

FAILURE TO THRIVE

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UNIVERSITY OF OTTAWA, MED2 UNIT IV

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CONFLICT OF INTEREST

- I have no conflict of interest to declare

SOCIAL MEDIA DISCLOSURE

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OBJECTIVES

1. Define “failure to thrive” (FTT).
2. Discuss the differential diagnosis for FTT in children.
3. Outline an appropriate history in a child with FTT.
4. Recognize the role of the multidisciplinary team in the management of FTT in children.

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FTT - DESCRIPTION

- Clinical syndrome of inadequate growth
 - Failure to gain weight appropriately
 - In more severe cases, linear growth and head circumference affected
- FTT is a descriptive term, not a diagnosis
 - Underlying cause must be considered
 - Now often being replaced with “growth faltering,” or “poor weight gain”

EPIDEMIOLOGY

- Common problem
 - Prevalence <2% to >10% (due to definition differences)
 - More prevalent among children in low-income households, with special health-care needs, of refugee status, born at lower birth weight
 - Tang et al. Pediatr Rev 2021.
- Important cause of stress for families
- Long term consequences
 - Increased incidence of developmental delays, learning and/or behavioural difficulties, nutrient deficiencies, persistent short stature

GROWTH CHARTS

- CDC (Centre for Disease Control)
- WHO (World Health Organization)
- CPEG (Canadian Pediatric Endocrine Group)

Take home points:

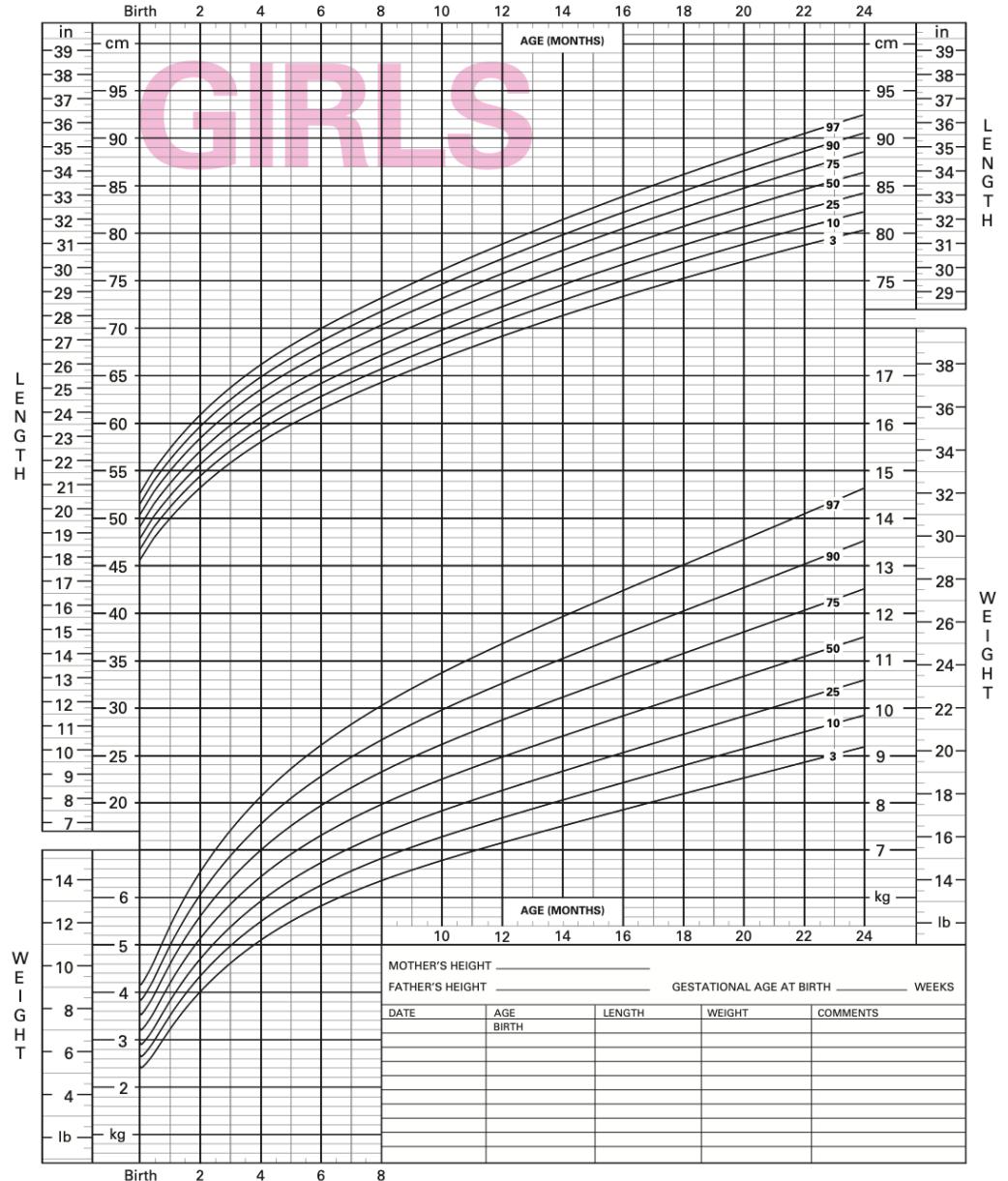
- Use the WHO Growth Charts for Canada (March 2014 revision)
 - Prefer Set 2 (3/10/25/50/75/90/97 centiles) over Set I (3/15/50/85/97 centiles) Marchand, Paediatr Child Health 2010
- Special populations (e.g. genetic syndromes like Down syndrome, Turner syndrome) have modified growth charts
- Use Fenton preterm growth charts for premature infants <37wk GA (from 22wk GA to 10 wks CGA)

WHO GROWTH CHARTS FOR CANADA



BIRTH TO 24 MONTHS: GIRLS

Length-for-age and Weight-for-age percentiles



SOURCE: Based on World Health Organization (WHO) Child Growth Standards (2006) and WHO Reference (2007) and adapted for Canada by Canadian Paediatric Society, Canadian Pediatric Endocrine Group, College of Family Physicians of Canada, Community Health Nurses of Canada and Dietitians of Canada.

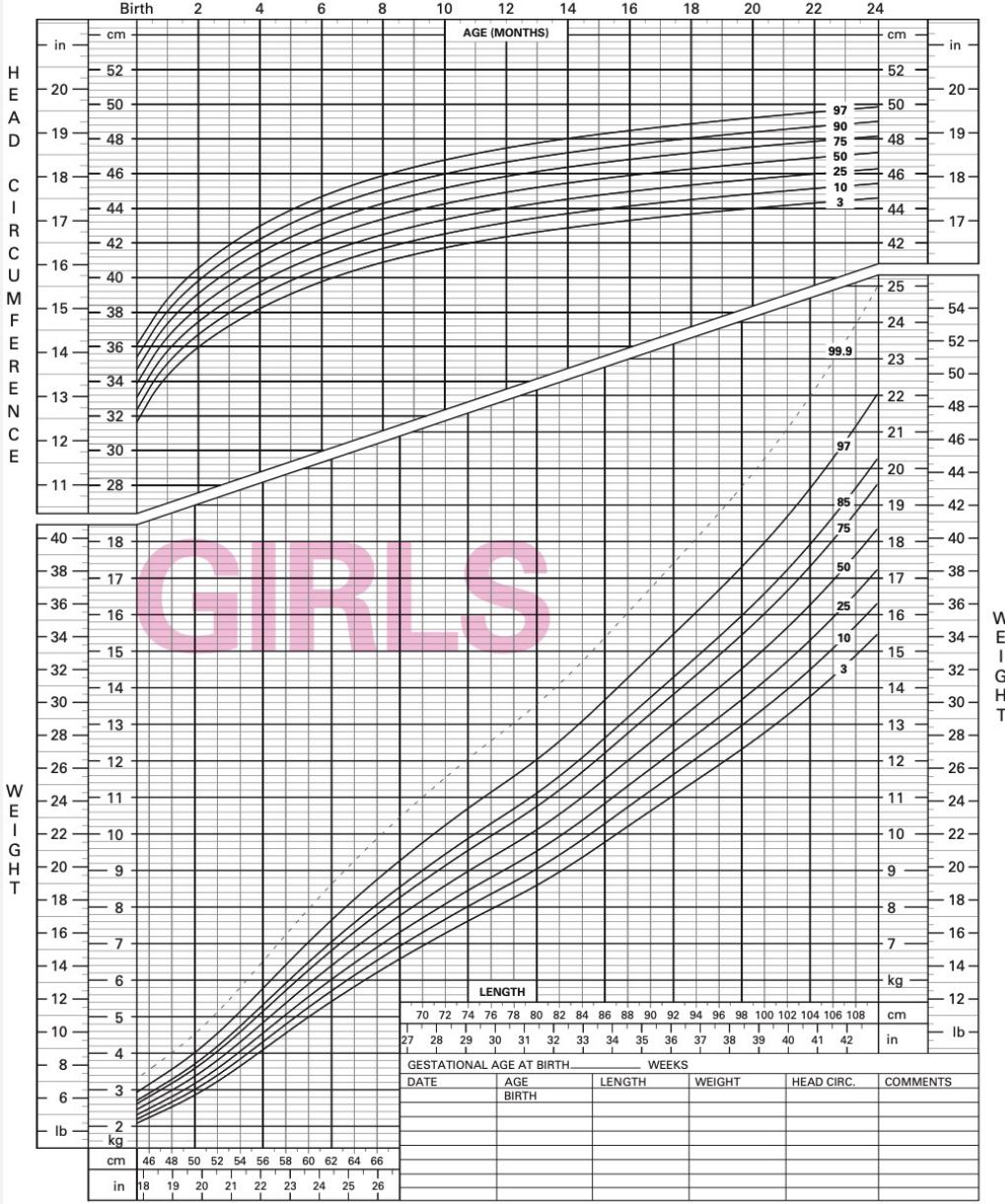
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WHO GROWTH CHARTS FOR CANADA



BIRTH TO 24 MONTHS: GIRLS

Head Circumference and Weight-for-length percentiles



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FTT - DEFINITION

- No universal consensus
 - Weight-for-age <3rd percentile
 - Weight-for-length <3rd percentile
 - Weight-for-age crosses 2 major percentile lines over time
 - Weight <80% ideal body weight-for-age

ASIDE

Finding the percent ideal body weight

- Ideal body weight:
 - Plot measured length/height on growth chart
 - Determine the length-for-age percentile
 - ★ • Find the same percentile on the weight-for-age and sex growth chart. This is the ideal body weight
- % Ideal body weight = $\frac{\text{actual weight}}{\text{ideal body weight}} \times 100$

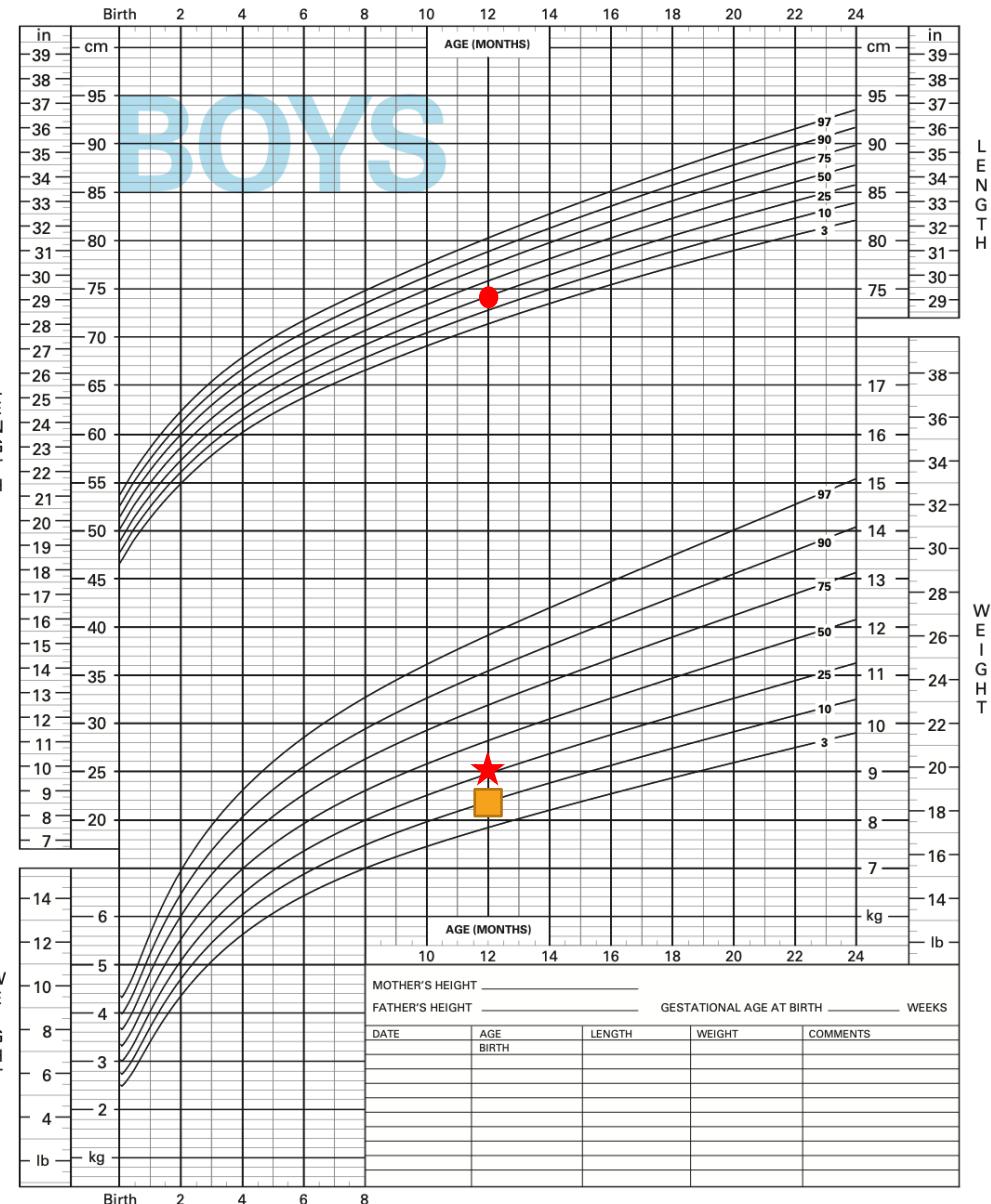
WHO GROWTH CHARTS FOR CANADA

BIRTH TO 24 MONTHS: BOYS

Length-for-age and Weight-for-age percentiles

NAME: _____

DOB: _____ RECORD # _____



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WHICH OF THE FOLLOWING DOES NOT REPRESENT FTT?

- A. A 6-month-old infant with normal birth parameters whose weight is now below the 3rd percentile
- B. A 9-month-old girl whose weight was at the 50th percentile and is now at the 10th percentile
- C. A 20-month-old boy whose weight is 70% of ideal body weight for age
- D. An 18-month-old girl whose weight and height have been 5th percentile since birth
- E. A breastfed infant that does not gain weight from 6 to 10 months with introduction of solids

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NORMAL GROWTH

- Healthy infant:
 - Loses 5-10% of birth weight (BW) in first week of life
 - Regains BW by 10-14 days of life
 - Doubles BW by 6 months
 - Triples BW by 1 year
- Breastfed infants gain weight at a faster rate than formula fed infants in first several months
- Average caloric requirements for first 12 months is 100 kcal/kg/d

WHICH OF THE FOLLOWING REGARDING PEDIATRIC GROWTH MEASUREMENTS IS FALSE?

- A. A premature infant's weight should be plotted according to "corrected age" until 1 year of age
- B. Infants' length should be measured on a recumbent until 2 years, then standing
- C. Children's growth parameters should be measured at every visit
- D. Head circumference should be plotted routinely until 3 years of age and thereafter if concerns
- E. Average weight gain for a 0-3 month-old infant is 30 g/day

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Corrected age = chronological age – weeks of prematurity

e.g. 28wk premature infant who is 40wks old chronologically has a corrected age of 12 wks old

Use until 2 years of age

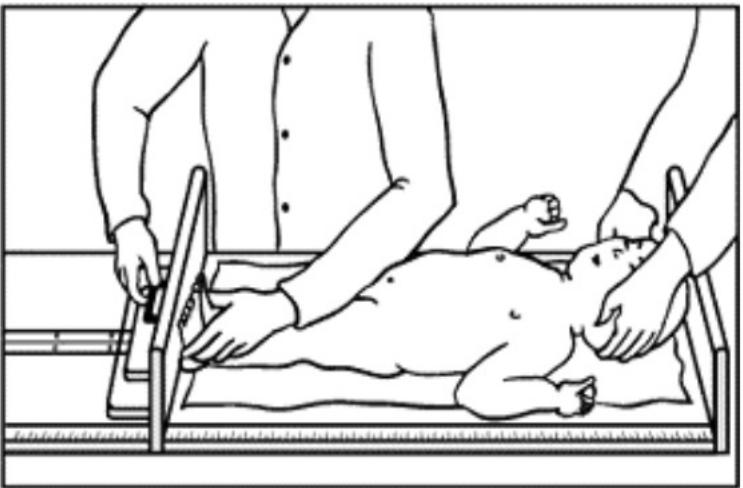


Illustration © Nardella, M, Campo, L, Ogata, B, eds. *Nutrition Interventions for Children with Special Health Care Needs*, Olympia, WA, State Department of Health, 2001³³. Used with permission.

Recumbent
Birth to 2-3yo

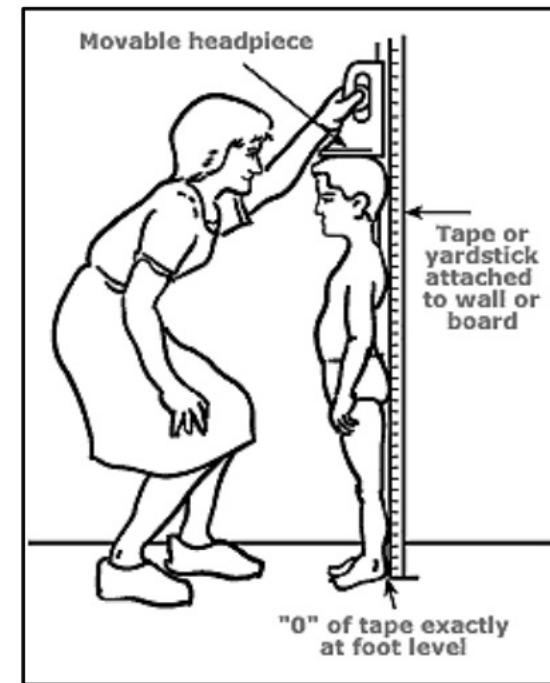


Illustration © Nardella, M, Campo, L, Ogata, B, eds. *Nutrition Interventions for Children with Special Health Care Needs*, Olympia, WA, State Department of Health, 2001³³. Used with permission.

Stadiometer
2yo or older

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CLASSIFICATION

- Historical classification:
 - Organic – medical issues
 - Non-organic – psychosocial and environmental factors
- Current understanding:
 - Multi-factorial continuum

DIFFERENTIAL DIAGNOSIS

1. Inadequate caloric intake
2. Inadequate nutrient absorption
3. Excess metabolic demand
4. Defective utilization of nutrients

I. INADEQUATE INTAKE

- Not enough food offered
 - Food insecurity
 - Difficult caregiver/child relationship
 - Inappropriate feeding technique
 - Neglect
 - Poor dietary intake (excessive fruit juice, restricted diet, inappropriate foods or serving sizes for age)
- Child not taking enough food
 - Low appetite: cerebral palsy, genetic syndromes, chronic constipation
 - Behavioural problems affecting intake (e.g. Autism)
 - Anatomical/mechanical problems: cleft palate, dental caries, adenoidal hypertrophy
- Emesis
 - Increased ICP, adrenal insufficiency, medications

2. INADEQUATE NUTRIENT ABSORPTION

- Malabsorption
 - Pancreatic disease: cystic fibrosis, Shwachman-Diamond syndrome
 - Cholestatic liver disease: biliary atresia, cirrhosis
 - Intestinal disease: celiac, IBD, NEC, short bowel syndrome, GI obstruction (pyloric stenosis, malrotation, intussusception)
 - Food sensitivity or intolerance: CMPI, lactose intolerance, gluten
- Increased losses
 - Infectious diarrhea
 - Chronic renal failure (Ca, P, vitamin D)

3. EXCESSIVE METABOLIC DEMAND

- Malignancy
- Chronic systemic infections (e.g. TB, TORCH)
- Chronic diseases:
 - Cardiac (e.g. heart failure)
 - Renal (e.g. chronic renal failure, renal tubular acidosis)
 - Respiratory (e.g. cystic fibrosis, bronchopulmonary dysplasia, interstitial lung disease)
 - Endocrine (e.g. hypo/hyperthyroidism, growth hormone deficiency)
 - Autoimmune (e.g. juvenile idiopathic arthritis)

4. DEFECTIVE UTILIZATION OF NUTRIENTS

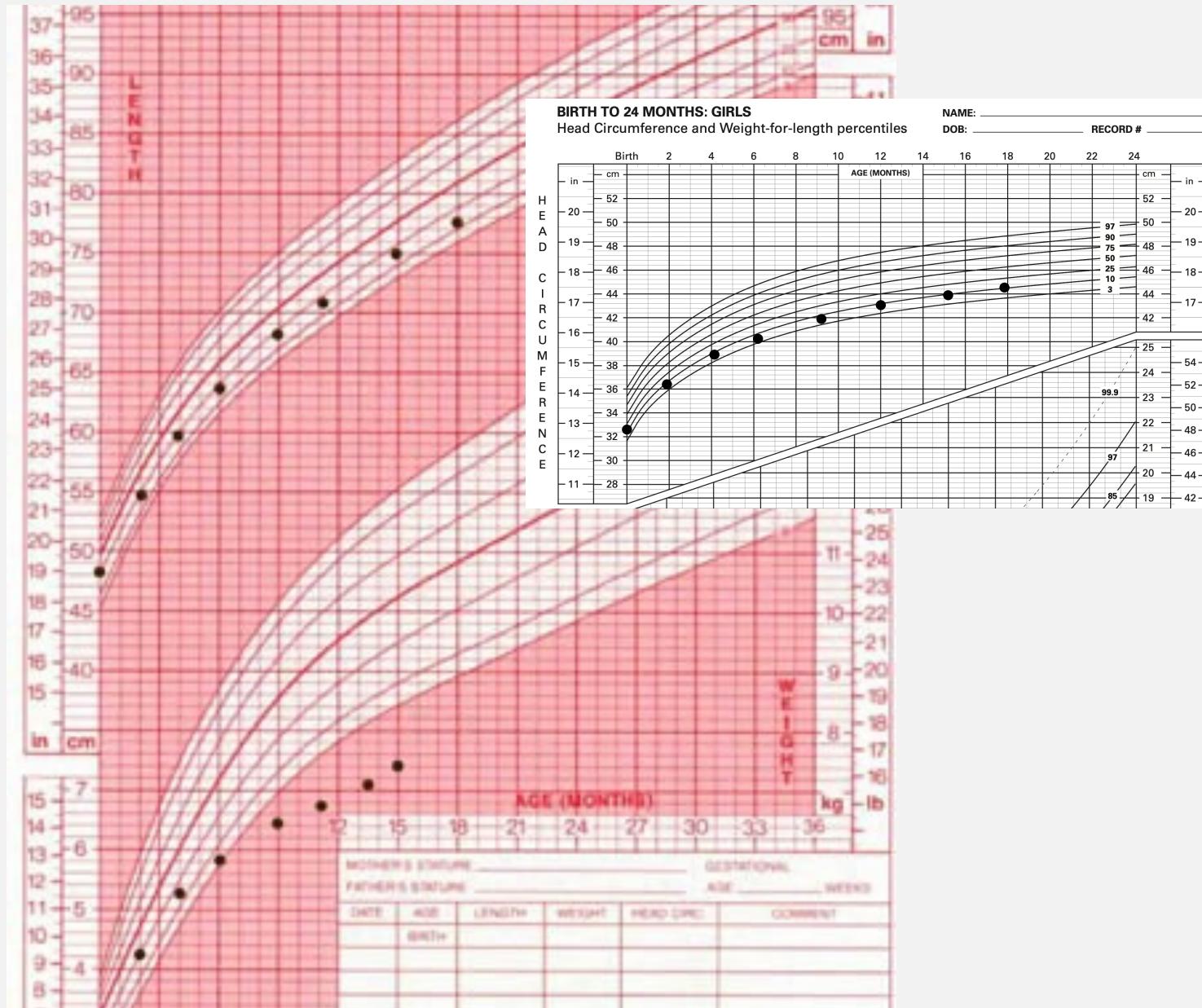
- Inborn errors of metabolism (e.g. galactosemia, methylmalonic acidemia)
- Storage disease (e.g. glycogen storage disease)

GENERAL GROWTH PATTERNS

Weight	Height	Head Circumference	Conditions
	N	N	Inadequate intake Inadequate absorption Increased demand Impaired utilization
		N	Constitutional growth delay Endocrinopathy
			Genetic conditions Metabolic conditions Congenital/perinatal insult

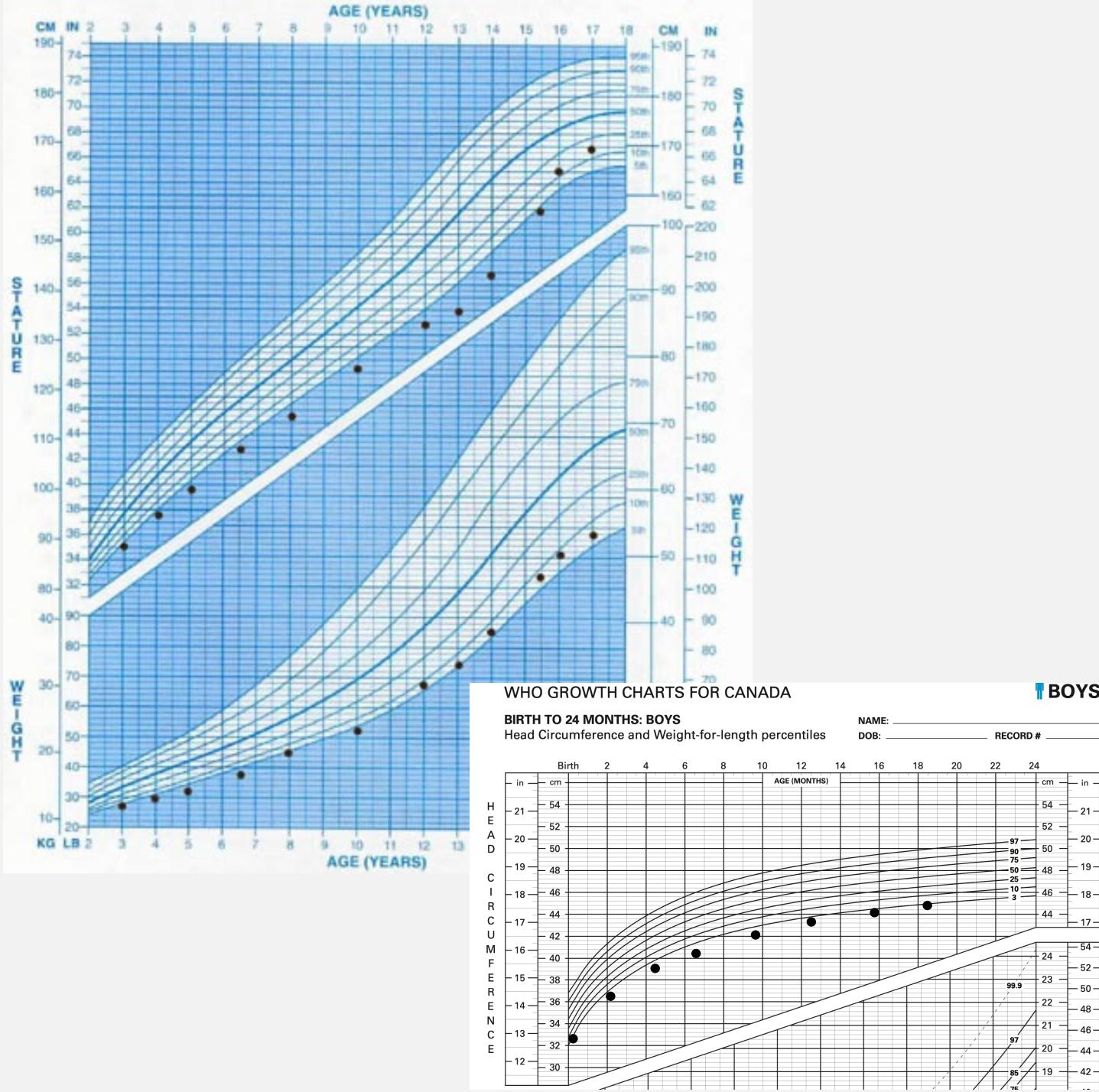
WHICH GROWTH PATTERN IS REPRESENTED?

- A. Constitutional growth delay
- B. Genetic condition
- C. Endocrine abnormality (e.g. growth hormone deficiency)
- D Malnutrition



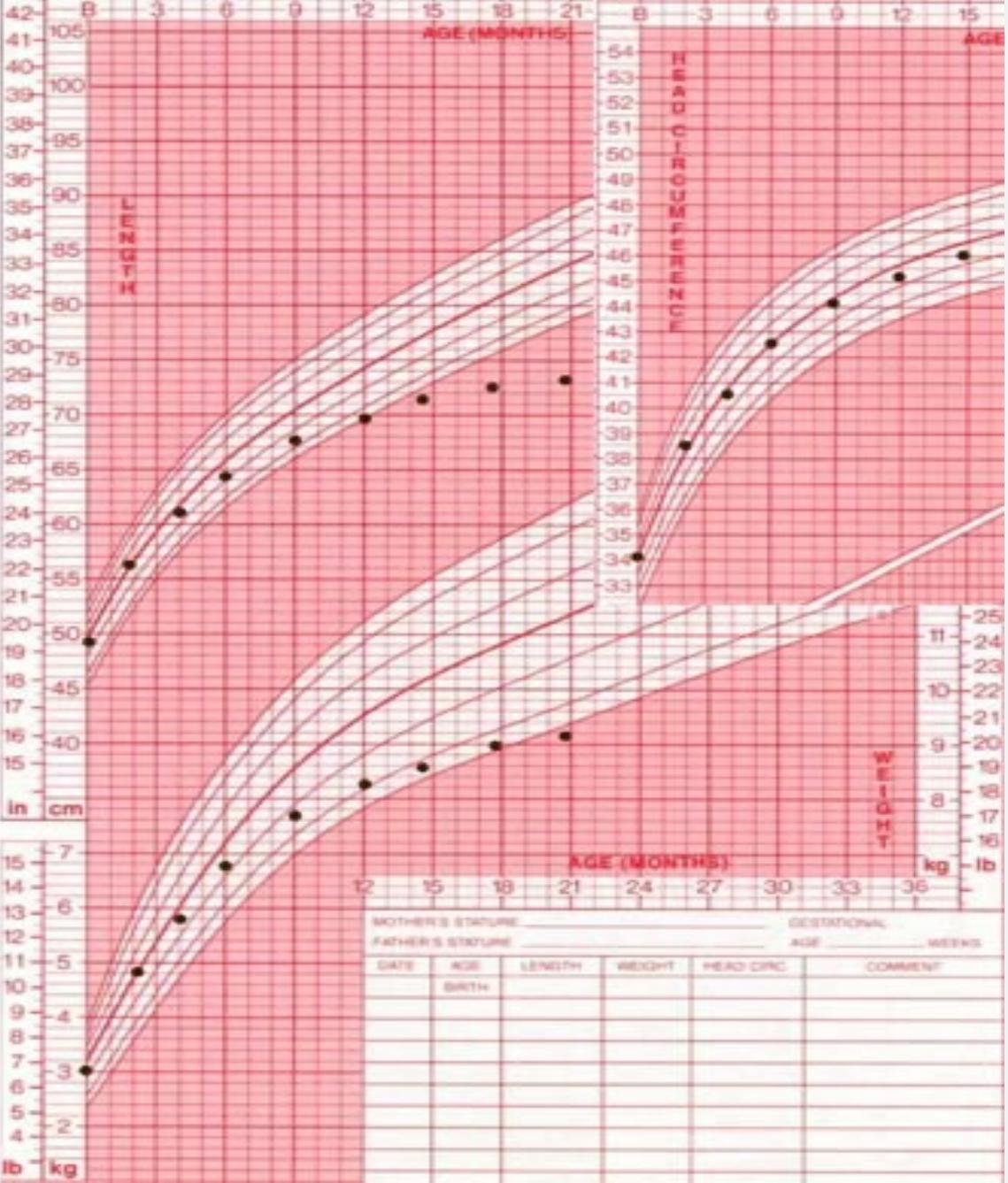
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WHO GROWTH CHARTS FOR CANADA

BOYS

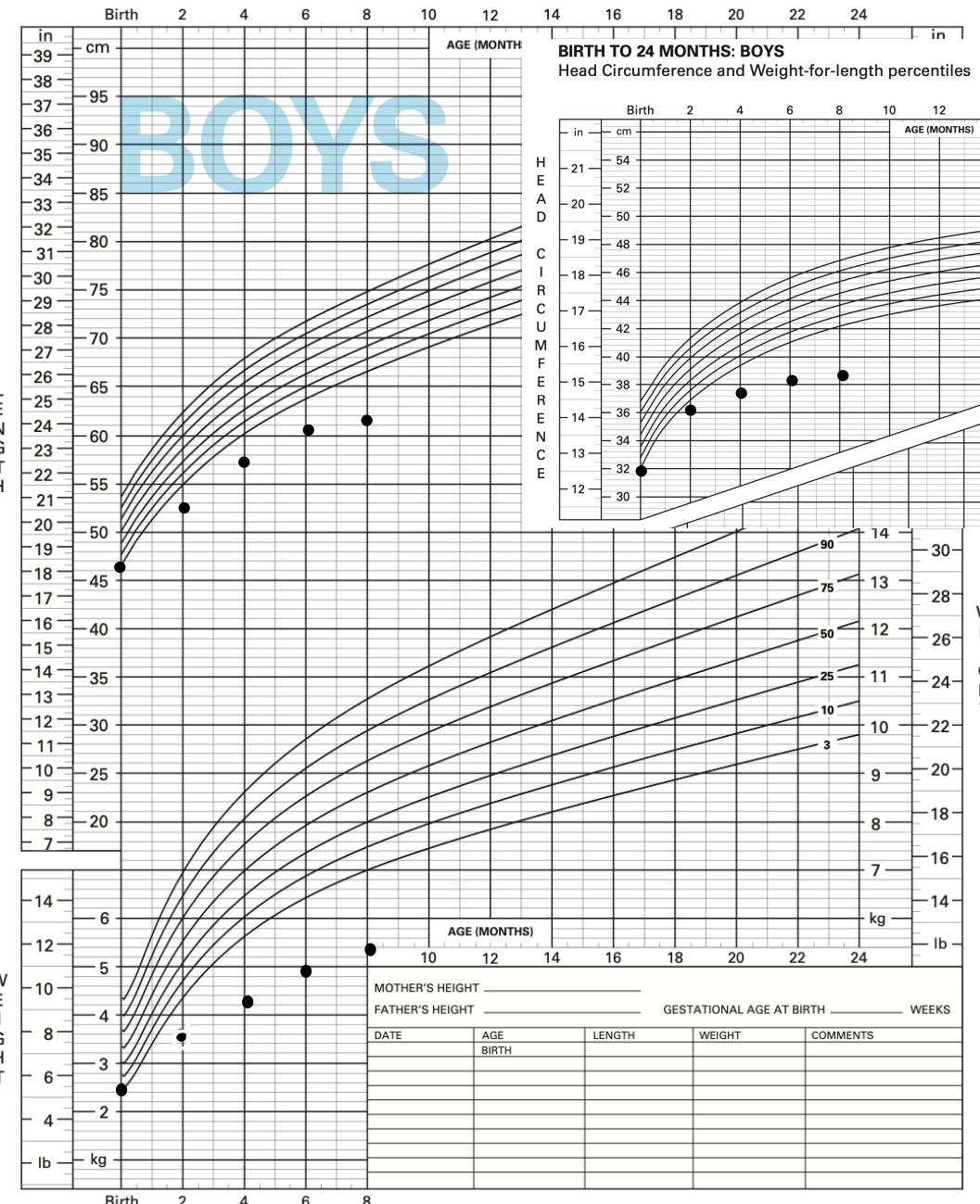
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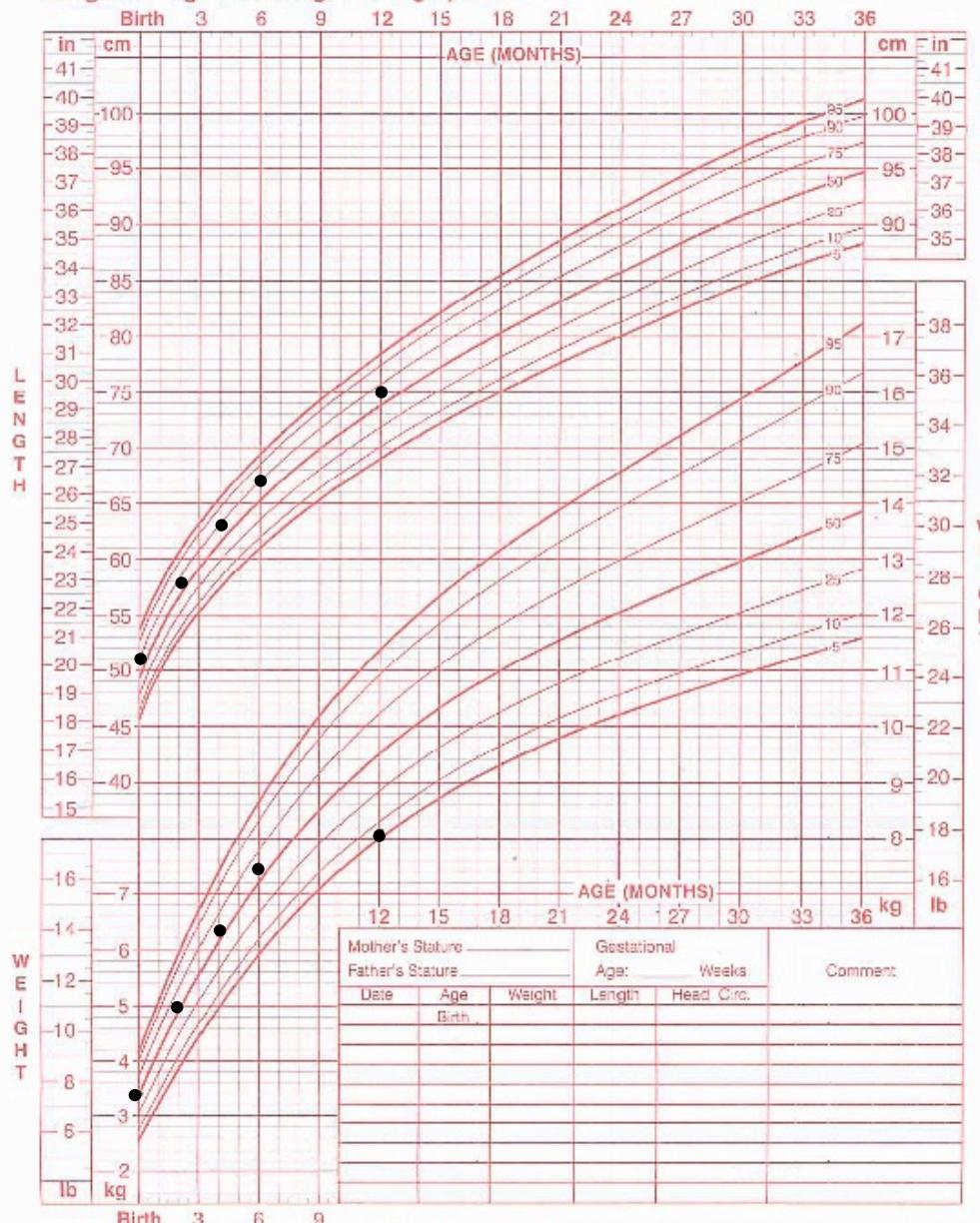
CASE: ALEX PETIT

- 14 month old girl
- First child to parents
- Born at term with BW 3.5kg
- Breastfed exclusively for 6 months, formula until 1 year, then cow's milk
- Started solids at 8 months
- Now drinks 5 bottles a day of milk, only likes to eat pasta, applesauce, and cookies
- Eats dinner with babysitter in front of TV



Birth to 36 months: Girls

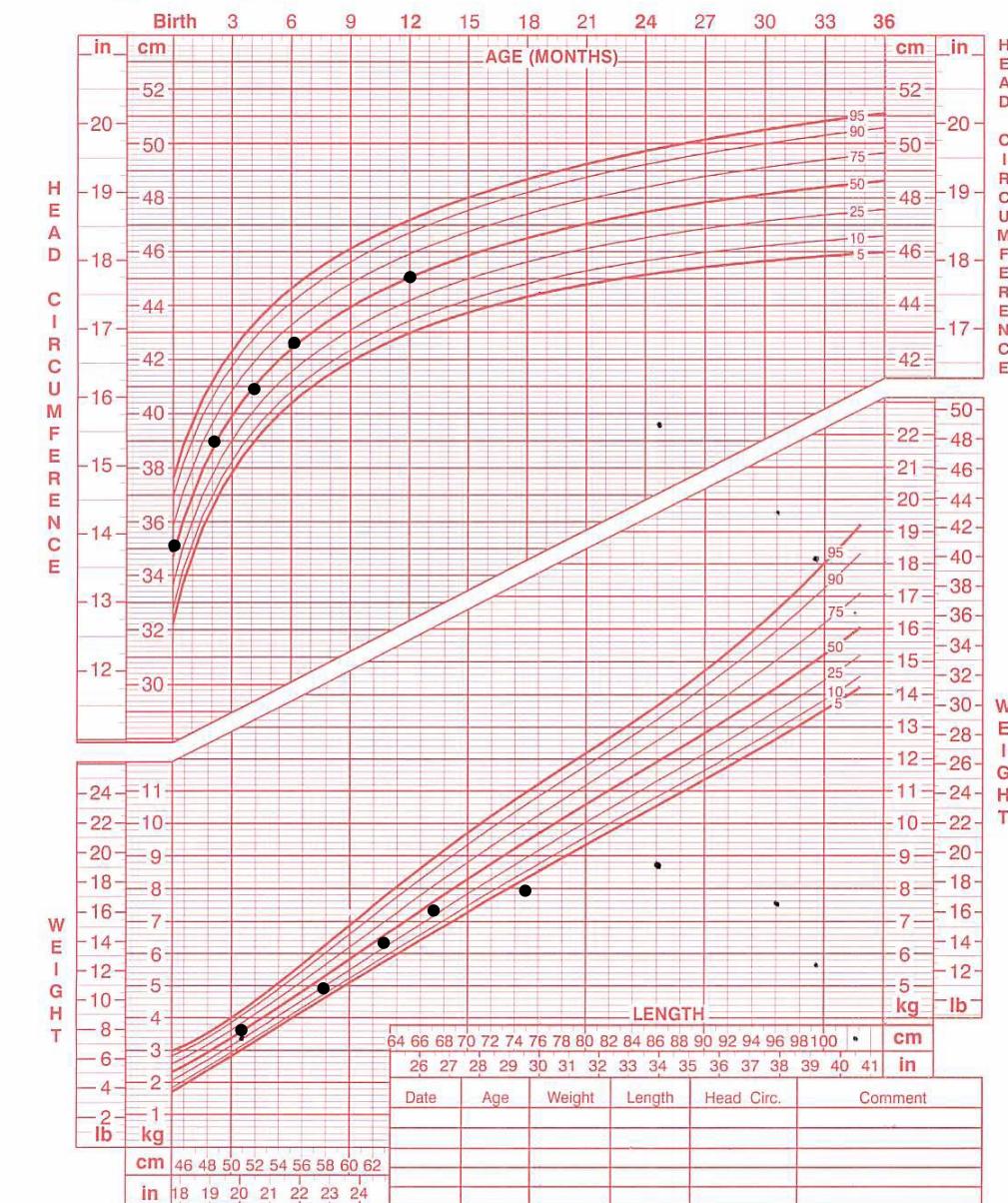
Length-for-age and Weight-for-age percentiles



SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000). <http://www.cdc.gov/growthcharts>

Birth to 36 months: Girls

Head circumference-for-age and Weight-for-length percentiles



SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000). <http://www.cdc.gov/growthcharts>

WHAT OTHER INFORMATION WOULD
YOU LIKE TO KNOW?

DIETARY HISTORY

- **What** does the child eat?
 - Breastfeeding, formula, solids
 - Quantity
 - Types of food
 - 3 day food diary helpful
- **When** does the child eat?
 - Frequency and duration of meals
- **Where** does the child eat?
 - Distractions
 - Environment (positioning, caregivers)

FEEDING BEHAVIOURS

- How does the caregiver know child is hungry (i.e. cues)?
- How does the caregiver react when child eats well/poorly?
- Does the child refuse food?
- Does the child feed differently with different people?
- Do the caregiver and child have struggles over feeding?
- Are there any cultural beliefs and practices?

HISTORY

- Pregnancy and Birth History
 - Pre-natal exposures: maternal infection, meds, alcohol
 - IUGR, gestational age, perinatal stress, birthweight
- Past Medical History
 - Chronic diseases may affect intake, absorption, energy needs
- Developmental History
 - Developmental and behavioural problems can play a significant role in FTT

HISTORY

- Very detailed thorough **Review of Systems** is critical
- Particularly inquiring re: signs or symptoms of a medical condition
- E.g.
 - Vomiting
 - Stooling habits
 - Sleep
 - Fevers
 - Rash

FAMILY HISTORY

- Weight and height of family members (parents and siblings)
- History of developmental delay or genetic conditions
- Illnesses that contribute to poor growth

PSYCHOSOCIAL HISTORY

- Psychosocial stressors are a leading cause of insufficient nutrient intake in children
 - E.g. poverty, parental depression, family discord, substance use
- Ask about:
 - Family composition and who lives at home
 - Employment status
 - Parental education/knowledge of appropriate diet
 - Degree of social isolation/supports
 - Family stress
 - Abuse

WHAT ELSE WOULD YOU LIKE TO DO?

PHYSICAL EXAM

- Identification of cause and effects
- Looking for:
 - Signs of underlying disease that may be impairing growth
 - Severity of growth failure and effects of malnutrition
 - Dysmorphic features suggestive of genetic disorder
 - Signs of possible abuse or neglect - DUTY TO REPORT
- Think of weight, height, head circumference as vital signs!

PHYSICAL EXAM

Physical Exam Clues	Potential Significance
Tachypnea/tachycardia?	
Hypertension?	
Pallor?	
Edema?	
Microcephaly?	
Cardiac murmur?	
Abdominal distention?	
Clubbing?	
Cheilosis?	

Physical Exam Clues	Potential Significance
Tachypnea/tachycardia?	Increased metabolic demands
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Cheilosis?	Vitamin deficiency



Source: Usatine RP, Smith MA, Mayeaux EJ, Chumley HS: *The Color Atlas of Family Medicine*, Second Edition: www.accessmedicine.com

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Cheilosis

WHICH OF THE FOLLOWING IS INCORRECT?

- A. It is important to observe the parent-child interaction during a consult for FTT
- B. The physical examination is often normal with an infant with FTT
- C. Laboratory investigations are always critical to identify a cause for FTT
- D. It is rare for a child with FTT to require hospitalization
- E. Psychosocial stressors are the main cause of insufficient nutrient intake in children of all ages

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INVESTIGATIONS

- Guided by careful history and physical examination
- Laboratory tests unlikely to reveal organic cause in absence of suggestive evidence on history or physical
- Basic: CBC+diff, lytes, gas, BUN, Cr, glucose, calcium, magnesium, phosphorus, albumin, total protein, iron studies, liver enzymes, TSH, serum immunoglobulins, TTG IgA and total IgA, urinalysis and culture
- Further: sweat chloride test, vitamin levels, stool culture, fecal elastase, zinc, lead, TB skin test, HIV serology, GI imaging, bone age

INVESTIGATIONS

- Most important to have a rationale for what you are ordering
- For example:

Test	Rationale
CBC+diff	Anemia, malignancy
Lyttes, extended lytes, gas, Cr, BUN	Renal tubular acidosis, monitor refeeding syndrome
Iron studies	Iron deficiency
TTG IgA and total IgA	Celiac disease (only test in children old enough to have been introduced to gluten)
Urine tests	Infection, glycosuria, renal pathology
Stool studies	Infection, malabsorption

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MANAGEMENT

- Primary goal of management of FTT is to improve nutritional status
- Identify the underlying cause and treat
- Nutritional intervention
 - Additional calories for catch-up growth
 - Increase caloric density (e.g. fortification; add oils, heavy cream, peanut butter)
 - Limit “empty” calories (e.g. juice)
- Support parents
- Close follow up critical

BEHAVIOUR MODIFICATION

- Parental reassurance (reduce anxiety)
- Structured mealtimes that are relaxed and social
- Reduce mealtime distractions
- Give children opportunity to feed themselves and make some choices
- Offer solids before liquids
- Praise child for positive behaviours
- Parents' role is to provide the food, child's role is to decide whether to eat and how much

MULTIDISCIPLINARY APPROACH

- May need:
 - Dietician
 - Occupational therapists and/or speech language pathologists
 - Social work
 - Psychologist

HOSPITALIZATION

- Rarely required
- Indications
 - Failed outpatient management
 - Concern for child's well-being or safety
 - Severe malnutrition (risk of refeeding syndrome)
 - Precise documentation of intake
 - Close observation of parent-child interaction
 - Initiation of nasogastric feeds
 - Serious underlying illness or medical problem

PHARMACOLOGIC INTERVENTION

- Vitamin/mineral supplements if deficient
- Only in exceptional cases for children with growth failure due to inadequate dietary intake with expert consultation
- Appetite stimulants
 - Cyproheptadine
 - Cannabinoid derivatives and megestrol acetate should not be given to healthy children

TUBE FEEDINGS

- Only in exceptional cases
- Can be traumatic for both child and family. Can increase oral aversion and decrease appetite
- Some indications:
 - Underlying disease is worsened by poor nutritional status, which can worsen outcomes
 - Oral intake is unsafe

BACK TO THE CASE – ALEX PETIT

- Physical examination normal
- CBC showed Hgb of 90 (anemic) MCV 68 (microcytic) and ferritin of 3 (low)
- What are your suggestions for management of Alex's case?

BACK TO THE CASE – ALEX PETIT

- Iron supplements
- Introduce new foods with meals with some old favourites
- Decrease milk intake
- Encourage high calorie foods
- Give 3 meals a day with snacks in between
- Turn off the TV/screens
- Eat with company in a high chair
- Follow up in 2 months

FTT SUMMARY

- FTT is common and should be identified
- Often multifactorial etiology – think about 4 categories
 - 1. Insufficient intake
 - 2. Inadequate absorption
 - 3. Increased metabolic demand
 - 4. Deficiency in nutrient utilization
- A good history and physical is most important
 - Empiric investigations are seldom helpful
- Treatment based on addressing underlying medical condition, increasing caloric intake, modifying behaviours and providing support to families
- A multidisciplinary approach and frequent follow up are necessary
- Early identification and intervention are important in improving long-term outcomes

SUGGESTED RESOURCES

- Marchand V, on behalf of the CPS Nutrition and Gastroenterology Committee. The toddler who is falling off the growth curve. *Paediatr Child Health* 2012; 17(8):47. <https://cps.ca/documents/position/toddler-falling-off-the-growth-chart>
- Marchand V, on behalf of the CPS Nutrition and Gastroenterology Committee. Promoting optimal monitoring of child growth in Canada: using the new World Health Organization growth charts. *Paediatr Child Health* 2018. <https://cps.ca/documents/position/child-growth-charts>
- Tang MN, Adolphe S, Rogers SR, Frank DA. Failure to thrive or growth faltering: medical, developmental/behavioral, nutritional, and social dimensions. *Peds in Review* 2021;42(11):590.



QUESTIONS?

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