Newborn and Infant Nutrition

A CLINICAL DECISION SUPPORT CHART

American Academy of Pediatrics
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Introduction

For 4 decades, the American Academy of Pediatrics (AAP) *Pediatric Nutrition* handbook has served as an invaluable reference for physicians, nurses, and other professionals caring for newborns, infants, children, and adolescents. With each new edition, this resource has been refined and expanded to provide more comprehensive guidance and the most up-to-date recommendations, with the new eighth edition now offering more than 1,700 pages of essential clinical information.

As the pediatrician's role and responsibilities continue to expand, nutritional care of the newborn and infant has emerged as a particularly crucial topic. We now know that virtually every element of a child's environment in these early weeks—including physical, social, and nutritional—contributes significantly to that child's development and lifelong health. To support pediatricians and other neonatal health care professionals in ensuring optimal nutrition during this critical period, the AAP is pleased to offer *Newborn and Infant Nutrition: A Clinical Decision Support Chart*.

This brand-new resource zooms in on some of the most valuable point-of-care guidance and tools in the latest edition of the handbook, enlarging and enhancing numerous tables and policy summaries in a colorful, dynamic format that is ideal for visual learners and busy clinicians. Designed to be quickly thumbed or even hung on the office wall, this clinical decision support chart puts the neonatal highlights of *Pediatric Nutrition* immediately at your fingertips.

The materials presented in this chart are derived directly from *Pediatric Nutrition* and have been reviewed by the AAP Committee on Nutrition to ensure they reflect the most current AAP policy. We hope you will find it a helpful, practical companion tool to the latest edition of the handbook in our shared mission of ensuring the best health and developmental outcomes for all children.

Acknowledgments

We are grateful to Steven A. Abrams, MD, FAAP, chair of the AAP Committee on Nutrition, for his input on this first edition of the clinical decision support chart, as well as for his careful review of the materials included. We would also like to thank Erin Freeman, RD, LD; Catherine A. Karls, MS, RD, CD, CNSC; Teresa M. Lee, MS, RD, LD; and Therese Ryzowicz, MS, RD, LD, for their very helpful review of portions of this chart.

Contents

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Every effort is made to keep *Newborn and Infant Nutrition: A Clinical Decision Support Chart* consistent with the most recent advice and information available from the American Academy of Pediatrics.

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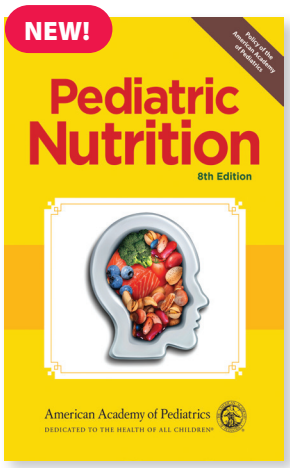

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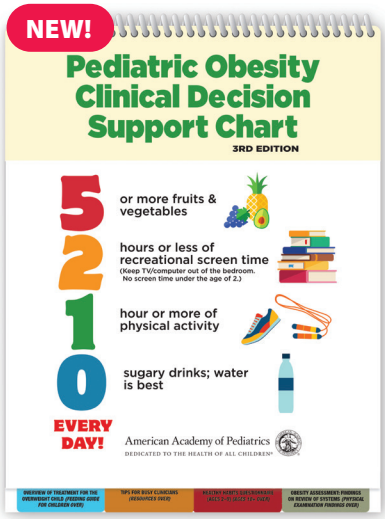

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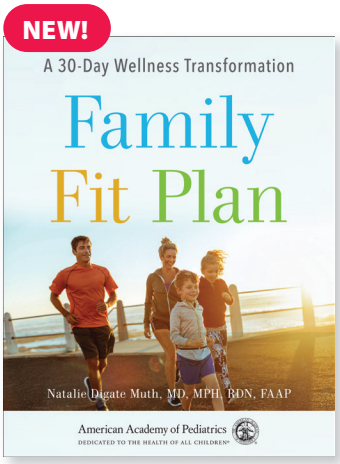

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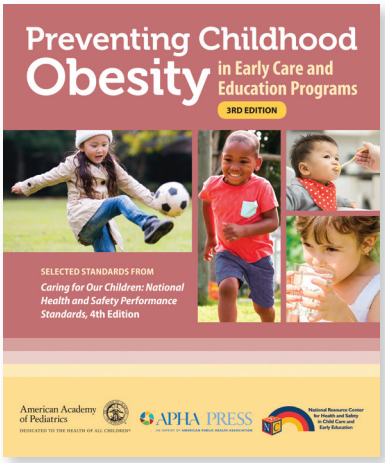

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Daily Reference Intakes

	RECOMMENDED INTAKES FOR INDIVIDUALS									
	Infants 0–6 mo	Infants 7–12 mo	Children 1–3 y	Children 4–8 y	Males 9–13 y	Males 14–18 y	Females 9–13 y	Females 14–18 y	Pregnancy ≤18 y	Lactation ≤18 y
Carbohydrate (g/day)	60*	95*	**130**	**130**	**130**	**130**	**130**	**130**	**175**	**210**
Total Fiber (g/day)	ND	ND	19*	25*	31*	38*	26*	26*	28*	29*
Fat (g/day)	31*	30*	ND	ND	ND	ND	ND	ND	ND	ND
n-6 Polyunsaturated Fatty Acids (g/day) (Linoleic Acid)	4.4*	4.6*	7*	10*	12*	16*	10*	11*	13*	13*
n-3 Polyunsaturated Fatty Acids (g/day) (α-Linolenic Acid)	0.5*	0.5*	0.7*	0.9*	1.2*	1.6*	1.0*	1.1*	1.4*	1.3*
Protein (g/day[a], *g/kg/d*)	9.1* *1.5**	**11.0** *1.5**	**13** ***1.1***	**19** ***0.95***	**34** ***0.95***	**52** ***0.85***	**34** ***0.95***	**46** ***0.85***	**71** ***1.31***	**71** ***1.31***
Vitamin A (µg/d)[b]	400*	500*	**300**	**400**	**600**	**900**	**600**	**700**	**750**	**1200**
Vitamin C (mg/d)	40*	50*	**15**	**25**	**45**	**75**	**45**	**65**	**80**	**115**
Vitamin D (IU/d)[c,d]	400*	400*	**600**	**600***	**600**	**600***	**600**	**600**	**600**	**600**
Vitamin E (mg/d)[e]	4*	5*	**6**	**7**	**11**	**15**	**11**	**15**	**15**	**19**
Vitamin K (mg/d)	2.0*	2.5*	30*	55*	60*	75*	60*	75*	75*	75*
Thiamin (mg/d)	0.2*	0.3*	**0.5**	**0.6**	**0.9**	**1.2**	**0.9**	**1.0**	**1.4**	**1.4**
Riboflavin (mg/d)	0.3*	0.4*	**0.5**	**0.6**	**0.9**	**1.3**	**0.9**	**1.0**	**1.4**	**1.6**
Niacin (mg/d)[f]	2*	4*	**6**	**8**	**12**	**16**	**12**	**14**	**18**	**17**
Vitamin B_6 (mg/d)	0.1*	0.3*	**0.5**	**0.6**	**1.0**	**1.3**	**1.0**	**1.2**	**1.9**	**2.0**
Folate (µg/d)[g,h,i]	65*	80*	**150**	**200**	**300**	**400**	**300**	**400**[g]	**600**[h]	**500**
Vitamin B_{12} (µg/d)	0.4*	0.5*	**0.9**	**1.2**	**1.8**	**2.4**	**1.8**	**2.4**	**2.6**	**2.8**
Pantothenic acid (mg/d)	1.7*	1.8*	2*	3*	4*	5*	4*	5*	6*	7*
Biotin (µg/d)	5*	6*	8*	12*	20*	25*	20*	25*	30*	35*
Choline[j] **(mg/d)**	125*	150*	200*	250*	375*	550*	375*	400*	450*	550*
Calcium (mg/d)	200*	260*	**700**	**1000**	**1300**	**1300**	**1300**	**1300**	**1300**	**1300**
Chromium (µg/d)	0.2*	5.5*	11*	15*	25*	35*	21*	24*	29*	44
Copper (µg/d)	200*	220*	**340**	**440**	**700**	**890**	**700**	**890**	**1000**	**1300**
Fluoride (mg/d)	0.01*	0.5*	0.7*	1*	2*	3*	2*	3*	3*	3*
Iodine (µg/d)	110*	130*	**90**	**90**	**120**	**150**	**120**	**150**	**220**	**290**
Iron (mg/d)	0.27*	**11**	**7**	**10**	**8**	**11**	**8**	**15**	**27**	**10**
Magnesium (mg/d)	30*	75*	**80**	**130**	**240**	**410**	**240**	**360**	**400**	**360**
Manganese (mg/d)	0.003*	0.6*	1.2*	1.5*	1.9*	2.2*	1.6*	1.6*	2.0*	2.6*
Molybdenum (µg/d)	2*	3*	**17**	**22**	**34**	**43**	**34**	**43**	**50**	**50**
Phosphorus (mg/d)	100*	275*	**460**	**500**	**1250**	**1250**	**1250**	**1250**	**1250**	**1250**
Selenium (µg/d)	15*	20*	**20**	**30**	**40**	**55**	**40**	**55**	**60**	**70**
Zinc (mg/d)	2*	**3**	**3**	**5**	**8**	**11**	**8**	**9**	**12**	**13**
Potassium (g/d)	0.4*	0.86*	2.0*	2.3*	2.5*	3.0*	2.3*	2.3*	2.6*	2.5*
Sodium (g/d)	0.11*	0.37*	0.8*	1.0*	1.2*	1.5*	1.2*	1.5*	1.5*	1.5*
Chloride (g/d)	0.18*	0.57*	1.5*	1.9*	2.3*	2.3*	2.3*	2.3*	2.3*	2.3*

NOTE: This table (adapted from the DRI reports, see www.nap.edu) presents Recommended Dietary Allowances (RDAs) in **bold type** and Adequate Intakes (AIs) in ordinary type followed by an asterisk (*). An RDA is the average daily dietary intake level sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy individuals in a group. It is calculated from an Estimated Average Requirement (EAR). If sufficient scientific evidence is not available to establish an EAR, and thus calculate an RDA, an AI is usually developed. For healthy breastfed infants, the AI is the mean intake. The AI for other life stages and gender groups is believed to cover needs of all individuals in the groups, but lack of data or uncertainty in the data prevent being able to specify with confidence the percentage of individuals covered by this intake.

[a] Based on g protein per kg of body weight for the reference body weight. Reference weights for g/kg/d taken from: Dietary Reference Intakes: The essential guide to nutrient requirements divided into smaller groupings. Based on NCHS/CDC 2000 Growth Charts. Institute of Medicine, 2006.

[b] As retinol activity equivalents (RAEs). 1 RAE = 1 µg retinol, 12 µg β-carotene, 24 µg α-carotene, or 24 µg β-cryptoxanthin in foods. The RAE for dietary provitamin A carotenoids is twofold greater than retinol equivalents (REs), whereas the RAE for preformed vitamin A is the same as RE.

[c] As cholecalciferol. 1 µg cholecalciferol = 40 IU vitamin D.

[d] Under the assumption of minimal sunlight.

[e] As α-tocopherol. α-Tocopherol includes *RRR*-α-tocopherol, the only form of α-tocopherol that occurs naturally in foods, and the 2*R*-stereoisomeric forms of α-tocopherol (*RRR-*, *RSR-*, *RRS-*, and *RSS*-α-tocopherol) that occur in fortified foods and supplements. It does not include the 2S-stereoisomeric forms of α-tocopherol (*SRR-*, *SSR-*, *SRS-*, and *SSS*-α-tocopherol), also found in fortified foods and supplements.

[f] As niacin equivalents (NE). 1 mg of niacin = 60 mg of tryptophan; 0-6 months = preformed niacin (not NE).

[g] As dietary folate equivalents (DFE). 1 DFE = 1 µg food folate = 0.6 µg of folic acid from fortified food or as a supplement consumed with food = 0.5 µg of a supplement taken on an empty stomach.

[h] In view of evidence linking folate intake with neural tube defects in the fetus, it is recommended that all women capable of becoming pregnant consume 400 µg from supplements or fortified foods in addition to intake of food folate from the diet.

[i] It is assumed that women will continue consuming 400 µg from supplements or fortified food until their pregnancy is confirmed and they enter prenatal care, which ordinarily occurs after the end of the periconceptional period—the critical time for formation of the neural tube.

[j] Although AIs have been set for choline, there are few data to assess whether a dietary supply of choline is needed at all stages of the life cycle, and it may be that the choline requirement can be met by endogenous synthesis at some of these stages.

Adapted from https://ods.od.nih.gov/Health_Information/Dietary_Reference_Intakes.aspx. Accessed May 30, 2017. Reference data for sodium and potassium accessed June 13, 2019.

	TOLERABLE UPPER INTAKE LEVELS (UL)							
	Infants 0–6 mo	Infants 7–12 mo	Children 1–3 y	Children 4–8 y	Males/Females 9–13 y	Males/Females 14–18 y	Pregnancy ≤18 y	Lactation ≤18y
Vitamin A (µg/d)[b]	600	600	600	900	1700	2800	2800	2800
Vitamin C (mg/d)	ND[f]	ND	400	650	1200	1800	1800	1800
Vitamin D (IU/d)	1000	1520	2520	3000	4000	4000	4000	4000
Vitamin E (mg/d)[c,d]	ND	ND	200	300	600	800	800	800
Vitamin K (µg/d)	ND	ND	ND	ND	ND	ND	ND	ND
Thiamin (mg/d)	ND	ND	ND	ND	ND	ND	ND	ND
Riboflavin (mg/d)	ND	ND	ND	ND	ND	ND	ND	ND
Niacin (mg/d)[d]	ND	ND	10	15	20	30	30	30
Vitamin B_6 (mg/d)	ND	ND	30	40	60	80	80	80
Folate (µg/d)[d]	ND	ND	300	400	600	800	800	800
Vitamin B_{12} (mg/d)	ND	ND	ND	ND	ND	ND	ND	ND
Pantothenic Acid (mg/d)	ND	ND	ND	ND	ND	ND	ND	ND
Biotin (µg/d)	ND	ND	ND	ND	ND	ND	ND	ND
Choline (mg/d)	ND	ND	1.0	1.0	2.0	3.0	3.0	3.0
Carotenoids[e]	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic[g]	ND[f]	ND	ND	ND	ND	ND	ND	ND
Boron (mg/d)	ND	ND	3	6	11	17	17	17
Calcium (mg/d)	1000	1500	2500	2500	3000	3000	3000	3000
Chromium	ND	ND	ND	ND	ND	ND	ND	ND
Copper (µg/d)	ND	ND	1000	3000	5000	8000	8000	8000
Fluoride (mg/d)	0.7	0.9	1.3	2.2	10	10	10	10
Iodine (µg/d)	ND	ND	200	300	600	900	900	900
Iron (mg/d)	40	40	40	40	40	45	45	45
Magnesium (mg/d)[h]	ND	ND	65	110	350	350	350	350
Manganese (mg/d)	ND	ND	2	3	6	9	9	9
Molybdenum (mg/d)	ND	ND	300	600	1100	1700	1700	1700
Nickel (mg/d)	ND	ND	0.2	0.3	0.6	1.0	1.0	1.0
Phosphorus (mg/d)	ND	ND	3	3	4	4	3.5	4
Selenium (µg/d)	45	60	90	150	280	400	400	400
Silicon[i]	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium (mg/d)[j]	ND	ND	ND	ND	ND	ND	ND	ND
Zinc (mg/d)	4	5	7	12	23	34	34	34
Sodium (g/d)	ND	ND	1.5	1.9	2.2	2.3	2.3	2.3
Chloride (g/d)	ND	ND	2.3	2.9	3.4	3.6	3.6	3.6

Adapted from Institute of Medicine (US) Committee to Review Dietary Reference Intakes for Vitamin D and Calcium. Summary tables. In: Ross AC, Taylor CL, Yaktine AL, Del Valle HB, eds. *Dietary Reference Intakes for Calcium and Vitamin D.* Washington, DC: National Academies Press (US); 2011. https://ods.od.nih.gov/Health_Information/Dietary_Reference_Intakes.aspx. Accessed May 30, 2017.

[a] UL = The highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population. Unless otherwise specified, the UL represents total intake from food, water, and supplements. Due to lack of suitable data, ULs could not be established for vitamin K, thiamin, riboflavin, vitamin B_{12}, pantothenic acid, biotin, or carotenoids. In the absence of a UL, extra caution may be warranted in consuming levels above recommended intakes. Members of the general population should be advised not to routinely exceed the UL. The UL is not meant to apply to individuals who are treated with the nutrient under medical supervision or to individuals with predisposing conditions that modify their sensitivity to the nutrient.

[b] As preformed vitamin A only.

[c] As α-tocopherol; applies to any form of supplemental α-tocopherol.

[d] The ULs for vitamin E, niacin, and folate apply to synthetic forms obtained from supplements, fortified foods, or a combination of the two.

[e] β-Carotene supplements are advised only to serve as a provitamin A source for individuals at risk of vitamin A deficiency.

[f] ND = Not determinable due to lack of data of adverse effects in this age group and concern with regard to lack of ability to handle excess amounts. Source of intake should be from food only to prevent high levels of intake.

[g] Although the UL was not determined for arsenic, there is no justification for adding arsenic to food or supplements.

[h] The ULs for magnesium represent intake from a pharmacological agent only and do not include intake from food and water.

[i] Although silicon has not been shown to cause adverse effects in humans, there is no justification for adding silicon to supplements.

[j] Although vanadium in food has not been shown to cause adverse effects in humans, there is no justification for adding vanadium to food and vanadium supplements should be used with caution. The UL is based on adverse effects in laboratory animals, and this data could be used to set a UL for adults but not children and adolescents.

Breastfeeding Support

QUICK REFERENCE FOR PAIN WITH BREASTFEEDING		
Breastfeeding Mother's Issue	**Cause of Pain**	**Recommendation**
Baby's lips tucked under—"grandpa lips" Not opening the mouth wide enough and getting only the nipple in the mouth	Poor latch	Untuck the lips Wait for a wide-open mouth; may need the baby to start feeding before becoming too awake and hungry to increase cooperation
Early days' discomfort from baby's vacuum suction Any blanching?	Discomfort in the first weeks vs high suckling pressure	Lanolin Deep breathing Review of good latch
Blister-like lesions on breast	Herpes	Avoid nursing on the affected side
Pink-tinged nipples Itching Shooting pain in the breast	*Candida* infection	Simultaneous antifungal treatment of mother and baby (all-purpose nipple ointment[a] not adequate)
Does baby's tongue extend beyond the gums? Does baby's tongue move up and sideways when you rub the gums?	Tongue-tie, other mouth abnormalities	If any suspicion, get a formal evaluation
Shiny white dot on the tip of the nipple	Bleb	Open up with a sterile needle; has a high rate of reoccurrence
Dry, flaky, rash History of allergies or eczema	Eczema or irritant dermatitis	Apply over-the-counter hydrocortisone and, if there's no improvement, may need a more potent prescribed version May have allergy to lanolin, detergents/bleach, soaps
Sensitivity of nipples to cold or stimulation Color change of nipple after nursing	Vasospasm of nipple; Raynaud phenomenon	Needs evaluation, will likely need prescription for nifedipine
Plentiful milk supply and baby pulls off with squirts of milk a few minutes into a nursing session	Clamping down due to oversupply	Lean back with nursing, because it affords baby better control of fast flow
Soreness beyond the nipple Area of redness on the breast Fever	Mastitis	Needs evaluation, will likely need antibiotics

[a] All-purpose nipple ointment consists of compounded antibiotic, antifungal, and anti-inflammatory ointments.

Adapted from Bunik M. Appendix B: quick reference for pain with breastfeeding. In: *Breastfeeding Telephone Triage and Advice.* 3rd ed. Itasca, IL: American Academy of Pediatrics; 2019:109. © 2013, 2016, 2019 Maya Bunik.

BREAST MILK STORAGE GUIDANCE			
	Storage Locations and Temperatures		
Type of Breast Milk	**Countertop** 77°F (25°C) or colder (room temperature)	**Refrigerator** 40°F (4°C)	**Freezer** 0°F (-18°C) or colder
Freshly expressed or pumped	Up to **4 hours**	Up to **4 days**	Within **6 months** is best Up to **12 months** is acceptable
Thawed, previously frozen	**1–2 hours**	Up to **1 day** (24 hours)	**NEVER** refreeze human milk after it has been thawed
Leftover from a feeding (baby did not finish the bottle)	Use within **2 hours** after the baby is finished feeding		

Adapted from Centers for Disease Control and Prevention. Proper storage and preparation of breast milk. https://www.cdc.gov/breastfeeding/recommendations/handling_breastmilk.htm. Updated December 9, 2019. Accessed December 17, 2019.

CAUSES OF HYPOGLYCEMIA IN NEWBORNS

Perinatal Stress (low glucose stores and/or increased glucose utilization as a result of stress-induced hyperinsulinism)

- Prematurity
- Birth asphyxia/ischemia; Cesarean delivery for fetal distress
- Maternal preeclampsia or hypertension
- Hypothermia
- Meconium aspiration syndrome
- Infection

Small for gestational age (SGA)

- Primary failure to produce and store glycogen

Appropriate for gestational age (AGA)

- Endocrine deficiency:
  - Hypopituitarism/growth hormone deficiency
  - Cortisol/ACTH deficiency
  - ACTH unresponsiveness
- Depletion of glycogen stores in congenital heart failure/congenital heart disease
- Inborn errors of carbohydrate, protein, and lipid metabolism
- Hyperinsulinism attributable to:
  - Alloimmune hemolytic disease of the newborn after exchange transfusion
  - Perinatal asphyxia
  - Maternal intrapartum treatment with glucose or with antihyperglycemia agents, such as sulfonylureas
  - Malposition of an umbilical catheter

Large for gestational age (LGA): hyperinsulinism

- Infant of a diabetic mother
- Beckwith-Wiedemann syndrome
- Gene mutations causing congenital hyperinsulinism (persistent hyperinsulinemic hypoglycemia of infancy [PHHI])[a] including:
  - SUR1 (sulphonylurea receptor type 1) inactivating gene mutation
  - KIR 6.2 (inward-rectifying potassium channel) inactivating gene mutation
  - SCHAD (short-chain L-3-hydroxyacyl-CoA dehydrogenase enzyme) inactivating gene mutation
  - GK (glucokinase) activating gene mutation
  - GDH (glutamate dehydrogenase) activating gene mutation
  - HNF4A (hepatocyte nuclear factor 4 alpha gene) inactivating gene mutation
  - HNF1A (hepatocyte nuclear factor 1 alpha gene) inactivating gene mutation
  - MCT1 (monocarboxylate transporter 1) activating gene mutation
  - SLC16A1 gene (solute carrier family 16, member 1)
  - UCP2 gene (uncoupling protein 2)

[a] Because these disorders can be of variable severity and may not always present at birth, they are not invariably associated with fetal overgrowth.

MONITORED FASTING FOR DIAGNOSTIC EVALUATION OF HYPOGLYCEMIA

If blood glucose reaches 45 mg/dL or less, select the following studies based on clinical judgment in the appropriate tube for your laboratory:

- Glucose
- Insulin
- C-peptide
- Beta-hydroxybutyrate
- Free fatty acids
- Cortisol
- Growth hormone
- Lactate: free-flowing blood
- Pyruvate: free-flowing blood
- NH3: free-flowing blood[a]
- Carnitine and acylcarnitine panel[a]
- Free T4 and TSH[a]
- Urine sample for organic acids and amino acids[a]
- IGF-1[a]
- IGF-2[a]

Note: Before starting the monitored fast, confirm that appropriate blood tubes are ready and labeled for these tests; some must be obtained on ice and in special tubes. After sending the blood sample, administer 30 µg/kg of glucagon intravenously or subcutaneously, and obtain blood for glucose concentration at 10, 15, 20, and 30 minutes. If the blood glucose has not increased with glucagon, administer 2 mL/kg of 25% glucose intravenously and feed or treat with a continuous glucose infusion as possible.

T4 indicates thyroxine; TSH, thyroid-stimulating factor.
[a] These tests do not need to be drawn during the hypoglycemic event.

Parenteral Nutrition

	PARENTERAL NUTRITION			
	Consensus Recommendations		Consensus Recommendations	
	<1000 g Birth Weight/kg/day	<1000 g Birth Weight/100 kcal	1000–1500 g Birth Weight/kg/day	1000–1500 g Birth Weight/100 kcal
Water/fluids, mL	140–180	122–171	120–160	120–178
Energy, kcal	105–115	100	90–100	100
Protein, g	3.5–4.0	3.0–3.8	3.2–3.8	3.2–4.2
Carbohydrate, g	13–17	11.3–16.2	9.7–15	9.7–16.7
Fat, g	3–4	2.6–3.8	3–4	3.0–4.4
Linoleic acid, mg	340–800	296–762	340–800	
Linoleate: linolenate = C18:2/C18:3	5–15	5–15	5–15	5–15
Vitamin A, IU	700–1500	609–1429	700–1500	700–1667
Vitamin D, IU	40–160		40–160	
Vitamin E, IU	2.8–3.5	2.4–3.3	2.8–3.5	2.8–3.9
Vitamin K_1, µg	10	8.7–9.5	10	10.0–11.1
Ascorbate, mg	15–25	13.0–23.8	15–25	15.0–27.8
Thiamine, µg	200–350	174–333	200–350	200–389
Riboflavin, µg	150–200	130–190	150–200	150–222
Pyridoxine, µg	150–200	130–190	150–200	150–222
Niacin, mg	4–6.8	3.5–6.5	4–6.8	4.0–7.6
Pantothenate, mg	1–2	0.9–1.9	1.2	1.0–2.2
Biotin, µg	5–8	1.3–7.6	5–8	5.0–8.9
Folate, µg	56	49–53	56	56–62
Vitamin B_{12}, µg	0.3	0.26–0.29	0.3	0.30–0.33
Sodium, mg	69–115	60–110	69–115	69–128
Potassium, mg	78–117	68–111	78–117	78–130
Chloride, mg	107–249	93–237	107–249	107–277
Calcium, mg	60–80	52–76	60–80	60–89
Phosphorus, mg	45–60	39–57	45–60	45–67
Magnesium, mg	4.3–7.2	3.7–6.9	4.3–7.2	4.3–8.0
Iron, µg	100–200	87–190	100–200	100–222
Zinc, µg	400	348–381	400	400–444
Copper, µg	20	17–19	20	20–22
Selenium, µg	1.5–4.5	1.3–4.3	1.5–4.5	1.5–5.0
Chromium, µg	0.05–0.3	0.04–0.29	0.05–0.3	0.05–0.33
Manganese, µg	1	0.87–0.95	1	1.00–1.11
Molybdenum, µg	0.25	0.22–0.24	0.25	0.25–0.28
Iodine, µg	1	0.87–0.95	1	1.00–1.11
Taurine, mg	1.88–3.75	1.6–3.6	1.88–3.75	1.9–4.2
Carnitine, mg	≈2.9	≈2.5–2.8	≈2.9	≈2.9–3.2
Inositol, mg	54	47–51	54	54–60
Choline, mg	14.4–28	12.5–26.7	14.4–28	14.4–31.1

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COMPONENTS OF MAINTENANCE PARENTERAL NUTRITION IN INFANTS AND CHILDREN			
	Weight		
Base Components	<10 kg	10–20 kg	>20 kg
Fluid	100–150 mL/kg	1000 mL + 50 mL/kg >10 kg	1500 mL + 20 mL/kg >20 kg
Calories	85%–90% of predicted from standard equation or patient history		
Dextrose GIR, mg/kg/minute (3.4 kcal/g)	10–14	8–10	5–6
Protein, g/kg (4 kcal/g)	2–3	1–2	0.8–1.5
Fat, g/kg (10 kcal/g)[a]	1–3	1–3	1–3
Electrolytes	**Infants and Toddlers**	**Children (<50 kg)**	**Adolescents (>50 kg)**
Sodium	2–5 mEq/kg		1–2 mEq/kg
Potassium	2–4 mEq/kg		1–2 mEq/kg
Chloride	As needed for acid-base balance		
Acetate	As needed for acid-base balance		
Minerals	**Infants and Toddlers**	**Children (<50 kg)**	**Adolescents (>50 kg)**
Magnesium (125 mg/mEq)	0.3–0.5 mEq/kg		10–30 mEq/day
Calcium	0.5–4 mEq/kg		10–20 mEq/day
Phosphorus (31 mg/mmol)	0.5–2 mmol/kg		10–40 mmol/day
Micronutrients[a]	**Infants and Toddlers**	**Children (<40 kg)**	**Adolescents (>40 kg)**
Multivitamin	Per manufacturer directions	Per manufacturer directions	Per manufacturer directions
Multitrace	Per manufacturer directions or dose individually	Per manufacturer directions or dose individually	Per manufacturer directions or dose individually
Zinc	50–250 mcg/kg/d	50–125 mcg/kg/d	2000–5000 mcg/day
Copper	20 mcg/kg/d	5–20 mcg/kg/d	200–500 mcg/day
Manganese	1 mcg/kg/d	1 mcg/kg/d	40–100 mcg/day
Chromium	0.2 mcg/kg/d	0.14–0.2 mcg/kg/d	5–15 mcg/day
Selenium	2 mcg/kg/d	1–2 mcg/kg/d	40–60 mcg/day
Heparin (optional)	0.5–1 U/mL	0.5–1 U/mL	0.5–1 U/mL

[a] Based on 20% lipid emulsion.

PEDIATRIC/INFANT PARENTERAL NUTRITION SOLUTIONS		
Name	**Manufacturer**	**Informational Website**
Aminosyn-PF: 10%	Hospira	https://www.rxlist.com/aminosyn-pf-10-drug.htm
Premasol: 6%, 10%	Baxter	http://www.baxtermedicationdeliveryproducts.com/pdf/PREMASOLPI6.14.pdf
Trophamine: 6%, 10%	BBraun	https://www.bbraunusa.com/en/products/b2/trophamine-glass500ml.html

Nutrition (Enteral) in Special Circumstances

	FORMULAS FOR LOW BIRTH WEIGHT AND PRETERM INFANTS (PER L)							
	Similac Special Care 24 Cal[a] Liquid (Abbott Nutrition, Columbus, OH)	Enfamil Premature 24 Cal[a] Liquid (Mead Johnson, Evansville, IN)	Similac Special Care 24 Cal[a] HP Liquid (Abbott Nutrition, Columbus, OH)	Enfamil Premature 24 Cal[a] HP Liquid (Mead Johnson, Evansville, IN)	Similac Special Care 30 Cal Liquid (Abbott Nutrition, Columbus, OH)	Enfamil Premature 30 Cal Liquid (Mead Johnson, Evansville, IN)	Neosure 22 Cal Liquid (Abbott Nutrition, Columbus, OH)	Enfamil NeuroPro EnfaCare 22 Cal Liquid (Mead Johnson, Evansville, IN)
Energy, kcal	812	812	812	812	1014	1014	744	744
Protein, g	24.3[b]	27[b]	26.8[b]	29[b]	30.4[b]	33[b]	20.8[b]	21[b]
Fat, g	44.1	41	44.1	41	67.1	51	40.9	39
Mineral								
Calcium, mg	1461	1340	1461	1340	1826	1670	781	890
Phosphorus, mg	812	730	812	730	1014	910	461	490
Magnesium, mg	97.4	73	97.4	73	122	91	67.0	60
Iron, mg	14.6	14.6	14.6	14.6	18.3	18.3	13.4	13.4
Zinc, mg	12.2	12.2	12.2	12.2	15.22	15.2	8.9	7.4
Manganese, µg	97	51	97	51	122	64	74	112
Copper, µg	2029	970	2029	970	2536	1220	893	670
Iodine, µg	49	200	49	200	61	250	112	156
Sodium, mEq	15.2	24.8	15.2	24.8	19.0	30.9	10.4	12.2
Potassium, mEq	26.8	20.5	26.8	20.5	33.5	25.4	27.0	20.0
Chloride, mEq	18.6	24.3	18.6	24.3	23.2	30.2	15.6	16.4

[a] 24 kcal/oz; 81 kcal/dL.
[b] Nonfat milk, whey protein concentrate.

	FORMULAS FOR LOW BIRTH WEIGHT AND PRETERM INFANTS (PER L) *(continued)*							
	Similac Special Care 24 Cal[a] Liquid (Abbott Nutrition, Columbus, OH)	Enfamil Premature 24 Cal[a] Liquid (Mead Johnson, Evansville, IN)	Similac Special Care 24 Cal[a] HP Liquid (Abbott Nutrition, Columbus, OH)	Enfamil Premature 24 Cal[a] HP Liquid (Mead Johnson, Evansville, IN)	Similac Special Care 30 Cal Liquid (Abbott Nutrition, Columbus, OH)	Enfamil Premature 30 Cal Liquid (Mead Johnson, Evansville, IN)	Neosure 22 Cal Liquid (Abbott Nutrition, Columbus, OH)	Enfamil NeuroPro EnfaCare 22 Cal Liquid (Mead Johnson, Evansville, IN)
Vitamin								
A, USP Units	10 144	11 000	10 144	11 000	12 681	13 700	2604	3330
D, USP Units	1217	2400	1217	2400	1522	3000	521	560
E, USP Units	32.5	51	32.5	51	40.6	64	26.8	30
K, µg	97.4	73	97.4	73	122	91	81.8	67
Thiamine (B_1), µg	2029	1620	2029	1620	2536	2000	1302	1340
Riboflavin (B_2), µg	5032	2400	5032	2400	6290	3000	1116	1490
Pyridoxine (B_6), µg	2029	1220	2029	1220	2536	1520	744	500
B_{12}, µg	4.5	2	4.5	2	5.58	2.5	3	2.2
Niacin (B_3), mg	40.6	32	40.6	32	50.7	41	14.5	7.4
Folic acid (B_9), µg	300	320	300	320	375	410	186	193
Pantothenic acid (B_5), mg	15.4	9.7	15.4	9.7	19.2	12.2	6.0	6.3
Biotin (B_7), µg	300	32	300	32	375.3	41	67	45
C (ascorbic acid), mg	300	162	300	162	375	200	112	119
Choline, mg	81	195	81	195	101	240	119	179
Inositol, mg	325	360	325	360	406	450	260	179

[a] 24 kcal/oz; 81 kcal/dL.
[b] Nonfat milk, whey protein concentrate.

OPTIONS FOR FORTIFICATION OF HUMAN MILK						
Product Type	**Product**	**Manufacturer**	**Formulation**	**Calories**	**Protein (g)**	**Fat (g)**
Human milk fortifier based on non-hydrolyzed cow milk	Similac Human Milk Fortifier Concentrated Liquid	Abbott Nutrition	Concentrated liquid, 5-mL packet	7	0.35	0.27
	Similac Human Milk Fortifier Powder	Abbott Nutrition	1 packet (0.9 g)	3.5	0.25	0.09
	Enfamil Human Milk Fortifier Powder	Mead Johnson Nutrition	1 packet (0.71 g)	3.5	0.275	0.25
	Enfamil Human Milk Fortifier Acidified Liquid[a]	Mead Johnson Nutrition	5-mL vial	7.5	0.55	0.575
Human milk–derived fortifier	Prolact RTF 26[b]	Prolacta Bioscience	100-mL bottle	88.7	2.6	5.1
	Prolact+6 H^2MF[c]	Prolacta Bioscience	30-mL bottle	43.1	1.8	2.8
Preterm newborn/infant hydrolyzed protein	Liquid Protein Fortifier	Abbott Nutrition	6 mL	4	1	–
	Similac Human Milk Fortifier Extensively Hydrolyzed Protein Concentrated Liquid	Abbott Nutrition	Concentrated liquid, 5-mL packet	7	0.5	0.21
Human milk–derived fat[d]	Prolact CR	Prolacta Bioscience	1 mL	2.6 kcal/mL	0.01	0.26
Transitional formula[e]	Similac NeoSure	Abbott Nutrition	Powder, 4.5 fl oz prepared	100	2.8	5.5
	Enfamil NeuroPro EnfaCare	Mead Johnson Nutrition	Powder, 4.5 fl oz prepared	100	2.8	5.3

[a] Acidified product being replaced by non-acidified product.
[b] 24 and 28 also available.
[c] +4, +8, and +10 also available.
[d] Powder product also available.
[e] Liquid also available.

COMPARISON OF ENTERAL INTAKE RECOMMENDATIONS FOR GROWING PRETERM INFANTS IN STABLE CLINICAL CONDITION					
Nutrient	Current Recommendation (per kg/day)	Current Recommendation (per 100 kcal)	LSRO, 2002 (formula-fed infants only, per kg/day)	Tsang et al, 2005 (per kg/day)	ESPGHAN, 2010 (per kg/day)
Fluids	135–200	—	NS	150–200	135–200
Energy, kcal	110–130 (85–95 IV)	—	100–141	110–120	110–135
Protein, g	3.5–4.5	3.2–4.1	3.0–4.3	3.0–3.6	4.0–4.5 (<1 kg) 3.5–4.0 (1–1.8 kg)
Lipids, g	4.8–6.6	4.4–6	5.3–6.8		4.8–6.6 (<40% MCT)
Linoleic acid, mg	385–1540	350–1400	420–1700	(4–15 E%)	385–1540
α-Linolenic acid, mg	>55	>50	90–270	(1–4 E%)	>55
DHA, mg	(18–) 55–60	(16.4–) 50–55	NS	NS	12–30
EPA, mg	<20	<18	NS	NS	(<30% of DHA)
ARA, mg	(18–) 35–45	(16.4–) 32–41	NS	NS	18–42
Carbohydrate, g	11.6–13.2	10.5–12	11.5–15.0 lactose 4.8–15.0	lactose: 3.8–11.8 oligomers: 0–8.4	11.6–13.2
Sodium, mg[a]	69–115	63–105	46.8–75.6	0–23	69–115
Potassium, mg[b]	78–195	71–177	72–192	0–39	66–132
Chloride, mg	105–177	95–161	72–192	0–35	105–177
Calcium, mg	120–200	109–182	148–222	120–230	120–140
Phosphate, mg	60–140	55–127	98–131	60–140	60–90
Magnesium, mg	8–15	7.3–13.6	8.2–20.4	7.9–15	8–15
Iron, mg	2–3	1.8–2.7	2–3.6	0–2	2–3
Zinc, mg	1.4–2.5	1.3–2.3	1.32–1.8	0.5–0.8	1.1–2.0
Copper, µg	100–230	90–210	120–300	120	100–132
Selenium, µg	5–10	4.5–9	2.2–6.0	1.3	5–10
Manganese, µg	1–15	0.9–13.6	7.6–30	0.75	<27.5
Fluoride, µg	1.5–60	1.4–55	NS	NS	1.5–60
Iodine, µg	10–55	9–50	7.2–42	11–27	11–55
Chromium, ng	30–2250	27–2045	NS	50	30–1230
Molybdenum, µg	0.3–5	0.27–4.5	NS	0.3	0.3–5
Thiamin, µg	140–300	127–273	36–300	180–240	140–300
Riboflavin, µg	200–400	181–364	96–744	250–360	200–400
Niacin, mg	1–5.5	0.9–5	660–6000	3.6–4.8	0.38–5.5
Pantothenic acid, mg	0.5–2.1	0.45–1.9	360–2280	1.2–1.7	0.33–2.1
Pyridoxine, µg	50–300	45–273	36–300	150–210	45–300
Cobalamin, µg	0.1–0.8	0.09–0.73	0.096–0.84	0.3	0.1–077
Folic acid, µg	35–100	32–91	36–54	25–50	35–100
L-Ascorbic acid, mg	20–55	18–50	10–45	18–24	11–46
Biotin, µg	1.7–16.5	1.5–15	1.2–44.4	3.6–6	1.7–16.5
Vitamin A, µg RE	400–1100	365–1000	245–456	700	400–1000
Vitamin D, IU	(400–1000 per day, from milk + supplement)	100–350 from milk only	90–324	150–400	(800–1000 per day) (100–350 per 100 kcal from milk only)
Vitamin E, mg α-TE	2.2–11	2–10	2.4–9.6	6–12	2.2–11
Vitamin K1, µg	4.4–28	4–25	4.8–30	(300 bolus injection)	4.4–28
Nucleotides, mg	NS	NS	NS	NS	<5
Choline, mg	8–55	7.3–50	8.4–27.6	14.4–28	8–55
Inositol, mg	4.4–53	4–48	4.8–52.8	32–81	4.4–53

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ARA indicates arachidonic acid; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; IV, intravenous; LSRO, Life Sciences Research Office; MCT, medium-chain triglyceride; RE, retinol equivalents; αTE, α-tocopherol equivalents.

[a] 1 mEq Na = 23 mg.

[b] 1 mEq K = 39 g.

ENTERAL PRODUCTS GROUPED BY USAGE INDICATION	
INDICATION	**PRODUCT**
Standard adult oral	Boost, Ensure Original, Carnation Breakfast Essentials, Kate Farms Standard
Standard adult tube feeding	Jevity 1 Cal, Nutren 1.0, Osmolite 1 Cal
High-protein oral	Boost High Protein, Ensure High Protein, Ensure Max Protein, Ensure Enlive
High-protein tube feeding	Fibersource HN, Isosource HN, Jevity 1.2 Cal, Osmolite 1.2 Cal, Promote, Replete, Vital HN
1.5 kcal/mL	Boost Plus, Ensure Plus, Nutren 1.5, Isosource 1.5 Cal, Jevity 1.5 Cal, Osmolite 1.5 Cal
2.0 kcal/mL	Nutren 2.0, Resource 2.0, TwoCal HN, Boost VHC (2.2 cal/mL)
Standard pediatric (>1 y)	Nutren Junior, PediaSure (1.0, 1.5), Boost Kid Essentials (1.0, 1.5), Kate Farms Pediatric Standard 1.2
Blenderized	Compleat, Compleat Pediatric, Compleat Pediatric Reduced Calorie, Kate Farms Standard, Kate Farms Pediatric Standard, Kate Farms Pediatric Peptide 1.5, Liquid Hope, Nourish, PediaSure Harvest, Real Food Blends, Compleat Organic Blends (plant, chicken), Compleat Pediatric Organic Blends (plant, chicken)
Clear fortified liquid	Ensure Clear, Boost Breeze
Peptide-based adult	Peptamen, Peptamen 1.5, Peptamen AF, Perative, Vital HN, Vital (1.0, 1.5), Impact Peptide 1.5, Peptamen Intense VHP, Kate Farms Peptide 1.5
Peptide-based pediatric	Peptamen Junior (1.0, 1.5), PediaSure Peptide (1.0, 1.5), Vital Peptide, Kate Farms Pediatric Peptide 1.5
Free amino acid adult	Tolerex, Vivonex T.E.N., Vivonex Plus, Vivonex RTF
Free amino acid pediatric (>1 y)	EleCare Jr, Neocate Junior, Neocate Splash, Vivonex Pediatric, Alfamino, PurAmino
Immune enhancing	Impact, Impact Peptide 1.5, Impact Advanced Recovery, Pivot 1.5 Cal, Ensure Surgery
Wound healing	Isosource HN, Replete, Impact, Impact Peptide 1.5, Perative, Juven
Diabetes	Boost Glucose Control, Diabetisource AC, Glucerna (1.0, 1.2, 1.5 Cal), Glytrol, Diabetishield
Kidney disease	Nepro, Novasource Renal, Renalcal, Suplena
Liver disease	NutriHep
Pulmonary disease	Nutren Pulmonary, Oxepa, PulmoCare
Inflammatory bowel disease	Peptamen AF, Vital AF 1.2 Cal, Modulen
Carbohydrate modulars	Polycal
Protein modulars	Beneprotein, ProMod, Complete Amino Acid Mix
Calorie enhancers	Duocal, Benecalorie
Fat modulars	MCT Oil, Microlipid, Liquigen

AAP Recommendations for Preventing Atopic Disease and Complementary Feeding

1

There is lack of evidence to support maternal dietary restrictions during either pregnancy or lactation to prevent atopic disease.

2

The evidence regarding the role of breastfeeding in the prevention of atopic disease can be summarized as follows:

- **A** There is evidence that **exclusive** breastfeeding for the first 3 to 4 months decreases the cumulative incidence of eczema in the first 2 years after birth.
- **B** There are no short- or long-term advantages for **exclusive** breastfeeding beyond 3 to 4 months for prevention of atopic disease.
- **C** The evidence suggests that any duration of breastfeeding beyond 3 to 4 months is protective against wheezing in the first 2 years after birth. This effect is irrespective of duration of exclusivity.
- **D** There is some evidence that longer duration of any breastfeeding, as opposed to less breastfeeding, protects against asthma even after 5 years of age.
- **E** No conclusions can be made about the role of any duration of breastfeeding in either preventing or delaying the onset of specific food allergies.

3

- **A** There is lack of evidence that partially or extensively hydrolyzed formula prevents atopic disease in infants and children, even in those at high risk for allergic disease.
- **B** In treatment of atopic conditions (of which milk protein allergy is the most common), maternal dietary restrictions for human milk–fed babies and/or use of hypoallergenic formula in formula-fed babies may be indicated.[a]

4

The current evidence for the importance of the timing of introduction of allergenic foods and the prevention of atopic disease can be summarized as follows:

- **A** There is no evidence that delaying the introduction of allergenic foods beyond 4 to 6 months prevents atopic disease, including peanut, eggs, and fish.
- **B** There is evidence that the early introduction of infant-safe forms of peanut reduces the risk for peanut allergies. Data are less clear for timing of introduction of egg.
- **C** Recommendations for the prevention of peanut allergy are based largely on the LEAP trial and endorsed by the AAP. An Expert Panel has advised peanut introduction as early as 4 to 6 months of age for infants at high risk for peanut allergy (presence of severe eczema and/or egg allergy). The recommendations contain details of implementation for high-risk infants, including appropriate use of testing (specific IgE measurement, skin-prick test, and oral food challenges) and introduction of peanut-containing foods in the health care provider's office versus the home setting, as well as amount and frequency. For infants with mild to moderate eczema, the panel recommended introduction of peanut-containing foods around 6 months of age, and for infants at very low risk for peanut allergy (no eczema or any food allergy), the panel recommended introduction of peanut-containing food when age appropriate and depending on family preferences and cultural practices (ie, after 6 months of age if exclusively breastfeeding).

Adapted from Greer FR, Sicherer SH, Burks AW; American Academy of Pediatrics Committee on Nutrition, Section on Allergy and Immunology. The effects of early nutritional interventions on the development of atopic disease in infants and children: the role of maternal dietary restriction, breastfeeding, hydrolyzed formulas, and timing of introduction of allergenic complementary foods. *Pediatrics*. 2019;143(4):e20190281.

[a] Lightdale JR, Gremse DA; American Academy of Pediatrics Section on Gastroenterology, Hepatology, and Nutrition. Gastroesophageal reflux: management guidance for the pediatrician. *Pediatrics*. 2013;131(5):e1684–e1695.

How to Guide Complementary Feeding

The following guiding principles are provided for introduction of complementary foods and for the progression through the second year of age.

1. **Choose first foods that provide key nutrients and help meet energy needs.** Iron and zinc are the micronutrients that become limiting for primarily breastfed infants, and they are also the most likely to be low in the diets of older infants. Thus, iron- and zinc-fortified infant cereals and meats are excellent first foods and are equally well accepted by infants. The suggested intake is approximately 2 servings/day for cereal (2 tablespoons/serving) or meat (1–2 oz/day meat or 1–2 small jars of commercially prepared single-ingredient meat/day).

2. **Introduce one "single-ingredient" new food at a time,** from any food group. Do not introduce other new foods for several days to observe for possible allergic reactions or intolerance. Foods most commonly associated with infant allergies are cow milk, eggs, soy, peanuts, tree nuts (and seeds), wheat, fish, and shell fish. There is no current convincing evidence that delaying the introduction of solid foods associated with infant allergies beyond 4 months has a significant protective effect on the development of atopic disease. Introduction of infant-safe peanut between 4 and 6 months of age in high-risk infants (those with severe eczema and/or egg allergy) is now recommended to reduce the prevalence of peanut allergy by up to 86%. Thus, for those at risk for allergies, "controlled exposure" rather than avoidance or delayed exposure is now recommended.

3. **Introduce a variety of foods.** By 7 to 8 months of age, infants should be consuming foods from all food groups. The food variety should progressively increase over the next several months. Parents should be encouraged to offer foods multiple times over several days (≥8 exposures) for infants and toddlers to become accepting of new flavors and textures.

4. **Withhold cow milk and other plant-based "milks" not formulated for infants during the first year after birth.** Fresh cow milk has been associated with low-grade intestinal blood loss in infants and, thus, is not recommended. So-called "milks," based on plant foods (eg, soy, rice, almond, or hemp) should not be used as a human milk or infant formula substitute (ie, when human milk or infant formula provides a significant portion of daily energy intake). The caloric density of these products is typically lower than that of human milk or infant formula; protein quality is low and the protein quantity is very low for most such beverages; products are not fortified with micronutrients to levels recommended for infants and young children; and some contain high levels of phytate, which bind iron, zinc, and calcium. Use of such alternative fluids as a major component of the diet has been associated with severe protein energy malnutrition and with growth faltering.

5. **During the second year, children usually should drink whole milk.** Low-fat milk may be considered if growth and weight gain are appropriate or especially if weight gain is excessive or family history is positive for obesity, dyslipidemia, or cardiovascular disease. Total dairy product intake of 16 to 24 oz is appropriate to meet calcium needs. Intakes greater than 32 oz/day predispose to iron deficiency.

The following guiding principles are provided for introduction of complementary foods and for the progression through the second year of age.

6

Juice consumption should be limited. No juice should be offered before 6 months of age, and it is best to avoid juice completely until the infant is at least 12 months of age. If juice is medically indicated for an infant older than 6 months, it should only be served in a cup, not a bottle. After 1 year of age, 100% fruit juice may be served as part of a meal or snack, but total daily volume should not exceed 4 oz/day for children 1 through 3 years of age. Juice drinks, which typically contain added sweeteners, should be discouraged. Dilution of juice with water may encourage excessive fluid consumption and grazing behaviors.

7

Ensure that complementary foods are prepared in a healthy and safe manner. Home preparation of pureed or mashed table foods is practical for many families. Practices to encourage include:

- **A** Match texture and consistency to infant's oral motor skills.
- **B** Use thick purees to enhance caloric density.
- **C** Provide healthy "single ingredient" foods, especially while total variety is still limited.
- **D** Avoid added sugar or salt.
- **E** Avoid foods that could be choking or aspiration risks (hot dogs, nuts, grapes, raisins, raw carrots, popcorn, hard candies).
- **F** Use caution when using a microwave to warm foods; check temperature before feeding to infants.

8

Encourage infant's involvement in feeding process. By 9 months of age, infants should be presented with finger foods, and an open cup may be introduced. Effective use of utensils develops progressively after approximately 12 months of age.

9

Encourage routine meal times and "responsive feeding," watching for and responding to infant's hunger and satiety cues. General feeding practices to encourage include:

- **A** Avoid intrusive behaviors (eg, force feeding) by care providers.
- **B** Establish routines for meals and snacks in a predictable schedule, typically allowing 2 to 3 hours between eating and drinking opportunities, resulting in eating 5 to 6 times per day (eg, 3 meals, 2–3 snacks).
- **C** Avoid "grazing" behaviors with snacks or liquids by allowing constant access to foods and drinks; eat only in a high chair, at a table, or at other designated areas.
- **D** Limit meals to 15 to 20 minutes, as appropriate for infants' or toddlers' attention spans.
- **E** Praise eating but resist attention for not eating; using food as means of punishment or a reward is not appropriate.
- **F** Minimize distractions during meal times (TV, videos, cell phones, other screens, pets, etc).
- **G** Resist offering multiple alternative choices of preferred foods if the foods initially offered are refused; calmly encourage tasting, do not force eating, and end meal after appropriate time.

10

Monitor appropriateness of growth as a guide to adequacy of complementary feeding practices. Avoid giving calorie goals to parents, which encourages overemphasis on numbers and may lead to intrusive feeding behaviors. The focus should be on the quality of food choices, the feeding environment, and feeding routines and behaviors.

Vitamin and Mineral Deficiency

VITAMIN DEFICIENCY STATES, RISK FACTORS, AND DIAGNOSTIC TESTS WITH RECOMMENDED INTAKE AND THERAPEUTIC DOSAGES

Nutrient	Recommended Intake	Deficiency Symptoms	Deficiency Risk Factors	Diagnostic Tests	Food Sources	Recommended Therapeutic Dosage
Vitamin A AI infants RDA 1–18 y	0–6 mo 1320 IU/d 7–12 mo 1650 IU/d 1–3 y 1000 IU/d 4–8 y 1430 IU/d 9–13 y 2000 IU/d 14–18 y 2310–3000 IU/d	Night blindness, infection (measles), keratomalacia	Fat malabsorption	Serum retinol Serum retinol-binding protein	Liver, eggs, dairy, vegetables	100 000–200 000 IU, orally
Vitamin D AI infants RDA 1–18y	Infants 400 IU/d Preterm infants: <1000 g 200–400 IU/d >1500 g 400 IU/d >1 y 600 IU/d	Rickets, hypocalcemia, tetany, osteomalacia, hypophosphatemia	Fat malabsorption, lack of sunshine	Radiograph, serum 25-OH-D	Fatty fish, egg yolk	2000–5000 IU day[a]
Vitamin E RDA all ages	0–6 mo 4 mg/d 7–12 mo 5 mg/d 1–3 y 6 mg/d 4–8 y 7 mg/d 9–13 y 11 mg/d 14–18 y 15 mg/d	Neuropathy, ataxia	Fat malabsorption	Serum alphatocopherol	Grain and vegetable oils	25 IU/kg/day for fat malabsorption
Vitamin K AI all ages	0–6 mo 2 µg/d 7–12 mo 2.5 µg/d 1–3 y 30 µg/d 4–8 y 55 µg/d 9–18 y 60–75 µg/d	Bleeding	Fat malabsorption, breastfeeding	PT, PIVIKA, clotting factors	Green vegetables, soy oil, seeds, fruits	1 mg, intramuscularly, in newborn infants
Thiamine (B_1) AI infants RDA 1–18y	0–6 mo 0.2 mg/d 7–12 mo 0.3 mg/d 1–3 y 0.5 mg/d 4–8 y 0.6 mg/d 9–13 y 0.9 mg/d 14–18 y 1–1.2 mg/d	Beriberi encephalopathy: symmetrical, peripheral neuropathy, edema; Wernicke encephalopathy: ophthalmoplegia, nystagmus, ataxia	HIV, alcohol abuse, dialysis, gastrointestinal tract disease, total parenteral nutrition, anorexia, furosemide, food faddism; inflammation in pediatric intensive care unit	Whole blood/RBC transketolase activation test, baseline and after thiamine pyrophosphate (TPP); or TPP level, urinary total thiamine	Unrefined grain, liver, pork, vegetables, dairy, peanuts, legumes, fruits, eggs	**Severe infantile:** 50–100 g parenteral ×1; **Children:** 10–25 mg/day parenteral × 2 wk, followed by 5–10 mg/day, orally, × 1 mo. **Mild:** 10 mg/day, orally, until resolution
Riboflavin (B_2) AI infants RDA 1–18y	0–6 mo 0.3 mg/d 7–12 mo 0.4 mg/d 1–3 y 0.5 mg/d 4–8 y 0.6 mg/d 9–13 y 0.9 mg/d 14–18 y 1–1.3 mg/d	Pharyngitis, cheilosis, angular stomatitis, glossitis, seborrheic dermatitis	Weaning from breastfeeding, breastfed from deficient mother, alcoholism, phototherapy, cystic fibrosis, malnutrition, thyroid insufficiency, adrenal insufficiency	RBC or 24-h urine riboflavin level or RBC glutathione reductase (but of limited value in glutathione reductase deficiency, G6PD deficiency, or beta-thalassemia)	Milk, cheese, eggs, liver, lean meats, green vegetables	**Infants:** 0.5 mg, orally, twice/wk. **Children:** 1 mg, orally, dose 3 ×/day until resolution
Niacin (B_3) AI infants RDA 1–18y	0–6 mo 2 mg/d 7–12 mo 4 mg/d 1–3 y 6 mg/d 4–8 y 8 mg/d 9–13 y 12 mg/d 14–18 y 14–16 mg/d	Diarrhea, dermatitis, dementia, glossitis, angular stomatitis, sun-exposed	Crohn disease; anorexia nervosa; Hartnup disease; Carcinoid syndrome; immigrant from area with non-fortified grains; medications isoniazid, anticonvulsants, antidepressants, 5-fluorouracil, 6-mercaptopurine, chloramphenicol, sulfas	24-h niacin and N-methylnicotinamide; or RBC NAD/NADP niacin number	Beef, liver, fish, pork, wheat flour, eggs	50–100 mg/dose, orally, 3 ×/day for several wk

VITAMIN DEFICIENCY STATES, RISK FACTORS, AND DIAGNOSTIC TESTS WITH RECOMMENDED INTAKE AND THERAPEUTIC DOSAGES (*continued*)

Nutrient	Recommended Intake	Deficiency Symptoms	Deficiency Risk Factors	Diagnostic Tests	Food Sources	Recommended Therapeutic Dosage
Pantothenic acid (B5) AI all ages	0–6 mo 1.7 mg/d 7–12 mo 1.8 mg/d 1–3 y 2 mg/d 4–8 y 3 mg/d 9–13 y 4 mg/d 14–18 y 5 mg/d	Not characterized		24-h pantothenic acid	Chicken, beef, potatoes, oats, tomatoes, liver, kidney, yeast, egg yolk, broccoli	
Pyridoxine (B_6) AI infants RDA 1–18 y	0–6 mo 0.1 mg/d 7–12 mo 0.3 mg/d 1–3 y 0.5 mg/d 4–8 y 0.6 mg/d 9–13 y 1 mg/d 14–18 y 1.2–1.3 mg/d	Glossitis, cheilosis, angular stomatitis, depression, confusion	Chronic renal failure; leukemia; pyridoxine-dependent seizure; alcoholism; medications isoniazid, hydralazine, penicillamine, theophylline	Plasma pyridoxal 5′-phosphate; 24-h urine 4-pyridoxic acid	Meat, liver, kidneys	**Without neuropathy:** 5–25 mg orally/day × 3 wk, **With neuropathy:** 10–50 mg/day, orally × 3 wk; then followed by 1.5–2.5 mg/day, orally. **Seizures:** 50–100 mg, intravenously or intramuscularly
Biotin (B_7) AI all ages	0–6 mo 5 µg/d 7–12 mo 6 µg/d 1–3 y 8 µg/d 4–8 y 12 µg/d 9–13 y 20 µg/d 14–18 y 25 µg/d	Hypotonia, exfoliative dermatitis	Infants with TPN without biotin, eating large amounts of undercooked eggs, holocarboxylase synthase deficiency, biotinidase deficiency, biotin transport defect, anticonvulsants	Urinary biotin or urinary 3-hyroxyisovaleric acid; lymphocyte propionyl-CoA carboxylase concentration, or leukocyte LSC19A3 transporter	Chard, tomatoes, romaine lettuce, carrots	**Acquired deficiency:** 150 µg/d
Folate (B_9) AI infants RDA 1–18y	0–6 mo 65 µg/d 7–12 mo 80 µg/d 1–3 y 150 µg/d 4–8 y 200 µg/d 9–13 y 300 µg/d 14–18 y 400 µg/d	Megaloblastic anemia, neural tube defect, cleft lip/palate	Poor intakes relatively common at 12 mo; consuming carbonated beverages; Crohn disease; fruit and carb; diarrhea; HIV, familial; medications methotrexate, trimethoprim, oral contraceptives, pyrimethamine, phenobarbital, phenytoin	Plasma or serum folate (acute); RBC folate (chronic deficiency); 5-methyltetrahydrofolate; or urinary total folate	Cauliflower, green vegetables, yeast, liver, kidney	**Infants:** 15 µg/kg/day, orally or intramuscularly. **Children 1–13:** 1 mg/day, followed by 0.1–0.5 mg/d; **Children >13:** 1 mg/day.
Cobalamin (B_{12}) AI infants RDA 1–18y	0–6 mo 0.4 µg/d 7–12 mo 0.5 µg/d 1–3 y 0.9 µg/d 4–8 y 1.2 µg/d 9–13 y 1.8 µg/d 14–18 y 2.4 µg/d	Megaloblastic anemia, ataxia, muscle weakness, spasticity, incontinence, hypotension, vision problems, dementia, psychosis, mood disturbance, neural tube defect	Breastfed children of strict vegans; post bariatric surgery or stomach or ileal resection; pernicious anemia; bacterial overgrowth of gut; phenylketonuria; Whipple disease; Zollinger-Ellison syndrome; celiac disease; medications H_2 blockers	Serum cobalamin concentration, plasma homocysteine or serum methylmalonic acid in PKU patient	Fish, eggs, cheese	**Children:** 30–50 µg/day, intramuscularly, × 2 wk, followed by 100 µg, intramuscularly, every mo, or 1 mg orally/day
Vitamin C AI infants RDA 1–18y	0–6 mo 40 mg/d 7–12 mo 50 mg/d 1–3 y 15 mg/d 4–8 y 25 mg/d 9–13 y 45 mg/d 14–18 y 65–75 mg/d	Osmotic diarrhea, bleeding gums, arthropathy, perifollicular hemorrhage	Overcooked foods, with minimal fruits and vegetables, anorexia nervosa, autism, ulcerative colitis, Whipple disease, dialysis, alcoholics, tobacco, total parenteral nutrition without vitamin C	White blood cell ascorbate concentration, urinary ascorbate, capillary fragility, widening of zone of provisional calcification of bone ends on radiograph	Citrus fruits	**Children:** 25–100 mg, orally, intramuscularly, or intravenously, 3×/day × 1 wk, followed by 100 mg orally/day

[a] These doses are above those of usual dosing and should be used with medical consultation. Data from

1. Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes for Thiamin, Riboflavin, Nicacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline.* Washington, DC: National Academies Press; 1998
2. Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids.* Washington, DC: National Academies Press; 2000
3. Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes for Calcium and Vitamin D.* Washington, DC: National Academies Press; 2011
4. Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc.* Washington, DC: National Academies Press; 2001
5. Setharaman U. Vitamins. *Pediatr Rev.* 2006;27(2):44–55

AAP Statement on Calcium and Vitamin D Requirements of Enterally Fed Preterm Infants

From Abrams SA, American Academy of Pediatrics Committee on Nutrition. Calcium and vitamin D requirements of enterally fed preterm infants. *Pedatrics*. 2013;131(5):e1676–e1683.

AAP Recommendations on Prevention of Rickets and Vitamin D Deficiency

To prevent rickets and vitamin D deficiency in healthy infants, children, and adolescents, a vitamin D intake of at least 400 IU/day is recommended. To meet this intake requirement, the AAP makes the following suggestions:

From Wagner CL, Greer FR; American Academy of Pediatrics Section on Breastfeeding, Committee on Nutrition. Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. *Pediatrics*. 2008;122(5):1142–1152.

AAP Recommendations for Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0–3 Years of Age)

1. Full-term, healthy infants have sufficient iron for at least the first 4 months after birth. Human milk contains very little iron. Exclusively breastfed infants are at increasing risk of iron deficiency (ID) after 4 completed months of age. Therefore, at 4 months of age, breastfed infants should be supplemented with 1 mg/kg/day of oral iron beginning at 4 months of age until appropriate iron-containing complementary foods (including iron-fortified cereals) are introduced in the diet. For partially breastfed infants, the proportion of human milk versus formula is uncertain; therefore, beginning at 4 months of age, partially breastfed infants (more than half of their daily feedings as human milk) who are not receiving iron-containing complementary foods should also receive 1 mg/kg/day of supplemental iron.

2. For formula-fed infants, the iron needs for the first 12 months can be met by a standard infant formula (iron content, 10–12 mg/dL) and the introduction of iron-containing complementary foods after 4 to 6 months of age, including iron-fortified cereals, meat, or other iron-containing foods. Whole milk should not be used before 12 completed months of age.

3. The iron intake between 6 and 12 months of age should be 11 mg/day. When infants are given complementary foods, red meat and vegetables with higher iron content should be introduced early. To augment the iron supply, liquid iron supplements are appropriate if iron needs are not being met by the intake of formula and complementary foods.

4. Toddlers 1 through 3 years of age should have an iron intake of 7 mg/day. This would be best delivered by eating red meats, cereals fortified with iron, vegetables that contain iron, and fruits with vitamin C, which augments the absorption of iron. For toddlers not receiving this iron intake, liquid supplements are suitable for children 12 through 36 months of age, and chewable multivitamins can be used for children 3 years and older.

5. All preterm infants should have an intake of iron of at least 2 mg/kg/day through 12 months of age, which is the amount of iron supplied by iron-fortified formulas. Preterm infants fed human milk should receive an iron supplement of 2 mg/kg/day by 1 month of age, and this should be continued until the infant is weaned to iron-fortified formula or begins eating complementary foods that supply the 2 mg/kg of iron. An exception to this practice would include infants who have received an iron load from multiple transfusions of packed red blood cells during their hospitalization.

AAP Recommendations for Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0–3 Years of Age) (*continued*)

6. Universal screening for anemia should be performed at approximately 12 months of age with determination of Hb concentration and an assessment of risk factors associated with ID/iron-deficiency anemia (IDA). These risk factors would include low socioeconomic status (especially children of Mexican American descent), a history of prematurity or low birth weight, exposure to lead, exclusive breastfeeding beyond 4 months of age without supplemental iron, and weaning to whole milk or complementary foods that do not include iron-fortified cereals or foods naturally rich in iron. Additional risk factors are feeding problems, poor growth, and inadequate nutrition, typically seen in infants with special health care needs. For infants and toddlers (1–3 years of age), additional screening can be performed at any time if there is a risk of ID/IDA, including inadequate dietary iron intake.

7. If Hb concentration is less than 11.0 mg/dL at 12 months of age, then further evaluation for IDA is required to rule this out as a cause of anemia. If there is a high risk of dietary ID as described in recommendation 6, then further testing for ID should be performed, given the potential adverse effects on neurodevelopmental outcomes. Additional screening tests for ID or IDA should include:
   - SF and CRP; or
   - CHr

8. If a child has mild anemia (Hb 10–11 mg/dL) and can be closely monitored, an alternative method of diagnosis would be to document a 1 g/dL increase in plasma Hb concentration after 1 month of appropriate iron replacement therapy, especially if the history indicates that the diet is likely to be iron deficient.

9. Use of the TfR1 assay as screening for ID is promising, and the AAP supports the development of TfR1 standards for use of this assay in infants and children.

10. If IDA (or any anemia) or ID has been confirmed by history and laboratory evidence, a means of carefully tracking and following infants and toddlers with a diagnosis of ID/IDA should be implemented. Electronic health records could be used not only to generate reminder messages to screen for IDA and ID at 12 months of age but also to document that IDA and ID have been adequately treated once diagnosed.

From Baker RD, Greer FR; American Academy of Pediatrics Committee on Nutrition. Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0–3 years of age). *Pediatrics*. 2010;126(5):1040–1050.

Food-Drug Interactions by Class

FOOD-DRUG INTERACTIONS BY CLASS		
Class	**Drug**	**Interaction**
Analgesics		
Anti-inflammatory miscellaneous	Acetaminophen	Food delays but does not decrease extent of absorption. Food may decrease gastrointestinal (GI) upset.
	Salsalate, sulfasalazine	Take with food.
Nonsteroidal anti-inflammatory		Take with food and a full glass of water to minimize GI side effects.
	Ibuprofen, naproxen, diclofenac, indomethacin	If on high dose, may need extra vitamin C, vitamin K, and folic acid.
	Aspirin	Avoid products that can affect blood coagulation (garlic, ginger). Salicylate accumulation can occur if combined with tea, raisins, or prunes. Fresh fruit can increase the excretion of aspirin. Curry powder, paprika, and licorice contain a small amount of salicylate, and intake should be limited.
Narcotic analgesics		Take with food.
Angiotensin-converting enzyme inhibitors (ACE-I)		Take on an empty stomach because food can decrease absorption. Avoid salt, calcium, and natural licorice.
	Captopril	Zinc deficiency with long-term use, which can alter taste perception.
	Quinapril	High-fat meals decrease absorption.
Anticonvulsants	Carbamazepine	Take with food or milk. Avoid grapefruit juice and other citrus fruits. May need vitamin D and calcium supplementation. Absorption decreased by fiber.
	Valproic acid, divalproex	May administer with food to decrease GI adverse effects.
Anti-arrhythmic	Digoxin	Fiber may decrease absorption. Food delays but does not decrease extent of absorption.
Anticoagulant	Warfarin	Limit foods containing vitamin K. High doses of vitamin E may increase risk of bleeding. Avoid garlic and ginger.
Antidepressant		
Benzodiazepines	Lorazepam, diazepam, alprazolam	Limit grapefruit juice and citrus consumption. Can take with or without food.
Monoamine oxidase inhibitors	Phenelzine, tranylcypromine	Follow physician's directions regarding diet exactly. Fatal blood pressure increase can occur. While on these medications and for 2 weeks after discontinuation, avoid alcohol and tyramine-containing foods, aged cheese, aged meat, soy sauce, tofu, miso, fava beans, snow peas, sauerkraut, avocados, bananas, yeast extracts, raisins, ginseng, licorice, chocolate, and caffeine.
	Lithium	To decrease GI adverse effects, may administer with food.
	Trazodone	Short acting: give after a meal or snack to reduce postural hypotension, sedation. Extended release: take on an empty stomach.
Tricyclic antidepressants	Amitriptyline, doxepin, imipramine	Fiber may decrease blood levels.
Antidiabetic	Metformin, glyburide	Fiber may reduce absorption.
	Glipizide	Extended release: take with breakfast. Immediate release: take 30 minutes before a meal (usually breakfast).
Antihistamine		Take with food if GI distress occurs.
	Fexofenadine	Avoid grapefruit, orange, and apple juice because they decrease bioavailability.

FOOD-DRUG INTERACTIONS BY CLASS (*continued*)		
Class	**Drug**	**Interaction**
Anti-infectives		Some can reduce effectiveness of oral contraceptives.
HIV	Amprenavir	Bioavailability decreased if administered with high-fat meal
	Didanosine	Best if taken 30 minutes before or 2 hours after a meal.
	Efavirenz	Take on an empty stomach. Food may cause adverse effects and increase drug concentration.
	Indinavir	Take 1 hour before or 2 hours after a meal. If combined with ritonavir may take with food.
	Nelfinavir	To improve bioavailability, take with food. Tablets can be dissolved in water or crushed and administered in pudding or other nonacidic foods.
	Ritonavir	Give with meals to improve palatability. Liquid is highly concentrated and has a poor taste. Best to save for patients on tube feedings.
	Saquinavir	To increase absorption, should give within 2 hours of a meal.
	Tenofovir disoproxil fumarate	Powder must be administered with food, applesauce, baby food, yogurt. Does not dissolve in liquid. Tablets can be taken regardless of meals.
Antiprotozoal	Atovaquone	Administer with a high-fat meal.
Penicillins	Penicillin, amoxicillin, ampicillin	Take on an empty stomach, but if GI upset occurs, take with food. Avoid guar gum fiber as it may reduce penicillin absorption.
	Amoxicillin and clavulanate (Augmentin)	Can give regardless of meals. To decrease GI adverse effects, take at the start of a meal. May mix with milk, formula, or juice.
	Cloxacillin, dicloxacillin	Take 1 hour before or 2 hours after a meal.
Cephalosporins	Cephalexin, cefaclor, cefixime, cefprozil, cefadroxil	Take on an empty stomach unless upsets stomach. Take medicine 1 hour before antacids.
	Ceftibuten	Capsule: administer with/without food. Suspension: administer 2 hours before or 2 hours after a meal.
	Cefpodoxime	Food increases absorption.
	Cefuroxime	Suspension: take with food. Tablet: can take with food if GI upset occurs.
Macrolides	Azithromycin, clarithromycin, erythromycin	Take with food if stomach upset occurs. Azithromycin should be taken on an empty stomach. Avoid carbonated drinks and citrus. Avoid antacids with all except for extended-release azithromycin.
	Metronidazole	Avoid alcohol, take with food to decrease GI upset, but extended-release preparation should be taken on an empty stomach.
Quinolones	Ciprofloxacin, levofloxacin	Preferably take on an empty stomach, but taking with food will minimize GI distress. Do not take with dairy or calcium-fortified products or fruit juices fortified with calcium. Can increase levels of caffeine causing excitability and nervousness.
Sulfonamides	Sulfamethoxazole	Take with food and lots of water.
Tetracyclines	Tetracycline, doxycycline, minocycline	Take on an empty stomach. Avoid dairy products, antacids, iron, and multivitamins containing iron because they can interfere with medication effectiveness.
Antifungals	Amphotericin B	May decrease availability of magnesium, potassium, sodium, and liposomal amphotericin B. May also cause hyperglycemia.
	Fluconazole, ketoconazole	Take with food to increase absorption.
	Griseofulvin	Administer with a fatty meal to increase absorption and to avoid gastrointestinal upset.
	Itraconazole	Do not take with grapefruit juice. Do not administer with antacids. Capsule and tablet should be taken with food but solution should be taken on an empty stomach.
	Ketoconazole	Take 2 hours before antacids to avoid decreasing absorption.

FOOD-DRUG INTERACTIONS BY CLASS (*continued*)		
Class	**Drug**	**Interaction**
Miscellaneous Anti-infectives	Chloroquine hydroxychloroquine	To decrease GI upset, can administer with food. The chloroquine phosphate tablets have a bitter taste that can be masked by mixing in chocolate syrup.
	Ethambutol	May take with food to decrease GI irritation.
	Isoniazid	Take on an empty stomach because food decreases bioavailability.
	Nitrofurantoin	Administer with food to reduce GI distress. Suspension may be mixed with formula, milk, water, or fruit juice
	Rifampin	Administer 1 hour before or 2 hours after meals on an empty stomach to increase absorption.
Beta Blockers	Atenolol, carvedilol, metoprolol, propranolol	Take with food to increase bioavailability. Food may also decrease the risk of orthostatic hypotension. Avoid natural licorice. Take 2 hours before or 6 hours after calcium supplement. Do not take with orange juice.
Bronchodilators	Albuterol	Take with food if GI distress occurs. May cause hyperglycemia and hypokalemia.
	Theophylline	High-fat meals increase levels and high carbohydrate meals may decrease drug level. Avoid or limit caffeine intake.
	Zafirlukast	Administer 1 hour before or 2 hours after meals. Bioavailability reduced 40% by food.
Calcium channel blockers	Diltiazem	Take before meals.
	Nifedipine	Can be administered with or without food.
Corticosteroids	Fludrocortisone, hydrocortisone, prednisone, prednisolone	Take with food or milk to decrease upset stomach. May want to decrease sodium intake. Limit grapefruit juice.
	Spironolactone, triamterene	Potassium sparing diuretics avoid potassium-rich foods.
Cholesterol-lowering agents	Simvastatin	Take with food, but avoid grapefruit juice. Best taken with evening meal to increase absorption.
	Cholestyramine	May require supplementation of folic acid and iron, as well as vitamins A, D, E, and K, with long-term use or high doses. Powder must be mixed in a liquid. Do not sip or hold in mouth as it can discolor teeth or cause decay of enamel.
Diuretics	Furosemide, hydrochlorothiazide	Food reduces bioavailability, but if gastrointestinal distress occurs, take with food. May need supplemental potassium, calcium, and magnesium. Avoid natural licorice.
	Triamterene, spironolactone, amiloride	Avoid eating foods containing lots of potassium.
Electrolytes	Potassium-all salts	Administer with meals and a full glass of water.
Gastrointestinal		
H2 blockers	Famotidine	May administer with antacids, iron, and food.
Proton pump inhibitors (PPIs)	Lansoprazole, omeprazole	Take 30 minutes before meals.
Immunosuppressants	Mycophenolate	Take 1 hour before or 2 hours after meals.
	Tacrolimus	Can be taken with or without food. Extended-release should be taken on an empty stomach.
Miscellaneous		
Iron salts	Ferrous sulfate, gluconate	Take on empty stomach, 2 hours before or 4 hours after antacids.
Alendronate		Take with plain water 30 minutes before a morning meal.
Allopurinol		Take after meals with plenty of fluids.
Sevelamer		Give with food. Give 1 hour before or 3 hours after other medications.

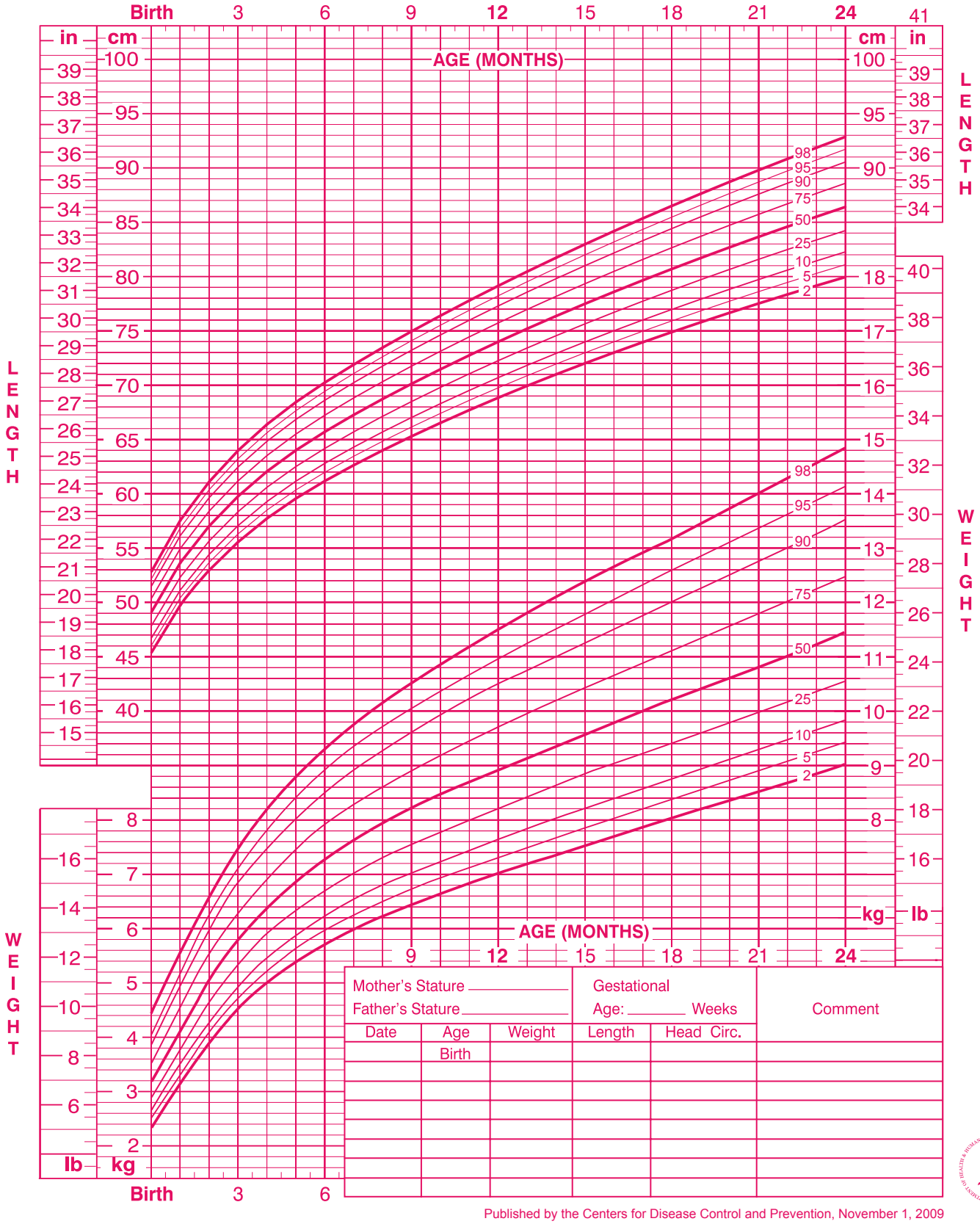
GRAPEFRUIT-DRUG INTERACTIONS			
Drug or Drug Class	**Effect of Grapefruit Juice on Drug Level**	**Implications/Significance**	**Specific Medications Within a Class**
Acetbutolol	Can decrease area under the curve (AUC)	Separate by 4 hours but may not be clinically significant	
Aliskiren	Decrease in AUC by up to 60%	Separate by 4 hours	
Amlodipine	Increase levels	Moderate effect, monitor blood pressure	
Amiodarone	Bioavailability increased by 50%	Avoid grapefruit juice	
Atorvastatin	Can increase serum concentration	Avoid quantities >1 qt/day	
Apixaban	Increase levels	May increase bleeding; drink grapefruit juice with caution	
Budesonide oral tablet or capsule	Increase levels significantly	Avoid grapefruit juice	
Buspirone	Increase drug levels	Avoid >1 qt per day of grapefruit juice, increase risk of sedation or dizziness	
Calcium channel blockers	Increase levels with some but varies	Can develop tachycardia, severe hypotension, flushing; current opinion is to avoid grapefruit juice with all	Amlodipine, diltiazem, felodipine, nicardipine, nifedipine, nimodipine, nisoldipine, verapamil
Carbamazepine	Increase levels	Avoid grapefruit juice	
Clomipramine	Increase level and perhaps toxicity	Avoid grapefruit juice	
Cilostazol	Increase levels and toxicity	Avoid grapefruit juice	
Clopidogrel	Reduce effectiveness	600 mL grapefruit juice reduces effectiveness of clopidogrel; avoid or minimal consumption	
Colchicine	Increase levels	Avoid grapefruit juice	
Cyclosporine	Increase levels	Avoid grapefruit juice	
Dronedarone	Increase levels significantly	Avoid grapefruit juice	
Erythromycin	Possibly increase in AUC and peak	Avoid grapefruit juice or choose a different antibiotic	
Fentanyl oral, transmucosal	Peak effects delayed	Avoid grapefruit juice with Actiq or Lazanda	
Fexofenadine	Decrease bioavailability	Avoid grapefruit juice	
3-hydroxy-3-methyl-glutaryl-coenzyme A (HMG-CoA) reductase inhibitors	Absorption and drug levels increased for many in this class	Headache, gastrointestinal complaints and muscle pain can occur; avoid grapefruit juice; pravastatin, rosuvastatin, and fluvastatin are not affected by grapefruit juice	Atorvastatin, lovastatin, simvastatin,
Itraconazole	Increase levels	Avoid grapefruit juice	
Levothyroxine	Decrease absorption	Avoid grapefruit juice	
Methadone	Increase levels	Avoid grapefruit juice	
Midazolam but not other benzodiazepines	Increase levels	Avoid grapefruit juice	Other benzodiazepines are not affected Diazepam
Pimozide	Increase levels	Avoid grapefruit juice	
Primaquine	Increase in AUC and peak level	Avoid grapefruit juice; risk of myelotoxicity	
Quinidine	Decreased rate of absorption	Avoid grapefruit juice	
Rilpivirine	Increase levels	Avoid grapefruit juice as increased risk of toxicity	
Sildenafil	Increase serum level	Avoid grapefruit juice, may increase risk of toxicity	
Sirolimus	Decrease clearance	Avoid grapefruit juice	
Tacrolimus	Increase level	Avoid grapefruit juice; if used concomitantly, monitor for toxicity	
Zolpidem	Increase level	Avoid grapefruit juice	

Infant Growth

Birth to 24 months: Girls
Length-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Mother's Stature _____ Father's Stature _____			Gestational Age: _____ Weeks		Comment
Date	Age	Weight	Length	Head Circ.	
	Birth				

Published by the Centers for Disease Control and Prevention, November 1, 2009
SOURCE: WHO Child Growth Standards (http://www.who.int/childgrowth/en)

Birth to 24 months: Girls
Head circumference-for-age and
Weight-for-length percentiles

NAME _____

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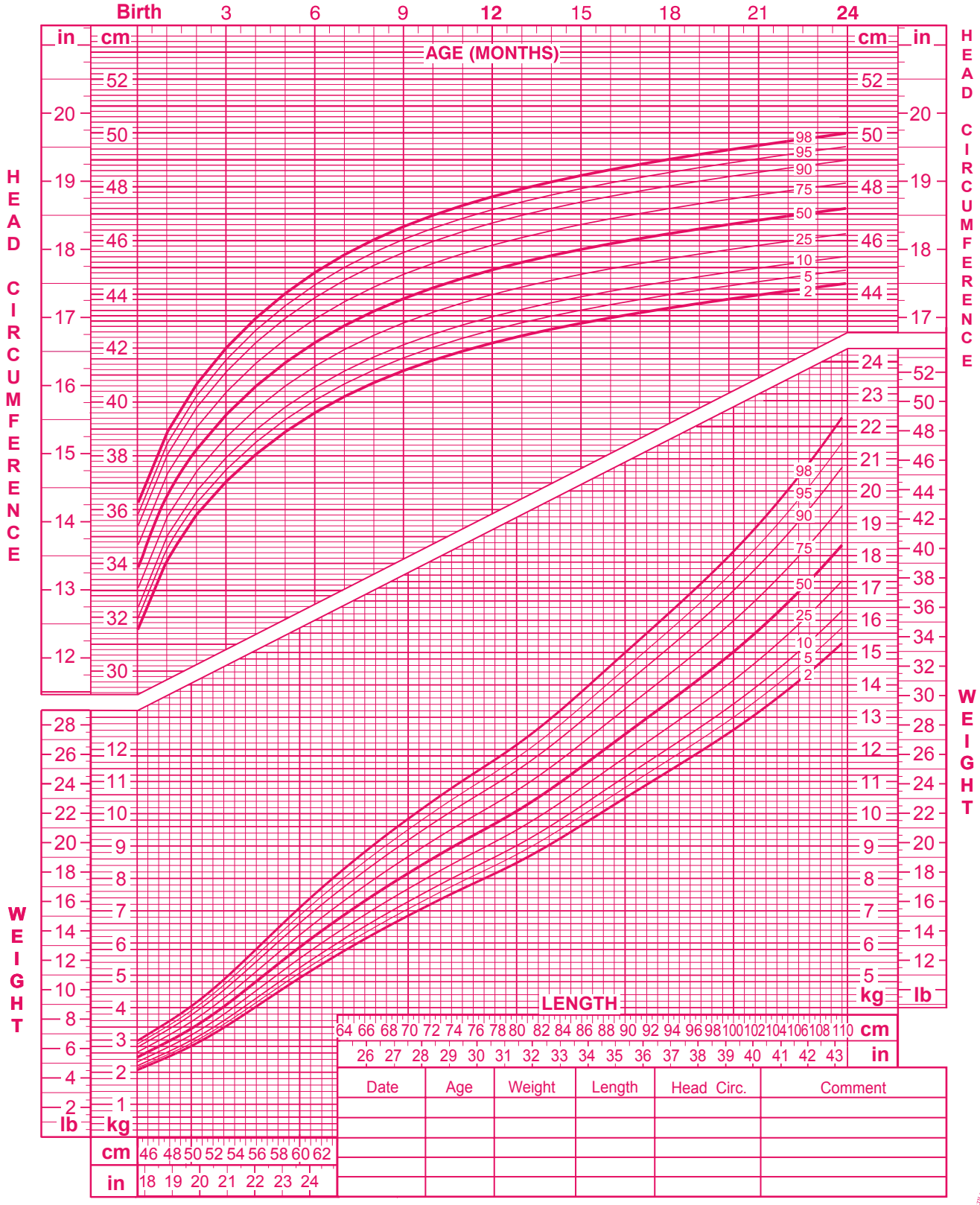

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Length-for-age and Weight-for-age percentiles

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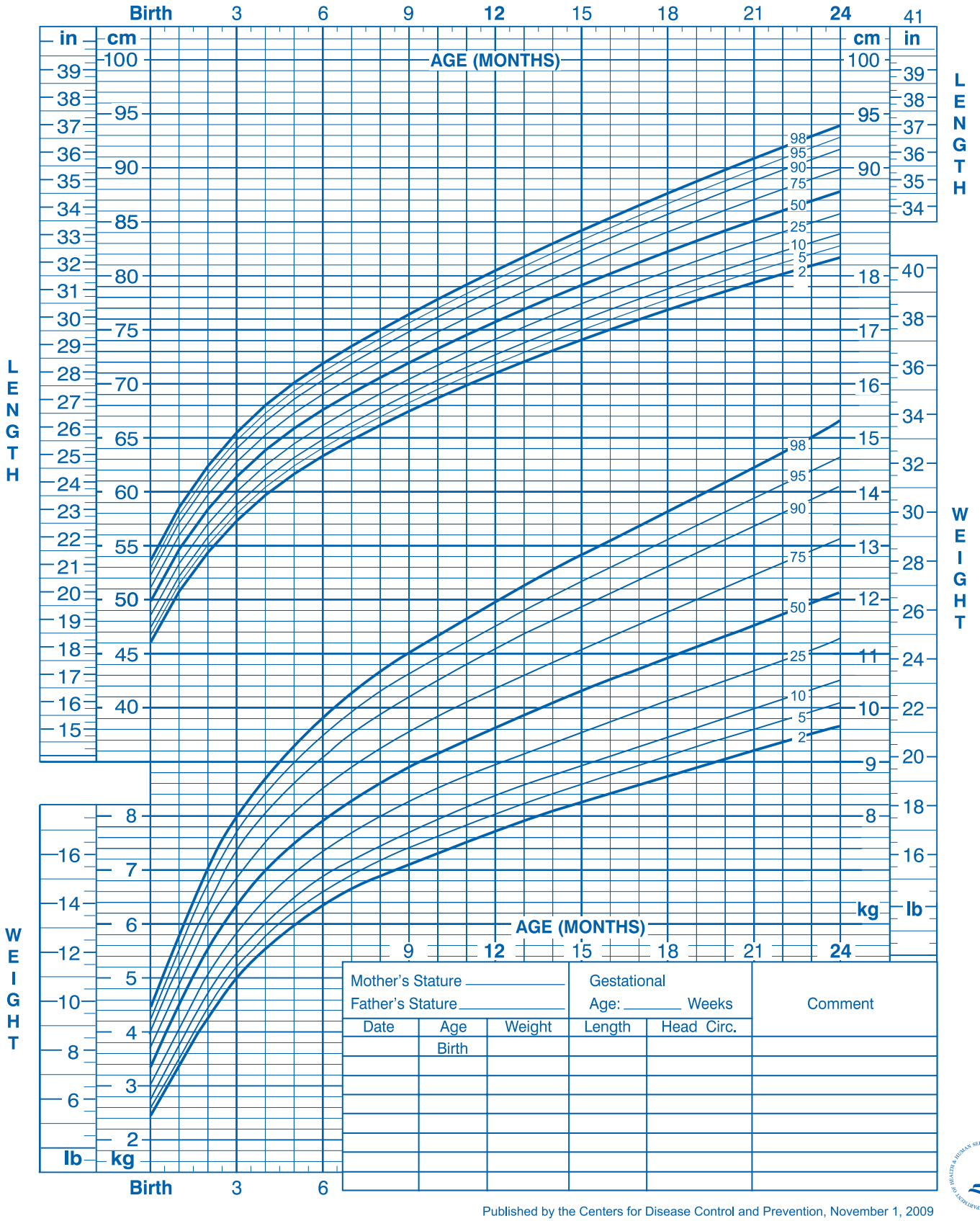

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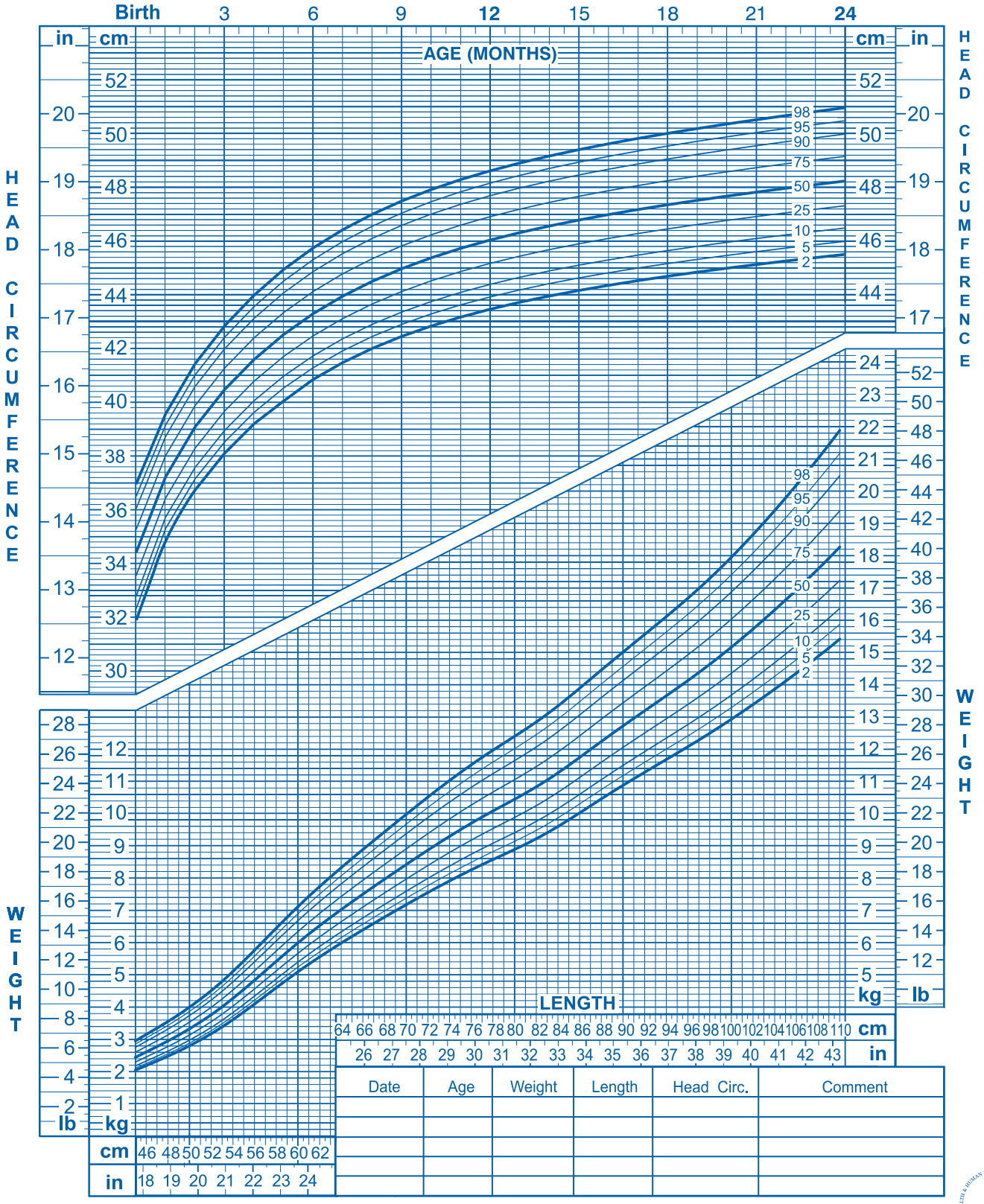

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Newborn and Infant Nutrition

A Clinical Decision Support Chart

American Academy of Pediatrics

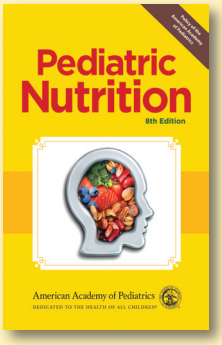
This new clinical decision support chart focuses on helping pediatricians and other health professionals ensure optimal nutrition in the crucial first weeks after birth, which can have significant effects on long-term health and developmental outcomes.

A variety of the most important tables, guidelines, and algorithms from the new eighth edition of the American Academy of Pediatrics policy manual, *Pediatric Nutrition,* are collected here for easy reference in an enlarged, expanded, colorized format.

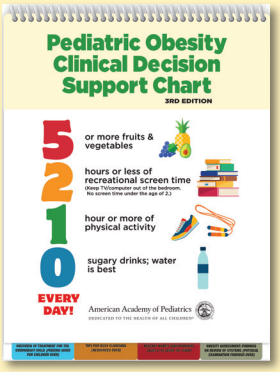
Contents include

- Daily Reference Intakes
- Breastfeeding Support
- Hypoglycemia
- Parenteral Nutrition
- Nutrition (Enteral) in Special Circumstances
- Complementary Feeding
- Vitamin and Mineral Deficiency
- Food-Drug Interactions by Class
- Infant Growth

Additional pediatric nutrition resources from the American Academy of Pediatrics include



Pediatric Nutrition,
8th Edition



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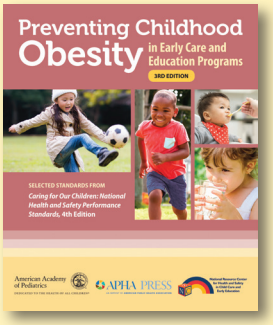
3rd Edition



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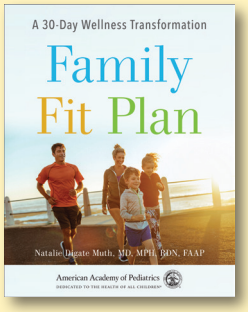

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