%). Of the 38 with an organic diagnosis, 31 had a gastrointestinal abnormality. Berwick *et al* were uncertain of the diagnosis in the remainder, who presented mostly as small children with normal growth velocity. They pointed out that those with an environmental cause tended to be further below the third centile than those of normal short stature and deviated down from it.[6]

Organic failure to thrive

One set of causes of organic failure to thrive includes deficient intake. Box 3, however, shows that differentiation between organic and non-organic failure to thrive due to deficient intake may be artificial, many patients having both elements. Another set of organic causes concerns malabsorption and excessive loss of nutrients (box 4). A third and final set of organic causes includes mostly rare conditions in which there may be complex interaction of poor nutrition, excessive catabolism, and endocrine disorders—for example, congenital heart disease, diabetes insipidus, congenital adrenal hyperplasia, renal tubular acidosis, and hypothyroidism. Dwarfing disorders—many chromosomal or dysmorphic—may be misinterpreted as or may include failure to thrive.

Box 3—Causes of failure to thrive with deficient intake

- Breast feeding failure
- Errors in artificial feeding
- Inability to feed optimally, as in impaired mental or motor development or owing to anomalies such as cleft palate
- Chronic illness (for example, congenital heart disease,[19] cirrhosis, chronic renal failure, chronic or recurrent urinary tract infection)
- Bizarre diets[20] (for example, unorthodox health beliefs, Munchausen syndrome by proxy)
- Chronic subdural haematoma (likely to be due to non-accidental injury)

OBJECTIVES OF CONSULTATION

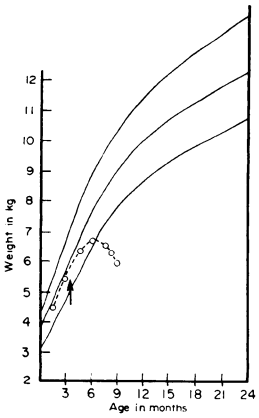
The first objective of consultation is to collect all known weight, length, and head circumference measurements from the personal child health record and elsewhere. Plot them on a standard growth chart. Inquire if measurements were made naked or clothed and whether there was consistency of operator and equipment. Always have a degree of scepticism, especially about length measurements, for which there is a paucity of data on reproducibility and accuracy. Even at age 5 the confidence interval for a 12 month height velocity measurement on a third centile child spans the eighth to 52nd centiles.[14] This approach should ensure that children such as 34 (41%) of those in Homer and Ludwig's series[13] and 81 (66%) of those in the series of Berwick *et al*[6] are not subjected to diagnostic investigations unnecessarily.

Next, plot parental heights if discoverable and inquire about the shape and size of close family members. If a slightly built parent is concerned about a mirror image child ask for and discuss photographs of herself as a baby.

Take a full history, particularly of food intake. With the help of a dietitian, if available, assess likely energy intake and begin to frame a hypothesis about whether psychosocial risk factors for failure to thrive are present.

Organic diagnosis among 82 patients admitted by Homer and Ludwig[13]

Organic diagnoses among 82 patients	No of cases
Genetic or chromosomal disorders	8
Gastrointestinal disorders (reflux oesophagitis, disaccharidase deficiency, pancreatic insufficiency, pyloric stenosis, necrotising enterocolitis with short bowel, malrotation)	7
Congenital heart disease	2
Chronic renal failure	1
Miscellaneous	3
Total	21



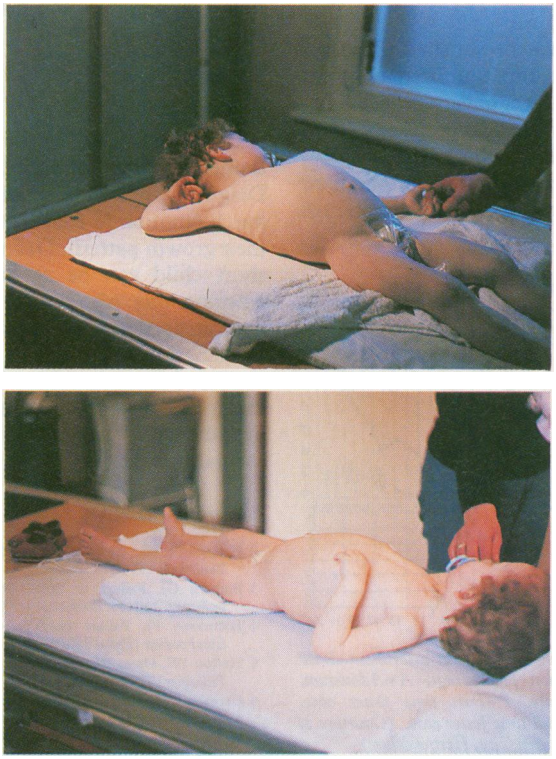
Typical weight chart of child with coeliac disease. (Courtesy of John Radcliffe Hospital, Oxford)

Examine the child for evidence of neglect or abuse as well as for dysmorphic or dwarfing syndromes and serious chronic disease.

Assess for developmental delay, particularly in aspects depending on environmental stimulation, such as social adaptive behaviour, speech, and language.

Make a preliminary diagnosis. If the probability is of a normal small infant tell the parents so—but consider two or three follow up visits to confirm that growth velocity is normal and the child symptom free.

If there is a reasonable likelihood of a purely "organic" diagnosis paediatric outpatient referral is probably necessary. Day attendance may then be arranged for investigation.



Child admitted for failure to thrive who turned out to have coeliac disease. (Courtesy of Dr R A F Bell)

If psychosocial factors seem dominant, decide whether coexisting organic disease needs to be excluded. If not, then decide whether further investigation and management should be by the paediatrician, or within a family therapy or child psychiatric department, or (if a child protection issue is apparent) by the local authority social services department.

INVESTIGATIONS

There should be no such concept as a "failure to thrivogram" when considering investigations. Berwick *et al* noted that abnormal test results aided diagnosis in only 20 (16%) of their inpatients, and only 0·8% of the average of 40 tests per patient—around 39 of 4880—were helpful.[6]

The pitfalls of a dogmatic approach should be obvious. For example, urinary tract infection is a well described cause of failure to thrive in infancy. But investigating all small infants with a single urine specimen collected in an adhesive bag may yield false positive results in up to 35%. Thus when urinary tract infection is definitely suspected in infants under 1, suprapubic aspiration is the investigation of choice. This is an invasive technique, however, so should not be routine. An apparently healthy, lively, afebrile infant of small stature does not need this investigation. An apathetic, irritable, or feverish infant does. Investigations which might prove useful are listed in box 5.

Box 4—Causes of failure to thrive with nutrient loss or malabsorption

Persistent vomiting

- Gastro-oesophageal reflux
- Pyloric stenosis

Diarrhoea/steatorrhoea

- Postenteritis enteropathy[21]
- Disaccharidase deficiency
- Cows' milk protein intolerance
- Giardiasis
- Coeliac disease
- Cystic fibrosis
- Inflammatory bowel disease
- Anatomical gut lesions

They should be used selectively according to pointers from the history and examination.

Non-organic failure to thrive

Don't be tempted to assume without question that poor growth in a child from a materially or emotionally deprived background adds up to neglect. The true position is likely to be more complex.

Suggested causes for non-organic failure to thrive have included emotional deprivation,[15] inadequate nutrition,[16] and a complex interaction whereby the difficulties of raising a "sickly child" may contribute to parental psychological distress and thus to a disrupted mother-child relationship.[17]

Skuse suggested that there may be particular qualities in a child, such as physical appearance, cry, or response to affection, which lessens its mother's desire to nurture it.[18] Slow, apathetic infants may be ignored while constantly demanding ones, such as voraciously feeding light for dates babies, may provoke tension and anxiety so are handled aggressively. Maternal depression, anxiety, or disorganisation may lead to inability to satisfy a difficult child's nutritional needs.

Box 5—Investigations and measurements sometimes required

- Full blood count
- C Reactive protein concentration
- Creatinine, electrolyte, glucose, and calcium concentrations
- Bilirubin and liver enzyme values
- Thyroid stimulating hormone and thyroxine concentrations
- Amino acid chromatography
- Urine microscopy and culture
- Urinary amino and organic acid chromatography
- Stool pathogen, parasite, and sugar detection tests
- Sweat electrolyte concentrations
- Abdominal ultrasonography (especially renal)
- Cerebral ultrasonography
- Chest radiography
- Contrast medium *x* ray swallow or meal
- Oesophageal pH monitoring
- Skeletal survey (for dwarfism, non-accidental injury)
- Jejunal biopsy with disaccharidase estimation and examination for giardiasis
- Electrocardiogram
- Echocardiogram

General practice assessment may be enough to diagnose patients who are small but normal or who have non-organic failure to thrive. When in doubt paediatric referral should be made. Investigation as a ward attender or day case may be needed when an organic diagnosis is suspected.

ADMISSION TO HOSPITAL

Hospital admission has long been the practice of paediatricians testing for non-organic failure to thrive. The aims of admission are fourfold: to observe the infant's feeding behaviour and mother-child interaction; to see whether the infant's weight gain returns to normal when he or she is removed from the family; to decide whether laboratory investigation is indicated after all; to gather evidence for use in child protection proceedings.

These aims may or may not be satisfied. Figure 2 shows the weight chart of a boy admitted on three occasions who became the subject of care proceedings. Despite plain evidence of a substantial increase in daily weight gain during each admission, both jejunal biopsy and referral to a gastroenterologist were required by the child's legal representative and to provide enough evidence at a care hearing.

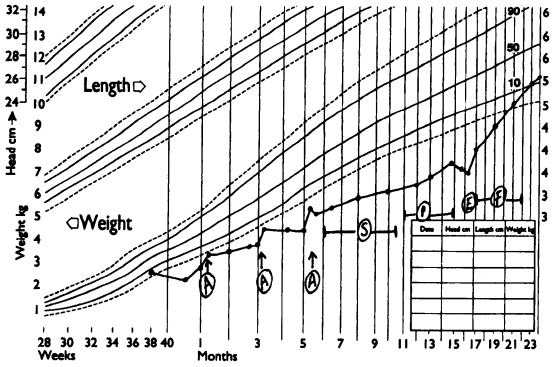


FIG 2—*Portion of Tanner and Whitehouse's growth assessment chart of boy who was subject of protection proceedings. A=Admission. S=Social Services support to family. P=Part time foster care. E=Emergency protection order. F=Full time foster care. (Courtesy of Castlemead Publications, Welwyn Garden City, Hertfordshire)*

The situation may be confounded if, as is common, the infant catches an acute respiratory or gastrointestinal infection while in hospital. Mother-child behaviour may be misinterpreted by less experienced or less open minded nurses and, in any case, may be hindered by the setting of inpatient care. A better solution might be temporary removal into care with weight measurements and behavioural observations provided by a skilled foster parent. Parents, however, are much more likely to accept hospital admission (which needs to be at least two to four weeks) than being subject to the perceived stigma of an assessment order. If admission is inconclusive there should be a further period of close outpatient observations. Continuing medical anxiety should provoke a further inpatient assessment.

Inpatient care should also disclose babies with inadequate intake and mothers who, by accident or design, prepare feeds incorrectly. If Munchausen syndrome by proxy is suspected because of mother's mental health state or affect (for example, postnatal depression, anorexia nervosa) feeds prepared by her should be analysed for nutrient and electrolyte content.

Box 6—Management of breast feeding failure

- Exclude other diagnoses
- Weigh before and after feeds throughout 24 hours if still uncertain
- Discuss with mother how important she regards breast feeding
- If infant's weight loss not dangerous and mother eager to continue, provide rest, counselling, practical nursing advice, and breast pump, if appropriate
- If weight loss dangerous or mother loth to continue introduce formula feeds

Box 6 summarises the management of breast feeding failure.

Conclusion

Like "croup," "failure to thrive" is an archaic though hallowed description in paediatric medicine. Diagnostic precision should be the aim: parents invest much emotion in feeding their children and observing their growth pattern. Defining as pathological a normal short child can be as harmful to family health as ignoring one who is ill or deprived. The standard clinical approach of careful history taking, thorough examination, attention to detail in measurement, and careful follow up should categorise most of these children. A symptomatic, unhappy, apathetic, or potentially abused child should be referred for secondary care.

1 Frankl DA, Zeisel SH. Failure to thrive. *Pediatr Clin North Am* 1988;35: 1187-1206.
2 Illingworth RS. *Common symptoms of disease in children.* 8th ed. Oxford: Blackwell, 1984.
3 Barbero GJ. Failure to thrive. In: Behrman RE, ed. *Nelson textbook of pediatrics.* 14th ed. Philadelphia: W B Saunders, 1992:214-5.
4 Hannaway PJ. Failure to thrive: a study of 100 infants and children. *Clin Paediatr (Phila)* 1970;9:96-9.
5 Hufton IW, Oates RK. Nonorganic failure to thrive: a long term follow-up. *Pediatrics* 1977;59:73-7.
6 Berwick DM, Levy JC, Kleinerman R. Failure to thrive: diagnostic yield of hospitalisation. *Arch Dis Child* 1982;57:347-51.
7 Kitchen WH, Ford GW, Doyle LW. Growth and very low birth weight. *Arch Dis Child* 1989;64:379-82.
8 Tanner JM, Whitehouse RH, Gairdner D, Pearson J. *Growth assessment charts.* Welwyn Garden City: Castlemead Publications, 1987.
9 Edwards AGK, Halse PC, Parkin JM, Waterston AJR. Recognising failure to thrive in early childhood. *Arch Dis Child* 1990;65:1263-5.
10 Smith DW, Truog W, Rogers JE, Greitzer LJ, Skinner AL, McCann JJ, *et al.* Shifting linear growth during infancy: illustration of genetic factors in growth from fetal life through infancy. *J Pediatr* 1976;89:225-30.
11 Porter B, Skuse D. When does slow weight gain become "failure to thrive?" *Arch Dis Child* 1991;66:905-6.
12 Murphy JF, Jenkins J, Newcombe RG, Sibert JR. Objective birth data and the prediction of child abuse. *Arch Dis Child* 1981;56:295-7.
13 Homer C, Ludwig S. Categorisation of etiologyof failure to thrive. *Am J Dis Child* 1981;135:848-51.
14 Voss LD, Wilkin TJ, Bayley BJR, Betts PR. The reliability of height and weight velocities in the assessment of growth (the Wessex growth study). *Arch Dis Child* 1991;66:833-7.
15 Fischoff J, Whitten C, Pettit M. A psychiatric study of mothers and infants with growth failure secondary to maternal deprivation. *J Pediatr* 1971;79: 209-15.
16 Russell Davies D, Apley J, Fill G, Grimaldi C. Diet and retarded growth. *BMJ* 1978;i:539-42.
17 Kotelchuck M, Newberger EH. Failure to thrive: a controlled study of familial characteristics. *J Am Acad Child Adolesc Psychiatry* 1983;22:322-8.
18 Skuse DH. Non oragnic failure to thrive: a reappraisal. *Arch Dis Child* 1985;60:173-8.
19 Poskitt EME. Failure to thrive in congenital heart disease. *Arch Dis Child* 1993;68:158-60.
20 Pugliese MT, Weyman-Daum M, Moses N, Lifshitz F. Parental health beliefs as a cause of nonorganic failure to thrive. *Pediatrics* 1987;80:175-82.
21 Thomas AG, Phillips AD, Walker-Smith JA. The value of proximal small intestinal biopsy in the differential diagnosis of chronic diarrhoea. *Arch Dis Child* 1992;67:741-4.

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