



The toddler who is falling off the growth chart

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Growth monitoring is an essential part of paediatric health care, from birth through adolescence. Growth and nutritional problems often occur between 18 months and three years of age. Health care professionals involved in the care of children need to follow growth closely in this period, be able to evaluate a toddler whose growth seems to be faltering, and know when and how to intervene.

Key Words: *Appetite; Growth; Nutritional intervention; Toddler*

Growth charts are the best tool to assess a child's growth and overall health. Children's height and weight usually, though not always, follow a given percentile from birth to adulthood. During the first two to three years of life, it is not uncommon to see a child's growth deviate from its previous percentile, either upward or downward. This phenomenon may be normal but can also indicate an underlying health problem. Physicians involved in the care of children must monitor weight, length or height, and head circumference closely to detect changes in a child's growth pattern. They also need to decide if, when and how to intervene when growth seems to be faltering.

GROWTH MONITORING

Monitoring growth is an essential part of paediatric care. Nutritional or health problems almost always affect growth. Correctly obtained serial measurements of weight and height are the best guide to assessing overall health and nutritional status.

The recently adopted WHO growth charts (for children at birth to five years of age) were developed from large samplings of children from around the world raised in optimal conditions. They represent actual distributions of weight and height according to age and sex, and allow the physician to compare a child's growth with a reference population. They are now considered to be the standard for monitoring growth and have superseded the US Centers for Disease Control (CDC) growth charts that were used previously (1-3).

CHANGES IN GROWTH PERCENTILE

While children usually follow the same percentile for weight and height (or length) for most of childhood, children growing normally may also change percentiles in their first two or three years, to adjust toward their genetic potential (4). Using the National Center for Health Statistics (CDC) growth charts (showing the third, 10th, 25th, 50th, 75th, 90th and 95th percentile), DW Smith showed that as many as 30% of normal children crossed one major percentile

Le tout-petit qui périclité sous la courbe de croissance.

La surveillance de la croissance est une partie essentielle des soins de santé pédiatriques, de la naissance jusqu'à l'adolescence. Les problèmes de croissance et d'alimentation se manifestent souvent entre 18 mois et trois ans. Les professionnels de la santé qui participent aux soins des enfants doivent surveiller la croissance de près pendant cette période, être en mesure d'évaluer un tout-petit dont la croissance semble péricliter et savoir quand et comment intervenir.

line and 23% crossed two in the first two years of life (5). Smith's estimates cannot be applied to the WHO growth charts because the major percentiles charted are different (the 0.1 percentile, 3rd, 15th, 50th, 85th, 97th, 99.9th percentile). Crossing two major channels on the WHO growth charts would represent a greater change, and one that cannot be considered 'normal'.

Birth weight and length are strong predictors of subsequent growth (6), but do not always reflect a child's genetic potential. Intrauterine growth may be affected by external factors (eg, maternal malnutrition or smoking, gestational diabetes, placental insufficiency). After birth, there may be some 'catch-up' if an infant was born smaller than her/his genetic potential, or a 'catch-down' if the child was born larger than his/her genetic potential.

Growth patterns also depend on feeding, with breastfed infants often growing faster than formula-fed infants in the first six months of life, and formula-fed babies growing faster after six months.

Children with a constitutional growth delay will start showing retarded linear growth in the first three years of life. After that time, growth resumes at a normal rate but parallel to or under the growth curve, or along the lower growth percentiles during the prepubertal years. After the age of three, there should be no more change in growth percentile until puberty.

CAUSES OF FALTERING GROWTH

Postnatal factors, such as nutritional or environmental problems, endocrinopathy or chronic disease may affect growth. In toddlers, growth failure is often the result of inadequate caloric intake but may also be the first sign of disease in an otherwise asymptomatic child. The growth curve alone gives a lot of information. Adjustment toward genetic potential usually affects weight and height similarly. Endocrinopathy usually affects height more than weight. Nutritional problems or systemic disease can affect weight first and linear growth later.

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TABLE 1
Leading causes of growth failure

Nutritional/caloric intake may be inadequate because

- the child is eating poorly
- anorexia associated with chronic disease is present
- eating and/or oral skills are lacking

Increased energy losses may be attributable to:

- emesis, or
- malabsorption associated with:
 - pancreatic disease (eg, cystic fibrosis, Shwachman-Diamond syndrome)
 - cholestatic liver disease
 - intestinal disease (eg, celiac disease, Crohn's disease)

Increased energy needs may be attributable to:

- an underlying chronic condition
- chronic or recurrent infections

An endocrine problem may be present:

- hypothyroidism
- growth hormone deficiency

Other (rare) causes of failure to grow in toddlers:

- the presence of a diencephalic tumour
- renal tubular acidosis

CONSEQUENCES OF FALTERING GROWTH

If an underlying condition is detected early, treated appropriately and the child is provided with adequate nutrition, growth failure may be reversible. If not, the child's ultimate height may be affected. The potential for catch-up growth depends on severity, duration and timing of the insult. Few studies have looked at the long-term consequences of failure to thrive on adult height, development and intelligence (7-9).

EVALUATING THE CHILD WHO IS FALLING OFF THE GROWTH CHART

Growth parameters

It is important to verify the accuracy of anthropometric measures. Optimally, children should be weighed in the same conditions (eg, undressed, no diaper), on the same scale, and measured appropriately using a height gauge.

Mid-parental height can be calculated to estimate a child's genetic potential:

Boys: (father's height + mother's height) / 2 + 6.5 cm ± 8.5 cm

Girls: (father's height + mother's height) / 2 – 6.5 cm ± 8.5 cm

Whether or not children fall within the limits of their growth potential, they should be evaluated for possible causes of growth failure when their growth pattern is abnormal.

Nutritional history

A complete nutritional history needs to be obtained. Caloric intake can be calculated from a 72 h food diary and compared to age-appropriate requirements with the help of a nutritionist. Caloric intake that is considered 'adequate' based on the child's actual weight is insufficient for catch-up growth.

Most of the time, inadequate intake occurs in perfectly normal children, but children with a chronic disease are often poor eaters. Children with a chronic or recurrent infection, an immune deficiency, inflammatory bowel disease (10) or celiac disease often have poor caloric intake while experiencing few or no gastrointestinal symptoms. Poor growth despite adequate intake may be seen in children with an endocrine disease, renal failure, renal tubular acidosis (11) or a genetic syndrome. Malabsorption should be

TABLE 2
Basic workup for a toddler with growth failure

Step 1

- Complete blood count
- Erythrocyte sedimentation rate or C-reactive protein
- Serum electrolytes, venous blood gas, blood glucose
- Blood urea nitrogen, creatinine
- Serum protein and albumin
- Serum iron, TIBC, saturation, ferritin
- Calcium, phosphorus and alkaline phosphatase
- Liver enzymes (AST, ALT, GGT)
- Serum immunoglobulins
- Tissue transglutaminases (accompanied by total IgA level)
- TSH
- Urinalysis

Step 2

- Sweat chloride
- Vitamin levels
- Fecal elastase
- Bone age

Step 3

- Refer to specialist

AST Aspartate transaminase; ALT Alanine aminotransferase; GGT Gamma glutamyl transpeptidase; IgA Immunoglobulin A; TIBC Total iron-binding capacity; TSH Thyroid stimulating hormone

suspected when a child does not grow despite having a higher caloric intake than would be needed normally.

It is also important to evaluate the child's feeding history and behaviour during meals. Issues to explore with caregivers might include the following:

- What were the child's first experiences with food?
- Is there a history of gastroesophageal reflux or food allergies?
- Was this child easy to feed?
- Did introducing solid foods or progressing to textured food pose problems?
- If the child was breastfed, was weaning difficult?
- Does the child eat at the table with the rest of the family?
- Who feeds this child?
- Is the child offered or exposed to distractions (eg, a toy, television) while eating?

Parental responses to feeding problems should also be explored. Feeding and growth problems often generate stress and anxiety and can affect the parent-child feeding relationship.

Medical investigation

While inadequate caloric intake in an otherwise normal child is the most common cause of growth failure, an underlying disease is sometimes found (Table 1). A complete history and a physical examination should be performed. If clinically indicated, a basic workup may be obtained (Table 2).

INTERVENTION

If no underlying disease is detected, parents should be reassured that their child is healthy. Explaining that not every child is meant to be on the 50th percentile, and that a child's growth is influenced by genetic potential, can be affirming. Then consider the following steps:

Be sure that adequate caloric intake is being provided

After carefully evaluating the child's diet, caloric intake needs to be optimized. Total intake takes into account requirements for age and the need for supplemental calories to ensure catch-up growth.

$$\text{Caloric needs (cal/kg/day)} = \frac{\text{caloric needs for weight age (cal/kg/day)} \times \text{ideal weight for height (kg)}}{\text{Actual weight (kg)}}$$

A nutritionist can analyze the child's diet and suggest simple ways to increase caloric density with easily available products such as cream, oil, powdered milk or glucose polymers. Age-appropriate formulas that provide 1 kcal/mL or 1.5 kcal/mL can be used to replace regular milk. Formulas are given after meals to avoid interfering with food intake.

Pharmacological intervention

In exceptional cases, pharmacological therapy may be considered for children with growth failure due to inadequate dietary intake. This intervention should only be undertaken after a careful assessment by an expert in this area. One advantage of using an appetite stimulant is that the child's behaviour toward food can be modified. The child feels hunger and is happier to eat. Parental anxiety is therefore diminished and mealtimes become less stressful.

Cyproheptadine is an antihistamine that is sometimes used to increase appetite. It can cause transient drowsiness. Tolerance develops over time, and it is necessary to cycle its use to maintain efficacy (13).

Other appetite stimulants, such as cannabinoid derivatives and megestrol acetate, have been used in some clinical situations but they should not be administered to healthy children (15).

Enteral nutrition/tube feedings

Tube feedings may be used in exceptional cases when a child does not grow, but they are traumatic for both child and family (12). Insertion of a nasogastric tube is an unpleasant experience and may cause increasing oral aversion and decreasing appetite in an already fragile child. These effects make eventual weaning off tube feeding more difficult. Tube feedings should only be used in patients whose underlying disease is worsened by their poor nutritional status, jeopardizing outcome, or if oral intake is deemed unsafe. In an otherwise normal child who fails to grow according to standards and in whom caloric intake is insufficient to achieve normal growth, tube feedings should only be used as a last resort.

Psychosocial intervention

Parents are often blamed for their child's growth problems, especially when caloric intake is inadequate or when the child exhibits difficult feeding-related behaviours. Food refusal in toddlers may arise from early unpleasant experiences with feeding, perhaps caused by gastroesophageal reflux or an allergy. Sometimes, memory of an unpleasant experience is present long after a problem resolves and still affects feeding behaviour. Forcing a child to eat and conflict over food make mealtimes stressful and unpleasant for the whole family. However, while parental anxiety may exacerbate a feeding problem, it is seldom the sole cause. Parents of children with growth failure may be under stress, feel fearful or helpless, be sensitive to questioning around their parenting skills or approaches to food, or be easily offended by comparisons with others (15). Health care professionals must be aware of the impact that their words and actions will have on families. Interventions should aim at reducing parental anxiety, returning the control of feeding to the child, and making mealtimes more enjoyable and positive family experiences (16). Forcing a child to eat may have more severe long-term consequences than a short period of slow weight gain. Involving a psychologist, occupational therapist or speech pathologist may also be helpful.

CONCLUSION

Following a child's growth is essential to detecting nutritional deficiencies or underlying disease. When a child's growth falters, a baseline workup and nutritional assessment should be performed. Depending on signs and symptoms, additional investigation and referral to a specialist may be considered. However, a change in growth percentile may occur in a normal child in the first two or three years of life. For an otherwise healthy child, with a normal baseline workup and who is growing within his/her genetic potential, parents can usually be reassured. Caloric intake should be optimized. If adequate growth cannot be achieved, cyproheptadine may be considered. Tube feedings should only be used as a last resort in the otherwise healthy child who falls off the growth chart.

RECOMMENDATIONS

When faced with a child who is not growing appropriately, the physician/nutritionist should:

1. Verify the accuracy of anthropometric measurements.
2. Plot the child's weight and length or height on the growth chart.
3. Calculate mid-parental height to estimate the child's growth potential.
4. Obtain a complete history and perform a physical examination.
5. Assess caloric intake using a food diary analysed by a trained nutritionist.
6. Evaluate the child's feeding history and mealtime behaviours and explore family dynamics.
7. Perform a basic workup.
8. Optimize oral caloric intake when it is found to be inadequate.
9. When behavioural issues interfere with nutrition, consult a psychologist, or an occupational or speech therapist, as appropriate.
10. Consider appetite stimulants only in refractory cases, and only after evaluation by an expert in this area.
11. Tube feedings are a last resort if the child has no underlying disease.

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