2020 Dietary Guidelines Advisory Committee: DRAFT - Part D. Chapter 7: USDA Food Patterns For Children Younger Than Age 24 Months

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This chapter includes questions examined by the
Data Analysis Food Pattern Modeling Working Group and the
Birth to 24 Months Subcommittee

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LIST OF QUESTIONS

Can USDA Food Patterns be established based on the relationships identified in the systematic reviews?

If so, how well do USDA Food Pattern variations meet nutrient recommendations for infants and toddlers?

If nutrient needs are not met, is there evidence to support supplementation and/or consumption of fortified foods to meet nutrient adequacy?

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INTRODUCTION – Birth to 24 Months

- Characterized by major changes in feeding patterns and dietary intake
  - Exclusive breastfeeding recommended for ~6 months (AAP 2020)
  - For infants not fed human milk or mixed-fed (i.e., both human milk and infant formula), commercial infant formula generally recommended until 12 months (AAP 2020)
  - Around 6 months of age - transition from sole consumption of human milk and/or infant formula to a varied diet that includes nutrient-rich complementary foods and beverages (CFB) (AAP 2020)

- Committee decided that USDA Food Patterns are not necessary for infants younger than age 6 months, and began food pattern modeling at age 6 months

Final protocols and draft conclusion statements available at DietaryGuidelines.gov
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INTRODUCTION – Milk Source

Human milk differs from infant formula in:

- Nutritional composition
- Bioavailability of nutrients
- Presence of bioactive substances

- Composition of human milk changes across time and in response to maternal diet

- Energy and nutrients needed from CFB vary by infant milk source

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INTRODUCTION – 6 to 12 Months

- First goal was combinations of CFB to meet nutrient needs of infants whose milk source is human milk (i.e., no infant formula)
  - Infant formula is fortified, so intakes of certain key nutrients considerably higher (e.g., iron)
- Then estimated the expected nutrient intakes of infants fed infant formula if they consumed the same types and combinations of CFB

Note: provision of key nutrients is only one of the ways in which human milk influences infant health and development - many health benefits of breastfeeding for the mother as well as the child.

*Food pattern modeling results for infants should not be interpreted as an evaluation of the value of human milk compared to infant formula; they are intended to demonstrate ways that nutritional goals can be met through CFB that **take into account** the milk source(s) in the child's diet.*

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INTRODUCTION – 12 to 24 Months

Food pattern modeling (FPM) for 12-24 months conducted separately:

- RDAs established for most nutrients for ages 12 months and older

- Infant formula is not recommended after 12 months

- Most infants (66%) in the U.S. no longer receive human milk after age 12 months

INTRODUCTION – Role of Complementary Feeding

Complementary feeding is important not only for providing nutrients, but also for:

- Introducing food types and textures that can be beneficial for:
  - Developing manual dexterity, hand-eye coordination, and dexterity of mechanical features involved in chewing and swallowing
  - Supporting the development of appropriate feeding and eating behaviors during childhood
  - Reducing risk of food allergies (e.g., peanut, egg)

- Implementing responsive feeding practices, modeling of healthy eating behaviors, and bonding through food and mealtimes

FPM focuses on nutrient intake and is not designed to address these other important aspects of complementary feeding.

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METHODOLOGY

- All questions were answered using food pattern modeling.

- Analytic framework and food modeling process was presented at March meeting.

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METHODOLOGY
Step 1: Food Pattern Modeling 6-24 Months

1. Establish Energy Levels

- DRI formulas for Estimated Energy Requirements (EER)
  - Account for energy deposition for the growing child (IOM 2005)

- Determined appropriate energy levels for each age-sex group
  - Based on age in months, reference body lengths, median body weights, and sex

- Five energy levels from 600 to 1,000 kcal, at 100 kcal "step" intervals, were chosen to cover the energy needs for the majority of the population ages 6 to 24 months

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METHODOLOGY
Step 2: Food Pattern Modeling 6-24 Months

2. Establish Nutritional Goals

- Specific nutritional goals selected based on the age-sex group(s)

- DRI goals (RDA or AI)
    - Energy
    - 3 macronutrients
    - 3 fatty acids
    - 12 vitamins
    - 9 minerals

- Other goals could include potential recommendations of the 2020 Committee

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3. Establish Food Groupings and Food Group Amounts

- Informed by existing food groups and subgroups in the USDA Food Patterns for ages 2 years and older published in the *2015-2020 Dietary Guidelines for Americans.*

- Options with different proportions of energy from human milk or infant formula created, and remaining energy for CFB calculated.

- Energy from human milk was modeled at 3 levels (low, average, and high) and applied to each of 3 age intervals (6 to 9 months, 9 to 12 months, and 12 to 24 months).

- Energy from infant formula also modeled at 3 levels, but only applied to 2 age intervals (6-9 and 9-12 months).

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DRAFT Table. Energy from Human Milk Modeled at Three Levels (Low, Average, and High) Applied to Each of Three Age Intervals (6 to 9, 9 to 12, and 12 to 24 Months) and the Amount of Energy Available for Complementary Foods and Beverages at 5 Estimated Energy Needs from 600 to 1,000 Kcal

Energy level (kcal)	600		700		800		900		1,000	
	CFB[2] kcal	HM[2] kcal	CFB kcal	HM kcal	CFB kcal	HM kcal	CFB kcal	HM kcal	CFB kcal	HM kcal
6 to 9 months										
HM level high (100% HM)	NA[2]	600	NA	700	NA	800				
HM level average (80% HM)	120	480	140	560	160	640				
HM level low (65% HM)	210	390	245	455	280	520				
9 to 12 months										
HM level high (70% HM)	180	420	210	490	240	560	270	630		
HM level average (55% HM)	270	330	315	385	360	440	405	495		
HM level low (40% HM)	360	240	420	280	480	320	540	360		
12 to 24 months										
HM level high (50% HM)			350	350	400	400	450	450	500	500
HM level average (35% HM)			455	245	520	280	585	315	650	350
HM level low (20% HM)			560	140	640	160	720	180	800	200

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3. Establish Food Groupings and Food Group Amounts

- Started with food group amounts for the 1,000-kcal level pattern established in the Healthy U.S.-Style Food Patterns in the 2015-2020 Dietary Guidelines for Americans.

- When total energy < 1,000 kcal, amounts of each food group were decreased such that the food group density in the pattern remained similar to the food group density of the 1,000 kcal Pattern.

- Modified combinations of CFB to reach all or most of the specified nutrient goals.

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4. Determine the Amounts of Nutrients that Would be Obtained by Consuming Various Foods Within Each Group

- Nutrient profiles for each food group or subgroup created, based on intake data for ages 6-24 months from WWEIA, NHANES 2015-2016

- Nutrient profiles calculated using weighted average of nutrient-dense forms of foods representing each food item cluster

- Representative foods in the dairy group differed from those used for ages 2+ because of the importance of adequate fat intake at 6-24 months.

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5. Evaluate Nutrient Level in Each Modeling Exercise Against Nutritional Goals

- Using the updated nutrient profiles for ages 6 to 24 months, the nutrients provided in each modeling exercise were compared to the goals, e.g., $\geq$ 90% of the RDA or AI

6. Adjust and Re-Evaluate to Align with Goals

- If nutrient goals not met, step-wise iterative approach used to make additional adjustments

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RESULTS OF FOOD PATTERN MODELING EXERCISES – Infants Fed Human Milk 6-12 mo

- In <u>first step</u>, with food group amounts in proportion to amounts in the 1,000-kcal Pattern for ages 2+, many nutrient gaps:
  - Low in iron and zinc, as expected, but also magnesium, phosphorus, potassium, sodium, choline, niacin, and vitamins A, B_6, C, D, and E
  - Iron content ~1-2 mg at 6-9 months and 1-4 mg at 9-12 months (far below the RDA of 11 mg).
  - Zinc content 1.4-2.5 mg at 6-9 months and 2-4 mg at 9-12 months (RDA = 3 mg).

- Thus, <u>second step</u> was to replace 56 kcal of grains with 56 kcal of fortified infant cereal (0.5 oz eq/day).
  - Iron content ~8-9 mg at 6-9 months and ~8-11 mg at 9-12 months. Still low for most energy levels and human milk proportion options.
  - Zinc content adequate (3-5 mg).

- <u>Third step</u> was to examine how much energy remained for other CFB, after including 56 kcal of fortified infant cereal.

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Table. Energy (Kcal) Provided by Human Milk or Infant Formula Plus 0.5 Oz Eq of Fortified Infant Cereal (HM + IC) and Remaining Energy Available for Other Complementary Foods and Beverages for Infants, by Age and Three Levels of Human Milk or Infant Formula Intake[1]

Energy level (kcal)		600			700			800			900			1,000		
Age (mo)	Energy Source	H[2]	A[2]	L[2]	H	A	L	H	A	L	H	A	L	H	A	L
6 to 9	HM[2] (or IF[2])	600	480	390	700	560	455	800	640	520						
	Total CFB[2]	0	120	210	0	140	245	0	160	280						
	Infant Cereal	0	56	56	0	56	56	0	56	56						
	Remaining CFB	0	64	154	0	84	189	0	104	224						
9 to 12	HM (or IF)	420	330	240	490	385	280	560	440	320	630	495	360			
	Total CFB	180	270	360	210	315	420	240	360	480	270	405	540			
	Infant Cereal	56	56	56	56	56	56	56	56	56	56	56	56			
	Remaining CFB	124	214	304	154	259	364	184	304	424	214	349	484			
12 to 24	HM (or IF)				350	245	140	400	280	160	450	315	180	500	350	200
	Total CFB				350	455	560	400	520	640	450	585	720	500	650	800
	Infant Cereal				56	56	56	56	56	56	56	56	56	56	56	56
	Remaining CFB				294	399	504	344	464	584	394	529	664	444	594	744

H, high; A, average; L, low; HM, human milk; IC, infant cereal; IF, infant formula; CFB, complementary foods and beverages

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Final step: examined how the remaining energy for CFB could be allocated across food groups and subgroups to move closer to nutrient adequacy for iron, zinc, potassium, and choline (the nutrients with the most critical gaps).

- Food combinations set up to include a minimum amount of seafood, eggs, and nuts, in accordance with recommendations to introduce these foods during this age period.

- A maximum for dairy (no more than 0.5 cup eq per day) was set, given that infants at this age are receiving human milk or infant formula.

- Remaining nutrient gaps were filled to the extent possible by prioritizing protein foods, particularly meat, because of the relatively high content and bioavailability of iron and zinc in red meats in particular.

Table. Approximate amounts of food groups and subgroups in example combinations of complementary foods and beverages for ages 6 to 12 months

Food Groups	6 to 9 months Daily amounts	6 to 9 months Weekly amounts	9 to 12 months Daily amounts	9 to 12 months Weekly amounts
Total fruits (cup eq)	⅛ to ¼	---	⅛ to ½	---
Total vegetables (cup eq)	⅛ to ¼	---	⅛ to ½	---
Red and orange	---	¼ to ⅔	---	½ to 1½
Starchy	---	¼ to ½	---	⅛ to 1
Dark green	---	Small amounts[1]	---	¼
Legumes	---	Small amounts[1]	---	¼
Other	---	¼ to ½	---	¼ to ¾
Total grains (oz eq)[2]	½ to ¾	---	½ to 1	---
Fortified infant cereals	½	---	½	---
Other grains including whole and refined	0 to ¼	---	0 to 1[2]	---
Total protein foods (oz eq)[3]	¾ to 2⅔	---	2 to 3	---
Meats	---	4⅔ to 16	---	8½ to 15½
Poultry	---	½ to 1¼	---	1
Seafood	---	≥3	---	≥3
Eggs	---	>1	---	≥1
Nuts and seeds	---	>½	---	>½
Total dairy (cup eq)	¼	---	½	---
Total added oils/fats (g)	0	---	0 to 7¾	---

1: "Small amounts" refer to less than ⅛ cup eq per week.

2: At least half of other grains as whole grains

3: Total protein foods includes a majority from meats rather than poultry because meat has higher iron content than poultry.

Abbreviations: eq, equivalents; d, day; wk, week; oz, ounce; g, gram

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For infants fed infant formula, human milk was replaced with infant formula in the models.

- Because these models included fortified infant cereal as well as infant formula, they had few shortfall nutrients, except for vitamin D and omega-3 fatty acids at some energy levels.

- However, the potential for excess intakes of certain nutrients exists.
  - Iron reaches 150-175% of the RDA at 6-9 months and 134-194% of the RDA at 9-12 months, though none of these estimates exceeded the UL for iron (40 mg).
  - Zinc reaches 226-302% (7 to 9 mg, respectively) of the RDA at ages 6-9 months and 232-339% (7 to 10 mg, respectively) of the RDA at ages 9 to 12 months. These estimates all exceed the UL for zinc (5 mg), though this UL has been challenged as being too low.

- Formula-fed infants do not need the extra iron and zinc from fortified infant cereal if formula intake is > 760 mL at 6-9 months or 690 mL at 9-12 months.

- Could substitute other grain products (preferably whole grain) for the 0.5 oz eq of fortified infant cereal.

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RESULTS OF FOOD PATTERN MODELING EXERCISES: Draft Conclusion Statements

Ages 6 to 12 Months

- The Committee was not able to establish a recommended food pattern for infants ages 6 to 12 months because of uncertainty about nutrient requirements for this age range and challenges in meeting the Recommended Dietary Allowance for iron through complementary foods and beverages.

- However, examples of potential combinations of complementary foods and beverages that come close to meeting almost all nutrient recommendations are described for a variety of scenarios differing in the proportion of energy coming from human milk or infant formula and complementary foods and beverages at ages 6 to 9 months and 9 to 12 months.

- The example combinations of complementary foods and beverages described by the Committee support consumption of fortified infant foods to meet nutrient adequacy for infants whose milk source is human milk (i.e., no infant formula).

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Ages 6 to 12 Months (continued)

- Formula-fed infants who also consume iron-fortified infant cereals may consume up to 2 times the Recommended Dietary Allowance for iron (22 milligrams per day) at ages 6 to 12 months, although iron intakes are not likely to exceed the Tolerable Upper Intake Level of 40 milligrams per day.

- Further work is needed to determine the feasibility of meeting all nutrient recommendations for infants fed human milk at ages 6 to 12 months from diets that do not include any fortified foods (e.g., fortified infant cereal, infant formula).

- With the exception of vitamin D, supplementation should not be necessary if fortified foods with appropriate levels of fortification are included in the diet of infants whose milk source is human milk. Vitamin D supplementation guidance from the American Academy of Pediatrics is provided in Part D. Chapter 6: Nutrients from Dietary Supplements During Infancy and Toddlerhood.

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RESULTS OF FOOD PATTERN MODELING EXERCISES – Ages 12 to 24 months (1 of 3)

Toddlers Fed *Neither* Human Milk Nor Infant Formula

- The first step was to set up a model that included food group amounts in proportion to the amounts in the 1,000 kcal Pattern for ages 2 years and older.

- Subsequent steps were designed to fill nutrient gaps evident in the first step models, e.g. for iron and calcium. Also set seafood at 3 oz eq/week, and increased whole grains (for potassium) and oils (for omega-3 and omega-6 fatty acids).

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Table. Amount from Each Food Group or Subgroup in the Healthy U.S.-Style Pattern Developed for Ages 12 to 24 Months Without Any Human Milk or Infant Formula

ENERGY LEVEL (kcal)	1,000	900	800	700
FRUITS (cup eq[1]/d[1])	1.00	1.00	0.75	0.50
VEGETABLES				
Total Vegetables (cup eq/d)	1.00	1.00	0.75	0.65
subgroup amounts in cup eq per week				
Dark green (cup eq/wk[1])	0.50	0.50	0.33	1.0
Red Orange (cup eq/wk)	2.50	2.50	1.75	1.00
Legumes (cup eq/wk)	0.50	0.50	0.33	0.75
Starchy (cup eq/wk)	2.00	2.00	1.50	1.00
Other (cup eq/wk)	1.50	1.50	1.25	0.75
GRAINS				
Total Grains (oz[1] eq/d)	3.00	2.50	2.25	1.75
Whole grains (oz eq/d)	2.00	2.00	2.00	1.50
Refined grains (oz eq/d)	1.00	0.50	0.25	0.25
PROTEIN FOODS				
Total Protein Foods (oz eq/d) *	2.00	2.00	2.00	2.00
subgroup amounts in oz eq per week				
Meats and Poultry (oz eq/wk)	7.70	7.00	7.00	8.75
Eggs (oz eq/wk)	2.25	2.25	2.75	2.00
Seafood (oz eq/wk)	3.00	3.00	3.00	3.00
Nuts, Seeds and Soy (oz eq/wk)	1.25	1.25	1.00	1.00
DAIRY (cup eq/d)	2.00	2.00	1.75	1.66
OILS (g[1]/d)	13	8	9	9

1: eq, equivalents; d, day; wk, week; oz, ounce; g, gram

Table. Summary of Energy, Macronutrient Distributions, and Select Nutrient Amounts and Percent of RDA or AI for the Healthy U.S.-Style Pattern Intended for Infants Ages 12 To 24 Months Without Any Human Milk or Infant Formula

		Energy Pattern			
		1,000	900	800	700
Energy	kcal	1,001	907	804	704
Protein	% of kcal	18%	19%	19%	23%
Fat	% of kcal	34%	32%	34%	35%
Carbohydrate	% of kcal	50%	51%	48%	44%
Calcium	mg	782	772	675	612
	% RDA[1]	112%	110%	96%	87%
Iron	Mg	8.43	7.88	7.16	6.20
	% RDA	120%	113%	102%	88%
Potassium	Mg	1,797	1,772	1,488	1,299
	% AI[1]	90%	89%	74%	65%
Zinc	Mg	7	7	7	6
	% RDA	243%	236%	220%	198%
Vitamin E	mg AT[1]	4.9	4.1	3.8	3.6
	% RDA	81%	69%	63%	60%
Vitamin D	IU[1]	260	258	235	214
	% RDA	43%	43%	39%	36%
Choline	mg	199	195	188	169
	% AI	100%	98%	94%	84%
Omega-3	g	1.2	0.9	0.9	0.9
	% AI	178%	135%	133%	130%
Omega-6	g	8.6	6.4	6.5	6.1
	% AI	123%	91%	93%	87%

1: RDA, Recommended Dietary Allowance; AI, Adequate Intake; AT, alpha tocopherol; IU, international units

Toddlers Fed Human Milk

- First step was a model with food group amounts in proportion to the amounts in the 1,000 kcal Pattern for ages 2 years and older.

- Adjustments to protein foods made, similar to those made for human milk-fed infants at 9-12 months, to increase iron and calcium.

- Adjustments made to vegetable subgroups to emphasize good sources of calcium and/or iron, including increases in dark green vegetables, legumes, red and orange vegetables, and other vegetables, and a corresponding decrease in starchy vegetables.

- Refined grains generally reduced to ¼ cup eq per day & adjustments made to dairy to allow for reallocation of some energy to oils (2-11 g/day) to increase fatty acid adequacy.

- Nutrient shortfalls still present for several nutrients.

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Table. Approximate amounts of food groups and subgroups in example combinations of complementary foods and beverages for toddlers ages 12 to 24 months fed human milk

Food Groups	12 to 24 months	
	Daily amounts	Weekly amounts
Total fruits (cup eq)	⅓ to ¾	---
Total vegetables (cup eq)	⅔	---
Red and orange	---	1½
Starchy	---	½ to ¾
Dark green	---	1 to 1½
Legumes	---	½
Other	---	¾
Total grains (oz eq)[1]	1 ¼ to 2 ¼	---
Total protein foods (oz eq)[2]	2 ¼ to 3	---
Meats	---	9 ¼ to 15 ¾
Poultry	---	1 to 3
Seafood	---	≥3
Eggs	---	≥1 to 2
Nuts and seeds	---	≥½ to 1
Total dairy (cup eq)[3]	¼ to 1¾	---
Total added oils/fats (g)[4]	2 to 11	---

1: Emphasis on whole grains ranging from 1-2 oz eq

2: Total protein foods includes a majority from meats rather than poultry because meat has higher iron content than poultry.

3: Dairy is zero in combinations where the human milk proportion is high and energy for complementary foods and beverages is small.

4: Grams of oils are lower when proportions of human milk are high and energy for complementary foods and beverages is small.

Abbreviations: eq, equivalents; d, day; wk, week; oz, ounce; g, gram

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Toddlers Fed a Lacto-Ovo Vegetarian Diet, and Fed Neither Human Milk Nor Infant Formula

- Started with the Healthy Vegetarian Style Pattern at the 1,000 kcal level. Nutrient shortfalls included choline, potassium, vitamin E, vitamin D, and omega-3 and omega-6 fatty acids.

- Adjusted to include 3 eggs per week to achieve choline.

- Grains shifted to emphasize whole grains.

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Table. Amount from Each Food Group or Subgroup in the Healthy Vegetarian Style Pattern Developed for Ages 12 to 24 Months Without Any Human Milk or Infant Formula

ENERGY LEVEL (kcal)	1,000	900	800	700
FRUITS (cup eq[1]/d[1])	1	1	0.75	0.5
VEGETABLES				
Total Vegetables (cup eq/d)	1	1	1	1
subgroup amounts in cup eq per week				
Dark green (cup eq/wk[1])	0.5	0.5	0.5	0.5
Red Orange (cup eq/wk)	2.5	2.5	2.5	2.5
Legumes (cup eq/wk)	0.75	0.75	0.75	0.75
Starchy (cup eq/wk)	2	2	2	2
Other (cup eq/wk)	1.5	1.5	1.5	1.5
GRAINS				
Total Grains (oz[1] eq/d)	3	2.75	2.25	1.75
Whole grains (oz eq/d)	2	2	1.75	1.25
Refined grains (oz eq/d)	1	0.75	0.5	0.5
PROTEIN FOODS				
Total Protein Foods (oz eq/d)	1	1	1	1
subgroup amounts in oz eq per week				
Eggs (oz eq/wk)	3.5	3.5	3.5	3.5
Nuts, Seeds and Soy (oz eq/wk)	4	4	4	4
DAIRY (cup eq/d)	2	1.75	1.75	1.5
OILS (g[1]/d)	15	10	8.5	9

1: eq, equivalents; d, day; wk, week; oz, ounce; g, gram

Table. Summary of Energy, Macronutrient Distributions, and Select Nutrient Amounts and Percent of RDA or AI for the Healthy Vegetarian Pattern Intended for Infants Ages 12 to 24 Months Without Any Human Milk or Infant Formula

ENERGY LEVEL (kcal)		1,000	900	800	700
Energy	kcal	999	898	810	703
Protein	% of kcal	16%	17%	18%	18%
Fat	% of kcal	36%	33%	34%	36%
Carbohydrate	% of kcal	51%	54%	52%	49%
Calcium	mg	805	726	707	609
	% RDA[1]	115%	104%	101%	87%
Iron	mg	9.0	9.0	7.6	6.3
	% RDA	126%	122%	108%	89%
Potassium	mg	1732	1649	1537	1330
	% AI[1]	87%	82%	77%	66%
Zinc	mg	6.7	6.4	5.9	4.9
	% RDA	224%	213%	198%	163%
Vitamin E	mg AT[1]	5.6	4.8	4.5	4.3
	% RDA	93%	80%	74%	71%
Vitamin D	IU[1]	239	214	211	183
	% RDA	40%	36%	35%	31%
Choline	mg	204	195	190	175
	% AI	102%	98%	95%	88%
Omega-3	g	1.4	1.0	0.9	0.9
	% AI	196%	148%	133%	129%
Omega-6	g	9.6	7.3	6.5	6.3
	% AI	137%	105%	92%	90%

1: RDA, Recommended Dietary Allowance; AI, Adequate Intake; AT, alpha tocopherol; IU, international units

Ages 12 to 24 Months

- For toddlers fed neither human milk nor infant formula, the Committee developed a Food Pattern for ages 12 to 24 months that is consistent with the proportions of food groups and subgroups recommended for children ages 2 years and older.

- This food pattern requires careful choices of foods and beverages but does not require inclusion of fortified products specifically formulated for infants or toddlers to meet nutrient recommendations.

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Ages 12 to 24 Months (continued)

- For toddlers who receive at least 20 percent of total energy from human milk at ages 12 to 24 months, the Committee was not able to establish a recommended food pattern because of uncertainty about nutrient requirements for this age range and challenges in meeting the Recommended Dietary Allowances.

- However, examples of potential combinations of complementary foods and beverages that come close to meeting almost all nutrient recommendations are described for a variety of scenarios differing in the proportions of energy coming from human milk and from complementary foods and beverages at ages 12 to 24 months.

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Ages 12 to 24 Months (continued)

- For toddlers fed a lacto-ovo vegetarian diet and fed neither human milk nor infant formula at ages 12 to 24 months, the Committee developed a Healthy Vegetarian Pattern that includes regular consumption of eggs, dairy products, soy products, and nuts or seeds, in addition to fruits, vegetables, grains, and oils.

- This Food Pattern requires careful choices of foods and beverages but does not require inclusion of fortified products specifically formulated for infants or toddlers to meet nutrient recommendations.

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Additional Considerations for Ages 6 to 24 Months Regarding Added Sugars

- The combinations of foods needed to achieve recommended intakes of key nutrients for ages 6 to 24 months leave virtually no remaining dietary energy for added sugars, apart from the very small amounts (less than 3 grams per day) already inherent in the foods used in modeling.

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Overview of Approach

- Challenging to develop recommended food patterns for infants and toddlers ages 6 to 24 months
  - Nutrient needs high relative to energy requirements
  - Amounts of CFB consumed are relatively low, especially at the younger ages

- Opted to start with modeling the contributions of food groups in proportion to the amounts in the 1,000 kcal Pattern for ages 2 years and older, with adaptations to correspond to estimated energy intakes and nutritional goals for 6-24 months.

- This has the advantage of developing Patterns that are feasible with respect to the types of foods consumed in the U.S., and that become consistent with the Patterns recommended for older age groups by age 24 months.

- However, the results do not necessarily represent the optimal combinations of foods and beverages for meeting nutritional goals, which requires a different modeling approach.

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Strengths of the Approach

- Modeled various scenarios regarding the potential contribution from human milk or infant formula

- USDA Food Patterns provide examples of amounts of food groups and subgroups to consume, but do not dictate the specific types of foods. Flexibility allows for:
  - Foods to be tailored to an individual's needs and preferences
  - Cultural preferences
  - Cost considerations

Limitations of the Approach

- Uncertainty regarding the nutrient composition of human milk.
- Nutritional goals in the models for 6-12 months based mainly on AI values, because RDAs available only for protein, iron, and zinc

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Iron is a key nutrient at 6-12 months

- Iron was the most limiting nutrient for infants fed human milk at 6-12 months. It was not possible to meet the RDA without including iron-fortified infant foods.

  - Iron-fortified infant foods have been an important strategy for reducing iron deficiency among infants in the U.S. for several decades.

- Fortified infant foods are not necessarily the only way for infants fed human milk to achieve the RDA.

  - Red meat is a good source of iron (and heme iron is better absorbed than non-heme iron), but obtaining required amounts solely from red meat (not including liver) may not be feasible.

  - Further work is needed to estimate the quantities of animal-source foods that would be needed by infants fed human milk to support adequate iron status without fortified foods.

- Infants fed infant formula have the potential for excess intakes of iron

  - Iron content of formulas most commonly used in the U.S. is relatively high (~1.8 mg/100 kcal), about 40 times the iron content of human milk.

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Potassium

- It was challenging to meet the AI for potassium (860 mg at ages 7 to 12 months; 2,000 mg at ages 1 to 3 years) in all of the models.
    - There are uncertainties regarding the AI values
    - Nonetheless, choosing potassium-rich foods is important at these ages

Iodine

- Iodine intakes could not be predicted because food composition data are not available for iodine.
- In situations in which neither the mother nor the infant consumes iodized salt or obtains adequate iodine from other sources (e.g., dairy products), iodine intakes of infants could be deficient.
- Underconsumption of iodine during infancy has important potential consequences for brain development, especially if maternal intake was also low during pregnancy.

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CONCLUSIONS: 6-12 months
(1 of 2)

- For infants ages 6 to 12 months, the Committee was not able to establish a recommended food pattern.

- Further work is needed to explore various options for meeting all nutrient recommendations during that age range, using tools such as linear programming and taking into account differences in iron bioavailability from different sources.

- The modeling exercises revealed the importance of prioritizing certain food groups and making careful food choices within food groups.
  - Certain animal-source foods are important sources of key "shortfall" nutrients at this age, including iron, zinc, choline, and long-chain polyunsaturated fatty acids.
  - Fortified infant cereals can contribute a substantial amount of some of these nutrients, particularly iron and zinc, but prioritizing consumption of meat, egg, and seafood is an important strategy for providing all of these crucial nutrients.

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- By contrast, dairy products (such as yogurt and cheese) are less crucial than other types of animal-source foods at ages 6 to 12 months because infants are still receiving human milk or infant formula, and dairy products tend to have low amounts of iron.

- Prioritizing fruits and vegetables, particularly those that are rich in potassium, vitamin A, and vitamin C, is another key element of healthy complementary food diets at ages 6 to 12 months, not only to provide adequate nutrition but also to foster acceptance of these healthy foods.

- In addition, introduction of peanut products and egg in the first year of life is advised, to build tolerance to food antigens (i.e., help prevent food allergies) and to provide good sources of fatty acids and choline.

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CONCLUSIONS: 12-24 months
(1 of 3)

- The Committee was able to establish a recommended Food Pattern for toddlers 12-24 months fed neither human milk nor infant formula that resembles the Pattern established for ages 2 and older.

- The Pattern allows for a variety of nutrient-rich animal-source foods, including meat, poultry, seafood, eggs, and dairy products, as well as nuts and seeds, fruits, vegetables, and grain products.

- Key aspects to emphasize include choosing potassium-rich fruits and vegetables, prioritizing seafood, making whole grains the predominant type of grains offered, and choosing oils over solid fats.

- In these Patterns, energy allocated to oils is minimal (6-13 g/d) and no energy remains for added sugars not already inherent in the Patterns.

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Range of Recommended Food group Amounts in the Healthy U.S.-Style Food Pattern Compared to the 5th to 95th Percentiles of Intakes in the Population for Children Ages 12 to 24 Months

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- For toddlers fed human milk at ages 12 to 24 months, the Committee was not able to establish a recommended food pattern but provides examples of potential combinations of CFB that come close to meeting almost all nutrient recommendations.

- Further work is needed to examine predicted nutrient intakes of toddlers fed human milk that take into account mineral bioavailability under various conditions.

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- For toddlers fed lacto-ovo vegetarian diets and fed neither human milk nor infant formula at ages 12 to 24 months, a Pattern was established that includes regular consumption of eggs, dairy products, soy products, and nuts or seeds, in addition to fruits, vegetables, grains, and oils.

- Because of concerns about iron bioavailability in the vegetarian pattern, the Committee recommends further modeling work that takes this into account.

- Careful choices of CFB within vegetarian diets are very important to meet nutrient needs.
    - The Healthy Vegetarian Eating Pattern developed is not a vegan diet, as the former includes substantial amounts of animal-source foods (egg and dairy).
    - Without supplements and/or fortified products, it is not possible to meet all nutrient goals with a vegan diet at this age.

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CONCLUSIONS (continued)

- These findings are not intended to provide a combination of CFB or food pattern that is right for every infant or toddler, because children develop at different rates, and many different circumstances influence feeding needs and decisions.

- Toddlers with relatively low energy intakes may benefit from food combinations that resemble those for 6-12 months, with a gradual shift to the patterns presented for 12-24 months.

- A general principle is to view the period from 6 to 24 months as a continuous transition from diets appropriate for infants to diets that resemble family food patterns.

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Transition from complementary food[1] patterns appropriate for infants to food patterns for ages 2 years and older: relative amounts of food groups and subgroups across energy levels in HUSS patterns

Fruits

Vegetables
- Dark green
- Red Orange
- Legumes
- Starchy
- Other

Grains
- Refined grains
- Whole grains

Protein Foods
- Seafood
- Eggs
- Nuts, Seeds, and Soy
- Meats and Poultry

Dairy Foods

Oils

700   800   900   1000 (1 y)   1000 (2 y)   1200
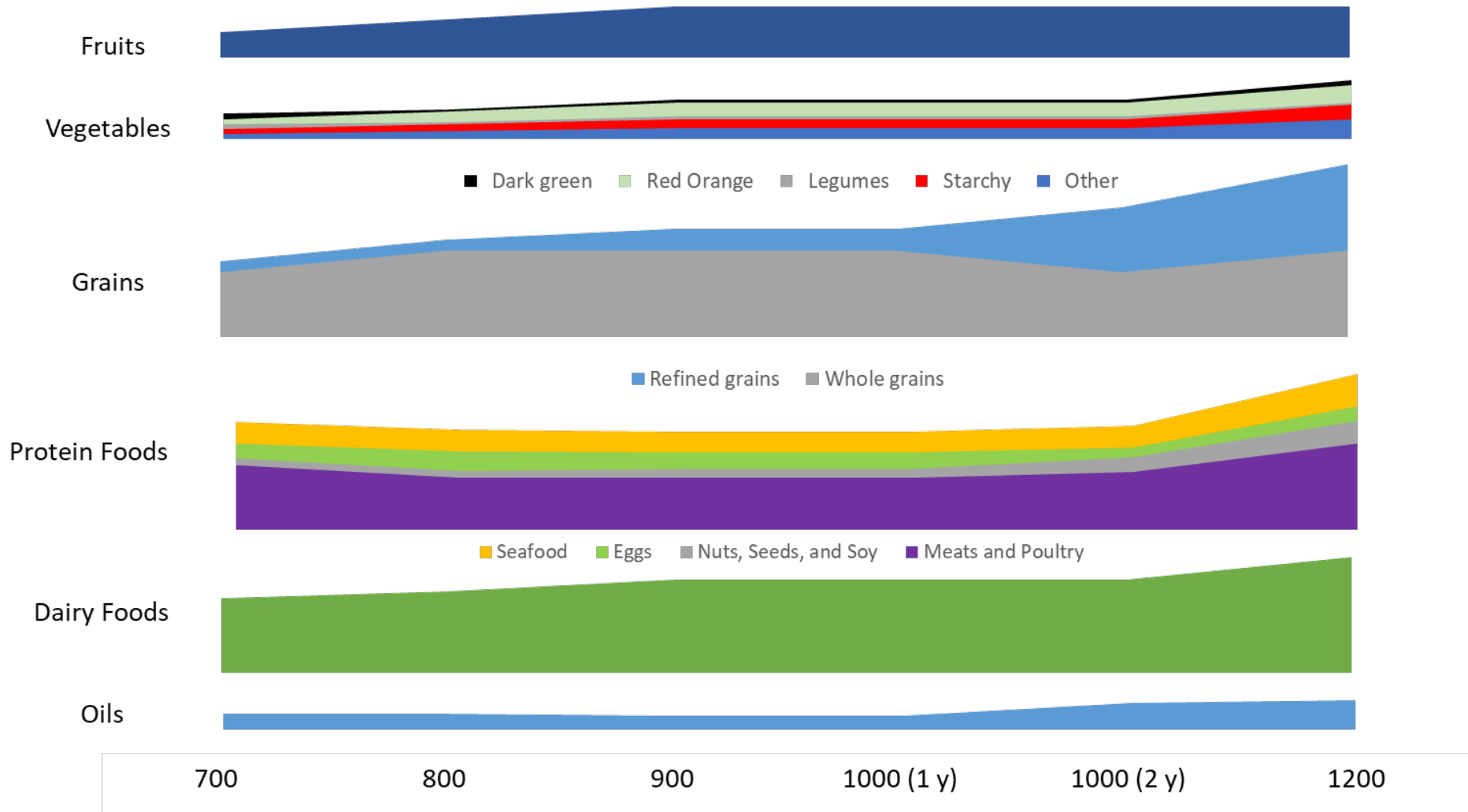
[1] Inclusive of CFB and not human milk or infant formula, modeled complementary food includes fluid milk, calcium fortified soy beverage, and 100% fruit and vegetable juice

Draft Evidence-Based Advice to USDA and HHS: Recommendations for Advice to Caregivers

1. Provide a variety of animal-source foods (meat, poultry, seafood, eggs and dairy), fruits and vegetables, nuts and seeds, and whole grain products, beginning at 6-12 months and continuing thereafter, to provide key nutrients, foster acceptance of a variety of nutritious foods, and build healthy dietary habits.

2. For infants fed human milk at 6-12 months, consider providing iron-fortified infant cereals or similar products to ensure adequate iron intake.

3. Provide good sources of omega-3 and omega-6 fatty acids, such as seafood, beginning at ages 6 to 12 months. To limit exposure to methylmercury for groups at risk, consult the U.S. Food and Drug Administration and the U.S. Environmental Protection Agency guidance regarding the types of seafood to choose.

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4. Introduce peanut products and egg between 6 and 12 months. Be careful to choose forms of peanut that do not present a choking risk. Evidence regarding benefits of introducing other potentially allergenic foods (e.g., tree nuts, shellfish, fish) in the first year of life is limited, but there is no reason to avoid them.

5. For toddlers 12-24 months whose diets do not include meat, poultry, or seafood, provide eggs and dairy products on a regular basis, along with soy products and nuts or seeds, fruits, vegetables, grains, and oils.

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6. Avoid foods and beverages with added sugars during the first 2 years of life.

   - The energy in such products is likely to displace energy from nutrient-dense foods, increasing the risk of nutrient inadequacies.

   - Moreover, consumption of sugar-sweetened beverages is linked with increased risk of overweight or obesity.

   - Because food preferences and patterns are beginning to form during this developmental stage, and taste and flavor preferences appear to be more malleable in this life stage than in older children, it is important that caregivers limit consumption of foods that contain added sugars, while encouraging consumption of nutrient-dense foods.

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SUMMARY:
Draft Evidence-Based Advice to USDA and HHS: Recommendations for Federal Agencies

- Develop communication and dissemination strategies that effectively address common misconceptions about diets for infants and children younger than age 24 months.
  - The importance of carefully choosing CFB may not be fully appreciated by the public. For example, the rhyme that "food before one is just for fun" implies that the only goal during infancy is fostering pleasant eating experiences, and that the nutritional contribution of CFB is not critical.
  - A more appropriate message is that "every bite counts," emphasizing the nutrients of concern for potential inadequacy and excess, while also conveying the need to make eating enjoyable and the importance of responsive feeding practices.

- Consider strategies for assisting caregivers and program managers to use the information about the CFB combinations and patterns described in this chapter.
  - In particular, guidance will be needed on how to operationalize providing the recommended amounts of food groups and subgroups shown in the tables online. This information is provided by energy level, but the energy intake of an infant or toddler is generally unknown by caregivers.

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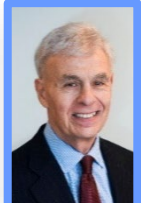
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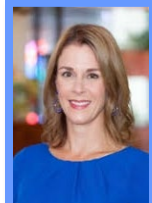
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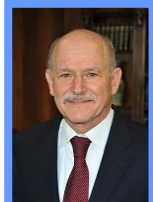
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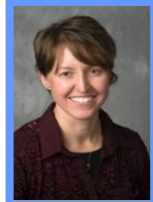**Teresa Davis, PhD**
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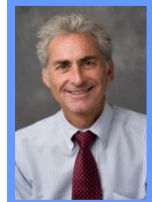University of California-Davis

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