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Association Between Infant Feeding Practices and Autism Spectrum Disorder: A Cross-Sectional Analytical Study Among Children Aged 3 to 10 Years in a Tertiary Care Hospital

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Abstract
Introduction: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition increasingly diagnosed during early childhood. Emerging evidence suggests that early-life exposures, particularly infant feeding practices, may influence neurodevelopmental outcomes. However, data from Indian settings remain limited.
Aim: To assess the association between infant feeding practices and the diagnosis of Autism Spectrum Disorder among children aged 3 to 10 years in a tertiary care hospital, and to identify maternal and child-related factors influencing suboptimal feeding.
Materials and Methods: A cross-sectional analytical study was conducted at the Department of Pediatrics, Sree Balaji Medical College and Hospital, Chennai, between January and June 2025. A total of 106 children (53 with ASD and 53 typically developing controls) aged 3–10 years were recruited using consecutive convenience sampling. Data on infant feeding practices were collected using a semi-structured questionnaire administered to caregivers. Multivariate logistic regression was performed to assess associations between feeding variables and ASD, with results expressed as adjusted odds ratios (aOR) and 95% confidence intervals (CI).
Results: Exclusive breastfeeding for ≥6 months was significantly lower in the ASD group (42.2%) compared to controls (75.6%) and was associated with reduced odds of ASD (aOR = 0.25; 95% CI: 0.13–0.48; P < 0.001). Early top feeding (aOR = 3.4), delayed initiation of breastfeeding (>1 hour) (aOR = 2.9), early complementary feeding (<6 months) (aOR = 2.6), and bottle feeding before six months (aOR = 2.2) were all significantly associated with increased odds of ASD. Commonly reported breastfeeding challenges among mothers of ASD children included poor oromotor coordination, weak bonding, and inadequate milk supply.
Conclusion: Suboptimal infant feeding practices—particularly lack of exclusive breastfeeding, early top feeding, and delayed breastfeeding initiation—are significantly associated with ASD. Exclusive breastfeeding emerges as a consistent protective factor. Public health strategies promoting optimal feeding practices and early maternal support may contribute to improved neurodevelopmental outcomes and potentially reduce ASD risk in early childhood.
Keywords: *Autism Spectrum Disorder, Exclusive Breastfeeding, Infant Feeding Practices, Neurodevelopment, Bottle Feeding, Breastfeeding Initiation, Early Nutrition.*

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by impairments in social communication and interaction, along with restricted and repetitive patterns of behavior. The global burden of ASD is rising, with increasing numbers of children being diagnosed during early childhood. This trend is attributed to heightened awareness, improved diagnostic tools, and evolving clinical practices (1). In India, although comprehensive epidemiological data are limited, tertiary care centers are witnessing a growing number of referrals for suspected neurodevelopmental delays, reflecting both increased recognition and utilization of pediatric developmental services (2,3).

Early-life exposures, especially those occurring during infancy, have garnered interest for their potential influence on neurodevelopment. Among these, infant feeding practices—such as the timing of

breastfeeding initiation, exclusivity of breastfeeding, and introduction of complementary or artificial feeds—are being increasingly studied for their association with ASD (4,5). Breast milk is rich in essential nutrients, neurotrophic factors, and immunological components that support early brain development, especially during critical periods of growth (6). Deviations from recommended feeding practices—such as delayed breastfeeding initiation, early top feeding, and reduced exclusivity—may negatively impact neurological maturation and the establishment of maternal–infant bonding (5,7).

A case-control study highlighted that late initiation of breastfeeding, non-intake of colostrum, prelacteal feeding, and bottle feeding were associated with higher risk of ASD. Moreover, the risk decreased in a dose-dependent manner with longer durations of exclusive and continued breastfeeding (7). In addition, several reviews have noted that children later diagnosed with ASD often exhibit feeding difficulties during infancy, including breastfeeding challenges, poor acceptance of solids, and atypical mealtime behaviors (8). However, the literature presents some inconsistency. While smaller observational studies report associations between feeding patterns and ASD risk, some larger cohort studies, especially from Western populations, have not found statistically significant relationships after adjusting for confounding variables—highlighting the complexity and the need for more targeted research in diverse settings (9,10).

In India, cultural beliefs, maternal literacy, healthcare access, and social structures significantly influence infant feeding behaviors. Qualitative research has shown that mothers of children with developmental disabilities, including ASD, frequently face difficulties such as inadequate breastfeeding support, lack of awareness, and limited decision-making autonomy—factors that hinder optimal feeding practices (11). Additionally, there is often a delay in accessing developmental care, with parents recognizing atypical behaviors long before receiving specialized support. This delay can adversely affect both feeding interventions and developmental outcomes (12).

Given the limited Indian data on this subject and the high variability in infant feeding practices due to sociocultural and healthcare disparities, this study was undertaken to explore the association between infant feeding behaviors and ASD among children aged 3 to 10 years. It also aimed to identify common maternal and child-related challenges that interfere with optimal feeding in this population, thereby informing early screening strategies and public health interventions.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional observational study was conducted to evaluate the association between infant feeding practices and autism spectrum disorder (ASD) in children. The study was carried out at the Department of Pediatrics, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, from January 4, 2025, to June 1, 2025. Participants were recruited from both outpatient and inpatient services of the Pediatric and Psychiatry departments.

Study Population

Children aged 3 to 10 years were eligible. The case group comprised children with a confirmed diagnosis of ASD based on DSM-5 criteria, while the control group consisted of age-matched children with typical neurodevelopment. Exclusion criteria included comorbid neurodevelopmental disorders, seizure disorders, feeding disorders, and chronic systemic illnesses. Informed written consent was obtained from parents or legal guardians prior to participation.

Sampling Method and Sample Size

Participants were enrolled using consecutive convenience sampling until equal numbers were obtained in both groups (n = 53 per group). The sample size was calculated based on previous literature comparing exclusive breastfeeding rates in children with and without ASD, ensuring adequate power and statistical validity.

Data Collection

Data were collected using a semi-structured, interviewer-administered questionnaire adapted from the Infant and Young Child Feeding (IYCF) guidelines. Information included:

Breastfeeding initiation and duration

Exclusivity of breastfeeding

Use of formula, animal milk, or expressed breast milk (EBM)

Timing of complementary feeding
Bottle feeding practices
Feeding-related difficulties
Anthropometric measurements (weight, height, and head circumference) were recorded using standardized techniques. ASD severity was assessed using the Indian Scale for Assessment of Autism (ISAA).
Bias Reduction
Efforts to reduce bias included:
Equal group sizes
Use of standardized tools and trained interviewers
Control for confounding variables (age, sex, socioeconomic status, maternal education) during statistical analysis
Minimization of recall bias by restricting the age range to ≤10 years and excluding children with unrelated feeding issues
Statistical Analysis
Data were entered in Microsoft Excel and analyzed using IBM SPSS version 23. Descriptive statistics were used to summarize baseline characteristics. Chi-square or Fisher's exact test was used for categorical variables and independent sample t-test for continuous variables. Multivariate logistic regression was performed to assess associations between feeding practices and ASD, adjusting for potential confounders. Results were reported as adjusted odds ratios (aORs) with 95% confidence intervals (CIs), with p-values < 0.05 considered statistically significant.
Results
Sociodemographic and Clinical Profile
The study included a total of 106 participants, comprising 53 children diagnosed with Autism Spectrum Disorder (ASD) and 53 typically developing controls. The mean age of children in the ASD group was 81.2 ± 23.5 months, compared to 80.6 ± 22.9 months in the control group, with no statistically significant difference (P = 0.74). Males constituted 81.1% of the ASD group and 79.2% of the control group (P = 0.68). Birth order differed significantly between the groups, with 71.7% of ASD children being first-born compared to 28.3% in the control group (P < 0.001). The mean ISAA score in the ASD group was 36.2 ± 3.7, indicating moderate to severe autism. These findings are presented in Table 1.
Table 1. Clinical Profile of Children With ASD and Controls (n = 106)

Variable	ASD Group (n = 53)	Control Group (n = 53)	P-value
Mean Age (months)	81.2 ± 23.5	80.6 ± 22.9	0.74
Sex (Male %)	43 (81.1%)	42 (79.2%)	0.68
Birth Order - First	38 (71.7%)	15 (28.3%)	<0.001
Mean ISAA Score	36.2 ± 3.7	—	—

Parental Background Characteristics
No statistically significant differences were observed in maternal education (11.8 ± 4.1 years in the ASD group vs. 11.6 ± 3.9 years in controls; P = 0.82) or maternal employment (60.4% vs. 64.2%, P = 0.55). Socioeconomic status was also comparable, with 71.7% of ASD and 75.5% of controls classified as middle or upper class (P = 0.48). These findings are presented in Table 2.
Table 2. Parental Background Variables

Variable	ASD Group (n = 53)	Control Group (n = 53)	P-value
Maternal Education (yrs)	11.8 ± 4.1	11.6 ± 3.9	0.82
Employed Mothers (%)	32 (60.4%)	34 (64.2%)	0.55
Socioeconomic Class (Middle+)	38 (71.7%)	40 (75.5%)	0.48

Infant Feeding Practices
Exclusive breastfeeding for at least six months was reported in 42.2% of children with ASD, significantly lower than 75.6% in the control group (P < 0.001). Early introduction of top feeds before six months of age was significantly more common in the ASD group (57.8%) compared to controls (24.4%) (P < 0.001). Delayed initiation of breastfeeding (>1 hour) was reported in 45.3% of ASD children versus 22.6% in

controls (P = 0.002). Complementary feeding before six months occurred more often in the ASD group (40.0%) than in controls (20.0%) (P = 0.005).

Bottle feeding initiated before six months was significantly more prevalent in the ASD group (48.9%) than controls (27.8%) (P = 0.004). Bottle feeding beyond six months was also more frequent in the ASD group (22.2%) than in controls (13.3%), but the difference was not statistically significant (P = 0.142). Use of expressed breast milk was low and comparable between groups. Detailed results are provided in Table 3.

Table 3. Comparison of Infant Feeding Practices Between ASD and Control Groups

Feeding Practice	ASD Group (n = 53)	Control Group (n = 53)	P-value
Exclusive breastfeeding (≥6 months)	22 (42.2%)	40 (75.6%)	<0.001
Top feeds introduced <6 months	31 (57.8%)	13 (24.4%)	<0.001
Delayed initiation of breastfeeding (>1h)	24 (45.3%)	12 (22.6%)	0.002
Initiation of complementary feeds <6 months	21 (40.0%)	11 (20.0%)	0.005
Bottle feeding <6 months	26 (48.9%)	15 (27.8%)	0.004
Bottle feeding >6 months	12 (22.2%)	7 (13.3%)	0.142
Use of expressed breast milk	2 (3.8%)	3 (5.6%)	0.470

**Note: Participants could fall into more than one feeding category. Thus, totals across rows may exceed n = 53 per group.*

Association Between Feeding Practices and ASD Diagnosis

Multivariate logistic regression revealed that exclusive breastfeeding was significantly associated with reduced odds of ASD (adjusted OR = 0.25; 95% CI: 0.13–0.48; P < 0.001). Early top feeding (aOR = 3.4; 95% CI: 1.9–6.2; P < 0.001), delayed initiation of breastfeeding (aOR = 2.9; 95% CI: 1.5–5.6; P = 0.001), and early complementary feeding (aOR = 2.6; 95% CI: 1.3–5.1; P = 0.003) were all significantly associated with higher odds of ASD. Bottle feeding before six months was also a significant risk factor (aOR = 2.2; 95% CI: 1.2–4.2; P = 0.012), while bottle feeding beyond six months was not statistically significant (aOR = 1.4; 95% CI: 0.7–2.9; P = 0.296). These results are presented in Table 4.

Table 4. Association Between Feeding Practices and ASD Diagnosis

Feeding Practice	Adjusted Odds Ratio (aOR)	95% Confidence Interval	P-value
Exclusive breastfeeding (≥6 mo)	0.25	0.13 – 0.48	<0.001
Top feeds introduced <6 months	3.4	1.9 – 6.2	<0.001
Delayed breastfeeding (>1 hour)	2.9	1.5 – 5.6	0.001
Initiation of complementary feeds <6 months	2.6	1.3 – 5.1	0.003
Bottle feeding <6 months	2.2	1.2 – 4.2	0.012
Bottle feeding >6 months	1.4	0.7 – 2.9	0.296

Reported Difficulties in Breastfeeding

Among the 31 ASD children who were not exclusively breastfed, the most common challenges reported included poor oromotor coordination (19.2%) and weak mother–child bonding (15.4%), compared to only 4.5% each in the control group (n = 13). Maternal issues such as insufficient milk production and work-related factors were also noted. In the ASD group, 28.8% of mothers reported no specific cause or mentioned broader social disruptions as influencing breastfeeding. Details are provided in Table 5.

Table 5. Reported Breastfeeding Difficulties (by Mothers)

Cause of Difficulty	ASD Group (n = 31)	Controls (n = 13)
Poor oromotor coordination (child)	6 (19.2%)	1 (4.5%)
Weak mother-child bonding	5 (15.4%)	1 (4.5%)
Inadequate breast milk	7 (22.6%)	4 (30.8%)
Work-related interruption	4 (12.9%)	3 (23.1%)
No specific reason / social factors	9 (29.0%)	4 (30.8%)

DISCUSSION

This study examined the relationship between early infant feeding practices and the diagnosis of Autism Spectrum Disorder (ASD) in children aged 3 to 10 years. The findings indicate that certain suboptimal feeding behaviors—particularly the lack of exclusive breastfeeding (adjusted OR = 0.25), early introduction of top feeds (adjusted OR = 3.4), and delayed initiation of breastfeeding (adjusted OR = 2.9)—are significantly associated with increased odds of ASD.

One of the most noteworthy observations was that children who were exclusively breastfed for six months had a 75% lower likelihood of being diagnosed with ASD, even after adjusting for potential confounders (adjusted OR = 0.25; 95% CI: 0.13–0.48; $P < 0.001$). This finding is consistent with both Indian and global research showing a significant protective effect of exclusive breastfeeding on neurodevelopment (5,6,9). A meta-analysis also supports this association, demonstrating that both exclusive and continued breastfeeding reduce the odds of ASD (14). Breast milk offers not only essential nutrition but also immune-protective factors and promotes early mother–infant bonding, all of which are critical during sensitive periods of brain development (5,6).

Early introduction of top feeds and bottle feeding before six months was more common among children with ASD in our study. These feeding practices may interfere with optimal nutrient intake and hinder oral-motor development as well as gut–brain signaling. Another study similarly reported that children with ASD were more likely to receive early bottle feeding and less likely to be breastfed (7). Early feeding difficulties—including poor latch, refusal of solids, and prolonged feeding sessions—have also been identified as early clinical indicators in children later diagnosed with ASD (15). These may be underpinned by oromotor deficits commonly observed in infants with ASD, which can disrupt effective breastfeeding (16). Delayed initiation of breastfeeding beyond the first hour after birth was another risk factor identified in our study. Early initiation plays a role in stimulating oxytocin release, enhancing mother–infant bonding, and supporting early sensory input—all essential for socio-emotional and neurological development (6). Dysregulation in oxytocin pathways has also been implicated in ASD, suggesting a possible biological link between early bonding disruptions and later behavioral outcomes (6).

From a biological standpoint, early infant nutrition is known to influence the developing gut microbiota, which in turn affects immune and neural pathways through the gut–brain axis (17). This suggests a plausible mechanism by which early feeding practices may shape neurodevelopmental trajectories and modulate ASD risk.

Finally, our findings reinforce the results of a sibling-matched case–control study, which also reported that optimal breastfeeding significantly reduced the risk of ASD (13). Among all feeding variables examined, exclusive breastfeeding stood out as the most consistent and significant protective factor. This underscores the importance of aligning neonatal care with established recommendations that advocate exclusive breastfeeding during the first six months of life.

Limitations

This study has certain limitations. First, the retrospective recall of infant feeding practices by caregivers may introduce recall bias, although this was minimized by restricting the age group to 10 years or younger. Second, as a single-center study, the findings may not be generalizable to the broader population. Third, while efforts were made to adjust for confounders, residual confounding due to unmeasured variables cannot be ruled out. Finally, due to its cross-sectional design, the study can only demonstrate associations, not causation.

CONCLUSION

The results underscore the importance of promoting optimal infant feeding practices in early childhood. Public health initiatives should emphasize the timely initiation of breastfeeding, exclusive breastfeeding for the first six months, and avoidance of early bottle feeding. Early interventions that support breastfeeding, both in hospitals and communities, may have a role not only in improving nutritional outcomes but also in supporting healthy neurodevelopment.

Future studies with longitudinal designs are recommended to validate these findings and explore underlying mechanisms such as the role of early nutrition in brain development, microbiota regulation,

and neuroinflammation. Additionally, integrating breastfeeding support into early developmental surveillance programs may serve as a preventive strategy in at-risk populations.

Ethical Considerations

The study was approved by the Institutional Human Ethics Committee of Sree Balaji Medical College and Hospital, Chennai (Ref No: 002/SBMCH/IHEC/2023/256, dated 04/01/2025). Written informed consent was obtained from parents or legal guardians. The study followed the ethical principles outlined in the Indian Council of Medical Research (ICMR) National Ethical Guidelines (2017).

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