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Original Research Article

Feeding behaviours in infancy of children later diagnosed with autism spectrum disorder

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ABSTRACT

Background: Autism spectrum disorder, the fastest growing childhood neurodevelopmental diagnosis, shows good outcomes with early intervention. The search for behavioral early markers is an important area of research. Studies of breastfeeding and weaning behaviours in autism have reported characteristic patterns which could be early indicators of this condition.
Methods: The study was a cross sectional survey of breastfeeding and weaning patterns during the first year of life in 50 children aged 15 months to 5 years, including 25 with ASD and 25 Neurotypical children. A semi-structured interview schedule and the brief assessment of mealtime behavior in children scale was used to elicit feeding history from their mothers. Data was analysed using descriptive statistics and tests of significance.
Results: There were significant differences in the patterns of early feeding of children with ASD, compared to the NT children. 64% ASD children showed dysregulated vigorous sucking during breastfeeding, without knowing when to stop. 52% of them breast fed for more than 40 minutes per feed. 68% continued to breastfeed beyond the age of 2 years. A significant proportion of ASD children also showed weaning difficulties such as limited variety (40%), food refusal (36%) and disruptive mealtime behaviour (32%).
Conclusions: Children with ASD show significantly more challenging breastfeeding and weaning behaviours in infancy, compared to NT children. These patterns could be identified by parents and health workers in early child development as possible early signs of ASD and prompt referral for further diagnostic evaluation.

Keywords: Autism spectrum disorder, Breastfeeding, Dysregulated sucking, Early identification, Weaning, India

INTRODUCTION

Autism spectrum disorder (ASD) is a complex developmental condition involving persistent challenges with social communication, restricted interests, and repetitive behaviour.[1] Though it has become the fastest-growing childhood developmental disability, yet diagnosis often does not occur until the preschool age.[2] Early identification, diagnosis, and intervention for children with ASD is known to improve outcomes.[3] Since ASD is a neurodevelopmental disability, the search for early markers of the condition in infancy is an important field of research.[4] Feeding difficulties in young children with autism have been an area of interest and identified as a common occurrence in several studies.[5-7] There are multiple factors that have been proposed to explain the high occurrence of feeding difficulties with ASD.[8] These include difficulties in self-regulation sensory difficulties and deficits in social communications.[9-13] These factors operate from early on in life and continue to persist, affecting the feeding behaviours of children with ASD from infancy to adolescence.[14] Poor nutrition resulting from decreased intake or inappropriate food choice can have significant, long term adverse impact on the health of children with ASD.[6]

Breast feeding is a complex dyadic interaction between mother and child, dependent on neuro-behavioural

regulation and sensory feedback.[15] There is a substantive body of research on breast feeding in ASD, with a focus on factors such as initiation of breastfeeding and duration, as well as exclusive breastfeeding.[16,17] The protective effect of breastfeeding has been highlighted by several studies including from India.[18] However, these results are inconsistent. The National Survey of Children's Health in the USA showed no association of a diagnosis of ASD with any measure of breastfeeding history.[19] A more recent multicentric longitudinal study from USA also reported no difference in initiation of breast feeding in mothers of children with and without ASD, though the former group breast fed their babies for shorter duration.[20] 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.[15] 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.[21] 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.[22] Our study is the first of its kind, exploring the early feeding, including patterns of sucking during the first year of life of young children with ASD in India. The objectives of the research were to describe breastfeeding, weaning and mealtime behaviours during the infancy of children later diagnosed with ASD and to evaluate for any significant difference in these feeding patterns compared to neurotypical children. The findings indicate unique feeding patterns during infancy that could serve as red flags for early detection of ASD.

METHODS

The study was a cross sectional, retrospective survey of 50 mothers who had children between 15 months to 5 years. Out of these, 25 mothers had children who were diagnosed with ASD at the community based Sethu centre for child development and family guidance, in North Goa, India between October 2021 to March 2022. A comparison group of 25 mothers of age matched neurotypical children who initiated breastfeeding soon after birth were also included.

Identification of families of children with ASD in study age group was done via the registration records of clients attending the Sethu Centre. Mothers of children aged 15 months to 5 years, who initiated breastfeeding soon after their birth were informed about the study and requested to participate voluntarily. Children who were born preterm, had any genetic conditions or anatomical deformities that could hamper breastfeeding, suffered birth complications or were admitted into neonatal intensive care units were excluded from the study. The comparison group was selected from the client population of a general paediatrician in North Goa, who were neurotypical breastfed children, attending regular well baby follow up visits.

After obtaining informed consent, mothers were interviewed over the telephone or in face-to-face interactions, using a semi- structured questionnaire to gather demographic data (e.g., parental age, level of education), birth details (e.g., birth order, type of delivery), breastfeeding experiences, weaning and mealtime behaviours in the first year. Feeding behaviours during weaning were assessed using the brief assessment of mealtime behaviour in children (BAMBIC) scale with the three main categories of limited variety, food refusal and disruptive behaviour.[23]

Statistical analysis

A descriptive analysis was done for the demographic factors and statistical analyses was done using SPSS version 25.[24]

RESULTS

50 mothers, 25 with children with ASD and 25 with NT children, were interviewed for this study and the results indicated many significant differences in the breast feeding and weaning patterns of ASD and NT children.

Table 1: Parental (mother's and father's) profile.

Variables	ASD group (N=25) Frequency (%)	NT group (N=25) Frequency (%)	P value
Mother's age (years)			
20-29	4 (12)	3 (12)	0.2
30-39	21 (88)	22 (88)	0.3
40-49	-	-	-
Father's age (years)			
20-29	--	--	--
30-39	15 (60)	--	--
40-49	10 (40)	25 (100)	0.014
Mother's education			
High School	2 (8)	6 (24)	0.029
Intermediate	2 (8)	3 (12)	0.89
Graduate	13 (52)	6 (24)	0.039
Postgraduate	8 (32)	10 (40)	0.612
Father's education			
High School	3 (12)	5 (20)	0.037
Intermediate	3 (12)	4 (16)	0.3
Graduate	13 (52)	6 (24)	0.039
Postgraduate	6 (24)	10 (40)	0.051

Parental characteristics

The parental profiles are indicated in (Table 1). There was no significant difference in the ages or educational profiles of the mothers and fathers between the two groups

Child characteristics

The (Table 2) summarises various child factors. The two groups were very similar in the mean weight and age, except for one characteristic. Most of the children in the ASD group were first born children which was significant ($p<0.05$).

Breastfeeding patterns

Total 24% (N=6) of the ASD children and 12% (N=3) of the NT children were given prelacteal feeds before breastfeeding was initiated. This difference was significant ($p<0.05$).

Table 2: Child characteristics.

Variables	ASD group (N=25) Frequency (%)	NT group (N=25) Frequency (%)	P value
Birth order			
1st child	19 (76)	11 (44)	0.041
2nd child	4 (16)	14 (56)	0.038
3rd child	2 (8)	-	-
Birth weight	2.72(±0.342)	(2.96±0.37)	0.32
Age (months)	36±9	32±6	0.602
Gender			
Male	22	18	1.12
Female	3	7	0.62

Table 3: Breastfeeding patterns.

Variables	ASD group (N=25) Frequency (%)	NT group (N=25) Frequency (%)	P value
Prelacteal feeds	6 (24)	3 (12)	0.021
Breast fed immediately after birth	18 (72)	16 (64)	0.779
Time interval between feeds (hours)			
Less than 2	4 (16)	11 (44)	0.010
2-4	20 (80)	10 (40)	0.031
More than 4	1 (4)	4 (16)	0.002
Duration of each feed			
Less than 20 minutes	8 (32)	17 (68)	1.56
20-40 minutes	4 (16)	7 (28)	0.84
More than 40 minutes	13 (52)	1 (4)	0.0009
Dysregulated breast feeds	16 (64)	5 (20)	0.0091
Exclusive breast feeds for 6 months	20 (80)	21 (84)	0.62
Difficulty in weaning off breast feeds	17 (68)	6 (24)	0.026

More than half of the ASD children (52%) showed longer duration of breast-feeding sessions, lasting over 40 minutes compared to only one NT child. This was highly statistically significant ($p<0.001$). 64% (N=16) ASD children and 20% (N=5) NT children had a dysregulated vigorous suck pattern without knowing when to stop, a statistically significant difference. ($p<0.01$). 68% of mothers (N=17) of ASD children breast fed their children beyond the age of 2 years compared to 20% mothers of NT (N=5) ($p<0.05$). Similarly, 68% of mothers (N=17) of ASD children described difficulty in stopping breastfeeds compared to 24% mothers of NT (N=6) ($p<0.05$). In summary, breast feeding problems were significantly more common in ASD compared to NT children. This data is summarised in (Table 3).

Breastfeeding was initiated immediately after birth in a majority of babies in both ASD (72%) and NT (64%) groups. 80% of the cases were breastfed with an interval of 2-4 hours. Breastfeeding with intervals of less than 2 hours ($p<0.01$) and an interval of more than 4 hours was significantly more in the NT group ($p<0.001$). A significantly higher proportion of ASD children were fed at intervals between 2-4 hours ($p<0.05$).

Age of weaning and type of weaning food

The ages of initiation and types of weaning foods were very similar in both ASD and NT children (Table 4). Weaning was started after 6 months in 100% (N=25) children in the ASD group and 92% NT children (N=23). The preferred food was pureed fruits and vegetables in 56% children (N=14) in the ASD group and 64% NT children (N=16). There were no significant differences between the two groups in the choice of weaning foods.

Table 4: Age of weaning and types of weaning food.

Variables	ASD group (N=25) Frequency (%)	NT group (N=25) Frequency (%)	P value
Age at which weaning started			
Less than 6 months	-	2	-
At 6 months	25	23	0.72
Types of weaning food			
Pureed vegetables and fruits	14 (56)	16 (64)	0.64
Rice and pulses	8 (32)	7 (28)	0.58
Commercial formula	3 (12)	2 (8)	0.88

Mealtime behaviour during weaning period (6m-12m)

There were three types of mealtime behaviours that were studied, as shown in (Table 5).

Limited variety

The behaviours in this category included child's nonacceptance of a variety of foods, unwillingness to try new foods and preference for the same food at every meal. 40% (N=10) mothers of ASD children described the child feeding on limited variety compared to only 4% (N=1) in the NT group. This was statistically significant (p<0.01).

Food refusal

The behaviours included turning face/body away from food, child screaming or closing mouth when food was presented. Food refusal was present significantly more often in 36% (N=9) of the ASD group compared to 4% (N=1) in the NT group (p<0.01).

Table 5: Mealtime Behaviour during weaning period (6-12 months).

Mealtime behaviour	ASD group N (%)	NT group N (%)	P value
Limited variety	10 (40)	1 (4)	0.0012
Food refusal	9 (36)	1 (4)	0.008
Disruptive behaviour	8 (32)	0	—

Disruptive behaviour

Aggressive behaviours like hitting, kicking, self-injurious behaviour, pushing the food away and spitting were examples of disruptive mealtime behaviours. These were seen in 32% (N=8) of the children with ASD compared with none present in the NT group. Though numerically present in a higher proportion of ASD children, a p value could not be calculated due to lack of a denominator. Thus, though the time of starting weaning and choice of foods was very similar in both the ASD and NT groups of children, children with ASD were significantly more likely to have weaning difficulties related to limited variety of foods, food refusal and disruptive mealtime behaviours, compared to NT children.

DISCUSSION

This is the first study from India comparing breast feeding and weaning patterns in children with and without ASD, during the first year of life, obtained via maternal reports. The results show several significant early feeding differences between the two groups of children, which have potential for clinical use as markers of growth and developmental concerns.

Breastfeeding patterns

The present study adds to the body of research that has explored the links between ASD and breastfeeding. Initiation of breastfeeding: In this study, 24% of children with ASD had been given prelacteal feeds (most commonly commercial formula feeds) compared to only 12% of the control group. Despite the introduction of prelacteal feeds in a quarter of the cases, the vast majority of mothers of children with ASD (72%) initiated breast feeds immediately after birth, which was higher than the mothers of NT children (64%), though the difference was not statistically significant. In their case-control study of 204 children, Al-Farsi et al found ASD was associated with prelacteal feeds and late initiation of breastfeeding.[16]

Duration of breastfeeding episodes: A prolonged duration of breastfeeding per episode ranging between 40-60 minutes was seen in 52% of the cases compared to only 4 % of the NT group. This was statistically significant. This pattern of prolonged sucking in children with ASD is strikingly different from what has been reported for neurotypical babies. Saki et al, studying patterns of feeding in exclusively breast fed neurotypical babies reported much shorter durations with a mean duration of feed per episode of 14.5 minutes at the age of 3 months and 12 minutes at the age of 6 months.[25]

Patterns of sucking: 64% of cases had a pattern of dysregulated breast feeding wherein the child had a vigorous suck without knowing when to stop compared to 20% of the NT group. This was statistically significant. The study by Lucas et al also described a similar dysregulated pattern of breastfeeding in children with ASD, where 9 out of 15 mothers interviewed said that their children would have vigorous prolonged feeding episodes without satiation.[15]

Hof et al in their population-based prospective study of feeding patterns of 3546 babies at 2 months and presence of autistic traits at 6 years found that a high proportion of the cohort showed eating problems in infancy.[22] In particular, 'drinking only small quantities' and 'being hungry and not satisfied' were associated with higher autistic traits scores at age of 6 years. These unusual patterns are likely to be due to poor self-regulation of appetite, a difficulty known to be associated with ASD.

Continuation of breastfeeding: 80% of cases and 84% of the control group followed the recommended WHO guidelines of exclusive breastfeeding till the age of 6 months.[23-26] This is a heartening result. However, many previous studies, have reported lower rates in children with ASD.[16,17,27] In a case -control study of Indian children from 2-6 years, George et al reported breast feeding duration under 6 months in those with ASD.[28] Another case control study of siblings from India conducted by Manohar et al found that children with ASD were sub optimally breastfed, compared to their neurotypical siblings.[18] Huxham et al surveyed 325 caregivers of children with ASD between 3-16 years, and found that only 19.1 % of children with ASD were exclusively breastfed for 6 months.[29] Berding et al also found lower exclusive breastfeeding rates in children with ASD.[30] Al Farsi et al in their case control study found that increased ASD risk

was associated with suboptimal breastfeeding practices including duration of exclusive breast feeding.[16]

Stopping breastfeeding: 68% cases in the present study had extended breastfeeds beyond the age of 2 years and also had difficulty weaning the child completely off the breast milk. This was shown to be significantly different from the NT group. Prolonged duration of breastfeeding was also reported in a study done by Lazaro et al, based on the narratives of mothers of ASD children, in which many of them continued breastfeeding till the age of 3-5 years.[21] Extended breastfeeds beyond the age of 2 years has been described in a case control study by Say et al where the mean duration of breastfeeding in children with ASD was 25 months compared to 21 months of the control group.[31]

Mealtime behaviour during weaning period (6-12 months of age)

The present study indicates that characteristic weaning challenges are more commonly seen in children with autism, as early as the first year.

Limited variety: 40% of cases in our study ate only a limited variety of food compared to 4 % of the control group. This was statistically significant. A study by Emond et al found that during weaning, ASD children at 6 months of age were significantly more likely to be "slow feeders" and "very choosy".[32] The ASD group also had a less varied diet than controls, and consumed less vegetables, salad and fresh fruit. A study by Seiverling et al, in children less than 3 years old, found that the ASD group showed significantly more limited variety and food selectivity based on texture and type compared to the control group.[33] A significant 65% of the children in a study by Huxham et al**,** in a slightly higher age group of 3-5 years, had specific preferences based on food presentation leading to a limited diet variety.[29] Bandini et al in their case control study also reported significantly more limited food repertoire in children with ASD (19.0 foods vs 22.5 foods), leading to inadequate intake of nutrients.[5] Crasta et al reporting from India also described food over-selectivity as being significantly more common in children with ASD to those with intellectual disability.[7]

Food refusal: A statistically significant 36% of the cases in our study would refuse to eat food compared with only 4% of the control group. Wallace et al in their study on feeding habits in infancy found that food neophobia and refusal to try new foods is two to three times more common in children with ASD than in non-ASD children.[34] Bandini et al reported that children aged 3-11 years with ASD exhibited significantly more food refusal than typically developing children (41.7% vs. 18.9% of foods offered).[5] In a study from India by Malhi et al, ASD children aged 4-10 years showed significant food refusal ($P<0.001$).[35] Our study reported a slightly lower percentage of food refusal compared to the other studies, most likely due to the younger age of our study population, who were still largely being breastfed in their infancy. It is likely that the prevalence of food refusal in ASD during early childhood increases with age.

Disruptive behaviour: 33% of the cases had disruptive behaviour in the ASD group compared to no such cases recorded in the NT group. Studies by Provost et al, showed that a significant number of preschool children with ASD exhibited disruptive behaviours like throwing or dumping of food.[36] Gray et al in a study of ASD children between 3-6 yrs. found that 92.3% exhibited disruptive behaviour during meals.[37] Malhi et al also showed that a significant number of ASD children aged 4 years exhibited disruptive behaviour during mealtimes.[35]

Based on the comparison of our study findings to other research that has been done before in the area of breastfeeding and feeding behaviours in young children with ASD, it is clear that certain important patterns in infancy like dysregulated breastfeeding and problematic mealtime behaviours as early as the first year of life are significantly more common in children with ASD, compared to neurotypical peers, as reported earlier. This has important implications for clinical practice, as well as future research, as discussed ahead. This study had the following limitations. The sample size was small. The absence of ASD in the control group was not confirmed by any ASD screening or diagnostic tool. Sensory profile screening and its relation to breastfeeding and mealtime behaviour was not included in the study. The breast feeding history did not include the onset of the dysregulated sucking pattern and its duration. Information about bottle feeding was not elicited too. While assessing weaning behaviours, the scores in the subcategories under the BAMBIC questionnaire were not reported separately. The early patterns of difficulties in breast feeding and weaning which have been reported for the first time in Indian mothers are very important. The impact of early nutrition, including breast feeding and weaning practices on child development is well established.[38] Promotion of breastfeeding, proper introduction of complimentary foods and attention to nutrition is a priority across various sectors, including health, child development and early education. To ensure the monitoring and promotion of breast feeding and correct weaning practices at the community level, health workers are trained to ask for, assess and correct any feeding concerns noticed by parents.[39]

Since children with ASD are highly likely to manifest breast feeding and weaning challenges, these early indicators can be readily picked up. Health workers can be trained to ask mothers specifically for unusual patterns like dysregulated sucking and difficulty in weaning as part of their regular interaction, without increase in their work load. The potential for picking up early unusual feeding patterns in children with ASD and making them an indication for referral and further assessment, can be the critical action that makes all the difference in the identification of a neurodevelopmental disability where time is of the essence.

CONCLUSION

This study picked up several significantly different and characteristic patterns during breastfeeding and weaning in the first year of life among children with ASD, compared with neurotypical children. These findings have great clinical potential and need to be studied on a wider scale. Given the influence of nutrition on early development and the campaign approach to the feeding of infants and young children, training health and early child development workers to identify pattens of dysregulated breast feeding with weaning difficulties during infancy can be a critical step in the early detection of ASD.

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