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Early Feeding Challenges in Children with Autism Spectrum Disorder: A Developmental Milestone Checklist

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Abstract **Original Research Article**

Aims: To develop and validate a developmental feeding milestone checklist for typically developing children and to identify early feeding related signs and symptoms in children later diagnosed with Autism Spectrum Disorder (ASD), highlighting feeding as a potential early red flag for ASD.

Study design: Cross sectional observational study.

Place and Duration of Study: The study was conducted in clinical and educational settings in Chennai, India, among children aged 3 - 8 years, over a period of

Methodology: A feeding developmental chart was developed based on literature review. The checklist was validated by speech language pathologists. Ten typically developing children (4 - 6 years) were assessed to confirm typical feeding sequences. Thirty children with moderate to severe ASD (3 - 8 years), diagnosed using ISSAA, were included. Feeding milestones were tracked through caregiver interviews focusing on breastfeeding, weaning, texture transition, and mealtime behaviors. Data were analyzed descriptively to identify common early feeding difficulties in ASD.

Results: All typically developing children followed a similar developmental feeding sequence. Among children with ASD, early feeding difficulties were highly prevalent: poor weight gain or reduced nutrition (96%), sucking/biting/chewing difficulties (93%), vegetative skill delays (93%), texture difficulties (90%), and food neophobia (90%). Ritualistic feeding behaviors, oral aversion, and breast/bottle feeding difficulties were reported in 86% of cases. These difficulties were present during infancy but remained unnoticed as early indicators of ASD.

Conclusion: Feeding difficulties in ASD are early, persistent, and multidimensional, involving oral motor, sensory, and behavioral components. Early feeding related abnormalities may serve as developmental markers for ASD and should be incorporated into early screening and referral protocols.

Keywords: Autism Spectrum Disorder, Feeding Milestones, Early Identification, Feeding Difficulties, Developmental Checklist.

1. INTRODUCTION

Autism spectrum disorder (ASD) is a complex developmental condition involving persistent or repetitive challenges with social communication (verbal and non-verbal communication), restricted interests, and repetitive motor/speech behaviour [1]. Now, it has become the fastest growing childhood developmental disability where the diagnosis often does not occur before the preschool age.[2] Early identification, diagnosis, and intervention for children with ASD is known to improve the development and independency of the children [3]. ASD is a neurodevelopmental disability, hence the search for early markers/red flags of the condition during the development of infancy and childhood is an important field of research [4]. Feeding difficulties in young children with autism have its own importance in the field of research [5-6]. There are multiple factors that have been proposed to explain the high occurrence of feeding difficulties with ASD and also feeding difficulties/ behaviours present during infancy of children were unnoticed and later diagnosed to be ASD [7]. These include difficulties in self-regulation sensory difficulties and deficits in social communications. These factors operate from early on in life and continue to persist, affecting the feeding behaviours of children with ASD from infancy to adolescence[8].

1.1Feeding Difficulties in ASD:

"Feeding difficulties" is an umbrella term that has been used to describe problems of food intake associated with characteristics such as limited food intake, restrictive diets, and the impact on nutrition, and food preference [9]. Recently, the literature on ASD and factors related to food is growing to predict the features of feeding difficulties is also an early sign of ASD [10]. Children with ASD have a higher risk of feeding problems [11], such as food selectivity, and many of these feeding difficulties continue from infancy into childhood, persist in adolescence, and even spill over into adulthood [12]. These symptoms are most distressing to the child's family members and healthcare professionals as they impact the child's adaptive function, health, growth and also put the individuals at risk for nutritional inadequacy and brain development deficits. Poor nutrition resulting from decreased intake or inappropriate food choice can have significant, long term adverse impact on the health of children with ASD.

Notably, recent studies indicate that early postnatal development depends on the nutritional status during the prenatal period [13], suggesting that inadequate nutrition during critical period of development is more likely to lead to permanent damage to brain rather than transient effects on the brain. Studies have shown that deficiencies in key nutrients such as zinc and vitamin D puts the child at risk for neurodevelopmental disorders such as autism spectrum disorder (ASD) [14]. It is important to highlight that feeding difficulties in patients with ASD during the early identification and intervention that could originate from different aspects, such as behavioral or sensorial dysfunctions. Also, some feeding difficulties can manifest during the first months of life and overlap with the symptoms of ASD, that could be an important warning sign for early diagnosis and intervention. It is important to highlight that there is no clear description in the literature of the signs of hunger and satiety during child development. Although there are developmental milestones which are crucial in terms of monitoring the development of babies and children given by Willging, Miller & Cohen in Pediatric Dysphagia [15].

There has been limited research exploring other breastfeeding behaviours of infants later diagnosed with ASD. However, the findings reveal early characteristic patterns. Lucas and Cutler performed qualitative interviews of mothers of children with ASD.Nine mothers described a dysregulated breastfeeding pattern of sucking without knowing when to stop. Lazaro and Ponde studying the narratives of mothers of children with ASD, highlighted three patterns of breastfeeding in autistic children, including continuation of breast feeding for 3-5 years [16]. More recently, Hof et al in their population-based study in the Netherlands, reported that infant feeding behavior of being excessively hungry was associated with later childhood autistic traits. [17] Given the strong association between

feeding habits and ASD, early recognition of feeding difficulties has prompted medical professionals to investigate how these habits form in children with ASD. While research on typically developing children highlights age-related variations in hunger and satiety cues, studies on early feeding indicators in ASD remain limited. This study aims to describe early childhood feeding-related signs and symptoms and explore their relevance to ASD diagnosis.

1.2 Aim:

The study aims to develop and validate a checklist for assessing feeding milestones in typically developing children and to describe early signs and symptoms of feeding difficulties in children with autism spectrum disorder (ASD). This study also aims to emphasize on the importance of recognizing feeding-related signs as potential indicators for a more detailed ASD diagnostic evaluation.

1.3 Objectives:

- To develop and validate a checklist for assessing feeding milestones in typically developing children and to describe early signs and symptoms of feeding difficulties in children with autism spectrum disorder (ASD).
- To describe breastfeeding, weaning and mealtime behaviours during the infancy of children who are later diagnosed with ASD and to evaluate for any significant difference in these feeding patterns compared to neurotypical children indicating unique feeding patterns during infancy that could serve as red flags for early detection of ASD.

2. MATERIAL AND METHODS

This cross-sectional study examines feeding difficulties in children with autism spectrum disorder (ASD). A feeding developmental chart was created based on a literature review to assess feeding milestones in ASD. Speech-language pathologists will validate the developmental chart, followed by a detailed feeding assessment. Feeding difficulties will be analyzed and compared to early signs of ASD, and findings will indicate unique feeding patterns during infancy that could serve as red flags for early detection of ASD.

2.1 Participants

It was assessed for 10 typically developing children of age rage 4 - 6 years old. The results also revealed that all of them followed a similar sequence of feeding development.
Then it included 30 children of ASD of age range 3 - 8 years old.

2.2 Diagnostic Criteria

The children with ASD were of moderate to severe ASD using ISSAA.

2.3 Data Collection Procedure

A developmental chart was prepared and was validated by speech language pathologist. The chart is as followed. Developmental Chart for Feeding:

≤3months (Liquids) (Breast/Bottle)	Open the mouth looking/search for a mother’s nipple or bottle
	Easily suck and swallow during feeding
	Movement of the tongue back and forward to suck
	Signs of hunger about 8 to 12 times in 24 h
	Posture of attention to feed moment

(Sucking)	Release of the breast/bottle when satisfied
3–6 months (Liquids-Purees) (Bottle – Cup Transition) (Blowing)	Clicking tongue / Spitting of food / Trills/ Blowing
	Grumble or cry
	Hands over mouth
	Smooth foods, purees and blenderized foods (Rice cereal, fruit or vegetable purees, soft cookies, toddler biscuits or puffs)
	Phasic biting pattern
	Introduction of cup
6–9 months (Purees- Solids) (Posture development) (Biting and Chewing)	Visual recognition and anticipatory mouth opening (Active search for food)
	Ability to hold easily dissolvable solid between gums or teeth, able to hold jaw in stationary position, uses intermittent phasic biting
	Leans forward to get closer to the breast or spoon
	Pushes the person's hand away
	Transition from feeding bottle to glass
	Introducing solid foods
9–12 months (Lip Closure and Chewing) (Co-ordination)	Points to food
	Reacts strongly to new smells and tastes
	Pushes food away or closes mouth
	Lip closure with swallowing
	Increased co-ordination of lip and tongue movements
	Phasic biting on harder solids
12 - 18 months (Rotatory chewing)	Easy to manage solid foods (Crackers, breads, casseroles, soft fruit pieces, And tender Meat such as flaked fish or chicken)
	rotary chewing pattern
	lip closes on edge of cup for seal while drinking
	Starting to learn how to eat on their own, more independent (self -/ drinking)

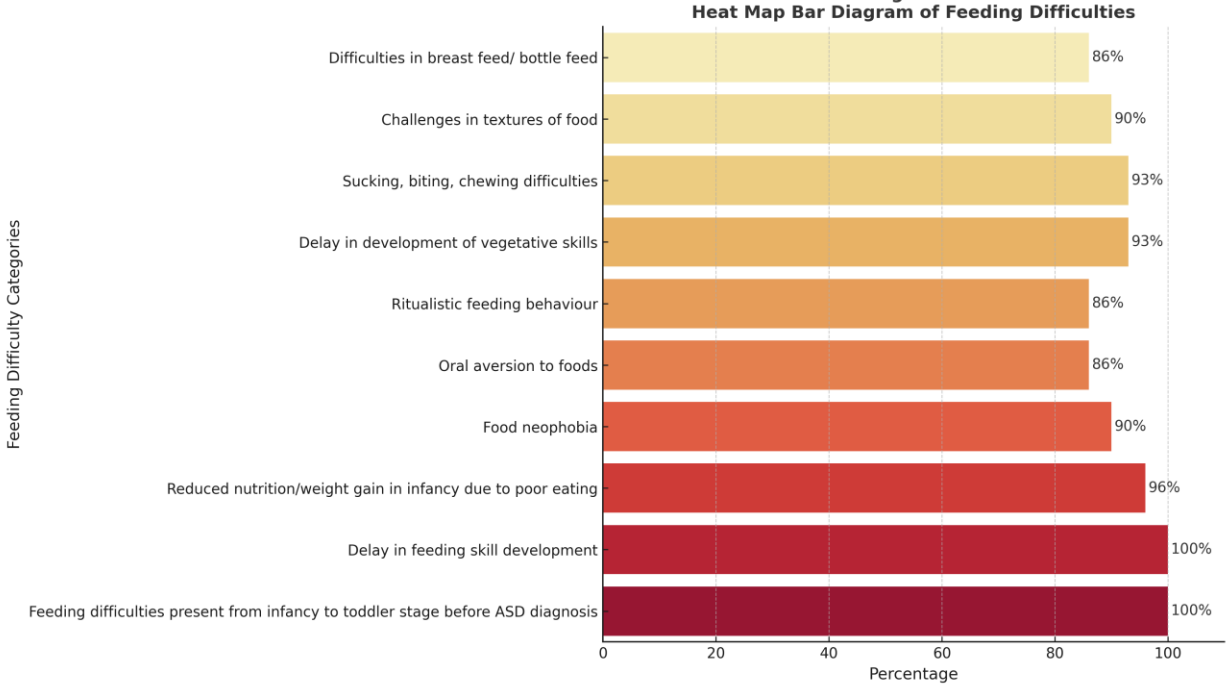
(Tries to Independent Feeding)	Uses utensils with some spills
	Combines words and gestures to express the desire for food
18-24 months (Independent eating)	Stops mouthing non-edible items
	Basic set of skills is in place for chewing
	Starting to learn how to eat on their own, more independent
	Develops ability to grade the opening of the jaw when biting foods of varying thickness
	Transferring food across the midline of the tongue from one side of the mouth to the other
	Age-appropriate solid foods (Tender meats, Steamed Vegetables, And fruits)
24 months- 36 months (wide range of textures)	Use of a sucking pattern for liquid
	Takes the caregiver to the food
	Wide range of textures / Eats a greater variety of foods
	Make their own rituals related to mealtime
	Can develop strategies to avoid certain foods
	Play with food

The developmental milestones were tracked by interviewing the parents and caregivers of the child. They were interviewed and the difficulties faced by them were also documented along with the delay in milestones.

3. RESULTS AND DISCUSSION

The documented difficulties are represented in a bar diagram.

Figure 1
Heat Map Bar Diagram of Feeding Difficulties



The figure demonstrates the prevalence of feeding difficulties among children priori to ASD diagnosis that were left unnoticed as red flags for autism. The difficulties included reduced nutrition or weight gain in infancy due to poor eating (96%), sucking, biting, and chewing difficulties (93%), and delays in the development of vegetative skills (93%). Additionally, challenges with food textures (90%) and food neophobia (90%) were commonly observed. Ritualistic feeding behaviors, oral aversion, and difficulties in breast or bottle feeding each accounted for 86% of cases. The findings also highlight that feeding challenges were not only pervasive but also multidimensional, ranging from oral-motor difficulties to behavioral manifestations, which may significantly affect nutritional outcomes and developmental progress in children with ASD. These feeding related symptoms could have also been red flags for early detection of ASD but was left unnoticed.

3.1 Discussion

The results of current study provide strong evidence that feeding difficulties are both pervasive and persistent in children with autism spectrum disorder (ASD) of moderate to severe severity, beginning in infancy and continuing through out early childhood. The results also indicate that delays in feeding skill development and persistent feeding difficulties from infancy to toddlerhood were universally reported (100%). It also included nutritional challenges such as poor weight gain in infancy (96%), along with oral-motor deficits including sucking, biting, and chewing difficulties (93%) that were highly prevalent. These results mirror prior research

showing that children with ASD are disproportionately affected by feeding difficulties compared to their neurotypical peers (Bandini et al., 2010; Crasta et al., 2014).

3.1.1 Early Feeding as a Developmental Marker

A key implication of these findings is that feeding-related behaviors may serve as early developmental markers or "red flags" for ASD during the infancy and toddler period. Previous studies have also documented atypical breastfeeding behaviors, such as difficulty regulating sucking or prolonged breastfeeding dependency, among children later diagnosed with ASD (Lázaro & Pondé, 2017). Hof et al. (2021) also demonstrated that excessive hunger and atypical eating patterns in infancy were predictive of later autistic traits. The consistency of such findings, along the current study, also highlights the inclusion of role of feeding in assessment and management for improving early ASD screening tools.

3.1.2 Multidimensional Nature of Feeding Challenges

Another significant finding is the multidimensional nature of feeding difficulties that is physiological, behavioural and sensory based. On the physiological level, oral-motor and vegetative delays affect a child's ability in transition across developmental feeding stages, from breast or bottle feeding to chewing and independent eating. On the behavioral and sensory level, ritualistic feeding patterns, food neophobia, and oral aversion increases restrictive eating and nutritional deficits. These difficulties also align with the literature emphasizing the interplay between sensory processing difficulties, rigid behaviors, and oral-motor impairments in children with ASD (Margari et al., 2020; Vissoker et al., 2015).

3.1.3 Impact on Nutrition and Development

Feeding difficulties plays a critical role for nutritional status, growth, and neurodevelopment. The high prevalence of reduced nutrition and poor weight gain observed underscores the risk of malnutrition and micronutrient deficiencies, which are known to have long-term consequences for brain development and adaptive functioning (Cusick & Georgieff, 2016). For example, deficiencies in zinc, vitamin D, and other nutrients have been associated with increased risk for neurodevelopmental disorders (Jensen et al., 2022). Thus, the unaddressed feeding problems not only affect physical health but also may exacerbate development delays in children with ASD.

3.1.4 Implications for Early Intervention

The clinical significance of these findings lies in their implications for early detection and intervention of feeding difficulties as red flags for ASD. Feeding challenges are often misdiagnosed as developmental issues or "picky eating," leading to missed opportunities for early identification of ASD. However, the current study provides evidences that such difficulties frequently occur prior to diagnosis. Thus, incorporating feeding assessments into developmental screening protocols could support earlier referrals for comprehensive evaluation and interventions that combine speech-language pathology, occupational therapy, and nutritional counseling may provide a more holistic approach to managing feeding problems in children with ASD.

3.1.5 Cultural and Contextual Considerations

It is also important to recognize the cultural context in which feeding practices occur. Caregiver reports revealed ritualistic feeding behaviors and oral aversion, which may be further shaped by cultural norms around feeding practices, dietary diversity, and parental expectations. Studies conducted in India have shown that feeding difficulties in ASD not only disrupt child development but also impose significant stress on caregivers who struggle to balance cultural expectations with their child's unique feeding needs (Crasta et al., 2014). Therefore, culturally sensitive assessment and intervention strategies are essential.

3.1.6 Limitations and Future Directions

The reliance on caregiver-reported data introduces the possibility of recall bias, particularly when parents are reflecting on feeding behaviors from infancy. Additionally, the study focused on children

with moderate to severe ASD, which may limit the generalizability of findings to children with milder presentations. Future longitudinal research is needed to validate feeding difficulties as early diagnostic markers and to investigate their trajectory across developmental stages.

4. CONCLUSION

This study underscores the high prevalence of feeding difficulties in children with ASD, with particular emphasis on early life challenges such as delays in feeding skill development, reduced nutritional intake, and oral-motor deficits. The results highlight that feeding difficulties are not only persistent but also multifaceted, influencing both physiological and behavioral domains. Importantly, the findings suggest that early feeding-related difficulties may serve as critical developmental markers for ASD and could support earlier screening and intervention. Recognizing and addressing these feeding challenges at the earliest stages may improve both nutritional outcomes and developmental trajectories for children with ASD.

COMPETING INTERESTS

The authors declare that they have no competing interests. There are no financial or personal relationships with other people or organizations that could inappropriately influence this work.

AUTHORS' CONTRIBUTIONS

'Author A and Author B' designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. 'Author C and Author D' managed the analyses of the study and data collection from the parents. 'Author B' managed the literature searche. All authors read and approved the final manuscript."

CONSENT (WHERE EVER APPLICABLE)

A consent form was obtained from the parents that the obtained information is been used for research purpose and no personal information will be shared.

ETHICAL APPROVAL (WHERE EVER APPLICABLE)

This is to inform that your research Early Feeding Challenges in Children with Autism Spectrum Disorder: A Developmental Milestone Checklist has been approved by the ETHICS Committee of Madras ENT Research Foundation (P) Ltd and MERF-Institute of Speech and Hearing (P) Ltd., after thorough review.

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