

Feeding and Swallowing Issues in Autism Spectrum Disorders

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Abstract: Children with autism spectrum disorder (ASD) often experience difficulties related to communication and behaviour. However, their feeding issues are most distressing to their families and healthcare professionals as they impact on the children's adaptive function and health. In comparison to typically developing children, those with ASD experience significantly more feeding difficulties. Children with ASD may display distinctive feeding difficulties and atypical feeding behaviours that include picky eating, limited independent feeding, need for increased feeding times, and a highly restrictive food repertoire. Many of these feeding difficulties continue into childhood, persist in adolescence, and even spill over into adulthood. This proves to be a formidable challenge, as feeding is an essential component for healthy nutrition, growth, and development. This article will highlight how particular food items that are eaten and preferred by affected children may be contributing to their exhibited feeding difficulties. Next, it will be shown how the children's restrictive diets supplant more healthy food options. When this is combined with the children's noted reduced physical activity, the consequences are especially serious, as they include not only malnutrition but also give rise to childhood obesity. In sum, it will be demonstrated that feeding difficulties in young children with ASD are not well understood nor managed. The dearth of knowledge about feeding issues in this population affects both assessment choices and, specifically, management practices – aspects that will be elaborated on in this article. Conclusions will include suggested future directions for enhancing and complementing knowledge of these issues for stakeholders.

Keywords: autism, Covid-19, feeding management, fussy eating

Introduction

Children with autism spectrum disorder (ASD) often experience difficulties related to communication, behaviour, and feeding. Research has shown that approximately 62% (range: 30–84%) of children with ASD will present with feeding difficulties, including increased food selectivity, greater likelihood of unhealthy eating habits, and associated mealtime-related behavioural problems in comparison to children with other disorders, and their neurotypically developing peers.^{1–4}

If feeding difficulties are not resolved, these children are at risk of developmental delays, stunting, and nutritional inadequacies related both to malnutrition as well as obesity.^{5,6} A study by Rogers, Magill-Evans and Rempel⁷ reported that, as children get older, many children with severe eating difficulties will have these persist into adolescence, and even adulthood, which can lead to long-term medical complications. As a result, high rates of feeding difficulties in children with ASD are pervasive, heterogeneous and complex in nature.

Children with ASD may display distinctive feeding difficulties and atypical feeding behaviours related to their ASD symptomology, and the development of challenges with eating. Feeding difficulties are a compounded problem in children with ASD and, as such, have been categorised and defined in the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5).⁸ According to the DSM-5, problems with eating involve persistent disturbances in feeding and feeding-related behaviours that impact on health and functioning.⁸ “Feeding difficulties” is an umbrella term that has been used to describe problems with limited food intake, restrictive diets, and the impact on nutrition, and food preference.^{9,10} However, it is important to note that this definition is primarily concerned with challenges in eating

and the impact, primarily, on weight and growth. Moreover, it is important to understand the ways in which children with ASD may be predisposed to other conditions, such as avoidant/restrictive food intake disorder (ARFID), and anorexia nervosa, and the additional challenges related to nutritional inadequacies.^{11,12}

Feeding challenges do not only impact the child, but can also have adverse effects on the family. Many healthcare practitioners and families struggle to find appropriate avenues to improve their child's feeding difficulties, that address not only problems with feeding but also aspects related to mealtime participation, socialisation, and the facilitation of communication.^{13,14} However, feeding difficulties are often not addressed in the assessment and management of school-aged children with ASD. Literature has often focused primarily on picky eating and increasing food intake in children with ASD, with little attention being paid to the impact on the child's development, or on mealtime activity and participation. As a result, the assessment and management of feeding difficulties have primarily been based on medical models of care, which focus on the child's specific feeding disorder as the "problem" that needs to be "fixed". Furthermore, limited attention has been paid to the ways in which context and culture may impact on the child's eating behaviours and *mealtime* experiences, specifically the establishment of mealtime routines and rituals for families with children with ASD. Therefore, this review will contribute to the ways in which we understand feeding difficulties within a biopsychosocial context, using the International Classification of Functioning, Disability and Health (ICF) framework,¹⁵ which can be used to make sense of the child's and family's mealtime experiences.

The purpose of this review is to discuss the nature and complexities of feeding difficulties in children with ASD. The aims of this review are to: (1) provide a summary of commonly reported feeding problems in children with ASD, including preferred and non-preferred food items, and the aversive effects of favourable food items on children's mood, behaviour and weight, (2) identify feeding characteristics that will impact on the child's activity and participation in the mealtime process, and (3) explore the current literature on the assessment and management of feeding difficulties in children with ASD, taking into consideration the contextual, social, and cultural aspects related to mealtimes. Implications for future directions and enhancement in the areas of research and practice will also be discussed.

Conceptualising ASD, Feeding Difficulties, and Mealtimes

A primary aim of this review is to establish commonly reported feeding difficulties and the subsequent impact on the child's mood, behaviour and weight. Feeding difficulties in children with ASD result in their insistence on the need for sameness, limited independent eating, and the need for increased feeding times. As many children with ASD may also have problems with communication, this results in families being unable to understand the feeding needs of the child, such as hunger, fullness, family food preferences or food availability, and preferred and non-preferred food items.^{6,16–18}

According to the ICF, paediatric feeding disorders are classified as problems with oral intake that are not age appropriate, and are associated with medical, nutritional or psychosocial challenges (Figure 1).¹⁹

In utilising the ICF framework, healthcare practitioners are better able to characterise feeding difficulties and the associated functional limitations on mealtimes.²⁰ The ICF understands the child's feeding difficulties both as a function and a result of the environment, and the facilitators as well as barriers on participation in family and community life. Thus, it is imperative to determine the origin of the eating irregularity regarding individual abilities and challenges, and the context that is impacting both the individual and family functioning.²¹ Individual functioning, the impact of feeding on activity and participation, as well as contextual factors will now be discussed in greater detail below.

Individual Functioning on Feeding Disturbances in Children with ASD

Factors associated with feeding disturbances in children with ASD are considered to be multifactorial (sensory, behavioural, psychological, communicative, or familial factors). Research has indicated that feeding difficulties may be both a cause and a consequence of ASD, with much variability reported in the literature. Some studies have indicated that the conceptualisation of feeding problems in children with ASD may manifest as anatomical, metabolic, gastrointestinal, motor or sensory difficulties, resulting in an increased risk for gastrointestinal problems.²² However, there have also been studies that have suggested that the abnormal eating patterns may trigger gastrointestinal difficulties and alter the gut microbiome in children with ASD.^{23,24} Therefore, it is unclear whether children with ASD have a predisposition to gastrointestinal problems, or if food preferences may in fact trigger gastrointestinal issues.²⁵ Despite our understanding of ASD and feeding difficulties,

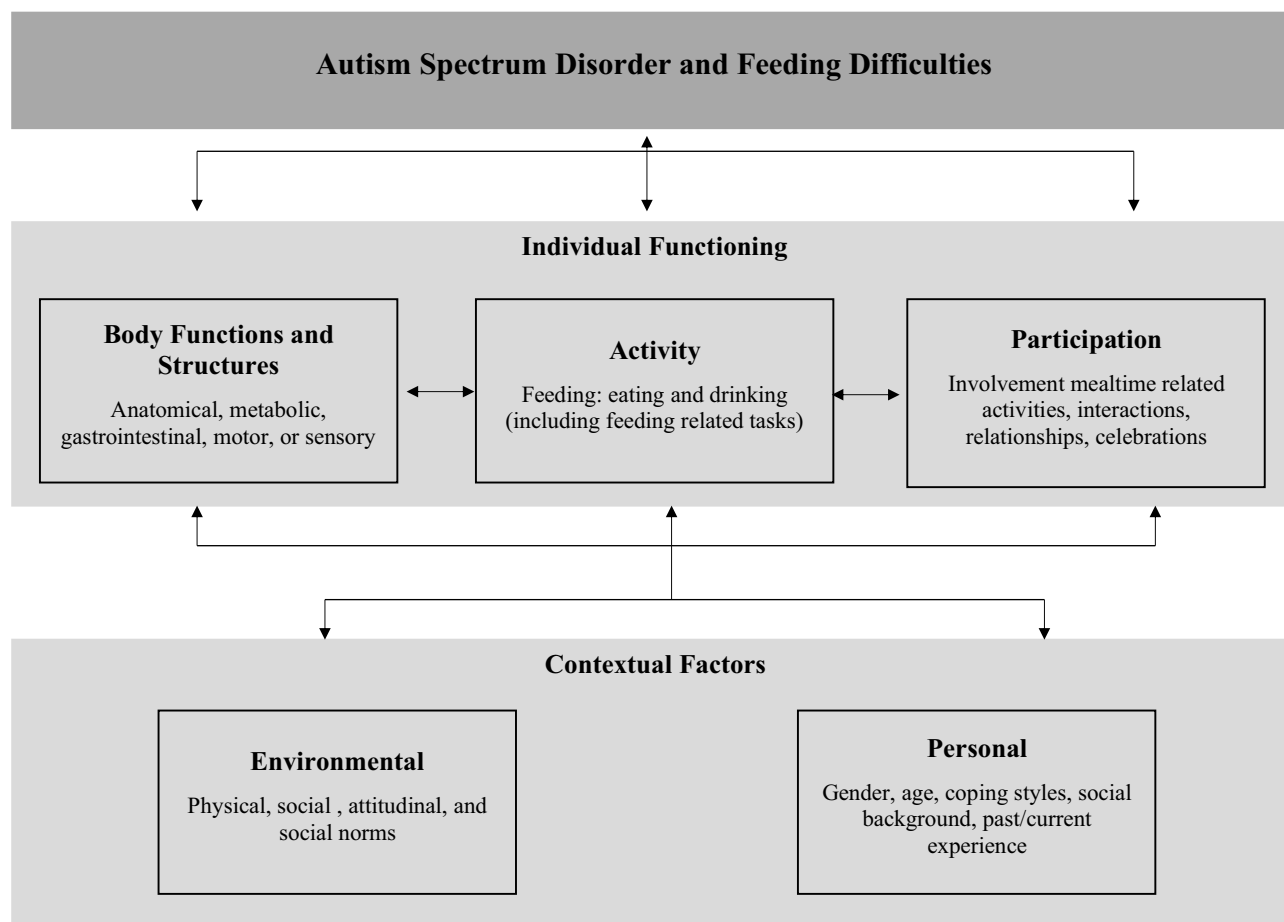


Figure 1 The ICF framework to show children with ASD and associated feeding difficulties.

Note: Adapted from Centers for Disease Control and Prevention. The ICF: An Overview. Available from: https://www.cdc.gov/nchs/data/icd/icfoverview_finalforwho10sept.pdf.⁸⁵

there is currently no defined aetiology for these noted challenges. Feeding difficulties are heterogeneous in nature and may be further complicated by other medical problems, as well as the child's food choices and general mealtime behaviours.

Children with ASD often have a preference for certain types of food based on taste, texture, colour or temperature.^{5,26–28} Food preference will impact on the child's weight (both under- and overweight), as well as their mood and behaviour, depending on their preferred foods.^{29,30} Research has also suggested that there has been an increase in obesity in children with ASD over the last two decades,^{31,32} with contributing factors being related to their eating patterns and diet.^{33,34}

There has been evidence to suggest that children with ASD consume less fruits and vegetables and may have lower levels of calcium and protein when compared to their typically developing peers.^{2,5,35,36} Evans et al,³¹ for example, investigated the dietary patterns in children with and without ASD between 3–11 years of age and found that children with ASD have a preference for less healthy food options and that they overconsumed snack food items, juices and sugar-rich foods when compared to their neurotypically developing peers. These results have been confirmed in other studies, indicating that often children with ASD have a preference for unhealthier food options, a lower-quality diet, and lower diet variety.^{4,5,36} However, these findings are not conclusive, since other studies have found contradictory results. Bandini et al²⁹ found that children with ASD consumed *less* fruits and vegetables to typically developing children as well as insufficient intake of certain nutrients and vitamins, whereas a study by Esteban-Figuerola et al⁵ showed that children with ASD in fact had a higher consumption of fruit and vegetables. This discrepancy in the literature could be as a result of research methods used and the absence of food

frequency questionnaires, input from parents on the child's dietary requirements, and the presence of certain restrictions (eg gluten or lactose-free), as well as contextual variations in the food options available and eaten.^{37,38}

Recent evidence has also suggested the impact of ASD on specific feeding and eating disorders, such as the relationship between ASD and avoidant/restrictive food intake disorder (AFRID), and anorexia nervosa (AN), which will be discussed in greater detail below. AFRID is a new diagnosis within the section of feeding and eating disorders in the DSM-5 and is defined as a persistent failure to meet nutritional needs due to a significant nutritional deficiency, weight loss, failure to gain weight, dependence on enteral feeding or oral supplements, or marked psychosocial functioning.⁸ Current evidence has confirmed that AFRID coexists with ASD and that sensory sensitivities may perpetuate AFRID through their food preferences and refusals, which may explain certain nutrient and vitamin deficiencies.^{11,12,39} Moreover, this also highlights the need to further assess children with a diagnosis of AFRID for ASD, to better understand the early identification of nutritional deficits and health outcomes.⁴⁰

There is a growing interest in understanding the relationship between ASD and AN, particularly for children still experiencing feeding difficulties into adolescence and adulthood, around which there is currently limited information and research. AN manifests during adolescence and is characterised by low body weight and an intense fear of gaining weight, as well as undue influence of weight on self-evaluation.⁸ Studies have shown that there is a higher prevalence of diagnosed ASD in individuals with AN, compared to the general population,^{41,42} and that ASD traits are elevated in individuals with AN regarding neuropsychological and social problems.⁴³ Moreover, adults with AN who do not experience recovery from their eating disorder often score higher on ASD screening tools.⁴² Therefore, understanding the associations between ASD and AN are crucial for management and clinical implications regarding eating disorder research. Previous studies have indicated poorer clinical outcomes, longer illness duration, and higher illness severity for individuals with both ASD and AN, and the need for adapted or modified interventions.^{41,44}

Fussy eating, as well as the presence of comorbid conditions, can increase the risk of secondary problems, and has been widely discussed in the literature.^{45–47} There is evidence to suggest that children not eating a healthy and balanced diet may experience changes in their disposition, such as increases or decreases in weight or changes in sleep patterns.⁴⁸ Furthermore, metabolic disturbances have been shown to be a determinant during the SARS-CoV-2 (Covid-19) outbreak (Lancet, 2020; WHO, 2020). During the Covid-19 pandemic, children had a poorer and unhealthier diet. Families reported that they struggled with caring for and feeding their child at home, and noted changes in their child's eating patterns, which was linked to reduced sleep quality, less physical exercise, and an impact on mood and well-being.^{49,50} Therefore, disordered eating may cause a number of additional problems related to the child's weight as well as their mood and behaviour – enhancing the prognosis of fussy eating in order to prevent persistent difficulties and secondary issues.

Activity and Participation

Recent research has indicated the importance of family mealtimes and the role that food and eating have on families, particularly with regard to beliefs and norms that facilitate a collective identity.⁵¹ Increased regularity of family mealtimes can also serve to promote security, unity and improved family functioning.⁵² Children with ASD present with a number of problematic mealtime behaviours, such as yelling, not sitting at the table, aggression and tantrums, often resulting in the further isolation of the child during mealtimes, both at school and at home.^{1,27} Further isolation is an important factor to note, especially for children with ASD, who have known socialisation and communicative problems. Moreover, isolation also results in reduced family cohesion, and impacts on the formation of family feeding routines and rituals.^{6,53} However, details of how this influences family mealtimes remain unclear and are yet to be explored from the perspective of the child and the family.

Fussy eating can also add to the stress of caregivers and family members. This means that feeding challenges are often twofold, impacting on the mealtimes for both the family and the child. As mentioned, children with ASD are often excluded from mealtimes both at home and at school as a result of their eating and mealtime behaviours.^{54,55} At home, children will commonly eat on their own, often eating different foods from the rest of the family. This increases their exclusion, resulting in a loss of many experiences that are critical for developing social skills. At school, children with ASD often do not join other children during snack- or lunchtimes at school, or participate in class parties that often

include special foods.⁵⁶ Therefore, many children with ASD often miss out on the benefits of shared mealtimes, such as social communication development, and participating in the mealtime process.⁵⁷ Families and teachers are often unsure of the best way to mitigate feeding challenges to ensure that the child still participates in the mealtime process. Moreover, children with ASD have been reported to be less socially motivated to participate in mealtimes, which could account for why so many are excluded from mealtimes and often will eat alone.⁵⁸

Environmental Characteristics

Diets and food preferences may vary across cultures and countries, which may indicate unique nutritional deficiencies in children with ASD. An example of this is in India, where the majority of families eat a vegetarian-based diet, compared to other cultures which may be primarily meat- or dairy-based.³ There are several known and potential risk factors associated with the body weight status of children with ASD, including sociodemographic background, and parental factors, such as parenting style and parenting stress.^{59,60} In addition, food intake and diet are not determined by the child alone, and additional factors should also be taken into consideration, such as food accessibility and security. The term “food security” is used to define a family’s food stability, food access and food availability.^{61,62} When families experience difficulties with any of the aforementioned parameters, this is known as “food insecurity”. Food insecurity may exacerbate challenges for children with disabilities and their families, particularly those who may require special food items. Food insecurity was also exacerbated for families and children with disabilities during Covid-19, due to decreases in employment and food access. Therefore, understanding the ways in which culture and context impact on feeding can transform how we view feeding in children with ASD.

Assessment for Feeding Difficulties in Children with ASD

Despite the high prevalence of feeding difficulties in the ASD population, there is still a dearth of research on the ways in which these challenges should be assessed and managed. A recent review by Page et al¹⁸ explored feeding difficulties in children with ASD, and reported on the limitations of assessment, as it primarily focused on eating behaviours and/or dietary intake as a measure of feeding difficulty. In addition, most studies have used neurotypically developing children (ie siblings) as direct comparisons to their understanding of typical and disordered feeding, which does not provide a comprehensive evaluation of the other ways in which children with ASD are impacted by their fussy eating.¹⁸

Assessments of feeding have focused on aspects related to food selectivity, regarding the number of food items the child eats and refuses.⁶³ Assessment measures present with a number of obstacles for cross-study comparison and the integration of different study findings. The majority of studies that report on the assessment of feeding in ASD, have used dietary recall as a measure to operationalise feeding difficulties. In a review by Chistol et al,⁶³ they reported on the different assessment measures, such as the Brief Assessment of Mealtime Behavior Inventory (BAMBI), and the Eating Profile, that have been used to identify ASD-specific eating behaviours, focusing on dietary and nutrient intake to quantify food selectivity.⁶⁰ However, assessment that uses dietary recalls and other intake assessments have a number of limitations, as they are often misreported, and those done in a more controlled environment (eg a laboratory) are time- and resource-intensive, making it unrealistic to real-world settings. Moreover, assessments of older children using dietary recall are often inaccurate, as many children are not at home for all of their meals and, as a result, the child’s feeding problems are often under-reported.

Understanding the limitations of assessment is essential to choosing therapies for children with ASD, that focus on individualised and family-centered approaches. While most studies have stated the use of parent-reported measures, these do not often include information pertaining to parents’ own eating behaviours, beliefs and values. Assessments need to focus on both the child and the family, especially due to increases in family stress.^{58,64} Caregivers are often primarily responsible for providing their child with food and mealtimes, specifically around food availability and the formulation of mealtime routines and rituals. However, guidelines for caregiver training in order to provide feeding interventions are lacking. Studies have indicated that parent-focused interventions have been used frequently with children with ASD to improve language development, social communication interactions, as well as problematic behaviours.^{65–67} This provides a good rationale to utilise a parent-focused approach to both assess and manage feeding

difficulties, and should be further explored to apply a more holistic understanding of the child, the family, and cultural and contextual considerations.

Management of Selective Eating in Children with ASD

Research has indicated that combined medical and behavioural intervention in highly structured settings has been well supported to improve severe food selectivity in children with ASD.⁶⁸ While there is not one universally accepted mechanism through which feeding difficulties can be managed, a review of previous literature has focused on the aspect of food selectivity and increasing the food repertoire when managing feeding challenges.⁶⁹ Koegel et al⁷⁰ examined whether food inflexibility and restrictiveness could be modified in children with ASD between the ages of 6.4–7.8 years of age by increasing acceptance of non-preferred food items. They found that parents' use of individualised reinforcement for trying new foods, as well as hierarchical exposure to non-preferred foods, increased food acceptance of non-preferred food items and also spontaneous requests for new foods. However, the authors reported that, due to the speed of improvements seen in the study, sensory processing challenges may not have been a factor that had been accounted for. These findings are significant, as research has indicated that between 45% and 96% of children with ASD may also present with associated sensory difficulties.⁷¹ Thus, when targeting feeding difficulties in children with ASD, it is important to consider the ASD diagnostic phenotype as well as other comorbidities, such as sensory difficulties. Unfortunately, only targeting changes in food preferences and dietary intake does not consider other aspects associated with successful feeding, such as the child's participation in different mealtime routines, and rituals such as sharing stories, or engaging in different cultural activities, such as praying.^{51,72} Further research in this area may guide intervention.

Given the intensity, duration and prevalence of feeding difficulties in children with ASD, preventative strategies and management in the home environment are needed, particularly as these programmes are often expensive and not available to all communities.⁷³ Therefore, parent training is emerging as a useful strategy when targeting food selectivity in children with ASD, especially as caregivers' use of inappropriate feeding strategies can further hinder the child's nutritional intake and increase maladaptive behaviours.¹⁹ A recent study by Johnson et al⁷⁴ piloted a parent training programme for children with feeding problems, delivering sessions over the course of twenty weeks. The programme was reported to be both acceptable and feasible for parents to use at home, and showed an increase in parent confidence when addressing feeding problems. These findings were corroborated in another study that explored the effects of home-based parent behavioural-skills training to improve treatment of food selectivity in children with ASD.⁷⁵ Results indicated an improvement in the number of foods eaten by all children in the study following treatment. Caregivers also reported an improvement in their own ability to incorporate behavioural skills into their interactions with their child. However, an important aspect to note in these two studies is that often these strategies – of incorporating behavioural skills into their interactions with their child – were not a regular part of caregivers' natural behaviour. Thus, parents may require specific training to ensure that they can utilise the techniques but also learn to incorporate them naturally into their mealtime routines and rituals. Furthermore, research has shown that caregivers will often use multiple strategies, that incorporate behavioural, environmental, social, and sensory approaches, to target their child's behaviour.^{14,33,51} Unfortunately, there have been only a limited number of studies that have employed both parent-reported measures as well as direct observation.

Another recent study by Ausderau et al¹⁴ explored the limitations of previous studies and utilised a parent-focused intervention in the context of the home environment, using recorded mealtime videos. The study looked at twelve families with a child with ASD (2–7 years of age). Ausderau et al¹⁴ identified six different strategies: (1) parent intervening and ignoring, (2) meal preparation and adaptability, (3) positive reinforcements, (4) play and imagination, (5) distractions, and (6) modelling. The strategies were used to target the child's interactions and behaviour in their different environments. Parents monitored and altered the physical and social environment around the child to support the child in the daily activity of mealtimes. In addition, the focus of many of the strategies was aimed not only at getting the child to increase their food selectivity but also to stay at the table, engage with family members, or eat a greater quantity of a preferred food. These findings highlight that, although the intake of new foods is important to many parents, and often the focus of many feeding interventions, it is not always the caregivers' main area of concern or focus. The findings

also emphasise the importance of incorporating the family into feeding management and having an understanding of the family's context and culture around mealtimes. These studies show that additional research studies are needed to develop evidence-based guidelines as well as practical methods that can be utilised by families to help improve fussy eating and mealtime behaviours before they exacerbate the child's health, social and psychological problems.

Given the high prevalence of eating difficulties in children with ASD, and the associated problems related to their sensory, nutritional, behavioural and communicative comorbidities, a multidisciplinary approach is both needed and recommended in the literature.⁷⁶ In addition, as ASD often coexists with other conditions, such as AFRID and anorexia nervosa, a multidisciplinary approach enhances management to consider not only feeding but also social skills, and provides a sensory profile for the child, which can assist in tailoring intervention to improve therapeutic outcomes.⁴⁰ It is important to note that many healthcare professionals face challenges in treating children with ASD, and those with comorbid conditions, which may be amplified due to lack of knowledge.⁴⁴ Therefore, it is important for healthcare professionals to work together, most notably speech-language pathologists (SLPs), occupational therapists (OTs), physical therapists (PTs), and dietitians, who are integral in the treatment of feeding difficulties in children with ASD.⁷⁷ However, it is important to note that the family, too, are core members of the multidisciplinary team (MDT), and should work in consultation with the aforementioned healthcare professionals.^{9,78} Therefore, working within a patient-centered approach to management will allow for the family's context and needs to be better understood. The family will be able to provide details of what the child eats, how the child eats, what the family eats, and their typical mealtime routines.

Parent-identified goals are an essential part of the management of feeding difficulties in children with ASD, as the family also play an integral role in improving feeding outcomes. Thus, healthcare professionals need to be cognisant of the family's specific mealtime needs, and may need to consult the family to better understand the ways in which they function, structure mealtimes, as well as manage feeding difficulties within their home environment. Therefore, I emphasise the need to understand and manage feeding within the framework of the ICF to better facilitate improvement of the child's feeding, but also to incorporate the family's own mealtime routines and rituals, and the impact of their environment.

Covid-19 and the Management of Feeding Difficulties

To date, there is limited research into feeding interventions that are appropriate for contexts outside of the therapy room, such as the home environment. In addition, it is important to consider our current context regarding Covid-19 and the impact the pandemic has had on interventions. Access to interventions that are timely, affordable and available have always been a barrier for children with ASD, however, resources and access have become matters of increased concern due to Covid-19.⁷⁹ Covid-19 resulted in the closure of schools and restaurants, that negatively impacted on the child and family routines and the availability of foods. In addition, research has indicated that many families experienced additional stressors during lockdown, such as increased frustration, boredom, financial stress, and stigma.^{80,81} Although lockdown measures have begun to decrease, and vaccine availability is increasing, it is important that we use the lessons learnt during this time to better understand and manage mealtimes for families of children with ASD.

In order to understand the management of feeding, we need to consider our current context and the application of different methods, such as teletherapy. Teletherapy has been found to be beneficial for children with ASD for speech, language and communication development.^{82,83} Teletherapy provides children with ASD continued stimulation with improved clinical outcomes, as well as high parent satisfaction regarding the therapy services.⁴⁶ Due to Covid-19, many caregivers were required to participate in the management of feeding difficulties using teletherapy, however, there has been limited research that has explored the assessment and management of feeding difficulties using this approach. The context and the family are integral to the management of children with ASD, and the incorporation of a team is integral for successful management and improved therapeutic outcomes.⁸⁴ Employing teletherapy methods also allows therapists an understanding of their clients' environment and resources, and of their mealtime routines and rituals; enabling them to observe mealtimes and provide strategies that are relevant and responsive to the family's feeding environment. Future research is required to evaluate the impact of teletherapy services on patient care and the feasibility and application for its ongoing use as a model for service delivery.

Conclusion

This review highlights that children with ASD present with a number of feeding difficulties when analysed using the ICF, including adaptive functioning, activities, participation in life and contextual environmental factors. Children with ASD present with feeding difficulties that can have a negative effect on their nutritional intake, mood, behaviour and weight. Many children with ASD have feeding challenges due to their ASD symptomology, associated behavioural, cognitive, psychological or familial factors. Holistic management that incorporates the ICF is urgently needed in order to better support these children and their families. It is important to understand the need for individualised outcome measures that will enable the facilitation of goals, in incremental steps, to be achieved. Families should be trained on how to improve these skills while focusing on feeding interventions, and to focus on gradual adaptations. An awareness by parents and clinicians is also required to understand what is neurotypical and what is ASD-specific. Because feeding problems can have adverse effects for children's development and family well-being, early diagnosis is important. The focus of intervention should not only be on food selectivity but also on understanding the impact of the child's feeding challenges and behaviours on the mealtime, their participation, and the influence this has on their mealtime partners, especially as these children have notable problems within these areas. Unfortunately, due to their difficulties, many children end up being further isolated and excluded from mealtimes. As a result, an MDT approach is required when both assessing and managing these problems.

The family are important members of the team and should be involved in management with regard to planning and appropriate goal formulation. Research should also take into account contextual variations, both in different countries and in consideration of the impact of the Covid-19 pandemic, particularly in low- to middle-income countries where there are limitations on resources and availability of feeding support. This review emphasises the importance of healthcare providers establishing home-based support, and of adaptation in the ways in which we manage feeding issues, including the use of teletherapy to better support children and their families within their feeding environment. In summary, this review provides a comprehensive discussion of the relationship between ASD, feeding, mealtimes and the ICF, to provide theoretical and practical assistance for the future management of feeding in this population. The relationship to feeding and the ICF is an interesting topic, and one that requires further exploration, especially considering the changing climate, and the impact of Covid-19 on this population. Research that employs different methods to collect data is needed to fill in the various gaps in this area, and to develop clinical guidelines that are applicable.

Abbreviations

AAC, augmentative and alternative communication; AN, anorexia nervosa; ARFID, avoidant/restrictive food intake disorder; ASD, autism spectrum disorder; BAMBI, Brief Assessment of Mealtime Behavior Inventory; Covid-19/SARS-CoV-2; DSM-5, Diagnostic and Statistical Manual of Mental Disorders-5; ICF, International Classification of Functioning, Disability and Health; MDT, multidisciplinary team; OT, occupational therapist; PT, physiotherapist; SLP, speech-language pathologist.

Submission Declaration and Verification

This work described has not been published previously, that it is not under consideration for publication elsewhere, that its publication is approved by the author who is responsible for the work that was carried out, and if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

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References

- Provost B, Crowe TK, Osbourn PL, McClain C, Skipper BJ. Mealtime behaviors of preschool children: comparison of children with autism spectrum disorder and children with typical development. *Phys Occup Ther Pediatr*. 2010;30(3):220–233. doi:10.3109/01942631003757669
- Mayes SD, Zickgraf H. Atypical eating behaviors in children and adolescents with autism, ADHD, other disorders, and typical development. *Res Autism Spectr Disord*. 2019;64:76–83. doi:10.1016/J.RASD.2019.04.002
- Malhi P, Venkatesh L, Bharti B, Singhi P. Feeding problems and nutrient intake in children with and without autism: a comparative study. *Indian J Pediatr*. 2017;84:283–288. doi:10.1007/s12098-016-2285-x
- Yeung SSY, Chan R, Li L, Chan D, Leung J, Leung T. Eating behaviors and diet quality in Chinese preschoolers with and without autism spectrum disorder: a case-control study. *J Pediatr*. 2021;237:258–266.e5. doi:10.1016/j.jpeds.2021.06.017
- Esteban-Figuerola P, Canals J, Fernández-Cao JC, Arija Val V. Differences in food consumption and nutritional intake between children with autism spectrum disorders and typically developing children: a meta-analysis. *Autism*. 2019;23(5):1079–1095. doi:10.1177/1362361318794179
- Baraskewich J, von Ranson KU, McCrimmon A, McMorris CA. Feeding and eating problems in children and adolescents with autism: a scoping review. *Autism*. 2021;25(6):1505–1519. doi:10.1177/1362361321995631
- Rogers LG, Magill-Evans J, Rempel GR. Mothers' challenges in feeding their children with autism spectrum disorder-managing more than just picky eating. *J Dev Phys Disabil*. 2012;24(1):19–33. doi:10.1007/s10882-011-9252-2
- American Psychiatric Association. Desk reference to the diagnostic criteria from DSM-5. *Choice Rev Online*. 2013;51(04):51-1822-51-1822. doi:10.5860/choice.51-1822
- Milano K, Chatoor I, Kerzner B. A functional approach to feeding difficulties in children. *Curr Gastroenterol Rep*. 2019;21. doi:10.1007/s11894-019-0719-0
- Keel PK, Kennedy GA, Wick MR. Eating disorders in children: is avoidant-restrictive food intake disorder a feeding disorder or an eating disorder and what are the implications for treatment? *FI000Research*. 2018;7. doi:10.12688/fi000research.13110.1
- Kambanis PE, Kuhnle MC, Wons OB, et al. Prevalence and correlates of psychiatric comorbidities in children and adolescents with full and subthreshold avoidant/restrictive food intake disorder. *Int J Eat Disord*. 2020;53(2):256–265. doi:10.1002/eat.23191
- Smile S, Raffaele C, Perlin R. Re-imagining the physicians' role in the assessment of feeding challenges in children with autism spectrum disorder. *Paediatr Child Health*. 2021;26(2):E73–E77. doi:10.1093/pch/pxaa008
- Jansen E, Harris H, Rossi T. Fathers' perceptions of their role in family mealtimes: a grounded theory study. *J Nutr Educ Behav*. 2020;52(1):45–54. doi:10.1016/j.jneb.2019.08.012
- Ausderau K, John BS, Kwaterski KN, Nieuwenhuis B, Bradley E. Parents' strategies to support mealtime participation of their children with autism spectrum disorder. *Am J Occup Ther*. 2019;73(1):7301205070p1. doi:10.5014/ajot.2019.024612
- Simeonsson RJ, Leonard M, Lollar D, Björck-Akesson E, Hollenweger J, Martinuzzi A. Applying the International Classification of Functioning, Disability and Health (ICF) to measure childhood disability. *Disabil Rehabil*. 2003;25(11–12):602–610. doi:10.1080/0963828031000137117
- Aponte CA, Romanczyk RG. Assessment of feeding problems in children with autism spectrum disorder. *Res Autism Spectr Disord*. 2016;21:61–72. doi:10.1016/j.rasd.2015.09.007
- Cherif L, Boudabous J, Khemekhem K, Mkawer S, Ayadi H, Moalla Y. Feeding problems in children with autism spectrum disorders. *J Fam Med*. 2018;1(1):30–39. doi:10.14302/ISSN.2640-690X.JFM-18-2252
- Page SD, Souders MC, Kral TVE, Chao AM, Pinto-Martin J. Correlates of feeding difficulties among children with autism spectrum disorder: a systematic review. *J Autism Dev Disord*. 2022;52(1):255–274. doi:10.1007/S10803-021-04947-4
- Goday PS, Huh SY, Silverman A, et al. Pediatric feeding disorder: consensus definition and conceptual framework. *J Pediatr Gastroenterol Nutr*. 2019;68(1):124–129. doi:10.1097/MPG.0000000000002188
- Lefton-Greif MA, Arvedson JC. Pediatric feeding and swallowing disorders: state of health, population trends, and application of the International Classification of Functioning, Disability, and Health. *Semin Speech Lang*. 2007;28(3):161–165. doi:10.1055/s-2007-984722
- Bölte S, Mahdi S, de Vries PJ, et al. The Gestalt of functioning in autism spectrum disorder: results of the international conference to develop final consensus International Classification of Functioning, Disability and Health core sets. *Autism*. 2019;23(2):449–467. doi:10.1177/1362361318755522
- Kral TVE, Eriksen WT, Souders MC, Pinto-Martin JA. Eating behaviors, diet quality, and gastrointestinal symptoms in children with autism spectrum disorders: a brief review. *J Pediatr Nurs*. 2013;28(6):548–556. doi:10.1016/J.PEDN.2013.01.008
- Srikantha P, Hasan Mohajeri M. The possible role of the microbiota-gut-brain-axis in autism spectrum disorder. *Int J Mol Sci*. 2019;20(9):2115. doi:10.3390/ijms20092115
- Björklund G, Pivina L, Dadar M, et al. Gastrointestinal alterations in autism spectrum disorder: what do we know? *Neurosci Biobehav Rev*. 2020;118:111–120. doi:10.1016/j.neubiorev.2020.06.033
- Margari L, Marzulli L. Eating and mealtime behaviors in patients with autism spectrum disorder: current perspectives. ncbi.nlm.nih.gov. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7504729/>. Accessed February 14, 2022.
- Nadon G, Feldman DE, Dunn W, Gisel E. Mealtime problems in children with Autism Spectrum Disorder and their typically developing siblings: a comparison study. *Autism*. 2011;15(1):98–113. doi:10.1177/1362361309348943
- Vissoker RE, Latzer Y, Stolar O, Rabenbach A, Gal E. Eating problems and patterns among toddlers and young boys with and without autism spectrum disorders. *Res Autism Spectr Disord*. 2019;59:1–9. doi:10.1016/J.RASD.2018.12.001

28. Bandini LG, Curtin C, Phillips S, Anderson SE, Maslin M, Must A. Changes in food selectivity in children with autism spectrum disorder. *J Autism Dev Disord.* **2017**;47(2):439–446. doi:10.1007/s10803-016-2963-6
29. Bandini LG, Anderson SE, Curtin C, et al. Food selectivity in children with autism spectrum disorders and typically developing children. *J Pediatr.* **2010**;157(2):259–264. doi:10.1016/J.JPEDS.2010.02.013
30. Demir AÇ, Özcan Ö. The nutritional behavior of children with autism spectrum disorder, parental feeding styles, and anthropometric measurements. *Nord J Psychiatry.* **2022**;76(1):64–70. doi:10.1080/08039488.2021.1934109
31. Evans EW, Must A, Anderson SE, et al. Dietary patterns and body mass index in children with autism and typically developing children. *Res Autism Spectr Disord.* **2012**;6(1):399–405. doi:10.1016/J.RASD.2011.06.014
32. Hill AP, Zuckerman KE, Fombonne E. Obesity and autism. *Pediatrics.* **2015**;136(6):1051–1061. doi:10.1542/PEDS.2015-1437/-/DCSUPPLEMENTAL
33. Ashley K, Steinfeld MB, Young GS, Ozonoff S. Onset, trajectory, and pattern of feeding difficulties in toddlers later diagnosed with autism. *J Dev Behav Pediatr.* **2020**;41(3):165. doi:10.1097/DBP.0000000000000757
34. Rogers M, Coates AM, Banks S. Meal timing, sleep, and cardiometabolic outcomes. *Curr Opin Endocr Metab Res.* **2021**;18:128–132. doi:10.1016/J.COEMR.2021.03.006
35. Sharp WG, Berry RC, McCracken C, Klin A, Jones W, Jaquess DL. Feeding problems and nutrient intake in children with autism spectrum disorders: a meta-analysis and comprehensive review of the literature. *J Autism Dev Disord.* **2013**;43:2159–2173. doi:10.1007/s10803-013-1771-5
36. Raspini B, Prosperi M, Guiducci L, et al. Dietary patterns and weight status in Italian preschoolers with autism spectrum disorder and typically developing children. *Nutrients.* **2021**;13(11):4039. doi:10.3390/nu13114039
37. Molina-López J, Leiva-García B, Planells E, Planells P. Food selectivity, nutritional inadequacies, and mealtime behavioral problems in children with autism spectrum disorder compared to neurotypical children. *Int J Eat Disord.* **2021**;54(12):2155–2166. doi:10.1002/eat.23631
38. Sharp WG, Postorino V, McCracken CE, et al. Dietary intake, nutrient status, and growth parameters in children with autism spectrum disorder and severe food selectivity: an electronic medical record review. *J Acad Nutr Diet.* **2018**;118(10):1943–1950. doi:10.1016/j.jand.2018.05.005
39. Yule S, Wanik J, Holm EM, et al. Nutritional deficiency disease secondary to ARFID symptoms associated with autism and the broad autism phenotype: a qualitative systematic review of case reports and case series. *J Acad Nutr Diet.* **2021**;121(3):467–492. doi:10.1016/j.jand.2020.10.017
40. Farag F, Sims A, Strudwick K, et al. Avoidant/restrictive food intake disorder and autism spectrum disorder: clinical implications for assessment and management. *Dev Med Child Neurol.* **2022**;64(2):176–182. doi:10.1111/dmcn.14977
41. Tchanturia K, Smith E, Weineck F, et al. Exploring autistic traits in anorexia: a clinical study. *Mol Autism.* **2013**;4(1):1–8. doi:10.1186/2040-2392-4-44
42. Huke V, Turk J, Saeidi S, Kent A, Morgan JF. Autism spectrum disorders in eating disorder populations: a systematic review. *Eur Eat Disord Rev.* **2013**;21(5):345–351. doi:10.1002/erv.2244
43. Rhind C, Bonfili E, Hibbs R, et al. An examination of autism spectrum traits in adolescents with anorexia nervosa and their parents. *Mol Autism.* **2014**;5(1):1–9. doi:10.1186/2040-2392-5-56
44. Nielsen S, Anckarsäter H, Gillberg C, Gillberg C, Råstam M, Wentz E. Effects of autism spectrum disorders on outcome in teenage-onset anorexia nervosa evaluated by the Morgan-Russell outcome assessment schedule: a controlled community-based study. *Mol Autism.* **2015**;6(1):1–10. doi:10.1186/s13229-015-0013-4
45. Głowska D, Skolmowska D, Nutrients DG. Population-based study of the changes in the food choice determinants of secondary school students: Polish adolescents' COVID-19 experience (place-19) study. *Nutrients.* **2020**. doi:10.3390/nu12092640
46. Ingram J, Maciejewski G, Hand CJ. Changes in diet, sleep, and physical activity are associated with differences in negative mood during COVID-19 lockdown. *Front Psychol.* **2020**;11:2328. doi:10.3389/FPSYG.2020.588604/BIBTEX
47. Pujia R, Ferro Y, Maurotti S, et al. The effects of COVID-19 on the eating habits of children and adolescents in Italy: a pilot survey study. *Nutrients.* **2021**;13:2641. doi:10.3390/nu13082641
48. Weir E, Allison C, Ong KK, Baron-Cohen S. An investigation of the diet, exercise, sleep, BMI, and health outcomes of autistic adults. *Mol Autism.* **2021**;12(1). doi:10.1186/S13229-021-00441-X
49. Simone M, Emery RL, Hazzard VM, Sed MEE, Larson N, Neumark-Sztainer D. Disordered eating in a population-based sample of young adults during the COVID-19 outbreak. *Wiley Online Libr.* **2021**;54(7):1189–1201. doi:10.1002/eat.23505
50. Lugo-Marin J, Gisbert-Gustems L, Setien-Ramos I, et al. COVID-19 pandemic effects in people with Autism Spectrum Disorder and their caregivers: evaluation of social distancing and lockdown impact on mental health and general status. *Res Autism Spectr Disord.* **2021**;83:101757. doi:10.1016/j.rasd.2021.101757
51. Ochs E, Shohet M. The cultural structuring of mealtime socialization. *New Dir Child Adolesc Dev.* **2006**;2006(111):35–49. doi:10.1002/cd.154
52. Holm L, Lund TB. Are family meals declining? The example of Denmark. In: *Context.* Woodhead Publishing; **2019**:227–240. doi:10.1016/b978-0-12-814495-4.00011-8
53. Curtiss SL. Integrating family ritual and sociocultural theories as a framework for understanding mealtimes of families with children on the autism spectrum. *J Fam Theory Rev.* **2018**;10:749–764. doi:10.1111/jftr.12298
54. Nadon G, Feldman DE, Dunn W, Gisel E. Association of sensory processing and eating problems in children with autism spectrum disorders. *Autism Res Treat.* **2011**;2011:1–8. doi:10.1155/2011/541926
55. Adams SN, Dadabhay A, Neille J. An exploration into mothers' experiences of feeding children with autism spectrum disorder in South Africa. *Folia Phoniatr Logop.* **2020**;73:164–173. doi:10.1159/000507928
56. Twachtman-Reilly J, Amaral SC, Zebrowski PP. Addressing feeding disorders in children on the autism spectrum in school-based settings: physiological and behavioral issues. *Lang Speech Hear Serv Sch.* **2008**;39(2):261–272. doi:10.1044/0161-1461(2008/025)
57. Johnson CR, Turner K, Stewart PA, et al. Relationships between feeding problems, behavioral characteristics and nutritional quality in children with ASD. *J Autism Dev Disord.* **2014**;44(9):2175–2184. doi:10.1007/S10803-014-2095-9
58. Postorino V, Sanges V, Giovagnoli G, et al. Clinical differences in children with autism spectrum disorder with and without food selectivity. *Appetite.* **2015**;92:126–132. doi:10.1016/J.APPET.2015.05.016
59. Kral TVE, Souders MC, Tompkins VH, Adriane M, Eriksen WT, Pinto-martin JA. Child eating behaviors and caregiver feeding practices in children with autism spectrum disorders. *Public Health Nursing.* **2014**;32(5):488–497. doi:10.1111/phn.12146

60. Lane AE, Geraghty ME, Rostorfer JL, Rostorfer JL. Problem eating behaviors in Autism Spectrum Disorder are associated with 1 suboptimal daily nutrient intake and taste/smell sensitivity 2. *Infant Child Adolesc Nutr.* 2014;6(3):172–180. doi:10.1177/1941406414523981
61. Pinstrup-Andersen P. Food security: definition and measurement. *Food Secur.* 2009;1(1):5–7. doi:10.1007/s12571-008-0002-y
62. Laborde D. Poverty and food insecurity could grow dramatically as COVID-19 spreads. *Glob Food Secur.* 2020;16–20. Available from: <https://pdfs.semanticscholar.org/3495/115d4692c8caade4ac8a2adaf658d808be29.pdf>.
63. Chistol LT, Bandini LG, Must A, Phillips S, Cermak SA, Curtin C. Sensory sensitivity and food selectivity in children with autism spectrum disorder. *J Autism Dev Disord.* 2018;48(2):583–591. doi:10.1007/s10803-017-3340-9
64. Suarez MA, Atchison BJ, Lagerwey M. Phenomenological examination of the mealtime experience for mothers of children with autism and food selectivity. *Am J Occup Ther.* 2014;68(1):102–107. doi:10.5014/ajot.2014.008748
65. Aldred C, Green J, Adams C. A new social communication intervention for children with autism: pilot randomised controlled treatment study suggesting effectiveness. *J Child Psychol Psychiatry Allied Discip.* 2004;45(8):1420–1430. doi:10.1111/j.1469-7610.2004.00338.x
66. Sofronoff K, Leslie A, Brown W. Parent management training and Asperger syndrome. A randomized controlled trial to evaluate a parent based intervention. *Autism.* 2004;8(3):301–317. doi:10.1177/1362361304045215
67. Odar Stough C, Dreyer Gillette ML, Roberts MC, Jorgensen TD, Patton SR. Mealtime behaviors associated with consumption of unfamiliar foods by young children with autism spectrum disorder. *Appetite.* 2015;95:324–333. doi:10.1016/J.APPET.2015.07.019
68. Ledford JR, Whiteside E, Severini KE. A systematic review of interventions for feeding-related behaviors for individuals with autism spectrum disorders. *Res Autism Spectr Disord.* 2018;52:69–80. doi:10.1016/j.rasd.2018.04.008
69. Marshall J, Ware R, Ziviani J. Efficacy of interventions to improve feeding difficulties in children with autism spectrum disorders: a systematic review and meta-analysis. *Wiley Online Libr.* 2014;41(2):278–302. doi:10.1111/cch.12157
70. Koegel RL, Bharoocha AA, Ribnick CB, et al. Using individualized reinforcers and hierarchical exposure to increase food flexibility in children with autism spectrum disorders. *J Autism Dev Disord.* 2012;42(8):1574–1581. doi:10.1007/S10803-011-1392-9
71. Schaaf RC, Benevides T, Mailloux Z, et al. An intervention for sensory difficulties in children with autism: a randomized trial. *J Autism Dev Disord.* 2014;44(7):1493–1506. doi:10.1007/S10803-013-1983-8
72. Park HJ, Choi SJ, Kim Y, Cho MS, Kim YR, Oh JE. Mealtime behaviors and food preferences of students with autism spectrum disorder. *Foods.* 2021;10(1). doi:10.3390/foods10010049
73. Sharp WG, Volkert VM, Scallion L, McCracken CE, McElhanon B. A Systematic review and meta-analysis of intensive multidisciplinary intervention for pediatric feeding disorders: how standard is the standard of care? *J Pediatr.* 2017;181:116–124.e4. doi:10.1016/j.jpeds.2016.10.002
74. Johnson CR, Brown K, Hyman SL, et al. Parent training for feeding problems in children with autism spectrum disorder: initial randomized trial. *J Pediatr Psychol.* 2019;44(2):164–175. doi:10.1093/JPEPSY/JSY063
75. Seiverling L, Williams K, Sturmey P, Hart S. Effects of behavioral skills training on parental treatment of children's food selectivity. *J Appl Behav Anal.* 2012;45(1):197–203. doi:10.1901/jaba.2012.45-197
76. Beaudry-Bellefeuille I, Pomoni M, Welch A, Moriyón-Iglesias T, Suárez-González M, Ramos-Polo E. Multidisciplinary approach to assessment and intervention of feeding problems in children with autism spectrum disorders: a clinical perspective. *Irish J Occup Ther.* 2021;49(2):77–83. doi:10.1108/IJOT-12-2020-0019/FULL/PDF
77. Andrew MJ, Sullivan PB. Feeding difficulties in disabled children. In: *Paediatrics and Child Health.* Vol. 20. Churchill Livingstone;2010:321–326. doi:10.1016/j.paed.2010.02.005
78. McComish C, Brackett K, Kelly M, Hall C, Wallace S, Powell V. Interdisciplinary feeding team: a medical, motor, behavioral approach to complex pediatric feeding problems. *MCN Am J Matern Nurs.* 2016;41(4):230–236. doi:10.1097/NMC.0000000000000252
79. Sutherland R, Trembath D, Antoinette Hodge M, Rose V, Roberts J. Telehealth and autism: are telehealth language assessments reliable and feasible for children with autism? *Wiley Online Libr.* 2019;54(2):281–291. doi:10.1111/1460-6984.12440
80. Amorim R, Catarino S, Miragaia P, Ferreras C, Viana V, Guardiano M. Impacto de la COVID-19 en niños con trastorno del espectro autista. [Impact of COVID-19 on children with autism spectrum disorder]. *Rev Neurol.* 2020;71(8):285–291. doi:10.33588/rn.7108.2020381
81. Bal VH, Wilkinson E, White LC, et al. Early Pandemic experiences of autistic adults: predictors of psychological distress. *Autism Res.* 2021;14(6):1209–1219. doi:10.1002/aur.2480
82. Tanner K, Bican R, Boster J, et al. Feasibility and acceptability of clinical pediatric telerehabilitation services. *Int J Telerehabil.* 2020;12(2):43. doi:10.5195/IJT.2020.6336
83. Capri T, Nucita A, Iannizzotto G, et al. Telerehabilitation for improving adaptive skills of children and young adults with multiple disabilities: a systematic review. *Rev J Autism Dev Disord.* 2021;8(2):244–252. doi:10.1007/S40489-020-00214-X/figures/1
84. Burrell A, Ives J, Unwin G. The experiences of fathers who have offspring with autism spectrum disorder. *J Autism Dev Disord.* 2017;47(4):1135–1147. doi:10.1007/s10803-017-3035-2
85. Centers for Disease Control and Prevention. TheICF: An Overview. Available from: https://www.cdc.gov/nchs/data/icd/icfoverview_finalforwho10sept.pdf. Accessed July 12, 2022.

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