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Original Article

# Factors Influencing Autism Spectrum Disorders in Children aged 16 to 30 Months in Urban and Rural Areas of Tumkur, India

**Pooja S Naik[1], Jamunashree Bettaiah[2], Sunil Kumar TR[3], Riyaj Ahmad Kalaburgi[4]**

[1] Junior Resident, Department of Paediatrics, Sri Siddhartha Medical College and Research Hospital, Tumkur - 572107, Karnataka, India
[2] Professor, Department of Paediatrics, Sri Siddhartha Medical College and Research Hospital, Sri Siddhartha Academy of Higher Education, Tumkur-572107, Karnataka, India
[3] Assistant Professor, Department of Orthopedics, Sanjay Gandhi Institute of Trauma and Orthopedics, Bangalore-560011, Karnataka, India
[4] Associate Professor, Statistician, Department of Community Medicine, Sri Siddhartha Academy of Higher Education,Tumkur-572107, Karnataka, India

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## Abstract

**Introduction:** The prevalence of autism spectrum disorders (ASD) has been increasing globally, therefore early identification could improve the quality of life. Previous research has demonstrated that genetic and environmental factors affect brain development and have identified several factors that correlate with an increased risk of ASD. Our study aim is to investigate various factors associated with risk of ASD in children aged 16 to 30 months in Tumkur.

**Methods:** A cross-sectional study was conducted among 600 toddlers aged 16-30 months and their caregivers in urban and rural parts of Tumkur. The Modified Checklist for Autism in Toddlers–Revised (M-CHAT-R) questionnaire was used to assess all participants.

**Results:** Out of 600 children screened, six were positive with ASD-like symptoms. The mean age was 22.24±4.11 months (N = 600) 29.17±1.33 months in screen positive toddlers, with a male to female ratio of 5:1. Analyses showed no statistically significant association between risk of autism and breastfeeding, immunization status, parent's education, gestational age, mode of delivery, place of delivery or socioeconomic status ($P > 0.05$).

**Conclusions:** ASD signs can appear early, with diagnoses possible by 12 months. Identifying risk factors can facilitate early detection for at-risk toddlers. This study provides insights into these factors and highlights the need for further research to improve early ASD detection.

## Correspondence

Jamunashree Bettaiah
Department of Paediatrics,
Sri Siddhartha Medical College and Research Hospital,
Sri Siddhartha Academy of Higher Education,
Tumkur-572107,
Karnataka,
India.
Email: drjamuna11@gmail.com

## Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication and interaction, associated with restricted and repetitive patterns of behavior.[1] According to estimates from CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network, about 1 in 36 children has been identified with ASD.[2] The prevalence of ASD is four times more prevalent among boys compared to females.[2] This increasing prevalence highlights the urgent need for a deeper understanding of the factors contributing to ASD.

ASD is usually diagnosed at 18 – 24 months of age, as this is when characteristic symptoms can be distinguished from typical development and from other developmental delays. However, the specific risk factors that contribute to ASD are complex. Contributing factors that might develop ASD include parental age and

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education, genetic predispositions, environmental factors, and maternal use of serotonin-modulating medication during pregnancy.[3] Modified Checklist for Autism in Toddlers–Revised (M-CHAT-R) is a widely used, simple, and cost-effective screening tool that helps parents to assess their child's risk for ASD.

Previous research has demonstrated that shorter breastfeeding duration is associated with increased risk of ASD in children.[4] A meta-analysis study reported that low birth weight, postpartum hemorrhage, male gender, and brain anomaly were associated with a decreased risk of autism.[5] However, till date, there is a dearth of comprehensive studies investigating most of the risk factors for the development of ASD among children in south India. To address this gap, we sought to study various factors associated with risk of ASD in children aged 16 to 30 months in Tumkur, India. Exploring these associations could provide valuable perceptions for developing preventive measures and identifying various intervention strategies to address the raising prevalence of ASD.

## Methods

The present cross-sectional study was conducted in the tertiary care hospital in rural and urban areas of Tumkur, South India, for a period of 18 months (July 2022 to January 2024). All the consecutive children aged 16 to 30 months and their caregivers, visiting OPD of Paediatrics, camps, Anganwadi and Montessories were included. Children diagnosed with neurodegenerative disorder / presence of any neurological deficits or with visual or hearing impairment were excluded from the study. Informed written consent was obtained from the parents / caregivers before the study initiation. Ethical committee clearance was obtained from Sri Siddhratha Medical College, Tumkur (SSMC/MED/IEC-93/July -2022) for the study initiation. The parents or guardians of the children who met the inclusion criteria are asked to fill out the M-CHAT-R questionnaire screening tool, which contains 20 items that rely on the parents' or guardians' observations of their children.[6] Permission to use the M-CHAT-R scale in this study has been granted by its developer. Parents respond to a series of questions. Each "no" response earns 1 point, while for items 2, 5 and 12, the scoring is reversed (meaning that a "yes" earns 1 point instead). The points are then accumulated to obtain a total score. This total score is further classified into the following categories: 0 - 2 (low risk of ASD), 3 - 7 (moderate risk of ASD) and 8 - 20 (high risk of ASD). A complete physical examination, including a neurological evaluation, is conducted for children who screen positive. They are then referred to a Paediatric neurologist for further evaluation and intervention. A list of risk factors for developing ASD were researched and assessed. Prevalence of autism was found to be 0.19%[7], estimating the expected proportion with 0.39% absolute precision and a 95% confidence interval.

Assuming non-response and 10%, the total sample size is 600. Formula for the same is as follows:

$$n = \frac{Z_{(1-\alpha/2)}^{2} * p * (1-p)}{d^2}$$

Where:

$Z(_{1-\alpha/2})^2$ = Standard normal variant from Z table (1.96 and 95%CI)

P = Expected prevalence based on study[7] (0.19%,)

d = allowable error (0.39%)

d = Minimum required sample

n = 527. Rounding off to 600

SPSS software 22.0 was used to analyses the data. Categorical data was represented in the form of frequencies and proportions and analyzed using a Chi-square test. Continuous data was represented as mean and standard deviation and analyzed using either Welch t test or student t test, depending on the homogeneity of variances. $P < 0.05$ was considered statistically significant.

## Results

The research included 600 toddlers, aged 16 - 30 months with a mean age of 22.24 ± 4.11 months. The demographic characteristics of the study population has been demonstrated in Table 1. There were 313 (52.17%) males with male to female ratio of 1.1:1. Out of 600 toddlers, 351 (58.5%) resided in urban areas and 564 (94%) were fully immunized. In regards to education status of the parents, 252 (42%) had either one of the parents educated upto 12Th Standard and 416 (69.33%) belonged to lower middle class (as per modified Kuppuswamy scale).

**Table 1:** Characteristics of the study participants

| Variables | N (%) or Mean±SD |
|---|---|
| Mean age (months) | 22.24 ± 4.11 |
| **Gender** | |
| Male | 313 (52.17%) |
| Female | 287 (47.83%) |
| Area of residence | |
| Urban | 351 (58.5%) |
| Rural | 249 (41.5%) |
| Vaccination status | |
| Fully immunized | 564 (94%) |
| Partially immunized | 36 (6%) |
| **Parent's education (12Th Standard)** | |
| Either one is educated | 252 (42%) |
| Both educated | 224 (37.33%) |
| Both uneducated | 124 (20.67%) |
| **Socioeconomic status (Modified Kuppuswamy scale)** | |
| Lower middle class | 416 (69.33%) |
| Upper middle class | 131 (21.83%) |
| Upper lower class | 53 (8.83%) |
| MCHAT-R score | 0.08 ± 0.82 |

Out of 600 toddlers, six participants reported MCHAT-R score of > 2 and were considered as screen positive. None of factors (area of residence, vaccinates status, parent's education, socioeconomic status, period of gestation, mode of delivery, place of delivery, type of feeding) significantly influenced the risk of ASD (P > 0.05; Table 2).

**Table 2:** Risk factors for children screening positive for autism spectrum disorders on M-CHAT- R

| | Screen Positivity | | P-value |
|---|---|---|---|
| | Yes | No | |
| Mean age (months) | 29.17 ± 1.33 | 22.17 ± 4.07 | < 0.001 m-w |
| **Gender** | | | |
| Male | 5 | 308 | 0.07 Ch |
| Female | 1 | 286 | |
| **Area of residence** | | | |
| Urban | 3 | 246 | 0.874 Ch |
| Rural | 3 | 348 | |
| Vaccination status | | | |
| Fully immunized | 6 | 558 | 0.504 Ch |
| Partially immunized | 0 | 36 | |
| **Parent's education (12Th Standard)** | | | |
| Either one is educated | 1 | 251 | 0.767 Ch |
| Both educated | 4 | 220 | |
| Both uneducated | 1 | 123 | |
| **Socioeconomic status (Modified Kuppuswamy scale)** | | | |
| Lower middle class | 5 | 411 | 0.511 Ch |
| Upper middle class | 1 | 130 | |
| Upper lower class | 0 | 53 | |
| **Period of gestation** | | | |
| 37 - 42 weeks | 5 | 527 | 0.946 Ch |
| < 37 weeks | 1 | 55 | |
| > 42 weeks | 0 | 12 | |
| **Mode of delivery** | | | |
| Cesarean section | 5 | 393 | 0.5Ch |
| Vaginal delivery | 1 | 199 | |
| Forceps delivery | 0 | 2 | |
| **Place of delivery** | | | |
| Private hospital | 3 | 316 | 0.3Ch |
| Government hospital | 3 | 276 | |
| Home | 0 | 2 | |
| **Type of feeding** | | | |
| Direct breastfeeding | 6 | 505 | 0.665 Ch |
| Formula fed | 0 | 44 | |
| Cow's milk | 0 | 45 | |

(M-W- Mann-Whitney U test; Ch: Chi square test)

## Discussion

In the present study, we examined several possible factors associated with the occurrence of ASD among toddlers from rural and urban areas of Tumkur. We found no statistically significant association between the risk of ASD and a range of factors, including mode of delivery, period of gestation, type of feeding, immunization status, parents education status and socioeconomic status. However, the results suggest that the etiology of ASD may be multifaceted and not solely due to the variables studied.

Studies have identified a sex difference in children with ASD, with prevalence estimates typically showing a sex ratio of approximately 4:1, favoring boys over girls.[8] Similarly, in our study, five out of six at risk of ASD were boys, indicating that boys are more likely to develop ASD than girls. It has also been reported that higher maternal education levels and higher socioeconomic status are strongly associated with a decreased likelihood of ASD.[9,10] Consistent with this, five out of six toddlers in this study belonged to lower-middle-class families. However, in contrast, the parents of four out of six toddlers who screened positive for ASD were educated.

Breastfeeding—especially during the critical phase of a child's development—can influence the gut microbiome and thereby play a key role in immune and neural development. Previous studies have also suggested that breastfeeding may have a protective effect against ASD, with children who were suboptimally breastfed during the first six months being more vulnerable to develop ASD than those who were exclusively breast-fed.[11,12] Contrastingly, all of the toddlers who were screen positive for ASD in this study were exclusively breast fed. Similar to our study, previous studies reported that the MMR vaccine was not associated with an increased risk of ASD.[13,14]

Perinatal factors, including gestational age, mode of delivery, and place of delivery, have also been investigated as potential risk factors for ASD.[15] Crump et al reported that the preterm and early-term birth were associated with an increased risk of ASD.[16] Children born preterm (gestational age < 37 weeks) have been reported to have approximately a 30% higher chance of developing ASD compared to those born at term.5 In contrast, our study found that five out of six toddlers with ASD were full-term babies. Curran et al found that children born via caesarean section are 20% more likely to be diagnosed with ASD.[17] Similarly, in our study, five out of six children who were screened ASD positive were born via Caesarean section.

Like other studies, this study has a few potential limitations. Although, it is a single-centric study with a small sample size, it provides preliminary insights into the occurrence of ASD. Since the study is cross-sectional, we were unable to monitor the detailed developmental deficits in the toddlers. Investigating multiple factors rather than focusing on a single factor will provide a more comprehensive understanding of ASD. Although toddlers at high risk of developing ASD were referred to psychiatrist or paediatric neurologist for comprehensive ASD diagnostic evaluation, further management in screen positive toddlers was not elaborated in this study. Hence, further large, multi-centric, longitudinal studies would provide better understanding of ASD. The increase in psychological stress in both parents and their toddlers is likely contributing to the rise in ASD cases. Therefore, routine screening of toddlers and counselling of parents / caregivers is necessary for early identification.

## Conclusions

ASD symptoms may appear at early stages of development, and the diagnosis can be made as early as at 12 months of age. Identifying these risk factors enables the detection of at-risk toddlers immediately after birth, allowing for early intervention. Present study offers valuable insights into risk factors that need to be investigated in future studies for the early detection of ASD in both rural and urban areas. The study also assists the Government and relevant organizations in taking necessary steps to lessen the burden on affected families by providing valuable counseling and support.

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**Conflict of Interest:** None

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