The Effects of Applied Behavior Analysis-Based Parent-Implemented Interventions for Children with Pediatric Feeding Disorder: A Systematic Review and Meta-Analysis

Ruqian Ma

A dissertation

submitted in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

University of Washington

2024

Reading Committee:

Kristen Missall, Chair

Danielle Dolezal

Nancy Rosenberg

Yanchen Zhang

Program Authorized to Offer Degree:

College of Education

University of Washington

Abstract

The Effects of Applied Behavior Analysis-Based Parent-Implemented Interventions for Children with Pediatric Feeding Disorder: A Systematic Review and Meta-Analysis

Ruqian Ma

Chair of the Supervisory Committee:

Kristen Missall

College of Education

Feeding difficulties occur at a high rate in children with normal development and at a disproportionally high rate in children with developmental disabilities. Prolonged problematic eating, categorized as pediatric feeding disorder (PFD), can result in poor physical growth and jeopardize overall health. Extant research on applied behavior analysis (ABA) based parent-implemented interventions (PIIs) has been widely accepted and found to be effective in supporting children with feeding difficulties. A vast majority of studies have separately explored the efficacy of ABA-based interventions and PIIs for children with feeding difficulties. In addition, previous meta-analyses and systematic reviews have focused on studies utilizing single-case research design. Present study comprehensively assessed the overall effectiveness of ABA-based PIIs for children with PFD with studies utilizing group experimental design. Meta-analytic procedures were used to estimate the effects of ABA-based PIIs on child and parent outcomes

for children with PFD. A total of 11 studies were included in the analysis. Characteristics of the parent training programs was summarized. A random-effect model was employed and the results showed a moderate but statistically significant effect size (g = -0.73, 95% CI [-1.34, -0.13]) for ABA-based PIIs on child feeding outcomes, indicating a positive impact on mitigating child feeding challenges. However, the effect size estimate for one of the parental outcomes (i.e., parent stress) was small and statistically nonsignificant (g = -0.38, 95% CI [-0.83, 0.07]). Moderator analysis was also performed to examine the moderating effects of the following variables on child feeding outcomes and parental outcomes: training delivery format, direct child participation, utilization of escape extinction, and utilization of consequence- and antecedent-based treatment package. Results showed that all four variables had a moderating effect on child feeding outcomes but only two variables showed a moderating effect on parental stress. This study not only marked as the first attempt to systematically evaluate the empirical evidence from group experimental designed studies, but also explored potential moderators that may play vital roles in the effectiveness of ABA-based PIIs with children with PFD. Discussion of the implications along with future directions conclude this dissertation.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

First, I would like to express my gratitude to my chair and committee members, Dr. Kristen Missall, Dr. Nancy Rosenburg, Dr. Yanchen Zhang, and Dr. Wendy Stone, for their continued guidance and support throughout the journey of this dissertation. I'd like to also thank Xi Pan and Joyce Zheng for undertaking the research assistant role and supporting the data collection and coding process.

Special appreciation goes to my dear mentor, Dr. Danielle Dolazel, whose mentorship opened the doors to the world of pediatric feeding disorder and paved the way for new possibilities in my academic and professional endeavors. I loved how you have always been such a supportive role in my life, guiding me in a unique way and allowing me to gain insights from self-reflection and practices.

I am deeply thankful to my mom, as well as my dad who is not with us anymore, for instilling in me a desire to learn and a willingness to embrace the challenges of unknowns. Mom, I grow up looking up to you as a hardworking professional, who taught me to chase my dream have a career as a women.

To my love, Bing, your immense patience and unconditioned support were bedrock of my resilience throughout this tedious yet remarkable journey. Your presence has been my anchor in the storms and my beacon of hope in moments of doubt. I loved that you see me as me and you find my weirdest jokes funny. I am extremely grateful for embarking on this lifelong journey with you and I am looking forward to our happily ever after.

To my beloved little person, Adrian, your presence brought light and inspiration to me each day, motivating me to strive for excellence in all aspects of my life. I put a halt on my

professional career for two years so that I can spend more quality time with you and I just want to say that I truly enjoyed all the moments of frustration and joy being your mother.

A warm thank you for my furry companions, Luna, Dora, and Boston for being my feet warmer at all times when I felt cold while writing. Thank you for being my constant companions through the highs and lows of this journey.

I also want to extend my appreciation to my dear friends, Pei-Chun Liao, Ghina Haidar, Zoey Du, Jing An, Paul Hobson, Meaghan Ferrick, for the unwavering friendship, encouragement, and support through graduate school especially at the time when I needed a hand-held. I appreciate all my online writing buddies who spent days and nights with me writing papers together.

Lastly, I am grateful to CARES for providing me with a sense of purpose and fulfillment beyond academic pursuits – it has been a very rewarding experience founding and working for the organization.

DEDICATION

To my loved ones.

Chapter 1. Introduction

Feeding is a complex and multisystemic process, which is essential for human life. Pediatric feeding problems affect children with normal development ages ranging from birth to 18, with an estimated prevalence from 25% to 45% (Benjasuwantep et al., 2013; Laud et al., 2009; Manikam & Perman, 2000; Silverman, 2015), as well as children with disabilities (Burklow et al., 1998). A further break down of the prevalence indicates that severe and persistent feeding problems are experienced by 3% to 10% of typically developing children (Lindberg et al., 1991). Kovacic et al. (2021) provided the newest estimate of prevalence of children 5 years of age or younger with a diagnosable feeding concern, which ranges from 1 in 23 to 1 in 37 in the United States (U.S.). Conversely, severe feeding problems occur with a higher prevalence rate, up to 89%, in children with developmental disabilities ages ranging from birth to 18 (Cermak et al., 2010; Ledford & Gast, 2006; Lukens & Silverman, 2014; Matson & Fodstad, 2009; Schwarz, 2003) such as those with autism spectrum disorder (ASD; Clark et al., 2019; Kodak & Piazza, 2008) and cerebral palsy (Andrew et al., 2012; Arvedon, 2013; Erkin et al., 2010; Reilly et al., 1996; Sleigh & Brocklehurst, 2004). Children with medical conditions such as cystic fibrosis (Crist et al., 1994), prematurity (Burklow et al., 2002; Rommel et al., 2003; Thoyre, 2007), gastroesophageal reflux disease (GERD; Mehta et al., 2018), dysphagia (Arvedson, 2008), and eosinophilic esophagitis (Mehta et al., 2018) are at an increased risk of developing feeding disorders (Linshield, 2006).

Diagnoses of Pediatric Feeding Problems

The term “feeding problems” is used to describe patterns of oral or enteral consumption of food or drinks that deviate from normal eating behavior, leading to negative psychosocial and health consequences (Laud et al., 2009; Manikam & Perman, 2000). Feeding problems are

heterogeneous with a wide range of topographies that disrupt the acquisition of nutrition and the development of age-appropriate feeding habits (Silverman, 2010). Common pediatric feeding problems include, but are not limited to, food refusal (e.g., severe restriction in the volume of intake), food selectivity (e.g., limited selection of food due to type and texture of food), atypical eating patterns (e.g., failure to transition from bottle feeding to age-appropriate textures, or transition to self-feeding), full dependence on supplemental feedings (e.g., use gastrostomy tube or nasogastric tube for food intake), and significant oral-motor deficits (e.g., difficulties with chewing and swallowing; Bachmeyer, 2009; Kerwin, 1999; Sharp et al., 2010; Silverman, 2010).

Feeding problems that are chronic and severe, also known as pediatric feeding disorder (PFD), are defined by impaired oral intake that are not age appropriate and are associated with medical, nutritional, feeding skills, and psychosocial problems (Dharmaraj et al., 2023; Goday et al., 2019). The classification of PFD is from the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (ICD-10) coding system, which was developed by the World Health Organization (Kerzner et al., 2015; WHO, 2020) and widely utilized by pediatric feeding community for its multidisciplinary approach to the assessment and treatment of pediatric feeding problems. In 2021, PFD was officially approved by the U.S. Centers for Disease Control and Prevention (CDC) as a stand-alone diagnostic code in the latest edition of the U.S. ICD-10 (Noel, 2023).

In 2013, the American Psychiatric Association (APA) accepted a new diagnostic classification, avoidant/restrictive food intake disorder (ARFID), in the *DSM-5* as an expansion to the diagnosis of feeding disorder of infancy and early childhood in the *DSM-IV-TR* (APA, 2013; APA, 2000). According to *DSM-5*, individuals with ARFID have a persistent failure to meet nutritional needs leading to outcomes such as weight loss and inadequate growth,

nutritional deficiency, dependence on supplemental feeding (i.e., enteral feeding or nutritional supplements), and/or psychosocial impairments without coincident body image problems (APA, 2013; Strand et al., 2019). This disorder is characterized by avoidance or restriction of foods resulting in restricted food variety or volume and leading to one or more negative physical and developmental consequences (i.e., weight loss, failure of growth, macro- or micro-nutrient deficiencies, delays in development, and significant impairment in psychosocial functioning; Ornstein et al., 2017) without a defined age criteria of onset. Contrasting to PFD's multidisciplinary approach, ARFID is a psychiatric diagnosis and evaluates feeding dysfunction manifested as an expression of fear/anxiety, lack of appetite, or sensory dysfunction (Noel, 2023). Both PFD and ARFID are acceptable diagnoses for individuals with pediatric feeding difficulties. The ARFID diagnosis is gaining increased attention and has been used interchangeably with PFD in the research literature (Sharp & Stubbs, 2019). For the purpose of this study, literatures on ARFID and PFD are included to provide a comprehensive understanding on etiology, epidemiology, assessment, and intervention of feeding difficulties.

Persistent PFD can result from multiple etiological contributors such as medical, nutritional, psychosocial, and feeding challenges (Lukens, 2011; Matson & Fodstad, 2009). Children under the age of 18 with PFD exhibit a range of challenges that often result in a number of detrimental outcomes such as significant weight loss, dependence of enteral feeding or oral nutritional supplementations, nutritional deficiencies, and poor growth (Goday et al., 2019; Sharp et al., 2010). The multifaceted nature of PFD calls for evidence-based treatments that can address biopsychosocial etiologies in multiple areas (Berlin et al., 2009; Matson & Fodstad, 2009; Sharp et al., 2010). Both assessment and treatment approaches need to be selected carefully to address multiple etiological factors that cause and maintain the symptoms to ensure

the child's safety and success with oral feeding (Goday et al., 2019; Matson & Fodstad, 2009; Piazza et al., 2015).

Historically, treatments for PFD have been rooted in the field of Applied Behavior Analysis (ABA; Iwata et al.,1982; Ledford et al., 2018; Matson & Fodstad, 2009). What drives the effectiveness of ABA as an intervention for PFD is its focus on manipulating antecedent situations and environmental consequences to make behavioral changes (Lukens, 2011). There is ample research supporting the use of ABA in addressing food acceptance, food refusal, and problematic mealtime behavior in children with PFD (Sarcia, 2020). Parent-implemented interventions (PII) based on ABA for individuals with PFD have been reviewed and studied in the last decade, with the majority focusing on utilizing single-case research methodologies (Gentry & Luiselli, 2008; Levin & Carr, 2001; Matson & Fodstad, 2009; Mueller et al., 2003; Najdowski et al., 2003).

ABA-based PIIs designed to treat PFD have been used widely and have shown promise in increasing food acceptance and decreasing food refusal (Gentry & Luiselli, 2008; Sharp et al., 2014). However, most behavioral interventions are typically delivered in a highly structured inpatient unit or through an intensive outpatient model, which are extremely expensive and time-consuming. Additionally, inpatient unit and intensive outpatient treatment centers are often difficult to access due to limited available treatment facilities across the country (Sharp et al., 2014). PIIs, on the other hand, can be delivered in a group setting or via telehealth with a flexible schedule that parents can join while they are at home. Moreover, children with less severe feeding difficulties may not require this level of service. Therefore, it is important to design an appropriate level of clinical service to care for children with various presentations of PFD, and PII appears to be an emerging model for such population (Sharp et al., 2014).

Contributing Factors of PFD

Research suggests that the etiology of PFD is an interaction of both biological and environmental variables; thus, the biopsychosocial model (Berlin et al., 2009) can work efficiently to account for both etiological factors (Fischer & Silverman, 2007; Lukens, 2011). Children with biological dispositions, such as challenges with swallowing (i.e., dysphagia), reflux, gastrointestinal (GI; e.g., constipation or diarrhea), and oral motor difficulties further complicate their food refusal or selective eating (Goday et al., 2019; Rommel et al., 2003; Sharp, Volert et al., 2017). However, children's food refusal behaviors may also be reinforced and maintained with specific behavioral and environmental antecedents and consequences (Babbitt et al., 1994), underscoring the role that non-biological factors play. More specifically, past studies have identified that negative reinforcement in the form of escape from eating is the most common for maintaining feeding problems (Aheam et al., 1996; Piazza et al., 2009; Piazza et al., 2003; Reed et al., 2004). In sum, Goday and colleagues (2019) noted that four important domains underlie PFD and acknowledged that impairment in one domain can lead to dysfunction in other domains.

Medical domain. Children with PFD often have associated medical conditions that can impact their eating, such as impaired structure or function of the GI, cardiorespiratory, and neurological systems (Goday et al., 2019). Approximately 40% to 70% of children with chronic medical concerns experience feeding difficulties (Lukens & Silverman, 2014; Sharp et al., 2017). For instance, children who have underlying GERD, in which gastric acid flows from the stomach to the esophagus, may be resistant to eat due to chest pain and discomfort (Kedesdy & Budd, 1998). Similarly, children with GI issues may associate the demand of eating and food with unpleasant consequences, such as pain, nausea, diarrhea or constipation, which will further

impede their willingness to eat (Sharp et al., 2017). Moreover, diseases of the airway and lungs, such as aspiration, can contribute to PFD (Goday et al., 2019).

Nutritional domain. Due to restricted quality, quantity, and variety of dietary intake with children with PFD, nutritional risks are concerning (Goday et al., 2019). A longitudinal study tracking infants with feeding disorders to middle childhood reported the prevalence of children impacted by malnutrition was 51%, with 22.2% experiencing severe chronic malnutrition (Ammaniti et al., 2012). In addition, other complications accompanying PFD can include overnutrition, micronutrient deficiency or toxicity, and dehydration (Goday et al., 2019). Autistic children, for example, often present with a restricted variety of food intake (e.g., they may refuse to consume an entire food group). In this case, the negative nutritional consequence may lead to micronutrient deficiency (i.e., lack of fiber) which may cause constipation and abdominal pain (Goday et al., 2019). Some children with chronic malnutrition may require artificial supports (e.g., nutritional supplement, feeding tube) to support growth (Sharp et al., 2017).

Feeding skills domain. Another contributing factor of PFD is the impairment with feeding skills. Children with PFD may have an altered feeding experience due to illness, injury, or developmental delay that can lead to deficits in feeding skills (Goday et al., 2019). Studies examining impairments in oral sensory functioning indicated that children with PFD often exhibit abnormal oral sensory functions in the forms of over-response (i.e., hypersensitivity) or under-response (i.e., hyposensitivity), which further hinder children's ability to tolerate differences in textures of foods such as flavor, temperature, bolus size, viscosity, texture, or appearance (Farrow & Coulthard, 2012; Naish & Harris, 2012). In addition, children with PFD also experience impairments in oral motor functioning with difficulties in controlling bolus,

ineffectiveness of chewing and grinding, and inefficiency in transiting bolus for swallow (Goday et al., 2019). Additional impairments in pharyngeal motor functioning, which can cause difficulty swallowing, are commonly seen in children with PFD (Arvedson, 2008). Another area of feeding skills deficit is the delay in neuromuscular coordination, meaning that children experiencing difficulties with neuromuscular coordination may impact their abilities to transition in using feeding or drinking utensils (Goday et al., 2019).

Psychosocial domain. Multiple psychosocial factors were identified to play an important role in developing and maintaining PFD (Berlin et al., 2009). Psychosocial factors encompass developmental factors, mental and behavioral health problems, social influences and environmental factors, which interplay with biological factors that further exacerbate individual feeding difficulties (Goday et al., 2019). First, developmental delays in motor, language, socialization, and cognitive skills, can be key factors influencing feeding development (Goday et al., 2019; Lukens, 2011). Children with one or multiple areas of developmental delays are at a higher risk of developing PFD. When developmental domains create a mismatch between child's feeding abilities and parents' feeding demands, eating can develop into an aversive experience which can result in long-lasting negative consequences (Goday et al., 2019). In addition, mental and behavioral health problems of the child and parent must be considered (Berlin et al., 2009; Goday et al., 2019). Caring for children with PFD is often stressful for parents and these stressors may be further amplified given a host of additional challenges such as comorbid psychiatric and developmental disabilities (Berlin et al., 2009; Garro et al., 2005; Greer et al., 2009). Finally, social factors such as parent management of mealtime behaviors, quality of parent-child interactions, family eating habits, family socioeconomic status, and cultural expectations for mealtime (e.g., caregiver's cultural beliefs for eating and nutrition intake) all

have significant impact on the development and maintenance of PFD (Goday et al., 2019; Lukens, 2011).

Of children referred to an interdisciplinary feeding program, 74% experience a combination of behavioral, structural, neurological, cardiorespiratory, or neurological conditions (Burklow et al., 1998). It is stressed that impairment in one domain can lead to dysfunction in other domains (Goday et al., 2019). Thus, a biopsychosocial model (Berlin et al., 2009) works efficiently to account for etiological factors (Fischer & Silverman, 2007; Lukens, 2011). Children with biological dispositions, such as challenges with swallowing (i.e., dysphagia), reflux, gastrointestinal (GI; e.g., constipation or diarrhea), and oral motor difficulties further complicate their food refusal or selective eating (Goday et al., 2019; Rommel et al., 2003; Sharp et al., 2017). Challenges from medical and developmental complexities may lead to more psychosocial barriers (Nadler et al., 2019). However, children's food refusal behaviors may also be reinforced and maintained with specific behavioral and environmental antecedents and consequences (Babbitt et al., 1994), underscoring the role that non-biological factors play. More specifically, past studies have identified that negative reinforcement in the form of escape from eating is the most common for maintaining feeding problems (Aheam et al., 1996; Piazza et al., 2009; Piazza, Fisher, et al., 2003; Piazza, Patel, et al., 2003; Reed et al., 2004).

Impact of PFD

There are long-term medical and social implications for children with PFD with regard to physical growth, cognitive functioning, and skill development (Clark et al., 2019). Chronic feeding difficulties jeopardize long-term physical growth and may result in negative outcomes that warrant feeding interventions (Ledford & Gast, 2006). More specifically, children with food selectivity may experience significant weight loss or gain, deficiency in certain nutrients and

inadequate micronutrient intake, which may result in invasive medical procedures such as the placement of a feeding tube (Clark et al., 2019; Curtin et al., 2015; Sharp et al., 2013). Chronic PFD also places children at risk for a number of negative medical and developmental outcomes such as malnutrition, developmental delay, exacerbated behavioral problems, psychosocial deficits, and poor academic achievements (Clark et al., 2019; Kerwin, 1999; Ledford & Gast, 2006; Maston et al., 2009; Sharp et al., 2013a; Sharp et al., 2010).

A severe PFD not only affects the child's overall development and health, but it can also have impact on the well-being of caregivers (Curtin et al., 2015). Managing chronic feeding difficulties often negatively impacts caregivers and decreases overall quality of family life by increasing parental stress, increasing the burden of caregiving and social isolation, and disrupting the parent-child relationship (Burrell et al., 2019; Greer et al., 2008; Sharp et al., 2014). For example, Pederson, Parsons, and Dewey (2004) explored the relationship between caregiver stress and negative mealtime behavior and revealed that parents of children with an enteral feeding tube reported high levels of stress due to constant caretaking demands. Marquenie and colleagues (2011) conducted a qualitative research on 14 mothers of autistic children and found consistent report from the participating mothers that their child's food selectivity has limited family's food choices and dinner time became a source of stress. Ausderau and Juarez (2013) arrived with a similar result after interviewing six mothers of autistic children with food selectivity and mealtimes were described as lacking enjoyment for their families.

Research has suggested that caregivers of children with chronic feeding problems also experience an increased level of parental stress (Fishbein et al., 2016; Greer et al., 2008). More specifically, parents were found to experience elevated stress during their child's hospitalization for chronic feeding problems especially when they were not given clarifications of specific

problems or intervention pathways (Garro et al., 2005). In addition, a negative association has been demonstrated between high levels of parental stress and positive parent-child interactions when feeding challenges started to exacerbate (Clark et al., 2019; Lucarelli et al., 2003). That is, when parents struggle to increase their child's food intake, their interactions with their child may become increasingly stressful, and in turn, their child's food refusal behaviors aggravate (Fishbein et al., 2016). Gradually, continuous disrupted parent-child interactions will create a vicious cycle of negative consequences leading to the decrease of family quality of life (Fishbein et al., 2016; Saurez et al., 2014). Specifically, Cerniglia and colleagues (2020) conducted a study to explore the emotional-behavioral functioning in a sample of children with ARFID, psychopathological risk of their mothers, and the quality of mother-child feeding interactions. The study compared three groups of children within ARFID sub-types and found each subtypes was associated with specific combination of internalizing and externalizing psychopathological problems in both child and their mothers (Cerniglia et al., 2020). The results of this study also supported previous findings on poor qualities of feeding interactions between the child and the mothers in all three ARFID sub-type groups (Cerniglia et al., 2020).

Best Practices for Children with PFD

PFD has a heterogeneous presentation of clinical symptoms coupled with neuromuscular, metabolic, skeletal, behavioral, and psychosocial dysfunction which warrants interdisciplinary teams to provide multifaceted assessments and interventions (Babbitt et al., 1994; Dharmaraj et al., 2023; Lukens & Silverman, 2014; Manikam & Perman, 2000; Nadler et al., 2019; Sharp et al., 2017; Tereshko et al., 2021). It is recommended that a team comprised of physicians, nurse practitioners, psychologists, registered dietitians, speech and language pathologists, occupational therapists, and social workers is well-suited to tackle the variety of components contributing to

feeding challenges (Nadler et al., 2019; Sharp et al., 2017; Silverman, 2010). Additionally, experts increasingly recognize that children with feeding disorders require different levels of care, with intensive treatment (i.e., day treatment and inpatient care) recognized as the standard of care for children with complex and severe feeding disorder (Sharp et al., 2017; Silverman, 2010).

Best Practices for Assessment for PFD

Assessment of PFD is a fundamental initial step in understanding an individual child's feeding difficulties. Due to complex etiological factors that contribute to feeding challenges, it is important for an interdisciplinary team of specialists to conduct comprehensive assessment (Tereshko et al., 2021). It is recommended that the assessment of PFD should be conducted by a team comprised of medical providers, mental health clinicians, dietitians, occupational therapists, and speech pathologists (Brigham et al., 2018). Silverman (2010) stressed the importance that the assessment of PFD should help clarify a family's treatment objectives and identify possible etiological contributors to aid the conceptualization and development of treatment pathways. It has been suggested that children with PFD require interdisciplinary evaluation including medical, psychosocial, and oral-motor (Luiselli, 1989; Nadler et al., 2019).

Assessment should include medical record review, physical examination, lab tests, clinical interview, caregiver-completed questionnaires, and feeding trial observation so the team can capture information encompassing behavioral, dietary, medical, and oral-motor factors (Brigham et al., 2018; Dharmaraj et al., 2023; Eddy et al., 2019; Kazman, 2019; Luiselli, 1989; Lukens & Silverman, 2014; Sharp et al., 2017; Silverman, 2010). In particular, it is important to capture and understand psychiatric, medical, developmental, psychosocial, and sociocultural factors contributing to the clinical presentations of PFD (Eddy et al., 2019; Katzman, 2019).

Standardized caregiver questionnaires are used commonly to identify specific mealtime behaviors to determine the frequency and severity of problem mealtime behaviors (Lukens, 2011; Poppert et al., 2015). Some examples include *Behavioral Pediatric Feeding Assessment Scale* (BPFAS; Crist & Napier-Phillips, 2001), *Children's Eating Behavior Inventory - Revised* (CEBI-R; Archer et al., 1991), and *Child Eating Behavior Questionnaire* (CEBQ; Wardle et al., 2001). Autistic children may present with specific feeding problems that require professionals to pay extra attention to patterns of behavior and past feeding experience (Sharp et al., 2016). For example, the *Brief Autism Mealtime Behavior Inventory* (BAMBI; Lukens & Linscheid, 2008), a specific parent-report questionnaire to assess mealtime behaviors in autistic children was developed in order to better characterize mealtime behaviors that are specific to autistic population (Sharp et al., 2016; Sharp et al., 2013b). A few standardized assessments are developed after the APA developed the diagnosis of ARFID, for example, *Eating Disorders in Youth-Questionnaire* (Hilbert & van Dyck, 2015), *Nine Item ARFID Screen* (Zickgraf & Ellis, 2018), and the *Pica, ARFID, and Rumination Disorder Interview* (Bryant-Waugh et al., 2019). In addition, structured interviews have been found to be promising for diagnosing ARFID (Kambanis & Thomas, 2023; Schmidt et al., 2019).

Amongst all the assessments, behavioral assessment (e.g., functional analysis) has become a critical assessment tool to understand the behavioral function of a problem behavior, which can lead to a better match of a consequent treatment method (Lukens, 2011; Piazza, Fisher, et al., 2003; Saini et al., 2019). Overall, with an interdisciplinary exam approach, the team can develop appropriate and achievable goals for managing global feeding difficulties as well as triage discipline-specific treatments.

Best Practices for Treatment for PFD

Given the complex nature of PFD, children with PFD need to be served by an interdisciplinary team to receive comprehensive care (Eddy et al., 2019; Katzman, 2019; Lock, 2015; Lukens, 2011; Sharp et al., 2019; Tereshko et al., 2021). Nadler and colleagues (2019) suggested that families benefit from working with a team rather than coordinating clinical care across providers and settings. In a systematic review conducted by Lukens and Silverman (2014), a total of 13 intervention studies for PFD were identified with 10 intervention programs involving multidisciplinary treatment at a day treatment or an inpatient hospitalization setting. Sharp and colleagues (2017) conducted a meta-analysis to extend previous findings by Lukens and Silverman (2014) and concluded intensive multidisciplinary treatment holds benefits in treating children with PFD. In particular, intensive multidisciplinary treatment has proven to be successful in improving severe feeding problems such as dependence on supplemental feedings (e.g., gastrostomy-tube dependence; Brown et al., 2014; Cornwell et al., 2010; Marinschek et al., 2019; Trabi et al., 2010). Intensive treatment programs demonstrate unique advantages compared to outpatient settings, including frequent and immediate medical and nutrition monitoring, greater environmental control, and more intense patient care (Silverman, 2010). Additionally, intensive treatment often includes systematic training for parents to promote generalization into home and community settings (Sharp et al., 2017; Silverman, 2010)

Treatment approaches to PFD vary across teams and specialties, however, it has been stressed that evidence-based treatments for PFD will likely need to be individualized (Mammel & Ornstein, 2017). Individuals with different clinical presentations of PFD also require different levels of intervention involving discipline-specific care, treatment intensity can range from an outpatient to day program to inpatient medical hospitalization (Brigham et al., 2018; Ornstein et al., 2017). Medical and nutritional stability and safety should be the first priority to consider

during the treatment course for PFD (Nadler et al., 2019). There is considerable evidence supporting the use of behavioral interventions in the treatment of PFD after medical and nutritional stability has been achieved (Kerwin, 1999; Kerwin, 2003; Linscheid, 2006; Luiselli, 1989; Lukens & Silverman, 2014; Sharp et al., 2017).

Behavioral interventions are key in feeding treatment because even in children with no obvious physiological precursors or developmental issues in feeding, feeding disturbances still have the possibility to worsen due to disrupted family functioning and caregivers' maladaptive behavioral responses to their child's feeding challenges (Lukens & Silverman, 2014; Murphy & Zlomke, 2016; Pitt & Middleman, 2018; Sharp et al., 2017; Thomas et al., 2017). Behavioral interventions, heavily based on ABA, have been found to be effective in changing behavioral interaction patterns, promoting skill building, and reducing problem behaviors in children with PFD (Nadler et al., 2019). The underlying components of behavioral interventions include the use of consequence-based strategies (e.g., escape extinction, reinforcement) and antecedent-based manipulations (e.g., demand fading, texture manipulations, presentation alterations; Sharp et al., 2017; Silverman, 2010). Emerging interventions such as cognitive-behavioral therapy (Dumont et al., 2019; Thomas & Eddy, 2018; Thomas et al., 2017), acceptance-based exposure treatment (Zucker et al., 2019), and family-based therapy (Fitzpatrick et al., 2015; Lock et al., 2015; Spettigue et al., 2018) have also shown some promise.

Limitations for Assessment and Treatment for PFD

Professionals have recognized the complex contributions of anatomic, physiologic, developmental, and behavioral factors in the development of feeding problems. Interdisciplinary evaluation and treatment approach to PFD has been identified as the most effective way to provide comprehensive care; however, there are notable barriers and limitations to be addressed.

Given the high prevalence of PFD within both the general population and children with developmental disabilities, current resources and treatment options in the community are not meeting needs (Sharp et al., 2016). In particular, specialized feeding programs employ an interdisciplinary team that requires extensive time and high cost. The cost of a day treatment program can range from $575 to $1,175 per day with a typical treatment course lasting 11 to 45 days (Williams, 2007). It is common that the total charge of a day treatment program exceeds $50,000 per child for the course of treatment (Sharp et al., 2016), which raises concerns about accessibility and affordability for families struggling with resources. Due to the high cost and exhaustion resources that needed for an interdisciplinary team, alternative service delivery modalities are in need for more exploration.

Parent-Implemented Intervention (PII)

In the last two decades, there has been a tremendous increase in efforts to conduct rigorous intervention research in the field of developmental disabilities, particularly in studies evaluating PII (Nevill et al., 2016; Siller & Morgan, 2018). According to the National Professional Development Center on Autism Spectrum Disorders (NPDC), PII is one of the evidence-based practices that can support the learning of autistic children and youth in home, school, and community settings (Wong et al., 2015). More specifically, extensive research has shown the effectiveness of PII in supporting autistic children in joint attention, social communication, social skills, play skills and imitation (Bottema-Beutel et al., 2014; Ingersoll & Gergans, 2007; Kasari et al., 2010; Minjarez et al., 2011; Pierucci, 2016; Raulston et al., 2019; Shire et al., 2015; Vernon, 2014; Verschuur et al., 2019), as well as decreasing challenging behaviors (Aman et al., 2009; Bearss et al., 2018; Drew et al., 2002; Ginn et al., 2015; Handen et al., 2015; Rogers et al., 2012; Sofronoff et al., 2004; Tellegen & Sanders, 2014; Whittingham et

al., 2009). Studies have also investigated the implementation of PII as a modality of treatment in supporting children with other disabilities, revealing clinical and practical promises. Other research has examined the effectiveness of PII in decreasing problem behaviors in children with attention deficit/hyperactivity disorder and children with disruptive behaviors such as conduct problems or self-injurious behavior (Fodstad et a., 2018; McIntyre, 2013; Sanders et al., 2000).

Definition of PII

PII includes a range of practices with synonymous terms, such as parent training, parent education, parent-mediated intervention, parent coaching, caregiver-mediated, and parent-directed intervention (Bearss et al., 2015; Postorino et al., 2017). PII includes a collection of evidence-based practices where parents learn to provide individualized intervention to support their child to increase a wide variety of skills and to decrease interfering behaviors in the home or community setting through a structured parent training program (Wong et al., 2015). The major goal of PII is to transfer knowledge from professionals to parents so that they can be the agent of intervention delivery, which in turn will promote and sustain improvements in children (Bearss, 2019).

Issues with lack of consensus of PII. Bearss (2019) recognized the inconsistency of terms used to describe PII and called for consensus among researchers and clinicians. The lack of uniformity in terminology and definition surrounding PII poses a significant challenge to clinicians' ability to provide consistent care to families and individuals with identified needs. Bearss (2019) stressed the importance of describing PII programs with specific features and formats to allow researchers and clinicians to differentiate PII to enable better selection of appropriate programs that meet the needs of the individual family.

Heterogeneity of PII. PII studies have varied significantly in key methodological variables such as participant characteristics, target symptom and skills, treatment component and approach, outcome measures, dosage, and sample size (Nevill et al., 2016). PII has been used in various programs where the parents are responsible for implementing the intervention partially or completely (Bearss, 2019; Schultz, 2013). In addition, PIIs can be designed to target core symptoms and can include treatments that focus on teaching parents how to promote language and communication (Aldred et al., 2004; Park et al., 2011), social interaction (Gengoux et al., 2019; Raulston et al., 2019; Wetherby et al., 2014), and imitation skills (Ingersoll & Gergans, 2007). PIIs can be delivered in small groups (O'Donovan et al., 2018; Rogers et al., 2014) or individually (Bearss et al., 2015b) and across settings such as home (Elder et al., 2011; Roberts et al., 2011; Sheinkopf & Siegel, 1998; Smith et al., 2000), community (Edwards et al., 2019; Stadnick et al., 2015), and via telehealth (Bearss et al., 2018; Meadan et al., 2016; Wainer & Ingersoll, 2015). There are multiple training modalities involved in a PII program including didactic instruction, role play, in-vivo coaching, supervision/feedback, homework, handouts, direct observation, and/or in-person or virtual home visits (Bears et al., 2013; Cheng et al., 2023; Kasari et al., 2014). The heterogeneity of PII increases the possibilities for further adaptation for varying levels of functioning, behavioral profiles, and socioeconomic backgrounds (Nevill et al., 2016).

Advantages of PII Compared to In-Clinic Service

Numerous studies have established the advantages of PII as a treatment modality, suggesting that interventions are more effective with involvement of family members compared to therapists alone (Buschbacker et al., 2004; Ingersoll & Dvortcsak, 2006). Including parents as mediators of training allows them to acquire necessary skills to cope effectively with their child's

developmental delays and areas of difficulties, which in turn bring positive collateral effects on familial functions such as enhanced parent-child interactions and improved family cohesion (Feldman & Werner, 2002; Koegel et al., 1996). In addition, parent involvement in treatment can further enhance parent well-being, including increased positive affect, enhanced self-efficacy and feelings of competence, improved parents' engagement, and reduced parental stress and strain (Brookman-Frazee & Koegel, 2004; Deb et al., 2020; Feldman & Werner, 2002; Iadarola et al., 2018; Jhuo & Chu, 2022; Koegel et al., 1996; Liu et al., 2020; Solomon et al., 2008; Strauss et al., 2012; Verschuur et al., 2019). More importantly, PII can facilitate better generalization of treatment to the home environment and maximize the amount of intervention a child receives (Dawson-Squibb et al., 2020; Matson et al., 2009; Strauss et al., 2012; Symon, 2005). Economically, PII is more cost-effective compared to other concentrated clinical care, requiring less frequent clinical contact than intensive interventions (Sharp et al., 2014; Wainer & Ingersoll, 2015).

Systematic Review and Meta-Analysis

A systematic review employs explicit methodologies for the identification, selection, evaluation, and synthesis of findings from distinct yet similar studies. An optional component of a systematic review is meta-analysis, a statistical technique that examines and consolidates results (Borenstein et al., 2021; Higgins et al., 2019; Lipsey & Wilson, 2001). The term "meta-analysis" was coined by Gene Glass in 1976, describing it as the "statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings" (Glass, 1976, p. 3). Meta-analysis involves aggregating data from numerous studies exploring the effects of similar interventions, followed by statistical analysis and data synthesis to draw comprehensive conclusions (Cooper et al., 2009). Meta-analysis empowers researchers to gauge

the strength of evidence, quantitatively combine results and explore heterogeneity among study results, ultimately delivering a more robust and accurate estimate of an intervention effect (Borenstein et al., 2021; Higgins et al., 2019). Because of the rigorous and comprehensive procedures integral to systematic reviews and meta-analyses, they are positioned at the top of the evidence-based pyramid (Tawfik et al., 2019). In this present study, a systematic review in conjunction with meta-analysis, is purposed to provide a more precise estimate of the intervention effect by methodically and comprehensively integrating current data from relevant studies.

Research Questions

Given the abovementioned advantages of PIIs in treating individuals with developmental disabilities and the high demands for accessing evidence-based treatments, especially ABA-based treatments that are proven to be effective for children with PFD, it is crucial to develop and further evaluate ABA-based PIIs that target to promote appropriate feeding behaviors and decrease challenging behaviors during mealtimes. Gaining a deeper understanding of the efficacy of ABA-based PIIs has the potential to empower researchers to enhance programs and assist clinicians in implementing suitable treatment methods for parents and families dealing with children affected by PFD and seeking services. In addition, the scarcity of current meta-analyses on the topic of feeding difficulties suggests a gap in the available research and a potential need for further investigation in this area. Meta-analysis is a valuable tool for synthesizing existing research findings and providing a more comprehensive understanding of ABA-based PIIs in treating PFD. Thus, through the application of meta-analysis, this study seeks to systematically and statistically address the following questions:

1. What is the population effect size of ABA-based PII for children with PFD on child-related feeding outcomes?
2. What is the population effect size of ABA-based PII for children with PFD on parent-related outcomes?
3. What are the characteristics of delivery format of training, training components of PII, and treatment components of PII?
4. To what extent do delivery format of training, training components of PII, and treatment components of PII moderate child-related feeding outcome?
5. To what extent do delivery format of training, training components of PII, and treatment components of PII moderate parent-related outcomes?

Chapter 2. Review of the Literature

Applied Behavior Analysis and the Treatments for PFD

Applied Behavior Analysis (ABA) is a branch of psychology applied in a variety of settings with many different individuals (Cooper et al., 2007). It is defined as a scientific approach "in which tactics derived from the principles of behavior and are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change" (Cooper et al., 2007, p. 40). ABA is a scientific approach to understand human behavior that uses behavior analytic principles to influence human behavior and make socially meaningful changes in behavior. Numerous studies have demonstrated the effectiveness of behavioral interventions for treating PFD in children with and without ASD, particularly interventions based on operant principles of behavior (Kerwin, 1999).

Core Principles of ABA

Implementers of ABA systematically apply the behavioral principles of learning in order to improve specified behaviors that are socially significant (Baer et al., 1968). The most used principles of behavior are derived from scientific exploration between a behavior response and events that can influence behavior. Based on studies by Watson and Skinner, behaviors are learned and can be changed through both respondent and operant conditioning (Williams & Williams, 2020). Because of the operant conditioning framework, the literature on behavioral interventions is largely focused on consequence-based strategies. Consequence-based interventions employ three important principles of behavior: reinforcement, punishment, and extinction (Sarcia, 2020). With reinforcement, a behavior is followed by a stimulus event and as the result, the future frequency of this behavior increases in similar conditions (Cooper et al., 2007; Sarcia, 2020). On the contrary, with punishment a behavior is followed by a consequence

and as the result, the future frequency of the behavior decreases in similar conditions (Cooper et al., 2007; Sarcia, 2020). Extinction is the withdrawal of reinforcement and as the result, the future frequency of the behavior decreases (Sarcia, 2020; Williams & Williams, 2020).

ABA Principles in Feeding Intervention. Following Skinner's introduction of the three-term contingency to the psychology field, implementers of ABA have employed scientific methods to analyze antecedents and consequences in order to change the frequency of a specified behavior. The three-term contingency is a fundamental concept in ABA, which refers to the following components: antecedent, behavior, and consequence (Cooper et al., 2007). Within the field of feeding interventions, researchers have examined the consequences delivered following challenging mealtime behaviors using either descriptive assessment or functional analysis (Borrero et al., 2010; Piazza, Fisher, et al., 2003). The results indicated that inappropriate mealtime behaviors were more likely to be maintained by escape or specific forms of attention (Borrero et al., 2010; Piazza, Fisher, et al., 2003). In addition, antecedents such as variables pertaining to the food items that are delivered at mealtimes were also studied. For example, Munk and Repp (1994) identified food avoidance was associated with certain aversive properties of food. They found that with manipulations of food property such as lowering the texture, children with feeding difficulties had an increase of food acceptance (Munk & Repp, 1994). Collectively, application of ABA principles for treating childhood feeding difficulties has shown promise for increasing functional eating habits.

ABA-Based Treatments for PFD

Treatments of PFD are commonly provided by an interdisciplinary team with a variety of specialized health-care providers including medicine, psychology, nutrition, speech-language pathology, occupational therapy, and other specialties (Fisher & Silverman, 2007; Lukens &

Silverman, 2014; Maston & Fodstad, 2009; Sharp et al., 2017; Tereshko et al., 2021; Williams et al., 2010). In particular, ABA-based treatments can be viewed as central to an interdisciplinary approach for treating PFD in children with and without identified disabilities (Silbaugh et al., 2016). Kerwin (1999) conducted the first comprehensive literature review in the area of treatment for severe feeding problems, acknowledging behavioral treatments as effective in treating PFD. Subsequent reviews continued to add support for the effectiveness of behavioral intervention in addressing feeding disorders such as food selectivity and food refusal, in children with and without ASD (Ledford & Gast, 2006; Ledford et al., 2018; Sharp et al., 2010; Silbaugh et al., 2016; Williams et al., 2010).

The treatment methods for feeding difficulties and inappropriate mealtime behaviors related to feeding in children with and without ASD often involve the use of ABA (Cooper et al., 2007; Iwata et al., 1982). ABA uses applied operant principles to improve eating and to decrease food refusal behaviors with single-case design methodologies to identify variables that influence behavior change (Iwata et al., 1982; Ledford et al., 2018). This behavioral-analytic approach is appropriate to address feeding disorders that are aggravated and maintained through environmental factors (De Moor et al., 2007; Sharp et al., 2010) and by the consequences that follow inappropriate mealtime behaviors (Piazza, Fisher, et al., 2003). Specifically, caregivers may reinforce a child's problematic behaviors to avoid complying with feeding-related demands (Babbit et al., 1994; Ledford et al., 2018).

ABA-based treatments for PFD usually involve multi-component packages (Hoch et al., 2001). Historically, the literature on feeding interventions has focused largely on the role of consequences and has not considered the functions of inappropriate mealtime behaviors that are commonly negatively reinforced (Borrero et al., 2010; Piazza, Fisher, et al., 2003). It is natural

that the field has been focusing more on the consequence-based procedures (e.g., non-contingent reinforcement, positive reinforcement, escape extinction; Cooper et al., 2007; Piazza et al., 2015). Another group of studies attempted to evaluate the efficacy of antecedent-based procedures (e.g., stimulus fading, simultaneous and sequential presentation of preferred and non-preferred foods, use of high-probability instructional sequence) in treating PFD (Cooper et al., 2007; Piazza et al., 2015). The literature supports the use of consequence-based procedure alone, antecedent-based procedure alone, or combining the two procedures in the field of feeding interventions and provides promising evidences in decreasing challenging behaviors and increasing food intake (Ahearn et al., 1996; Allison et al., 2012; Casey et al., 2006; Cooper et al., 1995; Patel et al., 2002a; Piazza, Fisher, et al., 2003; Tarbox et al., 2010; Voulgarakis & Forte, 2015).

Consequence-Based Procedures

Past research on behavioral treatments of food refusal behavior was influenced largely by the operant framework and has focused heavily on the role of consequences (Iwata et al., 1982; Piazza, Fisher, et al., 2003). Collectively, studies have explored the efficacy of consequence-based interventions, namely response reduction procedures and positive reinforcement-based interventions, for treating challenging feeding behaviors (Ahearn et al., 1996; Allison et al., 2012; Casey et al., 2006; Cooper et al., 1995; Kelley et al., 2003; LaRue et al., 2011; Patel et al., 2002a; Piazza, Fisher, et al., 2003; Riordan et al., 1980; Riordan et al., 1984; Tarbox et al., 2010; Voulgarakis & Forte, 2015; Wilder et al., 2005). Negative reinforcement is defined as “when a behavior is followed by the removal or termination of a stimulus that increases the future frequency of the behavior in similar conditions” (Cooper et al., 2007, p. 312). Negative reinforcement in the form of escape from eating demand has been identified as a primary

function that maintains feeding problems (Piazza, Patel, et al., 2003). As a result, escape extinction has been a commonly used form of response reduction procedure to prevent children from escaping the feeding demand. On the contrary, positive reinforcement "has occurred when a response is followed immediately by the presentation of a stimulus, and, as a result, similar responses occur more frequently in the future" (Cooper et al., 2007, p. 278).

Response reduction procedures. Negative reinforcement can play an important role in maintaining inappropriate behaviors at mealtime. Escape extinction is the most widely applied and empirically supported response reduction strategy for feeding difficulties (Ahearn et al., 1996; Cooper et al., 1995; LaRue et al., 2011; Patel et al., 2002a; Piazza, Fisher, et al., 2003; Piazza, Patel, et al., 2003; Tarbox et al., 2010; Voulgarakis & Forte, 2015). Ledford and Gast (2006) reviewed nine feeding intervention studies conducted with autistic participants, and six of them involved some form of escape extinction. Escape extinction involves termination of the reinforcement contingency that maintains a response (Iwata et al., 1994; Luiselli, 2000). Extinction procedures can be used to reduce a target behavior by withholding or terminating the reinforcer that maintains it. Extinction operates in the framework that with the abrupt withdrawal of reinforcement, the problematic behavior is likely to decrease (Cooper et al., 1995).

Common escape extinction procedures for food refusal include physical guidance, non-removal of the spoon, and re-presentation of the spoon (Ledford et al., 2018; Piazza et al., 2009). Physical guidance is when a therapist physically applies pressure to the temporomandibular joint of the child's jaw until child's mouth opens to take a bite (Piazza et al., 2015). Non-removal of the spoon is when a therapist presents a spoon or cup within an individual's bite zone and the spoon or cup is not removed until the child opens their mouth and takes a bite of the food or drink (Leford et al., 2018; Piazza et al., 2015). Re-presentation is a procedure occurs when a

therapist scoops food expelled from the child onto a spoon and replaces the food in the child's mouth (Ledford et al., 2018). These treatment procedures have one thing in common, which is that they are based on negative reinforcement (Ahearn et al., 1996).

Ahearn et al. (1996) compared two treatment packages involving response reduction procedures for food refusal. The researchers compared the effectiveness of physical guidance versus non-removal of the spoon as escape extinction procedures for three young children with chronic food refusal in a hospital setting. The experiment embedded an alternating treatments comparison of the two escape extinction procedures in a multiple baseline design across participants. All three participants consumed little to no food during baseline. After treatment packages were implemented, the percentage of bites accepted for all three children increased to at least 80% (Ahearn et al.1996). The results indicated that both the physical guidance and non-removal of the spoon procedures were effective in increasing food acceptance with physical guidance showing a more rapid attainment of the result (Ahearn et al., 1996).

Extending the use of escape extinction, Tarbox et al. (2010) and Voulgarakis and Forte (2015) evaluated the efficacy of escape extinction in the form of terminating mealtime. Tarbox et al. (2010) implemented a non-removal of the meal procedure in which the child was only allowed to leave the table if the meal has been completed. The procedure was successful in increasing child's food acceptance and meal completion (Tarbox et al., 2010). Similarly, Voulgarakis and Forte (2010) implemented a response reduction approach with an 8-year-old child with cerebral palsy whereby the child was allowed to exit the meal contingent upon the acceptance of a pre-set number of foods. A changing criterion design was used, and the results indicated that the number of accepted bites increased over time (Voulgarakis & Forte, 2010). Collectively, these experiments investigated whether response reduction procedures, especially

in the form of escape extinction, would influence children's levels of food acceptance and food refusal in the context of feeding difficulties. Clear evidence supports the effectiveness of escape extinction in treating feeding difficulties.

Negative reinforcement-based procedures. Aside from using response reduction procedures in feeding treatment for increasing food acceptance and consumption, procedures based on differential negative reinforcement of alternative behavior have rarely been reported in the behavioral feeding literature. Vaz and colleague (2011) examined the effects of implementing an avoidance procedure on self-feeding with one 6-year-old typically developing child with food selectivity. During the treatment, the child was offered two choices: self-feed one bite of a target food or being fed one bite of a target food and five bites of another food (Vaz et al., 2011). In this study, the experimenter operated on the assumption that the child would choose to self-feed one bite of the target food in order to escape from the demand of being fed of six bites of food. The experimenter used a reversal design to evaluate the effects of the avoidance procedure on acceptance across three target foods and the results indicated that self-feeding increased along with food acceptance during the avoidance treatment (Vaz et al., 2011).

Positive reinforcement-based procedures. Positive reinforcement-based procedures, such as differential reinforcement of alternative behavior (DRA) and noncontingent reinforcement (NCR), have been examined in feeding treatment to reduce the occurrence of collateral forms of negative behaviors and to increase food acceptance (Piazza et al., 2015). Positive reinforcement-based procedures are commonly used alone or in conjunction with escape extinction procedures in feeding treatment literatures (Hoch et al., 1994; Piazza et al., 2015). Bachmeyer (2009) reviewed behavioral intervention studies focused on treatment for children with selective eating or inadequate oral intake. Of the reviewed studies, seven of 12 studies used

positive reinforcement procedures in the absence of escape extinction, and all showed positive results in reducing food refusal and increasing compliance (Bachmeyer, 2009; Casey et al., 2006).

DRA procedures in feeding treatment. Positive reinforcement operates in the framework that a "stimulus presented as a consequence and responsible for the subsequent increase in responding" (Cooper et al., 2007, p. 278). DRA involves providing the child with access to preferred stimuli (i.e., in the form of access to adult attention, tangible items, or preferred foods) contingent on desired behavior (e.g., accept or swallow a bite of presented food or drink). In a case study conducted by Brown and colleagues (2002), parents were taught to use a DRA procedure using preferred foods as positive reinforcers with a 7-year-old boy with chronic food refusal. A multiple baseline design across three foods was employed and the results indicated that the child accepted and had an increased food consumption on foods he previously refused (Brown et al., 2002). In addition, Kern and Marder (1996) compared the relative efficacy between simultaneous reinforcement versus delayed reinforcement strategies on food acceptance with a 7-year-old boy with developmental disorder and food selectivity. Even though both reinforcement procedures were effective in increasing food acceptance, the simultaneous reinforcement produced a more rapid behavior change as well as a higher percentage of food acceptance (Kern & Marder, 1996).

Another study conducted by Kelley et al. (2003) evaluated the separate and combined effects of differential reinforcement procedures on cup drinking with a 3-year-old typically developing boy without using escape extinction. The treatment package in the study included both differential negative reinforcement procedure (i.e., the child was allowed to avoid presentation of the less preferred food by accepting the drink) and differential positive

reinforcement procedure (i.e., contingent access to preferred food following acceptance of the drink). The results suggested that cup drinking increased with the differential reinforcement-based procedures, both alone and in combination, in the absence of escape extinction (Kelley et al., 2003).

NCR procedures in feeding treatment. As an alternative to DRA procedure, NCR involves providing preferred stimuli continuously throughout the meal. Wilder et al. (2005) attempted to examine the use of NCR without escape extinction and showed contradictory results. In Wilder et al. (2005), a 3-year-old autistic girl with feeding difficulties participated the study and her treatment involved non-contingent access to a video with the therapist delivering attention on a fixed-time 30-second schedule during feeding sessions. During feeding sessions, her exhibition of self-injurious behavior resulted in a 15-second break from her preferred video. A reversal design revealed that NCR without the presence of escape extinction can be effective in increasing food acceptance and reducing self-injurious behavior in children with chronic food refusal (Wilder et al., 2005).

Combined consequence-based procedures. Drawing heavily from the operant framework, ABA-based interventions commonly employ a combination of consequence-based procedures. Riordan and colleagues (1980) conducted one of the first studies to use operant techniques in the treatment of feeding difficulties to promote appropriate feeding behavior. A treatment package with differential attention, escape extinction, and fading procedures with multiple baseline design was implemented with two children with developmental disabilities (Riordan et al., 1980). Both children's access to preferred food was made contingent upon the acceptance of non-preferred food and food expulsions were put on extinction (Riordan et al., 1980). The results were promising in increasing consumption and decreasing food expulsion for

both children (Riordan et al., 1980). The same group replicated the procedure and provided a similar treatment package to children with chronic food refusal (Riordan et al., 1984). The findings suggested that children included in the study showed improved behavior and increased food consumption (Riordan et al., 1984).

Similarly, Coe et al. (1997) explored the use of positive reinforcement procedure and escape extinction with two children with food refusal and gastrostomy tube dependence. The treatment package comprised of DRA and escape extinction. The detailed procedures included extinction of food avoidance while food acceptance was reinforced, extinction of food avoidance while food consumption was reinforced, and extinction of avoidance and expulsion while food consumption was reinforced (Coe et al., 1997). The results demonstrated a similar outcome as Riordan et al. (1980) and Riordan et al. (1984), where both children showed an increase of food acceptance and food consumption and a decrease of food expulsion (Coe et al., 1997).

To extend the research on the effectiveness of a combined consequence-based procedure, one study attempted to investigate the relative efficacy of manipulating reinforcement schedules on food acceptance. In the study by Casey et al. (2006), schedules of reinforcement were carefully manipulated for bite acceptance and food refusal. In the DRA plus escape extinction procedure, bite acceptance was placed on a fixed ratio schedule, with each accepted bite resulting in 20-30 seconds of positive interaction. The DRA only procedure placed bite acceptance on a fixed ratio schedule. In addition, the food of an escaped bite was placed on a variable ratio of two, meaning that every other refusal was permitted. The results showed an increase in the child's food acceptance and a reduction in refusal behaviors (Casey et al., 2006).

Moreover, the success of these combined consequence-based treatments has led to further investigation on assessing the relative effects of different consequence-based procedures. Piazza

and colleagues (2003) examined the combined effects of escape extinction procedures with positive reinforcement procedures to treat severe food refusal of four children with feeding difficulties. The experimenters implemented positive reinforcement alone, escape extinction alone, and positive reinforcement with escape extinction with all four participants and compared the effects of each components. The study showed that food consumption increased for all children when escape extinction was implemented. In contrast, positive reinforcement alone was not effective in increasing consumption for any participant (Piazza et al., 2003). Compared to escape extinction alone, positive reinforcement plus escape extinction was found to be beneficial in lowering levels of inappropriate behavior and crying (Piazza et al., 2003). Both Patel et al. (2002a) and Piazza et al. (2003) showed that positive reinforcement in the absence of escape extinction failed to increase food acceptance or food consumption for children with feeding difficulties. These findings were consistent with the Hoch et al. (1994) study which indicated that increased food acceptance and decreased food refusal were only observed when escape extinction was added to treatment.

Reed et al. (2004) conducted a similar analysis to compare the effects of positive reinforcement procedures versus escape extinction. Instead of using contingent positive reinforcement, Reed et al. (2004) implemented a non-contingent reinforcement (NCR). In the study, the experimenters implemented a NCR procedure alone, escape extinction alone, and NCR plus escape extinction with four children with feeding difficulties. A multi-element with reversal design was used to evaluate effects of different variables. During the NCR condition, reinforcers were available throughout the session and escape from the eating demand was allowed. The results were similar to Patel et al. (2002a) and Piazza et al. (2003), indicating that food consumption increased only when escape extinction was present. The NCR alone and the

NCR plus escape extinction procedures were concluded to be insufficient for increasing food consumption.

Allison et al. (2012) used a reversal design within a multi-element design to compare the effects of a DRA plus escape extinction procedure versus an NCR plus escape extinction procedure with a 3-year-old autistic boy with food selectivity. During DRA plus extinction, the therapist implemented a non-removal of the spoon procedure until the child accepted the bite. The child was presented with positive reinforcement after depositing the bite. Any expelled bites were presented again until the child accepted and swallowed the bite (Allison et al., 2012). During the NCR plus extinction, the child had access to preferred items and therapist attention throughout the session. The results showed both procedures were equally effective in increasing bite acceptance and reducing inappropriate mealtime behavior; the parent, however, indicated that NCR with extinction was more acceptable and easier to implement (Allison et al., 2012). This finding is contradictory to previous findings indicating that positive reinforcement procedures in the absence of escape extinction are often ineffective in increasing food acceptance (Patel et al., 2002a; Piazza et al., 2003; Reed et al., 2004).

To summarize, many studies have investigated the effectiveness of using positive reinforcement-based strategies alone with treating feeding difficulties and these studies have yielded mixed results. When used in conjunction with response reduction strategies, however, such as escape extinction, positive reinforcement-based interventions have a remarkable record for increasing food acceptance and food consumption in children with feeding difficulties. It is important to note that almost all the participants in the feeding treatment studies in which escape extinction was deemed not necessary were children who had established an eating pattern (Penrod et al., 2010). Many of these children demonstrated disrupted eating patterns such as

inadequate food intake or highly selective eating. To date, no studies have demonstrated effectiveness in increasing food acceptance with children with total food refusal with using positive reinforcement-based strategies alone. This suggest that interventions relying solely on positive reinforcement-based procedures show a biased effects with certain population. Consequently, it will be valuable to further identify to what extent the treatment effects of positive reinforcement-based interventions have within subgroups of PFD in the absence of response reduction interventions.

Antecedent-Based Procedures

Antecedent-based procedures put an emphasis on understanding the role of antecedent variables in the meal context, especially variables pertaining to the food items that are delivered to a child with PFD. Recent research indicates that antecedent variables are equally if not more critical to be studies in support child's feeding behavior change, rather than solely focusing on consequent variables (Seubert et al., 2014). Common antecedent-based procedures include stimulus fading (Ahearn, 2003; Kadey et al., 2013; Luiselli, 2000; Mueller et al., 2004; Najdowski et al., 2012; Patel et al., 2002b; Patel et al., 2001; Penrod et al., 2012; Piazza et al., 2002; Pizzo et al., 2012; Shore et al., 1998; Tiger & Hanley, 2006; Weber & Getierrez, 2015), simultaneous and sequential presentation of preferred and non-preferred foods (Ahearn, 2003; Najdowski et al., 2012; Piazza et al., 2002; Pizzo, 2012; Weber & Getierrez, 2015), providing visual cues and prompts, and the use of a high-probability instructional sequence (Merier et al., 2012; Patel et al., 2007; Penrod et al., 2012).

More specifically, stimulus fading is a common technique to shape appropriate feeding behaviors while fading in an alternative stimulus (e.g., non-preferred foods; Babbit et al., 2001). Stimulus fading strategies manipulate how foods are presented and may take the form bolus

fading (i.e., gradually increasing the amount of food on the spoon), altering the texture of foods presented (i.e., presenting non-preferred foods in a lower texture than preferred foods), blending preferred and non-preferred foods together, and simultaneous or sequential food presentation (Babbit et al., 2001). Conversely, demand fading is another commonly used antecedent-based strategy for addressing feeding difficulties. Demand fading is broadly defined as the process of gradually introducing the requests over time (Piazza et al., 1996). Luiselli (2000) implemented a treatment package with visual cueing and demand fading combined with positive reinforcement to increase food acceptance in a 3-year-old with chronic food refusal. During demand fading, the response criterion started with the child self-feeding one bite per meal and gradually increasing self-feeding during the course of treatment. Overall, the child was able to self-feed as an outcome of treatment with improved consumption across different types of foods (Luiselli, 2000).

Demand fading in the form of shaping is defined as systematically increasing the desired exposure with food items (Hodges et al., 2017; Koegel et al., 2012). Koegel and colleagues (2012) used a DRA coupled with shaping to target food flexibility in three autistic children with food selectivity. The shaping procedure is designed different levels of exposure where the child was presented with new foods using a systematic hierarchical sequence. This treatment package including seven-level hierarchy of acceptance paired with DRA procedure to reinforce the advancement of exposure. The results of study found to be successful in expanding food repertoire and further in increasing spontaneous requesting for other food items (Koegel et al., 2012). Hodges and colleagues (2017) used a shaping procedure alone, which involved systematically increasing the desired response with the food item, to increase food consumption in two autistic children. This study replicated similar hierarchical exposure procedure as Koegel

et al. (2012) and found all participants had an expansion on the number of new foods (Hodges et al., 2017). Weber and Getierrez (2015) implemented a treatment package composed of antecedent manipulations (e.g., shaping, simultaneous presentation, and sequential presentation) with a group of autistic children ages 2-7 to address food selectivity. The study extended previous literature to support the effectiveness of using antecedent-based interventions in the absence of escape extinction in increasing food acceptance (Weber & Getierrez, 2015).

Collectively, these studies demonstrated that antecedent manipulations can be effective interventions or to enhance treatment effects when added to a treatment package that is consequence-based (i.e., positive reinforcement-based procedure with or without response reduction) to support children with feeding disorders. Overall, antecedent-based strategies focus on why the demand to eat can be so aversive. The benefit of using antecedent-based strategies is to explore the aversive properties of particular foods or particular feeding demands to mitigate some of the negative consequences of eating. Compared to consequence-based interventions, antecedent-based strategies have the advantage of helping us understand some of the contributing factors of feeding problems (Seubert et al., 2014).

Evaluation of Treatment Effects

Based on the previous reviews, intervention studies for feeding difficulties in children with and without ASD have increasingly used consequence-based strategies alone or a combination of antecedent- and consequence-based treatment packages (Bachmeyer, 2009; Seubert et al., 2014). Unfortunately, the extent of manipulations on antecedent-based strategies alone or incorporating antecedent manipulations into a consequence-based treatment package is rarely studied. In some cases, it was sufficient to put in place antecedent-based strategies to increase food acceptance and reduce problem behaviors without any consequence-based

strategies (Hodges et al., 2017; Weber & Getierrez, 2015). Whereas, another alternative includes incorporating antecedent-based strategies into a consequence-based treatment package so that the overall effects can be enhanced (Koegel et al., 2012; Luiselli, 2000). There is limited research exploring the isolated effects versus combined effects of these subtle manipulations and to what extent of manipulations are needed for individuals in order to achieve success outcomes in treating feeding difficulties.

To systematically examine the independent treatment effects of various treatment components, component analysis has been a common method within behavioral treatment studies. Cooper et al. (1995) established using component analysis to successfully identify treatment variables that affected food acceptance. To demonstrate how response reduction procedures could increase food acceptance, Cooper et al. (1995) conducted a sequential component analysis to evaluate the active variables responsible for improving and maintaining appropriate eating and mealtime time behavior. Cooper et al. (1995) implemented treatment packages involving both positive reinforcement and escape extinction components for food refusal with four young children with food refusal in an inpatient unit, using a reversal design by removing and then implementing specific components. The treatment packages were individualized for each participant and the experiment design included four phases (i.e., baseline, treatment package, component analysis, and follow-up). For three out of four participants, escape extinction in the form of non-removal of the spoon was shown to be an essential part in facilitating food acceptance (Cooper et al., 1995). Cooper et al. (1995) also highlighted the advantage of using a sequential component analysis was that it possibly eliminated the utilization of more intrusive treatment components which were unnecessary for the individual.

With a similar attempt to isolate the effects of positive reinforcement from escape extinction component, Hoch and colleagues (2001) conducted component analyses of a multi-component intervention including escape extinction (i.e., in the form of non-removal of the spoon and re-presentation) and DRA in the treatment of food refusal in a group of children with chronic food refusal. Consistent with Cooper et al. (1995) findings, results suggested that escape extinction was necessary to increase food acceptance, increase food consumption, and decrease food expulsion for all four participants (Hoch et al., 2001). DRA procedure alone was only effective with the maintenance of treatment effects with one participant (Hoch et al., 2001).

In Penrod et al. (2010), researchers conducted a sequential component analysis of a parent-conducted multi-component treatment package including DRA, escape extinction in the form of non-removal of the spoon, and demand fading with three children with food selectivity. Parents were trained to deliver the treatment protocol with their child at home with sessions videotaped for weekly feedback from the research team. Treatment integrity data were collected for 40% of all sessions and parent implementation fidelity ranged from 93% to 100% across all phases of treatment (Penrod et al., 2010). The study utilized a multiple baseline across participant design and revealed that one child increased food consumption during DRA with reinforcer manipulation (Penrod et al., 2010). However, the two other children included in the study did not increase food consumption until the introduction of escape extinction (Penrod et al., 2010). Because the study sequentially introduced treatment components based on how participants responded to the intervention, the authors concluded that escape extinction was necessary for two participants to increase food acceptance and decrease inappropriate mealtime behavior (Penrod et al., 2010).

Overall, the majority of research conducted with children with PFD includes multiple components. Again, consequence-based interventions including positive reinforcement-based procedures and response reduction procedures, antecedent-based interventions, or both, are reliably demonstrating effectiveness in treating feeding difficulties. More research endeavors have been made to evaluate the independent treatment effects of various treatment components in order to identify necessary dosage and level of support that are needed by children with various needs to improve their feeding and eating experience.

ABA-Based PIIs for Children with PFD

ABA is a frequent intervention technique for PII for children with PFD (Dahlsgaard & Bodie, 2018; Mueller et al., 2003; Murphy & Zlomke, 2016; Sharp et al., 2014). PII grounded in ABA allows parents to participate effectively in their child's treatment for behavioral management and skill development (Bears et al., 2015a; Johnson et al., 2007). Given that children with PFD often need intensive intervention, it is critical and even necessary for parents to implement interventions at home or in the community. A systematic review conducted by Sharp et al. (2010) evaluated interventions for PFD and determined that 25 out of 48 studies, or 52%, included a PII component. Past research has shown a wide variability in parent involvement in their child's treatment process. Feeding interventions typically involve highly trained therapists to provide direct intervention with the child before generalizing intervention to parents (Burrell et al., 2019; Laud et al., 2009; Sharp et al., 2011).

Sharp et al. (2011) conducted a retrospective chart review study on a group of autistic children to examine their nutritional status and mealtime behavior before and after admission to a day-treatment program with a partial PII component. As a part of the day-treatment program, parents were trained on implementing protocols with their child in the clinic to help generalize

improvements in feeding behaviors. Most of the children in the study, 12 out of 13, had parents who completed caregiver training about halfway through the total number of sessions and were incorporated into treatment after demonstrating proficiency (Sharp et al., 2011). All participants showed an increase in food acceptance from baseline to discharge (Sharp et al., 2011). Parents were able to sustain improvements through generalization; however, parents were faded into treatment after significant progress had been achieved with a trained therapist (Sharp et al., 2011). Sharp et al. (2011) noted that because parents were often introduced into day-treatments after the child received individual intervention with a trained therapist, it is not known if comparable treatment outcomes would be achieved if parents served as primary interventionists from the onset of treatment.

Thus, the efficacy and feasibility of having parents as primary interventionists from the onset of intervention has become a focus of study (Anderson & McMillan, 2001; Bui et al., 2013; Dahlsgaard & Bodie, 2018; Gentry & Luiselli, 2008; Johnson et al., 2019; Johnson et al., 2015; Morawska et al., 2014; Muller et al., 2003; Najdowski et al., 2003; Najdowski et al., 2010; Tarbox et al., 2010; Seiverling et al., 2012; Sharp et al., 2019; Sharp et al., 2014; Werle et al., 1993). Overall, 12 of 26 studies have included PII at the beginning of treatment with parents as the primary interventionists. Of those 12 studies, 10 studies utilized single-case design with one randomized controlled study and one non-experimental study (Aponte et al., 2019).

Evaluating PII Using Single-Case Research Design

Werle and colleagues (1993) evaluated the effects of a behavioral parent training program for parents of children with chronic food refusal. The training involved behavioral strategies such as prompting and DRA for parents to offer foods that their child previously rejected. Results of a noncurrent multiple baseline design across 3 mother-child dyads indicated that all children had

an increase of food acceptance and in turn improved parent-child interactions (Werle et al., 1993). A single-subject research study conducted by Anderson and McMillan (2001) evaluated the efficacy of a PII treatment package including escape extinction and differential reinforcement of alternative behaviors (DRA) in a home setting with a 5-year-old child with pervasive developmental disorder and severe intellectual disability who displayed oral motor difficulties and food selectivity. Parents were instructed to videotape all the baseline and treatment sessions. Parents received training on verbal instruction, written instruction, modeling, and feedback from trained therapists after the completion of baseline (Anderson & McMillan, 2001). The experiment utilized an ABAB reversal design and revealed an increase in food acceptance, from 0% at baseline to 100%, when presented with novel food (Anderson & McMillan, 2001). Parent adherence to protocol ranged from 87% to 93% depending on the type of food presented (Anderson & McMillan, 2001).

In a 2003 study, Najdowski and colleagues found a parent-conducted functional analysis and treatment package consisting of DRA, escape extinction, and demand fading to be effective in increasing food acceptance at home and in a restaurant with a 5-year-old autistic boy with food selectivity. The child's mother was trained to deliver antecedents and consequences as instructed by the researcher to conduct functional analysis in a home setting, suggesting the child's food refusal was maintained by negative reinforcement (i.e., escape function). A multiple baseline across settings was utilized to evaluate the effects of DRA only and DRA plus escape extinction plus demand fading. During the treatment, the mother acted as her child's primary therapist and was instructed to collect data at home. The results indicated that a treatment package with DRA, escape extinction, and demand fading was more successful than DRA alone in increasing the child's acceptance of non-preferred food (Najdowski et al., 2003). Follow-up at

2, 4, 6, and 12 weeks after intervention suggested that behavioral changes were maintained and generalized across settings (Najdowski et al., 2003). Parents reported that the delivery of the treatment package was acceptable (Najdowski et al., 2003). The study failed to report data on procedural fidelity (Najdowski et al., 2003).

To extend their previous work, Najdowski et al. (2010) implemented a similar protocol comprised DRA, escape extinction in the forms of non-removal of the spoon and re-presentation of expelled bites, and demand fading with two autistic children and one typically developing child. A multiple baseline across participants design was used to examine the effectiveness of this treatment package with food selectivity. Parents were trained initially on the treatment protocol and were supervised until they met procedural fidelity of 90% or above. Results from all three children showed an increase in compliance of swallowing bites with the DRA plus escape extinction plus demand fading treatment package. Follow-up data also supported the maintenance of behavior change. Parents were in charge of all treatment implementation and data collection at home with support from the research team. This study emphasized closely monitoring parent implementation fidelity throughout the intervention (Najdowski et al., 2010). The study conducted by Najdowski et al. (2010) expanded on the previous work of Najdowski et al. (2003) by implementing a method for systematically decreasing the reinforcement magnitude and schedule.

Bui et al. (2013) trialed a procedure comprised of escape extinction and DRA to examine effectiveness with a 2-year-old autistic child with feeding difficulty. Parents received a 45-min training session to learn escape extinction procedures and a DRA strategy in the form of verbal praise (e.g., “very good,” “that’s good”) every time the child accepted a bite (Bui et al., 2013). Parents conducted all baseline and intervention sessions at home for 30 min each session (Bui et

al., 2013). The study employed a multiple baseline design across multiple meals and the results showed a significant increase in food acceptance across breakfast, lunch, and dinner (Bui et al., 2013). Results from the follow-up sessions revealed the behavioral gains maintained post treatment and parents reported positive changes in the child's other mealtime behaviors (Bui et al., 2013). The authors did not report on the parents' fidelity with implementing the treatment protocol.

Another single-case research study by Tarbox et al. (2010) adopted a modified escape extinction procedure in the form of non-removal of the meal, meaning the child was not allowed to leave the table until the food was finished, coupled with prompting a 3-year-old autistic child with food selectivity using an ABAB reversal design. Treatments occurred in the child's home; procedures were implemented by the child's parent with monitoring from a behavior consultant. Results of this study showed promise for increasing consumption of percentage of food presented (Tarbox et al., 2010). At a 9-week follow-up, results revealed that the child consumed 100% of his presented meal, indicating the maintenance of behavior change (Tarbox et al., 2010).

Escape extinction, used alone or in conjunction with positive reinforcement, has been widely investigated and many studies have found protocols using an escape extinction component to be effective in increasing acceptance and decreasing refusal (Anderson & McMillan, 2001; Bui et al., 2013; Najdowski et al., 2010; Najdowski et al., 2003; Penrod et al., 2010; Tarbox et al., 2010). In contrast, a smaller body of research has explored the outcomes of PII for PFD using other behavioral interventions without escape extinction. Gentry and Luiselli (2008) used a changing criterion research design to evaluate treatment outcomes with a 4-year old boy with pervasive developmental disorder and food selectivity using PII in the home setting.

A trained therapist scheduled in-home visits weekly to provide parent training on intervention procedures. The parent received verbal instruction, rehearsed implementation, and was observed during feeding intervention implementation followed by performance feedback (Gentry & Luiselli, 2008). The intervention procedures included a "mystery motivator" spinner to provide a delayed positive reinforcement, as well as a contingent plan for noncompliant behaviors (Gentry & Luiselli, 2008). The study showed that with this in-home PII, the child increased the consumption of types and amounts of foods and results maintained at follow-up (Gentry & Luiselli, 2008).

A concurrent multiple baseline study conducted by Cosbey and Muldoon (2016) evaluated a treatment package *EAT-UP* utilizing antecedent strategies coupled with positive reinforcement in three autistic boys with food selectivity. EAT-UP is a parent-implemented multicomponent intervention package including visual supports, hierarchical exposure, positive reinforcement, and functional communication training. Child variables on food acceptance and challenging mealtime behaviors were collected using both direct observation and pre- and post-intervention questionnaires. In addition, percent of parent implementation of target behaviors were also collected using direct observation. The results indicated that all children participated in the study demonstrated increases in food acceptance, expansion in dietary variety, and decrease in challenging mealtime behavior. Parents procedural fidelity was being tracked throughout training and all parents met the criteria of 90% fidelity before eliminating coaching. Social validity of the intervention was assessed and parents reported high level of satisfaction and an increased family's quality of life.

Collectively, the use of PII for feeding interventions has primarily been studied using single-case research design. A larger number of PII have been implemented within the clinic

setting where the parents received one-on-one training to implement feeding interventions after their child worked one-on-one with feeding therapists (Sharp et al., 2011). A growing number of studies have investigated the efficacy of intervention when parents are trained to implement treatment strategies from the onset of the intervention (Anderson & McMillan, 2001; Bui et al., 2013; Cosbey & Muldoon, 2016; Gentry & Luiselli, 2008; Najdowski et al., 2003; Najdowski et al., 2010; Penrod et al., 2010; Tarbox et al., 2010; Seiverling et al., 2012). Escape extinction, a common response reduction component, has been used extensively in feeding treatment due to the escape-maintained function of food refusal behavior (Piazza, Fisher, et al., 2003).

Evaluating PII Using Group Experimental Design

Single-case studies have reported uniformly positive outcomes for ABA-based PII with children with PFD, including significant improvements in accepting a wider variety of foods and decreasing mealtime-associated challenging behaviors (Ledford & Gast, 2006; Sharp et al., 2014). Although the outcomes of these investigations are promising, the majority of these programs are delivered individually to children within an intensive treatment setting with extensive support from a highly trained professional. This brings into consideration the possibility of whether improvements can be attained with reduced support, primarily by having parents implement strategies at home (Sharp et al., 2014). In addition, PII studies utilizing single-case research method often involve a limited number of participants, which raises the inquiries about the extent to which the findings can be applied to a more extensive and varied population. Thus, there is a pressing need to standardize and manualize interventions, allowing for replication studies with larger and more diverse samples. Moreover, there is a growing demand to devise alternative delivery formats that render parent training more accessible and feasible (Morawska et al., 2014). Among PII studies for children with PFD that employed group

experimental design, the parent training delivery methods was either individually delivered or group-based.

Individually-delivered PIIs. To ensure that the intervention for children with PFD is tailored to individual needs, a group of researchers have aimed at delivering parent training individually. Turner and colleagues randomly assigned two groups of children with persistent feeding difficulties and their families to two groups, a behavioral parent training (BPT) group and a standard dietary education (SDE), with the attempts to compare the treatment effects between these two groups (Turner et al., 1994). A group of 12 children with their families participated in the BPT group which consisted of six weekly individual sessions that covered topics such as behavioral management techniques on child's eating behaviors, feedbacks, in vivo practices, and relapse-prevention training. The other eight children and their families who were assigned to the SDE group received three to four sessions (of 30 to 50 minutes duration) of nutrition education with a variety of topics such as age-appropriate food intake, age-appropriate feeding behaviors, nutritional guidelines, and mealtime settings (Turner et al., 1994). Children in both groups showed improvements on the child feeding behaviors as well as an increase of dietary variety. Moreover, parents who received BPT showed more positive parent-child interaction and higher level of satisfaction on treatment outcomes than parents in SDE group (Turner et al., 1994).

Dovey and Martin (2012) implemented a 16-week therapeutic intervention with twenty four children with poor dietary variety and their families. Direct individual training was scheduled for four times throughout the 16-week treatment period. Parent training included health education, cognitive restructuring, social learning theory, behavioral principles that prepared parents for in vivo mealtime practices in the later sessions (Dovey & Martin, 2012).

Parent training follows an outline, but necessary changes were made so that it was tailored to individual needs. The study not only administered feeding-related questionnaires but also recorded the child's behavior during mealtimes (Dovey & Martin, 2012). The results indicated that children's dietary variety increased along with a reduction in problematic mealtime behaviors (Dovey & Martin, 2012).

Another manualized behavioral parent training program, *PT-F*, was developed by Johnson et al. (2015) for parents of autistic children with PFD. In *PT-F*, parents participated in a 9-session one-on-one training for 16 weeks (Johnson et al., 2015). Fourteen families of children between ages 2 and 7 attended a 60- to 90-min session weekly with tailored intervention strategies taught by a trained behavioral therapist (Johnson et al., 2015). Both treatment integrity (i.e., the delivery of treatment by the therapist as intended) and parent adherence to the delivered treatment were measured. The *PT-F* curriculum consisted of topics related to determining functions of mealtime maladaptive behaviors and antecedent-behavior-consequence models in changing feeding difficulties including reinforcement strategies, compliance procedures, and functional communication training (Johnson et al., 2015). Multiple modalities of training methods were employed during sessions, such as direct instruction, modeling, role-playing, parent in-session activity, and homework intending for individualization based on child-specific needs. Results were promising, supporting the overall feasibility and parent satisfaction of the treatment (Johnson et al., 2015). Both treatment integrity and parent adherence were high with an average score of 98.4% and 94.1%, respectively (Johnson et al., 2015). Child feeding outcomes based on parent report also showed significant increase in food intake, and general compliance and behavior improvements outside of mealtime (Johnson et al., 2015).

Johnson et al. (2019) expanded the original *PT-F* pilot study and recruited 42 autistic children between age 2 and 12 with feeding problems, and randomly assigned them to an 11-session *PT-F* parent training or a waitlist control. This randomized controlled study adopted the same procedure as the Johnson et al. (2015), but with more sessions (Johnson et al., 2019). Evidence for feasibility, high parent satisfaction, and strong implementation fidelity was documented for the treatment group (Johnson et al., 2019). Parent-reported child mealtime behaviors showed a greater reduction in children whose parents participated in the *PT-F* (Johnson et al., 2019).

In a recent dissertation, Breiner (2023) virtually delivered a two-session, parent-training approach, "ARFID Parent Training Program (ARFID-PTP)," to a group of 27 parents with children ages 5 to 12 with ARFID. Treatment sessions covered five core components which were psychoeducation, mealtime hygiene, daily food exposures, differential attention, and reward systems. The study focused on examining the feasibility and acceptability of a brief, virtual PII for children with ARFID. High acceptability and satisfaction ratings from the participating families suggested that ARFID-PTP is a highly acceptable treatment approach. In addition, feasibility was approved to be high as evidenced by high retention rate, high clinician adherence to treatment, and relatively low measurement burden (Breiner, 2023).

Group-based PIIs. Within the past two decades, studies on evaluating PIIs for children with PFD started to explore group-based parent training either in-person or via telehealth. A quasi-experimental research study conducted by Fraser et al. (2004) examined the effectiveness of a single-session parent education program called *Fun not Fuss with Food* (Fraser et al., 2004). Over 100 consenting parents with typically developing children with PFD were divided into 12 groups (Fraser et al., 2004). The *Fun not Fuss with Food* is a 150-min education program that

covers content areas of childhood nutrition and behavioral management strategies. Parents who attended the program reported improvements in their child's eating behaviors and decreases in their parental concerns (Fraser et al., 2004). Owen and colleagues conducted an interprofessional led parent group combined with mealtime observations for parents with children with PFD (Owen et al., 2012). The parent group consisted of five sessions with topics including individualized nutrition guidance, oral motor development strategies, mealtime behavior management strategies. A group of 30 parents participated in the parent training and reported decrease of children's feeding difficulties as well as decrease of parental problems with feeding (Owen et al., 2012).

Morawska et al. (2014) conducted a randomized controlled trial to evaluate a brief parenting discussion group, *Hassle Free Mealtimes Triple P* (HFMTP; Morawska et al., 2014), for childhood feeding difficulties. HFMTP is a 2-hour discussion group on positive parenting strategies for typically developing children who display problem behaviors at mealtime. Eighty-six parents with children aged 2 to 5 years old participated in the study with half of the parents randomly assigned to participate in the waitlist control (Morawska et al., 2014). HFMTP is based on behavioral interventions and social learning theory including topics around causes of feeding difficulties, establishing mealtime schedules, positive reinforcement, planned ignoring, consequences, and strategies to increase food assumption (Morawska et al., 2014). Multi-modal teaching methods included didactic instruction, video modeling, role-play, and homework. Results from pre- and post- measures supported the efficacy of this brief parenting intervention in ameliorating challenging behaviors during mealtimes based on parent report (Morawska et al., 2014). The results from the aforementioned studies have demonstrated the effectiveness of a brief parent training program in decreasing children's problem behavior associated with

mealtime, supporting a group-formatted brief intervention as a credible strategy when working with families (Fraser et al., 2004; Morawska et al., 2014).

Based on the preliminary success on group-based PII, a constellation of programs with structured manuals have explored the feasibility and effects of group-based PII for children with PFD (Dahlsgaard & Bodie, 2018; Sharp et al., 2019; Sharp et al., 2014). Sharp et al. (2014) first designed the *Autism MEAL Plan*, a behaviorally-based parent-training curriculum, to address PFD in autistic children. A randomized-controlled study evaluated the feasibility of this group-based parent-training curriculum and presented preliminary outcome data of the effectiveness of this curriculum (Sharp et al., 2014). Ten families participated in the treatment group and received eight, 1-hour group sessions covering topics including behavior strategies to decrease inappropriate mealtime behavior, functional communication training, and antecedent manipulation (Sharp et al., 2014). Following treatment, parents indicated high overall satisfaction with the program and reported reduced family stress (Sharp et al., 2014). Sharp et al. (2014) noted no changes in children's mealtime behaviors or dietary variety after parents received the curriculum and applied intervention strategies with their autistic children with PFD. Sharp et al. (2014) contributed the lack of improvements to the heterogenous nature of clinical presentations of PFD.

Sharp et al. (2014) further identified the importance of incorporating screening measures to quantify feeding concerns to determine the appropriateness of intervention. Moreover, the study did not provide details for how to train parents to implement interventions or present data on parent implementation fidelity. Some future directions were proposed by the authors to assess procedural fidelity and to enhance the overall training experience. They recommended including direct observation of parents' implementation to provide information regarding protocol drift

(Sharp et al., 2014). Adding activities such as coaching, modeling, and role-play were suggested for future group training (Sharp et al., 2014).

Extending from the pilot study conducted by Sharp et al. (2014), Sharp et al. (2019) conducted another 16-week randomized trial to compare the effects of parent training with parent education for autistic children with moderate food selectivity. The parent training group received 90-min sessions delivered over 12 weeks, whereas the parent education group received 90-min sessions of modified curriculum for 10 sessions (Sharp et al., 2019). A total number of 38 eligible children and their families participated in the study with 19 in the parent-training group and 19 in the parent education group (Sharp et al., 2019). Ratings on feasibility and parental satisfaction showed similar results to the Sharp et al. (2014) study, in which parents reported high level of satisfaction and strong social validity. Outcome measures also suggested that the *MEAL Plan* improved mealtime maladaptive behavior and promoted dietary diversity in autistic children with moderate food selectivity (Sharp et al., 2019). Follow-up results at the 1-month post-treatment visit also showed enduring changes in the child's behavior (Sharp et al., 2019). This study incorporated suggestions from Sharp et al. (2014) to include direct observations of parent-child dyads during meal demonstration as well as a screening tool with eligibility criteria to quantify feeding concern. In addition, Sharp et al. (2019) included the evaluation of therapist fidelity but did not address parent adherence to protocol.

Similarly, Dahlsgaard and Bodie (2018) reported outcomes of 21 children (ages 4-11) with PFD who displayed characteristics of being food selective after their parents participated in a manualized parent-only group treatment for seven sessions. Parents were trained with behavioral-based strategies to provide their children with daily in-home exposure to nonpreferred foods and manage problematic mealtime behaviors (Dahlsgaard & Bodie, 2018). Data were

collected at pretreatment, posttreatment, and at 3-month follow up. The curriculum was adapted from an evidence-based cognitive-behavioral therapy model for children with anxiety disorder (Dahlsgaard & Bodie, 2018). Parents were instructed to practice assigned behavioral strategies, such as exposure, habituation, differential reinforcement, and contingency management with their child at home. Parent adherence to the protocol of daily practice sessions was monitored throughout the intervention. Each group consisted of two to four parents who received verbal instruction, participated in role-play, and were provided feedback and problem-solving opportunities. Overall, results showed significant pre-post treatment reductions in symptoms associated with food selectivity among typically developing children and continued to maintain at 3-month follow-up (Dahlsgaard & Bodie, 2018). Ratings of parent satisfaction also suggested that parents were highly satisfied with treatment (Dahlsgaard & Bodie, 2018).

PII for children with PFD have been primarily delivered on an individual basis using single-case research design. Single-case research design allowed researchers to systematically examine the level of changes within each individual. However, the downside of individualized training is that it requires extensive resources that can hinder the ability to replicate and generalize findings. A team of researchers endeavored to assess several parent training programs that were delivered individually. They employed group experimental design methods with the aim of refining the program content while still allowing room for customization to address individual needs (Breiner, 2023; Dovey & Martin, 2012; Johnson et al., 2015; Johnson et al., 2019; Turner et al., 1994). To further make the PII programs more cost-effective and accessible, more researchers aimed at developing standardized and manual-based group training for parents (Sharp et al., 2014). Studies using group design can reach to a larger number of population, however, group-based PII studies for parents of children with PFD are still emerging. Results

from studies that evaluated the effectiveness of group-based PII for children with PFD have found mixed results in decreasing mealtime behaviors, but have shown overall support in increasing child's food acceptance (Dahlsgaard & Bodie, 2018; Fraser et al., 2004; Morawska et al., 2014; Sharp et al., 2019; Sharp et al., 2014). Overall, group-based PII have shown merits in being short-term, cost-effective, and accessible compared to individualized treatment using single-case research design.

Evaluating PII Using Systematic Review and Meta-Analysis

Systematic review and meta-analysis in the field of PFD are emerging. There are only a handful of studies adopted these methodologies in examining the effects of available interventions for PFD. There are a few possible limitations in conducting systematic reviews and meta-analyses in this particular field which contribute to the lack of studies utilizing these methodologies. First, PFD encompasses a wide spectrum of conditions and clinical presentations. Due to the heterogeneity in the presentations and underlying mechanisms involved in this disorder, it often requires individualized intervention approaches that can vary significantly in terms of content, intensity, and duration (Fisher & Silverman, 2007; Goday et al., 2019; Lukens & Silverman, 2014; Maston & Fodstad, 2009; Sharp et al., 2017; Williams et al., 2010). As a result, systematic reviews and meta-analyses may face difficulties in synthesizing findings from studies to provide clear and concise conclusions (Lukens & Silverman, 2014). In addition, numerous studies have utilized a single-case research design, while those studies that employ this approach often suffer from limited statistical power due to their small sample sizes (Lukens & Silverman, 2014). Mari-Bauset and colleagues (2013) commented in their systematic review that the quality of research reviewed in their study was weak. Many studies lack rigorous methodologies, appropriate control groups, or long-term follow-up data (Mari-Bauset et al.,

2013). These limited qualities of evidence can pose added challenges when attempting to draw robust conclusions through systematic reviews and meta-analyses.

Over the last decade, there have been only a few reviews that have provided a summary of the evidence regarding psychological and behavioral interventions in the treatment of PFD. The first one was conducted by Kerwin in 1999. Kerwin reviewed published studies between 1970 and 1997 reporting psychosocial and behavioral interventions targeting severe pediatric feeding problems. In the review, Kerwin (1999) identified the most effective intervention approaches including positive reinforcement for acceptance, escape extinction (i.e., nonremoval of the spoon), and swallow induction training. Another review conducted by Williams and colleagues (2010) identified 38 intervention studies that were published between 1979 and 2008. The authors' conclusion highlighted that the studies demonstrate the benefits of incorporating behavioral interventions in the treatment of severe feeding problems (William et al., 2010). Among the various behavioral interventions discussed in these studies, escape extinction emerged as a pivotal and actively contributing component (William et al., 2010).

Lukens and Silverman conducted a systematic review of the research evaluating the effects of psychological interventions of PFD (Lukens & Silverman, 2014). The review identified 13 studies published between 1998 and 2003. The authors used Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology, a risk of bias assessment, to estimate the quality of the existing evidence and concluded that the preponderance of evidence supports the positive effects of psychological interventions in the treatment of PFD (Lukens & Silverman, 2014). However, the limited data availability and the scarcity of studies employing randomized controlled trial (RCT) methodologies restricted the

extent of conclusions derived concerning the effectiveness of these interventions (Lukens & Silverman, 2014).

Sharp and colleagues conducted another systematic review and meta-analysis in 2017, which assessed intensive multidisciplinary interventions for PFD and included 11 studies conducted between 2000 and 2015. The key findings of this study included 1) multidisciplinary interventions should be considered as the standard care model for individuals with PFD; 2) ABA-based interventions are central components for positive changes in feeding-related outcomes (e.g., increasing oral intake, expanding food variety, and addressing mealtime problem behaviors); and 3) it is ideal to include caregivers in the intervention process in order to achieve better treatment generalization (Sharp et al., 2017). In 2021, Gomes and colleagues conducted a systematic review and meta-analysis on web-based parent interventions designed for parents of 0-12-year-old children with feeding difficulties with the aim to promote children's healthy diet and/or to prevent nutrition-related problems. The 12 RCT interventions studies that Gomes and colleagues reviewed targeted a wider range of target populations that included both healthy and clinical populations (Gomes et al., 2021). The meta-analysis results indicated that most programs' effects were relatively small and it suggested the needs to develop high-quality controlled trials with larger sample size (Gomes et al., 2021).

In contrast to the limited number of review studies that explored the impact of behavioral and psychological interventions in the treatment of PFD, a couple of systematic review studies have specifically examined food selectivity and feeding issues in autistic children. Ledford and Gast (2006) dentified nine intervention studies published between 1994 and 2000 that focused on the feeding problems and psychological treatment of PFD in autistic children. The results showed that all intervention studies included in the review reported successful outcomes of

treating feeding problems in autistic children. It also highlighted that the studies employed various behavioral approaches (e.g., differential reinforcement of acceptance, escape extinction, simultaneous presentation, sequential presentation, stimulus fading, and appetite manipulation), either individually or in combination (Ledford & Gast, 2006). Mari-Bauset and colleagues (2013) conducted the initial systematic review aimed at assessing the strength of evidence in treatment studies for food selectivity within autistic population. The study uncovered a prevailing consensus affirming a connection between food selectivity and ASD. The authors asserted that the behavioral interventions employed in the studies resulted in substantial enhancements in calorie intake and weight gain among autistic children (Mari-Bauset et al., 2013).

In 2014, Marshall and her colleagues conducted a review of 23 studies conducted between 2000 and 2013, all of which centered on early interventions for autistic children under the age of 6 with feeding challenges. The meta-analysis yielded a medium to large effect size (mean = 0.69, 95% CI 0.60-0.79), suggesting that the studies included in the review consistently reported positive effects in increasing desirable behaviors (e.g., food acceptance or grams consumed; Marshall et al., 2014). A subsequent systematic review was conducted by Ledford and colleagues in 2018. The authors identified 65 single-case research studies focusing on improving mealtime behaviors for autistic individuals and summarized the characteristics of the participants, procedures, study quality, and outcomes. The results revealed that interventions were typically implemented by clinicians/researchers in the clinical setting rather than indigenous adults in the typical setting (Ledford et al., 2018). In addition, the authors emphasized the importance of opting for less restrictive interventions when delivering treatment for feeding-related behaviors for autistic individuals (Ledford et al., 2018).

A group of occupational therapists attempted to define food selectivity and sensitivity issues in autistic children and further evaluate three types of intervention approaches (i.e., Sequential Oral Sensory, Sensory Integration, and DRA) utilizing a systematic review methodology (Reinoso et al., 2018). The results indicated that DRA intervention procedures were predominantly used to address food selectivity and consistently demonstrated favorable results in increasing food acceptance, whereas Sensory Integration showed promises in treating food sensitivity (Reinoso et al., 2018). Furthermore, Sequential Oral Sensory has demonstrated promises in targeting both feeding aversions and it was recommended by the authors (Reinoso et al., 2019). While this systematic review concentrated on intervention approaches frequently employed by occupational therapists, it consistently presented research findings supporting the efficacy of behavioral interventions in addressing maladaptive feeding behaviors (Reinoso et al., 2018). Diaz and Cosbey (2018) also performed a systematic review analyzing occupational therapy interventions that were implemented by caregivers targeting feeding difficulties in autistic children. A total of 13 single-case research design studies were evaluated using a modified Feasibility, Appropriateness, Meaningfulness and Effectiveness (FAME) scale (Diaz & Cosbey, 2018). The results indicated that behavioral strategies (e.g., DRA, shaping, and prompting) were used consistently and showed effectiveness in improving children's feeding outcomes (Diaz & Cosby, 2018).

A systematic review was conducted by Chawner and colleagues in 2019 and included 34 intervention studies from 2000 to 2018 that focused on increasing acceptance of new foods among individuals with developmental disorder (DD). Thirty-one out of 36 studies retrieved were based on ABA and the majority of studies utilized combined components during interventions, which were all consistent with previous findings (Chawner et al., 2019). Aponte

and colleagues (2019) conducted a scoping review of parent training for feeding problems in autistic children. This review marked the first attempts of a quantitative and comprehensive assessment of the outcomes of PII treatment for feeding. The review identified 26 studies published between 1996 and 2017 that utilized parent training as a part of the intervention package. According to the synthesized data, the majority (23 out of 26) of the studies utilized a single-case research design or case study and the rest of the three included one non-experimental design, one retrospective chart review, and one RCT (Aponte et al., 2019). This finding is consistent with previous findings that the research on treatment methods for PFD is predominantly comprised of single-case research studies. The authors emphasized the significance of transitioning from single-subject studies to group studies that incorporate standardized intervention and research protocols, enabling more definitive tests of efficacy (Aponte et al., 2019). Similar to clinician-delivered treatments for individuals with PFD, the results of this review indicated that most ABA-based PII for feeding employed multi-component behavioral treatment packages (Aponte et al., 2019).

In the most recent systematic review by Blennerhassett and colleagues (2023), 36 caregiver-led feeding intervention studies addressing food selectivity in autistic children were identified. To extend from Aponte and colleagues' (2019) review, this study put an emphasis on evaluating the effectiveness of the following three outcomes: 1) child's food intake and mealtime behaviors, 2) family-related outcomes (e.g., quality of life, caregiver/parental stress), and 3) the acceptability of the intervention. While similar conclusions were reached, the authors underscored the advantages of engaging caregivers in the intervention program at an early stage, highlighting that commencing parent training early on could prove to be an effective strategy for reducing healthcare resource utilization (Blennerhassett et al., 2023).

Limitations and Future Directions of ABA-Based PII for PFD

Despite noteworthy successes of PII in reducing feeding problems in children with and without ASD, there are several limitations with procedures and research designs in PII studies. The first limitation of ABA-based PII for PFD using group experimental design is the outcome measure of independent variable when evaluate the effectiveness of the parent training program (Aponte et al., 2019; Blennerhassett et al., 2023). Specifically, the first randomized controlled design evaluating a group-based PII for feeding problems in autistic children with PFD had pointed out the limitation of relying on parent reported data as an outcome measure (Sharp et al., 2014). An updated randomized clinical trial by Sharp et al. (2019) used the grams consumed data during direct meal observations as a secondary outcome measure but did not record other direct behavioral data such as bite acceptance, food refusal, or challenging mealtime behavior.

Another limitation of PII for PFD is the lack of standardized procedural fidelity checks after parents are trained to implement interventions, not alone using direct observation as an outcome measure (Aponte et al., 2019). A number of studies examining interventions to treat PFD did not provide procedural fidelity checks or information regarding specific strategies used for training the parents (e.g., Bui et al., 2013; Najdowski et al., 2003; Sharp et al., 2014). According to a systematic review of PII for children with food selectivity, only two out of eight studies reported data on parent performance and provided detailed information regarding training procedures within the study (Seiverling et al., 2012). It is critical for parents to maintain high fidelity while implementing interventions with their child for the treatment to be effective. Parent performance needs to be tracked throughout the parent training and treatment implementation phases. In both studies that reported parent performance data, researchers gave parents continuous feedback during initial training, and it was unclear whether the parents adhered to

protocols after the initial training was completed (Seiverling et al., 2012). Further studies need to focus on creating consistent measures of parent procedural fidelity during and after initial training to ensure protocols are implemented with high fidelity (Seiverling et al., 2012; Sharp et al., 2014).

Third, there is a need to evaluate which training modality is most effective for parents to ensure quality training. Literature in PII for feeding suggests that parents can be trained to implement feeding treatment with success in increasing food acceptance and decreasing food refusing in children with feeding difficulties (Anderson & McMillan, 2001; Werle et al., 1993). However, the specific strategies that are most effective for training parents to implement feeding treatments remain unknown (Mueller et al., 2003). Behavioral skills training, a procedure used to teach skills to a variety of populations using a wide variety of strategies such as direct instruction, modeling, rehearsal and feedback, has been studied in training parents to implement feeding interventions (Mueller et al., 2003). Both Mueller et al. (2003) and Seiverling et al. (2012) found that a behavioral skills training package could be used to successfully train parents to implement feeding interventions with high levels of fidelity. Results from Blennerhassett et al., (2023) also indicated that parents perceived the most beneficial components of PII for feeding included modeling which is a part of behavioral skills training. In addition, both Aponte et al. (2019) and Blennerhassett et al. (2023) stressed the importance of family-centered approach because parents value behavioral techniques that align with family values. Further studies may want to assess which specific strategies or components within the treatment package have the most success in training parents.

Fourth, there is a lack of systematic approach to evaluate acceptability. Assessing the acceptability of PII has involved various techniques, contributing to the intricacy of deriving a

consolidated conclusion from the literature. Nevertheless, its noteworthy that nearly all acceptability ratings were obtained from an abstract numerical score, or anecdotal feedback provided by parents, without considering the child's perspective (Blennerhassett et al., 2023). The authors proposed that employing a qualitative approach to assess acceptability with a supplementary numeric rating scale could offer a more comprehensive perspective from both parties involved (Blennerhassett et al., 2023).

In addition to the abovementioned limitations, several ethical concerns have been raised regarding the use of escape extinction, which is one commonly used behavioral treatment approach with evidence of effectiveness in reducing food refusal and increasing food acceptance. Because food refusal behaviors are often escape-maintained (Piazza, Fisher, et al., 2003; Piazza, Patel, et al., 2003), escape extinction is a common strategy in feeding interventions. The most common side effect of using escape extinction is extinction burst (Cooper et al., 2007; Lerman & Iwata, 1995). Extinction burst refers to a temporary increase in the frequency, intensity, or duration of a target response that occurs at the onset of extinction (Lerman et al., 1999). This temporary elevation in behavior can be detrimental in two ways. First, if the target behavior is dangerous, the extinction burst may result in injury or destruction (Vollmer & Athens, 2011). Moreover, the extinction burst may make parents less inclined to follow through the procedure because the behavior can be difficult to handle (Vollmer & Athens, 2011). Allison et al. (2012) found that parents rated escape extinction procedures as less acceptable when asked about acceptability of different treatment procedures.

Moreover, interventions that are forceful may cause an adverse impact on the child who is already fearful of the feeding demand (Hoch et al., 1994; Lerman & Iwata, 1995). Escape extinction often involve the use of physical prompts, non-removal of the spoon and re-

presentation of food, and these procedures can be seen as a form of "forced feeding" (Iwata et al., 1982; Riordan et al., 1984), can lead to other negative consequences in some cases. Physical prompting, for example, that are used to decrease food refusal can also be viewed as a punishment procedure (Tereshko et al., 2021). It can present problems such as contributing to the development of aspiration pneumonia (Perske et al., 1977) and can cause mealtimes to become aversive to children (Hoch et al., 1994; Piazza et al., 2009). Utilizing escape extinction in the form of non-removal of the spoon has also been associated with negative behaviors such as vocalizations and disruptions which can present difficulties to manage (Ahearn et al., 2001). Tereshko et al., (2021) stated that before implementing escape extinction procedure with a client, it is necessary to consult with medical and allied health professionals that such intervention procedure is warranted due to the severity of the individual's feeding problem.

Even though procedures that are more restrictive may result in faster behavior changes, given the side effects and ethical issues with the use of escape extinction procedures, the field of behavior analysis has been advocating for less restrictive procedures which can be very effective among children with PFD (Ledford et al., 2018). Van Houten and colleagues (1988) asserted that people have a right to receive the least restrictive effective treatment and behavior analysts have responsibilities to ensure that their clients are protected. As such, making sure that children are receiving least to most restrictive treatments should be a priority as a part of best practices when behavior analysts are working with children with PFD (Tereshko et al., 2021). According to the Behavior Analyst Certification Board's (BACB's), *Professional and Ethical Compliance Code for Behavior Analysts* requires implementers of ABA treatment should ensure that appropriate steps are taken to implement least restrictive procedures before moving toward to more restrictive procedures (BACB, 2014; Tereshko et al., 2021). Future studies should explore

alternative approaches besides escape extinction and develop appropriate guidelines for parents and professionals to implement (Ledford et al., 2018; Seubert et al., 2014).

Overall, future research should put an emphasis on utilizing better outcome measures (e.g., direct meal observation) as a standard tool to evaluate child outcomes instead of relying solely on parent reported data (Aponte et al., 2019; Sharp et al., 2014). In addition to improvements on standardization of outcome measures for child variables, it is also important to develop effective training methods and quality integrity checks to ensure procedural fidelity on both training delivery and intervention implementation (Aponte et al., 2019). Furthermore, future studies should include alternative intervention procedures other than escape extinction, ensuring safety and minimizing adverse events that may possibly arise during the intervention.

Statement of Purpose

ABA-based PII stands as one of the evidence-based practices with the potential to assist children dealing with PFD. There is considerable evidence for its efficacy in enhancing increasing food acceptance, reducing food refusal, and mitigating other feeding-related challenging behaviors. This support is based on an extensive body of evidence from both single-case research studies (e.g., Anderson & McMillan, 2001; Bui et al., 2013; Cosbey & Muldoon, 2017; Najdowski et al., 2003; Penrod et al., 2014; Tarbox et al., 2010) and group experimental designed studies (e.g., Dahlsgaard & Bodie, 2018; Dovey & Martin, 2012; Fraser et al., 2004; Johnson et al., 2015; Johnson et al., 2019; Morawska et al., 2014; Sharp et al., 2014; Sharp et al., 2019;). Unfortunately, the field of ABA-based PII for children with PFD currently lacks comprehensive systematic reviews and meta-analyses specifically focusing on group experimental design. These types of reviews are crucial as they are considered as the highest level of evidence within the research field and can provide a holistic understanding of the

effectiveness of these interventions. To date, 14 systematic reviews were identified with only three included a meta-analysis. Among those 14 studies, nine studies focused on feeding difficulties in autistic children and only three studies evaluated parent-implemented type of interventions (Aponte et al., 2019; Blennerhassatte et al., 2023; Chawner et al., 2019; Diaz & Cosbey, 2018; Gomes et al., 2021; Kerwin, 1999; Ledford et al., 2018; Ledford & Gast, 2006; Lukens & Silverman, 2014; Mari-Bauset et al., 2013; Marshall et al., 2014; Sharp et al., 2017; William & Seiverling, 2010). For those three review studies evaluating PII, reviewers paid special attention on synthesizing evidence from single-case research studies (Aponte et al., 2019; Blennerhassatte et al., 2023).

In order to close the gap, this present study aims to systematically review studies utilizing group experimental design. This methodology encompasses the involvement of multiple individuals concurrently, offering a nuanced understanding of the cumulative effects of ABA-based PII when implemented within groups of parents dealing with children with PFD. The shift from single-case research design to a group-based methodology allows for a more comprehensive examination of the intervention's broader implications and its effectiveness within a group context. Another contribution of this research is including intervention studies for children with and without ASD, which aims to consider a broader spectrum of evidence thus offering a more holistic understanding of ABA-based PII's effectiveness. In essence, this research represents an important step forward in the field by expanding the scope of assessment for ABA-based PII in the context of PFD. This study signifies a transition toward a more inclusive and group-oriented approach to treatment, and findings have the potential to shape the future of interventions for children with PFD.

Chapter 3. Methods

Inclusion and Exclusion Criteria

To gather evidence regarding the effectiveness of ABA-based PII for children with PFD, a meta-analysis of quantitative studies has been conducted. The procedures for this meta-analysis have also been registered in the International Prospective Register of Systematic Reviews (PROSPERO; No. 515974). Article selection procedure used in this study was in accordance with the Population, Intervention, Comparator, Outcome (PICO) framework proposed by the Cochrane Handbook for Systematic Reviews (Higgins et al., 2019). To be included in this systematic review, articles required to meeting the following criteria:

1. Population: (a) the sample involved pediatric populations (birth to 18 years of age), (b) target participant met the criteria for PFD or had a diagnosis of avoidant restrictive food intake disorder (ARFID) or failure to thrive or oral dysphasia or had dependency on enteral feeding or oral nutritional formula supplementation.

2. Intervention: (a) the intervention was implemented primarily by caregivers in either a clinical setting or a home setting, (b) at least one of the intervention strategies delivered to the child is ABA-based. According to the literature review, included articles must have utilized at least one intervention strategy that falls into two broad categories: consequence-based procedures (e.g., non-contingent reinforcement, positive reinforcement, escape extinction) or antecedent-based procedures (e.g., stimulus fading, simultaneous and sequential presentation of preferred and non-preferred foods, use of high-probability instructional sequence, prompting).

3. Comparator: The study's comparator includes either (a) a comparison group receiving a different intervention type than ABA-based PII for PFD or (b) a waitlist control. Additionally,

due to the limited number of studies in the field, single-group pre- and post-test designs were considered for inclusion in this analysis.

4. Outcome: the primary outcomes involved improving feeding-related issues such as increasing food acceptance and volume, expanding dietary variety, improving mealtime behaviors, or decreasing food refusal.

In addition, included studies must have employed one of the group experimental designs such as randomized controlled trial and quasi-experimental design (e.g., nonequivalent groups designs, pre-and post-test, and interrupted time-series design, etc.) to investigate treatment outcomes. Studies with designs other than group experimental designs (e.g., single-case research design, case report, commentary or opinion paper, discussion paper, systematic reviews, and meta-analysis) were excluded. Moreover, studies were excluded if the intervention was delivered partially by caregivers or if the intervention did not employ any ABA-based strategies as described above. Each article will reviewed carefully against inclusion and exclusion criteria as outlined in Appendix A.

Literature Search

The search was conducted in peer-reviewed English-language journals and other grey literature written in English. After initial informal scoping searches, nine bibliographic databases (CINAHL, Cochrane Library-Central, Embase, Education Resources Information Center (ERIC), Education Source, PsychINFO, ProQuest Dissertations and Theses, PubMed, Web of Science) were searched by the author for relevant published and unpublished literature from inception to January 31st, 2024. The compilation of keywords and Boolean search terms were formulated by referencing those employed in similar systematic reviews, such as those conducted by Aponte et al. (2019) and Blennerhassett et al. (2023), as well as terms featured in studies on ABA-based PII

studies in PFD. The search terms were classified into two main categories: those related to PFD such as ARFID, feeding difficulties, feeding disorder, and food selectivity; and those associated with the implementation approach, including parent-implemented, caregiver-implemented, and parent training. The specific terms and their variations were tailored to meet the criteria of each database, including using MESH terms and Boolean operators (see Table 1 for search syntax). To ensure the adequacy of the selected databases and search terms, consultation with a librarian specializing in education and social sciences research were sought throughout the search process. The search process resulted in 2,105 sources.

In addition, to ensure the inclusion of all pertinent studies overlooked by electronic searches, two complimentary manual searches were conducted. First, backward and forward searches of references contained in cited studies were performed. Next, a hand search was performed through the table of contents of most relevant journals to identify sources that may not have been indexed in the original searches due to recent publication. Eight journals (i.e., *Journal of Applied Behavior Analysis, Behavior Interventions*, *Behavior Research and Therapy*, *Behavior Analysis in Practice*, *Journal of Autism and Developmental Disorders*, *Journal of Developmental and Physical Disabilities*, *The Journal of Pediatrics*, *Journal of Pediatric Psychology*) were hand-searched for articles published between 2022 and 2023 as well as articles not yet assigned to an issue. This search process resulted in additional 4 sources.

Study Selection

Following the guidelines outlined by the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA; Page et al., 2021), the following selection process was conducted by the author. From the initial search, 591 duplicate articles were removed. Of the remaining, 1,518 articles, 1,435 were screened based on title and abstract and later removed

based on the inclusion and exclusion criteria using Rayyan (Ouzzani et al., 2016), a web-based tool for systematic review. Lastly, 83 articles underwent the full-text review to further assess the eligibility and 72 were excluded based on predefined inclusion and exclusion criteria, which resulted in the identification of 11 article for this systematic review and meta-analysis. Appendix B depicts the PRISMA flowchart outlining the search process.

Inter-Rater Agreement for Inclusion Criteria

Two research assistants were recruited by the author to perform related tasks such as initial screening and data coding after attending training sessions delivered by the author. One research assistant was a second-year graduate student in school psychology at a public university and the other research assistant was a second-year graduate student in counseling psychology program from a different public University. The author and one research assistant independently performed the initial screening of titles and abstracts using the Rayyan selection tool following the initial database search (Ouzzani et al., 2016). Rayyan facilitates the collaborative screening process, allowing two researchers to autonomously assess articles and compare selection results. Inter-rater agreement between the author and the research assistant were calculated by dividing the number of agreements regarding accuracy of the summaries by the number of agreements plus disagreements between the two raters and multiplying by 100. The reliability between the research assistant and the author was 95% as automatically calculated by Rayyan. In case of discrepancies between the primary researcher and abovementioned research assistant, a reassessment was carried out by a second research assistant using the inclusion criteria reliability form (refer to Appendix C).

Data Collection and Extraction

Both research assistants were trained for data coding. A codebook with all variable definitions was created by the author to ensure the accuracy and consistency across coders (Appendix D). A data collection and extraction form was utilized to gather all necessary information. Coders independently extracted identifiable characteristics from each study including the following domains: (a) general information, (b) participant characteristics, (c) research design, (d) features of the PII training program, (e) treatment components taught to the caregivers, (f) independent variables, (g) dependent variables, (h) intervention outcomes, and (i) effect size calculated using statistics provided within the manuscript. These domains were selected to align with the research questions outlined in this study.

The author independently coded all the studies first and both research assistants then coded 4 articles (36%) out of all the included articles. The author then compared the results with each research assistant respectively and interrater reliabilities for data coding were calculated. Inter-rater reliability was calculated using the agreements divided by the total number of agreement and disagreements multiplied by 100. The inter-rater reliability between the author and each research assistant was 94% and 96% respectively. Consultation and discussion amongst the author and research assistants were held to solve any uncertainty and disagreements related to coding.

Measures Used to Determine Child Outcomes

The objective of this meta-analysis was to assess the impact of PII on children with PFD and their parents. Specifically, the analysis focused on a single construct for children – feeding behavior. Various measures, either individually or in combination with other instruments, were

employed in one or more of the included articles to gauge alterations in children's feeding behaviors.

Behavioral Pediatrics Feeding Assessment Scale (BPFAS). The BPFAS is a parent-report measure with a total of 35 items designed to obtain information on the mealtime behavior of children between the ages of 6 months and 12 years (Crist & Napier-Phillips, 2001; Crist et al., 1994). The BPFAS yields to four domain scores (i.e., Child Frequency, Parent Frequency, Child Problem, and Parent problem) to examine patterns of child and parent feeding behaviors around mealtimes with a greater overall score indicates higher level of problems around mealtimes (Poppert et al., 2015). The questionnaire requires parents to respond on a five-point Likert-scale with "1" being never and "5" being always. Parents are also required to answer yes or no to the question to indicate whether the listed behavior is a problem for them.

The BPFAS has evidence of reliability and validity to assess feeding problems across a range of pediatric populations (e.g., children with feeding problems, children with cystic fibrosis, autistic children, and children with diabetes; Allen et al., 2015; Crist & Napier-Phillips, 2001; Crist et al., 1994; Davis et al., 2014; Dovey, et al., 2013; Dovey & Martin, 2012; Martins et al., 2008; Patton at al., 2006). The BPFAS also has demonstrated adequate sensitivity and specificity in differentiating children with feeding problems from children in a non-clinical population (Crist & Napier-Phillips, 2001). The subscales of BPFAS have shown sensitivity to the decrease of problem mealtime behavior following intervention (Dovey & Martin, 2012).

Parent and Toddler Feeding Assessment (PATFA). The PATFA is a 90-item assessment with six subscales designed to evaluate children's problematic mealtime behaviors, parenting strategies, and parental cognitions about mealtimes (Adamson & Morawaska, 2008). Parents are required to indicate whether a listed behavior is problematic (yes/no) and then rate

the frequency of common mealtime problems on a 5-point Likert scale ranging from 1 (never) to 5 (almost always). Of primary interest in the current study was the total frequency of problematic child feeding behaviors, calculated by summing parent frequency ratings on the child feeding items. This assessment tool has demonstrated good internal consistency and test-retest reliability (Adamson & Morawaska, 2008).

Brief Autism Mealtime Behavior Inventory (BAMBI). The BAMBI, developed by Lukens and Linscheid in 2008, is an 18-item questionnaire designed to assess mealtime behaviors commonly observed in autistic children. The questionnaire utilizes a Likert scale (1 = Never/Rarely to 5 = At Almost Every Meal) for parents to report the frequency of various behaviors. The total score, as well as scores on three subscales (Limited Variety, Food Refusal, and Features of Autism), are calculated. The Limited Variety subscale evaluates a child's willingness to try new foods and food preferences based on preparation, texture, or type. The Food Refusal subscale examines problem behaviors during meals, such as crying, expelling, and disruptions during meals. In addition, the Features of Autism subscale specifically assesses inattention, self-injury, and rigid behavior patterns during meals (Lukens & Linscheid, 2008). The BAMBI has demonstrated good internal consistency, high test–retest reliability, and effectively discriminates between autistic children and typical controls (Lukens & Linscheid, 2008).

Child Eating Behaviors Questionnaire (CEBQ). The CEBQ is a 35-item parent-report measure designed to assess children’s variation in eating styles related to obesity risk (Ek et al., 2016; Sleddens et al., 2008; Wardle et al., 2001). The CEBQ consists of a total of eight dimensions of feeding behaviors with four subscales of Food approach (i.e., Food responsiveness, Emotional overeating, Enjoyment of food, and Desire to drink) and four

subscales of Food avoidance (i.e., Satiety responsiveness, Slowness in eating, Emotional undereating, and Food fussiness; Poppert et al., 2015; Wardle et al., 2001). Parents are asked to rate their child's eating style using a five-point scale ranging from "Never" to "Always" (Hendy et al., 2010; Wardle et al., 2001). High scores on Food approach have been associated with higher weight whereas children with high scores on Food avoidance may found to have lower weight (Ek et al., 2016).

The CEBQ was originally validated with children in the United Kingdom ages 2-9 years old and it was shown to have a good internal consistency (Cronbach's alpha ranging from 0.72 to 0.91) and an acceptable test-retest reliability (correlation coefficients ranging from 0.52 to 0.87; Ek et al., 2016; Sleddens et al., 2008). The CEBQ was later validated in many other countries and used to assess children up to age 13 (Ek et al., 2016; Gao et al., 2020; Loh et al., 2013; Quah et al., 2017). The CEBQ was originally designed to assess mealtime behavior in non-clinical populations, but it has been widely used in populations with developmental disabilities such as ASD (Seiverling et al., 2011), and children with ARFID (Hendy et al., 2010). The Food fussiness subscale, in particular, was used as a measure of picky eating and found to have strong sensitivity in discriminating picky eaters from non-picky eaters (Steinsbekk et al., 2017).

Pica, ARFID, Rumination Disorder Interview (PARDI). The PARDI was originally developed as a structured diagnostic interview to assess pica, ARFID, and rumination disorder. It has undergone adaptations to include both self-report and caregiver-report versions, with a specific focus on ARFID (PARDI-AR-Q; Bryant-Waugh et al., 2019). The PARDI evaluates general eating patterns as well as ARFID-specific criteria (e.g., reliance on supplements, difficulty maintaining or gaining weight, and issues related to stunted growth). The PARDI-AR-Q is a 32-item questionnaire that delves into the distinctive characteristics associated with the

three subtypes of ARFID (Bryant-Waugh et al., 2023). In an initial validation study, the PARDI-AR-Q showed promising results in terms of its validity and reliability as a tool for identifying potential cases of ARFID in clinical or research settings (Bryant-Waugh et al., 2023).

Mealtime Observation Schedule – Revised (MOS-R). The MOS-R is an interval time-sampling procedure that parents' and child's mealtime behaviors were coded in 10-second intervals. The original MOS was derived from the Family Observation Schedule within the Positive Parenting Program (i.e., Tripple P; Sanders et al., 1989) and has been tailored for observations of child feeding behaviors and parent-child mealtime interactions across a wide age range (Sanders et al., 1993). The parent behavior is coded on 16 categories whereas child behaviors are coded on 18 categories. This is a direct behavioral recording form that allows clinicians and researchers to observe mealtime behaviors.

Measures Used to Determine Parent Outcomes

After examining the available literature, there is a widespread agreement that PII generally contributes to enhanced food acceptance and reduced problematic mealtime behaviors in children with PFD. However, the consensus on reported parent outcomes, when available, is less consistent. According to the literature, various constructs are identified as parent outcomes, and these constructs are not consistently reported across different studies. For instance, previous studies have explored common constructs of parent outcomes, including parenting-related stress (Johnson et al., 2015; Sharp et al., 2014; Sharp et al., 2019), parent satisfaction (Dahlsgaard & Bodie, 2019; Johnson et al., 2015; Sharp et al., 2014; Sharp et al., 2019; Turner et al., 2014), goal attainment (Owen et al., 2012), parent sense of efficacy (Johnson et al., 2019; Morawska et al., 2014; Sharp et al., 2019), parent adjustment (Morawska et al., 2014; Turner et al., 1994), and the impact of problematic mealtime behavior on family and parent-child relationships (Morawska et

al., 2014). Even when assessing the same construct, the measures employed in the literature vary. For instance, Morawska et al. (2014) evaluated parent satisfaction with the program using the Client Satisfaction Questionnaire (CSQ), while Johnson et al. (2015) utilized the Parent Satisfaction Questionnaire (PSQ) for assessing the same construct. The lack of uniformity of parent outcome constructs and measures has posed challenges in investigating the primary impact of PII on parent outcomes. In the present study, the author selected two parent outcome constructs that were most frequently reported in the existing literature: parenting-related stress and parent satisfaction with the received parent training program.

Parenting-Related Stress Outcome

Every parent encounters stress while navigating the daily responsibilities of parenting. However, when dealing with a child affected by PFD, who consistently rejects meals and exhibits challenging behaviors when presented with carefully prepared food, the likelihood of heightened stress in managing the child's mealtime behaviors increases (Berlin et al., 2009; Fishbein et al., 2016; Garro et al., 2005; Greer et al., 2009). Among the included studies, one instrument was used to determine the effect of PII on parenting-related stress.

The Parent Stress Index – Short Form (PSI-SF). The PSI-SF is a 36-item questionnaire designed to screen the overall level of parenting stress an individual is experiencing through self-report (Abidin, 1995). Responses are recorded on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The PSI-SF consists of three scales – Parental Stress, Parent-Child Dysfunctional Interaction, and Difficult Child. A Total Stress score can be computed by summing scores from these three subscales, with a higher score indicating elevated parental stress (Abidin, 1995).

Parent Satisfaction Outcome

Typically, information regarding parent satisfaction with treatment is gathered upon completion of the treatment. Enrolled parents are asked to fill out a questionnaire tailored to assess their satisfaction, covering aspects such as contentment with the treatment outcome, perceived usefulness of the information conveyed during sessions, and the ease of implementing the intervention at home. Unfortunately, most of the parent satisfaction rating scales were not standardized. The following two questionnaires were more frequently used within the PII studies:

Client Satisfaction Questionnaire (CSQ). The CSQ was designed as an assessment instrument to gauge client satisfaction with the Triple P program (Sanders et al., 2001). It has 17 items that evaluate treatment satisfaction, with 14 items utilizing a 7-point Likert scale and the remaining three items allowing clients to provide comments (Sanders et al., 2001). Scores of the CSQ ranges from 13 to 91, with higher scores indicating a higher level of overall satisfaction. More specifically, CSQ assesses the service quality, the program's alignment with parent needs and reduction of child problem behaviors, and whether parents would recommend the program to others.

Parent Satisfaction Questionnaire (PSQ). The PSQ was adapted from the questionnaire originally devised by the Research Units on Pediatric Psychopharmacology (RUPP) Autism Network (RUPP Autism Network, 2007) to evaluate parents' satisfaction across various dimensions of the training program. Parents were prompted to assess their satisfaction levels concerning the effectiveness of instructional tools (e.g., video vignettes, activity sheets, and homework) and the relevance of specific topics covered during the training sessions. Items were rated on either a three- or four-point Likert scale with higher scores reflecting higher satisfaction (Johnson et al., 2015; Johnson et al., 2019).

Data Analysis

The overall effects were calculated using the software R (R Core Team, 2020) via RStudio interface (RStudio Team, 2019) utilizing the metafor package (Viechtbauer, 2020). The metafor package was selected for its ability to conduct moderator analyses tailored to the needs of this study. Overall effect computation and moderator analysis are described below.

Computation of Effect Size

Due to the diverse statistical measures reported in each literature (e.g., *t*-test, *f*-test, Mann-Whitney *U* test, means and standard deviations, and *p*-values), all effect size data were initially encoded in the metric of Cohen's *d*.

Some studies have directly reported Cohen's *d* and some effect sizes were calculated from mean and standard deviation reported in the study. When this information was unavailable, Cohen's *d* was converted from other statistics (e.g., η^2; Cohen, 2013). The formulation for the conversion is listed below:

$$d = 2 * \sqrt{\frac{\eta^2}{1-\eta^2}}$$

To calculate the effect size Cohen's *d*, the formula used for calculation is as follows (Cooper et al., 2009):

$$d = \frac{\bar{Y}^{\mathrm{T}} - \bar{Y}^{\mathrm{C}}}{S_{pooled}} = \frac{\bar{Y}^{\mathrm{T}} - \bar{Y}^{\mathrm{C}}}{\sqrt{\frac{(n^{\mathrm{T}}-1)(S^{\mathrm{T}})^2 + (n^{\mathrm{C}}-1)(S^{\mathrm{C}})^2}{n^{\mathrm{T}}+n^{\mathrm{C}}-2}}}$$

The formula of calculating variance is listed below (Cooper et al., 2009):

$$var_d = \frac{n^{\mathrm{T}}+n^{\mathrm{C}}}{n^{\mathrm{T}}n^{\mathrm{C}}} + \frac{d^2}{2(n^{\mathrm{T}}+n^{\mathrm{C}})}$$

However, given the limited number of participants in several studies, along with substantial variations in measurements, PII training procedure, treatment components, and

population participant characteristics (e.g., mean age) across the studies, Cohen's *d* was subsequently converted into Hedge's *g* (Grissom & Kim, 2005). The utilization of Hedge's *g* is deemed more suitable as it has the potential to mitigate small-sample bias (Hedge & Olkin, 2014; Lakens, 2013). In addition, when compared to Cohen's *d*, using Hedge's *g* helps to adjust the pre-treatment differences between the treatment and control group during the calculation process (Hedge & Olkin, 2014; Lakens, 2013). Hedge's *g* calculation formula as denoted by:

$$\text{Hedge}'s\ g = \text{Cohen}'\text{s}\ d\ \times \left(1 - \frac{3}{4(n_1 + n_2) - 9}\right)$$

Guidelines for interpreting magnitude of Hedge's *g* are as follows: small effect = 0.2, medium effect = 0.5, and large effect = 0.8 (Hedge & Olkin, 2014).

Upon calculating all the effect sizes, a random-effects model was employed for meta-analysis to accommodate the variability in true effect sizes across different studies. This model assigns weights to each study based on its respective sample size when calculating the pooled effect size because the effect sizes vary across studies due to differences in samples and interventions (Cooper, 2015). As per Cooper (2015), the random-effects model posits that study-level variance, encompassing participant groups and treatment interventions, serves as an additional source of random influence on the study's outcome.

Moderator Analysis

As stated by Hall and Rosenthal (1991), a moderator is defined as "a variable that alters the relationship between two other variables" (p. 438). In the context of meta-analysis, moderator effects reflect the associations between the moderator variable and the average effect size. This highlights those certain variables, identified as moderators, can impact or adjust the connection between the main variables of interest, offering valuable insights into the complex dynamics within the meta-analytic results (Hedges & Pigott, 2004). Essentially, moderator analysis allows

researchers to explore how various study features may contribute to the variability in outcomes across different studies (Hedges & Pigott, 2004). Based on the variables assessed in the included articles, the following moderators were considered for further analysis: diagnostic status and PII training delivery format. Moderator analysis was performed using software R (R Core Team, 2020) with metafor package (Viechtbauer, 2020) and robumeta package (Zackary et al., 2017).

Heterogeneity

Heterogeneity plays a pivotal role in systematic reviews, especially in determining the appropriateness of conducting a meta-analysis (Borenstein et al., 2021; Song et al., 2001). Heterogeneity encompasses the extent of diversity in effect sizes observed across studies included in a meta-analysis. Assessing heterogeneity is essential as increased levels could be attributed to differences between studies (Borenstein et al., 2021). In a meta-analysis, heterogeneity arises from two primary sources of variability. First of all, there is within-study variability, also known as sampling error, which stems from the natural fluctuations inherent in any individual study (Huedo-Medina et al., 2006; Song et al., 2001).

Second, there is between-study variability, which is attributed to an array of characteristics that differ across studies, including variations in sample characteristics, differences in treatment approaches, disparities in study design quality, variations in outcome measures, and other related factors (Borenstein et al., 2021; Huedo-Medina et al., 2006; Song et al., 2001; Stogiannis et al., 2023). The observed differences among studies in meta-analyses often go beyond within-study variability. The presence of between-study variabilities indicates diverse study features contributing to the observed differences in meta-analysis results (Song et al., 2001). Thus, the evaluation of heterogeneity in meta-analysis holds significant importance as it influences the choice of statistical models applied to the meta-analytic database.

To assess the heterogeneity of the pooled effect size, three statistics were calculated using metagor package in R software (R Core Team, 2020; Viechtbauer, 2010): the tau-square (τ^2), I-square (I^2), and Cochran's *Q* (*Q*; Higgins & Thompson, 2002; Huedo-Medina et al., 2006). Tau-square (τ^2) signifies the variance of effects between studies, while I^2 was calculated to determine the extent of heterogeneity. The guideline to interpret I^2 is as follows: $I^2 = 0$ indicates homogeneity, $I^2 = 25$ indicates low heterogeneity, $I^2 = 50$ indicates medium heterogeneity, and $I^2 = 75$ indicates high heterogeneity (Higgins & Thompson, 2002). The Cochran's *Q* indicates the amount of variance attributed to differences in effect sizes across studies. A significant *Q* statistic suggests a heterogeneous distribution, indicating that study characteristics or moderating factors, rather than sampling error, account for the differences between studies (Hedges & Olkin, 2014).

In addition, a Forest plot was made for visual inspection of the heterogeneity. Forest plot is a graphical presentation summarizing the results from meta-analysis (Chang et al., 2022; Dettori et al., 2021). In the forest plot, each meta-analysis study is displayed as a box with a horizontal like indicating a 95% confidence interval. The size of each box reflects the study's weight, with larger size indicating more influential studies (Chang et al., 2022; Dettori et al., 2021). The diamond below the studies represents the overall effect estimate from the included studies (Dettori et al., 2021). Forest plot is a useful tool to observe heterogeneity. When the studies are more similar, there will be more overlaps of the confidence intervals. This suggests a more consistent pattern of results, indicating less heterogeneity among the studies (Chang et al., 2022).

Publication Bias and Other Confounding Factors

Publication bias, also known as file-drawer problem, is a common threat to the validity of systematic reviews and meta-analyses, where studies with positive or statistically significant results are more likely to be published than those with null or negative outcomes (Borenstein et al., 2021; Dickersin et al., 2005). This tendency can result in an overestimation of effect size since the included studies may not accurately represent the full spectrum of research findings (Borenstein et al., 2021; van Aert et al., 2019). While the author made extensive efforts to conduct a comprehensive search for all relevant studies, it is acknowledged that publication bias is inevitable, given the challenge of locating every study meeting the criteria. To address this concern, one strategy to mitigate publication bias is to incorporate unpublished or grey literature (Borenstein et al., 2021; Hopewell et al., 2005). Following the suggestions outlined in Hopewell et al.'s (2005) guide, the author conducted a thorough search using the Cochrane Central Register of Controlled Trials and electronic bibliographic databases such as PubMed, MEDLINE, EMBASE, ERIC, and PsychINFO. Additionally, efforts were made to uncover unpublished studies by accessing various sources, including dissertations, theses, conference papers, trial registries, and government reports (Borenstein et al., 2021; Higgins et al., 2019). The author endeavored to reach out to other researchers for information on unpublished work on three registered studies from the Cochrane Central Register of Controlled Trials, however, no responses were received.

Unfortunately, publication bias is merely one facet of non-reporting biases. Other factors, including citation bias, time-lag bias, language bias, outcome reporting bias, and more, can also introduce distortions in the evidence gathered in meta-analyses (Borenstein et al., 2021; Higgins et al., 2019; Page et al., 2020). Besides the aforementioned search strategies, there are also statistical methods to examine the presence of publication bias. A funnel plot, a type of scatter

plot, is a common visual tool that frequently used to investigate publication bias (Brush et al., 2023; Sterne et al., 2005). The individual study's estimated effect size is plotted on the horizontal axis, while a measure of study size is plotted on the vertical axis (Brush et al., 2023; Page et al., 2020; Sterne et al., 2005). Studies characterized by the highest precision in measurement are positioned at the top of the graph. Smaller and less precise studies typically exhibit a broader distribution at the graph's base, while larger and more precise studies tend to have a narrower spread at the top, making the graph look like a funnel (Brush et al., 2023; Page et al., 2020; Sterne et al., 2005). In the current study, funnel plots were generated using metafor package using the R software (Balduzzi et al., 2019; Harr et al., 2021; R Core Team, 2020) and asymmetry of the funnel plot was inspected by using the Egger's regression test.

Egger's regression test is the most widely used formal statistical assessment of the funnel plot asymmetry for the purpose of detecting publication bias (Egger et al., 1997; Lin & Chu, 2018). It examines the relationship between effect size estimates and their standard errors to determine if there is asymmetry in the funnel plot. In cases of publication bias, smaller studies with less precise estimates may be more likely to be published if they report significant results. Egger's regression test quantifies this asymmetry by fitting a regression line to the effect size estimates against their standard errors (Egger et al., 1997). A significant intercept in the regression line indicates potential publication bias, while a symmetrical funnel plot suggests its absence. Therefore, Egger's regression test aids in evaluating the reliability of meta-analytic findings and helps researchers assess the robustness of synthesized evidence (Egger et al., 1997; Lin & Chu, 2018).

Publication bias, indicated by an asymmetrical funnel plot, tends to conceal missing studies in a meta-analysis. Thus, the Trim-and-Fill method was also conducted to account for the

magnitude of the publication bias (Duval & Tweedie, 2000). The Trim-and-Fill is a non-parametric and iterative approach that imputes hypothetical “missing” studies in order to achieve the symmetry in the funnel plot (Duval & Tweedie, 2000). This method allows estimating the number of missing studies due to publication bias by “Trimming” studies from one side of the funnel plot that cause the asymmetry effect and then “Filling” supposed missing values on the other side (Shi & Lin, 2019; Sutton et al., 2000). The fewer number of imputed effect sizes, the less possibility of publication bias.

Chapter 4. Results

Descriptive Analysis

Participant Demographics

Analysis included 11 studies with a total of 396 child participants, with 284 individuals in the treatment group and 112 in the control group. Among the parent participants, totaling 396 individuals, 284 received PII training, while 112 were in the control group. Within the control group, 27 parents received standard services available in the treatment setting (e.g., standard parent education or dietary education), while 85 parents were part of the waitlist control group and received the intervention later. The average age of children in the treatment group ranged from 26.0 to 100.8 months, while those in the control group ranged from 28.6 months to 64.8 months. The age range for the child participants ranges from 12.0 month to 132.0 months. All 11 studies consisted of over 50% male children, with 73% males in the treatment group and 68% males in the control group. Moreover, 113 of the children participated in the studies included in this review had a diagnosis of ASD ($N_{treatment}$= 64, $N_{control}$=49).

Study and Treatment Characteristics

The main descriptive features of qualifying studies are summarized in Table 2. Out of the 11 studies analyzed, 10 were peer-reviewed publications, and one was an unpublished doctoral dissertation. Regarding study design, four studies employed a randomized control design, while seven utilized a quasi-experimental design with pre-test and post-test assessments. In terms of parent training delivery, six programs were conducted in group settings, whereas five were administered individually. Among these programs, three were delivered by an interdisciplinary team, five were facilitated primarily by a psychologist with or without support from psychology trainees, and one was led primarily by a behavioral analysist. Two parent training programs

consisted of only one session, while the remaining programs comprised more than two sessions, and treatment durations ranged from 1 day to 165 days (M = 91.54; SD = 58.34). Each training session lasted from 60 minutes to 150 minutes (M = 93; SD = 28.11). Seven out of 11 studies included follow-up sessions to assess outcome maintenance after the completion of the parent training program. Of the 11 parent training programs, nine were conducted in person, one was delivered virtually via a telehealth platform, and one utilized a combination of both delivery formats. As to treatment settings, 10 studies used parent-implemented treatments at home, while one study was conducted in both home and clinic environments.

Regarding the parent training components (see Table 3), all 11 training programs consisted of didactic instruction. Additionally, common elements of training involved: homework or activity sheets, assigned by one study; feedback, provided by six studies; and role-play and group discussions, utilized by five studies. Notably, five studies had children participating during parent training with three studies conducting direct mealtime observation, and one study conducted home visits. In five out of 11 studies, provider fidelity was examined by assessing protocol adherence based on the manual, resulting in a high provider fidelity rate of 97%. However, treatment fidelity was not measured or reported in most studies. Only three studies assessed and reported whether the intervention taught to the parents was implemented as intended, resulting in a relatively high treatment fidelity score of 88%.

The intervention strategies taught to parents encompassed a variety of approaches, including those derived from ABA as well as non-ABA strategies (e.g., psychoeducation, mealtime hygiene, nutrition education, cognitive reconstruction, oral-motor intervention). However, for the purposes of this study, non-ABA strategies were excluded from this analysis and only ABA-based intervention strategies were summarized (see Table 4) and later analyzed.

Parents were trained to deliver consequence-based strategies across all 11 studies, with eight studies also incorporating antecedent-based strategies, and four studies employing additional approaches like compliance training, relapse prevention, and generalization. Among consequence-based strategies, positive reinforcement was implemented in all the studies (e.g., through techniques such as differential reinforcement of alternative behavior, token economy, and behavior chart), planned ignoring was utilized in nine studies, escape extinction was a component in four studies, and one study used punishment procedures (i.e., time-out). Regarding antecedent-based strategies, seven studies utilized antecedent modification techniques such as stimulus shaping and demand fading, three studies included modeling strategies, and two studies employed prompting and physical guidance.

Effect Size Estimates

Effects of ABA-Based PII on Child Outcomes

Eleven studies reported the outcomes of child-related feeding challenges using various measures, including parent-reported rating scale, observational rating scale by other observers, and direct anthropometric measures (e.g., height, weight, body mass index). Among the 11 studies, BPFAS was utilized as a measure of child-related feeding outcomes in 3 studies, while BAMBI was employed in 4 studies. The remaining studies utilized PATFA, CEBI-R, MOS-R, and PARDI, respectively. The total score of the abovementioned rating scales was selected as a measure of child feeding outcomes. To account for the independence among the effect sizes reported within each study, robust variance estimation was applied to compute the mean effect size. According to the random-effects model, the overall effect appears moderate (g = -0.73, p = 0.018, 95% CI [-1.34, -0.13]; see Figure 1), indicating the positive impact of ABA-based PII on mitigating child-related feeding challenges. The 95% confidence interval for the overall effect

size ranges from -1.34 to -0.13, which does not include zero, indicating that the pooled effect size is statistically significant at the conventional alpha level of 0.05. However, there was significant heterogeneity (τ^2 = 0.94; I^2 = 91.89%; Q = 79.84, p < 0.0001; see Table 5) among the studies, implying variations in outcomes and underscoring the importance of exploring moderating factors. Sharp et al. (2014) observed an intriguing trend in their study findings, notably differing from those reported in other reviewed studies. Unlike their counterparts, Sharp et al. (2014) did not detect a significant change in mealtime behaviors, as indicated by the BAMBI scores.

Effects of ABA-Based PII on Parental Outcomes

The lack of standardized assessment tools for parent satisfaction across the 11 studies indicates a notable gap in the methodology of evaluating parent outcomes in the context of the PII programs in general. While nine studies addressed parent satisfaction regarding the PII, the absence of standardized measurement tools raises concerns about the consistency and comparability of the findings. Among these studies, eight utilized multiple-point Likert scales supplemented with open-ended questions to gauge parent satisfaction, while one study relied on anecdotal reports. For instance, Morawska et al. (2014) employed the CSQ measure, originally designed for the Triple P program (Sanders et al., 2001), while Johnson et al. (2015) and Johnson et al. (2019) adapted the PSQ measure from the RUPP Autism Network's parent-training program (RUPP Autism Network, 2007). However, the variability in questionnaire content was substantial, reflecting the ad hoc nature of these assessment tools. For example, the number of questions designed in the rating scale varied from six to 11 and Likert scale system ranged from 3-point to 10-point. These heterogeneities stemmed from the fact that the development of these satisfaction questionnaires was specifically tailored to the unique needs and objectives of each

individual study. Consequently, the lack of standardized assessment tools limited the comparability and generalizability of parent satisfaction outcomes across studies, highlighting the need for uniform measurement instruments in future research endeavors.

Another construct of parent outcomes was parent stress, and it was assessed in three studies among all the included articles (Johnson et al., 2015; Johnson et al., 2019; Sharp et al., 2014). The results of the analysis suggested a small and statistically nonsignificant negative effect of the PII on parent stress, with an estimated effect size of -0.38 (p = 0.1010; 95% CI [-0.83, 0.07]; see Figure 2). Total heterogeneity across the studies was moderate, accounting for approximately 30.44% of the variability in effect sizes. However, the test for heterogeneity was not significant (Q = 2.74, p = 0.25; see Table 5), indicating that observed variability does not substantially influence the overall findings. While the findings may have suggested a trend toward reduced parent stress following ABA-based PII, caution is warranted in interpretation due to the nonsignificant result.

Moderator Analysis

For research questions three and four, several moderators were identified and coded during data analysis, including 1) the training delivery format, 2) direct child participation, 3) the utilization of escape extinction procedures, and 4) the utilization of consequence and antecedent-based treatment package. Each of the abovementioned moderators were coded as a categorical factor as described in the codebook (see Appendix D). Employing a mixed-effect model, each of these factors was individually tested to assess whether they exerted moderating effects on child-related feeding outcomes as well as parental stress outcomes. This analysis aimed to determine the extent to which these variables influenced the effect sizes of the parent training interventions on improving child feeding behaviors, as well as on decreasing parental stress. In this context, a

mixed-effects model was selected due to its capability to account for both within-study and between-study variances, thus addressing heterogeneity comprehensively (Overton, 1998).

Training Delivery Format

First, the moderator analysis was conducted to examine how training delivery formats might impact child feeding outcomes across 11 studies. Parent training delivered one-on-one by professionals to an individual caregiver was coded as 0, whereas the training delivered to a group of caregivers in a group setting was coded as 1. The test for residual heterogeneity revealed a significant amount of unexplained variability among the studies which is beyond chance alone (Q_{within} = 69.23, *df* = 9, *p* <0.0001). When testing the effect of different training delivery formats, analysis found a statistically significant difference in child feeding outcomes based on the format used (see Table 6). When parent training was delivered one-on-one with an individual caregiver, the results demonstrated a significant negative impact (*g* = -1.07, *p* = 0.019). While the results for group-based parent training did not show statistical significance (*g* = -0.44, *p* = 0.28), this suggests that individually delivered training may have a more pronounced effect on child feeding outcomes compared to group-based training format.

Subsequently, the moderator analysis examined the impact of training delivery format on parent stress outcomes (see Table 7). The results indicated minimal residual heterogeneity, with a τ^2 of 0 (*SE* = 0.16) and an I^2 of 0.00%, suggesting little unaccounted variability in the outcomes. The residual heterogeneity test showed non-significance ($Q_{betwwen}$ = 5.29, *df* = 2, *p* = 0.07), indicating a lack of substantial variability across the studies. However, the mixed-effect model results showed a moderate and statistically significant estimate effect (*g* = -0.71, *p* = 0.02), indicating group-based parent training may have an effect on decreasing parent stress.

Direct Child Participation

The analysis then explored the impact of direct child participation during training sessions on child feeding outcomes. Direct child participation was to examine the extent of direct child involvement during parent training sessions. Direct child participation was reported in four studies (Dovey & Martin, 2012; Owen et al., 2012; Sharp et al., 2019; Turner et al., 1994) in the form of direct mealtime observations during parent training sessions. Studies with direct child participation were coded as 1, whereas those without direct child participation were coded as 0. The *Q* test for residual heterogeneity yielded a statistically significant result ($Q_{within} = 73.47$, $df = 9$, $p < 0.0001$), suggesting the presence of unexplained variability across the studies beyond chance alone. The moderator analysis results showed that direct child participation during parent training sessions has a large and statistically significant effect ($g = -0.87$, $p = 0.002$; see Table 6), suggesting that involving children in training sessions may be helpful in alleviating child feeding challenges. This finding underscores the need to carefully consider child participation dynamics in optimizing the effectiveness of parent training programs. The moderator analysis on parental stress was not performed because all the included studies did not report having direct child participation.

Utilization of Escape Extinction

Escape extinction has been used widely to decrease food refusal and increase food acceptance (Ledford et al., 2018). The variable of "utilization of escape extinction" was defined as the implementation of any escape extinction procedure (e.g., nonremoval of the spoon, re-presentation with expels) within the treatments that parents were trained to deliver to their child. Studies with the implementation of escape extinction were coded as 1 while studies without the implementation of escape extinction were coded as 0. To further examine the moderating effects of the utilization of escape extinction on child-related feeding outcomes, a mixed-effect model

was applied. Based on the model results, the estimated amount of residual heterogeneity τ^2 was 0.70 (*SE* = 0.38), with a corresponding I^2 of 89.22%, indicating substantial variability in outcomes across studies. Furthermore, the test of moderators yielded a significant result ($Q_{between}$ = 10.30, *df* = 2, *p* = 0.0058), indicating that the implementation of escape extinction procedure significantly influenced child feeding outcomes. Specifically, when escape extinction was not implemented, the estimated effect size was low and nonsignificant (*g* = -0.34, *p* = 0.31; see Table 6). However, when escape extinction was implemented as a part of the intervention, the estimated effect size was large and statistically significant (*g* = -1.39, *p* = 0.0023), which is indicative of a negative impact on child feeding outcomes.

The moderator analysis of escape extinction on parent stress outcomes found minimal variability in outcomes across the studies, as indicated by the estimated amount of residual heterogeneity of τ^2 of 0 (*SE* = 0.17) and an I^2 of 0.00%. The test of moderators yielded a marginally significant result ($Q_{between}$ = 5.78, *df* = 2, *p* = 0.056), suggesting a potential influence of the utilization of escape extinction procedure on parent stress outcome. As shown in the model results, the estimated effect were moderate and significant (*g* = -0.59, *p* = 0.016; see Table 7), suggesting that the implementation of escape extinction procedures may contribute to the decrease of parent stress levels.

Utilization of Consequence- and Antecedent-Based Treatment Package

This study also explored whether the utilization of a treatment package had a moderating effect on child-related feeding outcomes. Utilizing a combination of antecedent- and consequence-based treatment packages with children with feeding difficulties has become more common (Bachmeyer, 2009). To further define this variable, the utilization of multi-component treatment packages comprising both consequence and antecedent-based procedures. If the study

utilized such package, it was coded as 1, whereas 0 was assigned to studies did not implemented a treatment package. As indicated by the estimated amount of residual heterogeneity of τ^2 of 1.01 (*SE* = 0.53) and an I^2 value of 92.15 %, a substantial variability in outcomes was explained by chance alone. Further, testing for the residual heterogeneity also confirmed this with a statistically significant result (Q_{within} = 76.14, *df* = 9, *p* <0.0001). Regarding the implementation of the combination treatment package, the analysis revealed differences in child feeding outcomes based on whether the package was utilized. Notably, when treatment was implemented as a package, a moderate and statistically significant effect was found (*g* = -0.75, *p* = 0.045; see Table 6), implying the implementation of the combination treatment package may have profound effects on decreasing child feeding difficulties. The moderator analysis of this factor on parental stress outcomes was not performed because all the included studies used treatment combinations encompassing both consequence-based and antecedent-based interventions.

Publication Bias

This study employed two methods to assess potential publication bias. Firstly, the Funnel Plot and Egger's regression test were utilized, and secondly, the Trim-and-Fill approach was implemented. Figure 3 illustrates the outcomes of the Funnel Plot on the child-related outcomes. When visually inspecting the plot, it indicates potential publication bias through asymmetry, notably due to influential points outside the triangle area. However, when conducting statistical analysis Egger's regression test, the results yielded a non-significant finding (*t* = -1.94, *df* = 9, *p* = 0.0843), suggesting a normal distribution of effect sizes. Additionally, the Trim-and-Fill analysis found no missing studies in the distribution. While the Funnel Plot suggested the possibility of publication bias, the statistical tests did not substantiate this observation, indicating the necessity for additional exploration and testing to assess publication bias. Figure 4 illustrates

the outcomes of the Funnel Plot on the parent-related outcomes. The Funnel Plot was fairly balanced based on visual inspection, and the nonsignificant Egger's regression test (t = -0.62, df = 1, p = 0.647) also suggested a normal distribution of effect sizes. In addition, the Trim-and-Fill test estimated zero missing studies, indicating little to no threat of publication bias.

Chapter 5. Discussion

The evaluation of ABA-based PII for children with PFD largely encompasses single-case research design studies, which have consistently demonstrated positive outcomes, showcasing improvements in food acceptance and reductions of mealtime challenging behaviors (i.e., Aponte et al., 2019; Ledford & Gast, 2006; Sharp et al., 2010). However, the bulk of these interventions have been administered individually within intensive treatment settings, primarily by highly trained professionals. Even though effective, research found that the scalability and generalizability of such programs have raised questions. Consequently, there has been an increased emphasis on group experimental design in the field, allowing the possibility for larger-scale replication with more diverse populations. This meta-analysis synthesized the existing evidence to evaluate the efficacy of ABA-based PII studies employing a group experimental design in the context of PFD, thus addressing a notable gap in the literature. The subsequent sections delve into the overarching findings, their implications, the limitations and ideas for future research.

Summary of Findings

In general, the findings of this meta-analysis exhibited favorable effects of ABA-based PII for children with PFD. The synthesis of data across 11 studies involved a total of 396 child participants along with 396 parent participants. The random-effects weighted average effect size on child outcomes showed moderate in strength and statically significant (g = -0.73), indicating ABA-based PII has a potential of reducing child feeding problems. However, there was a lack of statistical significance of the effect sizes and a high heterogeneity among the studies which calls for caution when interpreting findings. This variability also reflects the nature of heterogeneity within different components of ABA-based PIIs (e.g., training characteristics, intervention

components, outcome measures), although the findings were consistent with previous studies (Lukens & Silverman, 2014) and pose challenges for drawing robust and synthesized conclusions.

Notably, Sharp et al. (2014) presented a unique outcome in their research, wherein they noted an absence of significant changes in mealtime behaviors when assessed using the outcome measurement tool BAMBI. This finding stood in contrast to other studies that were reviewed, which consistently reported positive effects of interventions on the mealtime challenges faced by children. The discrepancy in results could stem from various factors, including differences in sample characteristics, intervention protocols, or measurement tools utilized across studies. For instance, variations in the severity or specific nature of feeding difficulties among participants could have influence the outcomes observed. Additionally, nuances in the implementation of intervention strategies, such as the frequency or intensity of parent-child interactions, as well as details within parent training components, such as dosage or duration of the training, may have contributed to disparate findings.

Parental outcomes, specifically parent satisfaction level though not assessed with standardized tools across studies, appeared to demonstrate a consistent trend toward positivity across the reviewed studies. Future efforts on the standardization of measurement tools for assessing parental satisfaction could enhance comparability across studies and provide more robust evidence. When it comes to the level of parent stress, even though there was an indication of potential reduction after ABA-based PII, the confidence intervals for all the studies overlapped with zero, suggesting that the observed reductions in parent stress were not statistically significant. Therefore, it is not conclusive that ABA-based PIIs have a significant impact on reducing parent stress based on this analysis, which warrants further examination.

Moderators of Treatment Effectiveness

Training delivery format. During the analysis of the four factors impacting the effectiveness of ABA-based PIIs for child feeding outcomes, it was observed that each factor played a significant role in determining the efficacy of the interventions. The first moderating variable examined was the training delivery format. Consistent with each individual study's findings, both individual-delivered PIIs and group-based PIIs showed positive impact on child feeding outcomes based on the moderator analysis, except for Sharp et al. (2014). However, data analysis showed a statistical significance with a large effect size (g = -1.07) on child feeding outcomes when parent training was delivered individually compared to a small-to-moderate effect size (g = -0.44) when training was delivered in a group setting. Individual-delivered PIIs, as evidenced by studies conducted by Turner et al. (1994), Dovey and Martin (2012), Johnson et al. (2015), and Johnson et al. (2019), emphasize tailored interventions for children with PFD and their families, and yielded positive outcomes with improvements in children's food acceptance and feeding behaviors. The results align with expectations, given that individually-delivered PIIs are customized to the unique needs of each child. Moreover, these outcomes underscore the importance of tailoring evidence-based treatments for PFD, echoing the recommendations made by Mammal and Ornstein (2017) for personalized treatment approaches.

Even though the effect size of group-based PIIs on child outcomes was small-to-moderate, this type of training delivery format still offers a promising alternative to individually-delivered PIIs. PIIs utilizing group-based training delivery model, represented by studies such as Fraser et al. (2004), Owen et al. (2012), Morawska et al. (2014), and Sharp et al. (2019), present advantages in terms of cost-effectiveness and accessibility compared to individualized approaches. While Sharp et al. (2014) did not report positive changes in child feeding outcomes,

it still marked as the first randomized controlled trial to assess group-based PIIs for PFD, showcasing accessibility and feasibility for future studies.

The small-to-moderate effect size associated with group-based PIIs for improving child outcomes does not detract from their potential as a viable alternative to the individually-delivered approach. Studies such as those conducted by Fraser et al. (2004), Owen et al. (2012), Morawska et al. (2014), and Sharp et al. (2019) have highlighted the benefits of the group-based training model, particularly in terms of cost-effectiveness and increased accessibility. While individual PIIs may allow for tailored approaches that can achieve substantial outcomes with parents conducting interventions at home, group-based PIIs offer a strategic advantage in terms of scalability and the possibility for broader application across diverse populations. Consequently, while individually-tailored PIIs have proven effective, the prospect of achieving widespread implementation with group-based formats provides a compelling direction for future research and practice in the field of pediatric feeding interventions.

When investigating the moderating effects of training delivery format on parent stress outcomes, a moderate and statistically significant effect was observed when parents received training in a group setting. While group-based PII studies included in this meta-analysis did not specifically explore how parent training impacted parent stress, this result aligns with previous research which has consistently shown that when parents are taught with the skills and strategies to effectively manage their child's behaviors, they often experience a decrease in stress (Barlow et al., 2012; Bennett et al., 2013). Further reinforcing this point, a study examining the impact of PIIs on parents of autistic children revealed that such interventions did more than alleviate stress; they also equipped parents with valuable coping strategies for managing stress more effectively following group-based training (Lida et al., 2018). In Karst and Ven Hecke's (2012) article, they

recommended that PII should have a focus on building parental knowledge, enhancing skills, and offering comprehensive support to the entire family can substantially improve the effectiveness of these interventions. It is reasonable to assume that a group-based PII can address specific family needs associated with individual child's feeding challenges, while also drawing on the collective experiences and support that a group setting provides. This holistic approach not only strengthens individual parental capacity but also fosters a supportive network that reinforces family resilience, particularly in families raising children with PFD.

Direct child participation. In contrast to the intensive observation commonly seen in ABA-based interventions employing single-case research designs, ABA-based PIIs typically do not involve direct participation of the child during training sessions. Parents are usually instructed to practice with children after training session and training providers do not record direct assessments of a child's challenges. Nonetheless, exceptions do exist, as represented by the work of Dovey and Martin (2012), Owen et al. (2012), Sharp et al. (2019), and Turner et al. (1994). Notably, when children were actively involved in the training sessions, these studies exhibited a large, statistical significant effect size (g = -0.87) on child feeding outcomes. Whereas a moderate yet not statistical significant effect size (g = -0.54) was observed when children were not actively engaged during parent training. The nature of child participation also differed across these studies. For example, Owen et al. (2012) incorporated a child-observation picnic, allowing clinicians to directly observe and address specific mealtime challenges, facilitating tailored recommendations. Sharp et al. (2019) introduced active child involvement from session 5 onward, integrating parent-child meal demonstrations for real-time practice. Turner et al. (1994) implemented mealtime observations both in the home and clinic settings, using this as part of their outcome measurement.

The incorporation of direct child participation within ABA-based PII for children with PFD has not been universally adopted or evaluated as a core component of the interventions. However, the findings from this meta-analysis suggest that including the child in the sessions could be beneficial and warrants further exploration. The potential of active child involvement in enhancing treatment outcomes presents a compelling direction for future research, pointing toward the integration of observational learning and direct practice in the treatment process. By embracing such methods, PIIs could optimize treatment effects, making interventions more dynamic and immediately applicable to the real-world situations that children and their parents encounter daily. Moreover, it provides clinicians with direct observations of the child's feeding challenges within their natural mealtime environment. This approach can lead to a more precise assessment of the child's mealtime behaviors and, consequently, enable clinicians to offer more personalized recommendations that are closely aligned with each child's specific needs.

Utilization of escape extinction. Research within the domain of PFD has validated the effectiveness of escape extinction procedures, both as an independent intervention and when integrated with other types of treatment strategies, in improving food acceptance and decreasing food refusal behaviors. Analyses across several studies highlighted that the implementation of escape extinction, as part of a comprehensive intervention, markedly enhances treatment efficacy (i.e., Ahearn et al., 1996; Ledford & Gast, 2006; Tarbox et al., 2010; Voulgarakis & Forte, 2015). The moderator analysis on the utilization of escape extinction also confirmed that when such a procedure was implemented as a part of the intervention, the estimated effect size was large and significant (g = -1.39), compared to a small effect size of g = -0.34 when escape extinction was not a component of treatment. Additionally, the implementation of escape extinction also had a moderate effect on decreasing parent stress.

It is important to note that only a minority of studies reviewed included escape extinction, reflecting a cautious approach in the field toward applying less restrictive, more parent-friendly methodologies before resorting to more intensive strategies. Despite its effectiveness, the use of escape extinction raises several ethical and practical concerns, particularly when considering the occurrence of "extinction bursts." This increase in undesired behaviors following the withdrawal of reinforcement can pose significant risks, particularly if the target behaviors are severe, which may further dissuade parents from persisting with the prescribed procedures due the challenging nature of applying escape extinction procedure. In addition, such intensification can be disheartening and cause distress for the parents, especially for those who are the primary implementers of intervention strategies at home as managing these behaviors without professional guidance and oversight.

Consequently that escape extinction was only included in a third of studies reviewed reflects an overarching commitment within the field to prioritizing the least restrictive, yet effective treatment options (Ledford et al., 2018). This cautious progression toward more intensive strategies is contingent upon need and is always under strict professional oversight, ensuring the safety and wellbeing of children undergoing treatment for feeding difficulties. This trend also aligns with the ethical framework guiding behavioral interventions, advocating for treatments that are both efficacious and respectful of the child and family's needs (BACB, 2014; Tereshko et al., 2021).

Utilization of consequence- and antecedent-based treatment package. Parents trained in ABA techniques employed a wide range of strategies, with a predominance of consequence-based methods such as positive reinforcement, suggesting the critical role of these techniques in managing PFD. However, with the capacity to incorporate both consequence-based and

antecedent-based procedures, ABA-based PII treatments offer a comprehensive framework for modifying feeding behaviors. This integrated treatment framework has been shown to be highly effective, as evidenced by a substantial and significant effect size on child feeding outcomes (g = -0.75), underscoring its effectiveness compared to interventions lacking this combination treatment package. This empirical finding echoes prior research, affirming that a integration of both antecedent- and consequence-based strategies typically leads to stronger, more durable outcomes in child feeding interventions. The combined use of these strategies not only helps in increasing food acceptance and reducing food refusal but also equips parents with a fuller set of tools to address a broader range of feeding difficulties.

Clinical Implications

The findings suggest that both individual and group-based PIIs utilizing ABA-based strategies hold promise for addressing PFD in children. Individual-delivered interventions offer tailored support and intensive training, ideal for addressing specific needs. However, they may be resource-intensive and less accessible to a wider population. On the other hand, group-based interventions provide a cost-effective and accessible alternative, allowing for broader dissemination of intervention strategies. Incorporating both formats into clinical practice can offer flexibility in meeting the diverse needs of families. Clinicians should consider the feasibility and appropriateness of each intervention format based on the unique characteristics of the child and family. Individualized interventions may be more suitable for complex cases requiring intensive support, while group-based interventions can serve as valuable adjuncts in community settings, providing ongoing support and skill-building opportunities for families.

As we continue to unravel the complexities of PFD and its treatment, a combination of consequence-based and antecedent-based ABA strategies, complemented by comprehensive,

interdisciplinary approaches, appears to be the most promising pathway forward. However, it is imperative to delve deeper into exploring ethical and less intrusive alternatives to current ABA practices, particularly antecedent-based procedures. By embracing such alternatives, we can ensure that treatment modalities align with the evolving ethical standards in the field of pediatric feeding intervention. Moreover, prioritizing less invasive approaches underscores our commitment to promoting the well-being of children and their families. This emphasis on ethical considerations and minimizing the intrusiveness of interventions reflects a progressive approach aimed at enhancing the effectiveness and acceptability of treatments for PFD. By embracing a collective approach, we can better address the multifaceted needs of children with PFD and their families, ultimately paving the way for more effective and comprehensive treatment modalities in this critical area.

Limitations and Future Direction

While the current body of research presents promising outcomes for ABA-based PIIs in treatment PFD, there are notable limitations that need further attention. First, the considerable heterogeneity observed in intervention approaches and outcome measures across studies poses significant challenges to making direct comparisons and synthesizing findings. This diversity in methodologies and assessment tools complicates the process of drawing definitive conclusions regarding the efficacy of PII approaches. For instance, the current analysis revealed that reviewed studies often utilized multiple outcome measures to assess the same construct, exacerbating the difficulty of comparing results.

In addition, the field also faces a deficit of extensive, large-scale randomized controlled trials (RCTs) that can provide robust evidence for the efficacy of ABA-based PIIs across diverse populations. The absence of such rigorous studies hampers the ability to establish conclusive

evidence regarding the efficacy and generalizability of ABA-based PII interventions on children who fall on different places on the spectrum of feeding difficulties. Addressing these limitations and advancing the field will require a concerted effort to implement rigorous study design and to adopt standardized intervention protocols. By standardizing methodologies and intervention procedures, researchers can facilitate more reliable comparisons across studies, thus enabling systematic reviews and meta-analysis to generate more comprehensive insights into the effectiveness of ABA-based PIIs for PFD. Moreover, prioritizing the conduct of large-scale RCTs will be essential for establishing stronger evidence bases and informing clinical practice guidelines in the field of pediatric feeding intervention.

On the same note, the limited number of articles included in the current meta-analysis hindered the assessment of additional moderating effects due to the small statistical power. The small sample size restricted the ability to detect significant interactions or relationships between variables, highlighting the need for larger and more diverse datasets in future research endeavors. Expanding the pool of studies could provide a more comprehensive understanding of the factors influencing the effectiveness of interventions, allowing for more nuanced analyses of moderating effects. Additionally, larger sample sizes would enhance the generalizability of findings, contributing to the robustness of meta-analytic conclusions.

Furthermore, there exists a notable gap in research pertaining to the fidelity of PII implementations, particularly within studies employing group experimental designs. Surprisingly, only a fraction of studies, specifically 3 out of 11 (27%), conducted and reported measurements of treatment fidelity. This deficiency in assessing fidelity poses a significant limitation in validating the effectiveness of interventions. Ensuring that interventions are implemented as intended is crucial for determining their true impact on outcomes. Without

adequate fidelity checks, it becomes challenging to ascertain whether observed changes are attributable to the intervention itself or to other confounding factors. Thus, it is imperative for future studies to prioritize the development and utilization of robust fidelity measures. To address this gap, researchers and clinicians should focus on devising comprehensive fidelity checks that assess adherence to treatment protocols across all stages of intervention delivery. For example, mealtime observation with direct child participation during parent training may function as a component for fidelity checks to ensure parents' adherence to prescribed procedures.

Conclusion

In conclusion, the evaluation of ABA-based PIIs for children with PFD has yielded promising results, highlighting the effectiveness of such programs in decreasing child feeding difficulties and mediating parent stress. The present meta-analysis took an important step by analyzing studies utilizing group experimental design, offering insights into the collective impact of ABA-based PIIs on both child- and parent-related outcomes. By transitioning from focusing on single-case research design methodology to group experimental design, this research not only expands the understanding of intervention efficacy but also underscores the importance of accessibility and scalability. In essence, this study sets a precedent for future research endeavors, advocating for a shift toward more inclusive, group-oriented intervention strategies. This work signifies a commitment to advancing the field of ABA-based PII, with the ultimate goal of improving outcomes and quality of life for children with PFD and their families.

References

Abidin, R., Flens, J. R., & Austin, W. G. (2006). *The Parenting Stress Index*. Lawrence Erlbaum Associates Publishers.

Adamson, M., & Morawska, A. (2008). Parent and toddler feeding assessment. *Unpublished manuscript, Parenting and Family Support Centre, The University of Queensland, Brisbane*.

Ahearn, W. H. (2003). Using simultaneous presentation to increase vegetable consumption in a mildly selective child with autism. *Journal of Applied Behavior Analysis, 36*(3), 361-365. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1284450/pdf/14596577.pdf

Ahearn, W. H., Kerwin, M. E., Eicher, P. S., Shantz, J., & Swearingin, W. (1996). An alternating treatments comparison of two intensive interventions for food refusal. *Journal of Applied Behavior Analysis, 29,* 321-332. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1283995/pdf/8926224.pdf

Ahearn, W., Kerwin, M., & Eicher, P. (2001). An ABAC comparison of two intensive interventions for food refusal. *Behavior Modification, 25*(3), 385-405. https://doi-org.offcampus.lib.washington.edu/10.1177/0145445501253002

Aldred, C., Jonathan G., & Catherine, A. (2004). A new social communication intervention for children with autism: Pilot randomised controlled treatment study suggesting effectiveness. *Journal of Child Psychology & Psychiatry, 45*(8) 1420–1430. https://doi.org/10.1111/j.1469-7610.2004.00338.x

Allen, S. L., Smith, I. M., Duku, E., Vaillancourt, T., Szatmari, P., Bryson, S., Fombonne, E., Volden, J., Waddell, C., Zwaigenbaum, L., & Roberts, W. (2015). Behavioral pediatrics feeding assessment scale in young children with autism spectrum disorder: Psychometrics

and associations with child and parent variables. *Journal of Pediatric Psychology, 40*(6), 581-590. https://doi.org/10.1093/jpepsy/jsv006

Allison, J., Wilder, D. A., Chong, I., Lugo, A., Pike, J., & Rudy, N. (2012). A comparison of differential reinforcement and noncontingent reinforcement to treat food selectivity in a child with autism. *Journal of Applied Behavior Analysis*, *45*(3), 613-617. https://doi.org/10.1901/jaba.2012.45-613

Aman, M. G., McDougle, C. J., Scahill, L., Handen, B., Arnold, L. E., Johnson, C., Stigler, K. A., Bearss, K., Butter, E., Swiezy, N. B., Sukhodolsky, D. D., Ramadan, Y., Pozdol, S. L., Nikolov, R., Lecavalier, L., Kohn, A. E., Koenig, K., Hollway, J. A., Korzekwa, P., Gavaletz, A., … Research Units on Pediatric Psychopharmacology Autism Network (2009). Medication and parent training in children with pervasive developmental disorders and serious behavior problems: results from a randomized clinical trial. *Journal of the American Academy of Child and Adolescent Psychiatry*, *48*(12), 1143–1154. https://doi.org/10.1097/CHI.0b013e3181bfd669

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.) – *Text revision*. Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Author.

Ammaniti, M., Lucarelli, L., Cimino, S., D'Olimpio, F., & Chatoor, I. (2012). Feeding disorders of infancy: A longitudinal study to middle childhood. *International Journal of Eating Disorders*, *45*(2), 272-280. https://doi-org.offcampus.lib.washington.edu/10.1002/eat.20925

Anderson, C. M., & McMillan, K. (2001). Parental use of escape extinction and differential

reinforcement to treat food selectivity. *Journal of Applied Behavior Analysis*, *34*(4), 511-515. https://doi-org.offcampus.lib.washington.edu/10.1901/jaba.2001.34-511

Andrew, M. J., Parr, J. R., & Sullivan, P. B. (2012). Feeding difficulties in children with cerebral palsy. *Archives of Disease in Childhood-Education and Practice*, *97*(6), 222-229. http://dx.doi.org/10.1136/archdischild-2011-300914

Aponte, C. A., Brown, K. A., Turner, K., Smith, T., & Johnson, C. (2019). Parent training for feeding problems in children with autism spectrum disorder: A review of the literature. *Children's Health Care*, *48*(2), 191-214. https://doi-org.offcampus.lib.washington.edu/10.1080/02739615.2018.1510329

Archer, L. A., Rosenbaum, P. L., & Streiner, D. L. (1991). The children's eating behavior inventory: reliability and validity results. *Journal of Pediatric Psychology*, *16*(5), 629-642. https://doi.org/10.1093/jpepsy/16.5.629

Arvedson, J. C. (2008). Assessment of pediatric dysphagia and feeding disorders: Clinical and instrumental approaches. *Developmental Disabilities Research Reviews*, *14*(2), 118-127. https://doi-org.offcampus.lib.washington.edu/10.1002/ddrr.17

Arvedson, J. C. (2013). Feeding children with cerebral palsy and swallowing difficulties. *European Journal of Clinical Nutrition*, *67*(2), 9-12. https://doi.org/10.1038/ejcn.2013.224

Ausderau, K., & Juarez, M. (2013). The impact of autism spectrum disorders and eating challenges on family mealtimes. *ICAN: Infant, Child, & Adolescent Nutrition*, *5*(5), 315-323. https://doi-org.offcampus.lib.washington.edu/10.1177/1941406413502808

Babbitt, R. L., Hoch, T. A., Coe, D. A., Cataldo, M. F., Kelly, K. J., Stackhouse, C., & Perman, J. A. (1994). Behavioral assessment and treatment of pediatric feeding disorders. *Journal*

of Developmental and Behavioral Pediatrics, *15*, 278-291. DOI: 10.1097/00004703-199408000-00011

Babbitt, R. L., Shore, B. A., Smith, M., Williams, K. E., & Coe, D. A. (2001). Stimulus fading in the treatment of adipsia. *Behavioral Interventions: Theory & Practice in Residential & Community-Based Clinical Programs*, *16*(3), 197-207. https://doi-org.offcampus.lib.washington.edu/10.1002/bin.94

Bachmeyer, M. H. (2009). Treatment of selective and inadequate food intake in children: A review and practical guide. *Behavior Analysis in Practice*, *2*(1), 43-50. https://doi-org.offcampus.lib.washington.edu/10.1007/BF03391736

Balduzzi, S., Rücker, G., & Schwarzer, G. (2019). How to perform a meta-analysis with R: a practical tutorial. *BMJ Ment Health*, *22*(4), 153-160. https://doi.org/10.1136/ebmental-2019-300117

Bandini, L. G., Anderson, S. E., Curtin, C., Cermak, S., Evans, E. W., Scampini, R., Maslin, M., & Must, A. (2010). Food selectivity in children with autism spectrum disorders and typically developing children. *The Journal of Pediatrics*, 157(2), 259–264. https://doi.org/10.1016/j.jpeds.2010.02.013

Bandini, L. G., Curtin, C., Phillips, S., Anderson, S. E., Maslin, M., & Must, A. (2017). Changes in food selectivity in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *47*(2), 439-446. https://doi.org/10.1007/s10803-016-2963-6

Barkley, R. A., & Murphy, K. R. (1998). *Attention-deficit hyperactivity disorder: A clinical workbook (2nd ed.)*. Guilford Press.

Barlow, J., Smailagic, N., Huband, N., Roloff, V., & Bennett, C. (2012). Group-based parent training programmes for improving parental psychosocial health. *Cochrane Database of Systematic Reviews*, *6*, CD002020–CD002020. https://doi.org/10.1002/14651858.CD002020.pub3

Bearss, K. (2019). History and theoretical foundations of parent training. In Johnson, C. R., Butter, E. M., & Scahill, L. *Parent training for autism spectrum disorder: Improving the quality of life for children and their families*. APA Books.

Bearss, K., Burrell, T. L., Challa, S. A., Postorino, V., Gillespie, S. E., Crooks, C., & Scahill, L. (2018). Feasibility of parent training via telehealth for children with autism spectrum disorder and disruptive behavior: A demonstration pilot. *Journal of Autism and Developmental Disorders*, *48*(4), 1020-1030. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-017-3363-2

Bearss, K., Burrell, T. L., Stewart, L., & Scahill, L. (2015a). Parent training in autism spectrum disorder: What's in a name?. *Clinical Child and Family Psychology Review*, *18*(2), 170-182. https://doi.org/10.1007/s10567-015-0179-5

Bearss, K., Johnson, C., Handen, B., Smith, T., & Scahill, L. (2013). A pilot study of parent training in young children with autism spectrum disorders and disruptive behavior. *Journal of Autism and Developmental Disorders*, *43*, 829-840. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-012-1624-7

Bearss, K., Johnson, C., Smith, T., Lecavalier, L., Swiezy, N., Aman, M., ... & Sukhodolsky, D. G. (2015b). Effect of parent training vs parent education on behavioral problems in children with autism spectrum disorder: a randomized clinical trial. *JAMA*, *313*(15), 1524-1533. https://doi:10.1001/jama.2015.3150

Behavior Analyst Certification Board. (2014). *Professional and ethical compliance code for behavior analysts*. Author.

Beighley, J. S., Matson, J. L., Rieske, R. D., & Adams, H. L. (2013). Food selectivity in children with and without an autism spectrum disorder: Investigation of diagnosis and age. *Research in Developmental Disabilities*, *34*(10), 3497-3503. https://doi.org/10.1016/j.ridd.2013.07.026

Bellini, S., Peters, J. K, Benner, L., & Hopf, A. (2007). A meta-analysis of school based social skills interventions for children with autism spectrum disorders. *Remedial and Special Education, 28*(3), 153-162. https://doi-org.offcampus.lib.washington.edu/10.1177/07419325070280030401

Benjasuwantep, B., Chaithirayanon, S., & Eiamudomkan, M. (2013). Feeding problems in healthy young children: prevalence, related factors and feeding practices. *Pediatric Reports*, *5*(2), 38-42. https://doi.org/10.4081/pr.2013.e10

Bennett, C., Barlow, J., Huband, N., Smailagic, N., & Roloff, V. (2013). Group-based parenting programs for improving parenting and psychosocial functioning: A systematic review. *Journal of the Society for Social Work and Research*, *4*(4), 300–332. https://doi.org/10.5243/jsswr.2013.20

Berlin, K. S., Davies, W. H., Lobato, D. J., & Silverman, A. H. (2009). A biopsychosocial model of normative and problematic pediatric feeding. *Children's Health Care*, *38*(4), 263-282. https://doi-org.offcampus.lib.washington.edu/10.1080/02739610903235984

Blennerhassett, C., Richards, M., & Clayton, S. (2023). Caregiver-implemented feeding interventions for autistic children with food selectivity: a systematic review. *Review Journal of Autism and Developmental Disorders*, 1-19. https://doi-

org.offcampus.lib.washington.edu/10.1007/s40489-023-00378-2

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2021). *Introduction to meta-analysis*. John Wiley & Sons.

Borrero, C. S., England, J. D., Sarcia, B., & Woods, J. N. (2016). A comparison of descriptive and functional analyses of inappropriate mealtime behavior. *Behavior Analysis in Practice*, *9*(4), 364-379. https://doi-org.offcampus.lib.washington.edu/10.1007/s40617-016-0149-5

Borrero, C. S., Woods, J. N., Borrero, J. C., Masler, E. A., & Lesser, A. D. (2010). Descriptive analyses of pediatric food refusal and acceptance. *Journal of Applied Behavior Analysis*, *43*(1), 71-88. https://doi-org.offcampus.lib.washington.edu/10.1901/jaba.2010.43-71

Bottema-Beutel, K., Yoder, P. J., Hochman, J. M., & Watson, L. R. (2014). The role of supported joint engagement and parent utterances in language and social communication development in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *44*(9), 2162-2174. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-014-2092-z

Brigham, K. S., Manzo, L. D., Eddy, K. T., & Thomas, J. J. (2018). Evaluation and treatment of avoidant/restrictive food intake disorder (ARFID) in adolescents. *Current Pediatrics Reports*, *6*(2), 107-113. https://doi-org.offcampus.lib.washington.edu/10.1007/s40124-018-0162-y

Brookman-Frazee, L., & Koegel, R. L. (2004). Using parent/clinician partnerships in parent education programs for children with autism. *Journal of Positive Behavior*

Interventions, *6*(4), 195-213. https://doi-org.offcampus.lib.washington.edu/10.1177/1098300704006004020l

Brown, J. F., Spencer, K., & Swift, S. (2002). A parent training programme for chronic food refusal: A case study. *British Journal of Learning Disabilities*, *30*(3), 118-121. https://doi-org.offcampus.lib.washington.edu/10.1046/j.1468-3156.2002.00128.x

Brown, J., Kim, C., Lim, A., Brown, S., Desai, H., Volker, L., & Katz, M. (2014). Successful gastrostomy tube weaning program using an intensive multidisciplinary team approach. *Journal of Pediatric Gastroenterology and Nutrition*, *58*(6), 743-749. https://doi.org/10.1097/mpg.0000000000000336

Brush, P. L., Sherman, M., & Lambrechts, M. J. (2023). Interpreting meta-analyses: A guide to funnel and forest plots. *Clinical spine surgery*, 10.1097/BSD.0000000000001534.

Bryant-Waugh, R. (2019). Avoidant/restrictive food intake disorder. *Child and Adolescent Psychiatric Clinics*, *28*(4), 557-565. https://doi.org/10.1016/j.cppeds.2017.02.005

Bryant-Waugh, R., Stern, C. M., Dreier, M. J., Micali, N., Cooke, L. J., Kuhnle, M. C. Burton Murray, H., Wang, S.B., Breithaupt, L., Becker, K.R., & Misra, M (2022). Preliminary validation of the pica, ARFID and rumination disorder interview ARFID questionnaire (PARDI-AR-Q). *Journal of Eating Disorders*, *10*(1), 179. https://doi.org/10.1186/s40337-022-00706-7

Bryant-Waugh, R., Micali, N., Cooke, L., Lawson, E. A., Eddy, K. T., & Thomas, J. J. (2019). Development of the pica, ARFID, and rumination disorder interview, a multi-informant, semi-structured interview of feeding disorders across the lifespan: A pilot study for ages 10–22. *International Journal of Eating Disorders*, *52*(4), 378-387. https://doi.org/10.1002/eat.22958

Bui, L. T., Moore, D. W., & Anderson, A. (2013). Using escape extinction and reinforcement to increase eating in a young child with autism. *Behaviour Change*, *30*(1), 48-55. https://doi:10.1017/bec.2013.5

Burklow, K. A., McGrath, A. M., & Kaul, A. (2002). Management and prevention of feeding problems in young children with prematurity and very low birth weight. *Infants & Young Children*, *14*(4), 19-30. DOI: 10.1097/00001163-200204000-00004

Burklow, K. A., Phelps, A. N., Schultz, J. R., McConnell, K., & Rudolph, C. (1998). Classifying complex pediatric feeding disorders. *Journal of Pediatric Gastroenterology and Nutrition*, *27*(2), 143-147. https://doi.org/10.1097/00005176-199808000-00003

Burrell, T. L., Sharp, W., Whitehouse, C., & Johnson, C. R. (2019). Parent training for food selectivity in autism spectrum disorder. In Johnson, C. R., Butter, E. M., & Scahill, L. *Parent training for autism spectrum disorder: Improving the quality of life for children and their families*. APA Books.

Buschbacher, P., Fox, L., & Clarke, S. (2004). Recapturing desired family routines: A parent-professional behavioral collaboration. *Research and Practice for Persons with Severe Disabilities*, *29*(1), 25-39. https://doi-org.offcampus.lib.washington.edu/10.2511/rpsd.29.1.25

Casey, S. D., Cooper-Brown, L. J., Wacker, D. P., & Rankin, B. E. (2006). The use of descriptive analysis to identify and manipulate schedules of reinforcement in the treatment of food refusal. *Journal of Behavioral Education*, *15*(1), 39-50. DOI: 10.1007/s10864-005-9001-7.

Cermak, S. A., Curtin, C., & Bandini, L. G. (2010). Food selectivity and sensory sensitivity in children with autism spectrum disorders. *Journal of the American Dietetic*

Association, *110*(2), 238-246. https://doi-org.offcampus.lib.washington.edu/10.1016/j.jada.2009.10.032

Cerniglia, L., Marzilli, E., & Cimino, S. (2020). Emotional-behavioral functioning, maternal psychopathologic risk and quality of mother–child feeding interactions in children with avoidant/restrictive food intake disorder. *International Journal of Environmental Research and Public Health*, *17*(11), 1-16. https://doi.org/10.3390/ijerph17113811

Chang, Y., Phillips, M. R., Guymer, R. H., Thabane, L., Bhandari, M., & Chaudhary, V. (2022). The 5 min meta-analysis: understanding how to read and interpret a forest plot. *Eye (London)*, *36*(4), 673–675. https://doi.org/10.1038/s41433-021-01867-6

Chatoor, I., & Ganiban, J. (2004). The diagnostic assessment and classification of feeding disorders. In R. DelCarman-Wiggins & A. Carter (Ed.s.). *Handbook of infant, toddler and preschool mental health assessment* (pp. 289-310). Oxford University Press.

Chawner, L. R., Blundell-Birtill, P., & Hetherington, M. M. (2019). Interventions for increasing acceptance of new foods among children and adults with developmental disorders: a systematic review. *Journal of Autism and Developmental Disorders*, *49*(9), 3504-3525. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-019-04075-0

Cheng, W. M., Smith, T. B., Butler, M., Taylor, T. M., & Clayton, D. (2023). Effects of parent-implemented interventions on outcomes of children with autism: A meta-analysis. *Journal of Autism and Developmental Disorders*, *53*(11), 4147-4163. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-022-05688-8

Chistol, L. T., Bandini, L. G., Must, A., Phillips, S., Cermak, S. A., & Curtin, C. (2018). Sensory sensitivity and food selectivity in children with autism spectrum disorder. *Journal of*

Autism and Developmental Disorders, *48*(2), 583-591. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-017-3340-9

Chowdhury, M., Aman, M. G., Lecavalier, L., Smith, T., Johnson, C., Swiezy, N., McCracken, J. T., King, B., McDougle, C. J., Bearss, K., Deng, Y., & Scahill, L. (2016). Factor structure and psychometric properties of the revised Home Situations Questionnaire for autism spectrum disorder: The Home Situations Questionnaire-Autism Spectrum Disorder. *Autism*, *20*(5), 528-537. https://doi-org.offcampus.lib.washington.edu/10.1177/1362361315593941

Clark, R. R., Fischer, A. J., Lehman, E. L., & Bloomfield, B. S. (2019). Developing and implementing a telehealth enhanced interdisciplinary pediatric feeding disorders clinic: A program description and evaluation. *Journal of Developmental and Physical Disabilities*, *31*(2), 171-188. https://doi-org.offcampus.lib.washington.edu/10.1007/s10882-018-9652-7

Coe, D. A., Babbitt, R. L., Williams, K. E., Hajimihalis, C., Snyder, A. M., Ballard, C., & Efron, L. A. (1997). Use of extinction and reinforcement to increase food consumption and reduce expulsion. *Journal of Applied Behavior Analysis*, *30*(3), 581-583. https://doi-org.offcampus.lib.washington.edu/10.1901/jaba.1997.30-58

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.

Cooney, M., Lieberman, M., Guimond, T., & Katzman, D. K. (2018). Clinical and psychological features of children and adolescents diagnosed with avoidant/restrictive food intake disorder in a pediatric tertiary care eating disorder program: A descriptive study. *Journal of Eating Disorders*, *6*(1), 1-8. https://doi.org/10.1186/s40337-018-0193-3

Cooper, H. (2015). *Research synthesis and meta-analysis: A step-by-step approach* (Vol. 2). Sage Publications.

Cooper, H., Hedges, L. V., & Valentine, J. C. (2009). The handbook of research synthesis and meta-analysis 2nd edition. In *The Handbook of Research Synthesis and Meta-Analysis, 2nd Ed.* (pp. 1-615). Russell Sage Foundation.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis*. (2nd Ed.). Pearson.

Cooper, L. J., Wacker, D. P., McComas, J. J., Brown, K., Peck, S. M., Richman, D., Drew, J., Frischmeyer, P., & Millard, T. (1995). Use of component analyses to identify active variables in treatment packages for children with feeding disorders. *Journal of Applied Behavior Analysis*, *28*(2), 139-153. https://doi-org.offcampus.lib.washington.edu/10.1901/jaba.1995.28-139

Cornwell, S. L., Kelly, K., & Austin, L. (2010). Pediatric feeding disorders: Effectiveness of multidisciplinary inpatient treatment of gastrostomy-tube dependent children. *Children's Health Care*, *39*(3), 214-231. https://doi-org.offcampus.lib.washington.edu/10.1080/02739615.2010.493770

Cosbey, J., & Muldoon, D. (2017). EAT-UP™ family-centered feeding intervention to promote food acceptance and decrease challenging behaviors: A single-case experimental design replicated across three families of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *47*(3), 564-578. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-016-2977-0

Crist, W., & Napier-Phillips, A. (2001). Mealtime behaviors of young children: A comparison of normative and clinical data. *Journal of Developmental and Behavioral Pediatrics, 22*(5), 279–286. https://doi.org/10.1097/00004703-200110000-00001

Crist, W., McDonnell, P., Beck, M., Gillespie, C. T., Barrett, P., & Mathews, J. (1994). Behavior at mealtimes and the young child with cystic fibrosis. *Journal of Developmental and Behavioral Pediatrics, 15*, 157–161. https://doi.org/10.1097/00004703-199406000-00001

Curtin, C., Hubbard, K., Anderson, S. E., Mick, E., Must, A., & Bandini, L. G. (2015). Food selectivity, mealtime behavior problems, spousal stress, and family food choices in children with and without autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*(10), 3308-3315. https://doi-org.offcampus.lib.washington.edu/10.1007/s10803-015-2490-x

Dahlsgaard, K. K., & Bodie, J. (2018). The (extremely) picky eaters clinic: A pilot trial of a seven-session group behavioral intervention for parents of children with avoidant/restrictive food intake disorder. *Cognitive and Behavioral Practice*, *26*(3), 492-505. https://doi.org/10.1016/j.cbpra.2018.11.001

Davies, W. H., Satter, E., Berlin, K. S., Sato, A. F., Silverman, A. H., Fischer, E. A., Arvedson, J. C., & Rudolph, C. D. (2006). Reconceptualizing feeding and feeding disorders in interpersonal context: the case for a relational disorder. *Journal of Family Psychology*, *20*(3), 409. https://doi-org.offcampus.lib.washington.edu/10.1037/0893-3200.20.3.409

Davis, A. M., Canter, K. S., Stough, C. O., Gillette, M. D., & Patton, S. (2014). Measurement of mealtime behaviors in rural overweight children: An exploratory factor analysis of the

Behavioral Pediatrics Feeding Assessment Scale. *Journal of Pediatric Psychology, 39*, 332–339. https://doi.org/10.1093/jpepsy/jst089

Dawson-Squibb, J. J., Davids, E. L., Harrison, A. J., Molony, M. A., & de Vries, P. J. (2020). Parent education and training for autism spectrum disorders: Scoping the evidence. *Autism*, *24*(1), 7-25. https://doi-org.offcampus.lib.washington.edu/10.1177/136236131984

Dawson, J. E., Piazza, C. C., Sevin, B. M., Gulotta, C. S., Lerman, D., & Kelley, M. L. (2003). Use of the high-probability instructional sequence and escape extinction in a child with food refusal. *Journal of Applied Behavior Analysis*, *36*(1), 105-108. https://doi-org.offcampus.lib.washington.edu/10.1901/jaba.2003.36-105

De Moor, J., Didden, R., & Korzilius, H. P. L. M. (2007). Behavioural treatment of severe food refusal in five toddlers with developmental disabilities. *Child: Care, Health and Development*, *33*(6), 670-676. https://doi-org.offcampus.lib.washington.edu/10.1111/j.1365-2214.2007.00734.x

Deb, S. S., Retzer, A., Roy, M., Acharya, R., Limbu, B., & Roy, A. (2020). The effectiveness of parent training for children with autism spectrum disorder: a systematic review and meta-analyses. *BMC psychiatry*, *20*(1), 1-24. https://doi-org.offcampus.lib.washington.edu/10.1186/s12888-020-02973-7

Dettori, J. R., Norvell, D. C., & Chapman, J. R. (2021). Seeing the Forest by Looking at the Trees: How to Interpret a Meta-Analysis Forest Plot. *Global Spine Journal*, *11*(4), 614–616. https://doi.org/10.1177/21925682211003889

Dharmaraj, R., Elmaoued, R., Alkhouri, R., Vohra, P., & Castillo, R. O. (2023). Evaluation and Management of Pediatric Feeding Disorder. *Gastrointestinal Disorders*, *5*(1), 75-86. https://doi.org/10.3390/gidisord5010008

Diaz, J., & Cosbey, J. (2018). A systematic review of caregiver-implemented mealtime interventions for children with autism spectrum disorder. *OTJR: Occupation, Participation and Health*, *38*(3), 196-207. https://doi-org.offcampus.lib.washington.edu/10.1177/1539449218765459

Dickersin, K. (2005). Publication bias: Recognizing the problem, understanding its origins and scope, and preventing harm. In Rothstein, H. R., Sutton, A. J., & Borenstein, M. (Eds.). *Publication Bias in Meta-analysis: Prevention, Assessment and Adjustments* (pp. 9-33). John Wiley & Sons.

Douglas, J. E., & Bryon, M. (1996). Interview data on severe behavioural eating difficulties in young children. *Archives of Disease in Childhood*, *75*(4), 304-308. https://doi-org.offcampus.lib.washington.edu/10.1136/adc.75.4.304

Dovey, T. M., & Martin, C. I. (2012). A quantitative psychometric evaluation of an intervention for poor dietary variety in children with a feeding problem of clinical significance. *Infant Mental Health Journal, 33*, 148–162. https://doi-org.offcampus.lib.washington.edu/10.1002/imhj.21315

Dovey, T. M., Jordan, C., Aldridge, V. K., & Martin, C. I. (2013). Screening for feeding disorders: Creating critical values using the behavioural pediatrics feeding assessment scale. *Appetite, 69*, 108–113. https://doi.org/10.1016/j.appet.2013.05.019

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., Swettenham, J., Berry, B., & Charman, T. (2002). A pilot randomised control trial of a parent training

intervention for pre-school children with autism. *European Child & Adolescent Psychiatry*, *11*(6), 266-272. https://doi-org.offcampus.lib.washington.edu/10.1007/s00787-002-0299-6

Dumont, E., Jansen, A., Kroes, D., de Haan, E., & Mulkens, S. (2019). A new cognitive behavior therapy for adolescents with avoidant/restrictive food intake disorder in a day treatment setting: A clinical case series. *International Journal of Eating Disorders*, *52*(4), 447-458. https://doi-org.offcampus.lib.washington.edu/10.1002/eat.23053

Duval, S., & Tweedie, R. (2000). Trim and Fill: A simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341X.2000.00455.x

Eddy, K. T., Harshman, S. G., Becker, K. R., Bern, E., Bryant-Waugh, R., Hilbert, A., ... & Micali, N. (2019). Radcliffe ARFID workgroup: Toward operationalization of research diagnostic criteria and directions for the field. *International Journal of Eating Disorders*, *52*(4), 361-366. https://doi-org.offcampus.lib.washington.edu/10.1002/eat.23042

Edwards, G. S., Zlomke, K. R., & Greathouse, A. D. (2019). RUBI parent training as a group intervention for children with autism: A community pilot study. *Research in Autism Spectrum Disorders*, *66*, 1-10. https://doi.org/10.1016/j.rasd.2019.101409

Egger, M., Davey Smith, G., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ (Clinical research ed.)*, *315*(7109), 629–634. https://doi-org.offcampus.lib.washington.edu/10.1136/bmj.315.7109.629

Ek, A., Sorjonen, K., Eli, K., Lindberg, L., Nyman, J., Marcus, C., & Nowicka, P. (2016). Associations between parental concerns about preschoolers' weight and eating and

parental feeding practices: results from analyses of the Child Eating Behavior Questionnaire, the Child Feeding Questionnaire, and the Lifestyle Behavior Checklist. *PloS one*, *11*(1), 1-20. https://doi.org/10.1371/journal.pone.0147257

Elder, J. H., Donaldson, S. O., Kairalla, J., Valcante, G., Bendixen, R., Ferdig, R., Self, E., Walker, J., Palau, C., & Serrano, M. (2011). In-home training for fathers of children with autism: A follow up study and evaluation of four individual training components. *Journal of Child and Family Studies, 20*(3), 263-271. https://doi-org.offcampus.lib.washington.edu/10.1007/s10826-010-9387-2

Emond, A., Emmett, P., Steer, C., & Golding, J. (2010). Feeding symptoms, dietary patterns, and growth in young children with autism spectrum disorders. *Pediatrics*, *126*(2), 337-342. https://doi.org/10.1542/peds.2009-2391

Erkin, G., Culha, C., Ozel, S., & Kirbiyik, E. G. (2010). Feeding and gastrointestinal problems in children with cerebral palsy. *International Journal of Rehabilitation Research*, *33*(3), 218-224. DOI: 10.1097/MRR.0b013e3283375e10

Farrow, C. V., & Coulthard, H. (2012). Relationships between sensory sensitivity, anxiety and selective eating in children. *Appetite*, *58*(3), 842-846. https://doi.org/10.1016/j.appet.2012.01.017

Feldman, M. A., & Werner, S. E. (2002). Collateral effects of behavioral parent training on families of children with developmental disabilities and behavior disorders. *Behavioral Interventions: Theory & Practice in Residential & Community-Based Clinical Programs*, *17*(2), 75-83. https://doi.org/10.1002/bin.111

Field, D., Garland, M., & Williams, K. (2003). Correlates of specific childhood feeding problems. *Journal of Pediatrics and Child Health*, *39*(4), 299-304. https://doi.org/10.1046/j.1440-1754.2003.00151.x

Fischer, E., & Silverman, A. (2007). Behavioral conceptualization, assessment, and treatment of pediatric feeding disorders. *Seminars in Speech and Language*, 28(3), 223-231. https://doi.org/10.1055/s-2007-984728

Fishbein, M., Benton, K., & Struthers, W. (2016). Mealtime disruption and caregiver stress in referrals to an outpatient feeding clinic. *Journal of Parenteral and Enteral Nutrition*, *40*(5), 636-645. https://doi.org/10.1177/0148607114543832

Fisher, W. W., Piazza, C. C., & Roane, H. S. (2011). *Handbook of applied behavior analysis*. Guilford Press.

Fitzpatrick, K. K., Forsberg, S. E., & Colborn, D. (2015). Family-based therapy for avoidant restrictive food intake disorder: Families facing food neophobias. In K. L. Loeb, D. Le Grange, & J. Lock (Eds.). *Family therapy for adolescent eating and weight disorders* (pp. 276-296). Routledge.

Fodstad, J., Kirsch, A., Faidley, M., & Bauer, N. (2018). Demonstration of parent training to address early self-Injury in young children with intellectual and developmental delays. *Journal of Autism and Developmental Disorders, 48*(11), 3846-3857. https://doi.org/10.1007/s10803-018-3651-5

Fraser, K., Wallis, M., & John, W. S. (2004). Improving children's problem eating and mealtime behaviours: An evaluative study of a single session parent education programme. *Health Education Journal*, *63*(3), 229-241. https://doi.org/10.1177/001789690406300304

Freeman, K. A., & Piazza, C. C. (1998). Combining stimulus fading, reinforcement, and

extinction to treat food refusal. *Journal of Applied Behavior Analysis*, *31*, 691-694. https://doi.org/10.1901/jaba.1998.31-691

Gao, M., Xue, K., & Guo, H. (2020). Reliability and Validity Study of the Children's Eating Behavior Questionnaire in Chinese School-Age Children. *Journal of Nutritional Science and Vitaminology*, *66*(Supplement), S82–S86. https://doi.org/10.3177/jnsv.66.S82

Garro, A., Thurman, S. K., Kerwin, M. E., & Ducette, J. P. (2005). Parent/caregiver stress during pediatric hospitalization for chronic feeding problems. *Journal of Pediatric Nursing*, *20*(4), 268-275. https://doi.org/10.1016/j.pedn.2005.02.015

Gast, D. L., Lloyd, B. P., & Ledford, J. R. (2018). Multiple baseline and multiple probe designs. In D. L. Gast & J. R. Ledford (Eds.) *Single case research methodology: Applications in special education and behavioral sciences* (3rd ed., pp. 368-427). Routledge.

Gentry, J. A., & Luiselli, J. K. (2008). Treating a child's selective eating through parent implemented feeding intervention in the home setting. *Journal of Developmental and Physical Disabilities*, *20*(1), 63-70. https://doi.org/10.1007/s10882-007-9080-6

Ginn, N. C., Clionsky, L. N., Eyberg, S. M., Warner-Metzger, C., & Abner, J. P. (2015). Child-directed interaction training for young children with autism spectrum disorders: Parent and child outcomes. *Journal of Clinical Child and Adolescent Psychology, 18*, 1–9. https://doi.org/10.1080/15374416.2015.1015135

Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational Researcher*, *5*(10), 3-8. https://doi.org/10.2307/1174772

Goday, P. S., Huh, S. Y., Silverman, A., Lukens, C. T., Dodrill, P., Cohen, S., Delaney, A. L., Feuling, M. B., Noel, R. J., Gisel, E., Kenzer, A., Kessler, D. B., Kraus de Camargo, O., Browne, J., & Phalen, J. A. (2019). Pediatric feeding disorder: consensus definition and

conceptual framework. *Journal of Pediatric Gastroenterology and Nutrition*, *68*(1), 124-129. https://doi.org/10.1097/MPG.0000000000002188

Gomes, A. I., Pereira, A. I., Roberto, M. S., Boraska, K., & Barros, L. (2021). Changing parental feeding practices through web-based interventions: a systematic review and meta-analysis. *PLoS One*, *16*(4), e0250231. https://doi.org/10.1371/journal.pone.0250231

Greer, A. J., Gulotta, C. S., Masler, E. A., & Laud, R. B. (2008). Caregiver stress and outcomes of children with pediatric feeding disorders treated in an intensive interdisciplinary program. *Journal of Pediatric Psychology, 33*(6), 612-620. https://doi.org/10.1093/jpepsy/jsm116

Grissom, R. J., & Kim, J. J. (2005). *Effect sizes for research: A broad practical approach*. Lawrence Erlbaum Associates Publishers.

Hall, J. A., & Rosenthal, R. (1991). Testing for moderator variables in meta-analysis: Issues and methods. *Communications Monographs*, *58*(4), 437-448. https://doi.org/10.1080/03637759109376240

Handen, B. L., Aman, M. G., Arnold, L. E., Hyman, S. L., Tumuluru, R. V., Lecavalier, L., Corbett-Dick, P., Pan, X., Hollway, J. A., Buchan-Page, K. A., Silverman, L. B., Brown, N. V., Rice, R. R., Hellings, J., Mruzek, D. W., McAuliffe-Bellin, S., Hurt, E. A., Ryan, M. M., Levato, L., & Smith, T. (2015). Atomoxetine, parent training, and their combination in children with autism spectrum disorder and attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 54*(11), 905–915. https://doi.org/10.1016/j.jaac.2015.08.013

Harrer, M., Cuijpers, P., Furukawa, T.A., & Ebert, D.D. (2021). *Doing meta-analysis with R: A hands-on guide*. Chapman & Hall/CRC Press.

Hedges, L. V., & Olkin, I. (2014). *Statistical methods for meta-analysis*. Academic press.

Hedges, L. V., & Pigott, T. D. (2004). The power of statistical tests for moderators in meta-analysis. *Psychological Methods*, *9*(4), 426. https://doi.org/10.1037/1082-989X.9.4.426

Hendy, H. M., Williams, K. E., Riegel, K., & Paul, C. (2010). Parent mealtime actions that mediate associations between children's fussy-eating and their weight and diet. *Appetite*, *54*(1), 191-195. https://doi.org/10.1016/j.appet.2009.10.006

Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., Welch, V.A. (Eds.). (2019) *Cochrane handbook for systematic reviews of interventions* (2nd ed). John Wiley & Sons.

Higgins, J. P., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine*, *21*(11), 1539-1558. https://doi.org/10.1002/sim.1186

Hilbert, A., & van Dyck, Z. (2016). *Eating disorders in youth-questionnaire*. Retrieved from http://nbn-resolving.de/urn:nbn:de:bsz:15-qucosa-197246

Hoch, T. A., Babbitt, R. L., Ccoe, D. A., Krell, D. M., & Hackbert, L. (1994). Contingency contacting: Combining positive reinforcement and escape extinction procedures to treat persistent food refusal. *Behavior Modification*, *18*(1), 106-128. https://doi.org/10.1177/01454455940181007

Hoch, T. A., Babbitt, R. L., Farrar-Schneider, D., Berkowitz, M. J., Owens, J. C., Knight, T. L., Snyder, A. M., Rizol, L. M., & Wise, D. T. (2001). Empirical examination of a multicomponent treatment for pediatric food refusal. *Education & Treatment of Children*, *24*(2), 176–176. https://link-gale-com.offcampus.lib.washington.edu/apps/doc/A79210380/AONE?u=wash_main&sid=bookmark-AONE&xid=910185cb

Hodges, A., Davis, T., Crandall, M., Phipps, L., & Weston, R. (2017). Using shaping to increase foods consumed by children with autism. *Journal of Autism and Developmental Disorders*, *47*(8), 2471-2479. https://doi.org/10.1007/s10803-017-3160-y

Hopewell, S., Clarke, M., & Mallett, S. (2005). Grey Literature and systematic review. In Rothstein, H. R., Sutton, A. J., & Borenstein, M. (Eds.). *Publication Bias in Meta-analysis: Prevention, Assessment and Adjustments* (pp. 49-72). John Wiley & Sons.

Horowitz, F. D. (1992). John B. Watson's legacy: Learning and environment. *Developmental Psychology*, *28*(3), 360. https://doi.org/10.1037/0012-1649.28.3.360

Huedo-Medina, T. B., Sánchez-Meca, J., Marín-Martínez, F., & Botella, J. (2006). Assessing heterogeneity in meta-analysis: Q statistic or I^2 index?. *Psychological Methods*, *11*(2), 193. https://doi.org/10.1037/1082-989X.11.2.193

Iadarola, S., Levato, L., Harrison, B., Smith, T., Lecavalier, L., Johnson, C., Swiezy, N., Bearss, K., & Scahill, L. (2018). Teaching Parents Behavioral Strategies for Autism Spectrum Disorder (ASD): Effects on Stress, Strain, and Competence. *Journal of Autism and Developmental Disorders*, *48*(4), 1031–1040. https://doi.org/10.1007/s10803-017-3339-2

Iida, N., Wada, Y., Yamashita, T., Aoyama, M., Hirai, K., & Narumoto, J. (2018). Effectiveness of parent training in improving stress-coping capability, anxiety, and depression in mothers raising children with autism spectrum disorder. *Neuropsychiatric Disease and Treatment*, *14*, 3355–3362. https://doi.org/10.2147/NDT.S188387

Ingersoll, B., & Dvortcsak, A. (2006). Including parent training in the early childhood special education curriculum for children with autism spectrum disorders. *Topics in Early Childhood Special Education*, *26*(3), 179-187. https://doi.org/10.1177/10983007060080020601

Ingersoll, B., & Gergans, S. (2007). The effect of a parent-implemented imitation intervention on spontaneous imitation skills in young children with autism. *Research in Developmental Disabilities*, *28*(2), 163-175. https://doi.org/10.1016/j.ridd.2006.02.004

Iwata, B. A., Pace, G. M., Cowdery, G. E., & Miltenberger, R. G. (1994). What makes extinction work: An analysis of procedural form and function. *Journal of Applied Behavior Analysis*, *27*(1), 131-144. https://doi.org/10.1901/jaba.1994.27-131

Iwata, B. A., Riordan, M. M., Wohl, M. K., & Finney, J. W. (1982). Pediatric feeding disorders: Behavioral analysis and treatment. In A. J. Accardo (Ed.), *Failure to thrive in infancy and early childhood: A multi-disciplinary team approach* (pp. 296-329). University Park Press.

Jhuo, R. A., & Chu, S. Y. (2022). A review of parent-implemented Early Start Denver Model for children with autism spectrum disorder. *Children*, *9*(2), 285. https://doi.org/10.3390/children9020285

Johnson, C. R., Brown, K., Hyman, S. L., Brooks, M. M., Aponte, C., Levato, L., Schmidt, B., Evans, V., Huo, Z., Bendixen, R., Eng, H., Sax, T., & Smith, T. (2019). Parent training for feeding problems in children with autism spectrum disorder: Initial randomized trial. *Journal of Pediatric Psychology*, *44*(2), 164-175. https://doi.org/10.1093/jpepsy/jsy063

Johnson, C. R., Foldes, E., DeMand, A., & Brooks, M. M. (2015). Behavioral parent training to address feeding problems in children with autism spectrum disorder: A pilot trial. *Journal of Developmental and Physical Disabilities*, *27*(5), 591-607. https://doi.org/10.1007/s10882-015-9437-1

Johnson, C. R., Handen, B. L., Butter, E., Wagner, A., Mulick, J., Sukhodolsky, D. G., Williams, S., Swiezy, N. A., Arnold, L. E., Aman, M. G., Scahill, L., Stigler, K. A., McDougle, C. J., Vitiello, B., & Smith, T. (2007). Development of a parent training program for children with pervasive developmental disorders. *Behavioral Interventions*, *22*, 201–221. https://doi.org/10.1002/bin.237

Kadey, H., Piazza, C. C., Rivas, K. M., & Zeleny, J. (2013). An evaluation of texture manipulations to increase swallowing. *Journal of Applied Behavior Analysis*, *46*(2), 539-543. https://doi.org/10.1002/jaba.33

Kambanis, P. E., & Thomas, J. J. (2023). Assessment and treatment of avoidant/restrictive food intake disorder. *Current Psychiatry Reports*, *25*(2), 53-64. https://doi.org/10.1007/s11920-022-01404-6

Karst, J. S., & Van Hecke, A. V. (2012). Parent and family impact of autism spectrum disorders: A review and proposed model for intervention evaluation. *Clinical Child and Family Psychology Review*, *15*(3), 247–277. https://doi.org/10.1007/s10567-012-0119-6

Kasari C., Gulsrud A. C., Wong C., Kwon, S., & Locke, J. (2010) Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. *Journal of Autism and Developmental Disorders* 40(9), 1045–1056. https://doi.org/10.1007/s10803-010-0955-5

Kasari, C., Lawton, K., Shih, W., Barker, T. V., Landa, R., Lord, C., Orlich, F., King, B., Wetherby, A., & Senturk, D. (2014). Caregiver-mediated intervention for low-resourced preschoolers with autism: An RCT. *Pediatrics*, *134*(1), e72-e79. https://doi.org/10.1542/peds.2013-3229

Katzman, D. K., Norris, M. L., & Zucker, N. (2019). Avoidant restrictive food intake disorder. *Psychiatric Clinics*, *42*(1), 45-57. https://doi.org/10.1016/j.psc.2018.10.003

Kelley, M. E., Piazza, C. C., Fisher, W. W., & Oberdorff, A. J. (2003). Acquisition of cup drinking using previously refused foods as positive and negative reinforcement. *Journal of Applied Behavior Analysis*, *36*(1), 89-93. https://doi.org/10.1901/jaba.2003.36-89

Kennedy, C. H. (2005). *Single-case designs for educational research*. Prentice Hall.

Kern, L., & Marder, T. J. (1996). A comparison of simultaneous and delayed reinforcement as treatments for food selectivity. *Journal of Applied Behavior Analysis*, *29*(2), 243-246. https://doi.org/10.1901/jaba.1996.29-243

Kerwin, M. E. (1999). Empirically supported treatments in pediatric psychology: Severe feeding problems. *Journal of Pediatric Psychology*, *24*(3), 193-214. https://doi.org/10.1093/jpepsy/24.3.193

Kerwin, M. E. (2003). Pediatric feeding problems: A behavior analytic approach to assessment and treatment. *The Behavior Analyst Today*, *4*(2), 162-176. https://doi.org/10.1037/h0100114

Kerzner, B., Milano, K., MacLean, W. C., Berall, G., Stuart, S., & Chatoor, I. (2015). A practical approach to classifying and managing feeding difficulties. *Pediatrics*, *135*(2), 344-353. https://doi.org/10.1542/peds.2014-1630

Kodak, T., & Piazza, C. C. (2008). Assessment and behavioral treatment of feeding and sleeping disorders in children with autism spectrum disorders. *Child and Adolescent Psychiatric Clinics of North America 17*, 887-905. https://doi.org/10.1016/j.chc.2008.06.005

Koegel, R. L., Bharoocha, A. A., Ribnick, C. B., Ribnick, R. C., Bucio, M. O., Fredeen, R. M., & Koegel, L. K. (2012). Using individualized reinforcers and hierarchical exposure to

increase food flexibility in children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *42*(8), 1574-1581. https://doi.org/10.1007/s10803-011-1392-9

Koegel, R. L., Bimbela, A., & Schreibman, L. (1996). Collateral effects of parent training on family interactions. *Journal of Autism and Developmental Disorders*, *26*(3), 347-359. https://doi.org/10.1007/BF02172479

Kovacic, K., Rein, L. E., Szabo, A., Kommareddy, S., Bhagavatula, P., & Goday, P. S. (2021). Pediatric feeding disorder: a nationwide prevalence study. *The Journal of Pediatrics*, *228*, 126-131. https://doi.org/10.1016/j.jpeds.2020.07.047

Kuschner, E. S., Eisenberg, I. W., Orionzi, B., Simmons, W. K., Kenworthy, L., Martin, A., & Wallace, G. L. (2015). A preliminary study of self-reported food selectivity in adolescents and young adults with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *15*, 53-59. https://doi.org/10.1016/j.rasd.2015.04.005

Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: a practical primer for t-tests and ANOVAs. *Frontiers in psychology*, *4*, 1-10. https://doi-org.offcampus.lib.washington.edu/10.3389/fpsyg.2013.00863

LaRue, R. H., Stewart, V., Piazza, C. C., Volkert, V. M., Patel, M. R., & Zeleny, J. (2011). Escape as reinforcement and escape extinction in the treatment of feeding problems. *Journal of Applied Behavior Analysis, 44*(4), 719-735. https://doi.org/10.1901/jaba.2011.44-719

Laud, R. B., Girolami, P. A., Boscoe, J. H., & Gulotta, C. S. (2009). Treatment outcomes for severe feeding problems in children with autism spectrum disorder. *Behavior Modification*, *33*(5), 520-536. https://doi.org/10.1177/0145445509346729

Ledford, J. R., & Gast, D. L. (2006). Feeding problems in children with autism spectrum disorders: A review. *Focus on Autism and Other Developmental Disorders, 21*(3), 153-166. https://doi.org/10.1177/10883576060210030401

Ledford, J. R., Whiteside, E., & Severini, K. E. (2018). A systematic review of interventions for feeding-related behaviors for individuals with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *52*, 69-80. https://doi.org/10.1016/j.rasd.2018.04.008

Lerman, D. C., & Iwata, B. A. (1995). Prevalence of the extinction burst and its attenuation during treatment. *Journal of Applied Behavior Analysis, 28,* 93-94. https://doi.org/10.1901/jaba.1995.28-93

Lerman, D. C., Iwata, B. A., & Wallace, M. D. (1999). Side effects of extinction: Prevalence of bursting and aggression during the treatment of self-injurious behavior. *Journal of Applied Behavior Analysis*, *32*(1), 1-8. https://doi.org/10.1901/jaba.1999.32-1

Levin, L., & Carr, E. G. (2001). Food selectivity and problem behavior in children with developmental disabilities: Analysis and intervention. *Behavior Modification*, *25*(3), 443-470. https://doi.org/10.1177/0145445501253004

Lin, L., & Chu, H. (2018). Quantifying publication bias in meta-analysis. *Biometrics*, *74*(3), 785–794. https://doi-org.offcampus.lib.washington.edu/10.1111/biom.12817

Lindberg, L., Bohlin, G., & Hagekull, B. (1991). Early feeding problems in a normal population. *International Journal of Eating Disorders*, *10*(4), 395-405. https://doi.org/10.1002/1098-108X(199107)10:4<395::AID-EAT2260100404>3.0.CO;2-A

Linscheid, T. R. (2006). Behavioral treatments for pediatric feeding disorders. *Behavior Modification*, *30*(1), 6-23. https://doi.org/10.1177/0145445505282165

Liu, Q., Hsieh, W. Y., & Chen, G. (2020). A systematic review and meta-analysis of parent-mediated intervention for children and adolescents with autism spectrum disorder in mainland China, Hong Kong, and Taiwan. *Autism*, *24*(8), 1960-1979. https://doi.org/10.1177/1362361320943380

Lock, J. (2015). An update on evidence-based psychosocial treatments for eating disorders in children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, *44*(5), 707-721. https://doi.org/10.1080/15374416.2014.971458

Lock, J., Robinson, A., Sadeh-Sharvit, S., Rosania, K., Osipov, L., Kirz, N., Derenne, J., & Utzinger, L. (2019). Applying family-based treatment (FBT) to three clinical presentations of avoidant/restrictive food intake disorder: Similarities and differences from FBT for anorexia nervosa. *International Journal of Eating Disorders*, *52*(4), 439-446. https://doi.org/10.1002/eat.22994

Loh, D. A., Moy, F. M., Zaharan, N. L., & Mohamed, Z. (2013). Eating behaviour among multi-ethnic adolescents in a middle-income country as measured by the self-reported Children's Eating Behaviour Questionnaire. *PloS one*, *8*(12), 1-12. https://doi.org/10.1371/journal.pone.0082885

Loh, D. A., Moy, F. M., Zaharan, N. L., & Mohamed, Z. (2013). Eating behaviour among multi-ethnic adolescents in a middle-income country as measured by the self-reported Children's Eating Behaviour Questionnaire. *PloS one*, *8*(12).1-12. https://doi.org/10.1371/journal.pone.0082885

Lucarelli, L., Ambruzzi, A. M., Cimino, S., D'Olimpio, F., & Finistrella, V. (2003). Feeding disorders in infancy: an empirical study on mother-infant interactions. *Minerva Pediatrica*, *55*(3), 243-53.

Luiselli, J. (2000). Cueing, demand fading, and positive reinforcement to establish self-feeding and oral consumption in a child with chronic food refusal. *Behavior Modification*, *24*, 348-358. https://doi.org/10.1177/0145445500243003

Luiselli, J. K. (1989). Behavioral assessment and treatment of pediatric feeding disorders in developmental disabilities. *Progress in Behavior Modification, 24*, 91-131.

Lukens, C. T. (2011). Behavioral assessment of pediatric feeding problems. In Martin, C. R., & Watson, R. (Ed.s.). *Handbook of behavior, food and nutrition* (pp. 3437-3452). Springer.

Lukens, C. T., & Linscheid, T. R. (2008). Development and validation of an inventory to assess mealtime behavior problems in children with autism. *Journal of Autism and Developmental Disorders*, *38*(2), 342-352. https://doi.org/10.1007/s10803-007-0401-5

Lukens, C. T., & Silverman, A. H. (2014). Systematic review of psychological interventions for pediatric feeding problems. *Journal of Pediatric Psychology*, *39*(8), 903-917. https://doi.org/10.1093/jpepsy/jsu040

Mammel, K. A., & Ornstein, R. M. (2017). Avoidant/restrictive food intake disorder: a new eating disorder diagnosis in the diagnostic and statistical manual 5. *Current Opinion in Pediatrics*, *29*(4), 407-413. https://doi.org/10.1097/MOP.0000000000000507

Manikam, R., & Perman, J. (2000). Pediatric feeding disorders. *Journal of Clinical Gastroenterology, 30*(1), 34-46. https://doi.org/10.1097/00004836-200001000-00007

Marí-Bauset, S., Zazpe, I., Mari-Sanchis, A., Llopis-González, A., & Morales-Suárez-Varela, M. (2014). Food selectivity in autism spectrum disorders: a systematic review. *Journal of Child Neurology*, *29*(11), 1554-1561. https://doi.org/10.1177/0883073813498821

Marinschek, S., Pahsini, K., Scheer, P. J., & Dunitz-Scheer, M. (2019). Long-term outcomes of an interdisciplinary tube weaning program: A quantitative study. *Journal of Pediatric*

Gastroenterology and Nutrition, *68*(4), 591-594. https://doi.org/10.1097/MPG.0000000000002264

Marquenie, K., Rodger, S., Mangohig, K., & Cronin, A. (2011). Dinnertime and bedtime routines and rituals in families with a young child with an autism spectrum disorder. *Australian Occupational Therapy Journal, 58*(3), 145-154. https://doi.org/10.1111/j.1440-1630.2010.00896.x

Marshall, J., Ware, R., Ziviani, J., Hill, R. J., & Dodrill, P. (2015). Efficacy of interventions to improve feeding difficulties in children with autism spectrum disorders: a systematic review and meta-analysis. *Child: Care, Health and Development*, *41*(2), 278-302. https://doi.org/10.1111/cch.12157

Martins, Y., Young, R. L., & Robson, D. C. (2008). Feeding and eating behaviors in children with autism and typically developing children. *Journal of Autism and Developmental Disorders, 38*, 1878–1887. https://doi.org/10.1007/s10803-008-0583-5

Matson, J. L., & Fodstad, J. C. (2009). The treatment of food selectivity and other feeding problems in children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *3*(2), 455–461. https://doi.org/10.1016/j.rasd.2008.09.005

Matson, J. L., Fodstad, J. C., & Dempsey, T. (2009). The relationship of children's feeding problems to core symptoms of autism and PDD-NOS. *Research in Autism Spectrum Disorders*, *3*(3), 759-766.

Matson, M. L., Mahan, S., & Matson, J. L. (2009). Parent training: A review of methods for children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *3*(4), 868-875. https://doi.org/10.1016/j.rasd.2009.02.005

McIntyre, L. L. (2013). Parent training interventions to reduce challenging behavior in children with intellectual and developmental disabilities. *International Review of Research in Developmental Disabilities*, *44*, 245-279. http://dx.doi.org/10.1016/B978-0-12-401662-0.00008-7

Meadan, H., Ostrosky, M. M., Zaghlawan, H. Y., & Yu, S. (2009). Promoting the social and communicative behavior of young children with autism spectrum disorders: A review of parent-implemented intervention studies. *Topics in Early Childhood Special Education*, *29*(2), 90-104. https://doi.org/10.1177/0271121409337950

Meadan, H., Snodgrass, M. R., Meyer, L. E., Fisher, K. W., Chung, M. Y., & Halle, J. W. (2016). Internet-based parent-implemented intervention for young children with autism: A pilot study. *Journal of Early Intervention, 38*(1), 3-23. https://doi.org/10.1177/1053815116630327

Mehta, P., Furuta, G. T., Brennan, T., Henry, M. L., Maune, N. C., Sundaram, S. S., Menard-Katcher, C., Atkins, D., Takurukura, F., Giffen, S., Pan, Z., & Pan, Z. (2018). Nutritional state and feeding behaviors of children with eosinophilic esophagitis and gastroesophageal reflux disease. *Journal of Pediatric Gastroenterology and Nutrition*, *66*(4), 603-608. https://doi.org/10.1097/MPG.0000000000001741

Meier, A. E., Fryling M. J., & Wallace, M. D. (2012). Using high-probability foods to increase the acceptance of low-probability foods. *Journal of Applied Behavior Analysis, 45*(1), 149-53. https://doi.org/10.1901/jaba.2012.45-149

Minjarez, M. B., Williams, S. E., Mercier, E. M., & Hardan, A. Y. (2011). Pivotal response group treatment program for parents of children with autism. *Journal of Autism and Developmental Disorders*, *41*(1), 92-101. https://doi.org/10.1007/s10803-010-1027-6

Morawska, A., Adamson, M., Hinchliffe, K., & Adams, T. (2014). Hassle free mealtimes Triple-P: A randomised controlled trial of a brief parenting group for childhood mealtime difficulties. *Behaviour Research and Therapy*, *53*, 1-9. https://doi.org/10.1016/j.brat.2013.11.007

Morris, E. K., Todd, J. T., Midgley, B. D., Schneider, S. M., & Johnson, L. M. (1990). The history of behavior analysis: Some historiography and a bibliography. *The Behavior Analyst*, *13*(2), 131-158. https://doi.org/10.1007/BF03392530

Moxley, R. A. (1996). The import of Skinner's three-term contingency. *Behavior and Philosophy*, 145-167. https://www-jstor-org.offcampus.lib.washington.edu/stable/27759351?sid=primo

Mueller, M. M., Piazza, C. C., Moore, J. W., Kelley, M. E., Bethke, S. A., Pruett, A. E., Oberdorff, A. J., & Layer, S. A. (2003). Training parents to implement pediatric feeding protocols. *Journal of Applied Behavior Analysis*, *36*(4), 545-562. https://doi.org/10.1901/jaba.2003.36-545

Mueller, M. M., Piazza, C. C., Patel, M. R., Kelley, M. E., & Pruett, A. (2004). Increasing variety of foods consumed by blending nonpreferred foods into preferred foods. *Journal of Applied Behavior Analysis, 37,* 159-170. https://doi.org/10.1901/jaba.2004.37-159

Murphy, J., & Zlomke, K. R. (2016). A behavioral parent-training intervention for a child with avoidant/restrictive food intake disorder. *Clinical Practice in Pediatric Psychology*, *4*(1), 23. https://doi.org/10.1037/cpp0000128

Nadler, C., Slosky, L., Kapalu, C. L., & Sitzmann, B. (2019). Interdisciplinary treatment for pediatric feeding disorders. In R.D. Rieske (Ed.). *Handbook of interdisciplinary treatments for autism spectrum disorder* (pp. 131-150). Springer.

Naish, K. R., & Harris, G. (2012). Food intake is influenced by sensory sensitivity. *PloS one*, *7*(8), 1-4. https://doi.org/10.1371/journal.pone.0043622

Najdowski, A. C., Tarbox, J., & Wilke, A. E. (2012). Utilizing antecedent manipulations and reinforcement in the treatment of food selectivity by texture. *Education & Treatment of Children, 35*(1), 101-110. https://doi.org/10.1353/etc.2012.0004

Najdowski, A. C., Wallace, M. D., Doney, J. K., & Ghezzi, P. M. (2003). Parental assessment and treatment of food selectivity in natural settings. *Journal of Applied Behavior Analysis*, *36*(3), 383-386. https://doi.org/10.1901/jaba.2003.36-383

Najdowski, A. C., Wallace, M. D., Reagon, K., Penrod, B., Higbee, T. S., & Tarbox, J. (2010). Utilizing a home-based parent training approach in the treatment of food selectivity. *Behavioral Interventions: Theory & Practice in Residential & Community-Based Clinical Programs*, *25*(2), 89-107. https://doi.org/10.1002/bin.298

Nelson, E. L., & Patton, S. (2016). Using videoconferencing to deliver individual therapy and pediatric psychology interventions with children and adolescents. *Journal of Child and Adolescent Psychopharmacology*, *26*(3), 212-220. https://doi.org/10.1089/cap.2015.0021

Nevill, R. E., Lecavalier, L., & Stratis, E. A. (2018). Meta-analysis of parent-mediated interventions for young children with autism spectrum disorder. *Autism*, *22*(2), 84-98. https://doi.org/10.1177/1362361316677838

Noel, R. J. (2023). Avoidant restrictive food intake disorder and pediatric feeding disorder: the pediatric gastroenterology perspective. *Current Opinion in Pediatrics*, *35*(5), 566–573. https://doi.org/10.1097/MOP.0000000000001267

Norris, M. L., Spettigue, W. J., & Katzman, D. K. (2016). Update on eating disorders: Current perspectives on avoidant/restrictive food intake disorder in children and

youth. *Neuropsychiatric Disease and Treatment*, *12*, 213-218. https://doi.org/10.2147/NDT.S82538

O'Donovan, K., Armitage, S., Featherstone, J., McQuillin, L., Longley, S., Pollard, N. (2019). Group-based parent training interventions for parents of children with autism spectrum disorders: A literature review. *Journal of Autism and Developmental Disorders, 6*(1), 85-95. https://doi.org/10.1007/s40489-018-00155-6

Ornstein, R. M., Essayli, J. H., Nicely, T. A., Masciulli, E., & Lane-Loney, S. (2017). Treatment of avoidant/restrictive food intake disorder in a cohort of young patients in a partial hospitalization program for eating disorders. *International Journal of Eating Disorders*, *50*(9), 1067-1074. https://doi.org/10.1002/eat.22737

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid. A. (2016). Rayyan — a web and mobile app for systematic reviews. *Systematic Reviews*, 5:210, DOI: 10.1186/s13643-016-0384-4.

Overton, R. C. (1998). A comparison of fixed-effects and mixed (randomeEffects) models for meta-analysis tests of moderator variable effects. *Psychological Methods*, *3*(3), 354–379. https://doi.org/10.1037/1082-989X.3.3.354

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., … Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ (Clinical research ed.)*, *372*, n71. https://doi.org/10.1136/bmj.n71

Page, M. J., Sterne, J. A., Higgins, J. P., & Egger, M. (2021). Investigating and dealing with publication bias and other reporting biases in meta-analyses of health research: A review. *Research Synthesis Methods*, *12*(2), 248-259. DOI: 10.1002/jrsm.1468

Park, J, H., Alber-Morgan, R.S., & Cannella-Malone, H. (2011). Effects of mother-implemented picture exchange communication system (PECS) training on independent communicative behaviors of young children with autism spectrum disorders. *Topics in Early Childhood Special Education, 31*(1), 37–47. https://doi.org/10.1177/0271121410393750

Patel, M. R., Piazza, C. C., Kelly, M. L., Ochsner, C. A., & Santana, C. M. (2001). Using a fading procedure to increase fluid consumption in a child with feeding problems. *Journal of Applied Behavior Analysis, 34,* 357-360. https://doi.org/10.1901/jaba.2001.34-357

Patel, M. R., Piazza, C. C., Layer, S., Coleman, R., & Swartzwelder, D., (2005). A systematic evaluation of food textures to decrease packing and increase oral intake in children with pediatric feeding disorders. *Journal of Applied Behavior Analysis, 38,* 89-100. https://doi.org/10.1901/jaba.2005.161-02

Patel, M. R., Piazza, C. C., Martinez, C. J., Volkert, V. M., & Santana, C. M. (2002a). An evaluation of two differential reinforcement procedures with escape extinction to treat food refusal. *Journal of Applied Behavior Analysis, 35,* 363-374. https://doi.org/10.1901/jaba.2002.35-363

Patel, M. R., Piazza, C. C., Santana, C. M., & Volkert, V. M. (2002b). An evaluation of food type and texture in the treatment of a feeding problem. *Journal of Applied Behavior Analysis, 35,* 183-186. https://doi.org/10.1901/jaba.2002.35-183

Patel, M., Reed, G. K., Piazza, C. C., Mueller, M., Bachmeyer, M. H., & Layer, S. A. (2007). Use of a high-probability instructional sequence to increase compliance to feeding

demands in the absence of escape extinction. *Behavioral Interventions: Theory & Practice in Residential & Community-Based Clinical Programs*, *22*(4), 305-310. https://doi.org/10.1002/bin.251

Patterson, S. Y., Smith, V., & Mirenda, P. (2011). A systematic review of training programs for parents of children with autism spectrum disorders: single subject contributions. *Autism: The International Journal of Research and Practice*, *16*(5), 498–522. https://doi.org/10.1177/1362361311413398

Patton, S. R., Dolan, L. M., & Powers, S. W. (2006). Parent report of mealtime behaviors in young children with type 1 diabetes mellitus: Implications for better assessment of dietary adherence problems in the clinic. *Journal of Developmental and Behavioral Pediatrics, 27*, 202–208. https://doi.org/10.1097/00004703-200606000-00004

Pedersen, S. D., Parsons, H. G., & Dewey, D. (2004). Stress levels experienced by the parents of enterally fed children. *Child: Care, Health and Development*, *30*(5), 507-513. https://doi.org/10.1111/j.1365-2214.2004.00437.x

Penrod, B., Gardella, L., & Fernand, J. (2012). An evaluation of a progressive high-probability instructional sequence combined with low-probability demand fading in the treatment of food selectivity. *Journal of Applied Behavior Analysis*, *45*(3), 527-537. https://doi.org/10.1901/jaba.2012.45-527

Penrod, B., Wallace, M. D., Reagon, K., Betz, A., & Higbee, T. S. (2010). A component analysis of a parent-conducted multi-component treatment for food selectivity. *Behavioral Interventions*, *25*(3), 207-228. https://doi.org/10.1002/bin.307

Perske, R., Clifton, A., McClean, B. M., & Stein, J. I. (1977). *Mealtimes for severely and profoundly handicapped persons: New concepts and attitudes*. University Park Press.

Peterson, K. M., Piazza, C. C., Luczynski, K. C., & Fisher, W. W. (2017). Virtual-care delivery of applied-behavior-analysis services to children with autism spectrum disorder and related conditions. *Behavior Analysis: Research and Practice*, *17*(4), 286-297. https://doi.org/10.1037/bar0000030

Piazza, C. C., Fisher, W. W., Brown, K. A., Shore, B. A., Patel, M. R., Katz, R. M., ... & Blakely-Smith, A. (2003). Functional analysis of inappropriate mealtime behaviors. *Journal of Applied Behavior Analysis*, *36*(2), 187-204. https://doi.org/10.1901/jaba.2003.36-187

Piazza, C. C., Milnes, S. M., & Shalev, R. A. (2015). A behavior-analytic approach to the assessment and treatment of pediatric feeding disorders. In H. Roane, J. E. Ringdahl, & T. Falcomata, (Eds.). *Clinical and organizational applications of applied behavior analysis* (pp. 69-94). Academic Press.

Piazza, C. C., Moes, D. R., & Fisher, W. W. (1996). Differential reinforcement of alternative behavior and demand fading in the treatment of escape-maintained destructive behavior. *Journal of Applied Behavior Analysis*, *29*(4), 569–572. https://doi.org/10.1901/jaba.1996.29-569

Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. M., & Layer, S. A. (2003). On the relative contributions of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, *36*(3), 309-324. https://doi.org/10.1901/jaba.2003.36-309

Piazza, C. C., Patel, M. R., Santana, C. M., Goh, H., Delia, M. D., & Lancaster, B. M. (2002). An evaluation of simultaneous and sequential presentation of preferred and nonpreferred

food to treat food selectivity. *Journal of Applied Behavior Analysis, 35,* 259-270. https://doi.org/10.1901/jaba.2002.35-259

Piazza, C. C., Roane, H. S., & Kadey, H. J. (2009). Treatment of pediatric feeding disorders. In Matson J. L., Andrasik, F., & Matson, M. L. (Eds.). *Treating childhood psychopathology and developmental disabilities* (pp. 435-444). Springer.

Pierucci, J. M. (2016). Mothers' scaffolding techniques used during play in toddlers with autism spectrum disorder. *Journal of Developmental and Physical Disabilities*, *28*(2), 217-235. https://doi.org/10.1007/s10882-015-9459-8

Pitt, P. D., & Middleman, A. B. (2018). A focus on behavior management of avoidant/restrictive food intake disorder (ARFID): A case series. *Clinical Pediatrics*, *57*(4), 478-480. https://doi.org/10.1177/0009922817721158

Poppert, K. M., Patton, S. R., Borner, K. B., Davis, A. M., & Dreyer Gillette, M. L. (2015). Systematic review: mealtime behavior measures used in pediatric chronic illness populations. *Journal of Pediatric Psychology, 40*(5), 475-486. https://doi.org/10.1093/jpepsy/jsu117

Postorino, V., Sharp, W. G., McCracken, C. E., Bearss, K., Burrell, T. L., Evans, A. N., & Scahill, L. (2017). A systematic review and meta-analysis of parent training for disruptive behavior in children with autism spectrum disorder. *Clinical Child and Family Psychology Review*, *20*(4), 391-402. https://doi.org/10.1007/s10567-017-0237-2

Quah, P. L., Cheung, Y. B., Pang, W. W., Toh, J. Y., Saw, S. M., Godfrey, K. M., Yap, F., Chong, Y.S., & Mary, C. F. F. (2017). Validation of the Children's Eating Behavior Questionnaire in 3 year old children of a multi-ethnic Asian population: The GUSTO cohort study. *Appetite*, *113*, 100-105. https://doi.org/10.1016/j.appet.2017.02.024

R Core Team (2020). R: A language and environment for statistical computing. DOI: 10.1136/bmj.c332

Raulston, T. J., Hansen, S. G., Frantz, R., Machalicek, W., & Bhana, N. (2019). A parent-implemented playdate intervention for young children with autism and their peers. *Journal of Early Intervention*, *10*, 1-18. https://doi.org/10.1177/1053815119880943

Reaven, J., Blakeley-Smith, A., Nichols, S., & Hepburn, S. (2011). *Facing your fears: Group therapy for managing anxiety in children with high-functioning autism spectrum disorders*. Brookes.

Reed, G. K., Piazza, C. C., Patel, M. R., Layer, S. A., Bachmeyer, M. H., Bethke, S. D., & Gutshall, K. A. (2004). On the relative contributions of noncontingent reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, *37*(1), 27-42. https://doi.org/10.1901/jaba.2004.37-27

Reilly, S., Skuse, D., & Poblete, X. (1996). Prevalence of feeding problems and oral motor dysfunction in children with cerebral palsy: A community survey. *Journal of Pediatrics, 129*, 877-882. https://doi.org/10.1016/S0022-3476(96)70032-X

Reinoso, G., Carsone, B., Weldon, S., Powers, J., & Bellare, N. (2018). Food selectivity and sensitivity in children with autism spectrum disorder: A systematic review defining the issue and evaluating interventions. *New Zealand Journal of Occupational Therapy*, *65*(1), 36-42.

Reitzel, J., Summers, J., Lorv, B., Szatmari, P., Zwaigenbaum, L., Georgiades, S., & Duku, E. (2013). Pilot randomized controlled trial of a functional behavior skills training program for young children with autism spectrum disorder who have significant early learning

skill impairments and their families. *Research in Autism Spectrum Disorders, 7*(11), 1418–1432. https://doi.org/10.1016/j.rasd.2013.07.025

Research Units on Pediatric Psychopharmacology [RUPP] Autism Network. (2007). Parent training for children with pervasive developmental disorders: a multi-site feasibility trial. *Behavioral Interventions*, *22*(3), 179-199. https://doi-org.offcampus.lib.washington.edu/10.1002/bin.236

Riordan, M. M., Iwata, B. A., Finney, J. W., Wohl, M. K., & Stanley, A. E. (1984). Behavioral assessment and treatment of chronic food refusal in handicapped children. *Journal of Applied Behavior Analysis*, *17*(3), 327-341. https://doi.org/10.1901/jaba.1984.17-327

Riordan, M. M., Iwata, B. A., Wohl, M. K., & Finney, J. W. (1980). Behavioral treatment of food refusal and selectivity in developmentally disabled children. *Applied Research in Mental Retardation*, *1*(1-2), 95-112. https://doi.org/10.1016/0270-3092(80)90019-3

Roberts, D., & Pickering, N. (2010). Parent training programme for autism spectrum disorders: an evaluation. *Community Practitioner*, *83*(10), 27-30.

Roberts, J., Williams, K., Carter, M., Evans, D., Parmenter, T., Silove, N., Clark, T., & Warren, A. (2011). A randomised controlled trial of two early intervention programs for young children with autism: Centre-based with parent program and home-based. *Research in Autism Spectrum Disorders, 5*(4), 1553-1566. https://doi.org/10.1016/j.rasd.2011.03.001

Robinson, E. A., Eyberg, S. M., & Ross, A. W. (1980). The standardization of an inventory of child conduct problem behaviors. *Journal of Clinical Child & Adolescent Psychology, 9*(1), 22-28. https://doi.org/10.1080/15374418009532938

Rogers, S. J., Estes, A., Lord, C., Vismara, L., Winter, J., Fitzpatrick, A., Guo, M., & Dawson, G. (2012). Effects of a brief Early Start Denver Model (ESDM)–based parent

intervention on toddlers at risk for autism spectrum disorders: A randomized controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(10), 1052-1065. https://doi.org/10.1016/j.jaac.2012.08.003

Rommel, N., De Meyer, A. M., Feenstra, L., & Veereman-Wauters, G. (2003). The complexity of feeding problems in 700 infants and young children presenting to a tertiary care institution. *Journal of Pediatric Gastroenterology and Nutrition*, *37*(1), 75-84. https://doi.org/10.1097/00005176-200307000-00014

Rothstein, H. R., Sutton, A. J., & Borenstein, M. (2005). Publication bias in meta-analysis. In Rothstein, H. R., Sutton, A. J., & Borenstein, M. (Eds.). *Publication Bias in Meta-analysis: Prevention, Assessment and Adjustments* (pp. 1-7). John Wiley & Sons.

RStudio Team (2019). *RStudio: Integrated Development for R*. RStudio, Inc.

Rybak, A. (2015). Organic and nonorganic feeding disorders. *Annals of Nutrition and Metabolism*, *66*(5), 16-22. https://doi.org/10.1159/000381373

Saini, V., Jessel, J., Iannaccone, J. A., & Agnew, C. (2019). Efficacy of functional analysis for informing behavioral treatment of inappropriate mealtime behavior: A systematic review and meta-analysis. *Behavioral Interventions*, *34*(2), 231-247. https://doi.org/10.1002/bin.1664

Sanders, M. R. & Le Grice, B. (1989*). Mealtime Observation Schedule: An observer's manual*. Unpublished technical manual, University of Queensland.

Sanders, M. R., Le Grice, B., & Turner, K. M. T. (1993). *Mealtime observation schedule: An observer's manual* (rev. ed.). Unpublished technical manual, University of Queensland.

Sanders, M. R., Markie-Dadds, C., Tully, L. A., & Bor, W. (2000). The Triple P-positive parenting program: a comparison of enhanced, standard, and self-directed behavioral

family intervention for parents of children with early onset conduct problems. *Journal of Consulting and Clinical Psychology*, *68*(4), 624-640. https://doi.org/10.1037/0022-006X.68.4.624

Sanders, M.R., Markie-Dadds, C., & Turner, K.M. (2001). Practitioner's manual for standard triple P. Australian Academic Press.

Sarcia, B. (2020). The impact of applied behavior analysis to address mealtime behaviors of concern among individuals with autism spectrum disorder. *Child and Adolescent Psychiatric Clinics*, 29, 515-525. https://doi.org/10.1016/j.psc.2020.11.007

Schmidt, R., Kirsten, T., Hiemisch, A., Kiess, W., & Hilbert, A. (2019). Interview-based assessment of avoidant/restrictive food intake disorder (ARFID): A pilot study evaluating an ARFID module for the Eating Disorder Examination. *International Journal of Eating Disorders*, *52*(4), 388-397. https://doi.org/10.1002/eat.23063

Schreck, K. A., & Williams, K. (2006). Food preferences and factors influencing food selectivity for children with autism spectrum disorders. *Research in Developmental Disabilities, 27*(4), 353-363. https://doi.org/10.1016/j.ridd.2005.03.005

Schultz, T. R. (2013). *Parent-implemented intervention (PII) fact sheet.* Retrieved from https://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/Parent_Implemented_fact sheet.pdf

Schwarz, S. M. (2003). Feeding disorders in children with developmental disabilities. *Infants & Young Children*, *16*(4), 317-330. https://doi.org/10.1097/00001163-200310000-00005

Seiverling, L. J., Hendy, H. M., & Williams, K. E. (2011). Child and parent variables associated with texture problems in children's feeding. *Journal of Developmental and Physical Disabilities*, *23*(4), 303-311. https://doi.org/10.1007/s10882-011-9229-1

Seiverling, L., Williams, K. E., Hendy, H. M., Adams, W., Yusupova, S., & Kaczor, A. (2019). Sensory Eating Problems Scale (SEPS) for children: Psychometrics and associations with mealtime problems behaviors. *Appetite*, *133*, 223-230. https://doi.org/10.1016/j.appet.2018.11.008

Seiverling, L., Williams, K., Sturmey, P., & Hart, S. (2012) Effects of behavioral skills training on parental treatment of children's food selectivity. *Journal of Applied Behavior Analysis*, *45*, 197–203. https://doi.org/10.1901/jaba.2012.45-197

Seubert, C., Fryling, M. J., Wallace, M. D., Jiminez, A. R., & Meier, A. E. (2014). Antecedent interventions for pediatric feeding problems. *Journal of Applied Behavior Analysis*, *47*(2), 449-453. https://doi.org/10.1002/jaba.117

Sharp, W. G., & Stubbs, K. H. (2019). Avoidant/restrictive food intake disorder: A diagnosis at the intersection of feeding and eating disorders necessitating subtype differentiation. *International Journal of Eating Disorders*, *52*(4), 398-401. https://doi.org/10.1002/eat.22987

Sharp, W. G., Berry, R. C., Cole-Clark, M., Criado, K. K., & McElhanon, B. O. (2016). Assessment of feeding disorders in ASD: A multidisciplinary approach. In J. L. Matson (Ed.). *Handbook of assessment and diagnosis of autism spectrum disorder* (pp. 315-335). Springer.

Sharp, W. G., Berry, R. C., McCracken, C., Nuhu, N. N., Marvel, E., Saulnier, C. A., Klin, A., Jones, W., & Jaquess, D. L. (2013a). Feeding problems and nutrient intake in children with autism spectrum disorders: a meta-analysis and comprehensive review of the literature. *Journal of Autism and Developmental Disorders*, *43*(9), 2159-2173. https://doi.org/10.1007/s10803-013-1771-5

Sharp, W. G., Burrell, T. L., & Jaquess, D. L. (2014). The autism MEAL plan: A parent-training curriculum to manage eating aversions and low intake among children with autism. *Autism*, *18*(6), 712-722. https://doi.org/10.1177/1362361313489190

Sharp, W. G., Burrell, T. L., Berry, R. C., Stubbs, K. H., McCracken, C. E., Gillespie, S. E., & Scahill, L. (2019). The autism managing rating aversions and limited variety plan vs parent education: A randomized clinical trial. *Journal of Pediatrics, 211,* 185-92. https://doi.org/10.1016/j.jpeds.2019.03.046

Sharp, W. G., Jaquess, D. L., & Lukens, C. T. (2013b). Multi-method assessment of feeding problems among children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *7*(1), 56-65. https://doi.org/10.1016/j.rasd.2012.07.001

Sharp, W. G., Jaquess, D. L., Morton, J. F., & Herzinger, C. V. (2010). Pediatric feeding disorders: A quantitative synthesis of treatment outcomes. *Clinical Child and Family Psychology Review*, *13*(4), 348-365. https://doi.org/10.1007/s10567-010-0079-7

Sharp, W. G., Jaquess, D. L., Morton, J. F., & Miles, A. G. (2011). A retrospective chart review of dietary diversity and feeding behavior of children with autism spectrum disorder before and after admission to a day-treatment program. *Focus on Autism and Other Developmental Disabilities*, *26*(1), 37-48. https://doi.org/10.1177/1088357609349245

Sharp, W. G., Postorino, V., McCracken, C. E., Berry, R. C., Criado, K. K., Burrell, T. L., & Scahill, L. (2018). Dietary intake, nutrient status, and growth parameters in children with autism spectrum disorder and severe food selectivity: An electronic medical record review. *Journal of the Academy of Nutrition and Dietetics*, *118*(10), 1943-1950. https://doi.org/10.1016/j.jand.2018.05.005

Sharp, W. G., Stubbs, K. H., Adams, H., Wells, B. M., Lesack, R. S., Criado, K. K., Simon, E. L., McCracken, C. E., West, L. L., & Scahill, L. D. (2016). Intensive, manual-based intervention for pediatric feeding disorders: results from a randomized pilot trial. *Journal of Pediatric Gastroenterology and Nutrition*, *62*(4), 658-663. https://doi.org/10.1097/MPG.0000000000001043

Sharp, W. G., Volkert, V. M., Scahill, L., McCracken, C. E., & McElhanon, B. (2017). A systematic review and meta-analysis of intensive multidisciplinary intervention for pediatric feeding disorders: how standard is the standard of care?. *The Journal of Pediatrics*, *181*, 116-124. https://doi.org/10.1016/j.jpeds.2016.10.002

Sheinkopf, S. J., & Siegel, B. (1998). Home-based behavioral treatment for young children with autism. *Journal of Autism and Developmental Disorders, 28*, 15–23. https://doi.org/10.1023/A:1026054701472

Shi, L., & Lin, L. (2019). The trim-and-fill method for publication bias: practical guidelines and recommendations based on a large database of meta-analyses. *Medicine (Baltimore)*, *98*(23), e15987–e15987. https://doi.org/10.1097/MD.0000000000015987

Shire, S. Y., Goods, K., Shih, W., Distefano, C., Kaiser, A., Wright, C., Mathy, P., Landa, R., & Kasari, C. (2015). Parents' adoption of social communication intervention strategies: Families including children with autism spectrum disorder who are minimally verbal. *Journal of Autism and Developmental Disorders*, *45*(6), 1712-1724. https://doi.org/10.1007/s10803-014-2329-x

Shore, B. A., Babbitt, R. L., Williams, K. E., Coe, D. A., & Snyder, A. (1998). Use of texture fading in the treatment of food selectivity. *Journal of Applied Behavior Analysis, 31,* 621-633. https://doi.org/10.1901/jaba.1998.31-621

Silbaugh, B. C., Penrod, B., Whelan, C. M., Hernandez, D. A., Wingate, H. V., Falcomata, T. S., & Lang, R. (2016). A systematic synthesis of behavioral interventions for food selectivity of children with autism spectrum disorders. *Review Journal of Autism and Developmental Disorders*, *3*(4), 345-357. https://doi.org/10.1007/s40489-016-0087-8

Siller, M., & Morgan, L. (2018). Systematic review of research evaluating parent-mediated interventions for young children with autism: Years 2013 to 2015. In Siller, M., & Morgan, L. (Eds.), *Handbook of parent-implemented interventions for very young children with autism*. Springer.

Silverman, A. H. (2010). Interdisciplinary care for feeding problems in children. *Nutrition in Clinical Practice*, *25*(2), 160-165. https://doi.org/10.1177/0884533610361609

Skinner, B. F. (1938). *The behavior of organisms.* Appleton-Century-Crofts.

Skinner, B. F. (1953). *Science and human behavior.* Macmillan.

Sleddens, E. F., Kremers, S. P., & Thijs, C. (2008). The Children's Eating Behaviour Questionnaire: factorial validity and association with Body Mass Index in Dutch children aged 6–7. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 1-9. https://doi.org/10.1186/1479-5868-5-49

Sleigh, G., & Brocklehurst, P. (2004). Gastrostomy feeding in cerebral palsy: A systematic review. *Archives of Disease in Childhood*, *89*(6), 534-539. https://doi.org/10.1136/adc.2002.021170

Smith, T., Buch, G. A., & Gamby, T. E. (2000). Parent-directed, intensive early intervention for children with pervasive developmental disorder. *Research in Developmental Disabilities, 21*, 297–309. https://doi.org/10.1016/S0891-4222(00)00043-3

Sofronoff, K., Leslie, A., & Brown, W. (2004). Parent management training and asperger syndrome: A randomized controlled trial to evaluate a parent based intervention. *Autism, 8*(3), 301–317. https://doi.org/10.1177/1362361304045215

Song, F., Sheldon, T. A., Sutton, A. J., Abrams, K. R., & Jones, D. R. (2001). Methods for exploring heterogeneity in meta-analysis. *Evaluation and the Health Professions*, *24*(2), 126-151. https://doi.org/10.1177/016327870102400203

Spettigue, W., Norris, M. L., Santos, A., & Obeid, N. (2018). Treatment of children and adolescents with avoidant/restrictive food intake disorder: A case series examining the feasibility of family therapy and adjunctive treatments. *Journal of Eating Disorders*, *6*(1), 1-11. https://doi.org/10.1186/s40337-018-0205-3

Stadnick, N. A., Stahmer, A., & Brookman-Frazee, L. (2015). Preliminary effectiveness of project ImPACT: A parent-mediated intervention for children with autism spectrum disorder delivered in a community program. *Journal of Autism and Developmental Disorders*, *45*(7), 2092-2104. https://doi.org/10.1007/s10803-015-2376-y

Steinberg, C. (2007). Feeding disorders of infants, toddlers, and preschoolers. *British Columbia Medical Journal*, *49*(4), 183-186.

Steinsbekk, S., Sveen, T. H., Fildes, A., Llewellyn, C., & Wichstrøm, L. (2017). Screening for pickiness–a validation study. *International Journal of Behavioral Mutrition and Physical Activity*, *14*(1), 1-4. https://doi.org/10.1186/s12966-016-0458-7

Stern, K., & González, M. L. (2017). Brief Behavioral Knowledge Questionnaire: Measuring change in caregiver's knowledge following participation in a brief behavioral training. *Behavioral Interventions*, *32*(1), 35-53. https://doi.org/10.1002/bin.1454

Sterne, J. A.C., Becker, B. J., & Egger, M. (2005). The Funnel Plot. In Rothstein, H. R., Sutton, A. J., & Borenstein, M. (Eds.). *Publication Bias in Meta-analysis: Prevention, Assessment and Adjustments* (pp. 75-98). John Wiley & Sons.

Stogiannis, D., Siannis, F., & Androulakis, E. (2023). Heterogeneity in meta-analysis: a comprehensive overview. *The International Journal of Biostatistics*. *Ahead of print,* 1-31. https://doi.org/10.1515/ijb-2022-0070

Strand, M., von Hausswolff-Juhlin, Y., & Welch, E. (2019). A systematic scoping review of diagnostic validity in avoidant/restrictive food intake disorder. *International Journal of Eating Disorders*, *52*(4), 331-360. https://doi.org/10.1002/eat.22962

Strauss, K., Vicari, S., Valeri, G., D'Elia, L., Arima, S., & Fava, L. (2012). Parent inclusion in early intensive behavioral intervention: The influence of parental stress, parent treatment fidelity and parent-mediated generalization of behavior targets on child outcomes. *Research in Developmental Disabilities*, *33*(2), 688-703. https://doi.org/10.1016/j.ridd.2011.11.008

Suarez, M. A., Atchison, B. J., & Lagerwey, M. (2014). Phenomenological examination of the mealtime experience for mothers of children with autism and food selectivity. *American Journal of Occupational Therapy*, *68*(1), 102-107. https://doi.org/10.5014/ajot.2014.008748

Suarez, M. A., Nelson, N. W., & Curtis, A. B. (2012). Associations of physiological factors, age, and sensory over-responsivity with food selectivity in children with autism spectrum disorders. *The Open Journal of Occupational Therapy*, *1*(1), 1-20. https://doi.org/10.15453/2168-6408.1004

Suarez, M. A., Nelson, N. W., & Curtis, A. B. (2014). Longitudinal follow-up of factors associated with food selectivity in children with autism spectrum disorders. *Autism*, *18*(8), 924-932. https://doi.org/10.1177/1362361313499457

Sutton, A. J., Song, F., Gilbody, S. M., & Abrams, K. R. (2000). Modelling publication bias in meta-analysis: a review. *Statistical Methods in Medical Research*, *9*(5), 421–445. https://doi.org/10.1191/096228000701555244

Symon, J. B. (2005). Expanding interventions for children with autism: Parents as trainers. *Journal of Positive Behavior Interventions*, *7*(3), 159-173. https://doi.org/10.1177/10983007050070030501

Tarbox, J., Schiff, A., & Najdowski, A. C. (2010). Parent-implemented procedural modification of escape extinction in the treatment of food selectivity in a young child with autism. *Education and Treatment of Children*, *33*(2), 223-234. https://doi.org/10.1353/etc.0.0089

Tellegen, C. L., & Sanders, M. R. (2014). A randomized controlled trial evaluating a brief parenting program with children with autism spectrum disorders. *Journal of Consulting Clinical Psychology, 82*(6), 1193–1200. https://doi.org/10.1037/a0037246

Thomas, J. J., & Eddy, K. T. (2018). *Cognitive-behavioral therapy for avoidant/restrictive food intake disorder: Children, adolescents, and adults*. Cambridge University Press.

Thomas, J. J., Lawson, E. A., Micali, N., Misra, M., Deckersbach, T., & Eddy, K. T. (2017). Avoidant/restrictive food intake disorder: a three-dimensional model of neurobiology with implications for etiology and treatment. *Current Psychiatry Reports*, *19*(8), 1-15. https://doi.org/10.1007/s11920-017-0795-5

Thoyre, S. M. (2007). Feeding outcomes of extremely premature infants after neonatal care. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, *36*(4), 366-376. https://doi.org/10.1111/j.1552-6909.2007.00158.x

Tiger, J. H., & Hanley, G. P. (2006). Using reinforcer pairing and fading to increase the milk consumption of a preschool child. *Journal of Applied Behavior Analysis*, *39*(3), 399-403. https://doi.org/10.1901/jaba.2006.6-06

Trabi, T., Dunitz-Scheer, M., Kratky, E., Beckenbach, H., & Scheer, P. J. (2010). Inpatient tube weaning in children with long-term feeding tube dependency: A retrospective analysis. *Infant Mental Health Journal*, *31*(6), 664-681. https://doi.org/10.1002/imhj.20277

Twachtman-Reilly, J., Amaral, S. C., & Zebrowski, P. P. (2008). Addressing feeding disorders in children on the autism spectrum in school-based settings: Physiological and behavioral issues. *Language, Speech, and Hearing Services in Schools*, 39. 261-272. https://doi.org/10.1044/0161-1461(2008/025)

van Aert, R. C., Wicherts, J. M., & Van Assen, M. A. (2019). Publication bias examined in meta-analyses from psychology and medicine: A meta-meta-analysis. *PloS one*, *14*(4), e0215052. https://doi.org/10.1371/journal.pone.0215052

Van Houten, R., Axelrod, S., Bailey, J. S., Favell, J. E., Foxx, R. M., Iwata, B. A., & Lovaas, O. I. (1988). The right to effective behavioral treatment. *Journal of Applied Behavior Analysis*, *21*(4), 381-384. https://doi.org/10.1901/jaba.1988.21-381

Vaz, P. C., Volkert, V. M., & Piazza, C. C. (2011). Using negative reinforcement to increase self-feeding in a child with food selectivity. *Journal of Applied Behavior Analysis*, *44*(4), 915-920. https://doi.org/10.1901/jaba.2011.44-915

Vernon, T. W. (2014). Fostering a social child with autism: A moment-by-moment sequential analysis of an early social engagement intervention. *Journal of Autism and Developmental Disorders*, *44*(12), 3072–3082. https://doi.org/10.1007/s10803-014-2173-z

Verschuur, R., Huskens, B., & Didden, R. (2019). Effectiveness of parent education in pivotal response treatment on pivotal and collateral responses. *Journal of Autism and Developmental Disorders*, *49*(9), 1-17. https://doi.org/10.1007/s10803-019-04061-6

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, *36*(3), 1–48. https://doi.org/10.18637/jss.v036.i03

Vollmer, T. R., & Athens, E. (2011). Developing function-based extinction procedures for problem behavior. In W. W. Fisher, C. C. Piazza, & H. S. Roane (Eds.). *Handbook of applied behavior analysis* (p. 317–334). The Guilford Press.

Voulgarakis, H., & Forte, S. (2015). Escape extinction and negative reinforcement in the treatment of pediatric feeding disorders: A single case analysis. *Behavior Analysis in Practice*, *8*(2), 212-214. https://doi.org/10.1007/s40617-015-0086-8

Wainer, A. L., & Ingersoll, B. R. (2015). Increasing access to an ASD imitation intervention via a telehealth parent training program. *Journal of Autism and Developmental Disorders*, *45*(12), 3877-3890. https://doi.org/10.1007/s10803-014-2186-7

Wardle, J., Guthrie, C. A., Sanderson, S., & Rapoport, L. (2001). Development of the children's eating behaviour questionnaire. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *42*(7), 963-970. https://doi.org/10.1111/1469-7610.00792

Watson, J. B. (1913). Psychology as the behaviorist views it. *Psychological Review*, *20*(2), 158. https://doi.org/10.1037/0033-295X.101.2.248

Watson, J. B. (1924). *Psychology: From the standpoint of a behaviorist*. JB Lippincott company.

Weber, J., & Gutierrez, Jr, A. (2015). A treatment package without escape extinction to address food selectivity. *Journal of Visualized Experiments*, 102, 1-6. https://doi.org/10.3791/52898

Werle, M. A., Murphy, T. B., & Budd, K. S. (1993). Treating chronic food refusal in young children: Home-based parent training. *Journal of Applied Behavior Analysis*, *26*(4), 421-433. https://doi.org/10.1901/jaba.1993.26-421

Wetherby, A. M., Guthrie, W., Woods, J., Schatschneider, C., Holland, R. D., Morgan, L., & Lord, C. (2014). Parent-implemented social intervention for toddlers with autism: an RCT. *Pediatrics*, *134*(6), 1084-1093. https://doi.org/10.1542/peds.2014-0757

Whittingham, K., Sofronoff, K., Sheffield, J., & Sanders, M. R. (2009). Stepping stones Triple-P: An RCT of a parenting program with parents of a child diagnosed with an autism spectrum disorder. *Journal of Abnormal Child Psychology, 37*(4), 469–480. https://doi.org/10.1007/s10802-008-9285-x

Wilder, D. A., Normand, M., & Atwell, J. (2005). Noncontingent reinforcement as treatment for food refusal and associated self-injury. *Journal of Applied Behavior Analysis*, *38*(4), 549-553. https://doi.org/10.1901/jaba.2005.132-04

Williams, B. F., & Williams, R. L. (2010). *Effective programs for the treatment of autism: Applied behavior analysis models*. Routledge.

Williams, K. E., Field, D. G., & Seiverling, L. (2010). Food refusal in children: A review of the literature. *Research in Developmental Disabilities*, *31*(3), 625-633. https://doi.org/10.1016/j.ridd.2010.01.00

Williams, K. E., Hendy, H. M., Field, D. G., Belousov, Y., Riegel, K., & Harclerode, W. (2015). Implications of avoidant/restrictive food intake disorder (ARFID) on children with feeding problems. *Children's Health Care*, *44*(4), 307-321. https://doi.org/10.1080/02739615.2014.921789

Williams, K. E., Riegel, K., Gibbons, B., & Field, D. G. (2007). Intensive behavioral treatment for severe feeding problems: a cost-effective alternative to tube feeding? *Journal of Developmental and Physical Disabilities*, *19*(3), 227-235. https://doi.org/10.1007/s10882-007-9051-y

Wittenberg, J. V. (1990). Feeding disorders in infancy: Classification and treatment considerations. *The Canadian Journal of Psychiatry*, *35*(6), 529-533. https://doi.org/10.1177/070674379003500611

Wong, C., Odom, S. L., Hume, K. A., Cox, A. W., Fettig, A., Kucharczyk, S., Brock, M. E., Plavnick, J. B., Fleury, V. P., & Schultz, T. R. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders*, *45*(7), 1951-1966. https://doi.org/10.1007/s10803-014-2351-z

World Health Organization. (2020). Feeding disorder of infancy and childhood. In *International statistical classification of diseases and related health problems* (10th ed.). Retrieved from https://icd.who.int/browse10/2010/en#/F98.2

Zachary, F., Tipton, E., & Hou, Z. (2017). *Robumeta: Robust variance meta-regression*. Retrived from https://cran.r-project.org/package=robumeta

Zickgraf, H. F., & Ellis, J. M. (2018). Initial validation of the nine item avoidant/restrictive food intake disorder screen (NIAS): A measure of three restrictive eating patterns. *Appetite*, *123*, 32-42. https://doi.org/10.1016/j.appet.2017.11.111

Zucker, N. L., LaVia, M. C., Craske, M. G., Foukal, M., Harris, A. A., Datta, N., Savereide, E., & Maslow, G. R. (2019). Feeling and body investigators (FBI): ARFID division—An acceptance-based interoceptive exposure treatment for children with ARFID. *International Journal of Eating Disorders*, *52*(4), 466-472. https://doi.org/10.1002/eat.22996

Zucker, N., Copeland, W., Franz, L., Carpenter, K., Keeling, L., Angold, A., & Egger, H. (2015). Psychological and psychosocial impairment in preschoolers with selective eating. *Pediatrics*, *136*(3), e582-e590. https://doi.org/10.1542/peds.2014-2386

Figure 1

Forest Plot of Effect Size on Child Outcomes

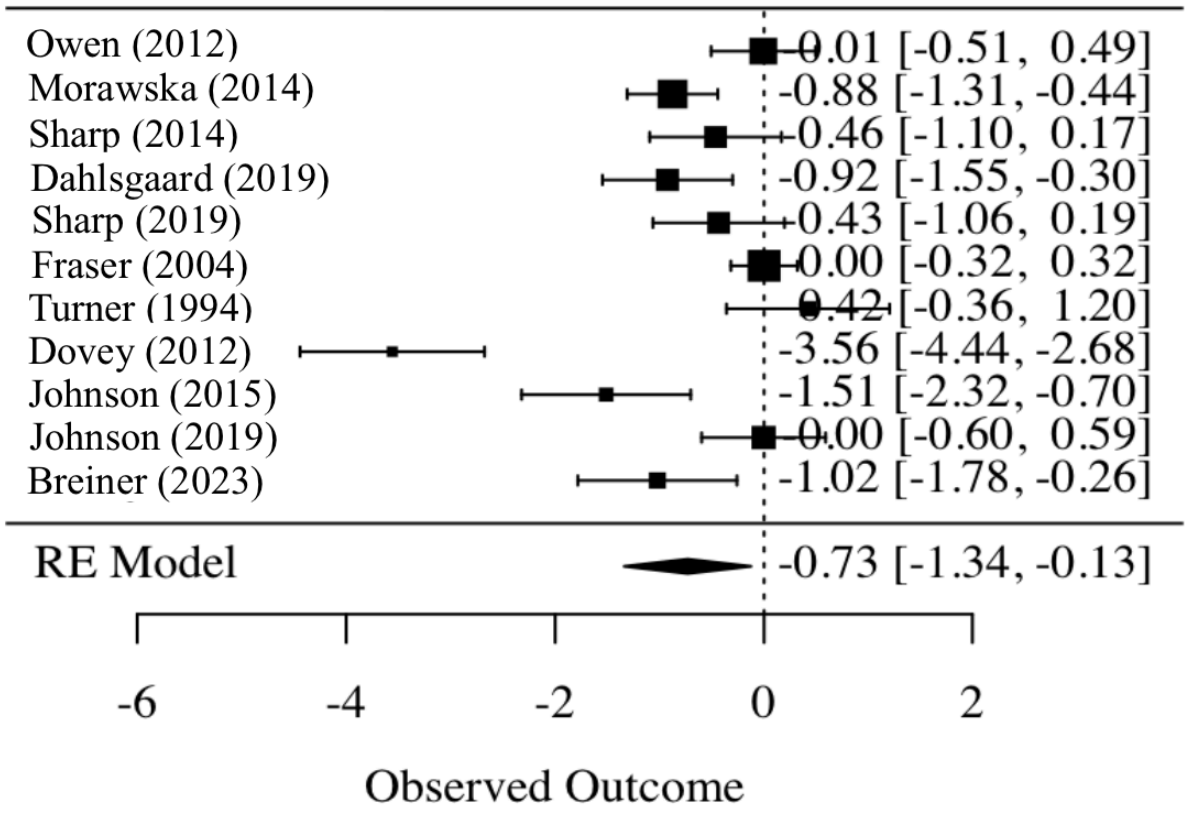


Figure 2

Forest Plot of Effect Size on Parent Outcomes

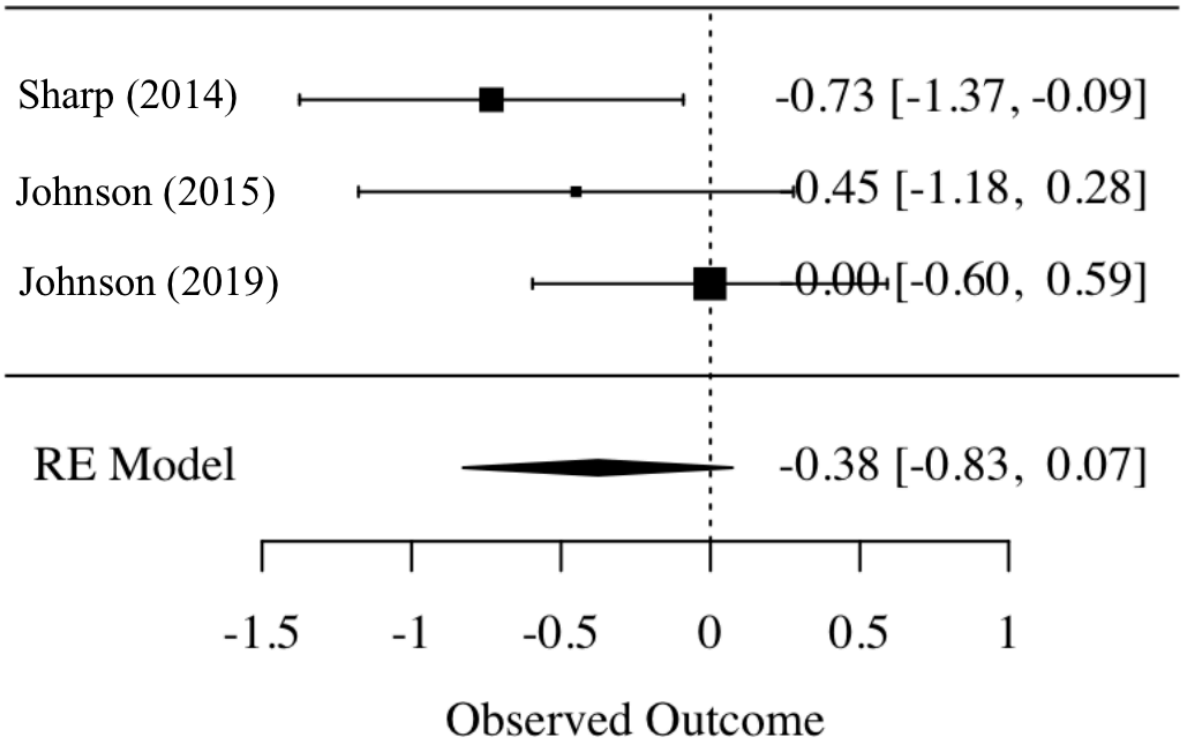


Figure 3

Funnel Plot on Child Effects (n = 11)

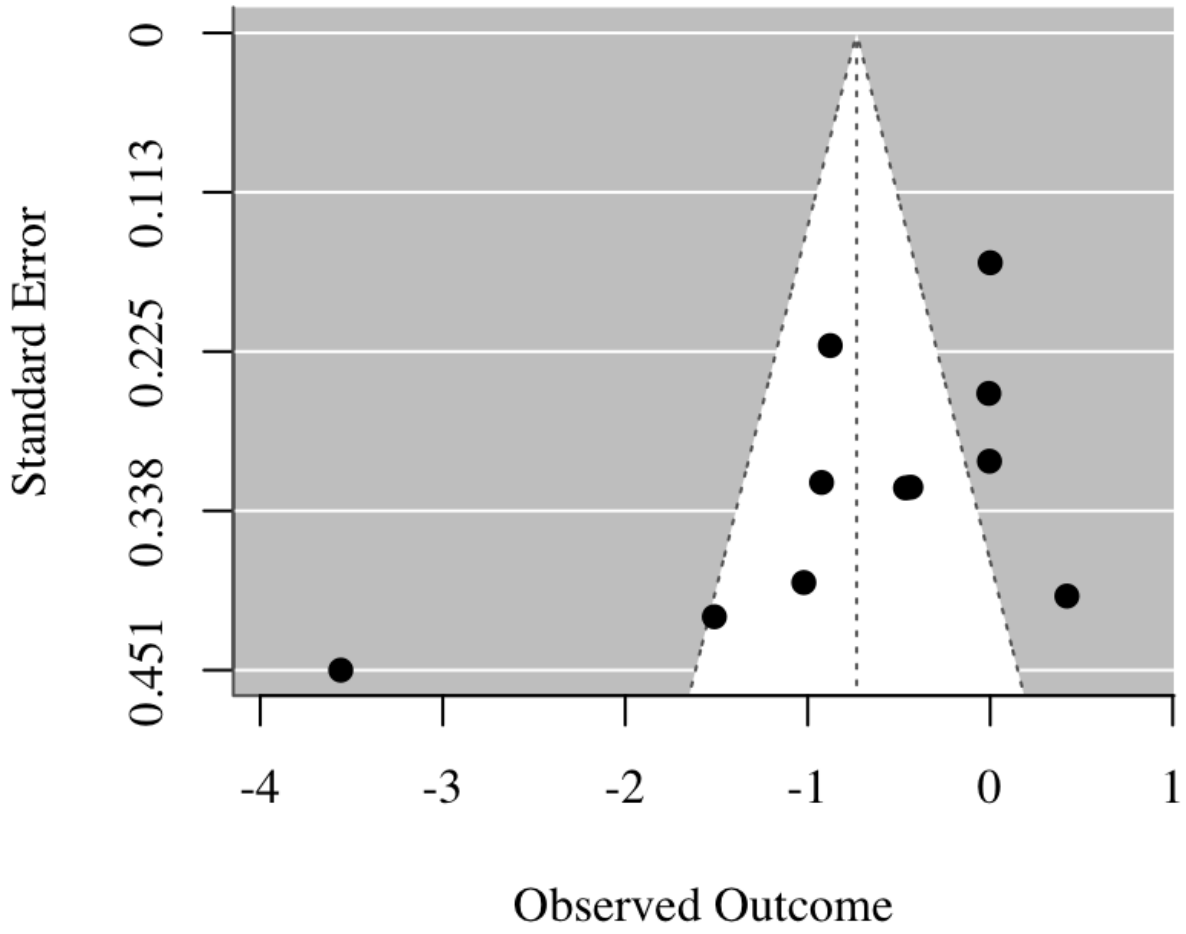


Figure 4

Funnel Plot on Parent Effects (n = 3)

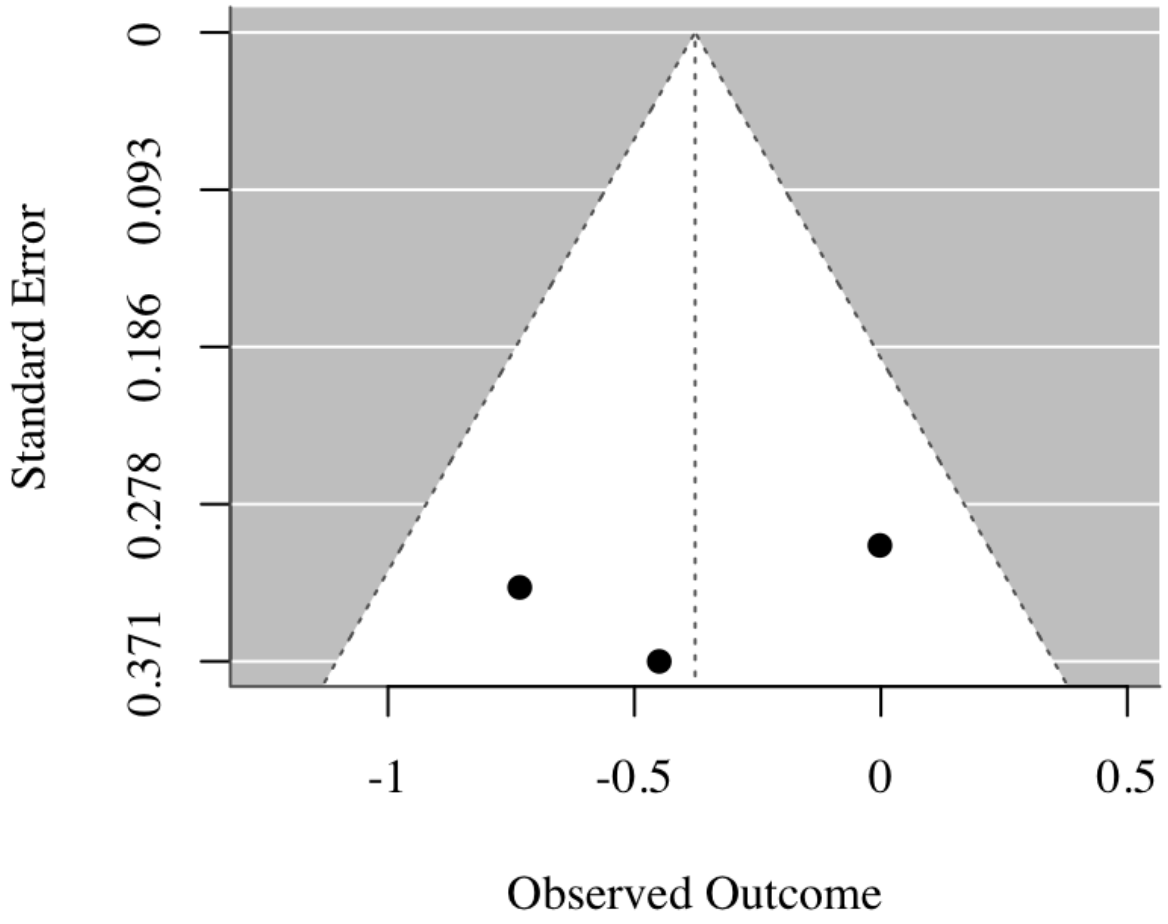


Table 1

Search Terms Used in Search Process

PFD search terms:	PII search terms:
Avoidant restrictive food intake disorder	Parent training
ARFID	Parent implement*
Feeding and eating disorder*	Parent program
Failure to thrive	Parent group
Feeding disorder*	Parent coaching
Feeding difficult*	Parent direct*
Food phobia	Parent education
Food refusal	Parent deliver*
Feeding problem*	Parent mediate*
Pediatric feeding disorder*	Parent orient*
Tube-dependent children	Parent based
Selective eating	Caregiver training
Food selectivity	Caregiver implement*
Food fussiness	Caregiver program
Food neophobia	Caregiver group
Picky eat*	Caregiver coaching
	Caregiver direct*
	Caregiver education
	Caregiver deliver*
	Caregiver mediate*
	Caregiver orient*
	Parent based
	Family training
	Family implement*
	Family deliver*
	Family orient*
	Family based

Table 2

Summary of Study Characteristics

Study ID	Author(s)	*N Tx/Ctrl*	Age Range (Months)	Intervention Name	Training for Parents (weeks/sessions/minutes)	Parent Training Components	ABA Components	Child Outcome Measurement	Parent Outcome Measurement
Study 1	Owen et al. (2012)	30/N/A	14-45	N/A	8 wks/5 sess./90-120 mins	Didactic, mealtime observation	Positive reinforcement	BPFAS	Parent satisfaction
Study 2	Morawska et al. (2014)	44/42	24-60	Hassle Free Mealtimes Tripple P (HFMTP)	NR /1 sess./120 mins	Didactic instruction, video modeling, in-vivo practice, feedback, group discussion, and homework	Positive reinforcement, planned ignoring, token economy, modeling	PATFA	CSQ
Study 3	Sharp, Burrell, & Jaquess (2014)	10/9	36-104	The Autism MEAL Plan	8 wks/8 sess./60 mins	Didactic instruction, feedback, homework	Positive reinforcement, escape extinction, planned ignoring, antecedent modification, physical guidance and prompting	BAMBI	PSI-SF, parent satisfaction

Table 2. *Cont.*

Study ID	Author(s)	*N Tx/Ctrl*	Age Range (Months)	Intervention Name	Training for Parents (weeks/sessions/minutes)	Parent Training Components	ABA Components	Child Outcome Measurement	Parent Outcome Measurement
Study 4	Dahlsgaard & Bodie (2019)	21/N/A	48-132	The Picky Eaters Clinic	7 wks/7 sess./ 90 mins	Didactic instruction, role-play, discussion, feedback, homework	positive reinforcement, planned ignoring, token economy, relapse prevention, generalization	BPFAS	Parent satisfaction
Study 5	Sharp, Burrell, Rashelle et al. (2019)	19/19	38-88	The Autism MEAL Plan	12wks/ 10 sess./90 mins	Didactic instruction, role-play, feedback, homework, mealtime observation	Positive reinforcement, escape extinction, planned ignoring, antecedent modification, physical guidance and prompting	BAMBI	Parent satisfaction
Study 6	Fraser et al. (2004)	75/N/A	24-120	Fun not Fuss with Food	NR/1 sess./150 mins	Didactic instruction	Positive reinforcement, antecedent modification, modeling	CEBI-R	N/A

Table 2. *Cont.*

Study ID	Author(s)	*N Tx/Ctrl*	Age Range (Months)	Intervention Name	Training for Parents (weeks/sessions/minutes)	Parent Training Components	ABA Components	Child Outcome Measurement	Parent Outcome Measurement
Study 7	Turner et al. (1994)	12/8	12-60	Behavioral Parent Training	6 wks/6 sess./ 60 mins	Didactic instruction, group discussion, mealtime observation, in-vivo practice, feedback, written instruction, homework	Positive reinforcement, planned ignoring, token economy, antecedent modification, modeling, punishment, relapse prevention, generalization	MOS-R	Parent satisfaction
Study 8	Dovey & Martin (2012)	24/N/A	26-85	N/A	12 wks/4 sess. /NR	Didactic instruction, mealtime observation, feedback, homework	Planned ignoring, modeling, escape extinction, antecedent modification	BPFAS	N/A
Study 9	Johnson et al. (2015)	14/N/A	24-84	Parent-training for Feeding Problems (PT-F)	16 wks/9 sess./ 60- 90 mins	Direct instruction, modeling, role-playing, parent activity sheets and homework	Positive reinforcement, escape extinction, planned ignoring, compliance training, antecedent modification, generalization	BAMBI	PSQ, PSI-SF

Table 2. *Cont.*

Study ID	Author(s)	*N Tx/Ctrl*	Age Range (Months)	Intervention Name	Training for Parents (weeks/sessions/minutes)	Parent Training Components	ABA Components	Child Outcome Measurement	Parent Outcome Measurement
Study 10	Johnson et al. (2019)	21/21	24-84	Parent-training for Feeding Problems (PT-F)	20 wks/11 sess./60-90 mins	Direct instruction, modeling, role-playing, parent activity sheets and homework, home visits	Positive reinforcement, planned ignoring, compliance training, antecedent modification, generalization	BAMBI	PSQ, PSI-SF
Study 11	Breiner (2023)	14/13	60-144	ARFID Parent Training (ARFID-PTP)	2 wks /2 sess./120 mins	Didactic instruction, role-play, written individualized treatment plan	Planned ignoring, token economy	PARDI	Parent satisfaction

Notes: Tx: treatment group, Ctrl: control group, BPFAS: Behavioral Pediatrics Feeding Assessment, PATFA: Parent and Toddler Feeding Assessment, BAMBI: Brief Autism Mealtime Behavior Inventory, CEBI-R: Children's Eating and Mealtime Behavior Inventory - Revised, MOS-R: Mealtime Observation Schedule - Revised, PARDI: Pica, ARFID, and Rumination Disorder Interview, CSQ: Client Satisfaction Questionnaire, PSQ: Parent Satisfaction Questionnaire, PSI-SF: Parent Stress Index - Short Form, N/A: Not available, NR: Not reported.

Table 3

A Summary of Parent Training Features

Parent Training Features	N	%
Training Provider		
Psychologist alone	5	45
Behavioral analyst alone	1	9
Interdisciplinary team	3	27
Number of Sessions		
n =1	2	18
n >1	9	82
Follow-up Sessions		
Yes	7	64
No	4	36
Training Delivery Modality		
Group-based	6	55
Individually delivered	5	45
Training Delivery Format		
In-person training	9	82
Virtual training	1	9
Combination	1	9
Parent Training Components		
Didactic instruction	11	100
Group discussion	5	45
Modeling (video or in-person)	3	27
Mealtime observation	3	27
In-vivo practice	1	9
Written instruction	2	18
Feedback	6	55
Role-play	5	45
Homework	8	73
Home visit	1	9

Table 4

A Summary of PII Characteristics

Parents Implemented Treatment Features	N	%
Treatment Setting		
Clinic	0	0
Home	10	91
Home and Clinic	1	9
Intervention Components		
Consequence-based Strategies	11	100
Positive reinforcement	11	100
Escape extinction	4	36
Planned ignoring	9	82
Punishment	1	9
Antecedent-based Strategies	8	73
Antecedent modification	8	73
Prompting and physical guidance	2	18
Modeling	3	36
Other Strategies	4	36
Compliance training	2	18
Relapse prevention	2	18
Generalization	4	36

Table 5

Random-effect Model Results

	Child Outcomes	Parent Outcomes
Q statistics(df)	79.84(10)	2.75(2)
p-value	< .0001	0.25
I^2	91.8%	30.44%
τ^2	0.94	0.05
Estimate	-0.73	-0.38
p-value	0.018	0.1
Standard Error	0.31	0.23
95% Confidence Interval	[-1.34, -0.13]	[-0.83, 0.07]

Table 6

Moderator Analysis on Child Outcomes

		Estimate	SE	p-value	95% CI	
Delivery Format						
	Individually delivered*	-1.07	0.46	0.02	-1.97	-0.17
	Group-based	-0.43	0.40	0.28	-1.22	0.35
Child Participation						
	No child participation	-0.54	0.46	0.24	-1.45	0.37
	Active child participation*	-0.87	0.43	0.04	-1.71	-0.02
Use of EE						
	No implementation of EE	-0.34	0.33	0.31	-0.99	0.32
	Implementation of EE**	-1.39	0.46	0.002	-2.29	-0.50
Use of Combo						
	No package	-0.62	0.61	0.31	-1.81	0.58
	Combo package*	-0.75	0.37	0.04	-1.49	-0.02

Notes: *Statistically significant, $\alpha = 0.05$; **Statistically significant, $\alpha = 0.01$.

Table 7

Moderator Analysis on Parent Outcome

		Estimate	SE	p-value	95% CI	
Delivery Format						
	Individually delivered	-0.17	0.23	0.46	-0.63	0.29
	Group-based*	-0.71	0.33	0.03	-1.36	-0.07
Use of EE						
	No implementation of EE	-0.002	0.30	0.99	-0.60	0.59
	Implementation of EE**	-0.59	0.24	0.01	-1.07	-0.11

Notes: *Statistically significant, $\alpha = 0.05$; **Statistically significant, $\alpha = 0.01$.

Appendices

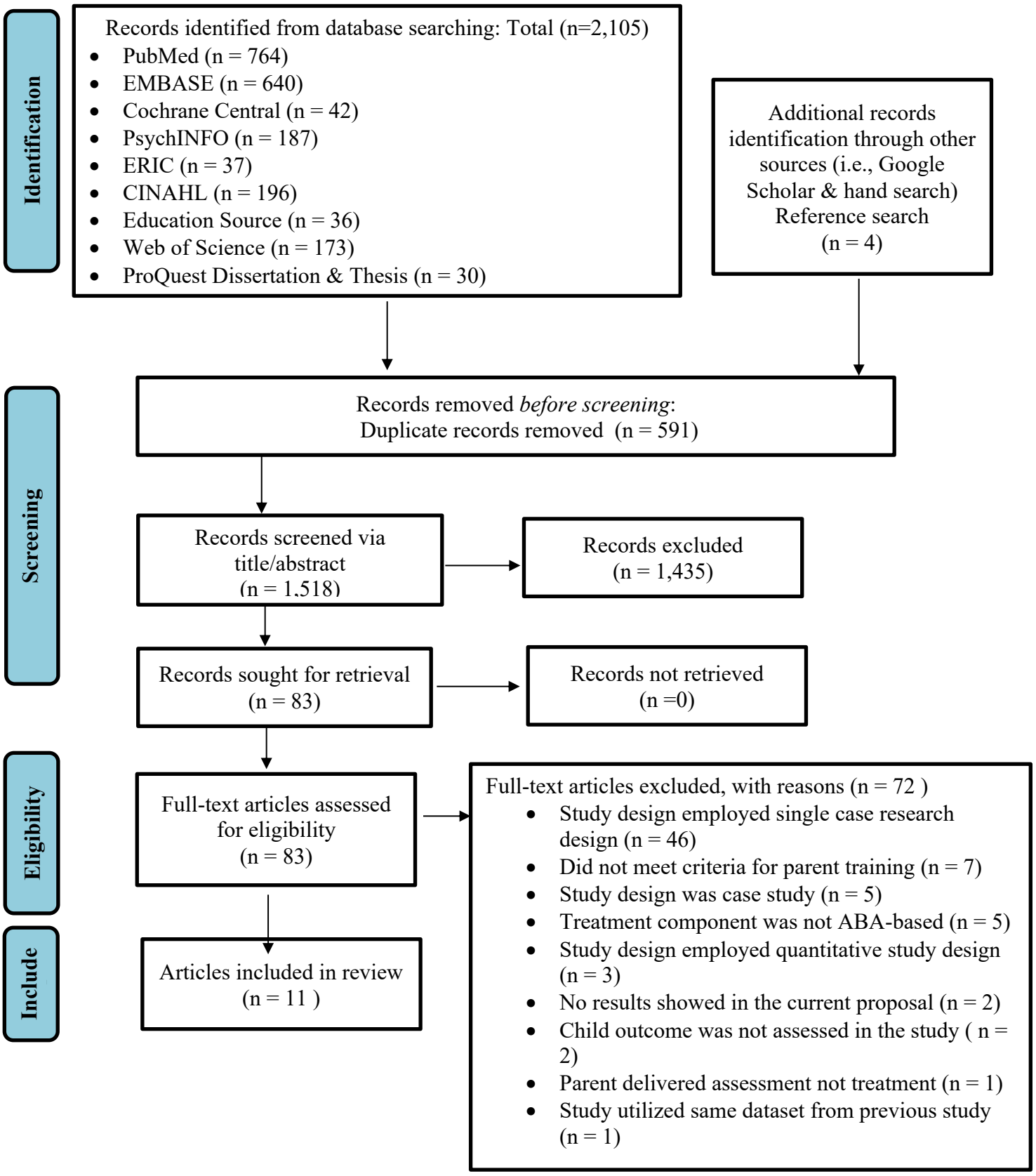
Appendix A

Inclusion and Exclusion Criteria for Studies

Number	Inclusion Criterion	Exclusion Criterion
1. The sample	Involved pediatric populations (birth to 18 years of age)	Did not involve pediatric population (18 years and older)
2. The target participant	• Met the criteria for PFD • Had a diagnosis of ARFID/failure to thrive/oral dysphasia • Had dependency on enteral feeding or oral nutritional formula supplementation	Did not meet the criteria for any of the abovementioned diagnosis or dependency on enteral feeding or other nutritional supplementation
3. The intervention was implemented	Entirely by caregivers/parents in either a clinical setting or a home setting	By clinicians or partially by caregivers/parents in either a clinical setting or a home setting
4. The intervention	Was based on ABA principles or involved the use of ABA-based strategies that are • Antecedent-based • Consequence-based • A combination of antecedent- and consequence-based	Did not utilize any ABA-based strategy
5. The intervention	Was used to primarily improve child outcomes which are feeding-related issues • increasing food acceptance and volume • expanding dietary variety • improving mealtime behaviors, • decreasing food refusal	Did not measure any child outcomes that are feeding-related
6. The study design	Utilized one of the following group experimental designs • randomized controlled trials • quasi-experimental design studies (e.g., nonequivalent groups designs, pre- and post-test, and interrupted time-series design, etc.)	Did not utilize any group experimental designs • single-case research design • case report, commentary, opinion, or discussion paper • systematic reviews and meta-analysis

Appendix B

PRISMA Flowchart



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Appendix C

Inclusion Criteria Reliability Form

Instruction: Please complete each column with “yes” or “no” based on the inclusion/exclusion criteria below. For studies you think that should not be included, please give the reason in the last column.

Study Code	English Publication	Participants are children with feeding difficulties/ARFID/PFD diagnosis	Intervention was primarily delivered by parents/caregivers	Intervention strategy/strategies delivered to the child is/are based on applied behavioral analysis principles	Child outcome (feeding-related issue) was measured as one dependent variable	Study method is group experimental design	Include?	If no, why?

Appendix D

Effectiveness of ABA-based PII for Children with PFD
Meta-analysis Codebook

This is a manual for coding group experimental design studies focused on ABA-based parent-implemented interventions for children with pediatric feeding disorder

Section 1: Participant Information

ID [STUDYID]: The ID# for each study, which has been pre-assigned by the primary investigator.

Coder [CODER]: Initial of the coder (e.x., DM).

Data [CODEDATE]: Indicate the date the study was coded (e.x., mm/dd/yy).

Author [AUTHOR]: Provide last name for the first author (e.g., Owen et al.)

Year [YEAR]: indicate the year in which the study was published. Indicate the year of completion if it unpublished grey literature.

Publication type [PUBTYPE]: indicate the type of publications
- 1 = Dissertation
- 2 = Peer-reviewed journal articles
- 3 = Unpublished work (other than dissertation)
- 4 = Other/unclear (describe in the final NOTES column)

Section 2: Study Design

Study Design [STDESIGN]: indicate the experimental design that was utilized by the study
- 1 = Randomized-control study
- 2 = pre- and post- design
- 999 = unknown

Study Analysis [STANALYS]: indicate the analysis method used in the study
- 1 = ANOVA
- 2 = MANOVA
- 3 = Paired t-test
- 4 = ANCOVA
- 5 = linear mixed model

Section 3: Participant Characteristics

Note: for this section, when possible, based coding solely on characteristics of study participants.

Parent Group Size of Intervention Group [nPTTX]: please report the total sample size that was included in the actual analysis portion for parent participants that were in the treatment condition.

Parent Group Size of Control Group [nPTCTL]: please report the total sample size that was included in the actual analysis portion for parent participants that were in the treatment condition.

Intervention Group Size [TXGROUP]: please report the total sample size that was included in the actual analysis portion for participants that were in the treatment condition.

Control Group Size [CTLGROUP]: please report the total sample size that was included in the actual analysis portion for the participants that were in the control group. For studies that did not include a control group, write "NONE."

Control Group Type [CTLTYPE]: please report the type of control group that was used in the study

1 = waitlist control

2 = treatment as usual (this category includes control group that only received standard services available in the intervention setting, e.g., parent education or standard dietary education which was always available to parents at the particular setting)

999 = if the study does not include a control group

Intervention Group Mean Age [TXAGE_M]: When available, report the mean age of the children in months. Write "999" if this information is not provided.

Control Group Mean Age [CTLAGE_M]: When available, report the mean age of the children in months. Write "999" if this information is not provided.

Age Range [AGERANGE]: When available, report the age of the youngest and oldest participant in the study. Convert years into months. Write "999" if this information is not provided.

Number of Male in the Intervention Group [TXnMALE]: Report the number of subjects in the treatment group who are male. Write "999" if this information is not provided.

Proportion Male in the Intervention Group [TXpMALE]: Report the proportion of subjects in the treatment group who are male. Write "999" if this information is not provided.

Number of Male in the Control Group [CTLnMale]: Report the number of subjects in the control group who are male. Write "999" if this information is not provided.

Proportion Male in the Control Group [CTLpMALE]: Report the proportion of subjects in the treatment group who are male. Write "999" if this information is not provided.

Diagnosis Other than Feeding Issues [OTHERDX]:

1 = ASD
0 = None

Section 4: Intervention Characteristics

Treatment Name [TXNAME]: indication the name of the primary parent training program

1 = Hassle Free Mealtimes Tripple P (HFMTP)
2 = Autism MEAL Plan
3 = The Picky Eater Clinic
4 = Fun Not Fuss with Food
5 = Behavioral Parent Training
6 = PT-F
7 = ARFID Parent Training (ARFID-PTP)

Provide Type [PROVIDER]: Give the label that best describes the majority of treatment providers.

1 = Medical personnel (physician or nurse practitioner)
2 = Dietician
3 = Psychologist or psychologist in training
4 = Occupational therapist
5 = Speech language pathologist
6 = Behavioral analyst
7 = Social worker
999 = if not reported

Protocol Adherence [PRADHERE]: report the protocol adherence, which stands for the extent to which the provider follow the treatment plan/standardized protocol. Write "999" if the information was not provided. Write "999" if parent adherence was checked but no data was reported.

Number of Parent Training Sessions [nSESSION]: report the number of sessions for the parent training

Training Session Length [LENGTH]: If reported, indicate the session length in minutes. If the session length is a range, take the medium. If only the range is given, report the range. If not indicated, generally report "999."

Treatment Duration [DURATION]: Report any information that might help determine the duration of treatment, reported in days. If there are "booster" sessions that occur after the post-treatment assessment, note this, but do not include for the planned treatment duration. Write "999" for Not Specified if information regarding duration is not provided.

Frequency of the Sessions [fSESSION]: Report the frequency of planned sessions (e.g., weekly, every other week, or single session). Write "999" for Not Specified if information regarding duration is not provided.

Training Delivery Format [DELIVER]: Report the format of training delivered to the parents.

0 = Delivered individually
1 = Delivered in a group

Treatment Follow-up [FOLLOWUP]: Indicate the type of follow-up or booster session included in the parent training program. Write "999" for Not Specified if information regarding duration is not provided.

Training Delivery Modality [PTFORMAT]: Report the format of parent training

0 = In-person training
1 = Virtual training
2 = Combination of in-person training and virtual conferencing

Treatment Setting [TXSETTING]: Report the treatment setting

0 = Treatment implemented in clinic
1 = Treatment implemented at home
2 = Treatment implemented both in clinic and at home

Parent Training Components [PTCOMP]:

1 = Direct didactic
2 = Group discussion
3 = Video modeling or in-person modeling
4 = Behavioral skills training
5 = Direct/indirect meal observations involving child
6 = In-vivo practice without involving child
7 = Written instruction and treatment plan
8 = Feedback
9 = Role-play
10 = Activity sheet and/or homework
11 = Home-visit

Parent Training Components with In-session Practice [PTPRACT]: Report of parent training components involving in-session practice (e.g., role-play and in-vivo practice)

0 = No in-session practice
1 = With in-session practice

Parents Implemented Behavioral Treatment Procedures [ABATX]:

1 = Consequence-based strategies only (e.g., positive reinforcement (e.g., attention, tangible), escape extinction (e.x., non-removal of the spoon), differential reinforcement (e.x., planned ignoring), token economy, punishment (e.x., time-out))

2 = Antecedent-based strategies only (e.x., stimulus fading, shaping, physical guidance, prompting, modeling)

3 = Other (e.g., compliance training, relapse prevention, generalization)

The Use of Escape Extinction [ABAEE]:

0 = Did not use EE as one of the treatment components
1 = Used EE as one treatment components

The Combination of Consequence-based and Antecedent-based interventions [ABACOMB]:

0 = Did not use a combination of consequence- and antecedent-based interventions
1 = Used a combination of consequence- and antecedent-based interventions

Child's Participation in the Parent Training [CHILDPT]: Indicate the child's direct participation in the parent training process (e.g., in-session mealtime practice, participation in the group) other than participating in homework practices

0 = No direct child participation during parent training sessions
1 = With direct child participation during parent training sessions

Section 5: Outcome

Main Outcome Measures [cOUTCOME]: Indicate the main outcome measures that were used to measure child feeing outcomes.

1 = Behavioral Pediatrics Feeding Assessment (BPFAS)
2 = Parent and Toddler Feeding Assessment (PATFA)
3 = Brief Autism Mealtime Behavior Inventory (BAMBI)
4 = Children's Eating Behaviors Inventory – Revised (CEBI-R)
5 = Mealtime Observation Schedule – Revised (MOS-R)
6 = Pica, ARFID, and Rumination Disorder Interview (PARDI)

Measure Type [cOTCTYPE]: Indicate the type of measures used for measuring main outcome:

0 = Indirect measure (e.g., Parent rating scale)
1 = Direct measure

Secondary Outcome Measures [pOUTCOME]: Indicate the secondary (parental) outcome measures that were used to measure parental outcomes.

1 = Parenting Stress Index – Short Form (PSI - SF)
2 = Parent satisfaction rating
3 = Other measures on parental outcomes

Parent Satisfaction Outcome [PTSATIS]: Outcome data of parent satisfaction

Parent Stress Outcome [PTPSI]: Outcome data of parent stress

Parent Fidelity [FIDELITY]: Indicate if the study collected data on parent fidelity. Write "999" for not reported.

Variables for outcome measures:

Pretreatment Mean of Main Feeding Outcome for Intervention Group [TXPRE_M]
Pretreatment Standard Deviation of Main Feeding Outcome for Intervention Group [TXPRE_SD]
Posttreatment Mean of Main Feeding Outcome for Intervention Group [TXPST_M]
Posttreatment Standard Deviation of Main Feeding Outcome for Intervention Group [TXPST_SD]
Pretreatment Mean for Control Group [CTPRE_M]
Pretreatment Standard Deviation for Control Group [CTPRE_SD]
Posttreatment Mean for Control Group [CTPST_M]