

## AHA SCIENTIFIC STATEMENT

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# Caregiver Influences on Eating Behaviors in Young Children

A Scientific Statement From the American Heart Association

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**ABSTRACT:** A substantial body of research suggests that efforts to prevent pediatric obesity may benefit from targeting not just *what* a child eats, but *how* they eat. Specifically, child obesity prevention should include a component that addresses reasons why children have differing abilities to start and stop eating in response to internal cues of hunger and satiety, a construct known as *eating self-regulation*. This review summarizes current knowledge regarding how caregivers can be an important influence on children's eating self-regulation during early childhood. First, we discuss the evidence supporting an association between caregiver feeding and child eating self-regulation. Second, we discuss what implications the current evidence has for actions caregivers may be able to take to support children's eating self-regulation. Finally, we consider the broader social, economic, and cultural context around the feeding environment relationship and how this intersects with the implementation of any actions. As far as we are aware, this is the first American Heart Association (AHA) scientific statement to focus on a psychobehavioral approach to reducing obesity risk in young children. It is anticipated that the timely information provided in this review can be used not only by caregivers within the immediate and extended family but also by a broad range of community-based care providers.

**Key Words:** AHA Scientific Statements ■ appetite regulation ■ caregivers ■ child ■ preschool ■ pediatric obesity ■ satiety

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## NEED FOR STATEMENT

A healthy body mass index (BMI) is 1 of 7 core factors that the American Heart Association emphasizes as important to ideal cardiovascular health.<sup>1</sup> Eight percent of infants (0–2 years of age) and 23% of children (2–5 years of age) in the United States suffer from excess adiposity.<sup>2</sup> There is wide recognition that cardiovascular disease prevention should begin in early childhood,<sup>3</sup> with a component aimed at reducing obesity.<sup>3,4</sup> Behavioral dimensions of eating (“eating behaviors”), collectively describing what, when, and how much children eat, are robust correlates of childhood weight status (Table),<sup>5–53</sup> and child obesity prevention efforts should benefit from a component focused on these. Yet, most interventions<sup>54</sup> and/or recommendations<sup>3,55</sup> to reduce child obesity risk only try to manipulate what a child eats. This review has been compiled to discuss the role of caregiver feeding behaviors in shaping child eating behaviors associated with healthy body weight outcomes.

### Focus of Statement

First, we describe available evidence on how caregiver feeding behaviors influence obesogenic child eating behaviors, adopting a developmental perspective prenatally to childhood, and consider the limitations

to this evidence. In the next section, we present evidence-based actions that caregivers may take to help provide a feeding environment that supports healthy eating behaviors in children. In the final section, we discuss challenges to implementation.

### Limitations to Statement

Although a wide variety of caregiver factors may influence child eating behaviors, such as attachment quality,<sup>56</sup> this review focuses only on caregiver factors that influence child eating behaviors within the immediate feeding environment. Although such factors also often associate with children’s dietary intake, this review does not discuss how caregivers may influence children’s dietary composition, quality, or variety. It is beyond the scope of this document to review any mechanisms underlying caregiver feeding and child eating behavior associations.

## THE FEEDING ENVIRONMENT

### Conceptual Framework

Feeding children is a reciprocal process that depends on the abilities of the caregiver and the child.<sup>56</sup> Early observational data<sup>57–59</sup> indicated that many children inherently vary their food intake in response to the

**Table. The Association of Appetitive Traits With Child Adiposity/Weight Status**

Appetitive Trait	Definition	Direction of Association	Evidence of Null Associations?*
Traits with consistent evidence across studies			
Eating in the absence of hunger	Eating when having recently consumed a meal to satiation	Positive <sup>17,29,36,37,40,42</sup>	...
Enjoyment of food	The extent to which palatable foods provoke eating	Positive <sup>27,28,38</sup>	...
Restrained eating	How strong attempts to restrain eating are	Inverse <sup>23,25,26</sup>	...
Satiety responsiveness	The extent to which children avoid eating, and for how long after, satiation	Positive <sup>27,28,38,44</sup>	...
Slowness in eating	Fewer bites per minute, usually as a meal progresses	Inverse <sup>27,28,38</sup>	...
Traits with null studies and studies suggesting a consistent direction of association with child adiposity			
Compensation of energy intake	The extent to which energy intake is reduced, following a caloric “preload”	Positive <sup>35,46</sup>	One exception <sup>45</sup>
Desire to drink	The tendency to carry drinks (often sweetened)	Positive <sup>28,38</sup>	One exception <sup>47</sup>
Emotional overeating	The extent of a tendency to eat in response to negative emotions	Positive <sup>27,38</sup>	One exception <sup>28</sup>
Emotional undereating	The extent of a tendency reduce food intake in response to negative emotions	Inverse <sup>27</sup>	Yes <sup>28,38</sup>
External eating/food responsiveness	Eating in response to external (usually food-related stimuli)	Positive <sup>23,26–28,38,44</sup>	One exception <sup>47</sup>
Food fussiness/pickiness	Selectivity regarding which foods are consumed	Positive <sup>22,24,27,38,49</sup> and inverse <sup>10,11,13,18,20,24,52</sup> both reported	Yes <sup>5–9,12,14–16,19,21,28,48,50,51,53</sup>

\*To date, to the authors’ knowledge.

caloric density of foods and energy expenditure to maintain healthy growth. This ability is thought to arise from the “satiety cascade,” which cues children to eat in response to hunger and stop eating in response to satiation, and a biobehavioral mechanism termed *eating self-regulation*.<sup>60</sup> Some studies refer to “regulation” over relatively short periods (eg, 24 hours, or immediately following a fixed preload meal),<sup>61</sup> while other studies consider eating self-regulation as children’s general behavioral responses to hunger, satiation, and satiety, which can be measured over a longer term.<sup>62</sup>

Under the assumption that eating self-regulation is present from birth (even in preterm infants<sup>63</sup>), caregivers are thought to either (1) support children’s innate eating self-regulation tendency or (2) promote a deviation from this tendency. Thus, early feeding research has focused on a didactic relationship between children and caregivers, examining the interrelationship between children’s appetite cues, caregiver responsiveness to these, and the effect this has on child eating self-regulation.

At the same time, observational data<sup>57–59,63</sup> reveal that children vary widely in the extent to which they demonstrate eating self-regulation, even in controlled settings. The strong heritability underlying child eating behaviors, ranging from 49% to 74% during the first year of life to 62% to 75% in early childhood (see Wood<sup>39,64</sup> for reviews), calls into question whether all children are born with good eating self-regulation, and highlights the need for research into a more tailored approach to the feeding environment that reflects children’s predispositions around eating. Yet it is not possible to infer the importance of environmental influences from heritability estimates. For example, the heritability for child BMI is inversely associated with parental education level<sup>65</sup> suggesting the environmental moderation of genetic effects. Changes in the heritability of standardized BMI across childhood ( $\approx 40\%$  at 4 years of age and 75% at 19 years of age<sup>66</sup>), thought to result from factors such as growing child autonomy over their personal food intake within the home, and increasing exposure to the wider obesogenic environment, demonstrate that heritable traits can still be influenced by the environment. When considered alongside decades of developmental science demonstrating that sociocultural context can have a powerful role in shaping a wide range of outcomes for children, including general self-regulatory skills,<sup>67–69</sup> these findings highlight a core concept underlying this scientific statement, which is that although strong heritability estimates suggest inherent individual differences in child eating self-regulation, they do not negate the potential for caregivers to shape or moderate the expression of children’s eating tendencies.

## CAREGIVER INFLUENCES UNDERLYING CHILD APPETITIVE TRAITS

### Prenatal Influences

Prepregnancy obesity,<sup>70</sup> maternal diet,<sup>71</sup> and excess weight gain<sup>70</sup> during pregnancy are all associated with increased risk of obesity among offspring. Long-standing research suggests that what a woman eats during pregnancy not only influences children’s taste preferences<sup>72–74</sup> (with effects that can occur across their lifetime<sup>75–77</sup>), but may also influence children’s growth via effects on appetite. Few human research studies exist on this topic, although higher correlations have been shown between children’s protein and fat consumption at 10 years of age with their mother’s intake of these macronutrients during pregnancy, than with her postnatal intake.<sup>78</sup> However, undernutrition may also be problematic; survivors of the Dutch famine (1944–1945) who experienced caloric restriction during pregnancy saw increased obesity rates in their children up to 30 years after birth.<sup>79</sup> Given the challenges of implementing long-term experimental studies in humans, animal studies, which allow for much greater experimental control of exposure, have been widely used to examine the association between diet and various health and health-related outcomes.<sup>80,81</sup> In animal studies, offspring of obese (but not lean) dams (female parent) who are subsequently fed a high-fat diet for 2 to 7 years, including during gestation and lactation, may be more likely to overconsume fat and sucrose,<sup>82</sup> be heavier at birth,<sup>83</sup> gain more weight,<sup>82</sup> and be more susceptible to diet-induced obesity<sup>83</sup> and poor glycemic control.<sup>83</sup> Dams who are fed a low-protein diet for discrete periods of gestation have female offspring who consume lower amounts of fat and show less compensation for changes in the caloric content of foods,<sup>84</sup> an effect not seen in males. Animal studies suggest that a prenatal diet impacts offspring neurocircuits involved in satiety<sup>85</sup> and alters offspring dopamine signaling.<sup>82</sup>

### The Feeding Environment

After birth, psychobehavioral aspects of the feeding environment become a more important influence on child eating self-regulation. To maintain good eating self-regulation in children, current research suggests that a caregiver’s overarching goal should be to allow children autonomy over their eating, such that they start and stop eating in response to their hunger and satiation. Yet recognizing the potential role of good dietary quality and variety in healthy growth trajectories for children,<sup>86,87</sup> and the availability of calorically dense, nutrient-poor foods for many children, caregivers also need to provide structure within the eating environment such that children can be autonomous without compromising a healthy diet. It is

important to acknowledge that factors such as cultural practices and beliefs (eg, preference for breastfeeding<sup>88</sup> or about ideal body size<sup>89</sup>) and resources (eg, food insecurity that may limit food options<sup>90</sup>) can shape caregivers' methods to achieve these goals. Thus, the challenge for caregivers is to provide structure and boundaries without decreasing children's eating autonomy to the extent that they no longer self-regulate their eating but instead look to external factors to cue eating.

In describing the behaviors that reflect caregiver goals around child feeding/eating, the literature has made the distinction between caregiver feeding styles and caregiver feeding practices. Feeding styles (Figure) capture the overall emotional climate of meals and are measured along 2 dimensions: responsiveness (represented by warmth, acceptance, and involvement during feeding) and demandingness (represented by parental control and supervision of feeding). Feeding behaviors are often categorized using these dimensions into 4 feeding styles: authoritarian, authoritative, indulgent, and uninvolved,<sup>91</sup> which characterize the extent to which a caregiver's overall feeding behaviors reflect responsiveness to the child within the context of boundary setting around food.<sup>91</sup> Alternatively, feeding practices describe specific goal-oriented behaviors and can be organized along higher-order dimensions of coercive control (eg, pressuring children to eat), structure (eg, limit setting), and autonomy support (eg, praise, active guidance).<sup>91,92</sup>

Both authoritative and indulgent feeders are considered high in responsiveness; however, they differ in that the indulgent feeding style is low in demandingness (indicating a lack of structure; Figure).<sup>91,93</sup> Of the 2 styles, it is the indulgent feeding style that is associated with higher child adiposity and lower child eating self-regulation, emphasizing the importance of setting boundaries around food.<sup>91,94</sup> Both authoritative and authoritarian feeders set boundaries around food (Figure),<sup>91,93</sup> but authoritarian parents are considered less responsive and show behaviors aiming to change the child's behavior overtly. Such overt behaviors can include using rewards and/or punishments to control food intake or physically struggling with the child, and are often labeled as directive.<sup>94,95</sup> Authoritative feeders also set boundaries but implement these via more covert nondirective strategies that support the child's autonomy.<sup>94,96</sup> These strategies include reasoning, complimenting, and exerting control over the food environment rather than the child, for example, making the most readily available foods nutrient-dense options from which the child can make selections, and setting mealtime routines within which the child can decide how much to eat.<sup>94</sup> When compared with the authoritarian feeding style, the authoritative style is associated with better child dietary quality.<sup>96,97</sup> As the key difference between these 2 styles lies in the higher responsivity of authoritative feeders to child cues, these findings highlight the need to implement boundaries within a responsive feeding environment.

		Responsiveness	
		Low	High
Demandingness	High	<p><b>Authoritarian</b></p> <ul style="list-style-type: none"> <li>• Sets boundaries around food.</li> <li>• Targets child eating behaviors directly</li> <li>• Often uses directive strategies.</li> </ul>	<p><b>Authoritative</b></p> <ul style="list-style-type: none"> <li>• Sets boundaries around food</li> <li>• Maintains responsivity to child hunger / satiation cues</li> <li>• Targets child eating behaviors covertly via the feeding environment</li> <li>• Supports child autonomy</li> </ul>
	Low	<p><b>Uninvolved</b></p> <ul style="list-style-type: none"> <li>• Low responsivity to child hunger / satiation cues</li> <li>• Boundaries around food are few</li> </ul>	<p><b>Indulgent</b></p> <ul style="list-style-type: none"> <li>• Maintains responsivity to child hunger / satiation cues</li> <li>• Boundaries around food are few</li> <li>• Lack of structure to the eating environment</li> </ul>

**Figure.** Characteristics of the feeding environments of caregivers with authoritarian, authoritative, uninvolved, and indulgent feeding styles and their relationship to the underlying dimensions of caregiver responsiveness and demandingness according to feeding style typology.<sup>91,92</sup>

A strong evidence base suggests that children's eating self-regulation is best supported when caregivers provide a feeding environment that covertly sets boundaries around food, such as meal timing and the types of foods eaten by children.<sup>96,98</sup> Using overt, directive attempts to control what children eat seems to have "spill-over" effects on *how* and/or *how much* they eat.<sup>95,99</sup> It seems that when children choose foods based on parental directives, they also start and stop eating in response to these and no longer self-regulate their eating to their appetite cues. The first 5 years of life is a time of rapid development; below, we discuss how each developmental stage during this time (infancy, toddlerhood, and preschool) poses unique challenges to maintaining a structured, yet responsive, feeding environment.

## Infancy

Responsive feeding is a reciprocal relationship—children need to communicate their needs for caregivers to respond to these. From infancy, children display a number of external appetite cues. The earliest hunger cues include sucking, opening/closing the mouth repeatedly, smacking and licking the lips, and increased alertness.<sup>100</sup> Corresponding fullness cues include turning the head away, increased interest in the environment, decreased activity level, frowning and grimacing, gaze aversion, and putting hand(s) to face.<sup>100</sup> Such cues are nonverbal and covert, and an early challenge to responsive feeding is the ability of caregivers to perceive and accurately interpret these cues, which varies considerably.<sup>101</sup> By contrast, crying is a late-stage feeding cue, which is widely recognized by caregivers,<sup>102,103</sup> but which may be confused with nonhunger infant distress. Caregivers endorsing crying as a reliable hunger cue are nearly 3 times as likely to have a pressuring feeding style, perhaps attributable to feeding when the infant is not hungry.<sup>102</sup> Infants who are fed to soothe non-hunger-related distress, which may sometimes be driven by caregivers mistaking distress signals for hunger, are also perceived to have a high responsiveness to food<sup>104</sup> and may have a higher BMI in childhood.<sup>105</sup> Interventions that have taught caregivers how to discriminate infant cues of hunger from cues of other distress and how to soothe non-hunger-related fussiness without food have had success in supporting healthy growth.<sup>106–108</sup> Parents of children in neonatal intensive care are more involved in feeding and show better awareness of infant distress cues after discharge when they had social support via an intervention.<sup>109</sup>

The ability of caregivers to recognize and respond to children's cues of internal hunger/satiation may be influenced by early feeding modality (bottle versus

breast). Many studies refute an association between breastfeeding and child obesity risk,<sup>110–115</sup> which is beyond the scope of this review to discuss. However, some studies have shown that breastfeeding is associated with better child eating self-regulation,<sup>116</sup> including better satiety responsiveness<sup>33,117,118</sup> and a lower likelihood of emptying a bottle or cup<sup>119</sup> than bottle feeding. Contrary findings have also been shown.<sup>120,121</sup> A small randomized study using weighted, opaque bottles that removed external cues to bottle fullness, resulted in less formula intake and greater maternal responsiveness to infant feeding cues compared with a standard bottle.<sup>122</sup> This effect was seen particularly in mothers who were less responsive to infant satiation cues (defined as highly pressuring).<sup>122</sup> It is theorized that less responsive mothers may be more susceptible to feeding in response to cues other than hunger/satiation from infants and so benefit the most from early interventions.<sup>122</sup> In addition, in-home recorded sessions found that breastfed infants displayed more engagement and disengagement clues than formula-fed infants,<sup>123</sup> perhaps making the hunger/satiation cues from infants fed at the breast easier to "read."

## Toddlerhood

The rapid development of toddlerhood enables children to communicate their appetite more overtly, such as with rudimentary language and reaching for food. Although this may make toddlers' appetites easier to read, toddlerhood brings new challenges as children strive for autonomy and independence. Striving for autonomy is thought to bring about 2 food-related behaviors that present a particular challenge to responsive, nondirective feeding: food neophobia (wariness of trying new foods) and food fussiness/"picky" eating (a more general selectivity regarding which foods are consumed).<sup>124</sup> Both of these behaviors can be associated with children eating a more limited, often less unhealthy diet, and with weight status (Table).<sup>19,21,51,125</sup> Food fussiness and neophobia can involve a disgust response to disliked foods, the rejection of foods on sight, and for some children a contamination response, where disliked foods touching or hidden under liked foods may lead to rejection of the whole meal.<sup>126</sup> Although this phase is developmentally normative and typically short-lived,<sup>21,127,128</sup> both behaviors also have traitlike dimensions that result in the persistence of these behaviors throughout childhood and adolescence for some children.<sup>127,129</sup> Little is understood about why food neophobia or fussiness persists in some children but not in others.<sup>124</sup> This uncertainty, surrounding an eating behavior that is often reported as a significant source of caregiver stress,<sup>21,130</sup> may push caregivers

to employ feeding strategies designed to reduce fussiness around food. Parents who perceive their children as more “picky” with food report using more directive attempts to control child intake than do parents who do not perceive their children as picky.<sup>21</sup> Picky eating in toddlerhood is associated with controlling feeding practices in caregivers, with mothers who perceive their children as “picky” more likely to report restriction and pressure to eat.<sup>21,125,131,132</sup> Not only may directive feeding behaviors pose challenges to child eating self-regulation, which can disrupt children’s ability to respond to internal hunger/fullness cues, thereby contributing to overweight, but they are also associated with increased parental stress at mealtimes.<sup>130</sup> Observational data show that stressful feeding encounters are not likely to stimulate a positive response from the child to novel and/or aversive-tasting foods,<sup>133–135</sup> and overall do not appear to alter children’s food acceptance.<sup>134,136,137</sup> Nondirective strategies such as repeatedly offering foods,<sup>52,138,139</sup> offering a familiar and accepted food alongside novel or refused foods (such as ketchup<sup>140</sup> or other palatable dip<sup>141</sup>), and having caregivers<sup>142–144</sup> and/or peers<sup>145–150</sup> model eating the food with enjoyment have been demonstrated to increase the consumption of a given food, to support children’s liking for a wider variety of healthy foods, and may help maintain responsivity in the feeding environment.

### Preschool Period

As the child progresses into the preschool period, food neophobia and food fussiness typically decline, and a wider variety of foods are consumed. Although the increased dietary variety is considered a positive development for health, the preschool period brings more possibilities for autonomy as children can access a greater variety of foods and self-feed more capably. Research suggests that for good child eating self-regulation, the preschool period is critical for boundaries around food but without overt control of child eating. Directive approaches that focus on what (or the amount) a child is eating directly, such as pressure to eat certain foods or restricting the types and amount of food consumed are often well intentioned (the goal is usually to improve dietary quality, for example, vegetable intake or overall variety<sup>151</sup>). However, pressure to eat has been associated with an impaired ability to self-regulate eating behaviors in preschool<sup>152</sup> and poorer energy compensation in childhood.<sup>46</sup> By contrast, restrictive feeding practices such as limiting intakes of certain (typically snack) foods, have been associated with higher consumption of food when not hungry,<sup>134</sup> energy intake,<sup>133</sup> adiposity,<sup>134</sup> and likelihood of failing to stop eating when full,<sup>46</sup> as well as poorer compensation for the energy density of food<sup>153</sup> in early childhood. In

preschool, more supportive approaches, such as questions, suggestions, and offering choices within a structured environment that limits the types of food available and the timing of meals rather than places limits on the child’s eating behaviors is associated with better eating self-regulation and growth trajectories.<sup>91</sup>

### Limitations of Research

Much, but not all, of the caregiver feeding research to date is cross sectional, particularly in the preschool age group, which makes it hard to rule out confounding influences such as socioeconomic status. Yet socioeconomic status is positively correlated with rates and duration of breastfeeding in most countries<sup>154,155</sup> and may be inversely correlated with child obesity,<sup>156,157</sup> suggesting it may confound the relationships between breastfeeding and child adiposity outcomes. Similarly, mothers with obesity are less likely to initiate breastfeeding,<sup>158–161</sup> and those who do breastfeed do so for shorter periods than their healthy-weight counterparts.<sup>158,159,161,162</sup> There may also be a confounding role for caregiver characteristics; parents with a high BMI are more likely to use controlling<sup>163,164</sup> and restrictive<sup>135</sup> feeding practices. One study in 7- to 12-year-old siblings discordant for parent feeding did not support a causal role in caregiver feeding control with child obesity risk,<sup>164</sup> which highlights the importance of considering factors in addition to caregiver feeding when developing strategies for child obesity prevention.

Even the extant longitudinal studies to date make it difficult to identify the direction of many associations. Evidence has supported directionality from child eating behaviors<sup>17,165,166</sup> and child BMI<sup>53,167,168</sup> to controlling feeding practices from caregivers, as well as the reverse.<sup>99,169,170</sup> Taken together, this and similar evidence suggests a bidirectionality between child eating behaviors and/or adiposity and caregiver feeding behaviors, which some studies have supported.<sup>168,171,172</sup> Finally, despite a strong theoretical foundation, there is relatively little empirical evidence demonstrating the benefits of approaches that reflect warmth and responsiveness to children’s eating cues while providing developmentally appropriate expectations, structure, and involvement, with more focusing on the sequelae of less responsive, more directive behaviors. Relatedly, much of the extant evidence is observational and only a small number of intervention programs have demonstrated evidence of effectiveness at changing caregivers’ food-related interactions and behaviors.<sup>107,108,173</sup>

### IMPLICATIONS FOR CAREGIVERS

Tremendous progress has been made linking specific aspects of the caregiver-provided feeding environment with children’s ability to self-regulate their eating

behaviors. The associated literature is now substantial and suggests that good eating self-regulation and lowered obesity risk is supported when:

1. Prenatal influences on child eating self-regulation are largely inferred from animal studies that support current advice<sup>1</sup> that pregnancies are initiated at a healthy weight; current dietary guidelines for the intake of total calories, fats, and sugars are adhered to throughout pregnancy; and weight gain during pregnancy is kept within guideline levels.
2. Caregivers have knowledge of infant hunger (such as opening the mouth wide or settling into the feed<sup>100</sup>) and satiety (such as taking interest in surroundings, decreases in activity level, pulling away abruptly or detaching from the nipple, and falling asleep<sup>100</sup>) cues and can distinguish these from non-appetite-related cues.
3. Caregivers are responsive to children's hunger and fullness cues, paying attention to children's verbal and nonverbal signals and not pressuring children to eat more than they wish. For a child who is not underweight (defined as having a BMI adjusted for age and sex according to published growth reference charts [zBMI] <2 SD from the World Health Organization [WHO] Median<sup>174</sup>), caregivers should allow children the choice of when to stop eating during a meal and perhaps the choice not to eat at all.
4. Caregivers do not focus on what or how much a child eats. Rather, a varied diet is encouraged via environmental structure such as the consistent and repeated offering of healthy foods to children, the use of "preferred" foods (such as a dip), and caregivers enthusiastically consuming the food themselves.
5. An appropriate structure around food is set that focuses not on child behavior specifically, but instead provides rules and limits around children's meals, via consistent snack routines, timing of meals, and selective availability of foods in the home.

## POTENTIAL CHALLENGES IN IMPLEMENTATION

Caregivers should feel empowered to contribute to the development of a healthy eating behavior trajectory in children. However, we recognize that translating these findings into actions can face significant challenges for caregivers.

### The Role of Child Development

Most children have developed the motor skills necessary to self-feed by around 14 months of age.<sup>175</sup> During this time, caregivers typically try to socialize children and their eating behaviors to their personal, familial, and cultural values. Such socialization is

enabled by children's rapid cognitive development during early childhood, when children learn language comprehension ( $\approx 11$ – $12$  months of age<sup>176</sup>), and that others have beliefs, requests, and intentions ( $\approx 14$  months of age<sup>177</sup>). However, such cognitive development also enables noncompliance with caregiver requests (the emergency of autonomy;  $\approx 1.5$  years<sup>178</sup>). Physically, height increases linearly until 4 years of age, at which time growth slows.<sup>179</sup> However, this pattern may be different for children with a lower birth weight who experience "catch up" growth in early life, which then slows to mirror the expected trajectory.<sup>179</sup> BMI typically has a strongly nonlinear growth trajectory, with significant changes in BMI growth rate at  $\approx 7$  to 9 months of age (peak)<sup>180</sup> and close to 6 years of age (trough).<sup>179</sup> Growth changes are often accompanied by changes in food consumption,<sup>181</sup> and emerging research shows that parent feeding practices are influenced by child BMI<sup>168,172</sup> and child eating behaviors<sup>17</sup> as well as the reverse. And we recognize that there are individual differences with how children transition through developmental periods and growth changes, and there is no one single healthy way. Taken together, this highlights that children's individual differences influence the feeding-eating relationship and can pose challenges to caregiver attempts to shape healthy eating behaviors in children.

### The Role of Child Characteristics

We have already shown that eating behaviors have strong heritabilities. Although a strong heritability does limit the potential for the environment to mediate the expression of child eating behaviors, we acknowledge that the downstream heritable phenotypes, such as temperament, may represent additional challenges to caregivers. There is now emerging evidence for associations between infant temperament, defined as "individual differences in reactivity and self-regulation that are assumed to have a constitutional basis,"<sup>182</sup> and elevated adiposity indices. Adiposity at 6, 9, and 12 months of age associates with early distress to limitations.<sup>183,184</sup> At 6 years of age, BMI associates with early infant low negative affectivity.<sup>184,185</sup> Poorer general self-regulation and self-soothing ability at 9 months of age has predicted BMI at  $\approx 4$  years of age.<sup>184,186</sup> Temperament may pose a challenge to responsive caregiver feeding practices if food is used to assuage distress<sup>105,187</sup> and may influence the associations of caregiver feeding with child eating behaviors, highlighting the reciprocal nature of the relationship between caregiver feeding and child eating.

### The Wider Socioeconomic Context

At a broader level, caregivers who are living in poverty or in underresourced circumstances may face unique

challenges to implementing recommended feeding practices. Income and socioeconomic status can influence feeding practices through many interrelated and complex pathways, including the relatively limited access to relatively more expensive healthy foods for many poor families,<sup>188</sup> especially when such foods require time, expertise, and facilities to prepare and store.<sup>189</sup> In addition, unpredictable job schedules can constrain meal planning and mitigate against regular routines such as family mealtimes.<sup>190–192</sup> Food insecurity may also impact a parent's food options<sup>193</sup> and drive caregivers to restrict the range of foods given to children to ensure consumption and avoid waste.<sup>194,195</sup> Living in poverty can increase caregiver stress; caregivers who are under stress have been found to engage in more restrictive feeding practices with their preschool-aged children.<sup>196</sup> An additional stressor that may influence caregiver feeding practices is the pressure to be a “perfect parent.” Although this has not been examined explicitly in regard to feeding, online social comparisons can negatively affect parenting and relationship outcomes, such as parental competence, coparenting relationship quality, and perceived social support.<sup>197</sup>

These social-contextual factors shape feeding practices at multiple levels. Mental health issues, such as depression, present challenges in child feeding.<sup>197</sup> Differences of opinion on feeding practices between caregiver and partner have been associated with conflict around feeding strategies during early childhood.<sup>198,199</sup> Culture may also shape which individuals are responsible for child feeding (eg, mothers versus fathers,<sup>200,201</sup> the role of grandparents<sup>202,203</sup>) and beliefs about the role of restrictive versus indulgent feeding<sup>204</sup> in achieving feeding or obesity prevention goals. This statement acknowledges that a single caregiver often does not control the child's entire feeding environment, which may pose a challenge to an individual caregiver's capacity to implement changes in their children's feeding environment. Caregivers may feel particularly frustrated when their feeding goals for their children are disrupted by others who care for the child, for example, grandparents or daycare providers.<sup>194</sup> It may be, therefore, helpful to develop advice for caregivers that includes strategies on how to navigate such conflicts, for example, by encouraging them to explain responsive feeding practices to others involved in their child's care and/or identifying ways to respect cultural and/or family-of-origin influences on feeding while incorporating other options (eg, healthier preparations of traditional foods).<sup>194</sup>

### Considerations

Any advice given to caregivers regarding their feeding behaviors needs to be offered within the context of implementation challenges. It is important to recognize that:

1. Infants and caregivers can learn from each other regarding healthy, responsive feeding practices and recognition of hunger and satiety cues, regardless of decisions about what the infant is fed.
2. Modifying one's feeding behaviors can be harder for some caregivers than others. Caregiver feeding behaviors are not “set” but differ on the basis of the child's temperament<sup>205</sup> and the caregiver's psychological well-being.<sup>206,207</sup> The guilt and judgment some caregivers feel when their child does not conform to their idea of “good eating behaviors”<sup>130</sup> can be relinquished, which may ultimately encourage a more responsive partnership between the caregiver and child with feeding.
3. Optimal feeding strategies may differ depending on a child's genetically influenced behavioral profile, and research has not yet delineated the form this tailoring should take. A caveat to an individually tailored approach to food parenting is that being critiqued for their weight and directly encouraged to lose weight may promote poorer body self-esteem and disordered eating in children.<sup>208</sup> Thus, strategies should likely be adopted for the whole family.<sup>209,210</sup>

## CONCLUSIONS AND FUTURE DIRECTIONS

A substantial body of literature links specific caregiver feeding behaviors to child eating self-regulation. Overall, the current literature suggests that caregivers focus not on child characteristics (how much the child eats or their adiposity) but on creating a structured environment that inherently limits undesirable behaviors (eg, eating certain foods) without requiring overt control over children. However, such implications should be seen in light of several pressing research needs, perhaps the most pertinent of which is integrating how children's individual differences in temperament, appetite, and adiposity shape parent feeding behaviors and influence their effects on feeding self-regulation. Caregiver feeding advice will need to be updated as such understanding increases. Further, recognizing the difficulties inherent with implementing change in the feeding environment, we encourage policies that address barriers within the wider socioeconomic context, including the social determinants of health, alongside individual caregiver efforts in child obesity prevention. Although efforts that encourage caregivers to provide a responsive, structured feeding environment could be an important component of reducing obesity and cardiometabolic risk across the life span, it is likely they will be most effective as part of a multilevel, multicomponent prevention strategy.



## Disclosures

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Jennifer O. Fisher	Temple University	NIH (R01 funding on sweet preferences in children) <sup>†</sup>	None	None	None	None	None	None
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\*Modest.

<sup>†</sup>Significant.

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Tracey Ledoux	University of Houston	University of Houston (PI on study funded by UH to pilot test a wellness program for families with toddler age children)*; USDA (co-I on project funded by USDA to develop, implement, and assess a child obesity prevention internship for Hispanic college students)*; American Cancer Society (co-I on a study to test obesity prevention strategies among African American families through faith-based organizations)*; United Health Foundation (co-I on grant to deliver obesity prevention programming to an underserved community)*	None	None	None	None	None	None
Katherine M. Morrison	McMaster University (Canada)	CIHR (funded grant to evaluate determinants of successful outcomes in pediatric weight management programs)†; CIHR (funded grant to examine the early life influences on the gut microbiota)†	None	None	None	None	None	None
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\*Modest.

†Significant.

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