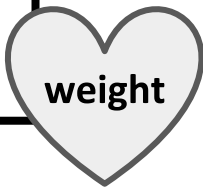


# Normal Growth



Age	Daily wt gain (g)	Monthly wt gain (kg)	Rec'd daily kcal (kcal/kg/day)
0-3mo	30	0.9	115
3-6mo	20	0.6	110
6-9mo	15	0.45	100
9-12mo	12	0.36	100
1-3y	8	0.24	100
4-6y	6	0.17	90-100
up to puberty		2 kg/year	

## When to use which growth chart:

- **Birth to 24 months:** breastfed or not
  - WHO charts (data from mostly breastfed infants)
  - Weight-for-length and head circumference
- **2 to 20 years:**
  - CDC charts (data from mostly bottlefed infants)
  - BMI

**WHO:** <http://www.who.int/childgrowth/standards/en/>

**CDC:** <https://www.cdc.gov/growthcharts/>

\*\* Other growth charts exist for VLBW/prematurity; Down, Turner, and Klinefelter syndromes; CP; achondroplasia

\* Term neonates may lose up to **10%** of their birth weight in the first few days of life

\* Breastfed babies gain weight relatively rapidly in the first 3-4 mo, then relatively slowly thereafter cf. formula-fed babies

\* Twins' weight/length/BMIs are usually less than singletons in first 2.5 years of life (even with GA correction); normalize by 4 years

Birth weight = ■

By 10-14 days ... ■

By 4 months ... ■ ■

By 1 year ... ■ ■ ■

By 2 years ... ■ ■ ■ ■

By 3 years ... ■ ■ ■ ■ ■

By 5 years ... ■ ■ ■ ■ ■ ■

By 7 years ... ■ ■ ■ ■ ■ ■ ■

**BMI** =  $wt / ht^2$  [in kg and m]

**BMI's %iles:**

< 5th	underweight
5th - 84th	normal
85th - 95th	overweight
95th - 99th	obese
> 99th	morbidly obese

\* BMI is not a perfect measure of adiposity; doesn't differentiate lean tissue and bone from fat

## Prematurity:

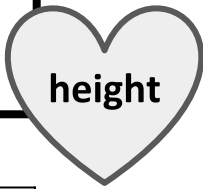
- Growth failure can be overdiagnosed
- *VLBW infants* → can catch up by *early school age*
- *Other preemies* → catch up *weight by 2yo, height by 2.5yo*

## References:

- Braun LR, Marino R. Disorders of Growth and Stature. Pediatrics in review. 2017;38:293.
- Bright Futures
- Jack J, Young SB. Harriet Lane handbook: Chapter 10 endocrinology, section VII growth. 2018.
- Keane V. Nelson's textbook of pediatrics. Chapter 15: Assessment of growth. 2016.
- Nichols J. UpToDate: Normal growth patterns in infants and prepubertal children. 2018.
- Weintraub B. Growth. Pediatrics in review. 2011;32:404.



# Normal Growth



\* Children reach ½ adult height by 24-30 mo  
 \* Children double birth length by 3-4 y

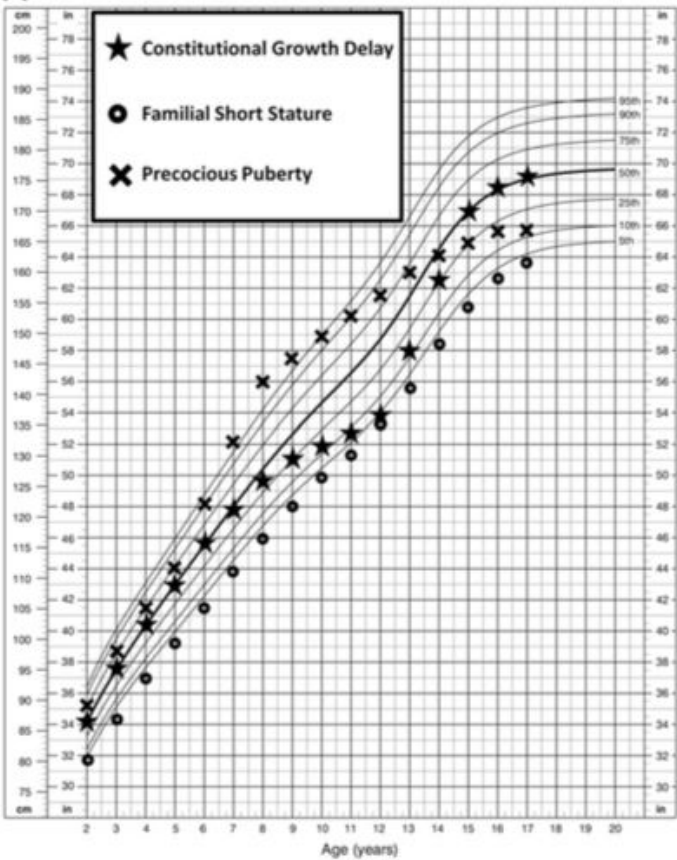
Age	Linear growth (cm/mo)	Head circ (cm/mo)
0-3mo	3.5	2
3-6mo	2	1
6-9mo	1.5	0.5
9-12mo	1.2	0.5
1-3y	1	0.25
4-6y	3 cm/year	1 cm/year
up to puberty	5 cm/year	

**Midparental height (MPH):**

Males:  $\frac{(\text{mom ht} + 13) + \text{dad ht}}{2}$

Females:  $\frac{\text{mom ht} + (\text{dad ht} - 13)}{2}$

\* Head circumference %ile should correlate with length %ile



- Things to keep in mind if concerned for growth abnormality:**
1. Is child consistent with her growth potential? (i.e., look at midparental height)
  2. Is she tracking along the same growth curve?
    - a. Dropping 2 or more curves could indicate pathology, especially after 3 or 4 yo
    - b. Some shifts are normal/expected: birth size is more due to maternal factors/in utero conditions rather than genetics, so there is commonly a shift towards the child's genetic potential btwn 6 and 18 mo
  3. Are abnormalities seen on any other/all growth charts?
    - a. Malnourishment (e.g., chronic dz, neglect, malabsorption): weight drops first, then height, then head circ
    - b. Congenital, genetic abnormality: mostly linear growth problems
    - c. Primary endocrine problem (e.g., hypothyroid, GH deficiency): normal/elevated weight-for-height while height drops



	CGD	FSS
<i>Growth velocity</i>	Decreased	Normal
<i>Bone age</i>	Delayed	Normal
<i>Puberty</i>	Delayed	Normal
<i>Adult height</i>	Normal (per MPH)	Short (per MPH)

\* There is a normal deceleration in height velocity right before puberty growth spurt (when both wt & ht rapidly accelerate)

Normal puberty	
Males	Females
9 - 14 y	8 - 13 y