Infant Nutrition

Assessing newborn health

Birth weight as an outcome

Key measure of the health status during pregnancy

Full term: 2.5-3.8kg; 47-54cm

Preterm: regardless of weight: <37wk gestation; incomplete development

Infant mortality

Deaths that occur within the 1st year of life

LBW- major factor of infant mortality

Standard newborn growth assessment

Assessment of health status right after birth

- Indicators: ht, wt, HC for gestational age
- SGA; IUGR: BW falls below the 10th percentile of weight for gestational age
- LGA> 90th percentile
- Appropriate for Gestational Age (AGA): 10-90th

Infant development

Right after birth:

- Root: turns cheek and opens mouth at touch
- Suckle
- Coordinate swallowing and breathing

à These reflexes are protective at this stage until they are replaced by movements during 1st few months of life

TABLE 8.2 ▸ Major reflexes found in newborns

NAME	RESPONSE	SIGNIFICANCE
Babinski	Baby's toes fan out when the sole of the foot is stroked.	Perhaps a remnant of evolution from heel to toe
Blink	Baby's eyes close in response to bright light or loud noise.	Protects the eyes
Moro	Baby throws arms out and then inward (as if embracing).	May help a baby cling to the mother in response to lou noise or when baby's head falls
Palmar	Baby grasps an object placed in the palm of his or her hand.	Precursor to voluntary grasping
Rooting	When a baby's cheek is stroked, baby turns head toward the cheek that was stroked and opens mouth.	Helps a baby find the nipple
Stepping	Baby is held upright by an adult and is then moved.	Precursor to voluntary walking forward; begins to step rhythmically
Sucking	Baby sucks when an object is placed in mouth.	Permits feeding
Withdrawal	Baby withdraws foot when the sole is pricked with a pin.	Protects a baby from unpleasant stimulation

SOURCE: From KAIL/CAVANAUGH. Human Development, 2nd ed.

Motor development

Reflects infant's ability to control voluntary muscular movement

- Development of muscle control is **top-down**: begins with head control and last is lower legs

- **Central- peripheral:** meaning the infant learns to control the shoulder and arm muscles before muscles in the hands

Motor development

Motor development influences both the ability of the infant to feed and the amount of calories expended in the activity

- *Ability to sit in a high chair- only when infant has achieved head control and sitting balance can oral feeding with a spoon take place*

Development of motor skills- increase in caloric requirements (increases activity)

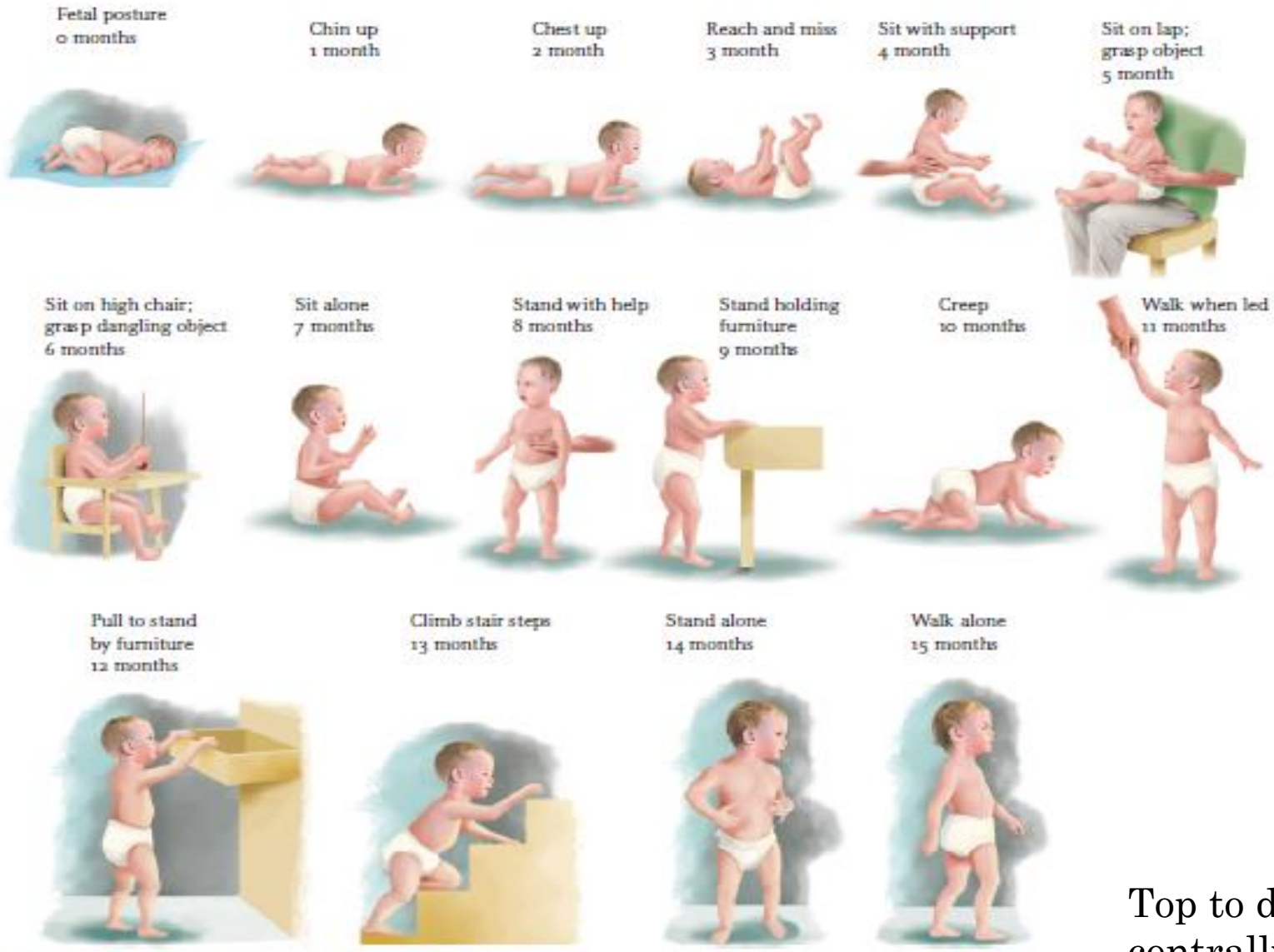


ILLUSTRATION 8.2 › Gross motor skills.

Based on Shirley, 1931, and Bayley, 1969.

SOURCE: From KAIL/CAVANAUGH. Human Development, 2E.

Top to down & centrally to peripherally

Critical periods

Fixed time period during which certain behaviors emerge

Theories:

- Piaget's stages of cognitive development
- Erickson's psychological stages of development
  - à *Window of development*- occur when certain skills must be learned in order for subsequent learning to occur

Healthy newborn: mouth source of pleasure and exploring

- E.g., prolonged period of respiratory support: baby may not associate mouth sensations with pleasure but rather discomfort→ CP of associating mouth sensations with pleasure is missed→ might have problems with feeding

Cognitive development

Concept of biological and environmental systems interacting

Sensorimotor development: infants gain knowledge through their senses and motor movements- they use skills they were born with e.g., looking, sucking, and listening to learn more about the environment

*Research findings: access to adequate calories and protein may not be sufficient for maximizing brain maturation **if** the social and emotional growth of the infant are not stimulated simultaneously*

SUBSTAGES DURING THE SENSORIMOTOR STAGE OF DEVELOPMENT

Substage	Age (months)	Accomplishment	Example
1	0–1	Reflexes become coordinated.	Sucking a nipple
2	1–4	Primary circular reactions appear —an infant's first learned reactions to the world.	Thumb sucking
3	4–8	Secondary circular reactions emerge, allowing infants to explore the world of objects.	Shaking a toy to hear a rattle
4	8–12	Means–end sequencing of schemes is seen, marking the onset of intentional behavior.	Moving an obstacle to reach a toy
5	12–18	Tertiary circular reactions develop,allowing children to experiment.	Shaking different toys to hear the sounds they make
6	18–24	Symbolic processing is revealed in language, gestures, and pretend play.	Eating pretend food with a pretend fork






Digestive system development

It takes up to 6 months for the infant GIT to mature- the time required varies considerably between individuals

- **3rd trimester**: swallow amniotic fluid- stimulate GIT to mature

At birth, the healthy newborn's digestive system is *sufficiently* mature to digest fats, protein, and simple sugars and to absorb fats & AAs

- It is <u>functional</u> but not fully mature

Digestive system development

During early infancy period- the coordination of peristalsis within the GIT improves

Maturation of peristalsis and rate of passage are associated with some forms of GI discomfort in infants

- Immaturity of the gut is associated with conditions including colic, gastroesophageal reflux (GERD), unexplained diarrhea, and constipation
  - Do not typically hinder growth/ do not interfere with absorption of nutrients

Energy and nutrient needs

Caloric needs

The caloric needs of typical infants **are higher/kg BW than at any other time of life**

Range of caloric requirements: 80-120kcal/KgBW

Factors that account for range in calories:

- Weight
- Growth rate
- Sleep/wake cycle
- Temperature and climate
- PA
- Metabolic response to food
- Health status and recovery from illness

Protein needs

Recommended protein intake:

- From birth- 6mos: averages 2.2 g/ kgBW
- From 6 to 12 mos: 1.6g/KgBW

Need is affected by body composition: more metabolically active muscle → more protein needs

Essential AAs required by healthy infants are constant across the 1st year of life

** Infants may exceed their protein needs based on the DRI when they consume more formula than recommended for age and when protein sources such as baby cereal are added to infant formula

Fats

No specific recommended intake level of fats for infants

BM provides 55% of its calories from fat→ this % reflects an adequate intake by infants

Cholesterol intake should not be limited in infancy- gonad and brain development

Fats

% of fat in the diet drops after the infant accepts baby foods-low in fat

Differences in digestion and transport of fats makes estimation of requirement complicated:

- ***SCFA, MCFA found in BM are more readily utilized than LCFA found in infant formulas***
- ***LCFA are the most common type in food→ they are more difficult for young infants to utilize***

Infants have high caloric needs compared to older children

- They use fat more regularly to generate E
- Cannot tolerate fasting long- do not sleep through the night

Metabolic rate, calories, fats, and proteins

The metabolic rate of infants is the highest of any period after birth

- Rapid growth rate
- High proportion of muscle weight

Glucose main source of E

In cases of low glucose intake-AA will be used for E and are hence unavailable for growth→ catabolic state→ *if it goes on for too long it will slow or stop growth*

Fluoride

Fluoride is low in BM

DRI for fluoride:

- < 6mos: 0.1mg/ d
- 7-12 mos: 0.5mg/d

F is incorporated into the enamel of forming teeth, including teeth that have not erupted

- Deficiency: tooth decay
- More than recommendation: tooth discoloration may occur

Vitamin D

Bone mineralization

Vitamin D is recommended for all infants starting shortly after birth at the level of 400 IU/day

- Exclusively and partially BF: vit D is low
- Vit D fortified formula: no need for supplemental vit D

Sodium

Regulates fluid balance

Estimated minimum requirements:

- 0-5mos:120mg
- 6- to 12: 200mg

BM content of Na was **used as the basis** for setting the requirements for infant- *formula matches this*

Illnesses such as diarrhea or vomiting cause the loss of Na and water/ ↑ the risk of dehydration

Infants do not need salt added to foods to maintain adequate sodium intake

Fiber

No recommendations for infants

Consumption of fruits, vegetables, and grains after 6mos

Lead

Elevated blood lead levels:

- Can be toxic to the developing brain
- Interfere with Ca and Fe absorption
- Slows growth and results in shorter stature

Lead:

- In water
- Lead-based paint

Screening for lead poisoning is recommended starting at 9-12 months of age

Physical assessment

Healthy newborns **double** BW by age **4-6months** and **triple** at **1 year**

- *Growth reflects nutritional adequacy, health status, economic status*

Table 8.3 Typical gains in weight and height for age in infancy[31]

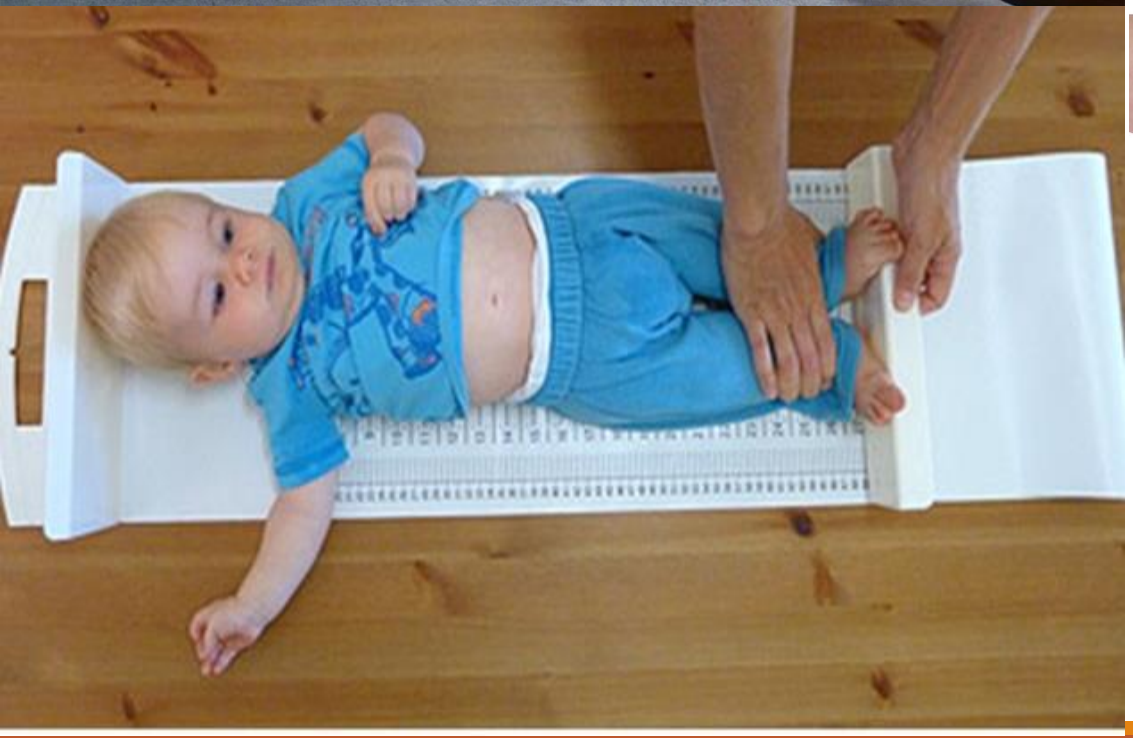
Age	Weight Gain Grams Per Day	Weight Gain Grams (Pounds) Per Month	Length Gain mm Per Day	Length Gain mm (Inches) Per Month
0–3 months	20–30	600–900 (1.3–2)	1	30 (1.2)
3–6 months	15–21	450–630 (1–1.4)	0.68	20 (0.8)
6–12 months	10–13	300–390 (0.7–0.9)	0.47	14 (0.6)

Physical assessment

Accuracy of assessment depends on:

- Calibrated scales
- Recumbent-length measurement board with an attached right-angled headpiece
- Non-stretch tape for measurement of head circumference

Equipment need to be checked for accuracy once/ month




MB100
DETECTO

Table 8.4 Measuring growth accurately in infants

To Avoid Measurement Errors

- Use measuring equipment that was calibrated recently
- Confirm that the scale is on zero before starting
- Make sure the infant is not holding or wearing anything that adds weight or length
- Confirm the position of the infant for length measurements:

  Head position—the infant's eyes are looking straight up and the head is in midline, touching the head board

  Neither hips nor knees are bent

  Heel is measured with foot flat against the foot board
- Head circumference measure is at the widest part of the head

To Avoid Growth Plotting Errors

- Calculate the age accurately in months after confirming the date of birth
- Confirm plotting on the metric scale if kilograms were measured, not the pound scale
- Confirm that the plotted weight and length are marked well enough to read easily without being so large as to change percentiles

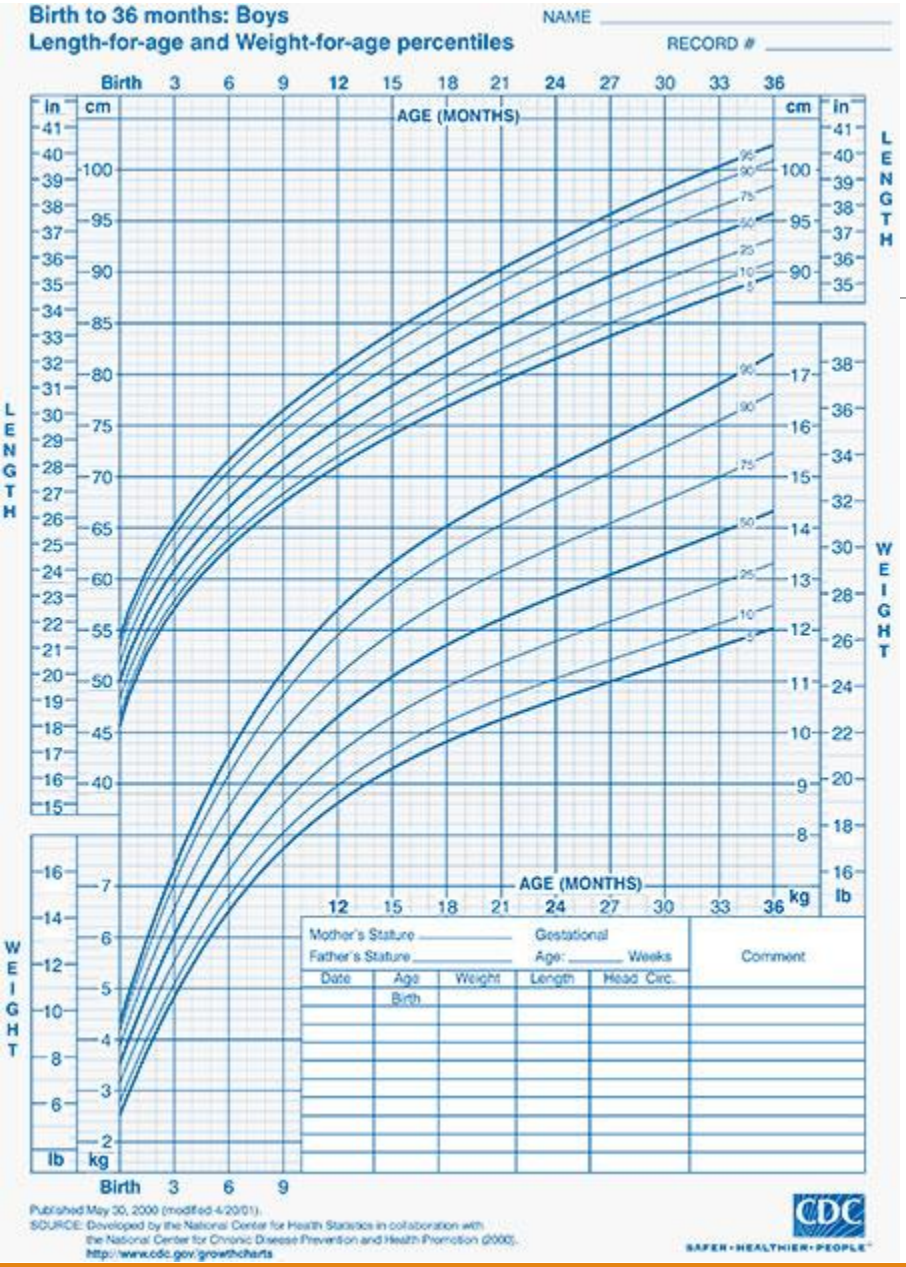
Interpretation of growth data

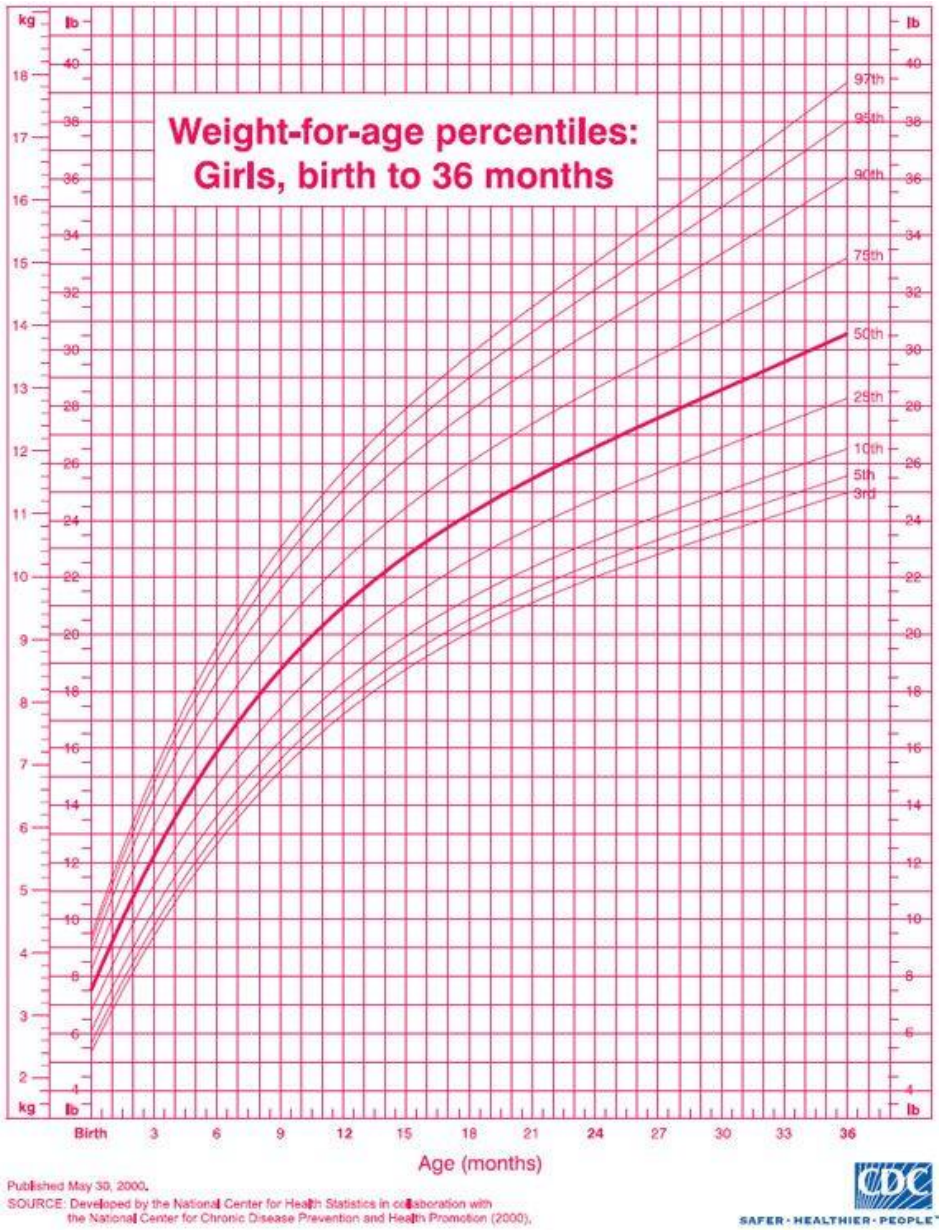
CDC growth charts

- Based on infants weighed nude on calibrated scales
- BF vs non BF

Growth charts for 0- 36mos olds consist of a prepared graph for each gender, showing:

- Weight for age
- Length for age
- Weight for length
- HC for age


Birth to 36 months: Boys
Length-for-age and Weight-for-age percentiles
NAME
RECORD #
AGE (MONTHS)
LENGTH
WEIGHT
Mother's Stature
Father's Stature
Gestational Age: Weeks
Comment
Date
Age
Weight
Length
Head Circ.
Birth
Published May 30, 2000 (modified 4/20/01).
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
CDC
SAFER·HEALTHIER·PEOPLE


Weight-for-age percentiles:
Girls, birth to 36 months
97th
95th
90th
75th
50th
25th
10th
5th
3rd
Age (months)
Published May 30, 2000.
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
CDC
SAFER·HEALTHIER·PEOPLE

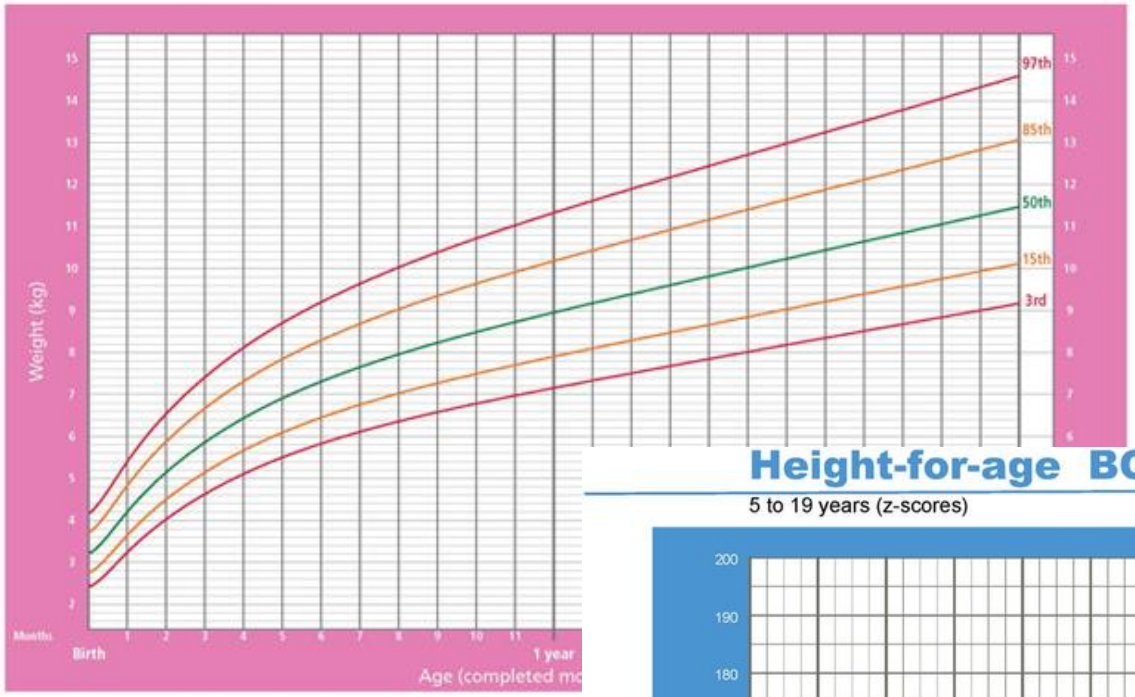
WHO growth charts (gender specific):

- Age range of 0–6 months
- 6 mos- 2 years
- Based on data from 6 countries
- Only includes infants who were BF for 6mos and live with a non-smoking mother

Weight-for-age GIRLS

Birth to 2 years (percentiles)

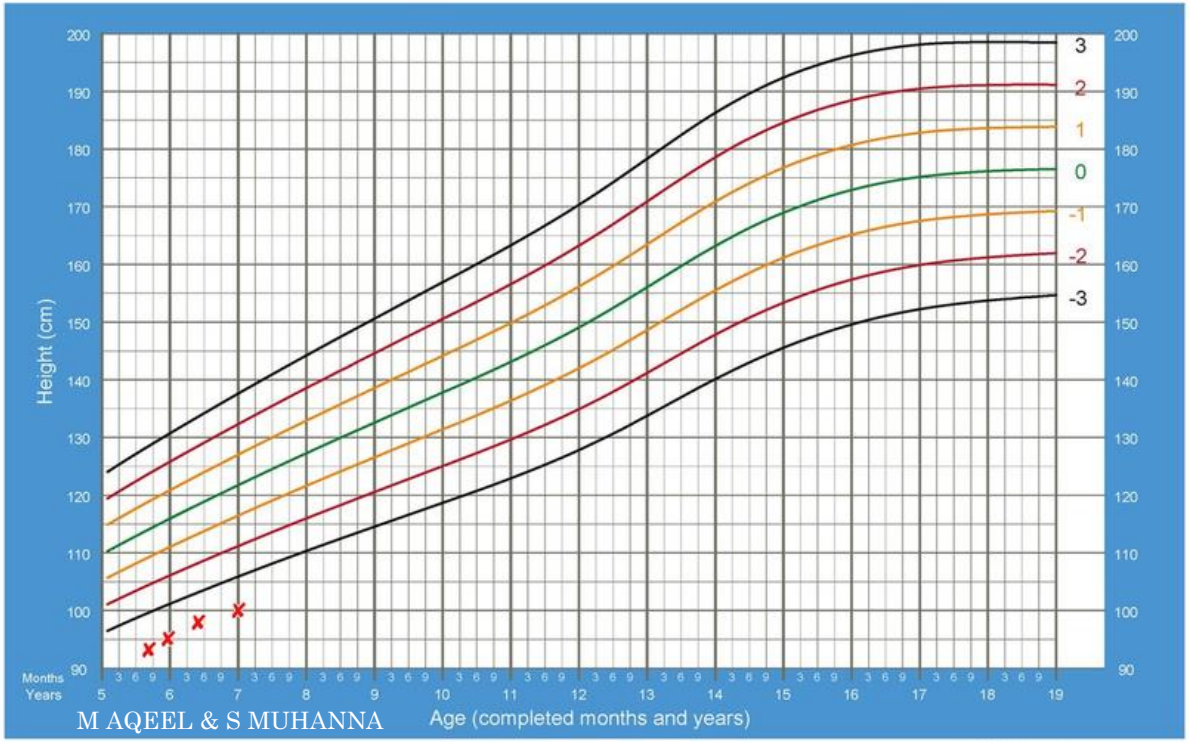
World Health Organization



Height-for-age BOYS

5 to 19 years (z-scores)

World Health Organization



M AQEEL & S MUHANNA

2007 WHO Reference

Measure frequently→ growth trend is clearer

Warning signs of growth difficulties are:

- Lack of weight or height gain
- Plateau in wt, length, or HC for more than 1 month
- A drop in wt without regain within a few weeks

Rate of wt gain during infancy is not necessarily predictive of future growth patterns after infancy, nor a risk for long-term overwt, compared to the wt-gain pattern later in childhood

Feeding in early infancy

Exclusive BF- first 6 months

BF up to 2 years + complementary feeding

The growth rate and health status are better indicators of the adequacy than the volume of breast milk or formula

Table 8.5 Typical daily volumes for young infants not being breastfed

Age of Infant	Typical Intake of Formula per Day (24 hours)
Birth to 1 month	16–20 fl oz per day, 8–12 feedings/day, 1–2.5 fl oz per feeding
1 to 2 months	18–26 fl oz per day, 8–10 feedings/day, 2–4 fl oz per feeding
2 to 3 months	22–30 fl oz per day, 6–8 feedings/day, 3–5 fl oz per feeding
3 to 4 months	24–32 fl oz per day, 4–6 feedings/day, 4–8 fl oz per feeding

Table 8.6 How infant formulas are modified compared to breast milk

Macronutrients	Breast Milk	Cow's Milk–Based Formula	Soybean-Based Formula
Protein	7% of calories	9–12%	11–13%
Carbohydrates	38% of calories	41–43%	39–45%
Fats	55% of calories	48–50%	45–49%

Other ways infant formulas are modified compared to breast milk

What Is Modified	How It Is Modified	Examples from Two Major Manufacturers
Calorie level	Increase in calories from 20 calories/fl oz to 22 or 24 calories/fl oz (for preterm infants).	EnfaCare Lipil is 22 calories/fl oz. Similac with Iron 24 is 24 calories/fl oz.
Form of protein	Protein is broken down to short amino acid fragments (hydrolyzed protein) or into single amino acids. Source of protein changed.	Similac Neosure Advance has amino acids. Enfamil Nutramigen has hydrolyzed milk protein. Prosobee has hydrolyzed soy protein in place of milk-based protein.
Type of sugar	Lactose is replaced by other sugars, such as sucrose or glucose polymers from various carbohydrate sources.	Enfamil LactoFree has lactose replaced by corn syrup solids (which provides glucose). Prosobee has carbohydrates from corn syrup solids. Neither has sucrose or lactose.
Type of fat	Long-chain fatty acids partially replaced with medium-chain fatty acids (MCT) and source of fat changed.	Pregestimil has about half of the long-chain fats, replaced by a mixture of vegetable oils. Enfamil Nutramigen has no MCT oil, but has vegetable oils in place of animal-based fats.
Allergy/intolerance	Replacement of milk-based protein with protein from soybeans or replacement of whole proteins with amino acid fragments or single amino acids.	Similac Isomil and Enfamil Prosobee have milk protein replaced by soy protein.

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Other ways infant formulas are modified compared to breast milk

What Is Modified	How It Is Modified	Examples from Two Major Manufacturers
Micronutrients	Increased calcium and phosphorus concentration for preterm infants. Decreased minerals related to renal function. Added essential fatty acids (see above). Lower supplemental iron.	Enfamil Premature Lipil Similac PM 60/40 is modified in calcium, phosphorus, and is low in iron. Similac Special Care Advance 24 is a low-iron formula sold only to hospitals for preterm infants. Enfamil Low Iron and Similac Low Iron have lower levels of iron than the standard formula.
Thickness	Added rice or fiber for gastrointestinal problems.	Similac Isomil D.F. (D.F. = diarrhea free) for short-term use; it has added fiber from soy. Enfamil A.R. has added rice.
Age of infant	Target age 0–12 months Target age 9–24 months	Similac Isomil Advance Similac Isomil 2

Cow's milk during infancy

Recommendation: **no use of cow's milk during infancy**

IDA has been linked to early introduction of whole cow's milk

Low iron availability may be a result of:

- GI blood loss
- The lack of iron-rich foods in the diet

Soy protein- based formula during infancy

AAP recommends limited use of formulas in which soy protein has been substituted for milk protein-when maternal BM is not available

- Little scientific evidence for use of soy formulas in infancy
- These formulas contain plant origin hormone-like components and dietary fiber components that can alter mineral absorption in healthy infants

Development of infant feeding skills

Presence of reflexes that prepare infants for feeding

Infants are born with food intake regulation mechanisms that change with the development of the infant

Early infancy: self-regulation of feeding is mediated by pleasure of the sensation of fullness

- Preference of sweet taste

Development of infant feeding skills

After the first 4-6 wks, reflexes fade and infants learn to purposely signal wants and needs

Period in between *early infancy-3yrs* → appetite and food intake are regulated by biological& environmental factors interacting with one another

3yrs: infants can verbalize that they are hungry

Table 8.8 Development of infant feeding skills

Chronological Age	Developmental Milestone	Feeding Skills
Birth to 1 month	Vision is blurry; hears clearly. Head is oversized for muscle strength of the neck and upper body.	Suckling and sucking reflexes. Frequent feedings of 8–12 per 24 hr. Only thin liquids tolerated.
1–3 months	Cannot separate movement of tongue from head movements. Head control emerges. Smiles and laughs. Puts hands together.	Volume increases up to 6–8 fl oz per feeding, so number of feedings per day drops to 4–8 per 24 hr. Sucking pattern allows thin liquids to be easily swallowed. Learns to recognize bottle (if bottle-fed).
4–6 months	Able to move tongue from side to side. Working on sitting balance with stable sitting emerging. Drooling is uncontrolled. Disappearance of newborn reflexes allows more voluntary movements. Teething and eruption of upper and lower central incisors.	Interest in munching, biting, and new tastes. Before 6 months, cannot easily swallow lumpy foods, but pureed foods swallowed. 6–8 fl oz per feeding and 4–5 feedings per day after 6 months (may be variable if breastfeeding). Holds bottle (if bottle-fed).
7–9 months	Hand use emerges, with pincer grasp and ability to release. Stable independent sitting. Crawling on hands and knees. Starting to use sounds, may say "mama" and "dada".	Self-feeding with hands emerges. Munching and biting emerges. Indicates hunger and fullness clearly. Prefers bottle, but little loss from a held, open cup.
10–12 months	Can pull to stand; standing alone emerges. Enjoys making sounds as if words. Can pick up small objects, such as a raisin. Can bang toys together with two hands. Has consistent routines about bedtime, diaper changing. Usually does not drool anymore.	Likes self-feeding with hands. Spoon self-feeding emerges. Drinks from an open cup as well as from a bottle. Uses upper and lower lip to clear food off a spoon. Enjoys chopped or easily chewed food or foods with lumps. Sitting position for eating Enjoys table foods even if some baby foods still used

Several models help assess readiness for consumption of solid foods

Developmental model:

- Being able to move the tongue from side to side without moving the head
- Keeping head upright and sit with little support before initiating spoon-feeding

Parents' ability to notice signs including hunger, satiation, discomfort influence feeding skill progression

Cues given by infants include

- Watching the food being opened
- Tight fists or reaching for the spoon- sign of hunger
- Becoming irritated if feeding pace is too slow or if feeder temporarily stops
- Playing with food or spoon- infant begins to feel full
- Slowing the pace of eating or turning away from food- they want to end the meal
- Stopping eating or spitting out food when they have had enough to eat

Successful feeding: infant relates positive and pleasurable attributes to satisfaction of their hunger

In case of pain (e.g., constipation or GER):

- Feeding problems later on: association of eating and pleasure is replaced by an association of eating and discomfort

- Cycle: baby is irritable→ cannot calm down- parent is frustrated- if this association is not replaced with a +ve one (problem may persist): pickiness, refusal of foods, difficult meal- time behavior

Introduction of solid foods

Introduction of solid foods

- **Main purpose** is to stimulate mouth muscle development more than fulfill nutritional needs which are met by BM

Beginning: small portion size 1-2 Tbsp, 1-2 meals/d

Eating solid food is a learning experience for baby:

- Spoon is not soft and warm like the breast
- Food texture is different

Recommendations for introducing food by spoon:

Offer a small spoon with a shallow bowl

Provide time for the baby to open his/her mouth and extend the tongue toward the food- *if they cannot do that then they are not ready to be spoon fed*

Wait for baby to swallow before giving the next feeding; rushing can cause choking and a bad feeding experience

The importance of feeding position

Improper position: choking, eating discomfort, ear infections

1st few months: semi-upright *(like in car seat)*

- Infant should not be in sleeping position since this can cause choking and overfeeding

Spoon feeding:

- Child sits upright with support for back and feet
- Hips and legs should be at 90 degrees- assist balance and digestion
- Caregiver sits in front of baby- eye contact

Resistance to learning feeding skills/ reacting to food in an unusual manner- signifies health or developmental difficulties

- E.g., reluctant infant: milk-protein intolerance

Preparing for drinking from a cup

Process of weaning starts in infancy and usually ends in toddlerhood

- Recommended age for weaning an infant from breast or bottle to drinking from a cup: 12-24months
- BF- 1st year of life: introduce cup after 6mos
- Developmental readiness for drinking from the cup begins at 6-8mos
- 10-12mos: try to hold his/her own cup

Preparing for drinking from a cup

Typical portion size of fluid from a cup is 30-60ml

Infant weaned too soon may plateau in weight because of ↓ total caloric intake- they are less efficient in mouth skills needed

Skills learned in drinking from an open cup encourage speech development

Food texture and development

Weaning is not complete until the caloric intake from BM is provided from foods and liquids

At 6-8mos: infant is ready for food with lump- soft texture to stimulate munching and jaw movement- motivate chewing

8-10mos: infants are able to chew and swallow soft mashed foods without choking

First foods

Baby cereal, such as iron-fortified cereal mixed with water or BM

Timing and spacing of new foods: to identify any negative rxns

- One new food over 2-3 days

Use of commercial baby foods is not a must

- Selection should be based on nutritional need of baby
- Jar serving- may not reflect recommended serving size for baby
- Portion size should be based on appetite

Food can be prepared at home

- Wider variety- prepare for later stages
- Must be careful to avoid bacterial contamination/ care for storage conditions
- Nutritional quality- adding sugar and salt jeopardize it

Inappropriate and unsafe food choices

May lead to choking- chewing not completely developed

Inability to clear food from mouth- sticky food e.g., peanut butter

Water

BM- adequate water for 6mos

Drooling- does not increase water needs

Hot weather- increase water needs (additional); should not replace BM/ formula

Juice (less nutritional alternative than BM/ formula): contribute to lower quality diets for infants

Sick child- vomiting, diarrhea: dehydration (infant can't signal thirst)

- Use of sports drinks to replace electrolytes: provide lower calories than BM/ formula: can lead to weight loss in infant

Juice can be introduced after 1 yr of age

- In a cup not bottle- to limit juice volume

How much food is enough for infants?

Excessive or inadequate food intake

- Babies sensitive to house environment- cry a lot- mistaken for hunger- overfeeding (less likely with BF)
- Infant who sleeps through usual house noises- may be fed less frequently- underfeeding

Typical forward and backward tongue movement at first attempt of spoon-feeding-may be interpreted as food rejection by new parents

Spitting of food: indicates learning how to swallow and does not signify taste preference

How infants learn food preferences

Experiences with food

- BF infants- more variety in taste than formula fed

Preferences can be learned

- Genetic disposition to sweet and against bitter food may modify preferences

Offering of limited variety/ with little interaction at meal time→ infant may learn to refuse to eat to get attention and is more likely to manipulate behaviors of adults more successfully as toddlers

Nutrition guidance

Infants and exercise:

- Provide a stimulating environment- for infants to explore and move

Supplements for infants (under certain conditions):

- Fluoride: in areas with no F in water or if BM is only form of nutrition after 6mos
- Iron: if mother was anemic during pregnancy
- B12: if mother is a vegan
- Vitamin D: infant is partially or exclusively BF
- Preterm infants/ LBW: vitamin A, E, Fe: low stores (accumulate in later stages in pregnancy)

Common nutritional problems and concerns

Failure to thrive

Condition of inadequate weight or height gain thought to be a result of **caloric deficit**

- Diagnosis during infancy or later

- **Organic**: *basis is a diagnosed medical illness*
  - Untreated GER, ear infection, respiratory illness, developmental disabilities
- **Nonorganic**: *not based on medical diagnosis*
  - Maternal depression, alcohol or drug abuse at home, over dilution of formula, feeding delegated to siblings

Table 8.10 Complete nutritional assessment of an infant to rule out failure to thrive

- Review records of weight, length, head circumference, fetal or maternal risk factors such as rate of weight gain during pregnancy, newborn screening results, Apgar scores, and physical exams after birth.
- Interpret all available growth records from providers, WIC, and emergency-room visits.
- Interpret current growth measurements and indicators of body composition, such as fat measurements.
- Review family structure, education, and social supports with attention to access to food and formula (if not breastfed).
- Analyze and interpret current food and fluid intakes as reported by the primary caregiver(s).
- Rule out a biological basis for FTT from available records and laboratory results.
- Observe and interpret parent–child interactions, feeding duration, and the feeding skills of the infant.

Nutrition intervention for FTT

First step is to increase caloric and protein intake; ensure a feeding schedule

RD: assess growth and nutritional adequacy, establish a care plan, and provide follow-up

Other interventions include:

- Agreement with caregivers about how and when intake and wt monitoring will be done
- Enrolling the infant in an early intervention program

Colic

A condition characterized by a sudden onset of irritability, fussiness, or crying in an infant between 2 wks-3 months of age who is growing and healthy

Might be related to the mothers food intake during BF- onions, garlic, cabbage…

Recommendations to relief colic include rocking, bathing, positioning the baby well for eating, or burping to relieve gas

Iron deficiency anemia (IDA)

Reserves in full-term infant reflect reserves of the mother

Less maternal stores- IDA during pregnancy: risk for anemia in infancy increases

Low family income: risk for iron deficiency (ID)

Infants who have ID may be exposed to other risk factors to their overall development including:

- LBW
- Generalized undernutrition
- long-term learning delays

Iron deficiency anemia (IDA)

Treatment: oral elemental iron administered as a liquid

BF infants: prescribed elemental oral iron; also receive iron through fortified baby cereal at 6 months of age

For infants who are not breastfed: iron fortified formula

Diarrhea and constipation

Diarrhea- can result from viral and bacterial infections, food intolerance, or changes in fluid intake- cause may or may not be identifiable

Diarrhea in infancy- serious problem if it leads to dehydration or infant becomes less responsive

Recommendation: keep feeding regular diet

- Continue BF/ formula- sufficient to prevent dehydration

Constipation

- Not a common concern in BF infants- stools are soft
- Formulas: soy based-more constipation than cow's milk- based formula

- To avoid constipation, ensure that the baby is getting enough fluid and no medications unless prescribed
  - *High fiber foods are not recommended-* chocking hazard
  - *Juices with laxative effect are not recommended-* may lead to diarrhea and fluid imbalance

Prevention of baby-bottle caries and ear infections

Baby-bottle caries are found in children older than 1yr, but are initiated by feeding practices during infancy

Infants derive comfort from sucking/ may fall asleep while doing so- if bottle is provided with juice/ milk- content will pool in mouth and lead to dental caries

Prevention of baby-bottle caries and ear infections

Risk for ear infections is correlated with excessive use of a bottle as a bedtime practice

If the infant is feeding by lying down while drinking, the liquid does not fully drain from the ear tubes-buildup of liquid increases the risk of ear infections

Feeding practices to limit Caries and ear infections related to bottles include:

- Limit the use of a bottle as part of a bedtime ritual
- Offer juices in a cup, not a bottle
- Put only water in a bottle if offered for sleep
- Examine and clean emerging baby teeth to prevent caries from developing

Food allergies

An infant may develop a food allergy to the protein in a cow's milk-based formula over time- *this usually happens after a **GI illness***

- **Healthy infant:** protein digestion and absorption is of grps of 2-3 AAs linked together

- **After an illness:** areas of inflamed intestinal lining may allow larger protein fragments to be absorbed- *these can trigger a local immune or inflammatory response*

The most common allergic reactions are respiratory and skin symptoms e.g., wheezing or skin rashes

True food allergies-*"hydrolyzed formula"*- protein is already broken down

Food intolerance

Frequently suspected in infants

- Families may think skin rashes, upper airway congestion, diarrhea, and other forms of GI problems to be food allergies, but often they are not

Suspected intolerance- provide infant with a specialized formula composed of *"hydrolyzed protein"*- contains enzymatically digested protein, or single AAs

- Expensive, taste might be rejected by infant

A family with a known allergy or intolerance may lower the risk of the allergy occurring in their infant by:

- Breastfeeding
- Postponing introduction of allergy-causing foods (e.g., wheat, eggs, and peanut butter) into the 2nd or 3rd year

It is important not to overly restrict food- nutritional inadequacies

Lactose intolerance

Lactose intolerance is characterized by cramps, nausea, and pain, and by alternating diarrhea and constipation

Infants who are BF may develop lactose intolerance

Diagnostic GI testing is needed to confirm true lactose intolerance

- In infants, **true** lactose intolerance is *uncommon* and tends to be overestimated

GI infections may *temporarily* cause lactose intolerance- irritated area of the GI interferes with lactose breakdown

"Lactose-free infant formulas": include modified corn starch or sucrose or formulas in which the disaccharide lactose is broken down into monosaccharides, such as in lactose-free cow's milk

Lactose intolerance is less common during infancy than at older ages in groups that are susceptible to it

An infant who was fed a lactose-free formula is likely to be able to eat dairy products later