Published in final edited form as:
J Med Speech Lang Pathol. 2009 ; MARCH: nihpa57357.

Early Feeding Abilities in Children with Cerebral Palsy: A Parental Report Study

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Abstract

Purpose—The goals of this study were to 1) describe the feeding skills of young children with cerebral palsy (CP); and 2) elucidate the type and severity of feeding problems for children with and without oral-motor involvement.

Method—Parents of 37 children (16 females, 21 males) with CP, who ranged in age from 11-58 months (mean age = 41 months), completed questionnaires regarding their child's past and current feeding abilities. Children were also clinically evaluated to determine whether each had evidence of oral-motor involvement.

Results—Children with CP and oral-motor involvement had significantly more difficulty with self-feeding, increased frequency of coughing and choking, increased prevalence of swallowing evaluation and feeding therapy, and were introduced to solid food at a later age relative to children with CP who did not have oral-motor involvement. Both groups of children were similar in their history of tube feeding, bottle feeding, difficulty with solid foods, use of adaptive equipment, duration of mealtimes, and presence of choking, coughing, and gagging.

Conclusions—Children with and without oral-motor involvement initially presented with similar feeding difficulties. However, feeding problems appeared to resolve to a greater extent in children without oral-motor involvement. The difficulties identified early in life, for children with oral-motor involvement, appeared to persist with development.

Keywords

cerebral palsy; oral-motor involvement; feeding; dysphagia

Cerebral palsy (CP) is a developmental disability that has been recognized as a chronic and debilitating health problem for well over a century, beginning with the early work of William Little (Little, 1843, 1862). Symptoms of CP may include, but are not limited to: increased muscle tone, fluctuating muscle tone, hyperactive reflexes, reduced coordination, random involuntary movements, difficulty walking, difficulty with hand use, difficulty eating, excessive drooling, and difficulty speaking (NINDS, 2006). CP is the most common cause of severe motor disability in children (Lepage, Noreau, Bernard, & Fougeyrollas, 1998); prevalence research indicates that approximately 2 per 1000 children have CP (Boyle, Decoufle, & Yeargin-Allsopp, 1994; Winter, Autry, Boyle, & Yeargin-Allsopp, 2002).

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A host of disabilities such as mental retardation, seizure disorder, and learning disabilities often co-occur with CP (Murphy, Yeargin-Allsopp, Decoufle, & Drews, 1993; Odding, Roebroeck, & Stam, 2006; Rosenbaum, Paneth, Leviton, Goldstein, & Bax, 2007). Along with gross and / or fine motor involvement, children with CP frequently have oral-motor involvement, which may include oral, pharyngeal, or esophageal dysphagia (Reilly, Skuse, & Poblete, 1996) and / or speech impairment. Although prevalence figures for oral-motor involvement in children with CP have varied among studies, research suggests that oral-motor dysfunction with subsequent feeding problems may be observed in up to 90% of preschool children with CP (Reilly et al., 1996) and even children with very mild CP may show evidence of oral-motor involvement and reduced functional feeding skills (Gisel, Alphonce, & Ramsay, 2000). Not surprisingly, the prevalence of feeding problems in children with CP appears to be positively correlated with severity and extent of motor involvement (Stallings, Charney, Daies, & Cronk, 1993a).

Regardless of the severity of the problems, prolonged feeding disorders can have a cascade of negative effects. For example, continual feeding problems can result in deficits in cognitive, emotional, and physical development (Manikam & Perman, 2000). Fung and colleagues (2002) reported that feeding difficulties in children with moderate to severe CP resulted in poor nutritional status and health, a finding that was also confirmed by Rogers (2004) who reported that “children with cerebral palsy are at high risk for feeding and swallowing disorders that can have significant health implications, including limited caloric intake and acute and chronic malnutrition” (p. S31). Unfortunately, malnutrition in individuals with CP is relatively common. In an investigation of 90 children with CP, Troughton and Hill (2001) determined that nearly half were undernourished

Results of investigations on undernutrition during early childhood suggest that “undernourished children generally had poorer fine and gross motor function, and levels of school achievement and cognitive function” (Grantham-McGregor & Ani, 2001, p. 4). Also documented were social and attentional deficits (Grantham-McGregor & Ani, 2001). Moreover, disordered feeding may also lead to increased vulnerability to illness and can eventually cause death (Manikam & Perman, 2000).

Previous investigations have examined feeding abilities in a wide range of individuals with CP (see Figure 1). However, a majority of these investigations over the past 15 years have included broad age ranges of participants with varying degrees of motor involvement. In most of these studies, data were pooled across children of various ages, making age-specific interpretation difficult. Yet, studies generally have shown that individuals with CP may have persistent difficulty in all stages of the feeding (e.g., self-feeding) and swallowing process. For example, problems may include the oral preparatory stage (e.g., poor mastication and drinking), the oral transport stage (i.e., inadequate lingual tone for bolus transport), the pharyngeal stage (e.g., coughing/choking, aspiration), and/or the esophageal stage (e.g. recurrent vomiting). The persistent feeding and swallowing problems may also result in continual malnutrition and consequential growth retardation.

Although early feeding problems are common in children with CP, the type and extent of these problems remains largely unexplored (Rogers, 2004). In addition, whether feeding problems resolve over time in certain children is unclear. The goal of the present investigation was to examine the development of feeding in a cohort of young children with CP who were between the ages of approximately 1 and 5 years. The primary data used in the study were from parent report; however, participants were also assessed clinically for the presence or absence of oral-motor involvement. Feeding abilities were considered separately for children with CP who did and did not have evidence of oral-motor impairment. This unique description of early feeding abilities will provide necessary information to help identify children with CP who may have

persistent feeding problems and those who may outgrow their feeding problems. The specific goals of the present study were to:

1. describe the feeding skills of young children (aged approximately 1-5 years) with CP;
2. elucidate the type and severity of feeding problems for children with and without oral-motor involvement.

Method

Participants

Participants in this study were from the upper Midwest portion of the United States. Children and their parents were recruited through a regional CP clinic, and through physicians in Sourthern Wisconsin serving children with CP. In addition, children were recruited through birth –to-three service providers and early intervention programs. Inclusion criteria for participation required that children: 1.) have a medical diagnosis of CP; 2.) be between the ages of approximately 12 months and 5 years of age; and 3.) have hearing abilities within normal limits. Data reported here are from 37 children (16 females, 21 males) between the ages of 11-58 months of age (mean 40.86 months; SD 11.7 months). Children and their families represented ethnic, racial, and socioeconomic diversity consistent with the demographics for the state of Wisconsin (U.S. Census, 2000).

Children were classified into two broad groups based on presence or absence of oral-motor involvement following clinical assessment. It is important to note that the term “oral-motor involvement” is used broadly here to refer to any kind of neurologically-based impairment involving the speech subsystems. Evidence was obtained via auditory perceptual assessment targeting identification of a motor speech disorder (i.e., dysarthria (Darley, Aronson, & Brown, 1969) and / or oral apraxia (Yorkston, Beukelman, Strand, & Bell, 1999)). Evidence was also obtained by observation of anatomy / physiology, including presence of drooling, or oral mechanism asymmetry at rest or in movement during speech or feeding. The observation of any one or more of these characteristics resulted in a designation of “oral-motor involvement.” Children were independently classified by two certified speech-language pathologists with expertise in speech motor disorders. 100% classification agreement was obtained.

Materials & Procedures

Feeding and swallowing data reported in this paper are based upon parent responses to a feeding and swallowing questionnaire (FSQ). Parent report is a standard tool in clinical assessment of child behavior and performance and is also widely used in behavioral research. In fact, the American Academy of Pediatrics recommends the use of parent report for early identification of developmental disabilities in young children (American Academy of Pediatrics, 2001). The validity of parent report measures has been established in a number of developmental domains including cognition (Johnson et al., 2004), language (Pan, Rowe, Spier, and Tamis-Lemonda, 2004; Fenson et al., 1993) and gross motor function in children with CP (Morris, Galuppi, & Rosenbaum, 2004; Morris, Kurinczuk, Fitzpatrick, & Rosenbaum, 2006). Furthermore, as noted by Rogers (2004), parental/caregiver report has historically been utilized as a measure of feeding and/or oromotor status in individuals with CP (see Dahl, M., Thommessen, M., Rasmussen, M., & Selberg, T., 1996; Fung et al., 2002; Gangil, A., Patwari, A.K., Aneja, S., Ahuja, B., & Anand, V.K., 2001; Reilly & Skuse, 1992; Reilly, et al., 1996; Stallings, Charney, Daies, & Cronk, 1993a & 1993b; Sullivan, et al., 2000).

The FSQ was an informal questionnaire created specifically for use in this investigation (see Appendix A). Questions comprising the FSQ were identified following a comprehensive review of published resources addressing feeding and swallowing assessment in children (e.g.

(Arvedson & Brodsky, 2002; Evans Morris & Klein, 2000; Hall, 2001; Robbins & Klee, 1987; Wolf & Glass, 1992; Workinger, 2005). The questionnaire was designed to be appropriate for use with all participants in this investigation despite a varying age range (approximately 1-5 yrs). The FSQ consisted of 12 primary questions specific to distinct feeding and/or swallowing skills (e.g. "Was or is your child able to take a bottle?). Response options included yes / no selections and follow-up questions were open-ended where appropriate. Questions addressed acquisition of feeding milestones as well as feeding assessment and intervention (e.g., history of tube feeding, bottle feeding, food consistency management, self-feeding[1], duration of mealtime, symptoms of feeding and swallowing problems, swallow evaluations, and feeding treatment). Face validity of the FSQ was established via a focus group of researchers and clinicians (n = 6) with expertise in feeding disorders who reviewed and discussed the proposed questionnaire until 100% consensus was reached regarding the inclusion of key questions relevant for children with CP.

Prior to clinical assessment, the primary caregiver was asked to complete the FSQ. Whenever possible, any incomplete or missing information and/or necessary clarifications were obtained by a follow-up phone call.

Statistical Analysis

Descriptive statistics were used to summarize the sample characteristics. Fisher's Exact Test was used to compare the resultant proportion data between the two participant groups (children with oral-motor versus no oral-motor involvement) and t-tests were used to identify significant mean differences between the two participant groups. Levene's Tests for Equality of Variance was completed prior to each t-test and there appeared to be evidence of heterogeneous variance in the data; therefore, a t-test which allows for differences in variance was utilized for all mean difference comparisons.

Results

Across all children enrolled in the investigation, 29/37 (78%) had clinical evidence of oral-motor involvement and 8/37 (22%) had no clinical evidence of oral-motor involvement (see Figure 2). The mean age of the children with and without oral-motor involvement was 42.00 months (11.13SD) and 36.75 months (13.45SD), respectively. There was no significant difference in mean age between the groups [$t(9.81) = 1.01$, $p = 0.34$]. Results presented below are organized according to oral-motor involvement group.

Prematurity

Birth information was known and reported for 29 of the 37 children. Of the children with known birth due dates, 13/29 (48%) were born prematurely (prior to 34 weeks), a figure consistent with demographic studies suggesting that approximately half of children with CP are born prematurely. Of the children with oral-motor involvement, 10/23 (43%) were born prematurely; of the children without oral-motor involvement 3/6 (50%) were born prematurely.

Tube Feeding

Across all children, 17/37 (46%) had a history of some type of tube feeding. Of the children who did not have oral-motor involvement, 3/8 (38%) had a history of naso-gastric/naso-jejunum tube feeding, although none were ever placed with a gastric tube (g-tube). Of the children with oral-motor involvement, 14/29 (48%) had at least one[2] type of feeding tube; 1/29 (3%) had a history of oral-gastric tube (OG-tube) feedings, 10/29 (34%) had a history of naso-

[1]Where self-feeding is defined broadly as any form where the child is putting food in her mouth independently with the use of fingers or utensils.

gastric/naso-jejunum tube (NG/NJ-tube) feedings, and 6/29 (21%) had been fed via a g-tube. At the time of FSQ completion, 5/29 (17%) of the participants with oral-motor involvement received their primary nutrition via a g-tube. Inferential statistics indicated that there was no significant difference in the history of feeding tube placement between the two groups [p = 0.70, Fisher's exact test].

Interestingly, of the children born prematurely without oral-motor involvement (with known birth histories), all had a history of tube feeding, while none of the children in that group who were not born prematurely had a history of tube feeding. Of the children with oral-motor involvement who were born prematurely, 6/10 (60%) had a history of tube feeding.

Bottle Feeding

Across all children, 35/36 (97%) were able to take a bottle[3]. However, 20/36 (56%) demonstrated some difficulty with bottle feeding. Of the children who did not have oral-motor involvement (n = 7), 7/7 (100%) were able to use a bottle, and 2/7 (29%) had some difficulty with bottle feeding. Of the children with oral-motor involvement (n = 29), 28/29 (97%) were able to use a bottle, and 18/29 (62%) had some difficulty with bottle feeding. There was no significant difference in the presence of difficulty with bottle feeding between the two groups [p = 0.20, Fisher's exact test].

Solid Food Management

Across all children who were primarily fed orally[4] (n = 32), 17/32 (53%) had difficulty transitioning to solid consistency food. Of the children who did not have oral-motor involvement 2/8 (25%) had difficulty transitioning to solid consistency food. Of the children with oral-motor involvement 15/24 (63%) had difficultly transition to solid consistency foods. There was no significant difference for difficulty transitioning to solid food between the groups [p = 0.11, Fisher's exact test].

Age at Introduction to Solid Food

Across all children who were primarily fed orally (n = 29), the average age at introduction to solid foods was 10.83 months. Of the children who did not have oral-motor involvement (n = 8), the average age at introduction to solid food was 8.38 months with a standard deviation of 1.85 months. Of the children with oral-motor involvement (n = 21) the average age at introduction to solid food was 11.76 months with a standard deviation of 6.77 months. The children with oral-motor involvement were introduced to solid foods at a significantly later age than children with no oral-motor involvement [$t(25.77) = 2.10$, $p < .05$]. Both groups of children had average ages (at introduction to solid food) relatively greater than children without CP. Children considered to be typically-developing are generally capable of managing solid consistencies between 4-6 months of age (Evans-Morris and Klein, 2000).

Self-Feeding

Across all children who were primarily fed orally (n = 32), 18/32 (56%) were able to self-feed. Of the children who did not have oral-motor involvement 7/8 (88%) were able to self-feed. Of the children with oral-motor involvement 11/24 (46%) were able to self-feed. Children with

[2]Some of the children had 1or more feeding tube types placed at different times. For example, a child may have been initially placed with an NG-tube and later it was removed and replaced with a g-tube.
[3]One child without oral motor involvement was breastfed exclusively and was therefore not included in the % calculation (n = 36) for bottle feeding.
[4]Throughout the remainder of this manuscript, the term “primarily orally fed” refers to the children who do not receive their primary nutrition via tube feedings.

oral-motor involvement were less likely to be able to self-feed than children without oral-motor involvement at the time the FSQ was completed [$p \leq 0.05$, Fisher's exact test].

Age at Onset of Self-Feeding

Across all self-feeding children who were primarily fed orally (n = 17), the average age at onset of self-feeding was 14.88 months. Of the children who did not have oral-motor involvement (n = 6), the average age at onset of self-feeding was 10.00 months with a standard deviation of 1.41 months. Of the children with oral-motor involvement (n =11) the average age at onset of self-feeding was 17.55 months with a standard deviation of 5.07 months. There was a significant difference in the average age at the onset of self-feeding; the children without oral-motor involvement began to self feed, on average, 7.5 months sooner than children with oral-motor involvement [$t(12.55) = 4.62$, $p \leq .001$].

Use of Special Adaptations

Across all children who were primarily fed orally (n = 32), 11/32 (34%) used special adaptations or equipment with feedings (e.g., cut-out cup, modified fork/spoon). Of the children who did not have oral-motor involvement 1/8 (13%) used special adaptations/ equipment for feeding. Of the children who did have oral-motor involvement 10/24 (42%) used special adaptations/equipment for feeding. No significant difference in the use of special adaptations or equipment with feeding was detected between the groups [p = 0.21, Fisher's exact test].

Duration of Mealtimes

Across all children who were primarily fed orally (n=32), 13/32 (41%) completed a meal in 10-20 minutes, 14/32 (44%) completed a meal in 20-30 minutes, and 5/32 (16%) completed a meal in 30-60 minutes. Of the children who did not have oral-motor involvement, a majority completed a meal in 10-20 minutes. Of children who did have oral-motor involvement, a majority completed a meal in 20-30 minutes. Mealtimes for five of the children with oral-motor involvement lasted between 30-60 minutes. In contrast, all children without oral-motor involvement completed meals in less than 30 minutes. There was no significant difference in the duration of mealtimes between the groups for any of the duration categories: *10-20 minutes* [p = 0.22, Fisher's exact test]; *20-30 minutes* [p = 1.00, Fisher's exact test]; *30-60 minutes* [p = 0.30, Fisher's exact test].

Symptoms of Feeding and Swallowing Problems

Coughing and/or choking are frequently cited clinical signs of swallowing dysfunction (Logemann, 1998) and a hyperactive gag reflex is a common in children with CP (Arvedson, 1993); depending on the severity of these symptoms a formal swallow evaluation may be warranted. Across all children who were primarily fed orally (n =32), 18/32 (56%) were reported to cough, 22/32 (69%) were reported to gag, and 21/32 (66%) experienced choking with oral intake regardless of oral-motor involvement. Of the children who did not have oral-motor involvement 5/8 (63%) were reported to cough, 6/8 (75%) were reported to gag, and 6/8 (75%) experienced choking with oral intake. Of the children who did have oral-motor involvement 13/24 (54%) were reported to cough, 16/24 (67%) were reported to gag, and 15/24 (63%) experienced choking with oral intake. No significant difference in the presence of coughing, gagging, or choking was detected between the groups for any of the symptoms: *coughing* [p = 1.00, Fisher's exact test]; *gagging* [p = 0.24, Fisher's exact test]; *choking* [p = 0.68, Fisher's exact test].

Frequency of Symptoms of Feeding and Swallowing Problems

The primary caregivers were asked to rate the frequency of coughing, choking, and/or gagging on a 7-point scale (1: never – 7: every meal; see Figure 3). Across all children who were reported to cough with oral intake[5] (n = 18), the average frequency rating was 3.17. Across all children who reported to gag with oral intake[3] (n = 22), the average frequency rating was 3.05. Across all children who were reported to choke with oral intake[3] (n = 21), the average frequency rating was 2.81.

Of the children who did not have oral-motor involvement and were reported to cough with oral intake[3] (n = 5) the average frequency rating was 2.00. Of the children who did not have oral-motor involvement and were reported to gag with oral intake[3] (n = 6) the average frequency rating was 3.33. Of the children who did not have oral-motor involvement and were reported to choke with oral intake[3] (n = 6) the average frequency rating was 2.00.

Of the children who did have oral-motor involvement and were reported to cough with oral intake[3] (n = 13) the average frequency rating was 3.62. Of the children who did have oral-motor involvement and were reported to gag with oral intake[3] (n = 16) the average frequency rating was 2.94. Of the children who did have oral-motor involvement and were reported to choke with oral intake[3] (n = 15) the average frequency rating was 3.13. There were no significant difference in the frequency rating of gagging [$t(20) = -0.48$, $p = 0.64$]. However, the children with oral-motor involvement had a greater average frequency of coughing than children without oral-motor involvement [$t(12) = 3.41$, $p < .01$]. Children with oral-motor involvement also had a greater average frequency of choking than children with no oral-motor involvement [$t(14) = 2.43$, $p < .05$].

Formal Swallow Evaluation

Given the presence of these clinical signs and symptoms of swallowing problems, it is logical that across all participants (n =37), 16/37 (43%) had had at least one formal swallow evaluation (i.e. modified barium swallow evaluation). Of the children who did not have oral-motor involvement 0/8 (0%) had ever undergone a formal swallow evaluation. Of the children who did have oral-motor involvement, 16/29 (55%) had received a formal swallow evaluation. There was a significant difference in the history of swallow evaluations between the two groups; children with oral-motor involvement were referred for swallow evaluations significantly more often than children without oral-motor involvement [$p < 0.01$, Fisher's exact test].

Feeding Treatment

Given the history of swallow study referrals it is not surprising that across all participants (n = 37), 20/37 (54%) had been enrolled in some type of feeding therapy. Of the children who did not have oral-motor involvement 1/8 (13%) had been enrolled in feeding therapy. Of the children who did have oral-motor involvement 19/29 (66%) had been enrolled in feeding therapy. Children with oral-motor involvement were enrolled in feeding therapy significantly more often than children with no oral-motor involvement [$p < 0.05$, Fisher's exact test].

Thickened Liquids

Across all participants who were primarily fed orally (n = 32), 5/32 (16%) currently consumed thickened liquids. Of the children who did not have oral-motor involvement 0/8 (0%) were currently drinking thickened liquids. Of the children with oral-motor involvement, 5/24 (21%)

[5]And excluding all children who received their primary nutrition via g-tube (n=5).

currently drank thickened liquids. There was no significant difference in the use of thickened liquids between the groups [p = .30, Fisher's exact test].

Discussion

The purpose of this investigation was to 1) describe the feeding skills of young children (aged approximately 1-5 years) with CP; and 2) elucidate the type and severity of feeding problems for children with and without oral-motor involvement. Parents of 37 children with a medical diagnosis of CP completed questionnaires regarding their child's past and current feeding abilities, and children were clinically evaluated to determine whether each had evidence of oral-motor involvement. Although a control group of typically-developing children was not included in this study, results suggest that on average children with CP had problems with several aspects of feeding, regardless of whether they had clinically observable involvement of the oral-motor musculature. For example, more than half of the children with CP had difficulty drinking from a bottle, the average age when solids were tolerated was considerably older than the chronological age expectation, and coughing, choking, and gagging were common during meals. Findings, which contribute new information to the existing literature, are elaborated in detail below

Oral-motor involvement

In this investigation, oral-motor involvement was clinically observable in 78% of children with CP. Judgments regarding oral-motor involvement were made based on both speech and non-speech observations of the child's oral musculature. This finding was slightly lower than that of Reilly et al. (1996) who found that 90% of children with CP may have feeding problems. The extent to which “feeding problems” encompassed self-feeding and other non-oral-motor variables is unclear from the study of Reilly and colleagues. Thus the results of Reilly and colleagues provide a more general estimate that is specific to feeding. Findings of the present study are higher than historical estimates of oral-motor involvement, which suggest that 31% to 59% of children with CP have oral-peripheral impairment (Wolfe, 1950). This result is difficult to interpret; however, for the present study audio and video recording equipment were used to carefully examine portions of the clinical assessment and to obtain reliability data. Such tools were not available for the earlier study of Wolfe (1950). As a result, clinical findings from the present study may be more accurate.

Tube feeding and bottle feeding

One potential contribution to the early feeding problems seen in the children with and without oral-motor involvement in this investigation may have been premature birth as detailed in the results section above. Feeding difficulties in preterm infants are common. In fact, children born prior to 34 weeks may not be able to feed orally initially “because of neurological immaturity or respiratory compromise” (McGuire, Henderson, Fowlie, 2004, p. 1227). Given the presence of tube feeding in the children born prematurely with no oral-motor involvement, it is reasonable to propose that prematurity may have played a contributing role in the early feeding difficulties reported in the current investigation.

At the time the FSQ was completed, 17% of the children with oral-motor involvement were currently g-tube fed whereas no child without oral-motor involvement was currently tube fed. This finding provides evidence that the very early feeding difficulties of children without oral-motor involvement tend to resolve, to some extent, over time.

Fifty-six percent of the children in the current investigation demonstrated difficulty with bottle feeding. Interestingly, a London-based population survey of feeding in children with CP also revealed that 56% children with CP (12-72 months of age) demonstrated difficulty with sucking

(for breast and/or bottle feeding) (Reilly et al., 1996). The similar finding across these two investigations confirms that early feeding problems are common in children with CP, regardless of oral-motor involvement, and must be considered and addressed early in development to avoid the short- and long-term consequences of feeding disorders.

Advancing textures

Over half of the children (53%) in the current investigation had difficulty transitioning to solid foods, although there was no significant difference between the groups. This finding is consistent with other research demonstrating that 52% of children with CP, between 12-72 months of age, had difficulty with solid foods (Reilly et al., 1996).

The average age at introduction to solids in the current investigation was 10.83 months of age; approximately 4-6 months later than children without CP (Evans-Morris and Klein, 2000). This finding differs from that of Reilly and Skuse (1992), who found that children with CP (15-39 months) were introduced to solid food at 4 months of age and there was no significant difference between the children with CP and a comparison group of typically-developing children. However, Reilly and Skuse (1992) did report that children with CP demonstrated more difficulty with management of solid food than children in the comparison group. One explanation of the difference in findings between the studies may be related to parental interpretation of the term “solids.” Some parents may have believed that “solid” referred to a pureed consistency food (i.e., baby cereal) and others may have interpreted it to mean harder consistency foods (i.e., crackers/cookies). Thus, this finding is somewhat difficult to interpret.

Mealtime: duration, self feeding, special adaptations

Although the results from this investigation suggest that mealtimes for the majority of children with oral-motor involvement last longer than the mealtimes for the majority of children with no oral-motor involvement, other research suggests that children with more severe oral-motor involvement may actually demonstrate *shorter* feeding times than children without or with minimal oral-motor involvement (Reilly et al., 1996). Feeding evaluations should therefore, not only assess duration of mealtime for fatigue-related concerns, but also nutritional adequacy of oral intake. Assessments should also take into account the fact that delayed self-feeding skills in children with oral-motor involvement may be secondary to increased upper extremity involvement.

Although the use of special equipment and adaptations was documented in 34% of the children in the current investigation, there was no significant difference between the groups in their use. One explanation for this finding may relate to the age of the children in this study. Because children were relatively young, they may not yet have been evaluated for adaptive equipment to enhance feeding.

Symptoms of swallowing problems

The prevalence of coughing, gagging, or choking ranged from 56-69%, a finding comparable to Reilly and colleagues (1996) who reported that 71% of children with CP age 12-72 months demonstrated “frequent coughing and choking” (p. 880). In the current investigation parents were asked to rate the frequency of these symptoms and there was no difference in the frequency rating of gagging between the two groups of children with CP. However, children with oral-motor involvement had a greater average frequency of coughing and choking than children without oral-motor involvement. Because there was no comparison group, it was not possible to determine if the presence and frequency of coughing, gagging, and/or choking were different in the children with CP than children with no evidence of CP. However, previous work suggests that the presence of coughing, gagging, and choking was significantly greater in children with CP than those without CP (Reilly and Skuse, 1992), and 53% of children with CP had recent

chest infections (Reilly et al., 1996). Given the potential for serious respiratory complications, the presence and frequency of coughing, gagging, and/or choking should be assessed during a feeding evaluation and referrals for a formal swallow evaluation should be made as appropriate.

Evaluation and therapy

As indicated in the results, children with oral-motor involvement were more likely to be enrolled in feeding therapy than children without oral-motor involvement. Only one child without oral-motor involvement was enrolled in therapy and that child's therapy was directed toward improving the child's acceptance of a larger variety of foods and not toward improving masticatory or swallow function. Of the children who did have oral-motor involvement 66% had been enrolled in feeding therapy, and although therapy was individualized to each child, and therapeutic goals were described by parents, five primary themes were identified in the current investigation 1) increase texture acceptance, 2) improve oral-motor motility (e.g., lips and tongue), 3) improve feeding ability (e.g., self-feed, use of utensils), 4) address oral sensitivity issues, and 5) improve chewing ability.

Summary of Findings

When children with CP were grouped based on the presence of oral-motor involvement, differences in skill level emerged. In general, both groups (i.e., children with and children without oral-motor involvement) initially presented with similar feeding difficulties (e.g., prevalence of feeding tube, difficulty with bottle feeding), but there was a divergence in feeding skill acquisition between the groups on more advanced skills. That is, not only did the children with oral-motor involvement have early feeding difficulties, but they were also introduced to solids at a later age, had more difficulty with self-feeding and demonstrated frequent coughing and choking during mealtime. Children with oral-motor involvement also had a significantly greater number of formal swallow evaluations and enrollment in feeding therapy. In contrast, the feeding problems in children without oral-motor involvement were only apparent on measures of early feeding skills and to a much lesser extent with later developing skills (when compared to the group of children with oral-motor involvement), suggesting greater resolution of early difficulties.

Caregiver report vs. clinical evaluation

Parental/caregiver report has long been used in a variety of fields to gather information about an individual's performance. This method provided valuable insight into typical “everyday” feeding practices that can not easily be replicated during one session in a controlled laboratory environment. Although parental/caregiver report has the potential to be biased by certain variables (e.g. personal opinion, motivation, observation skills, and/or mood) attempts were made to request quantitative (e.g., age at onset of solids) as well as descriptive information, thereby reducing the potential for parental/caregiver bias. Furthermore, although challenges with memory recollection should be a consideration in any investigation using parental/caregiver report, the issue was minimized in the current study by asking parents to 1) recall relatively broad aspects of past feeding development (i.e., use of tube feeding) and/or 2) recall current feeding performance (i.e., duration of meal time). Nonetheless, because the primary data reported in this study were based on parent report, results should be viewed as the first step in a line of inquiry investigating feeding development in young children with CP.

Participants

The number of participants in the current investigation (n = 37) was comparable to (or greater than) the number of participants in many of the previous investigations on feeding abilities in individuals with CP highlighted in Figure 1. However, what made the current investigation unique was that it described the development of feeding skills of 37 children within a relatively

narrow age range (11-58 months), rather than across a larger developmental period (i.e., early childhood → adolescents → adulthood). The results therefore provide much needed information which contribute to the emerging body of literature regarding early feeding skills in children with CP, an area which, according to Rogers (2004), remains largely unexplored.

Conclusion

Young children with CP have a range of feeding skills. When the children were grouped based on presence of oral-motor involvement (defined as the presence of any one or more of the following symptoms: dysarthria, apraxia, drooling and/or oral mechanism asymmetry), differences in skill level became more apparent. In general, children without oral-motor involvement initially presented with feeding difficulties but the feeding problems appeared to resolve as the children acquired more skills (when compared to children with oral-motor involvement). In contrast, the difficulties identified early in life, for children with oral-motor involvement, appeared to persist with development. Future inquiries should utilize a longitudinal approach to investigate the development of feeding skills in a larger number of young children with varying degrees of oral-motor involvement as well as to determine if the relative resolution of early feeding problems is specific only to children without oral-motor involvement. Future work should also be aimed at quantifying the oral-motor characteristics contributing to persistent feeding problems. This line of inquiry would provide necessary information into the underlying motor control processes of feeding in individuals with CP and may provide a means to earlier identify children at risk for continual feeding disorders.

Appendix

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Author Note The authors thank the children with CP and their families who participated in this research. This study was funded by grants K23DC007114 from the National Institute on Deafness and Other Communication Disorders and T32 HD07489 from the National Institute on Child Health and Development, National Institutes of Health.

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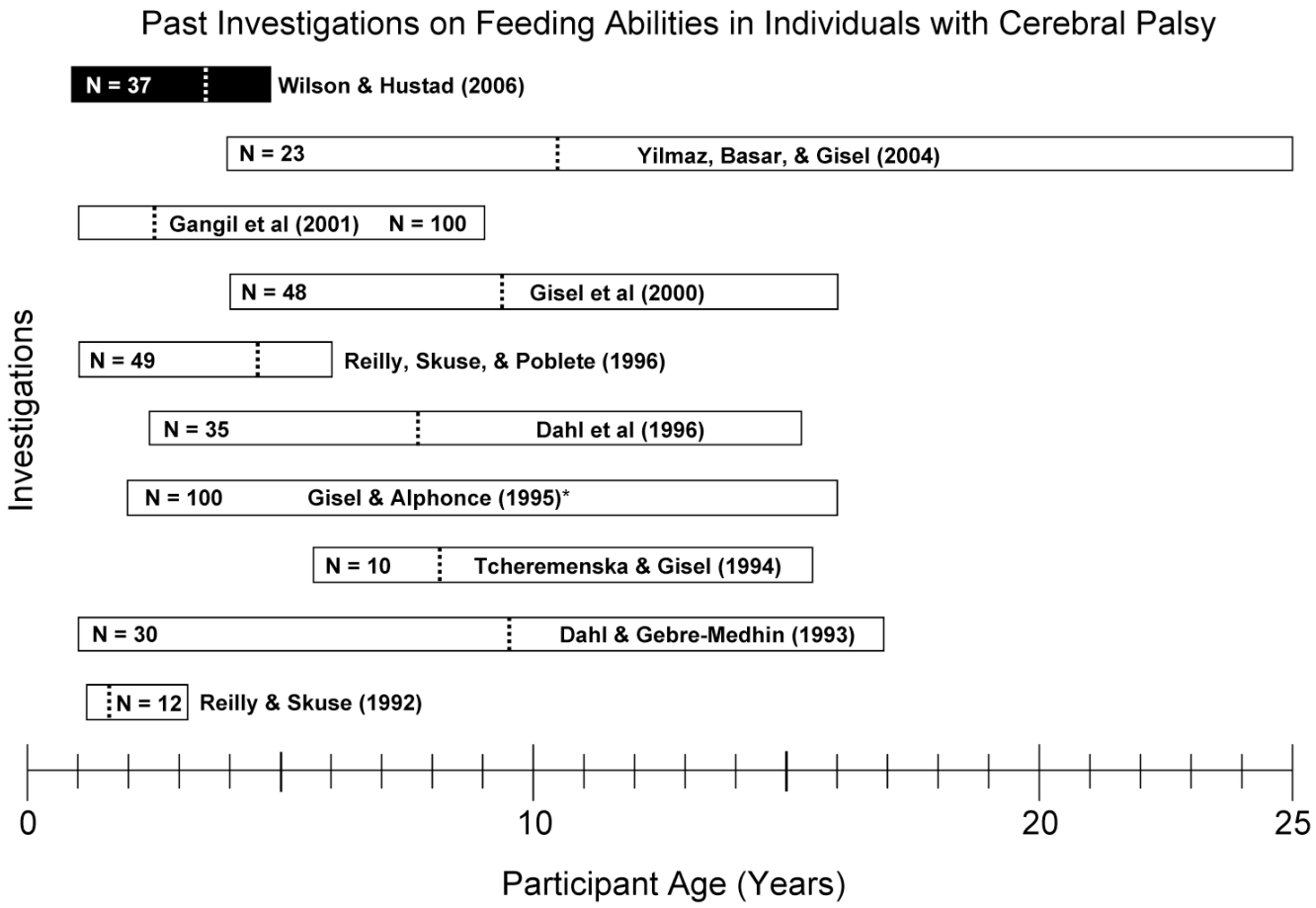

Figure 1.

Illustration of previous investigations on feeding abilities in individuals with cerebral palsy. For each investigation (vertical axis) the age range (years) of the participants is depicted along the horizontal axis. Each investigation includes the authors, the number (n) of participants, as well as the mean age of the participants.

* *Mean age not provided*

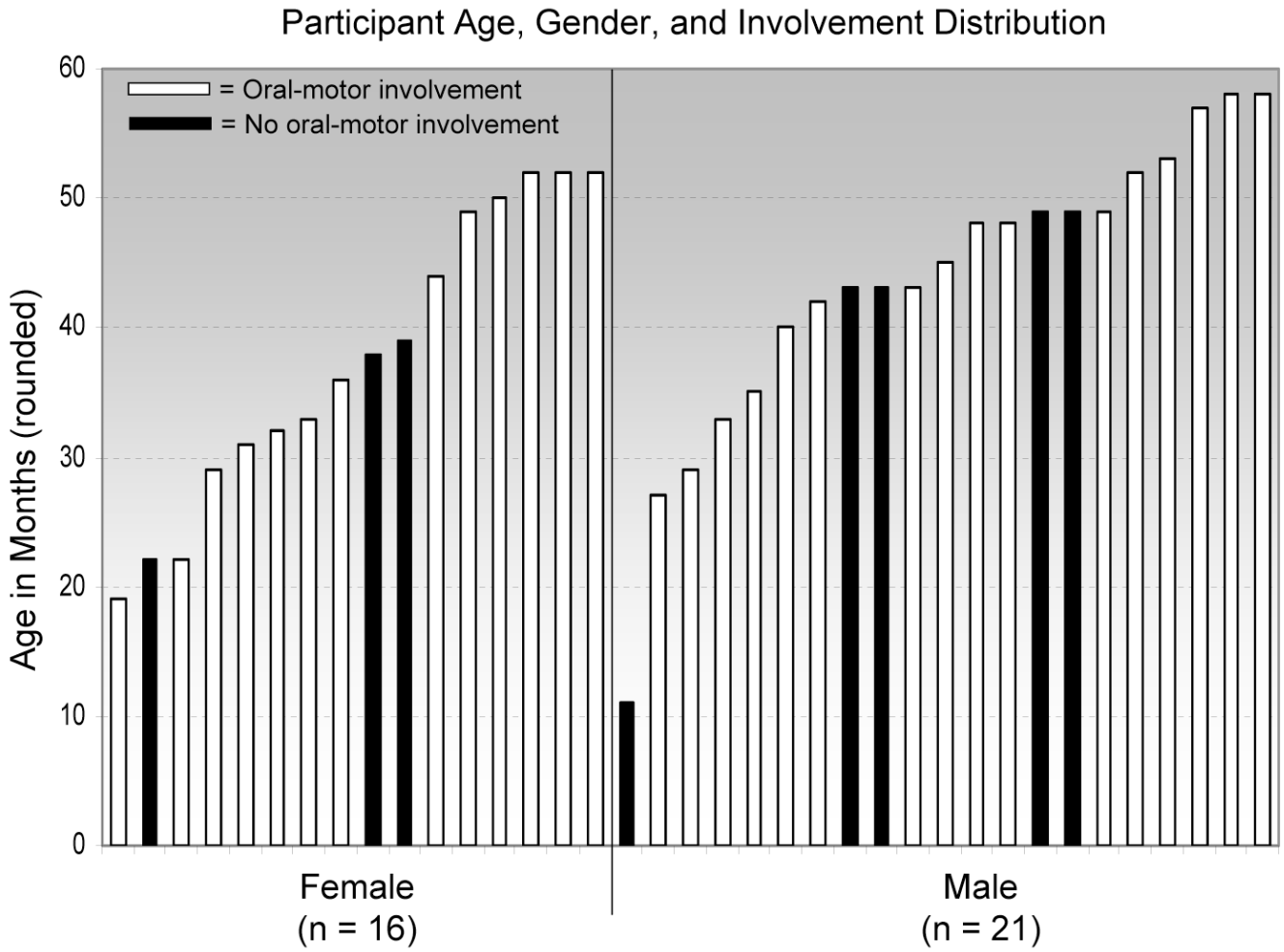

Figure 2.
Distribution of participant characteristics. The vertical axis represents the age distribution (months rounded). The horizontal axis represents the gender distribution. The presence or absence of oral-motor involvement is also reported; a black bar represents the absence of oral-motor involvement and a white bar represent the presence of oral-motor involvement.

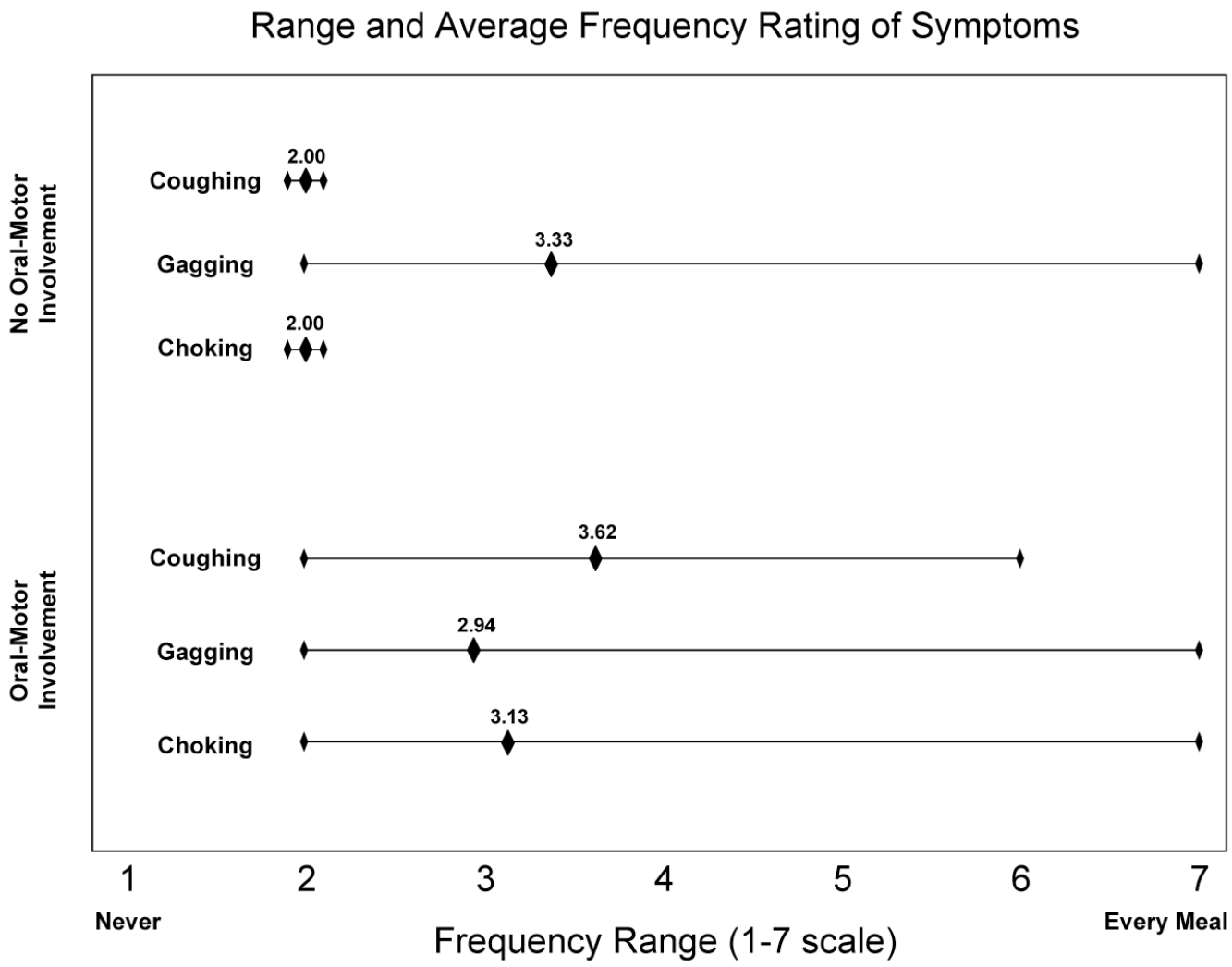

Figure 3.

The range and average frequency rating of coughing, gagging, and choking for children with oral-motor involvement and children without oral-motor involvement. The vertical axis represents the two oral-motor involvement categories and respective symptoms. The horizontal axis represents the frequency range of symptoms (1 = never, 7 = every meal). The average frequency rating for those children reporting the presence of coughing, gagging, or choking (i.e., frequency rating >1) is depicted by the large ♦ for each symptom across both groups. There was no significant difference in the presence of any symptom between the groups. However, children with oral motor involvement demonstrated significantly greater frequency of both coughing and choking. Note: all participants who demonstrated coughing or choking symptoms had a frequency rating of 2. Therefore the range and average was 2.