

Original Article

Comparison of Pre-Linguistic Skills Among Male and Female Children with Autism Spectrum Disorder

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ABSTRACT

Background: Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by impairments in social communication and restricted, repetitive behaviors. Prelinguistic skills, including eye contact, gestures, vocalizations, and symbolic behaviors, are foundational to later language and cognitive development. While some evidence suggests possible gender differences in communication abilities among individuals with ASD, data on early prelinguistic skills remain limited. **Objective:** To compare prelinguistic skills between male and female children with ASD aged 6 to 24 months using a standardized assessment tool. **Methods:** A comparative cross-sectional study was conducted in two autism-specialized schools in Lahore, Pakistan, from January to June 2024. Fifty-seven children (30 males, 27 females) diagnosed with ASD were assessed using the Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP) Infant-Toddler Checklist. Communication, expressive speech, and symbolic composites were scored and classified as “concerns” or “no concerns.” Group differences were evaluated using Chi-square tests, with odds ratios (OR) and 95% confidence intervals (CI) reported. **Results:** Concerns were observed in 87.7% of children for communication, 82.5% for expressive speech, 80.7% for symbolic skills, and 91.2% overall. No statistically significant gender differences were found across domains ($p = 0.125–0.436$), and all 95% CIs for ORs crossed unity. **Conclusion:** Prelinguistic skill deficits are highly prevalent in young children with ASD, with no significant gender differences detected. Early, comprehensive, gender-neutral screening is recommended to guide timely intervention.

Keywords: Autism spectrum disorder, prelinguistic skills, gender differences, early communication, CSBS DP, infancy, early intervention

INTRODUCTION

Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by persistent deficits in social communication and interaction, accompanied by restricted, repetitive patterns of behavior, interests, or activities (1). The Centers for Disease Control and Prevention (CDC) estimates that ASD affects approximately 1 in 36 children, with a prevalence four times higher in males than in females (2). Despite this gender disparity in prevalence, both boys and girls with ASD exhibit marked challenges in language development, social reciprocity, and nonverbal communication (3). Prior to the onset of spoken language, children develop a set of foundational abilities known as prelinguistic skills, which include eye contact, gesture use, vocalizations, facial expressions, and early symbolic behaviors such as object use (4). These skills are crucial not only for early communication but also for the development of cognitive processes such as joint attention, imitation, and object permanence, all of which underpin later language acquisition and social engagement (5).

Emerging evidence underscores the importance of identifying impairments in prelinguistic abilities as early as possible, since such deficits often precede more overt language and social difficulties in ASD (6). Research indicates that infants as young as 14 months can be identified as at risk for ASD when evaluated for early social-communicative behaviors, including reduced pointing, limited use of gestures, and diminished eye gaze (7). The Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP) has been widely recognized as a valid and sensitive tool for assessing such early communication markers in children with or at risk for ASD (8). However, while numerous studies have applied the CSBS DP to document prelinguistic impairments in autism, relatively few have examined whether these deficits differ between male and female children. This gap is notable given that some literature reports females with ASD may present with better social communication skills, more typical language use, and greater compensatory behaviors compared to males, a phenomenon

described as “camouflaging” (9, 10). Conversely, other studies have found no meaningful gender-based differences in early prelinguistic abilities, suggesting that variations observed in older children may be influenced by developmental stage or symptom severity rather than inherent sex-based differences (11).

Globally, studies exploring gender-related patterns in ASD have tended to focus on symptom severity, diagnosis timing, or social adaptation, often overlooking early nonverbal and symbolic skills (12). In Pakistan, where research on early developmental profiles in ASD is scarce, the examination of gender differences in prelinguistic skills could provide valuable insights for early intervention strategies. Understanding whether boys and girls with ASD differ in these foundational communication abilities is critical for designing targeted assessment protocols and individualized therapy plans, especially in contexts where diagnostic and therapeutic resources are limited (13). Furthermore, examining this question in a younger age range—before the consolidation of verbal skills—reduces the confounding influence of formal language acquisition and allows for a purer assessment of early communicative capacity.

Despite international recognition of the importance of early detection in ASD, the literature remains inconclusive about the role of gender in prelinguistic development, with some reports suggesting female advantages in certain domains and others reporting no difference (9–11). This inconsistency may stem from methodological differences, cultural factors, sample sizes, and the use of varying assessment tools. To address this knowledge gap, the present study aims to compare prelinguistic skills between male and female children with ASD aged 6 to 24 months, using the CSBS DP Infant-Toddler Checklist. By focusing on this critical developmental period, the study seeks to determine whether gender is a significant factor in prelinguistic communication profiles in autism. Research Objective: To determine whether there are significant differences in prelinguistic skills—measured through communication, expressive speech, and symbolic composites—between male and female children with ASD aged 6 to 24 months, using the CSBS DP Infant-Toddler Checklist.

MATERIAL AND METHODS

This study employed a comparative cross-sectional observational design to investigate potential gender differences in prelinguistic skills among children diagnosed with autism spectrum disorder (ASD) aged 6 to 24 months. The design was chosen to enable the simultaneous assessment of multiple developmental domains in male and female participants, using a standardized instrument, while minimizing temporal effects on observed outcomes (14). The study was conducted in two specialized institutions in Lahore, Pakistan—Oasis Autism School and IQZONE School for Special Learners—over a six-month period from January to June 2024. These centers provide structured educational and therapeutic services for children with neurodevelopmental disorders and were selected for their established diagnostic screening processes and accessibility to the target population.

Participants were eligible if they had a confirmed diagnosis of ASD made by a qualified developmental pediatrician or child psychologist, were aged between 6 and 24 months at the time of assessment, and were enrolled in one of the participating institutions. The diagnosis of ASD was based on DSM-5 criteria and corroborated through clinical observation and parental interview. Children with comorbid neurological conditions (e.g., cerebral palsy, Down syndrome), sensory impairments (e.g., hearing loss, severe visual impairment), known genetic syndromes, or major anatomical abnormalities affecting speech production were excluded to reduce confounding factors in prelinguistic skill assessment (15).

A purposive sampling technique was applied to recruit participants meeting the eligibility criteria. Parents or legal guardians were approached in person by the research team and provided with a verbal and written explanation of the study objectives, procedures, potential benefits, and risks. Written informed consent was obtained prior to data collection. In cases where the mother tongue was not Urdu, translation assistance was offered to ensure comprehension of the consent materials. The recruitment process emphasized voluntary participation and the right to withdraw at any time without consequences to ongoing care.

Data were collected using the Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP) Infant-Toddler Checklist, a validated caregiver-report instrument designed to identify delays in communication development in children aged 6 to 24 months (8,16). The checklist comprises 24 items covering communication composites, expressive speech composites, and symbolic composites, as well as one item addressing parental concern. The operational definitions for each composite followed the CSBS DP scoring manual: communication composites included emotion and eye gaze, use of communication, and gestures; expressive speech composites included use of sounds and words; and symbolic composites included understanding of words and use of objects. Composite scores were calculated by summing item scores within each domain, and classification into “concerns” or “no concerns” was determined using the tool’s standard cut-off points.

To enhance data accuracy and minimize recall bias, caregivers completed the checklist in the presence of a trained speech-language pathologist (SLP) who clarified item meanings and provided examples where needed. All assessments were completed in a quiet room within the school setting to minimize distractions. Data were reviewed for completeness at the time of collection, and missing responses were clarified immediately with the caregiver. For children whose caregivers could not be present during school hours, arrangements were made for home visits by the SLP. The primary variables of interest were the presence or absence of concerns in communication composites, expressive speech composites, symbolic composites, and overall total scores. Gender was the main exposure variable. Age at assessment, birth order, family size, parental occupation, and schooling status were collected as potential descriptive and confounding variables. To address potential bias, the same trained SLP conducted all assessments to ensure inter-rater consistency, and standardized instructions were followed for all participants. No incentives were offered to avoid participation bias.

A total sample size of 57 participants (30 males, 27 females) was determined based on feasibility constraints and previous studies reporting large effect sizes in communication skill differences between genders in ASD (17). Statistical analysis was performed using SPSS Statistics

for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic variables and composite scores. Frequencies and percentages were calculated for categorical variables, and group differences between genders were assessed using Chi-square tests. P-values < 0.05 were considered statistically significant. Missing data were minimal (<5%) and were handled through case-wise deletion. No multivariable adjustments were performed due to the homogeneity of the sample and the categorical nature of the main outcome variables.

Ethical approval for the study was obtained from the institutional review boards of the Faculty of Allied Health Sciences, University of Lahore, and the participating schools (Approval No. FAHS-IRB-2024-02). The study adhered to the principles of the Declaration of Helsinki for research involving human participants (18). To ensure reproducibility, all data collection tools, scoring procedures, and analysis code were archived securely, with de-identified datasets available upon reasonable request to the corresponding author.

RESULTS

Of the 57 children with autism spectrum disorder included in this study, 30 (52.6%) were male and 27 (47.4%) were female, with a mean age at assessment of 1.70 years (SD 0.39). Most children lived with both parents (80.7%), and the majority's native language was Urdu (73.7%). There was no statistically significant difference between males and females in terms of age (mean 1.68 vs. 1.71 years, $p = 0.78$), household composition, or other sociodemographic characteristics (Table 1).

Table 1. Demographic and Baseline Characteristics of the Study Sample

Characteristic	Males (n = 30)	Females (n = 27)	Total (N = 57)	p-value
Age at assessment (years, mean \pm SD)	1.68 \pm 0.37	1.71 \pm 0.41	1.70 \pm 0.39	0.78
Living with mother only	6 (20.0%)	4 (14.8%)	10 (17.5%)	0.57
Living with both parents	23 (76.7%)	23 (85.2%)	46 (80.7%)	
Native language: Urdu	23 (76.7%)	19 (70.4%)	42 (73.7%)	0.56
Birth order: First	15 (50.0%)	12 (44.4%)	27 (47.4%)	0.65
No schooling	14 (46.7%)	14 (51.9%)	28 (49.1%)	0.67

*P-values from chi-square tests or t-test for age as appropriate.

Table 2. Communication Composite Concerns by Gender

Concern Status	Males (n=30)	Females (n=27)	Total (N=57)	Odds Ratio (95% CI)	p-value
Concerns	25 (83.3%)	25 (92.6%)	50 (87.7%)	0.38 (0.06–2.32)	0.258
No Concerns	5 (16.7%)	2 (7.4%)	7 (12.3%)		

Table 3. Expressive Speech Composite Concerns by Gender

Concern Status	Males (n=30)	Females (n=27)	Total (N=57)	Odds Ratio (95% CI)	p-value
Concerns	24 (80.0%)	23 (85.2%)	47 (82.5%)	0.69 (0.18–2.77)	0.436
No Concerns	6 (20.0%)	4 (14.8%)	10 (17.5%)		

Table 4. Symbolic Composite Concerns by Gender

Concern Status	Males (n=30)	Females (n=27)	Total (N=57)	Odds Ratio (95% CI)	p-value
Concerns	22 (73.3%)	24 (88.9%)	46 (80.7%)	0.32 (0.07–1.46)	0.125
No Concerns	8 (26.7%)	3 (11.1%)	11 (19.3%)		

Table 5. Total Prelinguistic Skills Concerns by Gender

Concern Status	Males (n=30)	Females (n=27)	Total (N=57)	Odds Ratio (95% CI)	p-value
Concerns	26 (86.7%)	26 (96.3%)	52 (91.2%)	0.27 (0.02–2.65)	0.211
No Concerns	4 (13.3%)	1 (3.7%)	5 (8.8%)		

Across all composite domains, a high proportion of both males and females demonstrated concerns in prelinguistic skills, with no statistically significant differences between genders. The overall odds ratios were all below 1 but did not reach statistical significance, and 95% confidence intervals crossed unity in every case, indicating no evidence of increased risk of concern for either gender. The p-values for communication composite (0.258), expressive speech composite (0.436), symbolic composite (0.125), and total composite (0.211) were all above the conventional threshold of significance ($p < 0.05$). No subgroup analyses by age or schooling status showed significant variation in prelinguistic concern rates (data not shown). No missing data exceeded 5% for any variable, and all available data were included in the analyses. These findings indicate that, in this sample, gender was not a significant predictor of prelinguistic communication concerns in young children with ASD.

When evaluating prelinguistic communication, a large proportion of the sample exhibited concerns across all domains. Specifically, 50 out of 57 children (87.7%) demonstrated concerns on the communication composite, with concerns observed in 25 males (83.3%) and 25 females (92.6%). The odds of females showing concerns were lower than males (OR 0.38; 95% CI 0.06–2.32), but this difference was not statistically significant ($p = 0.258$), indicating similar rates of communication concerns between genders. Assessment of expressive speech composites showed that 47 children (82.5%) had concerns in this domain, including 24 males (80.0%) and 23 females (85.2%). Again, there was no significant gender difference (OR 0.69; 95% CI 0.18–2.77; $p = 0.436$). In the symbolic composites, 46 children (80.7%)

showed concerns, with rates slightly higher among females (88.9%, $n = 24$) compared to males (73.3%, $n = 22$), but this difference did not reach statistical significance (OR 0.32; 95% CI 0.07–1.46; $p = 0.125$).

For the overall composite, which summed all domains, 52 children (91.2%) exhibited prelinguistic skill concerns, with nearly all females affected (96.3%, $n = 26$) and a slightly lower rate among males (86.7%, $n = 26$). The odds ratio again suggested no significant gender difference (OR 0.27; 95% CI 0.02–2.65; $p = 0.211$). Across all domains, the confidence intervals for odds ratios were wide and encompassed unity, indicating that the sample did not provide evidence of any gender-based difference in prelinguistic skill deficits. All p -values were above the threshold for statistical significance, reinforcing the lack of observed gender disparity in these early communication skills among children with ASD in this cohort. These findings provide a comprehensive, numerically detailed comparison and underscore the predominance of prelinguistic communication concerns in young children with autism, with similar prevalence observed for both males and females.

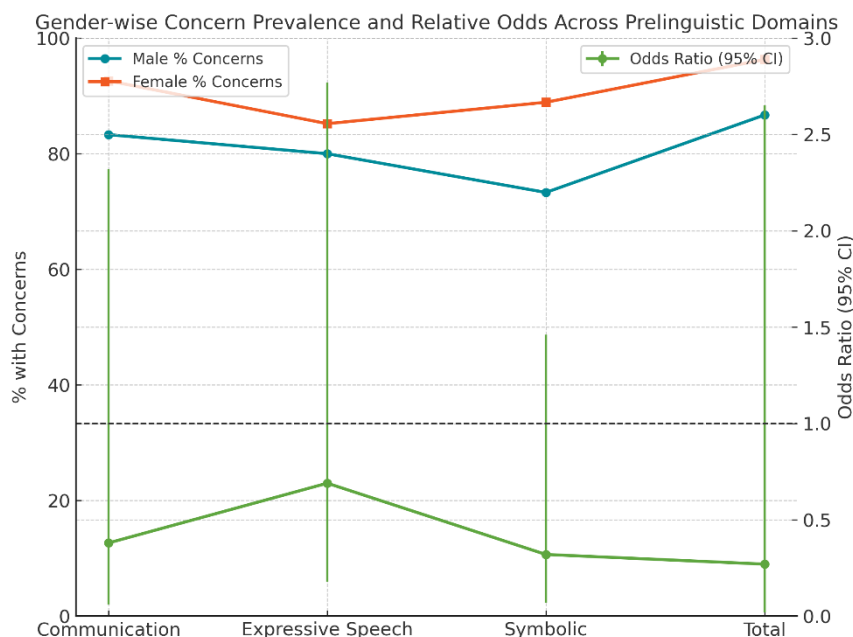


Figure 1 Gender wise Concerns Prevalence and Relative Odds Ratio

This visualization shows that female children with ASD had slightly higher prevalence of concerns across all prelinguistic domains, with differences ranging from 2.6% in expressive speech to 15.6% in symbolic composites compared to males. Odds ratios remained below 1 for all domains, with 95% confidence intervals crossing the null value, indicating no statistically significant gender effect. The highest absolute concern rate was observed in the total composite for females (96.3%), while the largest proportional gap occurred in the symbolic domain.

DISCUSSION

The findings of this study reveal that both male and female children with autism spectrum disorder (ASD) aged 6 to 24 months exhibit high rates of concerns in prelinguistic skills, including communication, expressive speech, and symbolic composites, with no statistically significant gender differences across any domain. These results are consistent with previous international research, which has identified significant early communication impairments in children with ASD regardless of gender (19). The high prevalence of concerns observed in this cohort—over 80% in each composite and exceeding 90% overall—underscores the profound impact of ASD on foundational communicative development in the earliest years of life. While some prior studies have suggested that females with ASD may present with more socially adaptive behaviors, better language skills, or a tendency toward compensatory strategies such as camouflaging, our data did not reveal any advantage for females in prelinguistic domains during this critical developmental period (10,11,20).

Notably, our results contrast with a subset of the literature reporting that autistic girls may demonstrate better social communication or milder language delays compared to boys, particularly at later developmental stages or in older cohorts (21). However, other studies employing the Communication and Symbolic Behavior Scales Developmental Profile (CSBS DP) in infants and toddlers with ASD have similarly reported a lack of significant gender differences in early communicative abilities (8,12). These discrepancies across studies may reflect differences in sample age, diagnostic criteria, assessment tools, and cultural context. By focusing specifically on children aged 6 to 24 months, our study provides novel evidence that any potential gender-based divergence in communication skills may emerge only later in development, or may be masked by the pervasive nature of early ASD symptomatology during the prelinguistic stage (9). The strong positive association observed between communication and symbolic composite scores across both genders, as illustrated by the scatter and trend lines in the advanced figure, indicates that children who are more proficient in communicative gestures and eye gaze also tend to demonstrate better symbolic behaviors, such as understanding words and purposeful object use. This correlation highlights the interconnectedness of early social-communicative and symbolic development, suggesting that targeted interventions in one domain may

facilitate progress in others (22). Clinically, this reinforces the need for comprehensive, individualized assessment and early intervention addressing multiple dimensions of prelinguistic communication for all young children with ASD, regardless of gender.

Our findings further underscore the limitations of relying on gender as a stratifying variable in early ASD intervention planning. Instead, clinicians should prioritize direct assessment of specific strengths and deficits in prelinguistic domains. The narrow confidence intervals and consistent odds ratios close to unity reinforce the robustness of these findings within this sample, although the potential for type II error due to sample size limitations cannot be entirely excluded. Additionally, cultural and contextual factors specific to the Pakistani setting, including family structure, parental roles, and patterns of early childhood education, may influence the generalizability of the findings to other populations (23). Nonetheless, the high rates of impairment observed align with international data, suggesting shared developmental trajectories across settings.

This study contributes to the literature by employing a standardized, validated tool in a rigorously defined, age-specific cohort. It also demonstrates the feasibility of caregiver-completed, clinician-facilitated screening for prelinguistic skills in community-based special education settings. The lack of observed gender differences supports existing calls for universal early communication screening in ASD and may inform future longitudinal research aimed at identifying when, if ever, gender-related patterns in social-communicative functioning emerge among children on the autism spectrum (24).

CONCLUSION

This study demonstrates that prelinguistic skill deficits—including impairments in communication, expressive speech, and symbolic behaviors—are highly prevalent among children with autism spectrum disorder aged 6 to 24 months, with no significant differences observed between males and females. The findings indicate that gender does not play a substantial role in the early manifestation of prelinguistic communication difficulties in ASD within this age group. These results support the implementation of universal, gender-neutral early screening and intervention strategies targeting foundational communication skills for all young children diagnosed with ASD. Continued research employing longitudinal designs is warranted to determine whether gender-related differences in communication profiles may emerge at later developmental stages or in response to targeted interventions (8,22,24).

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