

Evidence-Based Recommendations and Best Practices for Promoting Healthy Eating Behaviors in Children 2 to 8 Years

Healthy
Eating
Research

Technical Report | October 2021



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Expert Panel Members

Jennifer Fisher, PhD, MA, Panel Co-Chair

Professor, Department of Social and Behavioral Sciences
Associate Director, Center for Obesity Research and Education
Temple University
Philadelphia, Pennsylvania

Julie Lumeng, MD, Panel Co-Chair

Professor of Pediatrics, Medical School
Professor of Nutritional Sciences, School of Public Health
University of Michigan
Ann Arbor, Michigan

Alison Tovar, PhD, MPH

Associate Professor, Department of Nutrition & Food Sciences
University of Rhode Island
South Kingston, Rhode Island
Adjunct Associate Professor of Behavioral and Social Sciences,
School of Public Health Brown University
Providence, Rhode Island

Jason A. Mendoza, MD, MPH

Professor of Public Health Sciences, Fred Hutchinson Cancer
Research Center
Professor of Pediatrics, University of Washington School of
Medicine
Investigator, Seattle Children's Research Institute
Seattle, Washington

Jerica Berge, PhD, MPH, LMFT

Professor and Vice Chair, Department of Family Medicine and
Community Health
University of Minnesota Medical School
Minneapolis, Minnesota

Kirsten K. Davison, PhD

Donahue and DiFelice Endowed Chair
Associate Dean for Research
Boston College School of Social Work
Chestnut Hill, Massachusetts

Kyung Rhee, MD, MSc, MA

Professor of Pediatrics, Vice Chair of Equity, Diversity,
and Inclusion
Chief, Division of Child and Community Health
Medical Director, Medical Behavioral Unit, Rady Children's
Hospital of San Diego, Department of Pediatrics
University of California, San Diego
San Diego, California

Lori A. Francis, PhD

Associate Professor, Department of Biobehavioral Health
Penn State University
State College, Pennsylvania

Maureen M. Black, PhD

Professor, Department of Pediatrics
University of Maryland School of Medicine
Baltimore, MD
Distinguished Fellow
RTI International
Research Triangle Park, North Carolina

Monica L. Baskin, PhD

Professor, Division of Preventive Medicine
University of Alabama at Birmingham School of Medicine
Birmingham, Alabama

Rafael Pérez-Escamilla, PhD

Professor of Public Health, Social and Behavioral Sciences
Principal Investigator, Yale-Griffin CDC Prevention Research
Center (PRC)
Director, Office of Public Health Practice
Director, Global Health Concentration
Director, Maternal Child Health Promotion Program
Yale School of Public Health
New Haven, Connecticut

Sarah Bowen, PhD, MS

Professor, Department of Sociology and Anthropology
North Carolina State University
Raleigh, North Carolina

Sheryl O. Hughes, PhD

Associate Professor, Pediatrics-Nutrition
USDA/ARS Children's Nutrition Research Center
Baylor College of Medicine
Houston, Texas

Stephanie Anzman-Frasca, PhD

Associate Professor of Pediatrics
University at Buffalo
Buffalo, New York

Susan L. Johnson, PhD

Section of Nutrition, Department of Pediatrics
University of Colorado Denver, Anschutz Medical Campus
Aurora, CO

Panel Conveners

Mary Story, PhD, RD

Director, Healthy Eating Research
Professor, Global Health and Community and Family Medicine
Associate Director of Education and Training
Duke Global Health Institute
Duke University
Durham, North Carolina

Megan Lott, MPH, RD

Deputy Director, Healthy Eating Research
Duke Global Health Institute
Duke University
Durham, North Carolina

Panel Support

Alissa Smethers, PhD, RD, LDN

Postdoctoral Fellow, Monell Chemical Senses Center
Philadelphia, Pennsylvania

Lindsey Miller, MPH

Research Analyst, Healthy Eating Research
Duke Global Health Institute
Duke University
Durham, North Carolina

Lexi Wang

Graduate Student Worker, Healthy Eating Research
Duke Global Health Institute
Duke University
Durham, North Carolina

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Table of Contents

Introduction	6
Purpose and Aim	6
Rationale and Conceptual Frameworks and Models	7
Building on the Foundations of Responsive Approaches to Feeding Infants and Toddlers	7
Conceptual Model and Frameworks Informing the Expert Panel’s Approach	7
Background: The Typical Development of 2- to 8-Year-Olds	10
Growth Across Domains of Development from Ages 2 to 8 Years	10
Dietary Patterns of Children Ages 2 to 8 Years	12
Development of Food Acceptance during Childhood	15
Development of Healthy Appetites and Growth during Childhood	16
Methodology	18
Expert Panel Methodology	18
Literature Review Methodology	18
Development of Recommendations	18
Key Considerations for Reviewing the Evidence and Developing Recommendations	19
Narrative Review of the Evidence	20
Parenting Styles, Feeding Styles, and Food Parenting Practices	20
Fathers, Other Caregivers, and the Family System	21
Promoting Food Acceptance	22
Promoting Healthy Appetites and Growth	24
Evidence-Based Recommendations	27
Recommendations for Promoting Acceptance of Healthful Foods	28
Recommendations for Promoting Healthy Appetites and Growth	29
Implementation Considerations	30
Family Economics	31
Early Care and Education Programs	31
National School Meal Programs	32
Health Care System	33
Food and Nutrition Assistance Programs	34
Food and Beverage Marketing Targeting Children	34
Priorities for Future Research	35
Research Needs on the Development of Food Acceptance during Childhood	35
Research Needs on the Development of Healthy Appetites and Growth during Childhood	35
Conclusion	37
Appendices	38
References	49

Definitions

Appetite:¹ Appetite is defined as an instinctive or natural desire to eat and is described by hunger, satiation, and satiety. Hunger refers to biological cues and underlying processes that lead to the initiation of eating, whereas satiation refers to cues and processes that bring an eating episode to an end, and satiety refers to cues and processes that inhibit further eating until hunger returns.

Caregiver:² A person who provides direct care to a child with activities of daily living. Caregivers (e.g., parents, grandparents, guardians, childcare providers) have the capacity to influence the development of healthy eating behaviors among children 2 to 8 years by shaping the physical and social environments in which eating occurs, by serving as social role models that children learn to emulate, and by using food parenting practices to guide and socialize children's experiences related to eating.

Feeding styles:³ Feeding styles represent the application of parenting styles to feeding practices and are defined as the broad approach used by caregivers during eating episodes, including the emotional climate. Like parenting styles, feeding styles are characterized in terms of demandingness and responsiveness. Demandingness refers to how much the parent encourages or controls eating, and responsiveness refers to how parents respond to the child's cues and needs to encourage eating and support children's developing autonomy.

- **Authoritative:**⁴ Authoritative parenting styles provide reasonable expectations for their child, set limits, foster child autonomy, respect the child's opinion, provide warmth, and exhibit both high responsiveness/warmth and high demandingness/control. Authoritative feeding styles actively encourage child eating using non-directive behaviors and are responsive to the child's eating cues and needs for autonomy.
- **Authoritarian:**⁴ Authoritarian parenting styles employ power-assertive behaviors with their child and are generally unresponsive to the child's needs. Authoritarian feeding styles use highly directive behaviors to influence eating in an unsupportive way and are not responsive to the child's eating cues and needs for autonomy.
- **Indulgent:**⁴ Indulgent parenting styles display warmth and acceptance, but lack the necessary monitoring behaviors needed for children's developing autonomy. Indulgent feeding styles make few demands on the child to eat, but are responsive to the child's eating cues and needs for autonomy.
- **Uninvolved:**⁴ Uninvolved parenting styles are not appreciably interactive and make few demands on children. Uninvolved feeding styles make few demands on the child to eat and are not responsive to children's eating cues and needs for autonomy.

Food acceptance:⁵ The level of liking of a particular food. The biology of taste provides a foundational guide for food acceptance (e.g., easily accepting sweet tastes and rejecting bitter tastes), while children's experiences and learning

in the early eating environment shapes subsequent food acceptance development.

Food neophobia:⁶ A tendency to avoid or refuse new or unfamiliar foods. Food neophobia is a developmentally appropriate reaction for young children that generally resolves with repeated exposure.

Food parenting practices:⁷ The intentional (i.e., goal-oriented) or unintentional behaviors and actions performed by a parent that influences their child's behaviors and actions. Food parenting practices are thought to reflect three higher order dimensions:

- **Structure:**⁷ The organization of children's environments to facilitate children's competence to engage in healthy behaviors and avoid unhealthy behaviors, such as creating meal- and snack-time routines for a child, and providing consistency in the atmosphere and the amounts and types of foods available.
- **Autonomy support:**⁷ Supporting the child's developing psychological autonomy (e.g., giving choices) and independence by supporting of the child's self-feeding skills, engagement with food, choice and preferences, and nutritional knowledge.
- **Coercive control:**⁷ Parents' pressure, intrusiveness, and dominance in relation to children's feelings, thoughts, and behaviors.

Healthy growth:⁸ Physical growth rates vary by age and with changes in children's energy and nutrient needs. Growth is assessed by comparing a child's weight and/or height to established norms. The Centers for Disease Control and Prevention provide age- and sex-specific growth charts for evaluating growth of children aged 2 to 8 years and include indices of weight-for-age, stature-for-age, and body mass index-for-age. Healthy patterns of growth show a consistent trajectory over time. Any major shifts in growth patterns indicate the need for further assessment.

Parenting styles:⁷ A constellation of parental attitudes and beliefs toward child rearing, which create an emotional climate through which parental practices are expressed, including the quality of parent-child interactions. Parenting styles reflect the intersection of two independent dimensions—demandingness (i.e., expectations for self-control, limit setting) and responsiveness (i.e., sensitivity or nurturing). There are four types of parenting styles: (1) authoritative (high demandingness, high responsiveness); (2) authoritarian (high demandingness, low responsiveness); (3) indulgent/permissive (low demandingness, high responsiveness); and (4) uninvolved/neglectful (low demandingness, low responsiveness).

Picky eating:⁶ Characterized by consuming a limited type and amount of foods, unwillingness to try new foods, and rejecting foods based on certain sensory characteristics or textures.

Introduction

Childhood is a period of tremendous cognitive, socio-emotional, and physical development. Nutrition plays a vital role in growth, development, and overall health, as well as in the prevention of obesity and other lifelong, diet-related chronic diseases.⁹ Childhood is also recognized as a critical period for the development of eating behaviors and habits that reflect a complex interplay of biological predispositions for taste preferences and early experiences and learning in diverse environments, which ultimately serve as a child's general orientation to eating.^{10,11}

The home is the first fundamental food and eating environment in which a child's eating habits emerge and it remains a critical environment throughout childhood. Research conducted over the past four decades has highlighted the powerful role parents play in shaping the family food environment, both by providing a model of eating behavior that children learn to emulate and by shaping a variety of interactions through which eating behaviors are socialized.¹²⁻¹⁴ Children's early experiences and learning about foods and eating are also shaped by diverse interactions outside the home, including with other caregivers and peers, such as in early care and education and eventually school and after-school settings. These interactions expose children to a wide range of eating environments and social influences. Thus, all caregivers who routinely care for and feed children have the capacity to influence the development of healthy eating behaviors.

Data from the 2017-2018 National Health and Nutrition Examination Survey indicate that U.S. children 2 to 5 years of age consume approximately 75 percent of daily energy intake at home highlighting the important role of parents in shaping the early development of children's eating behaviors.¹⁵ However, approximately 60 percent of U.S. children under the age of 5 are in a non-parental childcare arrangement. Further, by the time children reach school age, somewhere between 33 and 38 percent of daily energy intake occurs *outside* the home. These trends underscore that children's eating occurs and is shaped by caregiving and food environments in a variety of settings, including home, childcare, school, and other places where children spend a large portion of their time and eating occurs such as homes of relatives or friends.

This report presents evidence-based recommendations for promoting healthy eating behaviors in children aged 2 to 8. Recommendations reflect expert consensus on current scientific knowledge in two broad areas: (1) promoting acceptance of healthful foods; and (2) promoting healthy appetites and growth. Research on the development of children's eating behaviors is relatively new, but rapidly evolving. The recommendations in this report were developed through a review of scientific research and consensus of a panel of national experts with diverse expertise in nutrition, pediatrics, psychology, child development, and sociology.

Purpose and Aim

The Dietary Guidelines for Americans, revised every five years, provide evidence-based recommendations about what foods and beverages to consume, and in what amounts, to promote health, prevent disease, and meet nutrients needs across the lifespan. However, the DGAs have not provided science-based advice or detailed recommendations on how to feed children. Guidance on both *what* and *how* to feed children is critical for the development of healthy eating behaviors, food acceptance, and achieving a healthy weight.

To address this critical information gap, Healthy Eating Research convened a national panel of experts to develop evidence-based recommendations and best practices for promoting healthy nutrition and eating behaviors in typically developing children from 2 to 8 years of age.

Recommendations reflect extensive basic and applied research expertise of panel members on topics including children's food preferences and eating behaviors, parenting styles, feeding styles, food parenting practices, settings where children receive care, child obesity, and cultural and socioeconomic influences.¹⁶

This report includes the following nine sections:

1. Introduction to children's eating behaviors;
2. Rationale for developing recommendations and presentation of conceptual frameworks and models that informed this work;
3. Background on the typical development of 2- to 8-year-olds, including growth and dietary patterns, and the development of food acceptance and healthy appetites and growth;
4. Methodology used to develop these recommendations;
5. Review of the evidence considered;
6. Recommendations for promoting food acceptance and healthy appetites and growth;
7. Considerations for implementing the recommendations;
8. Future research needs; and
9. Conclusions.

Rationale and Conceptual Frameworks and Models

Building on the Foundations of Responsive Approaches to Feeding Infants and Toddlers

A child's first 1,000 days (conception through 24 months of age) is a dynamic period for the development of feeding skills, food acceptance patterns, and growth. While preferences for the basic tastes (i.e., sweet, salty, sour, bitter, umami) are biologically determined, preferences for foods must be learned and are acquired through experiences shaped by caregiving. In 2017, Healthy Eating Research, a national program of the Robert Wood Johnson Foundation, released "Feeding Guidelines for Infants and Young Toddlers: A Responsive Parenting Approach"¹⁷ with the goal of empowering caregivers to promote optimal nutrition and development by offering healthier food and beverage options in response to child hunger and satiety cues. A diverse panel of experts was brought together to synthesize the scientific literature and develop evidence-based feeding guidelines for caregivers that focused on *what* and *how* to feed infants and toddlers. That panel also aimed to inform inclusion of dietary guidance for children under 2 years of age in the U.S. Dietary Guidelines for Americans (DGA); the DGA included recommendations for this age group for the first time in the 2020-2025 edition.¹⁸

Responsive feeding approaches are characterized by emotional support and the provision of developmentally appropriate foods, eating environments, and responses to child hunger and fullness cues.^{17,19} The 2017 report concluded that principles of responsive feeding associated with healthy eating are critical for fostering optimal child development and growth and foundational for food acceptance. Guidelines were developed separately for infants and toddlers and covered a broad range of feeding aspects, including what to feed, interpretation of hunger and fullness cues, how to introduce new foods, and

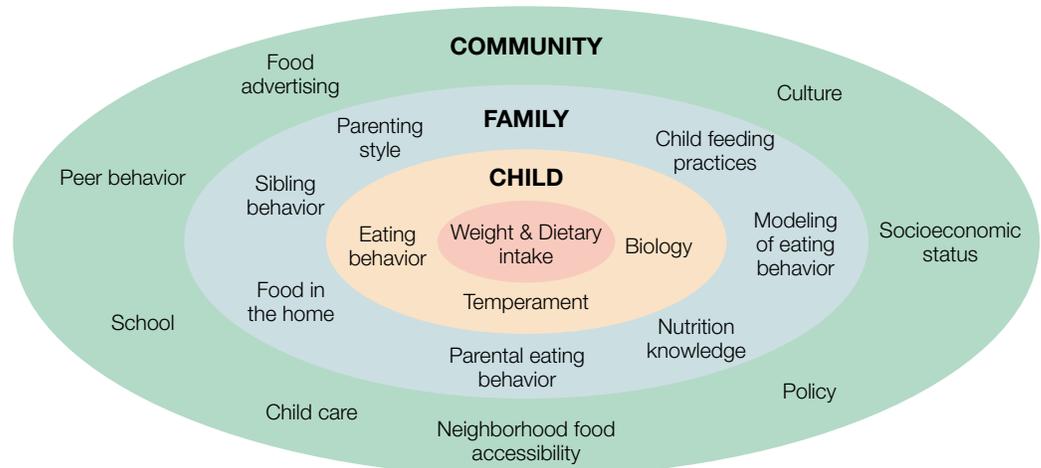
responsive feeding and sleeping routines. Economic and social determinants of health, including income, education, and home environments and resources were highlighted as important considerations for understanding and implementing responsive feeding. The recommendations presented in this report build on the foundations of those guidelines and focus on promoting healthy eating behaviors in children 2 to 8 years old.

Conceptual Model and Frameworks Informing the Expert Panel's Approach

The expert panel's identification of key elements necessary for promoting children's healthy eating behaviors is informed by the socioecological model of children's weight and dietary intake shown in **Figure 1**. The model is adapted from prior work focused on child obesity,^{20,21} and highlights the multiple levels of influence ranging from biology to culture.

Frameworks for parenting and feeding styles and for food parenting practices guided the panel's conceptualization of healthy eating and illustrated the role of caregivers. The literature on children's healthy eating and obesity prevention has traditionally included a substantial focus on the proximal influence of parents as key agents of change in shaping children's eating behaviors and weight gain. But to more fully examine how parents influence children's eating habits, it is necessary to understand the difference between the concepts of parenting, parenting styles, feeding styles, and food parenting practices. "Parenting" is the term generally used to explain how a parent influences a child's behaviors and development, whereas "*parenting style*" is a constellation of parental attitudes and beliefs toward child rearing, which create an emotional climate through which parental practices are expressed.²² Parenting styles are characterized in terms of demandingness (i.e., expectations for self-control, limit

Figure 1. Socioecological Model of Children's Weight and Dietary Intake



setting) and responsiveness (i.e., sensitivity or nurturing). These dimensions are used to describe four types of parenting styles: (1) authoritative; (2) authoritarian; (3) permissive/indulgent; and (4) uninvolved/neglectful (**Table 1**).

This framework of general parenting style, developed in the late 1960's by Diana Baumrind,²³ began to be applied to *feeding styles* in the mid-2000's.²⁴ "Feeding styles" are the broad approach that parents take to feed children, and the emotional climate in which feeding occurs. Similar to parenting styles, feeding styles are generally conceptualized as consisting of two dimensions: (1) demandingness, which refers to *how much* the parent encourages or controls eating (e.g., limit setting, rules, expectations), and (2) responsiveness, which refers to *how* parents respond to the child's cues and needs to encourage eating and support children's developing autonomy. There are also four types of feeding styles (**Table 2**).

In contrast to parenting and feeding styles, *food parenting practices* are specific goal-directed parent actions or behaviors designed to influence children's eating behaviors.²² Research on food parenting practices, primarily led by Leann Birch, began to receive increasing attention in the scientific literature in the 1990's.²⁵ Food parenting practices are conceptualized to be relatively more amenable to change than parenting styles and therefore are often targets of interventions that aim to influence children's eating behaviors.

The most contemporary conceptualization of food parenting is represented in a model set forth by Vaughn et al.,⁷ which provides the framework for food parenting used in this report (**Figure 2**). Many different types of food parenting practices have been identified and are broadly described in three dimensions: coercive control, structure, and support for child autonomy (**Table 3**). Food parenting practices reflecting *coercive control*, such as intrusiveness and pressure, are thought to be counterproductive to the development of

Figure 2. Conceptualization of Food Parenting (Vaughn et al, *Nutrition Reviews*, 2016)

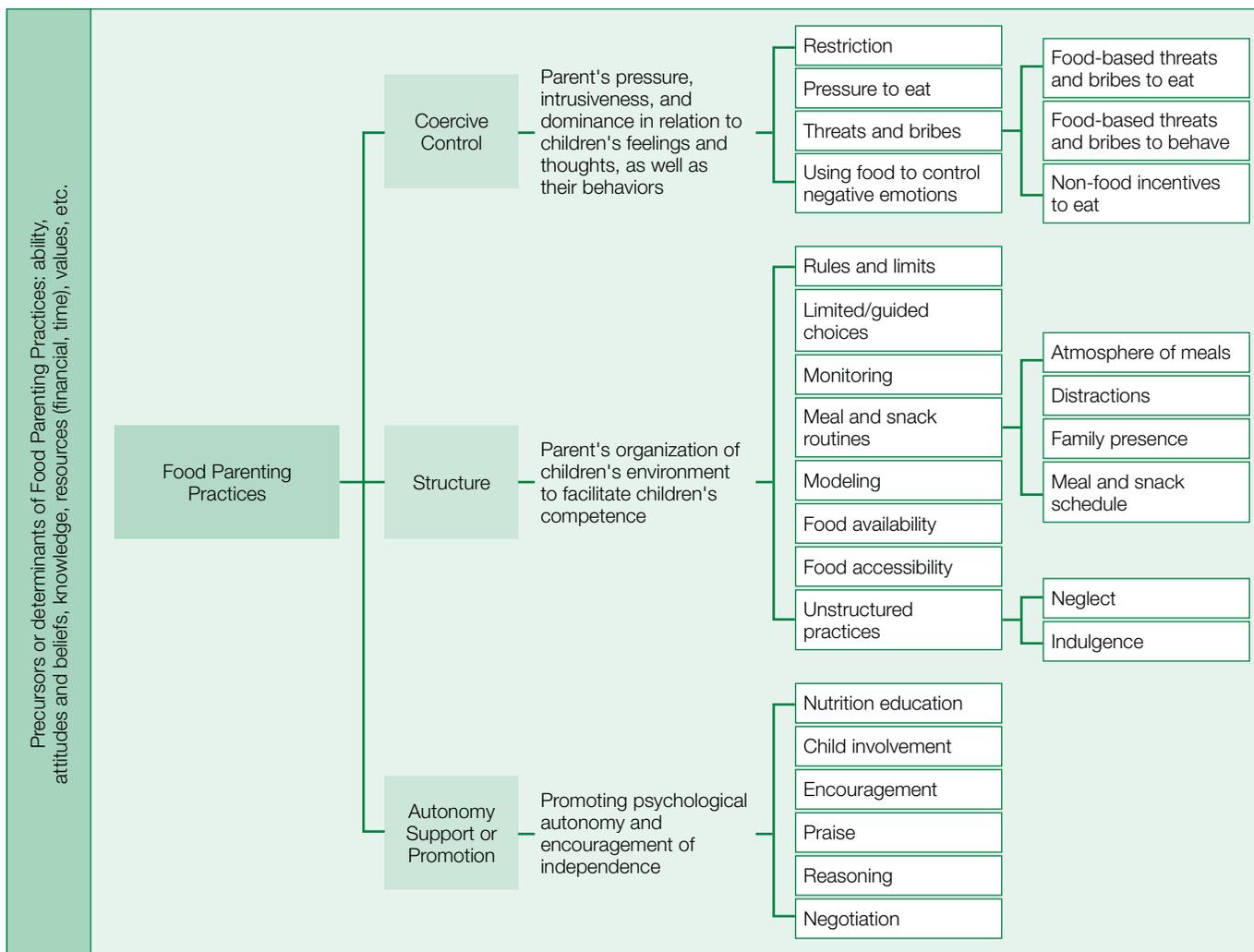


Table 1. Parenting Styles

Parenting Styles	Dimensions		Characteristics
	Demandingness	Responsiveness	
Authoritative	High	High	Nurturing, affectionate, non-punitive, discipline through guidance, open communication
Authoritarian	High	Low	Strict, inflexible, high expectations, high supervision, obedience
Permissive	Low	High	Nurturing, affectionate, few or inconsistent boundaries
Uninvolved	Low	Low	Emotionally detached, inconsistent boundaries

Table 2. Feeding Styles

Feeding Styles	Dimensions		Characteristics
	Demandingness	Responsiveness	
Authoritative	High	High	Parental involvement, nurturance, reasoning, and structure during feeding
Authoritarian	High	Low	Restrictive, punitive, rejecting, and power-assertive behaviors during feeding
Indulgent	Low	High	Warmth and acceptance in conjunction with a lack of monitoring of the child's eating behaviors
Uninvolved	Low	Low	Little control and involvement with the child during eating episodes

Table 3. Food Parenting Practices

Food Parenting Dimensions	Definition	Examples
Coercive Control	Parental pressure, intrusiveness, and dominance in relation to children's feelings, thoughts, and behaviors	Restriction, pressure to eat, threats and bribes, using food to control negative emotions
Structure	Parents' organization of children's environment to facilitate children's competence in engaging in healthy behaviors and avoiding unhealthy behaviors	Rules and limits, limited/guided choices, monitoring, routines, modeling, food availability, accessibility, and preparation
Autonomy support or promotion	Promoting psychological autonomy and encouragement of child's independence	Nutrition education, child involvement, encouragement, praise, reasoning, negotiation

healthful eating behaviors. Alternatively, practices providing *structure* are believed to promote healthful eating behaviors and discourage unhealthy behaviors by organizing the environment to facilitate these outcomes. Similarly, practices that *support children's autonomy* are believed to support healthy eating behaviors by providing encouragement and support of independence and internalization of healthful behaviors.

Different food parenting practices have different effects at different ages. For example, among children 7 and older, structured guidance/rule-making is more effective in preventing unhealthy eating, while for children 6 and younger, rewarding with verbal praise is more effective in promoting healthy eating and in preventing unhealthy eating.^{26,27} While most of the literature on food parenting practices has focused on controlling practices, including restriction, monitoring, and pressure to eat,²⁸ there are a growing number of studies assessing how practices focused on structure and autonomy support impact dietary behaviors and weight status.

Background: The Typical Development of 2- to 8-Year-Olds

Growth Across Domains of Development from Ages 2 to 8 Years

It is important to recognize that the development of children's eating behaviors is largely dependent upon overall child development, traditionally defined in four major domains: motor, cognitive, language, and social/emotional. Despite great variation in development across these domains between individual children, key developmental milestones can be tied to certain age ranges. The panel applied established evidence on the stages of child development to identify key milestones in the development of children's eating behaviors.²⁹ A general overview of typical development and how each may relate to eating behavior is provided in **Table 4**. Gross motor development has been omitted given it is less related to eating behavior; instead, more detail has been included on fine-motor and oral-motor development.

Table 4. Growth Across Domains of Development

<p>Motor Development</p>	<p>Between ages 2 and 3 years, children can eat without assistance. They can use a spoon to scoop food and a fork to stab food (though they may not always successfully get the food to their mouths). Children can use straws effectively, but are just beginning to use an open-mouthed cup independently. Children are able to chew with a closed mouth and can manage more textured foods like raw vegetables and meat. By this age, children have acquired molars, and are learning to chew and grind with their molars efficiently.</p> <p>Between ages 4 and 5 years, children can spread and cut with a knife. They can drink from an open-mouthed cup without assistance and without spilling.</p> <p>Between ages 5 and 8 years, children can use a fork and knife together to cut food and are able to use cutlery without being too messy.</p>
<p>Cognitive Development</p>	<p>Between ages 2 and 3 years, children can match and sort by shape and color (e.g., separate the green spherical peas from the orange cubed carrots). They understand the concept of "two" (e.g., "you can have two cookies") and the idea of counting. They know common colors (e.g., tomatoes are red, bananas are yellow). Children this age begin to be able to bargain.</p> <p>By age 4 years, children understand the concepts of "same" and "different" (e.g., "that is the same peanut butter that we eat at home"). Children this age begin to understand time (e.g., "snack time is in one hour," "you can have that candy tomorrow").</p> <p>By age 5 years, children can count ten or more items (e.g., "you can get yourself 10 crackers") and understand consecutive concepts (big, bigger, biggest). Children this age are aware of rules and will test boundaries by arguing the rules.</p> <p>Between ages 5 and 8 years, children begin to better understand others' perspectives, and that other people can have different opinions from their own. They begin to understand that objects can be categorized in different ways (e.g., vegetables vs. fruits; or as organic vs. not). Children this age can imagine the consequences of something happening without it actually happening (e.g., "What will happen if we leave the casserole in the oven too long?").</p>

Language Development

Between ages **2 and 3 years**, children can follow simple and familiar 2-step instructions (e.g., “Sit down and eat your cereal.”). They can discern affect and meaning based on the speaker’s tone of voice (e.g., a stern, “Eat your crackers,” versus an inviting, “Eat your crackers”). Children this age are only just beginning to be able to take conversational turns and are typically speaking in 2- to 3-word sentences (e.g., “I want cookie”), but much detail is lacking.

By **age 4 years**, children know names for groups or categories (e.g., apples and oranges are both fruit), which has implications for teaching about healthy eating. They can express themselves using words like “because” or “if” (e.g., “I don’t like this food *because* it has spots on it.”) Children ask more “why” questions (e.g., “Why do I need to eat this?”), and their questions will become more abstract and complex (e.g., “If I eat this, can I have ice cream?”). By age 4 years, children are also able to understand and use words to express emotions (e.g., “I am scared to eat that.”)

By **age 5 years**, children can proficiently talk about events that have happened in the past or will happen in the future, can follow directions with more than one step, and can engage more effectively in a conversation by taking turns. Therefore, children are able to begin to describe what they ate at a friend’s house or at preschool earlier that day, can request foods that they had at grandma’s house last week, and can ask about going out for ice cream later that day. When parents deliver prompts to children to eat, the prompts may become more complex with multiple steps as children better understand these multi-step instructions (e.g., “you need to eat your carrots and drink your milk before you can leave the table”). Children’s greater sophistication in conversations can contribute to lengthier negotiations in response to a command to eat their vegetables—instead of simply responding, “No,” or, “I don’t want to,” the child can now effectively engage in a multi-step, back-and-forth discussion with the parent. Children have also learned that using less direct language can be more effective in getting what they want—instead of saying, “I want that cookie,” the child has learned that saying, “Those cookies smell good. Could I have one?” is likely to be more effective.

Between **5 and 8 years**, children develop the ability to read, and therefore the ability to take in more written information about food (i.e., reading menus or food packages, and therefore also being newly influenced by written advertising).

Social/Emotional Development

Between ages **2 and 3 years**, children will become increasingly interested in modeling the behavior of others (i.e., eating like others eat). They tend to like routines and may become upset when routines are disrupted (e.g., when a snack is not offered at the usual time). Children are developing the ability to employ self-regulation strategies learned from previous experiences (e.g., distracting themselves while waiting for a snack). Children can begin to remember rules and can wait for a toy or a treat for about a minute and focus attention for about a minute. Children this age begin to understand that others can think and believe different things than they do (e.g., that when a parent thinks the soup is delicious, the soup may or may not be delicious in the child’s own opinion).

By **age 4 years**, children can understand and relate to how others are feeling (e.g., recognize that one child is excited, and another child is sad that the birthday cake has fruit in it). By this age, children may begin feeling generous and share food with friends, and they more readily express their likes and dislikes (e.g., “She likes peas. I don’t like peas.”). Children this age prefer to play with other children and may be increasingly influenced by peer behaviors (e.g., the food preferences of preschool peers may particularly influence their food choices). At this age, children still cannot differentiate between real and make believe (and may therefore be easily influenced by food advertising delivered by favorite characters). At this age, children typically can focus their attention for about 5 to 15 minutes. They can also describe ways to cope with anger or sadness.

By **age 5 years**, children can use words to describe more complex emotions (e.g., “I’m jealous she has pizza.”). Children this age are better at managing strong emotions, and less likely to have tantrums. They are also better able to hide the truth (e.g., “I ate the broccoli,” even when it is in a napkin in their pocket). At this age, children become more adept at apologizing for inadvertent mistakes (i.e., “I’m sorry I spilled my milk.”).

Between ages **5 and 8 years**, children increasingly want to be liked and please their friends (and may therefore become increasingly influenced by the eating behaviors of peers). They are spending more time with peers who have a growing influence on eating behavior. Children this age tend to test boundaries, but are generally still eager to please and begin to experience embarrassment (i.e., sneaking a cookie, and then being embarrassed when they are found out). At this age, children are often able to disguise emotions when they are upset (e.g., pretend to like the dinner served at a friend’s house).

Dietary Patterns of Children Ages 2 to 8 Years

The food and beverages children consume have a profound influence on their health and development. Because children do not consume nutrients in isolation, it is important to look at dietary patterns—the combinations of foods consumed over time. A healthy dietary pattern is needed for children to meet nutrient and energy needs and to support healthy weight and prevention of chronic disease. Establishing a healthy dietary pattern early in life is critical in order to lay the foundation for healthy dietary patterns that continue across the lifespan. **Table 5** outlines healthy dietary patterns for males and females 2 to 8 years of age. Goals for food group intakes are based on calorie needs, which vary by age, sex, height, weight, and activity level; this is why ranges of intake are listed for each food group.

The *2020-2025 Dietary Guidelines for Americans* (DGA)¹⁸ defines a healthy U.S.-style dietary pattern as including: (1) vegetables of all types—dark green, red, and orange; beans, peas, and lentils; starchy; and other vegetables; (2) fruits, especially whole fruit; (3) grains, at least half of which are whole grains; (4) dairy, including fat-free or low-fat milk, yogurt, and cheese, and/or lactose-free versions and fortified soy beverages and yogurt as alternatives; (5) protein foods, including lean or low-fat meats and poultry, eggs, seafood, beans, peas, lentils, nuts, seeds, and soy products; and (6) oils, including vegetable oils and oils in foods, such as seafood and nuts. Foods in such healthy dietary patterns are assumed to be in nutrient-dense forms and prepared with minimal added saturated fat, added sugars, refined starches, or sodium (salt).

The current dietary patterns of children aged 2 to 8 years do not align with the recommendations put forth by the *2020-2025 DGA*.¹⁸ For example, by 2 years of age, a child is more likely to eat processed foods high in sodium and added sugar than fruits or vegetables on any given day.³⁰ The Healthy Eating Index (HEI) score, a diet quality measure that assesses how well dietary intakes align with the *Dietary Guidelines for Americans*, highlights the need for dietary improvements in children across all developmental periods. In children 2 to 8 years of age, the average HEI scores range from a low of 55 (ages 5-8) to a high of 61 (ages 2-4) on a scale of 0 to 100, indicating that overall children’s diet quality is poor.¹⁸

Figure 3 illustrates the percentage of U.S. children ages 2 to 3 and 4 to 8 who are below, at, or above dietary goals for food group intakes. Fifty to sixty percent of these children meet intake recommendations for fruit, but less than 15 percent and 7 percent do so for vegetables and whole grains, respectively. Fifty-one percent of 2- to 3-year-old children meet recommendations for dairy intake, but this number drops to 27 percent among 4- to 8-year-old children. Seventy-two percent of 2- to 3-year-olds and 63 percent of 4- to 8-year-olds meet recommendations for protein foods.³¹ These less-than-

Table 5. Recommended Intakes

Age	2-4 Years		5-8 Years	
	Males	Females	Males	Females
Energy (kcal) ^a	1,000-1,600	1,000-1,400	1,200-2,000	1,200-1,800
Food Group Servings				
Vegetables (cup eq/day)	1.0-2.0	1.0-1.5	1.5-2.5	1.5-2.5
Fruits (cup eq/day)	1.0-1.5	1.0-1.5	1.0-2.0	1.0-1.5
Whole Grains (ounce eq/day)	1.5-3.0	1.5-2.5	2-3	2-3
Dairy (cup eq/day)	2.0-2.5	2.0-2.5	2.5	2.5
Protein Foods (ounce eq/day)	2-5	2-4	3-5.5	3-5
Oils (g/day)	15-22	15-17	17-24	17-22
Dietary Components to Limit				
Saturated Fat (% of total calories not to exceed)	10		10	
Added Sugars (% of total calories not to exceed)	10		10	
Sodium (mg/day) ^b	1,200 (age 2-3) 1,500 (age 4)		1,500	

Acronyms and abbreviations: EER = estimated energy requirement; eq = cup-equivalents; kcal = kilocalories; mg = milligrams

Footnotes:

a = Energy needs vary based on many factors, including age, sex, height, weight, and activity level. To estimate specific energy needs for an individual, please refer to the DRI Calculator for Healthcare Professionals, available at nal.usda.gov/fnic/dri-calculator.

b = Recommendation is to reduce intakes if above these values, which are the Chronic Disease Risk Reduction Intakes established by the National Academies of Sciences, Engineering, and Medicine in the DRIs for Sodium and Potassium, published by the National Academies Press in 2019.

Source: Dietary Guidelines for Americans, 2020-2025. Table 3-1: Healthy U.S.-Style Dietary Pattern for Children Ages 2 Through 8, With Daily or Weekly Amounts From Food Groups, Subgroups, and Components, page 74

Figure 3. Dietary Intakes Compared to Recommendations: Percent of US Children Who Are Below, At, or Above Each Dietary Goal or Limit

Figure 3a. Ages 2-3

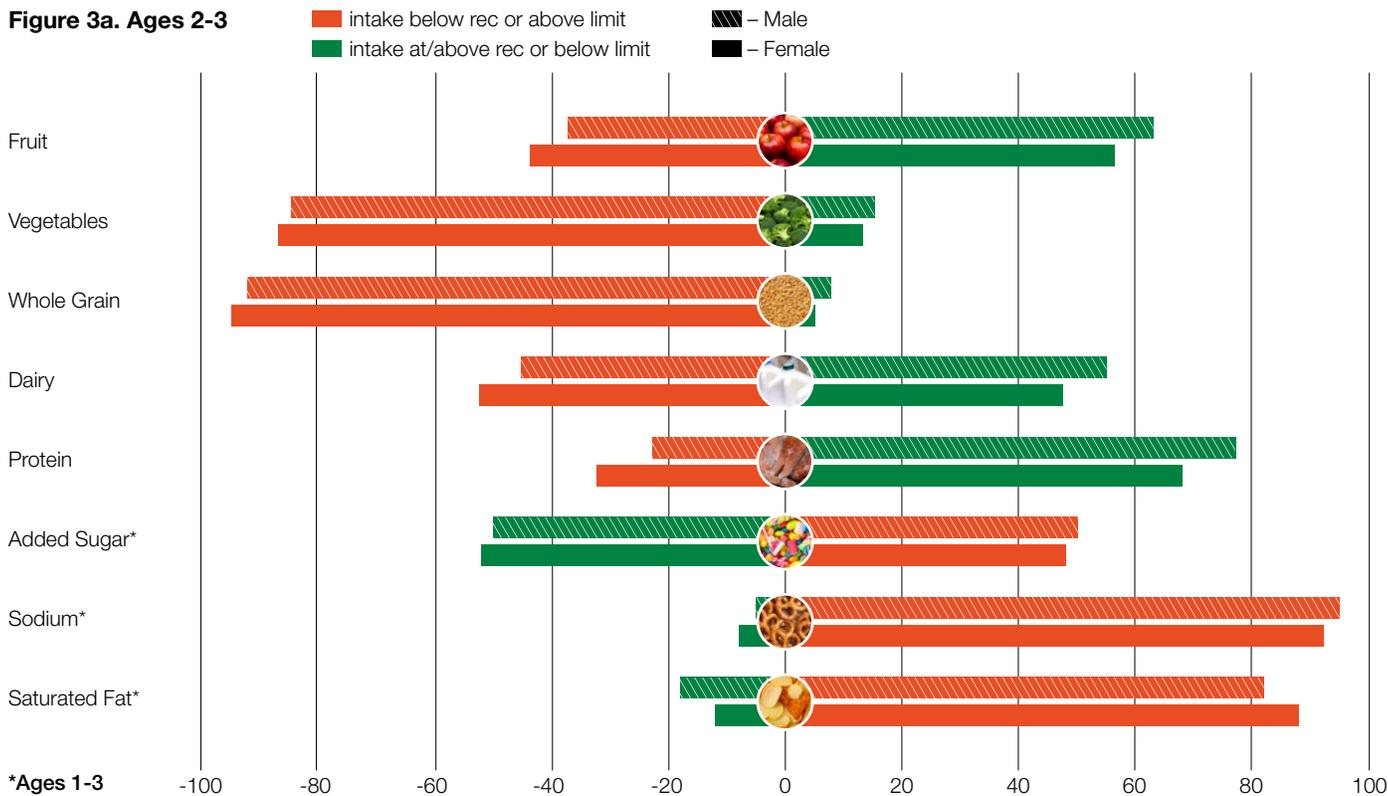
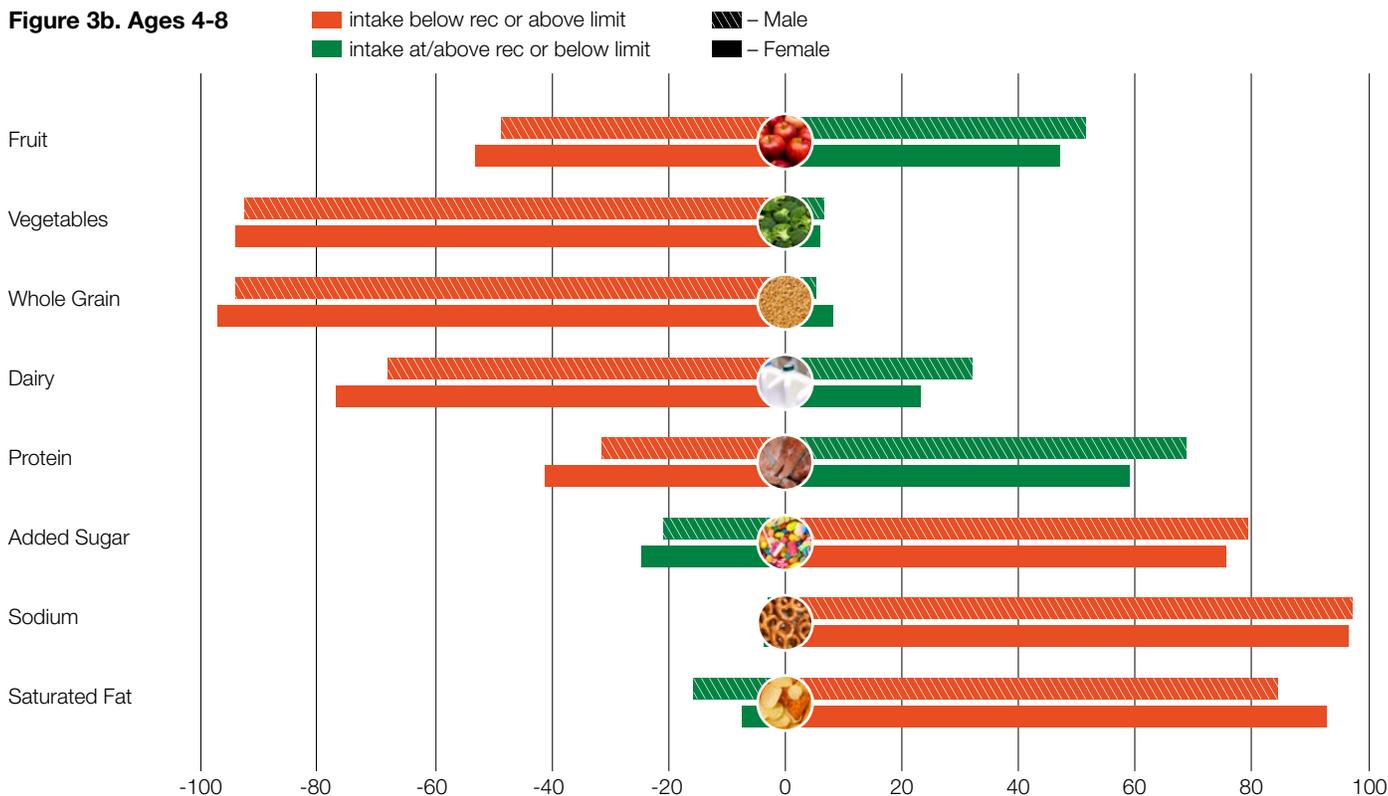


Figure 3b. Ages 4-8



optimal intake patterns are related to inadequate intakes of nutrients such as calcium, potassium, vitamin D, and fiber that are important for children’s growth and development. Because of documented disparities in diet quality by race, ethnicity, income, and education, some children are at a higher risk of consuming a poor-quality diet.^{31,32}

Additionally, the DGAs recommend that children limit intakes of added sugar as well as saturated fat to less than 10 percent of daily energy, and to reduce intakes of sodium that are above 1,200 mg/day (ages 2-3) or 1,500 mg/day (ages 4-8). Only about half of younger (ages 1-3) and close to one-quarter of older (ages 4-8) children meet the recommendation for added sugar,³¹ and about 15 percent (ages 1-3) and 12 percent (ages 4-8) of children meet the recommendation for saturated fat.³³ Only about 6 percent of children ages 1-3 and 4 percent of children ages 4 to 8 meet sodium recommendations.³⁴

With regard to the context of young children’s nutrient intakes, almost one-third of daily calories (29% for males and 28% for females) for children 2 to 5 years old are contributed by foods and beverages consumed during snacks. Among children 6 to 11 years of age, approximately one-quarter of daily calories (26% for males and 24% for females), are contributed by foods and beverages consumed during snacks.³⁵ This is not surprising given that among children ages 2 to 5, 52 percent of males and 45 percent of females consume 3 to 4 snacks per day, and among children ages 6 to 11, 41 percent of males and 38 percent of females consume 3 to 4 snacks per day (**Figures 4a and 4b**).³⁵

It is also noteworthy that a considerable portion of young children’s daily calories are contributed by foods and beverages consumed away from home. Among children 2 to 5 years of age, 25 percent and 27 percent of calories consumed by males and females, respectively, are contributed by these foods. Among children 6 to 11 years of age, 33 percent and 38 percent of calories consumed by males and females, respectively, are from foods and beverages consumed away from home.³⁶

Childhood obesity has been a significant health problem for the past 30 years and is undoubtedly related to children’s poor dietary patterns. According to the National Health and Nutrition Examination Survey,³² between 1999-2000 and 2017-2018 prevalence of obesity has plateaued among children younger than 2 years of age at about 9 percent and at about 14 percent for children 2 to 5 years of age. In contrast, prevalence of obesity has increased during this time among children ages 6 to 19 years. Between 1999-2002 and 2015-2018, the prevalence of obesity among children aged 6 to 11 years increased from nearly 16 percent to more than 19 percent, and youth aged 12 to 19 years experienced an increase from 16 percent to nearly 21 percent. Early data from 2020 are showing further increases in child overweight and obesity during the COVID-19 pandemic, with the greatest changes being among children ages 5 to 11.³⁷

Figure 4a. Distribution of Snack Occasions for Males and Females 2-5 Years of Age

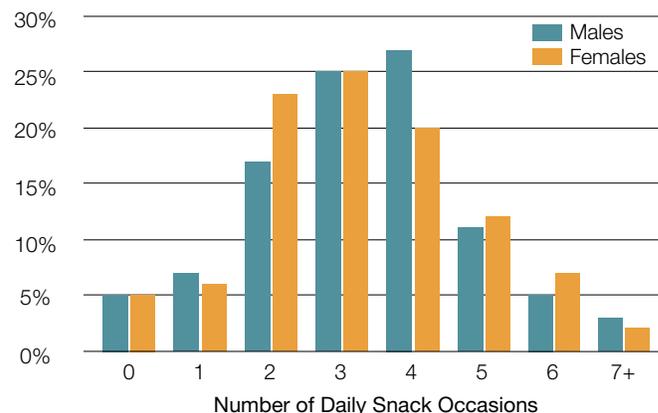
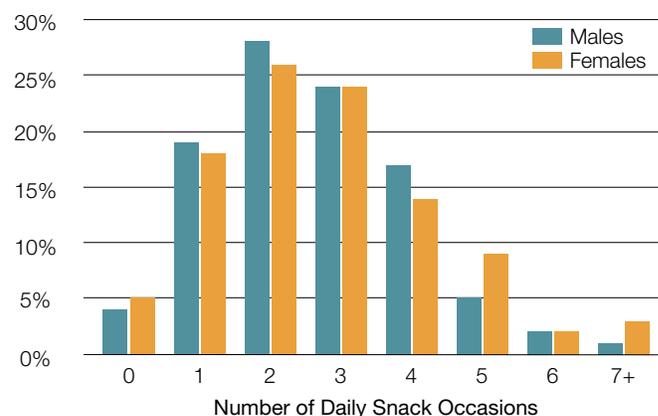


Figure 4b. Distribution of Snack Occasions for Males and Females 6-11 Years of Age



Source: U.S. Department of Agriculture ARS. Snacks: Percentages of Selected Nutrients Contributed by Food and Beverages Consumed at Snack Occasions, by Gender and Age, What We Eat in America, NHANES 2017-2018. 2020. (https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/1718/Table_29_DSO_GEN_17.pdf).

Rates of obesity among children of color are disproportionately higher than rates among white children, and have continued to increase across all ages for the past 30 years.³⁸ For comparison, only 3 percent to 4 percent of U.S. children ages 2 to 5 and 6 to 11 years are classified as underweight (defined as sex- and age-specific BMIC being less than the fifth percentile).³⁹

The overall pattern suggests that accumulated lifetime exposures (biological, behavioral, environmental, and systemic) continue to drive ongoing increases in obesity prevalence across the life course. Obesity, once established, is very likely to persist.⁴⁰ Understanding the development of obesity and how to support healthy eating behaviors in childhood is essential. Further, understanding the development of food acceptance and healthy appetites among children is foundational to multi-level approaches to prevent obesity and support healthy eating behaviors in childhood.

Development of Food Acceptance during Childhood

Children eat what they like and like what they know.⁴¹ Young children's intake of foods is closely aligned with food preferences,⁴²⁻⁴⁴ underscoring the fundamental role the development of healthy food preferences plays in promoting healthful eating patterns. A large body of research shows that children are born with innate preferences for taste that predispose them to readily like some foods and be initially wary of others.⁴⁵⁻⁴⁷ Preferences for food, on the other hand, are learned through experiences that are inherently social in nature, highlighting the powerful role of caregivers and the family eating environment in shaping children's acceptance of healthful foods.^{14,48} The nature of children's eating experiences varies with the contexts in which eating occurs as well as the people with whom children eat and generally reflects a wide range of family, cultural, and broader socio-environmental and socio-economic influences.

Taste Preferences

Biologically programmed taste preferences provide a strong foundation for food acceptance in childhood. Newborns show distinct preferences for sweet and umami tastes and initial rejection of sour and bitter tastes.^{47,49} These predispositions are thought to have evolved to favor survival by encouraging consumption of energy-rich foods and discouraging consumption of toxins and spoiled foods. Taste preferences change as development proceeds across childhood. For instance, children have heightened preferences for salt,^{50,51} sweetness,⁵¹⁻⁵³ and sour⁵⁴ in comparison to adults.^{38,53-57} Children also show heightened sensitivity for some bitter tastes throughout early childhood into adolescence.^{55,58} These patterns underscore that children establish eating habits in a fundamentally different sensory world than adults, with normative tendencies to prefer sweet foods and reject bitter tasting foods like some vegetables.^{55,59}

Taste preferences vary from person to person. Sensitivity to bitterness, in particular, is known to vary greatly among individuals; one person may detect bitterness at a low concentration whereas another may be insensitive to its taste or require very high concentrations to detect it. Genetic variation in the TAS2R38 gene produces individual differences in sensitivity to the bitter tastants,⁶⁰ such as 6-n-propylthiouracil (PROP).⁶¹ Children who exhibit sensitivity to the bitter taste of PROP tend to have lower liking and intake of some raw vegetables (e.g., spinach and broccoli), while also tending to have higher liking/intakes of sweet foods and consume less fat than non-tasters.^{58,61} Individual differences in taste preferences for bitterness as well as sweetness have been found to differ based on age, race/ethnicity, family history of addiction/depression, and taste receptor genotype.^{56,62,63} Children with sensitivity to bitter tastes may require additional strategies to learn to like some healthful foods with bitter taste profiles such as using dips and sauces, using preparation methods that yield milder tastes, and reinforcing children's willingness to try foods through praise and/or small non-food rewards.^{58,64}

The biology of taste provides a foundational guide for food acceptance; however, children's experiences and learning in their early eating environments shape the course of food preferences and eating habits. For example, children's heightened preferences for the taste of sweet compared with those of adults enhances the attractiveness and ready acceptance of foods high in sweetness.⁶⁵⁻⁷⁰ Yet children also develop liking and preferences for foods through associative learning and familiarization that occur as they accumulate eating experiences, underscoring the role of the family and socialization of eating behaviors.^{71,72} For instance, sweet foods are often provided to children as treats or rewards for good behavior, providing social reinforcement of children's liking for foods they are biologically predisposed to find attractive.^{73,74} Further, food media advertisements targeting children have been shown to encourage children's liking of, requests for, intake of, and loyalty to advertised brands and the unhealthy foods which are typically featured.

Food Neophobia

A common challenge to the acceptance of healthful foods during childhood is food neophobia, defined as fear of or reluctance to eat new foods.^{67,75} The degree of food neophobia changes as a child develops, with relatively low levels seen in late infancy during the introduction to complementary foods. However, children show pronounced and normative increases in food neophobia during toddlerhood and preschool years, where levels are at the highest point seen across the lifespan.⁷⁶ During this time, children may be reluctant to try and accept new foods and become more selective about the foods they are willing to try and eat.^{77,78} Reflecting biological taste predispositions, children may be particularly wary of some healthful foods like vegetables that are not terribly sweet, are not energy-rich, and can often be bitter.⁷⁹ These normative trends are a common cause of concern

for many parents when children become more limited in what they are willing to eat and show resistance to try new foods. For most children food neophobia is relatively short-lived and tends to diminish with age as children enter the school years.⁷⁶

Picky eating

A related challenge to acceptance of healthful foods during childhood is picky eating. Although there is not agreement in the field on a formal definition of picky eating (also known as “food fussiness”),^{76,80,81} the most commonly accepted definition is the rejection of a substantial amount of foods that are familiar (as well as unfamiliar).^{76,82-89} Picky eating is generally considered to consist of three key characteristics: (1) consuming a limited variety (food selectivity)^{65,69,70,76,89-103} and amount of foods;^{76,90-94,104} (2) rejecting foods based on certain sensory characteristics (appearance, aroma, feel, texture, or flavor),^{69,76,84,90,91} often requiring the preparation or presentation of meals in a very particular way;^{65,69,90,92,95-99} and (3) unwillingness to try new foods (food neophobia).^{76,79,88,91,105-107} Some have hypothesized that picky eating could be only parent perception,⁹⁶ but observational and experimental studies provide some validation,^{66,92,98} for example by indicating that picky eaters consume a lower variety of vegetables^{69,92} and have lower total intakes of vegetables.⁶⁹

The varying definitions result in an unclear prevalence of picky eating. Of the 25 percent of children identified by parents to have feeding difficulties, only an estimated 1 to 5 percent meet criteria for a feeding disorder.^{67,94,108,109} Avoidant restrictive food intake disorder (ARFID), also described as extreme picky eating where a child does not consume enough calories to grow and develop properly, was added to the Diagnostic and Statistical Manual of Mental Disorders V (DSM-V) in 2013 and requires one or more of the following: (1) significant weight loss, faltering growth, or nutritional deficiency; (2) dependence on enteral feeding or oral nutritional supplements; or (3) marked interference with psychosocial functioning. The prevalence of ARFID and effective treatment modalities is an active area of research. Treatment of ARFID is outside the scope of this report.

Children with picky eating tend to have lower intakes of vegetables,^{69,79,92,110} some micronutrients (iron, zinc), and fiber.⁶⁸ Importantly, however, picky eating does not have a consistent association with weight status and growth.^{6,68,111} Picky eaters show higher levels of negative affect, and sensory sensitivities to sight, sound, taste, smell, touch, and pain.⁷⁸ Picky eating has also been shown to be related to dimensions of child temperament including children’s enjoyment of novel experiences and sociability. While picky eating appears to have a trait-like, heritable component,^{88,112} it also has been associated with caregiver characteristics, including caregiver neophobia, dietary restraint, external cue eating, dietary intake, and home availability.^{6,113} These observations highlight caregivers’ influence on not only contributing to genetic predispositions

around behavior but also through a variety of behaviors that shape children’s exposure to new and healthful foods. Like food neophobia, many children show signs of picky eating during early childhood that tend to lessen with age.^{68,112}

Development of Healthy Appetites and Growth during Childhood

Children’s regulation of eating behaviors reflects complex and dynamic interactions between biology and the environment. It has historically been believed that children are born with an innate capacity to regulate their own eating behavior. For example, in some controlled research studies, young children demonstrated an ability to self-regulate short-term energy intake by making adjustments to subsequent food intake in response to the energy content of foods previously consumed.^{114,115} A growing body of evidence, however, has demonstrated that this capacity varies widely among children and at younger ages than previously thought.¹¹⁵ Children’s capacity to regulate intake has been shown to be influenced by the types and amounts of foods available, the social aspects of the eating environment, and children’s behavioral and biological predispositions towards eating.

Appetite is defined as an instinctive or natural desire to eat. Behavioral predispositions towards eating are broadly described in terms of food approach and food avoidance. Food approach is defined as a combination of behaviors characterized by food responsiveness (i.e., the degree to which external food cues encourage an individual to eat) and the reinforcing value of food (i.e., the willingness to consciously work to obtain food).¹⁰ Some examples of food approach behaviors include eating in the absence of hunger (i.e., the number of calories a child consumes when palatable foods are offered following a satiating meal) and emotional eating (i.e., greater likelihood of eating in response to negative affect). Food avoidance is defined as a combination of behaviors characterized by satiety sensitivity (i.e., the degree to which one is capable of ceasing consumption in response to internal signals—typically conceptualized as signals from the gut).¹⁰

Observational studies indicate that children with higher levels of food approach or motivation to eat tend to have higher body mass index,^{10,116-122} whereas children with higher levels of food avoidance tend to have poorer diet quality. These behavioral predispositions are thought to be shaped, in part, by genetic influences and have trait-like qualities. Individual differences in eating behaviors are reliably observed by parents beginning in infancy and track over time. Furthermore, twin and family studies provide evidence that eating behaviors reflecting appetite are heritable or under genetic influence. Therefore, the evidence for promoting healthy appetites in children necessarily overlaps with the evidence for preventing and treating childhood obesity.

At the same time, multiple lines of evidence document that children’s eating behaviors are highly influenced by environmental and social cues within and outside households. Multiple types of research indicate that cues from broader eating environments shape food acceptance and can detract from children’s attendance to internal cues of hunger and satiety. The current “obesogenic” food environment works against promotion of healthy eating behaviors by providing ubiquitous access to and aggressive marketing of shelf-stable, convenient, palatable, energy-dense, and low-cost foods that are often found in large portion sizes and are otherwise nutrient-sparse. A robust body of research demonstrates that these aspects of

the food environment alter young children’s food selection and promote excessive caloric intake, by overriding internal cues of hunger and satiety.^{123,124} Trends in recent decades of increases in snacking occasions and growing portion sizes may also overwhelm homeostatic controls of eating behavior and normalize the frequent consumption of larger portion sizes of foods high in sugar and fat.

Because caregivers filter children’s exposure to the broader food environment and socialize children’s food selection, they play a critical role in shaping healthy eating behaviors.



Methodology

Expert Panel Methodology

In 2020, Healthy Eating Research (HER) convened a national panel of experts to develop evidence-based best practices and recommendations for promoting healthy nutrition and feeding patterns in typically developing children 2 to 8 years of age. The panel was composed of 15 individuals with expertise in nutrition, pediatrics, psychology, child development, family medicine, and sociology (see page 2 for a full list of expert panel members). HER convened the panel monthly from February 2020 to March 2021 using video conference technology; each meeting was approximately 1.5 hours. The meetings were led by the panel chairs, recorded, and made available to panel members for review throughout the process. Expert panel members also provided regular feedback via email and Qualtrics surveys to gain consensus on recommendations and gather input on considerations for the recommendations (i.e., applicability among income sub-groups and various cultures). Panel co-chairs held additional calls as needed with select members of the panel to obtain feedback in their specific areas of expertise.

The development of the expert panel recommendations for promoting healthy eating behaviors in children outlined in this report followed a multi-step process:

1. Initial discussions involving HER, RWJF, the expert panel chairs, and the panel members to gain consensus on the scope of the recommendations;
2. Review of the literature on key topics—promoting acceptance of healthful foods and promoting healthy appetites and growth among 2- to 8-year-olds;
3. Discussions of the literature review findings during monthly panel meetings;
4. Preliminary drafting of recommendations by expert panel chairs based on evidence reviewed and panel discussions; and
5. Review and revision (as needed) of the recommendations by panel members and finalization of recommendations and best practices based on panel consensus.

Several of these steps are described in greater detail below.

Literature Review Methodology

The panel used an expert-led process to synthesize findings of narrative and systematic reviews, published primarily during the past five years (2015-2020), of research to promote development of healthy eating behaviors (i.e., aligned with optimal nutrition and physical growth) among children 2 to 8 years of age. The evidence described in this report reflects two broad areas of focus: (1) promoting acceptance of healthful foods, and (2) promoting healthy appetites and growth.

Within these areas the following key topics were identified by the panel co-chairs and HER staff: promoting a healthy appetite and weight, food preferences and food acceptance, taste preferences, food neophobia/picky eating, parenting styles and food parenting practices, appetitive traits and food motivation, family meals, fathers and other caregivers, child care, and family-based obesity prevention interventions. For each key topic a review of narrative reviews, systematic reviews, and meta-analyses published in the past five years (2015-2020) was conducted (see **Appendix 1** for details on the search strategy for each topic). Approximately one dozen review articles were included per topic. Older reviews and meta-analyses (published 6-10 years prior, i.e., 2010-2014) were also considered when they provided unique insights and/or supplemented topics on which few recent reviews had been published. Searches for relevant content in prominent journals and academic book chapters were conducted to broaden the number of search engine returns, if necessary. Additional literature, such as original peer-reviewed research studies or relevant reviews provided by the expert panel members on special topics (e.g., diversity, equity, and inclusion; child care; parenting interventions), was also included. This methodology is similar to that used by the Dietary Guidelines Advisory Committees, as well as previous HER expert panels.

A full list of the literature included, with research questions and key findings from each study, can be found in **Appendix 2**.

Development of Recommendations

The expert panel co-chairs drafted preliminary recommendations based on the literature findings and inputs from panel members with relevant expertise. Panel members reviewed the preliminary recommendations and supporting research during meetings, followed by the deliberation and revision of draft recommendations.

The goal was that all recommendations be reached by consensus. The panel made decisions by agreement rather than majority vote and areas of disagreement were noted. The levels of consensus included, “I can say an unqualified yes,” “I can accept the decision,” “I do not fully agree with the decision, however, I will not block it and will support it,” and “I do not agree and

do not support the decision.” The final recommendations were reviewed and agreed upon by all members of the expert panel for this technical report.

Key Considerations for Reviewing the Evidence and Developing Recommendations

This report’s recommendations for promoting food acceptance and healthy appetites and growth among children are derived largely from observational research on food parenting conducted during the past 40 years. Research has historically focused nearly exclusively on coercive and controlling food parenting practices—such as pressuring children to eat or restricting access to specific foods—with an emphasis on reducing use of these practices given their association with unhealthy eating behaviors, diet quality, and growth patterns. More recent work has increasingly adopted a strengths-based perspective focusing on positive parenting practices, with the goal of identifying and promoting what parents “could do” as opposed to only what they “should not do,” but this is still a growing body of research.

In addition to the observational nature of most of the research in these topic areas, the panel considered the following additional limitations when developing recommendations:

- Research has historically focused on food parenting practices among cohorts that are predominantly non-Hispanic white, well-resourced mothers of preschool-aged children. Although emerging work is beginning to include older children, other caregivers, and more diverse populations, generalizability of the literature remains severely limited by a lack of diversity and cultural context in study populations, study designs, and the lens through which study results have historically been interpreted. The expert panel discussed at length the caution and caveats necessary when attempting to translate this literature into broadly generalizable recommendations.
- Much of the literature focuses on family-based approaches to obesity prevention. This literature provides converging evidence for a number of adaptive and supportive food parenting practices and enhances ecological validity by providing evidence of the utility of these approaches in a real-life context. However, these family-based programs were bundled interventions, of which discrete food parenting practices were just one part. Therefore, although these studies can provide indirect support for the recommendations herein, they do not provide direct evidence of their mechanistic role in effects on children’s healthy eating, diet, and growth.
- The panel’s goal was to develop recommendations for typically developing children, 2-8 years old. Developing recommendations to treat children with Avoidant Restrictive Food Intake Disorder (ARFID) or those with other feeding disorders or medical issues impacting feeding was beyond the scope of this project. However, the literature related to promoting food acceptance includes both typically developing children as well as children with complex medical conditions, developmental differences, and/or ARFID. Given that ARFID has only been recently identified (2013) in DSM-V, some conclusions drawn from older literature may be based upon study cohorts that included children with unidentified ARFID.
- Research findings from studies involving cohorts of children aged 3 to 5—which comprise the majority of the literature—may not be generalizable to younger or older children, as dramatic development occurs across all domains during this six-year age span. For example, children develop from only just being capable of feeding themselves with a fork (2 years old) to being able to prepare and cook some foods for themselves (8 years old). Children’s dietary repertoire also expands during the third year of life (e.g., 24-36 months), following the introduction to an adult-like diet in the prior year. Children’s ability to communicate their preferences expands from only beginning to string two words together to using language in complex ways to reason with and influence their caregivers. The social environment of children’s lives also expands dramatically as they progress from early caregiving and childcare arrangements characterized primarily by parallel play with peers, to the sophisticated social interactions and dynamics occurring in the elementary school classroom. Finally, biological factors, including basic taste sensitivities and preferences,¹²⁵ and caloric needs change substantially during this developmental window. Thus, careful consideration should be given in terms of how study findings may be moderated by the child’s age.

The expert panel also discussed at length how to ensure that recommendations are sensitive to the one in seven U.S. children who live with food insecurity (a number that increased to one in five during the COVID-19 pandemic).¹²⁶ The panel recognizes that many of these recommendations are difficult to implement in food insecure households. Parents report feeling shame and embarrassment related to their inability to adequately provide food for their families.¹²⁷ The panel felt it was critical that recommendations are delivered and implemented in a manner that does not exacerbate that shame. Research on food parenting practices within food insecure families is limited, and the generalizability of these recommendations to these families must be carefully considered.

Narrative Review of the Evidence

Parenting Styles, Feeding Styles, and Food Parenting Practices

Family systems shape the dynamics of who is involved in caregiving of the child (e.g., spouse, grandparents) and the complexities of those caregiver-child relationships and intergenerational differences. The child feeding styles and practices that parents and caregivers use reflect values, attitudes, and beliefs related to child rearing that are shaped by parent and family characteristics, socio-cultural factors, and economic factors. They also reflect parental perceptions of the child's behavior and body size, as well as parental ideals for body size, health, and development. The manner in which caregivers determine the types and amounts of foods provided, model eating behaviors, and guide children's eating is generally conceptualized as occurring through feeding styles (Table 2) and food parenting practices (Table 3). These feeding styles and food parenting practices also occur in the context of parenting styles (Table 1). An overview of the concepts of parenting styles, feeding styles, and food parenting practices is provided in the Background section.

Parenting styles, feeding styles, and feeding practices are central to the concept of "food parenting" and have been a focus of much research over the past 40 years to examine impacts on child diet quality, weight, and health.

Evidence on Parenting and Feeding Styles

A 2013 review of literature on the influence of parenting style and/or feeding styles on childhood obesogenic behaviors and body weight¹²⁸ found that across studies of parenting style ($n = 40$) and feeding style ($n = 11$), an authoritative style (characterized by nurturing, reasoning, and structure during feeding) appeared to be the most protective parenting and feeding style, and the indulgent feeding style (characterized by warmth, but a lack of monitoring of the child's eating behaviors) was consistently associated with negative health outcomes. Overall, results of parenting style studies were relatively inconsistent due to differences in conceptualization and measurement, whereas the results for feeding style studies were much more cohesive. Specifically, an authoritative style was associated with greater child intake and home availability of fruits and vegetables, and lower child intake of foods high in added sugars and fat.

In another review of 31 research articles,¹²⁹ more authoritative parenting and less indulgent feeding styles were associated with healthier child growth. Food parenting practices such as restriction and pressure to eat are consistently linked to higher child weight, but the directionality of the relationship remains unclear (i.e., these practices may be responsive to child characteristics, as opposed to causal). In another review

of 11 prospective cohort studies,¹³⁰ most (but not all) studies showed an important role of authoritative parenting in preventing excessive rates of weight gain. In another recent review¹³¹ authoritative parenting and feeding styles were consistently associated with better child health outcomes, such as dietary quality and weight, whereas indulgent feeding styles were associated with problematic child eating behaviors, poorer dietary quality, and higher weight. Moreover, authoritative general parenting styles were associated with healthier child weight status over time. In one review of 13 research articles involving Latinx children,¹³² indulgent/permissive parenting and feeding styles and greater pressure to eat were associated with higher weight status.

In summary, authoritative parenting and feeding styles are associated with positive eating and health outcomes, whereas indulgent parenting and feeding styles are associated with negative outcomes.

Evidence on Food Parenting Practices

Several reviews have examined food parenting practices (parental practices in the feeding context). In one systematic review of 88 articles,²⁶ including a meta-analysis of 32 of them, practices associated with healthier dietary intake (i.e., greater fruit and vegetable consumption, less consumption of sugar-sweetened beverages and snacks) included availability, parental modeling, active guidance/education for healthy foods, and restrictive guidance/rule-making for unhealthy foods. Overall, in the meta-analysis, the effect sizes for fruit and vegetable intake were substantially greater for parental modeling of eating and food availability in the home ($d=0.32$ and 0.24 , respectively) than for praise, active guidance, pressure, and food rewards (range $d=-0.04$ to 0.15). Similarly, the effect sizes for unhealthy food intake (sugar-sweetened beverages, snacks) were substantially greater for parental modeling and non-availability ($d=0.35$ and 0.34 , respectively) than for praise, pressure, food rewards, and restrictive guidance ($d=-0.04$ to 0.14).

In a systematic review of 47 research articles examining associations between feeding and child snacking (i.e., consuming energy-dense foods in between meals),¹³³ the most consistent predictor of child snacking was home availability of unhealthy foods (10 of 11 studies). Restrictive food parenting practices were also positively associated with greater snacking in 13 of 23 studies. The few studies examining positive feeding behaviors had inconsistent results. In a review of 22 studies of food parenting practices (most of which were cross-sectional),¹²⁹ greater restriction was positively associated with weight in 14 of 18 studies, greater pressure was negatively associated with weight in 11 of 15 studies, and monitoring of intake showed no association in 14 of 17 studies. Overall, the temporal pattern of results suggested that restriction and pressure were more likely to be responses to child weight status as opposed to causal influences on child weight.

The literature began to include a greater focus on positive food parenting practices, such as structure and autonomy support, around 2016. A narrative review including these positive feeding constructs⁷ reported beneficial effects of parental modeling, food availability, and eating routines. This review described limited evidence to support beneficial effects of rules and limits, monitoring, food preparation, reasoning, praise, and encouragement. The review described, but did not provide evidence to support, the potential beneficial effects of guided choices, child involvement, and nutrition education.

Overall, parental modeling of healthful food consumption and household availability of healthful foods have beneficial effects on child eating behaviors, while parental modeling of unhealthful food consumption and household availability of unhealthful foods are related to poor eating behaviors.

Fathers, Other Caregivers, and the Family System

The majority of the literature on food parenting during childhood has focused on mothers, to the exclusion of fathers and other caregivers. According to the 2020 U.S. Census, 70 percent of children live with both parents, 21 percent with their mother only, 4 percent with their father only, and 4 percent with neither parent.¹³⁴ Fathers have had an increasingly active role in parenting over the last several decades. About half of fathers report being responsible for mealtimes at least half of the time¹³⁵ and 96 percent of fathers who live with their children and 30 percent of those who live apart from their children share a meal with their child every day or several times a week.¹³⁶

Fathers

Despite the increasing role that fathers play in children's healthy eating, a recent systematic review and content analysis¹³⁷ reported that across 667 observational studies on parenting and childhood obesity published between 2009 and 2015, fathers represented only 17 percent of parent participants. Further, only 8.5 percent of studies reported results separately for mothers and fathers, and only 1 percent of studies included only fathers (while 36 percent included only mothers). A systematic review of 23 studies examining the influence of fathers on feeding behaviors¹³⁸ reported a range of findings across studies. At least some of the studies reported findings similar to those described in studies not focused on fathers, including correlations between father and child BMI and dietary intake, adverse effects of controlling food parenting practices (e.g., pressuring and restricting), and beneficial effects of providing structure. A scoping review¹³⁹ of 77 studies of fathers' food parenting practices reported that 32 percent of fathers were involved in "food work" (e.g., shopping, cooking, feeding); while father involvement in these practices has increased over time, it still remains lower than mother involvement. Links between father involvement and child dietary outcomes were mixed; however, overall controlling practices (e.g., restriction, pressure) were associated with adverse dietary

and weight outcomes, and responsive practices (e.g., modeling) were associated with beneficial outcomes. Further, several studies have reported that congruence between mothers' and fathers' food parenting is beneficial.

Overall, fathers are under-represented in the food parenting literature despite their growing role in household food duties. Current evidence suggests that among fathers, social modeling and structure are associated with positive outcomes while restrictive practices are associated with adverse dietary and weight outcomes.

Grandparents

A growing body of literature has focused on the role of grandparents in shaping children's dietary intake. A recent review¹⁴⁰ examining the influence of grandparental care on the dietary intake, food-related behaviors, food choices, and weight status of their preschool and school-aged children found mixed results. Of 16 studies on multi-generational households nine reported grandparent attitudes and behaviors as negative influences (e.g., indulgent feeding, providing energy-dense food, use of food as reward), three reported positive influences (e.g., modeling, teaching, monitoring, encouraging fruit and vegetable intake), and seven reported conflict or tension between grandparents and parents around child feeding (e.g., disregard for parents' rules, different definitions of healthy feeding). Four studies reported positive associations between grandparent cohabitation and child obesity risk. Another review¹⁴¹ reported five of six identified studies showed a higher risk of child overweight or obesity in households including a grandparent.

In summary, although nearly 1 in 10 children live with a grandparent, research examining the influence of grandparents on children's eating is limited. The available evidence, however, suggests common tensions between parents and grandparents regarding structure and rules around feeding.

Family Meals

The role of the family in the field of eating behavior research has generally been examined in the context of the family meal. In one review¹⁴² of 33 studies focused on family meals with children ages 2 to 12 years, 28 studies focused on frequency, with few studies focusing on characteristics of the family meal such as length, location, and people present. In this review, most families (73%) of children ages 2 to 5 years reported having a family meal five or more times per week. A meta-analysis of 17 studies involving children and adolescents¹⁴³ found that sharing three or more family meals per week was associated with a 12 percent lower risk of overweight/obesity, 20 percent lower risk of unhealthy eating, 24 percent higher odds of healthy eating, and 7 percent lower risk of eating disorders. Importantly, the literature on family meals is based primarily on observational studies. It is therefore difficult to determine if family meals cause healthier eating behaviors, and if they do, to identify the mechanism of effect.

In a separate narrative review of 81 observational studies,¹⁴⁴ family meals were associated cross-sectionally with healthier diets (better nutrient intake, more nutrient-dense foods, and fewer nutrient-poor foods and beverages), but the association with lower obesity risk was weak. In qualitative work, parents perceived that the benefits of family meals included teaching social skills, manners, and food and cooking skills, as well as greater family connectedness, bonding, and communication. Differences in how family meals are defined and/or family mealtime frequency, make it difficult to compare study findings.

In summary, family meals have been associated with healthy eating behaviors among children^{145,146} and parents.¹⁴⁷ Additionally, eating with caregivers and other family members provides children with rich opportunities for socialization around eating and connecting with others. However, causation and mechanisms of actions have yet to be established. It is important to note that the frequency with which shared meals occur often reflects socioeconomic status, gender and caregiving roles in the family, and culture.^{148,149} The frequency of family meals also differs with parental feeding styles.¹⁵⁰ Household composition and employment may also influence family meals and food parenting practices.^{149,151} For instance, caregivers who place a high priority on family meals but have incompatible work schedules may not be able to carry out family meals with the same frequency as caregivers with more stable work schedules. Importantly, eating with children and providing a warm and positive eating environment can take many forms that can include sitting and talking with children while they eat, sharing a healthful snack together, or eating together with other family members as connoted in the term “family meal.”

Promoting Food Acceptance

Food acceptance is a process that plays out over time as children accumulate positive experiences consuming foods.²⁷ Positive experiences are thought to promote food acceptance by increasing familiarity and learned safety.¹⁵² Caregivers play an important role in what foods become accepted via their feeding practices, food modeling behaviors, and influence over the foods that are available and become familiar to children.¹⁴ Caregivers often determine whether children like or dislike new foods after offering those foods only once or a few times. These perceptions may cause caregivers to prematurely stop offering foods before the process of acceptance has fully played out and limit further offers of foods that might ultimately be accepted. This is compounded by the observation that some caregivers perceive exploratory behaviors that may facilitate children’s acceptance of new foods¹⁵³—such as smelling, touching, and playing with foods—as undesirable and poor table manners.²⁷ A varied body of research suggests that encouraging children to try new foods and helping children learn to enjoy new foods is more effective for promoting food acceptance than pressuring children to eat foods.^{14,154,155}

Repeated Exposure

Robust experimental evidence indicates that repeated taste exposure produces increases in intake and liking of new foods.¹⁵⁶ A particularly comprehensive review that synthesized findings from 43 experimental studies (including 16 in infants and 9 in children ages 2 to 10) found a robust effect of repeated exposure on children’s liking and intake of vegetables.¹⁵⁷ While the vast majority of evidence on repeated exposure focuses on infancy and early childhood (particularly ages 2 to 5),¹⁵⁸ newer studies also show effects of repeated exposure on new and previously disliked foods among school-aged children, although the number of studies are limited.¹⁵⁶

The number of exposures required to produce acceptance among young children is thought to range between five to 15, as experimental studies have typically evaluated effects with seven to 14 exposures.¹⁵⁹ More recent literature in this area suggests that the number of exposures needed to boost acceptance may be lower than initially thought.^{156,159} Multiple newer studies conducted during infancy, early childhood, and middle childhood support the idea that eight or fewer exposures can increase food and flavor acceptance,^{156,158} with some studies showing effects with as few as three to six exposures.¹⁶⁰⁻¹⁶² While little research has directly compared children of different ages in the same study, the body of evidence suggests that infants may require fewer exposures than preschool aged children,¹⁵⁶ who show normative heightened levels of food neophobia, and among school aged children, who have accumulated a greater history of experiences with food and eating. For most children, promoting acceptance of new foods may require as few as two to three exposures and in other cases as many as 10 to 15 exposures.

Additional key findings from the review of literature on repeated exposure include:

- Effects of repeated exposure to foods have been demonstrated in diverse settings including early care and education settings,^{71,160} home,¹⁶³⁻¹⁶⁵ and at school.¹⁶⁶⁻¹⁶⁸
- While the preponderance of research has focused on acceptance of new foods, effects have also been demonstrated with previously disliked foods.^{164,167}
- Successful exposures to new foods can be done through small tastes; full portions need not be consumed.^{163,165-167}
- Most studies have evaluated effects of repeated exposure on liking and intake over a relatively short period;¹⁵⁶ few studies have included long-term periods of follow up to establish the extent to which such experiences have lasting effects on liking and/or intake.¹⁶⁹

Additional Strategies for Promoting Food Acceptance

The effects of repeated exposure to promote food acceptance ultimately rest on children's willingness to try or taste foods. Willingness to try new foods, in turn, may vary based on the type, texture, and appearance of new foods as well as the child's general inclination to explore new foods. Indeed, observational data suggest that the extent to which repeated exposure is effective in producing acceptance appears to vary with characteristics of foods as well as appetitive traits, specifically fussy or picky eating.⁶ Biologically-based sensitivities to texture, taste, and smell, as well as fear of new foods, may decrease willingness to taste new foods and thereby effectiveness of providing repeated exposure.⁷⁸ Indeed, experimental trials find that repeated exposure may not be effective for a quarter to a third of children.¹⁷⁰ Children who show higher levels of food fussiness or picky eating also exhibit higher levels of food neophobia or fear of new foods.^{6,76} This observation is consistent with evidence that children with high levels of food neophobia, or fear of new foods, may require a greater number of exposures to new foods to achieve acceptance⁶⁴—in one study as many as 27 exposures.¹⁷¹ Additional strategies that create positive experiences and associations with new foods may be useful supplements to repeated exposure for children who are hesitant to try new foods.^{64,172}

Social modeling. Experimental studies show remarkably consistent effects of social modeling on children's willingness to try, liking, and intake of novel foods.¹⁷³ Effects have been observed when social models are directly observed in person^{172,174} and when the behavior and choices of models are indirectly revealed^{175,176} (e.g., such as when told of a peer's choices or watching a video). Studies in young children suggest that social modeling influences of peers are particularly salient¹⁷⁷ and may be more effective social models than adults;^{174,178} this observation has been interpreted to suggest that adults

may not be seen as reliable sources regarding the palatability of foods relative to peers. Experimental studies also suggest that negative social modeling (e.g., dislike of foods) has been shown to negatively influence young children's acceptance of foods.¹⁷⁹ Similarities in dietary intake among family members are thought to reflect influences of food availability or shared environment as well as social modeling.¹⁸⁰⁻¹⁸⁴

Incentives. Providing small, tangible incentives or rewards (e.g., stickers) have shown some benefits beyond repeated exposure alone for increasing children's acceptance of novel and moderately liked vegetables.^{73,157,165,185} Similarly, providing intangible incentives in the form of praise for trying new foods is associated with higher fruit and vegetable intake, particularly among younger, preschool aged children.^{26,73,185} A number of studies that paired token rewards (usually stickers) with social modeling demonstrated positive effects on liking and intake among preschool aged children.¹⁶⁴ Providing food rewards in exchange for children's consumption of foods (i.e., instrumental consumption) has negative influences on liking of target foods,^{73,186} whereas providing foods as rewards can enhance children's liking of the foods used as rewards.¹⁸⁷ Token rewards and praise are not superior to repeated exposure, but may enhance the effects of repeated exposure by encouraging children's willingness to try new foods.

Associative conditioning. Experimental studies have demonstrated the role of associative conditioning processes in children's food acceptance, particularly liking,¹⁵⁷ where children learn to accept foods through flavor-flavor learning (i.e., positive associations with an already liked flavor, like pairing a new vegetable with a dip) and flavor-nutrient learning (i.e., how satiating a particular food is leads to liking of the food).^{153,188} It is important to note, however, that these strategies show little additional advantage beyond repeated exposure alone in infants, toddlers, and preschool children.¹⁵⁶ However, such strategies can facilitate willingness to try among bitter-sensitive children and those who are otherwise reluctant to taste new foods.

Sensory exposure. Tasting foods is the most critical part of learning to accept new foods,¹⁸⁹ yet a small body of recent studies suggest that other types of sensory exposure may also increase children's willingness to try new foods.^{190,191} For instance, experimental studies show that visual exposure to unfamiliar vegetables via picture books increased familiarity, willingness to try, and intake of vegetables among preschool aged children.¹⁹²⁻¹⁹⁴ Additionally, sensory interventions that provide visual, auditory, tactile, and olfactory exposure during playtime increase children's willingness to touch, taste, and enjoy fruits and vegetables.^{195,196} Effects of non-tasting exposure are more modest than repeated taste exposure. However, these studies suggest that such approaches may be helpful adjuncts to repeated exposure by providing opportunities for familiarity that do not require but may ultimately encourage tasting.

Socioenvironmental, Economic, and Cultural Influences on Repeated Exposure and Parenting

Providing young children with repeated exposure to a wide variety of healthful foods involves physical, financial, emotional, and time resources that may not be available at all times and/or to all families. Availability, access, and cost, in particular, may limit the ability to offer repeated exposure to healthful foods among families with low incomes and those experiencing food insecurity.¹⁹⁷ Qualitative research reveals that concerns about cost, food spoilage, and waste may limit the feasibility and/or acceptability of providing repeated exposure to healthful foods, particularly fruits and vegetables, among families with low incomes.¹⁹⁸⁻²⁰⁰ Among families from households with food insecurity or lower incomes, parents may not be able to provide repeated exposure to a variety of healthful foods out of the need to ration food resources within the family and prioritize children's intake, for example.²⁰¹ Additionally, household chaos due to work demands, child-care arrangements, and seeking food assistance may strain mealtime interactions and reduce the priority of providing repeated exposure to healthful foods.²⁰² Because parents' primary goal in child feeding is getting children to eat (over acceptance of a variety of foods), strategies to help parents promote consumption of less easily accepted foods could help improve children's dietary quality among families with limited resources.

In summary, much of the evidence on promoting food acceptance comes from a largely experimental literature and highlights the fundamental role of repeated exposure in the development of food acceptance. However, providing young children with repeated exposure to a wide variety of healthful foods involves physical, financial, emotional, and time resources that may not be available at all times and/or to all families. A separate, mostly cross-sectional literature on food parenting practices has found consistent positive associations of children's intake of healthful foods with parent social modeling, home availability of healthful foods, and praising the child's behavior.²⁶ This evidence base has tended to focus on younger preschool-aged children and involved higher resource and white samples.²⁶

Promoting Healthy Appetites and Growth

As discussed earlier, food approach behaviors, such as eating in the absence of hunger, emotional eating, food cue responsiveness, enjoyment of food, and food reinforcement, have been linked with higher body mass index and obesity in a number of studies.¹¹⁶⁻¹²² Therefore, the evidence for promoting healthy appetites in children necessarily overlaps with the evidence for preventing and treating childhood obesity

Potential Inferences from the Childhood Obesity Prevention and Treatment Literature

Over the last 30 years, numerous multi-level behavioral interventions have sought to prevent or treat childhood obesity with only modest success. Generally, the literature converges on several concepts: (1) healthy dietary intake appears to be a more robust contributor to preventing excess weight gain in children than physical activity, though physical activity is essential for weight maintenance and cardiovascular health; (2) the ideal diet to prevent excess weight gain in children remains elusive and likely differs across individuals and cultures, though diets high in added sugar, particularly in the form of sugar-sweetened beverages, consistently predict excess weight gain;²⁰³ (3) dietary intake is the final common pathway of a multitude of brain-based behaviors conceptualized as "appetite," and those behaviors show substantial individual variability; and (4) appetitive behaviors show individual variability at birth, substantial change over time in early childhood, and are shaped by nature, nurture, and the interaction of the two.

Some degree of inference regarding effective approaches to promoting healthy appetites in children may be possible from the evidence for obesity prevention and treatment. The literature on obesity prevention and treatment is largely composed of traditional randomized controlled trials with bundled interventions, making it impossible to disentangle whether the mechanism of any intervention's effect on children's weight is operating through changes in appetite. Therefore, this section more thoroughly discusses individual studies rather than individual constructs. Nonetheless, reviewing patterns in this literature may be informative. For young children, these interventions are nearly universally focused on parenting or family-based approaches, although most of the literature available focuses on children older than the age range of focus in this report.

A systematic review and meta-analysis of 22 randomized controlled trials for the prevention and treatment of childhood obesity among school-aged and younger children²⁰⁴ found that 73 percent of home-based interventions had an effect, on average reducing BMI z-score by 37 percent. These bundled interventions included a range of parental involvement components, including goal-setting, problem-solving, monitoring, social support, and stimulus control (i.e., availability and accessibility), as well as a range of nutrition

strategies including managing portion size, limiting snacking, increasing fruit and vegetable consumption, and decreasing consumption of sugar-sweetened beverages and energy-dense foods. The study designs did not allow for examination of whether any of these behavioral approaches to promoting healthy eating were the mechanism of effect.

A systematic review and narrative synthesis²⁰⁵ of family-based interventions focused on childhood obesity sought to understand the key characteristics of programs that contribute to positive dietary and physical activity behavioral outcomes (though it focused only on studies including children ages 7 to 13 years) and the mechanisms of change. Of the 36 studies reviewed, only 11 provided sufficient information for a realistic analysis (i.e., analysis focused on explaining the mechanism of change) and of those—while all demonstrated some favorable changes in diet or physical activity—only three had a randomized-controlled trial design. In these studies, the five behavior-change techniques used most frequently included goal-setting, problem-solving, social support, demonstration of the behavior, and restructuring of the physical environment.

A systematic review of family-based nutrition interventions for childhood obesity management among children ages 5 to 18 years²⁰⁶ included eight studies with a healthy eating component; four of the eight targeting fruit and vegetable intake and two of the five targeting sugar-sweetened beverage intake showed significant effects. Among those studies demonstrating a significant effect on fruit and vegetable intake, behavioral strategies included modeling, availability, positive reinforcement, goal-setting, problem-solving, monitoring, and rules about healthy eating. Among those studies showing a significant effect on sugar-sweetened beverage intake, behavioral strategies included modeling, availability, positive reinforcement, goal-setting, problem-solving, monitoring, family meals, and preparing food at home. Overall, the authors concluded that behavior change techniques emphasizing intervention components such as setting family-based goals for healthy eating, modifying the home food environment, and emphasizing the role of family support (i.e., social support, restructuring, the physical environment) were characteristics of successful interventions, though notably, these same behavior change techniques were used in both successful and unsuccessful interventions.

Overall, systematic reviews of family-based interventions did not provide appreciable detail of intervention content

involving parenting, and descriptions of intervention content tended to focus on behavior-change techniques and nutrition/behavior targets (e.g., smaller portion sizes). Studies have also focused on a mix of prevention and treatment approaches. In summary, although the inferences possible from the family-based childhood obesity prevention and treatment literature are limited, the overall pattern suggests an important role for goal-setting, problem-solving, monitoring, modeling, and structuring of the environment (e.g., food availability and accessibility). The study designs bundled these approaches with intervention elements focused on physical activity, sedentary behavior, and other obesity-related behaviors, which precludes the identification of mechanisms of any effect on healthy eating.

A separate literature focuses on effects of general parenting styles on childhood obesity. A review of 21 weight-loss interventions that included a focus on parenting²⁰⁷ concluded that overall, family-based treatment programs incorporating training for authoritative parenting styles, parenting skills, child management, and family functioning had positive effects on youth weight loss. Additional key elements also seemed to include appropriate structure and boundaries in the home environment, positive reinforcement for child health behaviors (e.g., praise), and effective parent-child communication. A systematic review of childhood obesity prevention and treatment interventions addressing general parenting styles²⁰⁸ identified seven studies involving four parenting interventions; all studies showed small to moderate intervention effects on at least one weight-related outcome (though five of the seven studies involved fewer than 50 children). Overall, the authors concluded that the pattern of results suggest that interventions that promote authoritative parenting may be an effective strategy for prevention and treatment of childhood obesity.

Triple P, also known as the Positive Parenting Program, is one of the most common general parenting interventions, and focuses on principles such as sensitivity, praise, modeling, and effective discipline approaches (e.g., ground rules, planned ignoring, time out, consequences). Importantly, in a systematic review of Triple P²⁰⁹ that included 33 studies, only five reported outcomes beyond the duration of the intervention. The authors described bias in the literature, with preferential reporting of positive outcomes, and concluded that there is no convincing evidence that Triple P works across populations or has long-term benefit. Thus, although more authoritative parenting approaches might be effective for promoting healthy eating, there is little to no evidence for effective interventions that promote authoritative parenting.

Interventions to Reduce Food Approach Behaviors

The literature examining interventions to reduce food approach behaviors (eating behaviors and thoughts that involve a movement toward or desire for food) in children is much more limited than that examining bundled behavioral interventions for childhood obesity. Nonetheless, examining this literature provides some evidence regarding potential approaches for addressing these behaviors.

A systematic review of 19 studies examining eating in the absence of hunger among children younger than 12 years²¹⁰ identified only one behavioral intervention study, which focused on children ages 8 to 12 years (n=36). In this intervention, food cue exposure training (i.e., learning to recognize and “ride out” a craving) was more effective than appetite awareness training (i.e., learning to recognize hunger and satiety cues) in reducing eating in the absence of hunger.²¹¹ In a randomized controlled trial of 91 preschool-aged children testing an intervention of play-based programs designed to help children inhibit an impulse to eat in the absence of hunger, the intervention reduced eating in the absence of hunger among overweight children (though it was not clear if the effect was through improved ability to inhibit an impulse).²¹²

A recent systematic review and meta-analysis examining laboratory-based interventions to reduce food craving²¹³ identified only four studies that included children younger than age 10 years (one of which was described above). Among 8- to 12-year-old children, training to reduce attention bias for food reduced eating in the absence of hunger in the laboratory.²¹⁴ Among 7- to 10-year-old children, training to reduce children’s

attention bias for palatable food cues subsequently reduced children’s intake of energy-dense food in the laboratory.²¹⁵ Finally, in an intervention with children as young as 6 years of age, encouraging reappraisal of palatable foods (i.e., imagining that the food is far away and avoiding focusing on its taste and smell) reduced food craving (which was also detectable on brain imaging).²¹⁶

Few studies have examined whether children can be taught to more accurately attend to hunger and satiety cues. In two randomized controlled trials (one involving 84 children aged 8 to 12 years, and another involving 47 children aged 6 to 12 years) appetite awareness training reduced BMI more effectively than the control condition; neither study examined eating behaviors or dietary intake.^{217,218} Finally, a randomized controlled trial involving 25 preschool-aged children demonstrated that an intervention designed to teach children to respond to internal hunger and satiety cues improved their ability to self-regulate caloric intake.²¹⁹

Overall, few studies have examined behavioral interventions to reduce food approach behaviors in children ages 2 to 8 years, and no review articles addressing this topic in young children were identified. Existing studies have primarily been in older children, and have often taken place in laboratory settings with short-term follow up. The approaches in these studies have focused on reducing cravings and attention bias for food, as well as improving children’s ability to recognize and respond to hunger and satiety cues. Though the literature is limited, some evidence suggests beneficial effects.





Recommendations for Caregiving Behaviors and Practices to Support the Promotion of Healthy Eating Behaviors among Children 2 to 8 years of Age

The expert panel's recommendations are presented in two categories: (1) recommendations for promoting acceptance of healthful foods and beverages, and (2) recommendations for promoting healthy appetites and growth. The recommendations were developed to influence the food parenting practices of parents and caregivers with the goal of providing the structure and autonomy support considered necessary for the development of healthy eating habits. The theoretical constructs informing each recommendation is provided in parentheses (where appropriate).

The panel recognizes that many families in the United States experience food insecurity or lack reliable access to healthy food in their communities, making it difficult to feed their children. Healthy, affordable food should be available in every community. No one in America should go hungry. No parent should have to choose between buying food for their children

or paying rent. Additional resources and policies needed for healthy food provision and to support implementation of these recommendations are included in the *Implementation Considerations* section of this report.

The following recommendations for promoting food acceptance may not be appropriate for children with disabilities, sensory sensitivities, and high levels of food refusal. Care for children with complex medical problems, developmental differences, and eating or feeding disorders will often require additional supports guided by their health care provider. Review of the extensive literature involving these populations and its translation to recommendations specific to these groups is outside the scope of this report.

Practical tips on how to implement these recommendations are included in **Appendix 3**.

Provide children with abundant opportunities to learn about and have positive experiences with new foods by structuring the food environment and supporting children’s autonomy.

Structure the food environment to support food acceptance

- **Provide repeated exposure to new foods.** This is the most simple and effective strategy shown to promote liking and intake of healthy new foods among young children.¹⁵⁷
 - Repeated exposure may be most effective during early childhood although recent studies suggest that it will also be helpful for school-aged children.¹⁵³
 - Children can require up to 15 exposures to accept new foods, but newer studies suggest that eight or fewer exposures can increase food and flavor acceptance.^{156,178}
 - Successful exposures to new foods can occur through small tastes (full portions need not be served/consumed).
 - Caregivers should continue to offer opportunities to try new foods even if a child has refused the item on several occasions.
- **Make healthy foods and beverages available to children throughout the day at planned meals and snacks.** Children learn to like what is familiar and appealing to them. (Availability construct)

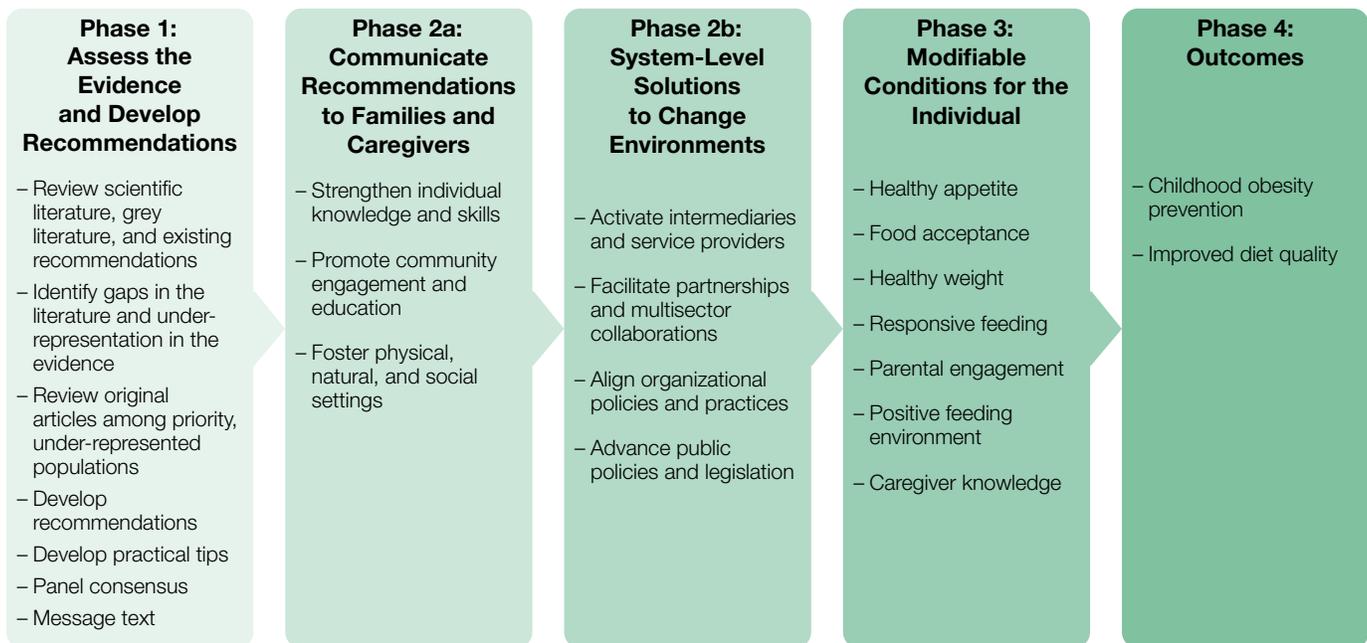
Support children’s autonomy in learning to accept healthful foods

- **Model for children how delicious new foods can be.** Children are quicker to try new foods and show greater levels of acceptance when observing peers and adults eating and enjoying the same foods and beverages.¹⁷⁴ (Social modeling construct)
- **Offer positive reinforcement, such as small non-food rewards (e.g., stickers) and verbal praise, for trying new foods.**^{73,157} This may facilitate repeated exposure by encouraging children to try new foods. (Material/social rewards construct)
- **Encourage children to learn about new foods by using all of their senses—looking, smelling, hearing, touching, and tasting.** Tasting foods is most critical to learning to accept new foods, but non-tasting sensory exposures may increase willingness to try new foods.¹⁹⁰ (Sensory exposure construct)
- **Pair new foods with familiar flavors.** For example, providing vegetables with dips/dressing may encourage children to try new foods. (Foods paired with highly liked flavors; Flavor-flavor and Flavor-nutrient learning construct)
- **Include children in food preparation.** This could include growing, choosing, preparing, and serving foods at home and school settings.^{155,220,221} (Gardening, cooking studies construct)
- **Get creative and offer foods in positive ways.** For example, give new foods fun names (e.g., emerald dragon bites) and/or associate foods with familiar cartoon characters (e.g., “Dora the Explorer loves broccoli!”).²²² (Associative conditioning/behavioral economics construct)

Provide children with the support to make healthy choices and eat moderately by structuring the food environment and supporting children’s autonomy to regulate appetite.

<p>Structure the food environment to promote healthy appetites and prevent overeating and excessive intake of nutrient-poor foods</p>	<ul style="list-style-type: none">• Have family meals as much as your schedule allows. Family meals support children’s intake of healthful foods and provide opportunities to connect and communicate with children.^{223,224}<ul style="list-style-type: none">– Create eating routines, such as shared meals, as much as the family schedule allows.^{223,224}– Plan healthy meals.^{204-207,225-237}– Model eating healthy foods.^{204-207,225-237}• Offer child-appropriate portion sizes.^{204-207,225-237}• Provide repeated exposure to new healthy foods.^{204-207,225-237}• Limit the amount of sugary drinks and snack foods in the home. The availability of sugary drinks and snack foods in the home and parents’ consumption of these foods is closely linked with children’s intake of these foods.²⁶<ul style="list-style-type: none">– Reserve sugary drinks and sweets for special occasions like family celebrations.^{204-207,225-237}– Make healthful foods more available and energy-dense nutrient poor foods less available in the home.• Limit eating out/take-out foods.^{204-207,225-237}
<p>Support children’s autonomy in regulating appetite</p>	<ul style="list-style-type: none">• Have family members and other caregivers’ model healthy eating.• Encourage fruit, vegetable, and water intake.^{204-207,225-237}• Be responsive to and respect child hunger and fullness cues.• Use praise and encouragement when making healthy choices.• Give children fixed choices—for example, would you prefer strawberries or grapes?
<p>Avoid highly coercive and controlling food parenting practices</p>	<ul style="list-style-type: none">• Avoid pressuring children to eat and being highly restrictive about specific foods. These practices can interfere with some children’s self-regulation of intake.^{7,133,238}

Figure 5. I+PSE Conceptual Framework for Action



Adapted from: Tagtow A, Herman D, Cunningham-Sabo L. Next-Generation Solutions to Address Adaptive Challenges in Dietetics Practice: The I+PSE Conceptual Framework for Action. *Journal of the Academy of Nutrition and Dietetics*.

Implementation Considerations

The environments in which a family, caregiver, and child live, learn, and play have a strong influence on healthy eating behaviors. Knowledge of recommendations to promote development of healthy eating behaviors is important, but caregivers also need access to adequate social, economic, and family support to successfully incorporate these recommendations into their daily routines.

Social determinants of health such as income, education, access to quality health care, and the neighborhood or community of residence profoundly influence health, well-being and quality of life. For example, grocery stores with numerous healthy options are more likely to be located in middle to high-income neighborhoods, whereas neighborhoods of predominantly low incomes are more likely to have fewer grocery stores and more corner/convenience stores, which often lack a variety of healthy foods. Strategies are needed to address the challenges families and caregivers face in helping children develop healthful eating habits, and to explore how policies, systems, and environmental solutions can be leveraged or modified to support proper implementation of the recommendations in and outside the home.

HER uses a systems-thinking approach to understand the larger context in which feeding occurs and to address challenges to promoting healthy eating behaviors among young children

using multi-dimensional strategies, as shown in **Figure 5**. This figure is adapted from the Individual plus Policy, System, and Environmental (I+PSE) Conceptual Framework for Action²³⁹ to outline the process (Phase 1) and potential applications for these recommendations in a variety of settings (Phase 2a and 2b), which the panel hopes will lead to the formation of coordinated multidimensional strategies that produce a change in modifiable conditions and outcomes for young children and families (Phases 3 and 4).

The following sections outline opportunities to strengthen individual knowledge and skills, promote community engagement and education, activate service providers, facilitate partnerships and multisector collaborations, align organizational policies and practices, foster physical and social settings, and advance public policies and legislation in settings where young children and families spend time, with the goal of strengthening implementation of these recommendations and ultimately impacting child weight and diet quality. The implementation of the recommendations by caregivers and parents is strongly impacted by family economics and social support, thus the following sections also consider specific policies that may facilitate implementation among socioeconomically disadvantaged families.

Family Economics

A parent or caregiver's ability to implement these recommendations, both in the home and in settings outside the home (i.e., early child care and school), is influenced by economic and social determinants of health. Families with low incomes, for example, face specific challenges in implementing feeding guidelines, mainly due to limited time and resources. Thus, the most critical policy actions needed to support the development of healthy eating habits of young children are those that improve equitable access to financial security, good paying jobs with benefits, and health care. The following actions are imperative to ensure all children in the United States have an equal opportunity to pursue a healthier life, which includes access to the healthy foods and support necessary for developing healthy dietary patterns early in life:

1. Family income support: Identify economic/income policies that will lift families out of poverty. This could include increasing the federal minimum wage to a living wage and/or guaranteeing a livable wage to all families (i.e., universal basic income).
2. Paid parental leave: Explore opportunities to provide paid parental leave to all Americans in order to enable and support individuals in caring for and bonding with young children.
3. Promote policies and programs that help individuals and families build wealth and address racial wealth disparities.

Early Care and Education Programs

In 2016, 60 percent of children from birth to 5 years old in the United States participated in at least one weekly nonparental care arrangement, 59 percent of which received care at a center, 41 percent from a relative, and 22 percent from a non-relative, commonly in family child care homes.²⁴⁰ This number was higher among children 3 to 5 years old, with 73 percent under non-parental care, and the large majority of those children (82%) at a child care center.²⁴⁰ Center-based arrangements include day-care centers, Head Start programs, preschools, and other early childhood programs. The Child and Adult Care Food Program is a federal nutrition assistance program that provides more than 4.2 million income-eligible children nutritious meals and snacks each day.²⁴¹ In addition, Head Start is a robust program that promotes school readiness in young children from families with low income, provides services in a variety of settings, and reached 38 percent of eligible children ages 3 to 5 in 2018-2019.²⁴²

Given the widespread reach of these programs, and especially to children from families with low income, early child care and education programs should be considered an important setting for integration and dissemination of these recommendations. Actions to consider that will enable implementation of the recommendations and, overall, support the development of healthy eating behaviors among young children in early child care settings include:

Practices and Policies

- Increase collaboration between child-care providers, parents, and social services.
 - Support innovative approaches for child-care settings to promote parental or caregiver involvement, using Head Start as a model. For example, Head Start has a Code of Federal Regulations that specifies that parents must be included in all aspects of programs and requires that services be provided directly to parents.
 - Establish consistent messaging regarding healthy eating, including responsive feeding, and food acceptance to parents or caregivers across delivery models and sources, such as pediatricians, WIC, and child-care settings.
 - Support collaborations and partnerships between child-care providers and social services (e.g., SNAP, Medicaid, WIC) to address food insecurity and support effective childhood obesity prevention practices.
- Call for policies and practices that promote the availability and consumption of healthful foods, and support implementation of best practices for how to feed young children as recommended in this report.
 - Establish minimal requirements or standards for healthy food practices as part of state child-care licensing regulations, and include specific standards as part of the Quality Rating and Improvement System (QRIS, which assesses the quality at Early Care and Education programs and school-age education programs).
 - Ensure CACFP meal pattern guidelines are aligned with the latest Dietary Guidelines for Americans recommendations, and urge for best practices that support the promotion of healthy food acceptance and healthy appetites and growth as recommended in this report.
 - Allocate additional federal, state, or local funding to provide technical assistance and training for providers, and facility-level interventions around menu changes, hands-on nutrition education activities, and communication with parents.

- Promote early child care meal strategies such as taste tests, repeated exposures of new items, or inclusion of “flavor bars,” which allow the inclusion of culturally appropriate foods and seasonings, as part of the feeding environment. Additional opportunities to enhance the cultural appropriateness of child-care setting meals and food choices should be explored through research, technical assistance, and funding support.
- Support policies that expand the availability of healthful meals in child-care settings, such as via Farm to Early Care and Education Programs or the USDA Fresh Fruit and Vegetable Snack Program, and utilize Local Wellness Policies to further reduce less healthy options offered through traditional fundraisers (e.g., bake sales) or classroom celebrations and to support recommendations for promoting food acceptance and healthy appetites and growth.

System-Level Approaches

- Change practices and policies to reduce administrative burden and make it easier for family child care homes and smaller centers to participate in the CACFP, which will ultimately increase child participation in the program.
- Leverage broad public health initiatives and resources, such as funds produced through taxes on unhealthy foods, to invest in early care and education settings, with a focus on nutrition and health.
- Promote child-care provider wellness policies that support the retention of experienced caregivers in the child-care industry, such as increasing minimum wage and mandating paid maternity leave for a reasonable amount of time.

National School Meal Programs

The National School Lunch Program (NSLP) provides lunch to more than 30 million children in an average week day, 21.5 million of whom are from families with low incomes. About 15 million children participate in the School Breakfast Program.²⁴³ Eligible elementary students have the highest participation in the School Meal Programs compared to middle and high school students (83% compared to 79% and 72% for NSLP and 41% compared to 35% and 31% for SBP).²⁴⁴ Many of these children consume up to half of their daily calories from school meals. Nutrition standards for reimbursable meals and snacks and a la carte foods and beverages were updated following passage of the 2010 Healthy, Hunger-Free Kids Act, resulting in more fruits, vegetables, and whole grain-rich foods, as well as limits on total calories, sodium, and removal of trans fats. As a result, schools provide the best mean diet quality of major U.S. food sources for school-age children.²⁴⁵

What children consume at school is influenced by a variety of factors including cafeteria-level strategies and policies that influence availability of healthy options. Actions to consider that may enable implementation of the recommendations and support healthy eating and food acceptance among young children in elementary school settings include:

Practices and Policies

- Support the implementation of strategies at the cafeteria level that increase students’ consumption of healthy foods:²⁴⁶
 - Offer more food choices for students. Within a given meal component (i.e., vegetable, grain, fruit), offering at least two choices to students shows strong potential to improve meal consumption.
 - Pre-slice fruit. Evidence suggests that kids are more likely to consume pre-sliced fruit compared to whole fruit because whole fruit like apples and oranges can be difficult to consume in a short amount of time. Furthermore, young children may struggle to hold and bite larger fruits and older children may have concerns of eating whole fruit related to losing teeth and tooth pain, or perceived mess.
 - Set minimum lengths for lunch periods. Lunch periods of at least 30 minutes have been shown to have the greatest benefits for students.
 - Implement recess before lunch. Having recess occur before instead of after lunch has a positive association with consumption of school foods. Recess before lunch may also reduce disruptive student behavior in the cafeteria.
 - Limit access to snack foods and beverages in schools. Children are more likely to consume more of their school meals when snack foods and beverages are limited or unavailable.
 - Enhance palatability and cultural awareness of meals. Evidence suggests that initiatives to improve the cultural relevance of recipes and incorporate culturally appropriate flavors is associated with increased consumption of school meals. This strategy can be cost-effective by hiring chefs or partnering with volunteer chefs from local restaurants.
 - Additional opportunities to improve school meal consumption that need to be explored further include nutrition education, choice architecture (e.g., placing the healthiest items—like fruit and veggies—first in the cafeteria line), and taste tests or repeated exposures of new items through initiatives like “flavor bars.”



- Support policies that expand the availability of healthful meals in elementary schools, such as via Farm to School Programs or the USDA Fresh Fruit and Vegetable Snack Program, and use Local Wellness Policies to further reduce less healthy options offered through traditional fundraisers (e.g., bake sales) or classroom celebrations.

Systems-Level Approaches

- Allocate additional resources for training cafeteria staff on scratch-cooking, enlisting technical assistance to enhance existing school meal recipes or adapting recipes for cultural relevance, and for purchasing school kitchen equipment to allow school cafeterias to improve the palatability of meals.
- Align the meal pattern requirements and nutrition standards for the National School Lunch Program and School Breakfast Program with the 2020-2025 Dietary Guidelines for Americans. This includes incorporating an added sugar standard for both NSLP and SBP.
- Eliminate loopholes in the Smart Snack standards to ensure foods and beverages sold to children at school align with the 2020-2025 Dietary Guidelines for Americans.
- Support federal policies that expand the availability and accessibility of healthful meals and reduce stigma, such as Healthy Free Meals for All and Community Eligibility Provision.
- Support access to safe water via drinking fountains.

Health Care System

Professionals in the health care system have an important role to play in educating and counseling parents and caregivers to promote healthy appetites, food acceptance, and obesity prevention in young children. Actions that can be taken in the health care system include:

Practices and Policies

- Inform and educate health care providers about these recommendations and best practices so that they may be integrated into early intervention counseling of families in clinical and non-clinical settings.
- Better coordinate and integrate WIC nutritionists and pediatricians so that consistent messages are delivered to families. Specific strategies to foster the coordination of WIC nutritionists and pediatricians should also be explored, such as integration of data systems.
- Support implementation by a combination of counseling with text messaging and web-based support and information, as well as with community-based care, such as through community health care centers.

Systems-Level Approaches

- Integrate these recommendations into nutrition education resources and guidance through Medicaid and the Children's Health Insurance Program.
- Integrate these recommendations into Home Visiting Programs, such as The Maternal, Infant, and Early Childhood Home Visiting Program.
- Give health care providers additional nutrition education and weight bias training.

Food and Nutrition Assistance Programs

Federal food and nutrition assistance programs serve as a safety net for families with low incomes. Examples of these programs include the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), the Supplemental Nutrition Assistance Program (SNAP), and School Meal Programs. The foods and nutrition education made available through the various food and nutrition assistance programs are largely informed by policies at the federal and local levels. Actions that can be taken at the systems-level to incorporate the recommendations in food and nutrition assistance programs include:

- Encourage policies within federal nutrition assistance programs that improve the healthfulness of meals served, engage parents and caregivers, and align program nutrition guidance with the recommendations. Such policies should be prioritized in WIC, SNAP-Ed, Head Start, and afterschool and summer programming.
- Incorporate these recommendations into existing WIC Nutrition Education Guidance by USDA, to be used by State agencies.
- Incorporate recommendations into the 2025-2030 Dietary Guidelines for Americans (DGA) for *how* to feed young children to build on the incorporation of responsive feeding as a strategy to promote healthy diets in 0- to 2-year-olds in the 2020-2025 DGA.
- Support integration of these recommendations into the emergency feeding system, such as through guidance and resources distributed by the Emergency Food Assistance Program and used by the charitable food system nationwide.
- Support the following SNAP-specific system-level policies:
 - Maintain the increase of SNAP benefits for families granted in the updated Thrifty Food Plan and COVID-19 relief bills (and formerly 2009 ARRA package)—giving families with low incomes more resources for purchasing healthier foods.
 - Adapt the Summer Pandemic-Electronic Benefit Transfer program as a permanent model to give additional food resources to families with low incomes during the summer.
 - Double investments in programs like SNAP-Ed and GusNIP (fruit/vegetable incentive programs) to allow SNAP participants to purchase more fruits and vegetables.
 - Integrate recommendations into SNAP-Ed programs nationwide (see Food Assistance Programs section below).

Food and Beverage Marketing Targeting Children

Food and beverage marketing targeting children is an important component of the commercial determinants of health, which have been described as strategies and approaches used by the private sector to promote products and choices that are detrimental to health.²⁴⁷ Recent research has shown that young people see more than 50,000 advertisements each year on television alone, and nearly 50 percent of this media is for fast food, sugary beverages, or snack foods.²⁴⁸ In recent years, digital or new media marketing, like YouTube and social media platforms, has seen significant growth further increasing children's exposure to such advertisements.²⁴⁹ Moreover, data supports that children are influenced by food and beverage advertising when it comes to food choices and developing preferences.

Federal regulations for marketing to children need to be strengthened, as companies self-regulate. The vast majority of foods allowed for marketing remain unhealthy. Most notably and worrisome from an equity lens, a report released in 2019 found that junk food advertising targets Latino and Black children.²⁵⁰ A recent study exploring the marketing of unhealthy foods and beverages in quick-service restaurants also found that these foods were disproportionately targeted to communities with low income and minority communities.²⁵¹ These advertisements have been shown to influence food purchasing patterns, which exacerbate health disparities. Actions that incorporate the recommendations at the systems level to limit the negative impact of targeted food marketing include:

- Strengthen voluntary standards and federal regulations for food marketing to children to align with the 2020-2025 Dietary Guidelines for Americans.
- Support policies that prevent the targeted marketing of unhealthy foods to socioeconomically-disadvantaged populations.



Priorities for Future Research

The expert panel acknowledges that this report's recommendations are largely based on studies of predominantly non-Hispanic, white, well-resourced families, which is not reflective of the tremendous diversity of parents, caregivers, and families involved in feeding young children in the United States. The following research priorities can help address these limitations.

Research Needs on the Development of Food Acceptance during Childhood

- Research to identify effective approaches for children with high levels of food fussiness, food neophobia, and picky eating. Specifically, there is a need to better understand individual differences in the effectiveness of repeated exposure and other strategies.
- Research to examine strategies to promote liking of and intake of healthful foods among older, school-aged children, who have greater autonomy over their eating choices than younger children and have accumulated a greater complexity of positive and negative experiences with foods.
- Research to evaluate strategies to promote food acceptance in racially and ethnically diverse and lower-income populations, as well as in the context of diverse cultural practices that are not well-represented in the existing literature.
- Research in more diverse, ecologically valid settings (such as child care and school) to examine the wider range of social influences as well as policy influences that shape the availability of healthful foods, caregiver influences, and children's behavior.

Research Needs on the Development of Healthy Appetites and Growth during Childhood

- Research on caregivers' food parenting practices that support healthy eating behaviors, including behavioral research to identify developmentally appropriate supportive practices and experimental/intervention research to evaluate the efficacy and effectiveness of authoritative approaches.
- Novel trial designs and improved intervention reporting²⁵² to enable disentangling intervention effects within bundled interventions in order to refine intervention approaches.
- Longitudinal investigations, experimental studies, and randomized controlled trials to better infer and understand temporality, directionality, and causation of feeding styles and food parenting practices.
- Studies that characterize both parent and child contributions and perspectives, along with the reciprocal nature of their interactions.
- Longitudinal studies to examine if and how responsive food parenting practices during infancy and early toddlerhood influence healthy eating behaviors during later childhood.
- Research to identify supportive practices in the context of diverse cultural beliefs and practices (e.g., food is revered and not to be played with, orderliness and tidiness are valued and therefore self-feeding is avoided until the child can self-feed neatly²⁵³).

- Research that extends beyond categorizing individuals based on race and instead relies on a more comprehensive framework of ethnicity, considers the many social determinants of health (including experienced racism), and avoids conflating race and ethnicity.²⁵⁴
- Research to examine how food parenting may change as children develop, including the practices most critical for supporting optimal eating behavior regulation and growth outcomes at various stages of development.
- Research on effective approaches for children with high levels of food approach versus food avoidance, including examination of parenting practices to support individual differences in children's behavioral dispositions towards eating.
- Research to examine contributions and roles of key caregivers in addition to mothers (e.g., fathers, partners, and grandparents) in supporting children's healthy eating behaviors and growth.
- Studies in child-care and school settings that provide empirical support for policy level approaches to facilitate children's healthy eating behaviors and growth. Research that spans environments (e.g., home and school) is needed to examine how consistency and integration of messaging across settings can improve outcomes.
- Research to characterize benefits of family meals for children younger than age 6, including randomized controlled trials that test effects of family meals.
- Improved methods to measure children's food consumption outside the home setting and across multiple environments.
- Research to examine food parenting practices among families with low incomes or food insecurity.
- Research to examine how health inequities resulting from poverty, structural racism, and discrimination affect development of children's healthy eating behaviors, with attention to the potential effects of factors such as food insecurity, housing instability, and lack of access to quality education, health care, and transportation.
- Research that includes more refined conceptualizations of child development and considers how child developmental stage across a range of domains may moderate intervention effects or study findings.
- Research to describe the interplay between general parenting styles, feeding styles, and food parenting practices and effects on children's eating outcomes.



Conclusion

Research conducted over the past four decades highlights the fundamental role of caregivers in shaping the development of children's eating behaviors. This report's recommendations, intended primarily for caregivers of young children in home and other settings such as child care and school, represent a comprehensive and pragmatic approach for communicating with this audience about how to feed young children to promote food acceptance and healthy appetites and growth. Approaches that provide structure to the food environment and children's behaviors, but also support children's increasing needs for autonomy in eating, have been shown to promote these outcomes in young children.

Socioecological and developmental frameworks for understanding children's eating highlight multi-level influences of the child, caregiver, family, and broader socioeconomic and cultural contexts. For this reason, there is a great need for research that considers influences on children's eating across a broader range of development and in diverse populations that are not well-represented in the literature, which has historically focused on food parenting among cohorts composed predominantly of non-Hispanic, white, well-resourced mothers of preschool-aged children. This report details a series of research needs to address gaps in understanding the development of healthy eating behaviors in children.

The report also includes recommendations for system changes to facilitate caregiver implementation of the recommendations. Identifying policies and practices as well as systems approaches for promoting healthy eating behaviors and dietary patterns in the contexts where eating occurs provides tremendous opportunities for positively influencing children's eating and health on a population level.



Appendices

- 1. Literature Review Search Strategy**
- 2. Table of Included Research**
- 3. Practical Tips for Promoting Healthy Eating Behaviors in Children Ages 2 to 8 Years**

Appendix 1. Literature Review Search Strategy

Search strategy topics and terms

Topic	Search Terms
Child-care environments and policies	Child, children AND child-care center OR childhood education and care OR child care – AND intake OR intervention OR dietary intervention OR dietary OR policy OR environment OR food
Family-based obesity prevention interventions	References provided by expert panel
Family meals, fathering, other caregivers	Child, children AND family meals OR fathers OR caregivers – AND intake OR weight
General parenting interventions	References provided by expert panel
Food acceptance	Child, children AND food preference OR food acceptance – AND associative conditioning OR repeated exposure
Parenting styles & food parenting practices	Child, children AND food parenting OR feeding practices OR feeding styles – AND social/adult modeling OR praise OR child involvement OR encouragement and support OR reasoning OR negotiation OR authoritative
Picky eating	Child, children AND picky eating OR neophobia
Taste preferences	Child, children AND taste preference OR sweet preference OR bitter sensitivity OR salt preference

In order to be included, articles needed to meet the following criteria:

- be classified as a review, systematic review, or meta-analysis;
- published within the past decade (i.e., 2010 and later);
- published in the English language;
- human subjects only;
- include children between the ages of 2 to 8 years (though allowances were made for studies including children ages 2 to 5 years and/or 6 to 12 years); and
- evaluate one or more of the outcomes of interest.

Appendix 2. Table of Included Research

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Francis L, Shodeinde L, Black MM, Allen J. Examining the Obesogenic Attributes of the Family Child Care Home Environment: A Literature Review, <i>Journal of Obesity</i> , 2018. ²⁵⁵	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Family Child Care Homes that cared for children 2-5 years	United States, of 8 studies that reported provider or child race, 4 had majority Latino providers/children, 3 had majority white providers, 1 had majority Black providers	Family Child Care Homes lack written policies on nutrition and physical activity, have limited equipment and space for playtime activities, have inadequate nutrition training for providers, have poor food parenting practices, and poor nutrition-related communication with families	National Institutes of Health
Garvin TM, Weissenburger-Moser Boyd L, Chiappone A, Blaser C, Story M, Gertel-Rosenberg A, et al. Multisector Approach to Improve Healthy Eating and Physical Activity Policies and Practices in Early Care and Education Programs: The National Early Care and Education Learning Collaboratives Project, 2013–2017. <i>Prev Chronic Dis</i> 2019;16:180582. ²⁵⁶	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers that served infants, toddlers, and/or preschoolers	United States	Development, implementation, and evaluation of policy and practice-based partnerships to promote healthy eating and physical activity among children attending early care and education programs may contribute to obesity prevention in the United States	Centers for Disease Control and Prevention
Larson N, Looby AA, Frost N, Nanney MS, Story M. What can be learned from existing investigations of weight-related practices and policies with the potential to impact disparities in US child-care settings? A narrative review and call for surveillance and evaluation efforts, <i>J Acad Nutr Diet</i> , 2017;117:1554-1577. ²⁵⁷	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers or Family Child Care Homes that served infants, toddlers, and/or preschool children	United States	Scientific gaps exist in understanding of policies designed to promote health equity in the social and physical child-care environments of young children	Healthy Eating Research Program
Matwiejczyk L, Mehta K, Scott J, Tonkin E, Coveney, J. Characteristics of effective interventions promoting healthy eating for pre-schoolers in childcare settings: An umbrella review, <i>Nutrients</i> , 2018, 10, 293. ²⁵⁸	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers for children 0-6 y	Majority from United States	Successful interventions were multi-component, multi-level targeting both environmental and individual-level determinants of healthy eating behaviors	None
Seward K, Finch M, Yoong SL, Wyse R, Jones J, Grady A, Wiggers J, Nathan N, Conte K, Wolfenden L. Factors that influence the implementation of dietary guidelines regarding food provision in centre based childcare services: A systematic review, <i>Preventive Medicine</i> , 2017, 197-205. ²⁵⁹	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers	Majority from Canada and the United States	Barriers involve the acquisition of new foods, cooking instruments, recipes and upskilling of staff that increase expenses incurred by services as well as beliefs about children's dislike of new foods. Facilitators involve provision of assistance and support (e.g., working with food vendors, experienced cooks and using pre-tested recipes)	Priority Research Centre for Health Behaviour, Hunter New England Population Health, University of Newcastle
Ward S, Bélanger M, Donovan D, Carrier N. Systematic review of the relationship between childcare educators' practices and preschoolers' physical activity and eating behaviours, <i>Obesity Reviews</i> , 2015, 16, 1055-1070. ²⁶⁰	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers or Family Child Care Homes	Majority United States, 6 of 15 studies were primarily Black or Hispanic/Latino	Educators may play a positive role in promoting healthy behaviors in children, but this is mainly based on a small number of intervention type studies of low or moderate quality	Canadian Institutes of Health Research Charles Best Canada Graduate Scholarships Doctoral Award, Gérard-Eugène-Plante Doctoral Scholarship
Ward DS, Welker E, Choate A, Henderson KE, Lott M, Tovar A, Wilson A, Sallis, J. Strength of obesity prevention interventions in early care and education settings: A systematic review, <i>Preventive Medicine</i> , 2017, 95, S37-S52. ²⁶¹	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers for children 2-6 years	Majority United States, followed by Australia, Germany, Switzerland; Majority of those that reported were low to middle income and were predominately Black, Latino and/or other	Multi-component ECE interventions with parent engagement are mostly likely to be effective	None
Zhang Z, Pereira JR, Sousa-Sá E, Okely AD, Feng X, Santos R. Environmental characteristics of early childhood education and care centres and young children's weight status: A systematic review, <i>Preventative Medicine</i> , 2018, 106, 13-25. ²⁶²	What child-care environments and policies support healthy eating behaviors in children?	Child-care environments and policies	Child-care centers for children 0-6 y	United States, Germany, Sweden, Israel, Vietnam	To promote healthy weight, ECEC settings should improve their active environments, reduce opportunities for sedentary behaviors and limit servings of high sugar and high fat food. For most environmental factors, strong evidence is not yet available	None
Ash T, Agaronov A, Young TL, Aftosmes-Tobio A, Davison KK. Family-based childhood obesity prevention interventions: a systematic review and quantitative content analysis. <i>International Journal of Behavioral Nutrition and Physical Activity</i> . 2017;14(1):113. ²²⁵	What parenting components are included in successful family-based obesity prevention interventions?	Family-based obesity prevention interventions	<18 years	Majority United States, Europe and Australia; Low SES and Hispanic/Latino families well represented	To ensure a broad evidence base, more interventions implemented in developing countries and targeting racial minorities, children at both ends of the age spectrum, and media and sleep behaviors would be beneficial	None

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Enright G, Allman-Farinelli M, Redfern J. Effectiveness of Family-Based Behavior Change Interventions on Obesity-Related Behavior Change in Children: A Realist Synthesis. <i>International journal of environmental research and public health</i> . 2020;17(11):4099. ²⁰⁵	What parenting components are included in successful family-based obesity prevention interventions?	Family-based obesity prevention interventions	7-13 years	Majority of studies United States, followed by Australia, Europe, United Kingdom, and Other	Implications for enhancing future policy and practice include involving parents in goal-setting, motivational counselling, role modeling, and restructuring the physical environment to promote mutual empowerment of both parents and children, shared value and whole-family ownership in which intrinsic motivation and self-efficacy are implicit	Authors supported by National Health and Medical Research Council scholarship and fellowship
Pamungkas RA, Chamroonsawasdi K. Home-Based Interventions to Treat and Prevent Childhood Obesity: A Systematic Review and Meta-Analysis. <i>Behav Sci (Basel)</i> . 2019;9(4). ²⁰⁴	What parenting components are included in successful family-based obesity prevention interventions?	Family-based obesity prevention interventions	NS	NS	Home-based interventions successfully reduced BMI	This research was partially funded for publication by Faculty of Public Health, Mahidol University, Thailand
Perdew M, Liu S, Naylor P-J. Family-based nutrition interventions for obesity prevention among school-aged children: a systematic review. <i>Translational Behavioral Medicine</i> . 2020. ²⁰⁶	What parenting components are included in successful family-based obesity prevention interventions?	Family-based obesity prevention interventions	5-18 years	Majority of studies United States, half targeted minority populations and low SES	Successful nutrition interventions targeting children 5-18 years old appear to include setting family-based goals, modifying home food environment, hands-on approaches to teaching nutrition (games, group-based activities), and fruit and vegetable vouchers	This project was funded by Mitacs and any additional funding that Megan Perdew received during her MSc at the University of Victoria
McCullough MB, Robson SM, Stark LJ. A Review of the Structural Characteristics of Family Meals with Children in the United States. <i>Advances in nutrition</i> (Bethesda, Md). 2016;7(4):627-40. ¹⁴²	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	2-18 years	United States, majority white, but also including Black, Latino, Asian, Native American	Studies characterized family meals with the use of ≥1 of the following structural features: frequency or mean number of family meals per week, length of family meal, people present at meal, and where meals occurred	National Institute of Diabetes and Digestive and Kidney Diseases
Hammons AJ, Fiese BH. Is frequency of shared family meals related to the nutritional health of children and adolescents? <i>Pediatrics</i> . 2011;127(6):e1565-74. ¹⁴³	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	2-17 years	Majority of studies from United States, also Australia, Canada, Finland, Japan, New Zealand	The frequency of shared family meals is significantly related to nutritional health in children and adolescents. Children and adolescents who share family meals 3 or more times per week are more likely to be in a normal weight range and have healthier dietary and eating patterns than those who share fewer than 3 family meals together	U.S. Department of Agriculture National Institute of Food and Agriculture
Martin-Biggers J, Spaccarotella K, Berhaupt-Glickstein A, Hongu N, Worobey J, Byrd-Bredbenner C. Come and get it! A discussion of family mealtime literature and factors affecting obesity risk. <i>Adv Nutr</i> . 2014;5(3):235-47. ¹⁴⁴	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	No restrictions on child age	NS	More frequent family meals are associated with greater consumption of healthy foods in children, adolescents, and adults. Increased family meal frequency may decrease risk of overweight or obesity in children and adolescents. Frequency of family meals differs by ethnicity, SES, and child age	USDA/National Institute of Food and Agriculture
Davison KK, Gicevic S, Aftosmes-Tobio A, Ganter C, Simon CL, Newlan S, et al. Fathers' Representation in Observational Studies on Parenting and Childhood Obesity: A Systematic Review and Content Analysis. <i>Am J Public Health</i> . 2016;106(11):e14-e21. ¹³⁷	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	0-17 years	Majority of studies from United States, Europe, United Kingdom, Australia, New Zealand, Papua New Guinea	Fathers are underrepresented in research on parenting and obesity among children	Predoctoral training grants: National Institute of General Medical Sciences of the National Institutes of Health, Maternal and Child Health Bureau, National Institute of Child Health and Human Development
Davison KK, Haines J, Garcia EA, Douglas S, McBride B. Fathers' food parenting: A scoping review of the literature from 1990 to 2019. <i>Pediatric Obesity</i> . 2020 Oct 1;15(10). e12654. ¹³⁹	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	6 mo-18 years	United States, Europe, United Kingdom, Australia, Canada, Asia, Of race reported, 24 studies white, 12 studies Hispanic/Latinx, 10 studies Black	Fathers are involved in food parenting, but at lower levels than mothers; there are few consistent mother-father differences in food parenting practices; and fathers' controlling food parenting is linked with negative nutrition outcomes in children while responsive food parenting is linked with positive child outcomes	Eunice Kennedy Shriver National Institute of Child Health and Human Development
Litchford A, Savoie Roskos MR, Wengreen H. Influence of fathers on the feeding practices and behaviors of children: A systematic review. <i>Appetite</i> . 2020;147:104558. ¹³⁸	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	Birth-18 years	United States, Australia, Canada, Belgium, Netherlands, Iceland, United Kingdom, and other European countries	Father's BMI was positively correlated with child's BMI, father's dietary intake was predictive of child's dietary intake, food availability in the home influenced child intake, father's food parenting style predicted their children's eating behaviors and congruent parenting by mothers and fathers produced the best child food choices	None
Morgan PJ, Young MD. The Influence of Fathers on Children's Physical Activity and Dietary Behaviors: Insights, Recommendations and Future Directions. <i>Curr Obes Rep</i> . 2017;6(3):324-33. ²⁶³	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	5-12 years	Australia	Fathers' behaviors and parenting practices likely play an important role in promoting healthy behaviors in children, the evidence base is limited	None

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Young KG, Duncanson K, Burrows T. Influence of grandparents on the dietary intake of their 2-12-year-old grandchildren: A systematic review. <i>Nutr Diet.</i> 2018;75(3):291-306. ¹⁴⁰	What is the influence of family meals, fathering, other caregivers on children's eating behaviors?	Family meals, fathering, other caregivers	2-12 years	United States, China, Greece, Australia, Canada, Japan, Most low to middle SES, diverse race/ethnicity	Grandparents in caregiving roles may negatively influence the dietary intake and weight status of their grandchildren	New South Wales Health Education Training Institute Rural Research Capacity Building Program
Gerards SM, Sleddens EF, Dagnelie PC, de Vries NK, Kremers SP. Interventions addressing general parenting to prevent or treat childhood obesity. <i>Int J Pediatr Obes.</i> 2011;6(2-2):e28-45. ²⁰⁸	What are the effects of general parenting interventions on weight status?	General parenting interventions	0-18 years	United States, Israel, Canada, United Kingdom; Primarily white	Despite the emerging observational evidence for the role of parenting in children's weight-related outcomes, few interventions have been developed that address general parenting in the prevention of childhood obesity	Dutch Heart Foundation
Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. <i>Clin Child Fam Psychol Rev.</i> 2010;13(3):231-53. ²⁰⁷	What are the effects of general parenting interventions on weight status?	General parenting interventions	6-19 years	Primarily white	Family-based treatment programs that incorporated training for authoritative parenting styles, parenting skills, or child management, and family functioning had positive effects on youth weight loss	Office of Research at The University of South Carolina, National Institutes of Child Health and Human Development
Wilson P, Rush R, Hussey S, Puckering C, Sim F, Allely CS, et al. How evidence-based is an 'evidence-based parenting program'? A PRISMA systematic review and meta-analysis of Triple P. <i>BMC Medicine.</i> 2012;10(1):130. ²⁰⁹	What are the effects of general parenting interventions on weight status?	General parenting interventions	1-16 years	NS	Mothers generally report that Triple P group interventions are better than no intervention, but there is no convincing evidence that Triple P interventions work across the whole population or that any benefits are long-term	None
Brotman LM, Dawson-McClure S, Huang K-Y, Theise R, Kamboukos D, Wang J, et al. Early childhood family intervention and long-term obesity prevention among high-risk minority youth. <i>Pediatrics.</i> 2012;129(3):e621-e8. ²⁶⁴	What are the effects of general parenting interventions on weight status?	General parenting interventions *original research	4 years	NS	Among youth at high risk for obesity, early intervention that promotes effective parenting led to meaningful differences in obesity in preadolescence	National Institute of Mental Health, Institute of Education Sciences, J. Ira and Nicki Harris Family Foundation
Gerards SM, Dagnelie PC, Gubbels JS, van Buuren S, Hamers FJ, Jansen MW, et al. The effectiveness of lifestyle triple P in the Netherlands: a randomized controlled trial. <i>PLoS One.</i> 2015;10(4):e0122240. ²⁶⁵	What are the effects of general parenting interventions on weight status?	General parenting interventions *original research	4-8 years	Netherlands	Although the Lifestyle Triple P intervention showed positive effects on some parent reported child behaviors and parenting measures, no effects were visible on children's body composition or objectively measured physical activity	Netherlands Organization for Health Research and Development
Magarey AM, Perry RA, Baur LA, Steinbeck KS, Sawyer M, Hills AP, et al. A parent-led family-focused treatment program for overweight children aged 5 to 9 years: the PEACH RCT. <i>Pediatrics.</i> 2011;127(2):214-22. ²⁶⁶	What are the effects of general parenting interventions on weight status?	General parenting interventions *original research	5-9 years	Australia	Using approaches that specifically target parent behavior, relative weight loss of ~10 percent is achievable in moderately obese prepubertal children and can be maintained for 2 years from baseline	None
West F, Sanders MR, Cleghorn GJ, Davies PS. Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change. <i>Behav Res Ther.</i> 2010;48(12):1170-9. ²⁶⁷	What are the effects of general parenting interventions on weight status?	General parenting interventions *original research	4-11 years	Australia, primarily white	The 12-week intervention was associated with significant reductions in child BMI z score and weight-related problem behavior. At the end of the intervention, parents reported increased confidence in managing children's weight-related behavior, and less frequent use of inconsistent or coercive parenting practices	Telstra Foundation
Barends C, Weenen H, Warren J, Hetherington MM, de Graaf C, de Vries JHM. A systematic review of practices to promote vegetable acceptance in the first three years of life. <i>Appetite.</i> 2019;137:174-97. ¹⁵⁸	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	0-3 years	Australia, Brazil, Canada, Denmark, France, Germany, Greece, Japan, Netherlands, Portugal, United Kingdom, United States	Repeated exposure was the most effective strategy to promote vegetable intake; Exposure to a variety of vegetables was also effective at increasing intake	Danone, the Netherlands; Wageningen University, the Netherlands
Appleton KM, Hemingway A, Rajska J, Hartwell H. Repeated exposure and conditioning strategies for increasing vegetable liking and intake: systematic review and meta-analyses of the published literature. <i>Am J Clin Nutr.</i> 2018;108(4):842-56. ¹⁵⁷	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Humans of any age	NS	Repeated exposure, a variety of vegetables, and the use of rewards are recommended for increasing vegetable liking and intake	EU FP7-funded project: VeggiEAT
Anzman-Frasca S, Ventura AK, Ehrenberg S, Myers KP. Promoting healthy food preferences from the start: a narrative review of food preference learning from the prenatal period through early childhood. <i>Obes Rev.</i> 2018;19(4):576-604. ¹⁷²	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	0-11 years	NS	Multiple studies in infancy, early childhood, and middle childhood support the idea that 8 or fewer exposures can increase food and flavor acceptance	None

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Blissett J. Chapter 3 - Effects of Modeling on Children's Eating Behavior. In: Lumeng JC, Fisher JO, editors. <i>Pediatric Food Preferences and Eating Behaviors</i> : Academic Press; 2018. p. 53-72. ¹⁷⁴	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Childhood, NS	NS	Peers may be more effective in modeling eating behavior for children; Modeling is effective in promoting novel food choice, the amount of food consumed, and changing food preference	None
Nekitsing C, Hetherington MM, Blundell-Birtill P. Developing Healthy Food Preferences in Preschool Children Through Taste Exposure, Sensory Learning, and Nutrition Education. <i>Curr Obes Rep</i> . 2018;7(1):60-7. ¹⁹⁰	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Preschool	NS	Repeated taste exposure strategies are the best evidenced for increasing intake of unfamiliar vegetables; strategies such as experiential learning and nutrition education may also have a role	ESRC Collaborative Award
Marty L, Chambaron S, Nicklaus S, Monnery-Patris S. Learned pleasure from eating: An opportunity to promote healthy eating in children? <i>Appetite</i> . 2018;120:265-74. ²⁶⁸	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Childhood, NS	NS	Pleasure from eating is a complex phenomenon that is partly learned across eating experiences during childhood	None
Holley CE, Farrow C, Haycraft E. A Systematic Review of Methods for Increasing Vegetable Consumption in Early Childhood. <i>Curr Nutr Rep</i> . 2017;6(2):157-70. ¹⁷⁸	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	2-5 years	Australia, Denmark, France, Netherlands, United Kingdom, United States	Repeated exposure is a well-supported strategy for increasing vegetable intake; Peer modeling and non-food rewards may also be effective strategy	None
Mura Paroche M, Caton SJ, Vereijken CMJL, Weenen H, Houston-Price C. How Infants and Young Children Learn About Food: A Systematic Review. <i>Frontiers in Psychology</i> . 2017;8(1046). ¹⁵²	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	0-3 years	Australia, Belgium, Canada, Denmark, France, Germany, Ireland, Netherlands, United Kingdom, United States	Identified four developmental processes for how children learn about food: familiarization, observational learning, associative learning, categorization	None
Birch LL. Learning to Eat: Behavioral and Psychological Aspects. <i>Nestle Nutr Inst Workshop Ser</i> . 2016;85:125-34. ¹⁴	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Childhood, NS	NS	Children learn about food and eating in the family environment, evidence suggests responsive parenting may help children learn to eat in the current obesogenic environment	None
Johnson SL. Developmental and Environmental Influences on Young Children's Vegetable Preferences and Consumption. <i>Adv Nutr</i> . 2016;7(1):220S-31S. ²⁷	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Childhood, NS	NS	Repeated exposure to novel and rejected foods is one of the most powerful strategies to improve acceptance; other influencers include: experiential learning, availability/accessibility, parental intake and modeling, parental feeding styles	Alliance for Potato Research and Education
Keller KL. The use of repeated exposure and associative conditioning to increase vegetable acceptance in children: explaining the variability across studies. <i>J Acad Nutr Diet</i> . 2014;114(8):1169-73. ⁶⁴	What strategies promote acceptance of healthy foods among typically developing children?	Food acceptance	Childhood, NS	NS	Individual and environmental characteristics should be considered to determine the most effective strategy to introduce new food into a child's diet	None
Blaine RE, Kachurak A, Davison KK, Klabunde R, Fisher JO. Food parenting and child snacking: a systematic review. <i>Int J Behav Nutr Phys Act</i> . 2017;14(1):146. ¹³³	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	2-18 years	Australia, Netherlands, United Kingdom, United States	Restrictive feeding and home access to unhealthy foods was most consistently associated with snacking among young children	None
Haines J, Haycraft E, Lytle L, Nicklaus S, Kok FJ, Merdji M, et al. Nurturing Children's Healthy Eating: Position statement. <i>Appetite</i> . 2019;137:124-33. ²⁶⁹	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	NS	NS	Four themes were identified that encourage and support healthy eating: positive parental feeding, eating together, a healthy home food environment, the pleasure of eating	Danone Institute International
Hughes SO, Papaioannou MA. Maternal Predictors of Child Dietary Behaviors and Weight Status. <i>Curr Nutr Rep</i> . 2018;7(4):268-73. ¹³¹	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	NS	NS	Authoritative feeding styles have been associated with better child diet quality and weight; Indulgent feeding styles have been associated with problematic eating behaviors and increased weight	Danone Institute International
Larsen JK, Hermans RC, Sleddens EF, Engels RC, Fisher JO, Kremers SP. How parental dietary behavior and food parenting practices affect children's dietary behavior. Interacting sources of influence? <i>Appetite</i> . 2015; 89:246-57. ²⁷⁰	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting Styles & Food Parenting Practices	NS	NS	The presentation of a conceptual model that bridges a gap by considering how children's dietary intake is influenced by parent's dietary behavior and the impact of food parenting practices	None

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Miller AL, Miller SE, Clark KM. Child, Caregiver, Family, and Social-Contextual Factors to Consider when Implementing Parent-Focused Child Feeding Interventions. <i>Curr Nutr Rep.</i> 2018;7(4):303-9. ²⁷¹	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	NS	NS	Multiple factors and levels (child-, parent-, family-, social-) need to be addressed to promote best food parenting practices	None
Ochoa A, Berge JM. Home Environmental Influences on Childhood Obesity in the Latino Population: A Decade Review of Literature. <i>J Immigr Minor Health.</i> 2017;19(2):430-47. ¹³²	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	2-18 years	Latino	Identified the following factors associated with childhood obesity in Latino children: parental influences, screen time, physical activity/ sedentary behavior, socioeconomic status/food security, sleep duration	National Heart, Lung, and Blood Institute
Rollins BY, Savage JS, Fisher JO, Birch LL. Alternatives to restrictive feeding practices to promote self-regulation in childhood: a developmental perspective. <i>Pediatr Obes.</i> 2016;11(5):326-32. ²³⁸	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	NS	NS	Restrictive food parenting practices are counterproductive, but parents need effective alternatives to help moderate children's intake of energy-dense foods and promote self-regulation	National Confectioners' Association
Shloim N, Edelson LR, Martin N, Hetherington MM. Parenting Styles, Feeding Styles, Feeding Practices, and Weight Status in 4-12-Year-Old Children: A Systematic Review of the Literature. <i>Front Psychol.</i> 2015;6:1849. ¹²⁹	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	4-12 years	Australia, Brazil, Germany, Malaysia, Netherlands, Turkey, United Kingdom, United States	Uninvolved, indulgent, and highly protective parenting was associated with higher BMIs in children, while authoritative parenting was associated with a healthy BMI; Behaviors and styles that are specific to the feeding context were consistently associated with child BMI	Nestec SA, Nestle, Vevey Switzerland
Sokol RL, Qin B, Poti JM. Parenting styles and body mass index: a systematic review of prospective studies among children. <i>Obes Rev.</i> 2017;18(3):281-92. ¹³⁰	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	<18 years	Australia, United States	The literature provides evidence that authoritative parenting style may be protective against overweight and obesity	National Institutes of Health, Carolina Population Center
Vaughn AE, Ward DS, Fisher JO, Faith MS, Hughes SO, Kremers SP, et al. Fundamental constructs in food parenting practices: a content map to guide future research. <i>Nutr Rev.</i> 2016;74(2):98-117. ⁷	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	NS	NS	The presentation of a conceptual model presents three overarching themes of higher-order food parenting constructs: coercive control, structure, autonomy support	Centers for Disease Control and Prevention
Vollmer RL, Mobley AR. Parenting styles, feeding styles, and their influence on child obesogenic behaviors and body weight. A review. <i>Appetite.</i> 2013; 71:232-41. ¹²⁸	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	<18 years	NS	While results related to parenting styles are inconsistent in the literature, an authoritative feeding style is found to be the most protective style whereas indulgent is most associated with negative health outcomes	None
Yee AZ, Lwin MO, Ho SS. The influence of parental practices on child promotive and preventive food consumption behaviors: a systematic review and meta-analysis. <i>Int J Behav Nutr Phys Act.</i> 2017;14(1):47. ²⁶	How can parenting promote a healthy appetite (and weight) in childhood?	Parenting styles & food parenting practices	<18 years	NS	Parental behaviors correlate with children's intake; availability and modeling show the strongest associations with both healthy and unhealthy food intake	None
Brown CL, Vander Schaaf EB, Cohen GM, Irby MB, Skelton JA. Association of Picky eating and Food Neophobia with Weight: A Systematic Review. <i>Child Obes.</i> 2016;12(4):247-262. ¹¹¹	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	0-18 years	NS	No association was found between child weight status and food neophobia, and the association with picky eating is unclear	Supported in part by a grant from NICHD/NIH Mentored Patient-Oriented Research Career Development Award and from the Health Resources and Service Administration National Research Service Award
Cardona Cano S, Hoek HW, Bryant-Waugh R. Picky eating: the current state of research. <i>Curr Opin Psychiatry.</i> 2015;28(6):448-454. ²⁷²	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Childhood to adulthood	NS	Picky eating has a higher prevalence in preschool children and seems to decrease thereafter	None
Cole NC, An R, Lee SY, Donovan SM. Correlates of picky eating and food neophobia in young children: a systematic review and meta-analysis. <i>Nutr Rev.</i> 2017;75(7):516-532. ⁷⁹	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	≤ 30 months	Australia, Canada, China, France, Ireland, Netherlands, Singapore, Sweden, United Kingdom, United States	The most examined correlates of picky eating were child's sex, weight status, dietary intake, parent feeding beliefs and practices; correlates show high variability due to a lack of an operational definition and standard measurement tool	National Institute of Food and Agriculture, U.S. Department of Agriculture

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Damsbo-Svendsen M, Frost MB, Olsen A. A review of instruments developed to measure food neophobia. <i>Appetite</i> . 2017; 113:358-367. ²⁷³	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	2-65 years	NS	13 instruments were identified to assess neophobia and willingness to try unfamiliar foods	Nordea-fonden Foundation
Johnson SL. Developmental and Environmental Influences on Young Children's Vegetable Preferences and Consumption. <i>Adv Nutr</i> . 2016;7(1):220S-231S. ²⁷	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Childhood	NS	A model proposes that the path to child vegetable acceptance involves two steps: 1) willingness to try vegetables and 2) vegetable intake; Influences include child traits, environmental inputs, and learning	None
Kerzner B, Milano K, MacLean WC, Jr., Berall G, Stuart S, Chatoor I. A practical approach to classifying and managing feeding difficulties. <i>Pediatrics</i> . 2015;135(2):344-353. ⁹⁴	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Childhood	NS	A model identifies 3 eating behaviors that concern parents: limited appetite, selective intake, and fear of feeding; the model incorporates a range of normal to severe behavior and caregiver feeding styles	None
Lafraire J, Rioux C, Giboreau A, Picard D. Food rejections in children: Cognitive and social/environmental factors involved in food neophobia and picky/fussy eating behavior. <i>Appetite</i> . 2016; 96:347-357. ⁸⁶	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Childhood	NS	Food neophobia/picking eating contribute to a reduction in dietary diversity, thus having negative consequences on children's health; Food rejections by children fall under multiple cognitive and social/environmental factors	Fonds Français pour l'Alimentation et la Santé
Russell CG, Russell A. Biological and Psychosocial Processes in the Development of Children's Appetitive Traits: Insights from Developmental Theory and Research. <i>Nutrients</i> . 2018;10(6). ²⁷⁴	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Infancy to middle childhood	NS	Developed a model of the development of appetitive traits in children and integrated biological and psychosocial influences	None
Samuel TM, Musa-Veloso K, Ho M, Venditti C, Shahkhalili-Dulloo Y. A Narrative Review of Childhood Picky eating and Its Relationship to Food Intakes, Nutritional Status, and Growth. <i>Nutrients</i> . 2018;10(12). ⁹⁵	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	4 mo-15 years	Canada, Germany, Ireland, Jerusalem, Korea, Netherlands, New Zealand, People's Republic of China, Sweden, Switzerland, United Kingdom, United States	Picky eaters consume less vegetables compared to non-picky eaters, but vitamin and mineral levels generally exceeded recommended values; No consistent relationship between childhood picky eating and growth status	None
Taylor CM, Emmett PM. Picky eating in children: causes and consequences. <i>Proc Nutr Soc</i> . 2019;78(2):161-169. ⁶⁸	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Childhood	NS	For most children the behavior of picky eating seems to spontaneously resolve; Children with picky eating may have poor dietary variety; however, there is little evidence of a consistent effect on growth trajectories	Wellcome Trust
Wolstenholme H, Kelly C, Hennessy M, Heary C. Childhood fussy/picky eating behaviours: a systematic review and synthesis of qualitative studies. <i>Int J Behav Nutr Phys Act</i> . 2020;17(1):2. ¹¹³	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	1 years to young adult	Australia, France, United Kingdom, United States	Developed a conceptual model that illustrates the relationships between child characteristics (e.g., fussy eating), parent feeding beliefs, food parenting practices, mealtime emotions, and parent awareness of food preferences	Galway Doctoral Scholarship
Johnson SL, Moding KJ, Bellows LL. Chapter 4 - Children's Challenging Eating Behaviors: Picky eating, Food Neophobia, and Food Selectivity. In: Lumeng JC, Fisher JO, eds. <i>Pediatric Food Preferences and Eating Behaviors</i> . Academic Press; 2018:73-92. ⁶	What is the role of picky eating in food acceptance among typically developing children?	Picky eating	Childhood	NS	Picky eating refers to eating challenges in a typically developing child, and these challenges generally respond over time to repeated exposure and positive modeling by caregivers or peers	None
Liem DG, Russell CG. The Influence of Taste Liking on the Consumption of Nutrient Rich and Nutrient Poor Foods. <i>Front Nutr</i> . 2019; 6:174. ⁴⁶	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to adult	NS	Individual characteristics may partly explain differences in short term intakes of foods varying in taste profiles; however, they have not been able to consistently explain long term food choices	None
Mennella JA, Nolden AA, Bobowski N. Chapter 1 - Measuring Sweet and Bitter Taste in Children: Individual Variation due to Age and Taste Genetics. In: Lumeng JC, Fisher JO, editors. <i>Pediatric Food Preferences and Eating Behaviors</i> : Academic Press; 2018. p. 1-34. ⁶⁰	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Childhood	NS	Children most prefer higher levels of sweet than adults; Individual differences in genes and experiences need to be considered, for example, children vary in sensitivity to the bitter taste of PTU based on variation of TAS2R38, and children were more sensitive than some adults	National Institutes of Health, National Institute of Deafness and Other Communication Disorders
Appleton KM, Tuorila H, Bertenshaw EJ, de Graaf C, Mela DJ. Sweet taste exposure and the subsequent acceptance and preference for sweet taste in the diet: systematic review of the published literature. <i>Am J Clin Nutr</i> . 2018; 107(3):405-19. ²⁷⁵	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	6 mo to adults	NS	Evidence from controlled studies suggests that a higher sweet taste exposure tends to lead to reduced preferences for sweetness in the shorter term, but very limited effects were found in the longer term	Unilever R&D

Citation	Research Question	Topic	Age/Setting	Demographics	Key Findings	Funding Disclosure
Liem DG. Infants' and Children's Salt Taste Perception and Liking: A Review. <i>Nutrients</i> . 2017; 9(9). ³⁸	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	Australia, Brazil, Italy, Japan, Korea, Nigeria, Spain, United Kingdom, United States	Children most prefer higher salt concentrations than adult. The addition of salt to food increases children's consumption of those foods; however, salt liking does not seem to correlate with salt intake	None
Forestell CA. Flavor Perception and Preference Development in Human Infants. <i>Ann Nutr Metab</i> . 2017; 70 Suppl 3:17-25. ²⁷⁶	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	NS	Children's basic biology predisposes them to prefer sweet tastes and avoid bitter; 8-10 exposures to a food will increase intake even in the food is initially rejected while further exposures may be needed to increase liking	None
Fidler Mis N, Braegger C, Bronsky J, Campoy C, Domellöf M, Embleton ND, et al. Sugar in Infants, Children and Adolescents: A Position Paper of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. <i>J Pediatr Gastroenterol Nutr</i> . 2017; 65(6):681-96. ²⁷⁷	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	2-19 years	NS	Healthy approaches to food and beverage intake should be established early in life, with the goal of preventing negative health effects in childhood and adulthood	Slovenian Research Agency
De Cosmi V, Scaglioni S, Agostoni C. Early Taste Experiences and Later Food Choices. <i>Nutrients</i> . 2017; 9(2). ⁴⁵	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	NS	Early varied and repeated exposure (e.g., in utero, during breast feeding) increases children's willingness to try new foods within a positive social environment	None
Sylvetsky AC, Conway EM, Malhotra S, Rother KI. Development of Sweet Taste Perception: Implications for Artificial Sweetener Use. <i>Endocr Dev</i> . 2017; 32:87-99. ²⁷⁸	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	NS	Children have an innate liking for sweetness; however, the influence nonnutritive sweeteners have on children's intake and body weight remain to be established	None
Beckerman JP, Alike Q, Lovin E, Tamez M, Mattei J. The Development and Public Health Implications of Food Preferences in Children. <i>Front Nutr</i> . 2017; 4:66. ²⁷⁹	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	NS	Two areas are highlighted to improve children's diet quality: 1) Promote healthy food preferences through breastfeeding and early exposure to healthy foods and 2) Limit the extent to which innate preferences for sweet and salty tastes lead to poor diet quality	National Institutes of Health, National Council of Science and Technology
Keller KL, Adise S. Variation in the Ability to Taste Bitter Thiourea Compounds: Implications for Food acceptance, Dietary Intake, and Obesity Risk in Children. <i>Annu Rev Nutr</i> . 2016; 36:157-82. ⁵⁸	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Childhood	African American, Asian, Caucasian, England, Filipino, Latino, India, Irish, Japanese	Genetic variation in the ability to taste bitter thiourea compounds may have implications in children's dietary patterns and health; Children who are sensitive to bitter may require dips/sauces in order to accept and consume bitter-tasting vegetables, while children insensitive to bitter may have greater intakes of high fat foods and excess body weight	None
Mennella JA, Bobowski NK, Reed DR. The development of sweet taste: From biology to hedonics. <i>Rev Endocr Metab Disord</i> . 2016; 17(2):171-8. ²⁸⁰	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Childhood	NS	Children are vulnerable to the current food environment due to their biological drive to prefer sweet, and increasing healthy behaviors in childhood is key to reducing their risk of lifestyle-related diseases	National Institutes of Health
Mennella JA, Bobowski NK. The sweetness and bitterness of childhood: Insights from basic research on taste preferences. <i>Physiol Behav</i> . 2015; 152(Pt B):502-7. ⁵⁵	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Childhood	NS	Children's heightened preference for sweet makes them vulnerable to overconsumption and early exposure to sweetened foods teaches them the context in which sweet taste should be experienced	National Institute of Deafness and Other Communication Disorders, National Institutes of Health
Nehring I, Kostka T, von Kries R, Rehfuss EA. Impacts of in utero and early infant taste experiences on later taste acceptance: a systematic review. <i>J Nutr</i> . 2015; 145(6):1271-9. ²⁸¹	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	Denmark, Netherlands, United Kingdom, United States	Exposure to bitter and specific tastes increased the acceptance of these tastes; however, studies on sweet and salty tastes showed equivocal results	Federal Ministry of Education and Research, Munich Centre of Health Sciences
Mennella JA. Ontogeny of taste preferences: basic biology and implications for health. <i>Am J Clin Nutr</i> . 2014; 99(3):704S-11S. ⁴⁷	What is the role of taste preferences in food acceptance among typically developing children?	Taste preferences	Infant to childhood	NS	Children prefer higher levels of sweet and salty and reject lower levels of bitter tastes than due adults; however, sensory experiences beginning early in life can help shape children's food preferences	National Institutes of Health

Appendix 3. Practical Tips for Promoting Healthy Eating Behaviors in Children Ages 2 to 8 Years

Practical Tips for Promoting Liking of Healthful Foods

Provide Structure

- Keep healthy foods, like fruit and vegetables, out on the counter and visible to children during snack or meal times. Keep cut up vegetables in the refrigerator for a quick snack.
- Provide a few small bites of a new food. Small tastes are enough to promote liking and can reduce food waste.
- Offer first courses. Offering vegetables as a before-dinner appetizer gives children the opportunity to eat healthy foods when hungry and without other competing foods.
- Use frozen. Using frozen vegetables prevents food spoilage and waste by allowing small amounts to be offered to children at any given meal or snack.

Support Children's Autonomy

- Ask children what they think. Asking children about their preferences conveys support. Ask them what they think about foods they have tried (e.g., “Is it thumbs up, thumbs down, or in-between?”) and honor their answers. Let children know that their taste buds may need to try a food up to 15 times before knowing if they really like it or not.
- Eating and enjoying foods with your child at meals and snacks may increase children’s willingness to try and liking of new foods.
- Enjoy family foods. Foods shared at family meals and gatherings, including cultural foods, provide an opportunity for families to share and enjoy healthy foods with children. Family recipes help children experience foods in varied ways that can help promote acceptance and also carry on cultural and family traditions.
- Use praise to convey love and encourage trying new foods. Focus praise on children’s willingness to try (‘great job trying’) rather than the child (‘you are a good boy’).
- Tell your child a story or find picture books about food. Let your child hold, wash, and help prepare foods. Play a tasting game where children close their eyes and guess the names of foods by touching and smelling. These types of exploration may be helpful for young children, particularly those who are wary of trying new foods.

- Get children involved. Getting children involved with food and offering options helps give children ownership over their choices. Give a choice of two vegetables and let children decide which to try at a snack or dinner.
- Make it fun. Giving foods fun names can help make new foods more appealing to young children. Describe new foods in ways that highlight similarities with foods your child already likes (e.g., “it is crunchy like carrots”).

Practical Tips for Promoting Healthy Appetites and Growth

Provide Structure

- Keep healthy foods in sight, in reach and easy to eat. Make healthy choices easy for children to eat.
- Limit the number of sweets/snacks in the house. Limiting the availability of treats in the house limits the frequency of saying “no” to requests.
- Offer appropriate portion sizes for children. Start small and take a break for 5-10 minutes before providing second portions. Leave second helpings of energy-dense foods out of sight in the kitchen or on the stove.
- Create eating routines as much as your family’s schedule allows and involve children in implementing these routines. Have regular meals and snacks together to create a time and space to strengthen communication and relationships with children.
- Avoid screens and other distractions while eating.
- Model healthy eating and moderation.
- Avoid using food to soothe emotions or as a reward. Give hugs or attention instead.

Support Children's Autonomy

- Eat with your child as much as possible. Children look to others to know what, when, and how much to eat. Limit eating sweets and snacks in front of your child. Enjoy healthful foods with your child.
- Talk about eating in moderation. Help children learn to identify and listen to their hunger or fullness cues. Talk to children about how their stomach feels before, during, and after eating.

Practical Tips for Implementing Recommendations in Early Child Care and Education Settings

- Implement taste tests or inclusion of “flavor bars,” which allow the inclusion of culturally appropriate foods and seasonings as part of the feeding environment.
- Increase the availability and accessibility of healthy foods and snacks and limit the availability of unhealthy snacks (e.g., don’t leave chips on the counter, limit classroom celebrations and fundraisers involving sweets).
- During playtime, allow kids to taste, touch, and smell new foods.
- Engage caregivers and parents in food activities and nutrition education when possible.
- Use tangible rewards (e.g., stickers) and verbal praise when children try new foods.
- Have food picture books or coloring books available for children to use during play or quiet times.

Practical Tips for Implementing Recommendations in National School Meal Programs

- Offer more food choices for students within a given meal component.
- Pre-slice fruit when possible rather than serving whole.
- Set minimum length of lunch periods. Lunch periods of at least 30 minutes have been shown to have the greatest benefits for students.
- Implement recess before lunch to increase consumption and reduce disruptive student behavior in the cafeteria.
- Limit access to foods and beverages sold during the school day. Children are more likely to consume more of their school meals when competitive foods and beverages are limited or unavailable.
- Enhance the cultural flavors of school meals. This strategy can be cost-effective by hiring chefs or partner with volunteer chefs from local restaurants.
- Additional opportunities to improve school meal consumption that need to be explored further include nutrition education, choice architecture (e.g., placing the healthiest items—like fruit and veggies—first in the cafeteria line), and taste tests or repeated exposures of new items through initiatives like “flavor bars.”

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Healthy Eating Research



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About Healthy Eating Research

Healthy Eating Research (HER) is a national program of the Robert Wood Johnson Foundation. Technical assistance and direction are provided by Duke University under the direction of Mary Story PhD, RD, program director, and Megan Lott, MPH, RDN, deputy director. HER supports research to identify, analyze, and evaluate environmental and policy strategies that can promote healthy eating among children and prevent childhood obesity. Special emphasis is given to research projects that benefit children and adolescents and their families, especially among lower-income and racial and ethnic minority population groups that are at highest risk for poor health and well-being and nutrition-related health disparities. For more information, visit www.healthyeatingresearch.org or follow HER on Twitter at [@HERResearch](https://twitter.com/HERResearch) or Instagram at [@HealthyEatingResearch](https://www.instagram.com/HealthyEatingResearch).

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