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Research Article

Effectiveness of Caregiver Education on Increasing Oral Feeding For Children with Developmental Disabilities: A Scoping Review of the Literature

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- Feeding difficulty
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Abstract

Aims: Objectives include to examine current studies on the effectiveness of caregiver education used to increase oral feeding of children with developmental disabilities. Specific objectives were to identify the types of available evidence and to identify any knowledge gaps.

Methods: A scoping review of the literature was conducted of the literature related to caregiver education and oral feeding difficulty with children with developmental disabilities. Five databases were searched; articles included were on children with developmental disabilities aged one to twelve years old, describing caregiver education as an intervention aimed at improving feeding.

Results: 23 articles were included in the analysis. The studies ranged from three Level I, four Level II, fifteen level III, and one Level IV based on Oxford Centre for Evidence-Based Medicine Hierarchy. Critical analysis of the studies on effectiveness showed themes that caregiver education had a positive effect on caregiver empowerment, caregivers were able to follow through with demonstrated feeding and behavioral strategies, and both home or group delivered interventions were effective.

Conclusion: Based on the review and analysis, there is strong support for all the major themes: empowering parents through education with children with developmental disabilities and feeding needs, using different service delivery of parent education, and parents learning behavioral interventions to implement.

INTRODUCTION

Feeding difficulty is a common problem in the pediatric population affecting 25% of children [1]. Caring for children with special needs, such as feeding challenges, places an increased burden on caregivers compared to parents of typically developing children. These parents often experience increased levels of stress, daily activity interferences, extra meal preparation burdens, and social isolation [2]. It is common for these caregivers to seek out therapy services that can help improve feeding times and decrease the stress of both the child and the caregiver.

Feeding therapy is a complex and multifaceted area of treatment. Feeding interventions provided by occupational therapy (OT) practitioners typically target sensory system deficits, oral motor control, or problematic mealtime behaviors. These mealtime behaviors can include food refusal, elopement, hitting, screaming, or self-harm. Caregiver education and training may be implemented into feeding therapy for children, depending on the therapist and clinical setting. However, it is often difficult for parents to incorporate new strategies or routines into their day [3]. This can perpetuate the problem behaviors seen at mealtimes, which will continue to cause high levels of stress for the family. Despite occupational therapists treating pediatric feeding difficulties, there is paucity of research specifying what the therapists are actually doing including caregiver education even though the relationship in the therapy is identified as crucial [4]. More defined methods from therapists for providing caregiver education may be merited to improve outcomes for children with feeding challenges. The objective of this scoping review was to compile, analyze, and evaluate effective means of providing caregiver education to increase oral feeding for children with developmental disabilities.

METHOD

A scoping review was conducted to address the following question: How is caregiver education used to increase oral feeding for children with developmental disabilities? A second aim was to identify the characteristics of effective caregiver

education. This review was conducted by a doctoral student and two experienced occupational therapy educators who specialize in pediatric practice.

The search strategies for each database were developed by an occupational therapy doctorate student in collaboration with a research librarian at Touro University Nevada. Keywords included *child*, *caregiver*, *education*, developmental disability, and *feeding*. Databases used for the search were PubMed, CINAHL, OTseeker, PsycINFO, and Cochrane Library. To ensure current evidence, the search was narrowed to only studies published from 2011-2022. Studies in this review were focused on parent or caregiver education to narrow the intervention approach used to improve oral feeding for children. Children in the studies were between the ages of one and twelve years old with a developmental disability and feeding challenges. Articles written in English that were published in peer-reviewed journals were included.

Preliminary searches for oral feeding interventions yielded high numbers of studies for infants in the NICU so research specific to this population was excluded. Infant feeding is fundamentally different from that of toddlers and older children as they are dependent on bottle or breastfeeding for the majority of their nutritional intake. Feeding interventions for adolescents are approached differently than those for younger children due to developmental changes. Therefore, criteria were limited to children between the ages of one and 12 years old.

Study Selection

Initial searches yielded a total of 1,122 articles with 910 remaining after duplicates were removed. After sorting through the titles and abstracts for articles that did not meet inclusion criteria, 102 articles remained. The abstracts of each of these were reviewed by two authors and 65 of them were removed due to irrelevance to the research question. The remaining 37 full articles were reviewed by two authors. Where any discrepancies were found between the two authors, the third author reviewed the full article and provided the final opinion. Fourteen articles were eliminated due to lack of caregiver education, children over 12 years old, or a later randomized control trial was already included. A total of 23 articles were included in the scoping review.

Data Extraction

Per recommendation of Joanna Briggs Institute [5], a planned extraction approach was used for the scoping review with two reviews scoping review authors extracting data independently. The extraction table was guided by the review question. Each of the articles contained in this review were analyzed for the level of evidence using the Oxford Center for Evidence-Based Medicine (OCEBM) as outlined in the American Occupational Therapy Association (AOTA) [6]. Articles that met the criteria for levels I through IV were included in the review. The study design, description of the subjects, intervention and outcome measures were also analyzed and categorized as recommended by Refer to Table 1 for a summary. After the extraction process, two of the authors independently conducted a qualitative content analysis of the studies and developed over arching themes concerning caregiver education to increasing feeding of children with developmental disabilities. The two authors then came together and combined their themes based on thematic recurrence and the number of studies represented in each theme.

RESULTS

The 23 articles included in this scoping review were evaluated for common themes and findings. The level of evidence from these articles were three Level I, four Level II, fifteen Level III, and one Level IV. The studies were grouped into three major themes: empowering caregivers (16 studies), caregiver education delivery (20 studies), and behavioral intervention approaches (14 studies). The first two themes apply specifically to the caregiver training and the last theme describes the type of interventions that was used with the children and taught to the caregivers.

Empowering Caregivers

In 16 of the articles reviewed, the main purpose of the intervention was to empower caregivers to be able to provide the necessary strategies to improve oral feeding for their children. These studies implemented various techniques for educating caregivers as well as different approaches to feeding children. Primary outcome measures for these studies included parent attitude surveys, caregiver stress levels, and competency measures for implementing feeding strategies. The strength of evidence for this theme is strong with three Level I, three Level II, and ten Level III studies.

Reducing Stress Focus

Self-efficacy and stress levels were major outcomes from seven of these studies. Following lecture-style courses, Sharp et al. [2], found that parent stress significantly decreased and Miyajima et al.[7], found that short lectures followed by discussion and one-on-one training with a therapist significantly improved parents' perceived level of difficulty feeding their child as well as their self-efficacy. Mlinda et al. [8], found that group training for caregivers improved caregiver skills related to feeding their child with CP, improved parent-child interactions, and decreased parent stress levels.

Reductions in caregiver stress levels were observed in two separate studies with similar intervention methods of operant conditioning and systematic desensitization of children with feeding difficulties [9,10]. More individualized caregiver training provided through telehealth or home visits to change eating behaviors also demonstrated improved caregiver mental health outcomes in measurements of parental self-efficacy and empowerment [11,12].

Family-Centered Focus

Family-centered interventions, typically focused on family mealtimes, were used by three of these studies. Muldoon

Table 1: Extraction Table

Authors	Level of evidence/Design	# of Participants/ Diagnosis/Age Range	Intervention/Outcome Measures
Aclan & Taylor [21]	Evidence: Level IV Design: Single subject	n=2 ASD with feeding difficulties 4-8 yo	Intervention: 15 to 20 sessions of caregiver training. Focus on caregiver instruction and feedback using behavioral strategies using antecedents and consequences. Outcome Measures: Number of inappropriate behaviors, bites, and maintenance of improvement.
Alaimo et al. [16]	Evidence: Level IV Design: Single subject	n=3 Developmental delay; food selectivity 3-7 yo	Intervention: Teaching caregivers behavioral skills training to increase mealtime eating within in a hospital-based setting. Families receive 2 hours per therapeutic sessions for 4 to 5 days. Outcome Measures: Number of bites consumed and inappropriate mealtime behavior.
Bachmeyer- Lee et al. [17]	Evidence: Level IV Design: Single subject	n=3 ARFID 2-4 yo	Intervention: The children participated in an intensive feeding intervention (3 hours four times per week weaning down to 1hr per month) with a therapist and reached acceptable levels of bite acceptance and mealtime behavior before parents were trained on feeding protocol. Training focused on escape extinction, attention extinction provided by the caregiver. The therapist gave positive and corrective feedback to the caregivers *in-vivo* as necessary (at the moment). Outcomes Measures: Level of food acceptance and inappropriate mealtime behavior.
Caldwell et al. [15]	Evidence: Level III Design: one group, nonrandomized pre-posttest study	n=20 Sensory food aversion 18 months-5 yo	Intervention: Caregiver education using Mealtime PREP program by 4 occupational therapists. Parents were trained on 9 strategies focused on child participation of meal time, child-led exploration, food play. Outcomes Measures: Parent adherence to the protocol and parents' perception of negative mealtime behaviors.
Caldwell et al. [17]	Evidence: Level III Design: One group, nonrandomized pre-posttest study	n=11 Sensory food aversion 18-36 months	Intervention: Parent training with behavioral activation as a part of Mealtime PREP program. Parents encouraged children to participate in mealtime using positive reinforcement and multiple experiences with food. Outcome Measures: Parent adherence to the strategies and the pre and post results on the Behavioral Pediatrics Feeding Assessment Scale.
Clark et al. [20]	Evidence: Level III Design: one group, nonrandomized pre-posttest study	n=3 ASD with mild food sensitivity 3-6 yo	Intervention: Parent education with video modeling to teach parent to implement a structured meal procedure to decrease food selectivity. Outcome Measures: Bite acceptance during the structured meal procedures.
Dahlsgaard & Bodie [26]	Evidence: Level III Design: one group, nonrandomized pre-posttest study	n=21 ARFID 4-11 yo	Intervention: Seven session parent training on behavioral intervention and daily in-home exposures to nonpreferred foods. Outcome Measures: Parent satisfaction, parent adherence to treatment.
Johnson et al. [16]	Evidence: Level II Design: RCT feasibility study	n=37; 17 in the intervention group and 20 in the control group ASD with feeding difficulties 2-11 yo	Intervention: 11 sessions, 3 telehealth, and 1 home visit. The Parent Training for Feeding Program (PT-F) targeted disruptive mealtime behaviors, food refusal, and food selectivity. Outcome Measures: Mealtime behaviors, eating behaviors, and Aberrant Behavior Checklist (ABC).
Lock et al. [12]	Evidence: Level II Design: RCT feasibility study	n=28; 16 in the intervention group and 12 in the control group ARFID 5-12 yo	On average 14 sessions of family-based treatment focused changing eating behaviors, parent empowerment, coping with uncertainty compared to usual care. Outcome Measures: Parental self-efficacy (PvARFID), improved weight (BMI), and clinical severity (PARDI).
Marshall et al. [10]	Evidence: Level I Design: parallel-group randomized clinical trial	n= 98; 43 met the criterial for medically complex and 55 met the criterial for non-medically complex but still having feeding difficulties. All the participants were randomly assigned to an operant conditioning (OC) or systematic desensitization (SysD) group of intervention. Medically complex history or history of mild to moderate feeding difficulties 5-11 yo	Intervention: Ten sessions of intervention in one week or spread out through 10 weeks based on parent preference. The sessions were based on operant condition or systematic desensitization on food. Parent education took place in every other session. Outcome measures: oral motor skills checklist, 3-day food diary, Behavioral Pediatrics Feeding Assessment Scale (BPFAS), Eyberg Child Behavior Inventory (ECBI) for non-meal time behaviors.
Marshall et al. [9]	Evidence: Level I Design: parallel-group randomized clinical trial	n=68 33 ASD 35 Non -medically complex All participants had feeding difficulties. 2- 6 yo	Intervention: Ten sessions of intervention in one week or spread out through 10 weeks based on parent preference. The sessions were based on operant condition or systematic desensitization on food. Parent education took place in every other session. Outcome Measures: Sensory Profile, Parent Evaluation of Developmental Milestones (PEDS-DM), food diary, BPFAS, Parent Stress Index

Miyajima et al. [7]	Evidence: Level III Design: one group, nonrandomized pre-posttest study	n=23 ASD or limited language skills with food selectivity 3-6 yo	Intervention: Two parent training in lecture format and discussion to reduce food selectivity. One session with an occupational therapist in between the lectures. Outcome measures: Number of foods the child would eat and parents' perspectives regarding their self-efficacy and feeding difficulties.
Mlinda et al. [8]	Evidence: Level I Design: RCT	n=110; 63 in intervention group and 47 in control group Moderate to severe cerebral palsy Under 5 yo	Intervention: 6 to 8 intervention sessions consisted of individual and group training for caregivers. Intervention consisted education on positioning, utensils, feeding methods. Also, one session at the participant's home. Outcome measures: positioning of the child, speed of feeding, oral motor skills, functional feeding skills as reported by an occupational therapist and parent report of stress.
Muldoon & Cosbey [13]	Evidence: Level III Design: One group, nonrandomized pre-posttest study	n=3 ASD with challenging mealtime behaviors 3-5 yo	Intervention: Two times a week for six weeks of intervention consisted of EAT-UP program that model behavioral techniques for the parents. Registered behavior technicians were the interventionist after a SLP designed the individualized meal plan including components of: communication, food presentation, social environment, and the physical environment. Outcome measures: Brief Mealtime Behavior Inventory (BAMBI), Behavioral Pediatric Feeding Assessment Scale (BPFAS) and Family Quality of Life Scale.
Murphy & Zlomke [28]	Evidence: Level IV Design: Single subject	n=1 ARFID 6 yo	Intervention: Treatment was parent-mediated and included psychoeducation, *in vivo* parent coaching, parent modeling, differential reinforcement, gradual exposure to novel foods provided by a clinician with a psychology background during 18 sessions over 6 months. Outcome measures: Variety of accepted foods and number of bites of different foods.
Pangborn et al. [19]	Evidence: Level IV Design: Single subject	n=2 Failure to Thrive and G-tube dependency 2 yo	Intervention: Seven part training focused on child and therapy feeding session first follow by parent training. Training used immediate feedback to parent, modeling, and reviewing videotaped session led by the parent. Feeding sessions were inpatient and 1-2 times a day for 4-5 days a week. Outcome measures: Correct use of feeding protocol. Number of problem behaviors, accepted foods and number of bites.
Seiverling et al. [29]	Evidence: Level IV Design: Single subject	n=2 ASD with food selectivity and aggressive behaviors Age: 5 yo and 6 yo	Intervention: Intensive feeding intervention using behavioral intervention and sensory integration therapy provided by behavioral therapist and an occupational therapist. Intervention included 20 minute sessions x 30 daily sessions. Family training focused on behavioral techniques followed the intervention. Outcome Measures: Number of bites, sips of drink, and inappropriate mealtime behaviors.
Seiverling et al. [18]	Evidence: Level IV Design: Single subject	n=3 ASD with food selectivity 4 to 8 yo	Intervention: Home-based family training using written instructions, modeling, observation of videotaped parent feeding with feedback. Parents conducted 6 taste sessions a day for 3 weeks. Outcome Measures: Food acceptance of the child by bites, diet variety, and disruptive behavior. Adherence to training steps by parents.
Sharp et al. [25	Evidence: Level II Design: RCT feasibility study	n= 38 Tx group: 19 Control group: 19 ASD with feeding difficulties 3-8 yo	Intervention: MEAL Plan program: 10 group training and 3 follow up sessions. Parent education on behavior management, mealtime structure followed by practiced feeding of children with individualized instruction and feedback provided by psychologists. Outcome measures: therapist fidelity, meal time behaviors, and efficacy of the MEAL Plan program.
Sharp et al. [2]	Evidence: Level II Design: RCT pilot study	n=10 ASD with food aversion 3 to 8 yo	Tx: MEAL Plan consisting of 8 lecture course provided by a behavioral psychologist in a group setting focused on behavior management and strategies for self-feeding. Outcome Measures: Social validity, parent perception of effectiveness, and parental stress.
Silbaugh et al. [24]	Evidence: Level IV Design: single subject	n=1 ASD with food selectivity 4yo	Intervention: Intensive 2-6 sessions per day with a total of 45 sessions at home provided by a behavioral analyst. Focus was on physical guidance for spoon to mouth and lip closure, ignoring negative behavior, and parenting training. Outcome Measures: Numbers of bites, guided acceptance, inappropriate mealtime behaviors.
Sira & Fryling [23]	Evidence: Level III Design: single subject	n= 1 ASD with food selectivity 9 yo	Intervention: 1 to 2 times a week for a total of 35 sessions provided by a behavioral analyst. The treatment focused on using highly preferred reinforcers, peer modeling with sibling, parent training of method, follow up one month later. Outcome Measures: Number of bites of food.
Tanner & Andreone [27]	Evidence: Level III Design: Single subject	n=1 ASD with food selectivity 3 yo	Intervention: A 12-step graduated exposure food hierarchy was constructed and the child was led through the hierarchy using ABA therapy and token reinforcement in 20 minute sessions. There were over 100 sessions during a 9 month period. Parent training was also provided. Outcome Measures: Number of foods accepted and generalization to other settings with the parent. Number of refusal food behaviors.

and Cosbey [13], found that a family-centered approach with individualized mealtime plans from the techniques outlined in the Easing Anxiety Together with Understanding and Perseverance (EAT-UP) program improved the amount and variety of food consumed by the children. Lock et al. [12], had similar success for child eating behaviors with a family-based treatment for parent empowerment. Caldwell et al. [14], utilized parent training that included setting goals, receiving training for new skills, and scheduling activities to implement the new skills. Results showed that parents were able to implement the strategies taught and that child-feeding behaviors improved.

Building Caregiver Competency Focus

Skills competency was emphasized in 11 of these studies. For these studies, major outcomes included adherence to intervention techniques taught to the parents by therapists. For example, Caldwell et al. [15], reported that parent adherence to intervention protocol improved throughout the study and parent perception of negative mealtime behaviors decreased. In several studies, parent outcomes included the percentage of adherence to intervention strategy steps as measured by a checklist and percent increase of use of intervention strategies from pre to post-test were were used effectively [13,14,16-18].

Several phase approaches were tested to build parental competence. A seven-phased approach was used in a study by Pangborn et al. [19]. Following each phase, a parent-led meal was provided for the child and observed by the therapist. If sufficient adherence to the training was observed at any phase, training for that caregiver was finished. Adherence to the protocol gradually increased with all of the caregivers during the course of the study. Problem behaviors from the children decreased with continued intervention from caregivers. A phased approach was also used by Clark et al. [20]. In this study, they measured the number of steps from the protocol completed correctly by each parent during the feeding sessions followed directly by therapist feedback. All the parents only required 2 or less phases to reach an effective competency level as the feeder.

Direct instruction methods were used in several studies to improve caregiver delivery of the interventions. Children with cerebral palsy benefitted from skill-based training in Mlinda et al. [8]. They provided parent training on feeding skills specifically for children with cerebral palsy. In the study by Aclan and Taylor [21], parents were provided instructions on how to implement the antecedent and consequences for bite acceptance and behavior. Parent use of correct antecedent and consequence behaviors improved following feedback. Miyajima et al. [7], utilized various approaches to changing the oral, cognitive, or sensory aspects of the food or mealtime to increase the number of foods the child would eat. Parents were able to successfully implement recommendations provided and food acceptance for the children increased significantly.

Caregiver Education Delivery

Descriptions of the various strategies used for providing caregiver education were provided in 20 of the articles. Strategies utilized include home-based treatment, group sessions, and a combination of strategies. It is also noted that 6 of the articles specifically mentioned using written materials as a means of providing education to caregivers. Several of the studies also used program manuals for guiding the treatment and caregiver training. The evidence for this theme is strong with three Level I, three Level II, thirteen Level III, and one Level IV studies.

Home-based Treatment

Seven of the studies implemented home-based treatment. This treatment method is typically used as a means of improving generalization of skills in the natural environment and increased access to therapy for families [22]. For example, Caldwell et al. [15], and Seiverling et al. [18], both noted improved mealtime behaviors for children after providing interventions within the families' homes including increased food acceptance and decreased escape behaviors.

Inclusion of family members during in-home training is another benefit to home-based treatment. Sira and Fryling [23], focused on peer modeling of a sibling to improve feeding behaviors and bite acceptance. Parent education was provided to effectively use peer modeling. The intervention took place at the family's home during their regular mealtimes. Bite acceptance was significantly improved during treatment and at follow-up sessions.

Home visits can also improve generalization of skills learned in the clinic. Johnson et al. [11], conducted an intervention consisting of 11 independent instruction sessions in the clinic, three telehealth sessions, and one home visit. These sessions targeted disruptive mealtime behaviors, food refusal, and food selectivity. The intervention resulted in improved mealtime behaviors. Mlinda et al. [8], provided a home visit following group training sessions to improve carryover of skills to the child's natural environment.

Teaching new skills to parents or caregivers is positively influenced by providing training within the family's natural environment. Silbaugh et al. [24], conducted therapist-led interventions within the home with the parents present for each session. After the sessions with the therapist implementing physical guidance methods, the mother was then trained to use the same strategies. Gradual food acceptance was observed with physical guidance strategies and a decrease in expulsion of food was also seen with this method. Similar results were seen when the child's mother began implementing the intervention. Aclan and Taylor [21], provided instruction on the use of antecedents and consequences to change behavior and then provided positive or corrective feedback for the caregivers. Follow-up sessions indicated good maintenance of behaviors from parents and their children.

Group Sessions

Group training sessions, typically delivered in a clinic, were

utilized in five of these studies. The group training ranged from two to ten sessions with some of the studies including individualized training in addition to the group sessions. The group training sessions did not have children present with the exception of Sharp et al. [25]. Results from these studies indicated positive outcomes for both the children and their caregivers.

Sharp et al. [25], conducted ten group training sessions and three follow-up sessions. The first four sessions were with caregivers only and then children joined for parts of sessions five through ten. The sessions provided education and training on nutrition, behavior management, mealtime structure, and methods to introduce new foods. Direct feedback was provided when children were present for interventions. The results indicated that the group program was effective in helping increase the diversity of foods consumed and decrease the difficult mealtime behaviors of children with ASD and moderate food selectivity.

Miyajima et al. [7], also conducted an intervention for parents of children with ASD. The training was two 40-minute lectures followed by a discussion for the parents. The program consisted of education for parents about what causes food selectivity for children with ASD and intervention approaches appropriate for their child's needs. Parent perspectives of their child's food selectivity were also examined. Parents were able to request a one-on-one meeting with an OT between the first and second session. Food acceptance for the children increased significantly following the program as well as caregiver ability to implement positive mealtime strategies.

Caregivers of children with cerebral palsy benefitted from a group training conducted by Mlinda et al.[8]. They provided education and training in the clinic for six to eight sessions and then one session was held in the participant's home. An OT provided education on positioning for feeding, food consistency, techniques for feeding, and appropriate feeding utensils. Statistically significant differences were seen between the control and intervention groups for positioning, feeding speed, and child involvement.

Dahlsgaard and Bodie [26], used a unique group caregiver approach to elementary aged children with ARFID (avoidant/restrictive food intake disorders). The interventionists spent a few hours evaluating the children but then the intervention was solely focused on the caregivers in seven group sessions. During these group sessions, the parents were trained to carry out food exposure and contingency management of problem behaviors during at meal times management at home. The social reinforcement of the members of the group motivated participants during the training program. Parents followed through with strategies at the end of the seven sessions and at three months with a high level of satisfaction.

Therapist Implementation Followed by Caregiver Training

Many of the studies within this scoping review focused on training the caregiver in conjunction with providing interventions for the child. However, four studies did not start training the caregiver until a certain level of mastery for bite acceptance or mealtime behavior had been reached by the child while working directly with the therapist. Different types of interventions were applied for the children and various methods were used to train the caregiver in these studies.

Direct therapist training for continued caregiver implementation of a successful therapist-led intervention was provided by Bachmeyer-Lee et al. [17], and Aclan and Taylor [21]. Both of these studies indicated that child bite acceptance stayed high and negative mealtime behaviors were low throughout the parent training portion. Follow-up sessions for Aclan and Taylor [21], had continued success with bite acceptance and improved mealtime behaviors.

Peer modeling from a sibling was facilitated by a therapist in a study by Sira and Fryling [23]. During the interventions, highly preferred reinforcers were identified for both of the children. The peer model was then observed following instructions and taking a bite followed by access to a reward. The subject was then presented with the same opportunity to consume the target food. Following implementation of this intervention from the therapist, the parent was trained to use the same methods. Bite acceptance for the child with ASD improved during the intervention and continued at similar levels during follow-up sessions.

Graduated exposure for a child with ASD was used by Tanner and Andreone [27]. The graduated exposure hierarchy progressed through 12 steps from accepting a non-preferred food in the same room to taking a bite of the non-preferred food. The intervention was then taught to a caregiver for generalization at home. The child's food varieties improved throughout the study and his parents reported decreased challenging mealtime behaviors at home following the intervention.

Combination of Strategies

In nine of the studies reviewed, a mixture of strategies were used to provide caregiver education and training. These strategies were either delivered directly by the therapist or provided via handouts or video recordings. In each of them, multiple delivery methods were used to increase caregiver retention and performance of the skills taught. Each of these interventions demonstrated improved either bite acceptance or mealtime behaviors or both.

Alaimo et al. [16], provided parent training which consisted of written and verbal instructions, modeling of the protocol, simulation of common mealtime circumstances with one of the researchers acting as the child, feedback from the researchers on correct implementation of the protocol, and rehearsal of protocol scripts. A total of five scripts were used to address common mealtime behaviors. Dahlsgaard and Bodie [26], used instruction methods in a group setting that included verbal education, role-playing, and opportunities to ask questions.

Murphy and Zlomke [28], taught differential reinforcement and direct strategies to the child's mother through direct instruction and coaching with follow-up skills for practicing previously learned skills. The coaching was delivered from the therapist on the other side of a one-way glass to a headphone in the mother's ear while the mother worked with the child directly.

Pangborn et al. [19], provided training in seven phases. Following each phase, a parent-led meal was provided for the child and observed by the therapist. If sufficient adherence to the training was observed at any phase, training for that caregiver was complete. In the first phase, the caregivers observed the therapist and a rationale for interventions was provided. In the second phase, verbal and written instructions were provided to the caregiver. The third phase consisted of reviewing a video recording of previous parent-led sessions with feedback from the therapist. The fourth phase involved caregivers taking data on previously taught material during a therapist-led meal. Modeling was utilized in the fifth phase of training. Phase six was role play and phase seven was immediate feedback.

Seiverling et al. [18], used parent training that included reading instructions, modeling from the therapist, observation of the mother performing the skill, and feedback from the therapist. The therapist then allowed the mother to complete the skill without feedback. Skills targeted in the interventions included escape behaviors and food acceptance.

Clark et al. [20], used two phases of instruction. The first phase involved the parents receiving a binder with written instructions and video links to modeling of the material. They were instructed to read the material and watch the videos before their first feeding session. If the parent was able to correctly perform 80% of the steps for the protocol, they did not need to move to the second phase. The second phase consisted of direct therapist feedback during the feeding session until 80% of the protocol steps were performed correctly.

Bachmeyer- Lee et al. [17], provided training in four phases: written instructions, in-vivo feedback (positive and corrective comments specific to the protocol, always presented in a positive manner), post-training (no feedback provided), and follow-up sessions. Parent training focused on escape extinction (blocking the child from leaving the area and non-removal of food), attention extinction, and removal of preferred reinforcers for negative mealtime behavior or lack of bite acceptance.

In Marshall et al. [9], parent training included subjects such as nutrition, behavior, and feeding skills. Written materials were given to parents with verbal explanations. They were also guided through observations of the therapist working with their child. Every other session, the parents participated with their child and increasing amounts of the interventions were conducted by the parent.

Marshall et al. [9], utilized immersive treatment and feedback from therapists during the parent training portion. The immersive process involved having the caregiver sit in on the sessions with the therapist and child. The therapist gradually turned over more of the session to the caregiver.

Behavioral Intervention Approaches

This theme focuses on the types of intervention strategies that were used with the children and taught to the caregivers. These studies were generally interested in decreasing the negative mealtime behaviors and increasing the variety or amount of food consumed by the child. A total of 14 studies utilized a behavioral intervention approach to improve feeding for children. The level of evidence is strong with two Level I, one Level II, ten Level III, and one Level IV studies.

Positive Reinforcement

Four studies utilized positive reinforcement as the primary means of intervention to improve mealtime behaviors and increase oral feeding. These included token economies, operant conditioning, and access to desired objects or activities. Caregivers were trained to implement these skills through a variety of methods including written instructions, therapist modeling, direct instruction, and feedback.

A token economy was used while implementing graduated exposure in a study by Tanner and Andreone [27]. The therapist led the child through the 12 graded exposure steps and provided token reinforcement for each step tolerated by the child. The therapist kept the sessions fun and playful for the child.

Operant conditioning and systematic desensitization were used by both Marshall et al. [9], and Marshall et al. [10], as intervention methods for children with either a medically complex history or children with ASD. Operant conditioning involved prompts and reinforcement for desired behaviors. The schedule for delivering the reinforcement was slowly extended based on the child's responsiveness. Systematic desensitization was a play-based intervention that included gradual exposure to foods in a playful and exploratory manner. Positive reinforcement was given for any attempts to try new foods. Improvements in feeding and mealtime behaviors were seen in children with ASD and children with medically complex histories with both operant conditioning and systematic desensitization. Children with ASD showed more food varieties following treatment with operant conditioning [9].

Positive reinforcement paired with peer modeling was used by Sira and Fryling [23]. The peer was observed taking a bite of the target food and receiving access to a preferred reinforcer. The same food was then presented to the child with ASD and access to their preferred reinforcer was given if the child took a bite of the food. Bite consumption increased from 0% at baseline for all three target foods to 74-100% during the intervention and stayed high during follow-up sessions.

Escape Extinction

The primary focus of two of the articles was on escape extinction methods as their intervention. Silbaugh et al. [24],

wanted to determine the effectiveness of physical guidance behaviors and food acceptance. Non-removal of the spoon was paired with physical prompts for increased food acceptance. A chin prompt was used to prevent expulsion of the food. Praise was given for any acceptance of food and planned ignoring was used for negative behaviors. Gradual food acceptance was seen with non-removal of the food along with a decrease in food expulsion with physical prompting.

Bachmeyer- Lee et al. [17], used escape extinction, withdrawal of attention, and removal of preferred activities or toys during the intervention. The caregiver was taught to keep the offered bite at the child's lips until they opened their mouth. They blocked the child from leaving the table by extending their arms across their path. The child was allowed access to desired activities or toys unless they did not accept the offered bite of food. All negative mealtime behaviors were given no other consequence than removal of attention. Bite acceptance improved and negative behaviors decreased following the treatment sessions.

Multiple Behavioral Strategies

Eight of the 14 studies with behavioral intervention approaches implemented a combination of behavioral strategies during the interventions. Positive reinforcement was a component of each of these interventions, however, there were a variety of other behavioral interventions used in combination with positive reinforcement, making these unique from the four previously mentioned. For example, a combination of non-removal of bites, reinforcement of positive behaviors, and planned ignoring was used by Alaimo et al [16,18,28]. All of these studies showed improved mealtime behaviors and bite acceptance.

Attention to antecedents and consequences associated with mealtime behaviors was taught to caregivers by Aclan and Taylor [21]. Antecedents included gaining the attention of the child, providing a prompt to eat the food, and removing distractions before presenting the food. Consequences ranged from providing positive reinforcement within five seconds of eating the food to redirecting the child from undesired behaviors. Bite acceptance and mealtime behaviors improved following caregiver implementation of these strategies. Johnson et al. [11], also used positive reinforcement and manipulation of antecedents and consequences to change behaviors. The training program resulted in improved mealtime behaviors for the children in the intervention group.

Similar strategies were used by Clark et al [20]. Positive reinforcement of desired behaviors (bite acceptance) and attention withdrawal for inappropriate behaviors (hitting, screaming, gagging, etc.) which showed mixed results. One of the children did not accept any bites during the course of the intervention. The other two boys progressed from baseline to the end of the intervention with 0% to 75% and 78% to 100% bite acceptance of target foods.

Challenges related to children ARFID were addressed by Dahlsgaard and Bodie [26]. They provided a seven-session training for parents that included behavioral strategies as well as food exposure techniques. Positive reinforcement strategies were utilized to encourage the child to try new foods. Education provided by Dahlsgaard and Bodie [26], resulted in decreased pickiness in children diagnosed with ARFID. They taught caregivers concepts such as frequent food exposure, planning of mealtime schedules to induce hunger at appropriate times, positive reinforcement, and differential reinforcement (giving less attention to undesired behaviors). Statistically significant improvements were seen in child pickiness and mealtime behaviors at home.

Behavioral strategies were also addressed by Sharp et al. [2]. While they did note significant findings for caregiver stress levels, child outcome measures had no changes from pre- to post-assessment following the eight-week lecture-style course. The curriculum focused on behavior management strategies and approaches to help the child to self-feed. Other unique concepts taught included the concept of slow but steady improvement of behaviors, objective identification of behaviors, child-led interventions, and the likelihood that behaviors will get worse before improving with the implementation of a new behavioral method.

Researchers in a study by Seiverling et al. [29], explored the effectiveness of sensory interventions used in addition to behavior interventions. The study applied sensory integration therapy (SIT), in conjunction with behavior interventions that included ignoring negative behaviors and praising positive behaviors. Acceptance of bites/drinks increased throughout the intervention and negative behaviors decreased for both participants. The researchers concluded that the addition of the SIT did not impact the consumption of food or decrease negative behaviors any more than just doing behavior interventions. However, they reported that using SIT helped the children transition to feeding therapy easier than when they didn't use sensory activities.

DISCUSSION

Based on the findings from this scoping review, there are a variety of methods that can be used to educate caregivers in order to improve oral feeding for their children. As caregivers mastered strategies and techniques, caregivers felt more competent and perceived less stress associated with feedings and meal times [2,7-12]. Completing education and training in the child's natural environment also contributed to improved caregiver competence and carry over of a child's feeding skills [11,8,24,21]. Regardless of location or approach to education, building caregiver skill competence was essential to intervention technique adherence [7,8,13-21]. It is also important to structure intervention and education approaches around the family priorities and routines [12-14].

Analysis of the themes extrapolated specific effective strategies that were used within caregiver education. Combinations of education strategies were often used to provide caregivers information and training including written, manualized, verbal,

and modeling/simulation [16,18,26]. Group education and training was found to be beneficial for both parental and child-based outcomes [7,8,25,26]. A phased approach to education and caregiver involvement in feeding interventions was also utilized to ensure caregiver competence and carryover [17,19,20]. Overwhelmingly, behavioral strategies were used with the children including positive reinforcement [17,19,20], and escape extinction [20,24]. The use of behavioral interventions that were commonly used in the 23 studies within this review have shown a reduction in parental stress and negative mealtime behaviors.

While there were many methods of education described in the literature, one technique that was not represented well in the 23 articles is coaching [30,31]. This approach involves goal setting and problem solving with the family and includes an educational component. This type of approach is family centered and focuses on outcomes meaningful to the family and child. Instruction is embedded into the daily routines and caregivers are more empowered to make changes with the use of this approach. Some of these same strategies were mentioned throughout the 23 articles found for this review, however no studies included coaching specifically as intervention.

Responsive feeding strategies have also been extensively researched but were not found using the search strategies for this review. This method has been shown to improve oral feeding, decrease oral and food aversions, and improve child experiences with food [32,33]. Additional research into this model and how to teach this approach to caregivers may prove beneficial to improving oral feeding for children with developmental disabilities and challenges with eating. Lastly, sensory-based intervention was described in only two of studies. Seiverling et al. [27], and Tanner & Andreone [29], even though sensory strategies are often used to desensitize and prepare children to eat non-preferred foods.

LIMITATIONS

Within the studies included in the review, only three of the studies were well designed randomized controlled trials and many of them did not have a control group. Most of the studies typically consisted of very small sample sizes with ten or less participants leading to the potential of volunteer or referral bias. Blinding was not used for most of the studies and caregivers were aware of the interventions used for their children. Lastly, parent report was commonly used as outcome measures which may contribute to reporting bias.

CONCLUSION

This scoping review demonstrates significant support for caregiver education for children with developmental disabilities experiencing feeding difficulties utilizing a variety of strategies. This information can be used to inform therapy practice, specifically how therapists educate parents to improve their sense of mastery and competency approaching meal time and feeding. Future areas of research include examining the coaching model and educating caregivers on responsive feeding techniques and sensory-based approaches to decrease oral aversions.

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