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## Research Article

# Age and Ability to Complete an Assessment of Fullness -

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## ABSTRACT

**Objective:** Examine the age at which children can complete a five-point assessment of fullness.

**Design:** This was a longitudinal study which included a laboratory visit at baseline and a survey follow-up at six months and 12 months after the baseline laboratory visit. The examination of age and ability to complete a five-point assessment of fullness took place during the baseline laboratory protocol. Following a standardized laboratory protocol with parent-child dyads, parents were asked to leave the room, while children completed a self-assessment of fullness with a trained research assistant.

**Setting:** The study took place in a laboratory setting designed to simulate a home eating environment.

**Participants:** Fifty-eight parents (96.6% mothers) and their 2.5-6-year-old children, 51.7% White.

**Main Outcome Measure(s):** The dependent variable was likelihood of competently completing the fullness task and the independent variable was the child's age. Ability to complete the task was measured by children's demonstration of accurate knowledge of where their stomach was and ability to indicate their degree of fullness on a five-point scale.

**Analysis:** Visual scatterplot inspections, mean comparisons, and binomial logistic regressions were conducted.

**Results:** Age explained 50% (Nagelkerke  $R^2$ ) of the variance in children's ability to self-determine fullness and 84.5% of cases. Older children, around the age of 4.5 years, were more likely to complete the assessment than children under 3.5 years of age,  $p < .005$ .

**Conclusions and Implications:** Researchers, clinicians, teachers and parents may begin to use self-assessments of fullness within the context of child feeding with children around 4.5 years of age.

**Keywords:** Age and fullness; Self-assessment; Child fullness; Fullness assessment; Fullness

## INTRODUCTION

Obesity rates in children in America continue to rise, and overweight status and obesity are associated with multiple chronic health outcomes including Type II diabetes [1], heart disease [2], and several types of cancer [3,4]. Given that increases in childhood obesity cannot be fully explained by genetics interventions pertaining to the various constructs that have been implicated in the etiology of overweight status are a crucial starting point for the development of accessible, impactful interventions that can help mitigate obesity risk in the family.

There is little to no consensus within the literature regarding the meaning of the term 'fullness' in the context of eating, and great debate about whether or not the construct of fullness differs from satiety. The debate centers around the denotation of the words fullness and satiety and the degree to which the physiological state of not being hungry is impacted by the intake of food [5,6]. Evidence suggests that infants are capable of responding to the energy density of what they consume [7]. However, parenting practices around feeding have the ability to further facilitate or hinder children's self-regulatory abilities when eating, i.e., how much they eat and do not eat in response to cues of hunger and satiety [8,9]. These same feeding practices have been tied to children's obesity risk. For example, across several studies, practices such as pressure to eat and restriction have been associated with higher child weight *via* their impact on child eating [10].

This lack of agreement in the field poses great challenges to researchers and clinicians attempting to improve children's ability to stop eating when they are full. Although debate about the definition of fullness and satiety are likely to continue, there is a general agreement that parents are capable of responding to children's cues of hunger and satiety, termed responsiveness. Caregiver responsiveness during feeding is a known deterrent to obesity.

The child obesity prevention committee convened by the National Academy of Sciences recommends that child care centers implement "responsive feeding" in order to scaffold children's inborn ability to self-regulate when eating [11]. Responsive feeding involves caregivers allowing children to eat in response to their own internal cues of

hunger and fullness, i.e., interoception [12]. Theoretically, caregiver scaffolding of child fullness during mealtimes is a simple, affordable way to foster optimal self-regulation around eating [13,14]. However, evidence suggests that parents often mistrust children's perceptions of fullness. To this point, Hodges and colleagues recently found that parents of children in their first two years of life are more responsive to their infant's hunger cues than fullness cues: 75% of mothers were observed to be responsive to child hunger cues, whereas only 45% were similarly responsive to fullness cues [15]. While studies with older children are less common than with infants, existing research suggests that parents do not trust pre-school aged children's ability determine their fullness level [16].

It is important to help parents understand the age at which their child comprehends and can communicate their own feelings of fullness, so that, 1) parents can scaffold understanding of fullness in children who are not yet able to independently determine levels of fullness, and 2) parents can listen to and respect feelings of fullness when children are able to determine and express fullness levels on their own. Currently, there is an absence of self-assessments of fullness for children and an inadequate understanding of the age at which children can accurately comprehend the concept of fullness and recognize their own fullness.

### Self-assessments

Self-assessments allow researchers and clinicians to understand the perceptions of individuals and to gather relevant information needed to inform intervention selection. Children are capable of using self-assessments. The most common application of self-assessments in children is in medical settings. Several visual scales have been developed to help medical staff assess pain and discomfort in young children [17,18]. For example, the Wong-Baker Faces Pain Scale allows clinicians to assess how much pain patients are experiencing in order to tailor treatments to individual patient needs [19]. The ordinal scale features six cartoon-like faces typically used to depict emotional states ranging from a very happy, smiling face to a sad, tearful face. It was developed to more accurately assess pain in children aged three to eight years, without relying on verbal descriptions of pain or behavioral observations, and is now commonly used in pediatric

clinical and hospital settings. Researchers have found that children aged five years and older can provide meaningful self-reports of pain intensity using age-appropriate pain scales [17].

There is a dearth of self-assessment measures around child fullness. Fisher and Birch developed a subjective, three-figure, self-report of hunger and fullness as a component of the Eating in the Absence of Hunger task [20]. Initially utilized in a study with five to seven-year-old girls, figures depicting a “hungry,” “half-full,” and “full” person were displayed, and children pointed to their fullness level following a standard meal (see Fisher and Birch (2002) for detailed protocol). A similar three-point scale was used in a study employing a different protocol to measure food reinforcement (i.e., the relative reinforcing value of food) in preschool children (three to five year olds). The children were read a story about “Peter Pumpkin Eater,” in which Peter transitions from being hungry to full as he eats a pumpkin as demonstrated by pictures of Peter with 1) an empty stomach, 2) a half empty/full stomach, and 3) a full stomach. The children were then asked to indicate their level of fullness on a three-point scale using the cartoon Peter Pumpkin Eater figures [21].

### Current study

Self-assessments of child fullness are critical for use by parents and caregivers within the home when child eating behaviors are in formation. They enable parents to gauge children’s fullness levels, so that parents can better engage in responsive feeding practices and establish healthier feeding behaviors during formative developmental years. However, given the dearth of research around children’s ability to self-assess fullness, especially using a more precise five-point scale within a research protocol designed specifically to determine the age at which fullness can be accurately self-assessed in children, more research is clearly needed. Before the existing research in areas of responsive feeding practices and childhood obesity prevention can be effectively applied to settings where it is most practically required, with parents in the home, the age at which children can self-assess fullness must be determined and an age-appropriate self-report measure must be examined and replicated. This study serves as a critical step in this direction by determining at what age children may be able to complete a five-point assessment of fullness.

## METHODS

### Participants and procedures

A convenience sample of participants was recruited through fliers, local community events focused on providing services for families, an online university research system, and online postings to parents in the Houston area. Participants received \$50, a parking validation and sticker book for their child in exchange for attending this in-person laboratory visit. The sample size was determined prospectively based on power analysis using G\*Power Software.

Participants were initially screened for eligibility according to the following criteria: being the parent of a child between the age of 2.5 and 6 years, who has no known food allergies, and speaking English. Once eligibility was confirmed, parent-child dyads came to the research lab where parents provided consent and child assent prior to engaging in any study activities. The study followed a standardized protocol to maximize internal validity. Participant dyads then engaged in a 15-minute free play/snack time activity. Snack choices for all participants included the same standardized, pre-packaged servings of: lemon-lime soft drink, fruit punch, apple juice, water, fish-shaped crackers, fruit snacks, apple sauce, and chocolate candies

in a candy-coated shell. Participants were instructed that they could play with their child and/or consume a snack from the available options on the table. This standardized free play/snack was followed by a four-minute, clean-up activity. Next, the parent was asked to leave the room and the experimenter asked the child the following series of questions pertaining to their fullness. First, the experimenter asked the child if they knew where their stomach was. Children who did not answer or looked confused were probed further with similar words such as “tummy”. If the child answered in the affirmative and could demonstrate understanding by pointing at their stomach, the experimenter, using a standardized script, asked the child to indicate their degree of fullness utilizing various figures depicting levels of fullness (see Frankel (2012) for more detailed protocol). Once this fullness task was completed, parents were given the opportunity to fill out questionnaires while the child colored or played with toys with the research staff. Child weight and height were measured by trained research staff in the lab. The study was approved by the Institutional Review Board at the University of Houston.

### Measures

**Fullness figures:** Perceptions of child fullness were assessed with figures adapted from Fisher and Birch [20]. To increase variability in child and maternal responses, the number of figures was increased from three to five. The figures were labeled “hungry,” “a little bit hungry,” “halfway full,” “almost full,” and “full” (see Frankel et al., 2015 [16] for more information).

**Analyses:** Analyses were conducted using SPSS 24. The age of children, as well as whether or not they were able to complete the task, was plotted on a scatterplot diagram and identified as two different colors in order to conduct visual inspections. Mean comparisons were conducted by looking at means of children who were able to complete the task compared to means of children who were not able to complete the task. Binomial logistic regressions were conducted to test if ability to complete or inability to complete the fullness assessment depended on age.

## RESULTS

Sixty parents and their children between the ages of 2.5 and six years (Table 1) participated in this study. One participant was determined to be unable to consent due to issues with English comprehension and, therefore, did not reach the consent phase. Another participant completed the study but did not report child demographic information. Therefore, demographic information and study data is available for 58 participants. Most of the parents were mothers ( $n = 56, 96.6\%$ ), approximately half the sample was White ( $n = 30, 51.7\%$ ), and about 60% had a yearly household income below \$50,000 ( $n = 35, 60.3\%$ , see table 1).

The scatterplot diagram indicates that young children (under 3.5 years of age) tend to be unable to complete the fullness task with the exception of one child who was closer to five years old and unable to complete (Figure 1). The majority of children in the study (79%) were able to complete the fullness assessment. Child mean age was 4.08 ( $n = 58, SD = 1.07$ ). Children who were able to locate their stomach and complete the fullness task were older ( $M = 4.36$  years old,  $n = 46, SD = 0.95$ ) than children who were not able to locate their stomach ( $M = 2.91$  years old,  $n = 12, SD = 0.67$ , See figure 2).

A binomial logistic regression was performed to determine the likelihood that age impacts children’s ability to locate or inability to locate their stomach. The logistic regression model was statistically

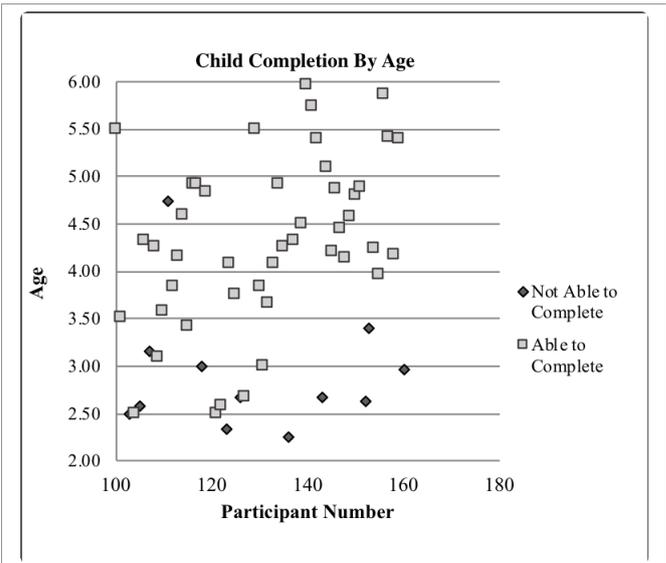
significant,  $\chi^2(1) = 17.78, p < .005$ . Age explained 50% (Nagelkerke  $R^2$ ) of the variance in children’s ability to self-determine fullness and 84.5% of cases. Older child age was associated with a higher likelihood of being able to determine fullness.

**DISCUSSION**

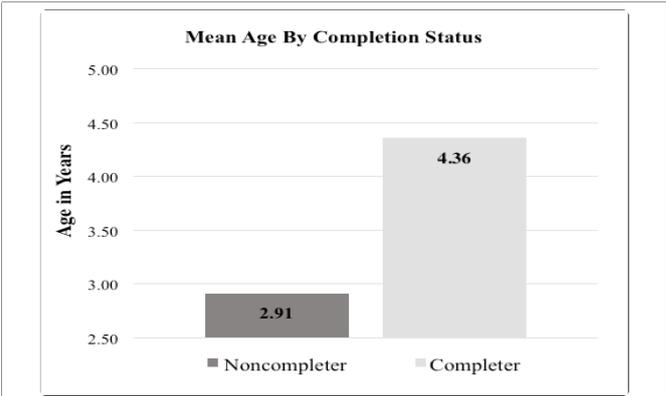
Although caregiver and parent responsive feeding practices are promoted by researchers as being important in the context of feeding [11], research indicates that many parents do not trust their child’s feelings of hunger and fullness [16]. Parental distrust of children’s ability to understand their own hunger and fullness is potentially harmful to children [8,22], because repeated parental attempts to override children’s internal cues of hunger and satiety by using maladaptive feeding practices such as control force children’s hunger and fullness to be regulated by external rather than internal factors [8]. This has the potential to diminish children’s innate self-regulatory abilities putting them at greater risk for maladaptive eating behaviors, obesity, and related negative health outcomes [23].

**Table 1:** Demographics of sample (n = 58).

| Variables                         | n,% or Mean (SD) |
|-----------------------------------|------------------|
| <b>Parent Gender</b>              |                  |
| Male                              | 2, 3.4%          |
| Female                            | 56, 96.6%        |
| <b>Parent Age</b>                 | 31.14 (6.11)     |
| <b>Child Gender</b>               |                  |
| Male                              | 26, 44.8%        |
| Female                            | 32, 55.2%        |
| <b>Child Age in Years</b>         | 4.08 (1.07)      |
| <b>Race</b>                       |                  |
| White                             | 30, 51.7%        |
| African American                  | 22, 37.9%        |
| American Indian/Alaska Native     | 1, 1.7%          |
| Asian                             | 2, 3.4%          |
| Multi-Racial                      | 2, 3.4%          |
| Not Reported                      | 1, 1.7%          |
| <b>Ethnicity</b>                  |                  |
| Hispanic                          | 18, 31.0%        |
| Non-Hispanic                      | 40, 69.0%        |
| <b>Relationship Status</b>        |                  |
| Single, never married             | 13, 22.4%        |
| Married                           | 29, 50.0%        |
| Divorced                          | 3, 5.2%          |
| Relationship, not living together | 6, 10.3%         |
| Relationship, living together     | 7, 12.1%         |
| <b>Yearly Household Income</b>    |                  |
| Less than \$15,000                | 10, 17.2%        |
| \$15,000-\$24,999                 | 10, 17.2%        |
| \$25,000-\$49,999                 | 15, 25.9%        |
| \$50,000-\$74,999                 | 9, 15.5%         |
| \$75,000-\$99,999                 | 3, 5.2%          |
| \$100,000-\$149,999               | 8, 13.8%         |
| \$150,000 and above               | 3, 5.2%          |



**Figure 1:** Scatterplot diagram of children who were able to complete the fullness assessment by age period children (under 3.5 years of age) tend to be unable to complete the fullness task. There was one child who was closer to five years old and unable to complete but the rest of the children above 3.5 years of age were able to complete the fullness task.



**Figure 2:** Mean age of children who were unable to complete the fullness task and children who were able to complete the fullness task. The mean age of children who were able to locate their stomach and complete the fullness assessment was 4.36 years old (n = 46, SD = 0.95) while the children who were unable to complete the fullness assessment were younger (M = 2.91 years old, n = 12, SD = 0.67).

In a recent study assessing habitual consumption during school snack-time in children aged six to 13 years, van de Gaar et al. [24] found that overall agreement between observed and child-reported eating and between parent and child reports of consumption were poor to fair. This discrepancy further indicates the problematic nature of over-reliance on parent-report and observational measures in relation to child fullness and eating behaviors.

Results from this study indicate that preschool children at around the age of 4.5 can complete a five-point fullness assessment. Additionally, this study was conducted in a controlled, laboratory environment following a snacking opportunity with a four-minute break between the snack and fullness assessment to maximize internal validity. Parents were not in the room at the time of the assessment, so children were not able to look to the parents for cues. However, a major limitation of the study is that we were not able to accurately

assess “how full” the children actually were. Future studies utilizing self-assessment of fullness in children might explore pairing the fullness assessment with 24-hour recalls in order to gain information on construct validity. However, there is literature suggesting that 24-hour recalls are not well-tied to children’s intake [25]. Determining “how full” a child *really* is might require the inclusion of an additional measure of validity such as imaging of the stomach itself with an ultrasound.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

The finding that children are able to complete the fullness task and select their own fullness level on a five-point scale at around 4.5 years of age suggests that researchers, clinicians, teachers and parents can seek feedback from children at and above 4.5 years of age in the context of child feeding. Self-assessments of fullness fulfill several important uses with preschool children. Firstly, they can be used in research examining caloric intake, because they allow researchers to estimate just how hungry or full children are before feeding them. Similarly, this study shows that five-point fullness figures can be used in classroom settings by teachers or by researchers to gather information about children’s “baseline” hunger levels. This data may be informative as a baseline measure to be used in studies examining fullness levels pre and post eating task (e.g., Eating in the Absence of Hunger task), but it may also be important as a tool for gathering information about food insecurity. Lastly, and perhaps most importantly from a clinical perspective, the use of self-assessments of fullness has a potential interventional benefit during a critical period of development. It has the potential to get children thinking about their level of fullness during eating occasions which might encourage them to listen to their own hunger and fullness cues. By increasing children’s interoceptive sense pertaining to fullness and satiety, self-assessments of fullness may serve to promote healthy self-regulatory abilities surrounding eating. Giving children an opportunity to self-assess fullness during mealtimes also provides parents with opportunities to learn to trust and respect children’s feelings of hunger and fullness, an important step in responsive feeding practices [12,26].

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