

# CLINICAL MANIFESTATION OF AUTISM AMONG GIRLS AND BOYS OF PAKISTANI POPULATION

Madiha Khalid<sup>1</sup>, Hashim Raza<sup>2</sup>and Ghazala Kaukab Raja<sup>1\*</sup>

## ABSTRACT

Autism Spectrum Disorder (ASD) is diagnosed in males approximately four times as often as females. So ASD had been discussed according to its manifestation in males leading to females under diagnosed or poorly studied. Recently, many studies focused upon what ASD look like in females. Considering core behavioral impaired features of ASD in males and females separately, variable findings were published by several scientific groups some showing no difference while other on the same time showing significantly different behavioral pattern among sexes. This has provoked more interest in recent years to study potentially under-diagnosis of females. Thus the aim of the present study was to investigate the verbal and non-verbal communication including social interactions, restricted and repetitive behavior patterns and sensory symptoms in a cohort of ASD girls in comparison to boys to investigate linking of ASD behaviors impairments with gender

**Key Words;** ASD, Autism, Autism among sexes

- 
1. Department of Biochemistry, PMAS Arid Agriculture University Rawalpindi, Pakistan.

Pakistan Institute of Medical Sciences Islamabad, Pakistan.

**\*Corresponding Author:** Ghazala Kaukab Raja [Ghazala@uair.edu.pk](mailto:Ghazala@uair.edu.pk)

## INTRODUCTION

Autism spectrum disorder (ASD) is characterized by aberrant social, communication, restricted and repetitive behaviors. Clinical and subclinical manifestations of ASD begin during the first years of life or later in the second year <sup>1</sup>. In first year, onset could be accompanied by delayed speech development which is most common initial symptom recognized by parents <sup>2</sup>. This so-called “early onset” pattern is thought to occur in the majority of individuals with ASD while in the second pattern of onset which is referred to as regressive autism, children show apparently

normal pattern of behavior development for the first one year but later in second year of life, their previously acquired skills are lost along with onset of autistic symptoms<sup>3</sup>.

As far as deficiencies in behaviors are concerned, almost one-third to one-half of ASD child are failed to develop enough natural speech to meet their daily communication needs<sup>4</sup>. Moreover, under the domain of lack of social interactions, the major problems faced by ASD child are lack of joint attention and poor understanding<sup>5,6</sup>. Restricted and repetitive behaviors (RRBs) and fixative interests form another class of abnormal behavior among ASD children which are characterized by high frequency, repetition in an invariant manner, and desire for sameness in the environment<sup>3</sup>. Although some of stereotyped behaviors such as hand flapping, rocking, and banging objects are normal part of infant development but in ASD, RRBs are considered as core feature and required for its diagnosis according to Diagnostic and Statistical Manual for Mental Disorders (DSM)<sup>7,8</sup>. Sensory behaviors were not formally included in the domain of the repetitive behavior diagnostic criteria but later on unusual sensory interests or behaviors were assessed and strong links were found between sensory behaviors and repetitive motor behaviors<sup>9</sup>.

Prevalence of ASD is reported as 4:1 ratio with every 4 affected males there is one affected female<sup>10,11</sup>. It is a perfect example of sexually dimorphic disease which is well documented in the previous literature with the exact causes still poorly understood. Many autoimmune disorders i.e systemic lupus erythematosus and multiple sclerosis predominantly were previously reported as female biased, however some of the neurodevelopmental disorders, such as language impairment and attention deficit hyperactivity disorder (ADHD) including ASD are males biased<sup>12,13</sup>.

Several clinical and epidemiological studies suggesting higher frequency of ASD in boys than in girls explained two main approaches. The first one suggests that this difference could be due to the differences in biological structure of male and female brain as amygdala is larger in boys as compared to girls and also there are more neurons in cerebral cortex of male, while other hypothesis was postulated by Baron-Cohen who introduces the idea of “extreme male brain”, which emphasized the cognitive and affective difference between male and female<sup>14</sup>. However this approach tried to explain why males are more prone to ASD than female but specific differences in manifestation of ASD between sexes and more possible and frequent *diagnostic detection* in males could not be answered. Actually, it is thought that difference in male-to-female ratio arises because most of the females remain under diagnosed due to their “non-male-typical”

presentation<sup>15</sup>. Reason behind under diagnosed females could be explained as most of the girls are unable to meet typical ASD diagnostic criteria designed for high levels of autistic-like traits<sup>16</sup>.

After diagnosis, number of studies focus on presentation of ASD among sexes and tried to explore difference in ASD phenotypes in males and females. Some meta-analysis have tried to clarify the similarities and differences in behavioral pattern of males and females with ASD<sup>17</sup>. Variable findings have been reported in this regard, some suggesting less repetitive, restrictive behaviors in females while other reported females with developmental language delay and greater communication skills deficiencies than boys<sup>18-20</sup>. On the other hand, some studies reported no differences in ASD core dysfunctions among sexes<sup>21-23</sup>. However, findings from different studies are complex and do not always relate to each other in a straightforward manner as strong evidence of a sex difference in prevalence are here but still there is very little information about sex differences in developmental characteristics and behavioral features<sup>24</sup>. So examination of both functional impairment and clinical manifestations among male vs. female patients with ASD may be one of important steps towards understanding of biological mechanisms underlying the ASD<sup>28</sup>. Furthermore among behavior disorders it is very difficult to define problem exactly since they may be depend on the perception or sensitivity of an individual who are at the receiving end of these behaviors<sup>29</sup>. Previously, many studies found no overall sex differences in ASD severity when only several standard assessment tools were considered .However, remarkable differences came forward when each core symptom area of ASD was considered separately<sup>30-32</sup>.

In Pakistan, unfortunately, child mental health area is largely neglected and ASD is still under diagnosed. With only few notable exceptions, health-care professionals in Pakistan, are unaware and are not trained for diagnosis or early screening and intervention of ASD. Absence of proper diagnostic procedures and protocols for diagnosis and treatment lead to the diagnosis of ASD in multiple settings by multiple professionals with a very little or no formal training and knowledge of child developmental and psychiatric disorders. Furthermore, parent also take their child to different health-care professionals and get different diagnosis as every professional handle the case according to his own specialty. As a result, ASD child may get diagnosis of ADHD, language disorder, learning disability or obsessive-compulsive disorder. So keeping in mind the above mentioned facts, present study was designed to properly diagnose ASD patients on specific diagnostic criteria and to assess the difference of clinical symptoms and adaptive behaviors among girls as compared to boys of Pakistani population for the first time as sex differences in symptom

presentation may contribute to differential identification of ASD across sexes. This study will prove as an initial step towards awareness of ASD and specific autistic features which are more prevalent among Pakistani autistic children according to different social setup of Pakistani community.

## **METHODS**

In the present study we recruited 93 autistic patients (25 females and 66 males). All of them were of Pakistani origin. The consensus diagnosis was made by experienced psychiatrists by using a combination of the Autism Diagnosis Observation Schedule (ADOS) and Diagnostic and Statistical Manual of Mental Disorders 5<sup>th</sup> edition (DSM-5) as the assessment instruments. Complete information covering all necessary areas of behavior impairments of ASD was obtained from parents of ASD child. Ethical approval for this research was obtained from the Ethics committee of our Institution and Hospital. Informed consents were obtained from parents of all patients. Multinomial logistic regression was calculated for all aspects of behaviors by SPSS v20. Any value which was  $\leq 0.05$  was considered as significant.

## **RESULTS**

In the present study, we compared distribution of clinical variables covering all necessary areas of communication, social interaction, sensory behaviors and restricted and repetitive behaviors of ASD among girls in comparison to the boys of Pakistani population. Our results indicated that different behavior patterns which are hallmark of ASD are distributed differently among autistic girls as compared to boys.

### **Deficit in Verbal, Non-verbal, Social Communication and Social Interactions**

Among the category of verbal and nonverbal communication and social interactions, “Back and forth conversation” was found to be less impaired in girls as compared to boys as we found OR of 0.75 in girls (Figure 1, Table 1). Impairment in sharing of enjoyments and joint referencing was found to be associated with girls with odds of 1.15 (p 0.86) and 1.79 (p 0.39) respectively. Girls showed less impairment in terms of reduced understanding with odds of 0.75 and p-value of 0.81 however they are unable to follow even simple instructions as OR was 1.8 with p-value of 0.20. Further, in terms of aggressive behavior girls are less aggressive as compared to boys with odds of 0.35 and significant p-value of 0.05. Moreover, among reduced sharing of emotions and

affects the clinical variable “no reciprocal smile” was found to be significantly associated with girls with OR of 3.32 and p-value of 0.01 while the absence of any response when name is called is associated with girls with odds of 2.26 with p-value of 0.09. Similarly, absence of any interest in peers is associated with girls with odds of 1.14 with p-value of 0.90. As far as behavior patterns under the umbrella of lack of initiation of social interaction were concerned, impairments in social use of eye contact and impairment in the use and understanding of gestures (e.g. pointing, waving, nodding/shaking head) were found to be associated with girls with odds of 1.03 ( $p$  0.93) and 0.67 ( $p$  0.43) respectively (Figure 1, Table 1).

### **Stereotyped or Repetitive Behaviors**

Among stereotypic and repetitive behaviors, echolalia was found in girls with odds of 0.59 and p-value of 0.31. Producing unusual noise and liking of circularly moving things was associated with girls with odds of 0.95 ( $p$  0.93) and 0.49 ( $p$  0.15) respectively. However rocking and swaying was found with odds of 1.28 and p-value of 0.68. Further looking closely from corner of eye and liking of moving objects was associated with girls with odds of 0.37 and 0.75 respectively. p-values were 0.04 and 0.54 respectively. Adherence to routines/rituals was also found in girls with odds of 0.43 with p-value of 0.30 while presence of idiosyncratic language was found with odds of 1.5 and statistically non-significant p-value of 0.45 (Table 1, Figure 2).

### **Sensory Symptoms**

For the sensory symptoms of ASD, covering of ears in noise was associated with girls with odds of 0.65 and p-value of 0.37 while behavior of smelling everything was found with odds of 0.30 and significant p-value of 0.03 (Table 1). Similarly bothering of tags of clothes and licking behavior was associated with odds of 0.32 and 0.93 with p-values of 0.15 and 0.89 respectively (Table 1, Figure 3).

## **DISCUSSION**

Being male is considered as one of the most influential and well-established risk factors in the case of ASD. Most of the studies estimated the sex ratio of 3–4 males per female across the diagnostic spectrum<sup>33</sup>. Predominant features and phenotype of ASD were more frequently studied and even diagnostic criteria and instruments for ASD were preferentially designed on the basis of what ASD looks like in a male. In a result, ASD manifestation in females generally do not meet diagnostic

criteria leading to a smaller number of females being diagnosed and an apparent male bias in prevalence and enormous phenotypic data is from males with ASD. Nevertheless, many studies suggest that females may also show different cognitive, behavioral, neuroanatomical, or molecular expression patterns but unfortunately, studies of sex differences in the ASD phenotype have often included modest female sample sizes, focused exclusively on adults and focused on a limited number of domains (e.g., symptoms or cognition)<sup>21</sup>. Thus, no previous studies have been able to comprehensively evaluate the major differences in core symptoms or overall cognitive ability between boys and girls. So overall, there is increasing awareness of the need to better understand females with ASD and how their neurobiology, symptoms, and clinical detection may differ from those of males<sup>34,35</sup>.

In the present study, we compared behavior patterns which are commonly studied and are important for diagnosis of ASD according to DSM-V between autistic girls in comparison to autistic boys of Pakistani origin. We observed different behavior patterns are differently distributed among both groups. Some behaviors are more common in girls while some of the behaviors are more frequently distributed among boys. In terms of verbal communication previous studies indicated worst verbal and language abilities in females as compared to males<sup>31,36</sup>. However, in the present study, odds ratio of 0.75 for absence of back and forth conversation of girls is indicative of the fact that boys are having more conversation problem than girls. On the other hand, parameters like reduced sharing of enjoyments, absence of joint referencing, and inability to follow instructions are more common in girls and there is trend of association of these behaviors with girls with more odds although this difference is not statistically significant. Further, other parameter like understanding, reading of gestures (e.g. pointing, waving, nodding/shaking head) and impairments in social use of eye contact were less likely to be impaired in girls than boys. Moreover aggressive behavior was also found to be less common among girls as odds were very low i.e. 0.35 with significantly p-value of 0.05 indicative of the fact that this behavior is significantly associated with boys. Furthermore, impairments in reciprocating social smile and social use of eye contact and being nonresponsive towards own name was found in girls with more odds than boys however p-values were statistically non-significant. Previously some studies suggested more impaired social communication and interactions in girls as compared to boys while other showing more sever socio-communication problems among males<sup>193734</sup>. However, our study

showed no clear difference between both groups as some of the variables were more severely impaired among girls while some impairments were more common in boys. Although difference were statistically non-significant but it could also be observed from our results that may be girls are showing more impaired behaviors in terms of social/emotional behaviors up to certain extent.

Restricted and repetitive behaviors represent another important set of parameters for ASD diagnosis had been treated as by-product of social and communication aspects of ASD for the long time despite of the fact that they serves as a core diagnostic feature and can be teased apart from social and communicative ability of ASD individual. They have received far less attention than other domains <sup>38</sup>. We found clear difference among both groups in terms of stereotyped or repetitive behaviors, in which girls showed less stereotyped or repetitive behaviors as compared to boys. These results are consistent with previous findings by several other groups who confirmed this behavior more common in males <sup>34,39</sup>. Antezana L. et al., (2019) were first to report that girls with ASD may have increased compulsive, sameness and restricted RRBI compared to boys but we found reverse of it <sup>40</sup>. Our findings indicated out of 8 parameters studied under RRBs, only rocking and swaying and idiosyncratic language was found in girls with more odds than boys. All other behaviors like echolalia, producing unusual noise, liking moving objects and specifically circularly moving objects were less common among girls. Moreover, it was found that girls follow routines and rituals less likely as compared to boys. Similarly looking the things very closely from eye corner was also less common among girls indicating that stereotypic behaviors are more common among boys than girls.

It is well known fact that ASD children have more tactile and taste/smell sensitivities and difficulties <sup>41</sup>. They have been found to be involved in unusual sensory processing and abnormalities. Almost 94.4 percent of the ASD individuals were reported with extreme levels of sensory processing on at least one sensory quadrant <sup>42</sup>. However there is heterogeneous presentation of these symptoms in terms of presence/frequency of sensory symptoms <sup>43</sup>. Our findings indicated that sensory symptoms are less common among ASD girls than boys which are consistent with previously reported findings of more sensory behaviors among males <sup>44</sup>. Although statistically significant difference was not observed however less odds of sensory behaviors among girls suggested that these symptoms are not frequently observed among girls.

Overall our findings suggests that ASD girls showed less severely impaired externalized behavior such as aggressive behavior and increased repetitive/restricted behaviors and interests

while in terms of internalized behaviors such as social/emotional behavior, more trend of impairments was observed among ASD girls. Since ASD is a complex disorder and most of the health professionals are unaware of its diagnosis in Pakistan so we did a preliminary study and took an initiative step towards its understanding among health professionals as well as common people. Additional work is required to unpack the possibility and consequences of missed diagnoses in females. As more males are diagnosed with ASD than females, so one caveat of this study could be a small girl sample size which may be the reason of statistically non-significant p-values for most of the behaviors even after odds were greater than 1. So, more studies with improved sample size should be done to strengthen the results from Pakistani population.

### **Acknowledgements**

We thank the PIMS hospital Islamabad and all the families for their cooperation in sample collection, and the Kaukab Raja lab for assistance.

### **Conflict of Interest Statement**

All authors report no conflicts of interest.

## **REFERENCES**

1. Palomo R, Belinchon M, Ozonoff S (2006).. Autism and Family Home Movies: A Comprehensive Review. *J Dev Behav Pediatr.* 27:59-68.
2. De Giacomo A, Fombonne E. (1998). Parental recognition of developmental abnormalities in autism. *Eur Child Adolesc Psychiatry.* 7:131-6.
3. Kanner L. Autistic disturbances of affective contact. *Nerv Child.* 1943; 2:217–250.
4. Noens I, Van Berckelaer-Onnes I, Verpoorten R, et al. (2006).The ComFor: An instrument for the indication of augmentative communication in people with autism and intellectual disability. *J Intellect Disabil Res.* 50: 621-32.

5. Hobson RP, Meyer JA. (2005) Foundations for self and other: A study in autism. *Dev Sci.* 8:481-91.
6. Llaneza DC, DeLuke SV., Batista M, et al (2010). Communication, interventions, and scientific advances in autism: A commentary. *Physiol Behav.*100: 268-276.
7. American Psychological Association (APA). *DSM IV*; 1994.
8. Arnott B, McConachie H, Meins E, et al (2010). The frequency of restricted and repetitive behaviors in a community sample of 15-month-old infants. *J Dev Behav Pediatr.* 31: 223-9.
9. Watt N, Wetherby AM, Barber A, et al (2008). Repetitive and stereotyped behaviors in children with autism spectrum disorders in the second year of life. *J Autism Dev Disord.* 38:1518-3.
10. Bertrand J, Mars A, Boyle C, et al 2001). Prevalence of autism in a United States population: the Brick Township, New Jersey, investigation. *Pediatrics.* 108:1155-61.
11. Baird G, Simonoff E, Pickles A, et al (2006). Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP). *Lancet.* 368:210-215.
12. Szatmari P, Offord DR, Boyle MH (1989). Ontario Child Health Study: Prevalence of Attention Deficit Disorder with Hyperactivity. *J Child Psychol Psychiatry.* 30:219-30.
13. Viding E, Spinath FM, Price TS, et al (2004). Genetic and environmental influence on language impairment in 4-year-old same-sex and opposite-sex twins. *J Child Psychol Psychiatry Allied Discip.*45:315-25.

14. Baron-Cohen S, Knickmeyer RC, Belmonte MK (2005). Sex differences in the brain: Implications for explaining autism. *Science*. 310:819-23.
15. Lai MC, Lombardo M V., Pasco G, et al (2011). A behavioral comparison of male and female adults with high functioning autism spectrum conditions. *PLoS One*. 6:e20835.
16. Dworzynski K, Ronald A, Bolton P, et al (2012). How different are girls and boys above and below the diagnostic threshold for autism spectrum disorders. *J Am Acad Child Adolesc Psychiatry*. 51:788-97.
17. Van Wijngaarden-Cremers PJM, Van Eeten E, Groen WB, et al (2014). Gender and age differences in the core triad of impairments in autism spectrum disorders: A systematic review and meta-analysis. *J Autism Dev Disord*. 44:627-35.
18. Mandy W, Chilvers R, Chowdhury U, et al (2012). Sex differences in autism spectrum disorder: Evidence from a large sample of children and adolescents. *J Autism Dev Disord*. 42:1304-13.
19. Frazier TW, Georgiades S, Bishop SL, et al (2014). Behavioral and cognitive characteristics of females and males with autism in the simons simplex collection. *J Am Acad Child Adolesc Psychiatry*. 53:329-40.
20. Hartley SL, Sikora DM (2009). Sex differences in Autism spectrum disorder: An examination of developmental functioning, Autistic symptoms, and coexisting behavior problems in toddlers. *J Autism Dev Disord*. 39: 1715-22.
21. Lai MC, Lombardo M V., Suckling J, et al (2013). Biological sex affects the neurobiology of autism. *Brain*. 136: 2799–2815.

22. Holtmann M, Bölte S, Poustka F (2007). Autism spectrum disorders: Sex differences in autistic behaviour domains and coexisting psychopathology. *Dev Med Child Neurol.* 49:361-6.
23. McLennan JD, Lord C, Schopler E. (1993). Sex differences in higher functioning people with autism. *J Autism Dev Disord.* 23: 217-27.
24. Giarelli E, Wiggins LD, Rice CE, et al (2010). Sex differences in the evaluation and diagnosis of autism spectrum disorders among children. *Disabil Health J.* 3:107-16.
25. Turk V. ( 2003). *Mental Retardation: Definition, Classification, and Systems of Supports*, 10th edn. *J Intellect Disabil Res.* 53, 327-329.
26. Ventola P, Saulnier CA, Steinberg E, et al (2014). Early-emerging social adaptive skills in toddlers with autism spectrum disorders: An item analysis. *J Autism Dev Disord.* 44:283-93.
27. Knapp M, Romeo R, Beecham J ( 2009). Economic cost of autism in the UK. *Autism.* 13:317-36.
28. Rinehart NJ, Cornish KM, Tonge BJ (2011). Gender differences in neurodevelopmental disorders: Autism and Fragile X syndrome. *Curr Top Behav Neurosci.* 8:209-29.
29. Smith S, Branford D, Collacott RA, et al (1996). Prevalence and cluster typology of maladaptive behaviours in a geographically defined population of adults with learning disabilities. *Br J Psychiatry.* 169:219-27.
30. Lai DC, Tseng YC, Hou YM, et al ( 2012) . Gender and geographic differences in the prevalence of intellectual disability in children: Analysis of data from the national

disability registry of Taiwan. *Res Dev Disabil.* 33:2301-7.

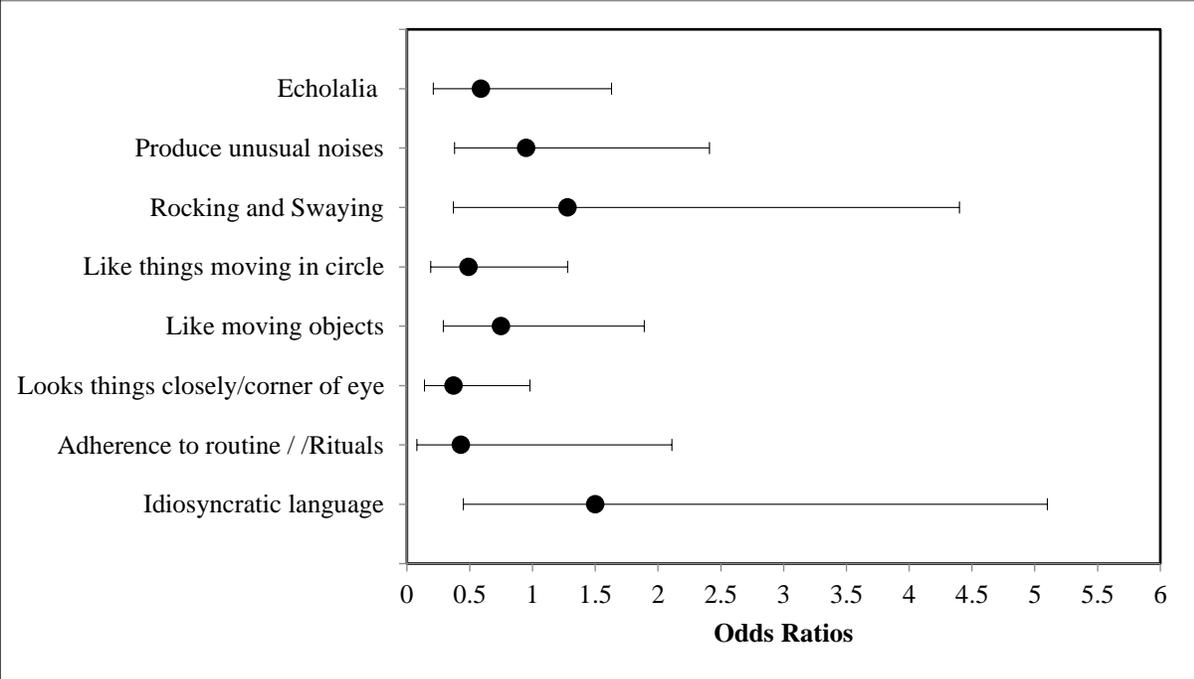
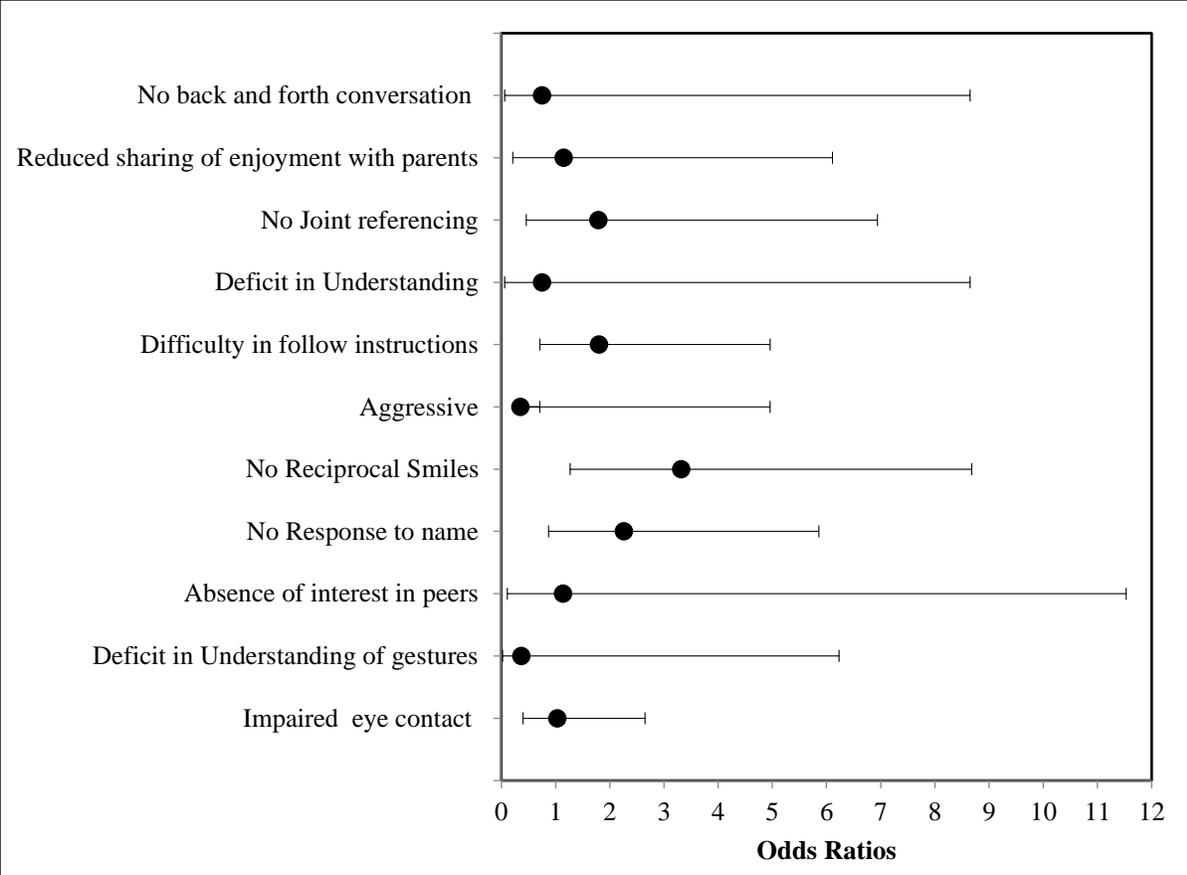
31. Carter AS, Black DO, Tewani S, et al (2007). Sex differences in toddlers with autism spectrum disorders. *J Autism Dev Disord.* 37:86-97.
32. Mayes SD, Calhoun SL.(2011). Impact of IQ, age, SES, gender, and race on autistic symptoms. *Res Autism Spectr Disord.* 5: 749-757.
33. Blumberg SJ, Bramlett MD, Kogan MD, et al (2013). Changes in prevalence of parent-reported autism spectrum disorder in school-aged U.S. children: 2007 to 2011-2012. *Natl Health Stat Report.* 20:1-11.
34. Wilson CE, Murphy CM, McAlonan G, et al ( 2016). Does sex influence the diagnostic evaluation of autism spectrum disorder in adults. *Autism.* 20:808-19.
35. Lai MC, Lombardo M V., Auyeung B, et al. 2015). Sex/Gender Differences and Autism: Setting the Scene for Future Research. *J Am Acad Child Adolesc Psychiatry.* 54:11–24.
36. Lord C, Schopler E, Revicki D (1982). Sex differences in autism. *J Autism Dev Disord.* 12: 317–330.
37. Tillmann J, Ashwood K, Absoud M, et al (2018). Evaluating Sex and Age Differences in ADI-R and ADOS Scores in a Large European Multi-site Sample of Individuals with Autism Spectrum Disorder. *J Autism Dev Disord.* 48:2490-2505.
38. Szatmari P, Bryson SE, Boyle MH, et al (2003). Predictors of outcome among high functioning children with autism and Asperger syndrome. *J Child Psychol Psychiatry Allied Discip.* 44:520-8.

39. Knutsen J, Crossman M, Perrin J, et al.( 2018). Sex differences in restricted repetitive behaviors and interests in children with autism spectrum disorder: An Autism Treatment Network study. *Autism*. 23:858-868.
40. Antezana L, Factor RS, Condy EE, et al (2019).. Gender differences in restricted and repetitive behaviors and interests in youth with autism. *Autism Res*. 12:274-283.
41. Wiggins LD, Robins DL, Bakeman R, et al ( 2009). Breif report: Sensory abnormalities as distinguishing symptoms of autism spectrum disorders in young children. *J Autism Dev Disord*. 39:1087-91.
42. Crane L, Goddard L, Pring L. ( 2009). Sensory processing in adults with autism spectrum disorders. *Autism*. 13:215-28.
43. Ben-Sasson A, Hen L, Fluss R, et al ( 2009). A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders. *J Autism Dev Disord*. 39:1-11.
44. Bitsika V, Sharpley CF, Mills R ( 2018). Sex differences in Sensory Features between boys and girls with Autism Spectrum Disorder. *Res Autism Spectr Disord*. 51: 49-55.

**Table 1: Odds Ratios showing association of clinical phenotypes of ASD with ASD girls**

<b>1.Deficit in verbal, non-verbal and social communication and social interactions</b>	<b>Boys (%)</b>	<b>Girls (%)</b>	<b>Girls OR(95%CI) p-value</b>
Failure of normal back and forth conversation	97%	96%	0.75(0.0650 to 8.6558) 0.81
No Shared enjoyment with parents	91%	92%	1.15(0.2163 to 6.1149) 0.86

No Joint referencing	80%	88%	1.79(0.4662 to 6.9402) 0.39
No Understanding	97%	96%	0.75(0.0650 to 8.6558) 0.81
Do not Follow instructions	53%	68%	1.8(0.7139 to 4.9623) 0.20
Aggressive	47%	24%	0.35(0.7139 to 4.9623) <b>0.05</b>
No Reciprocal Smiles	35%	64%	3.32(1.2715 to 8.6882) <b>0.01</b>
No Response to name	44%	64%	2.26(0.8769 to 5.8672) 0.09
Absence of interest in peers	95%	96%	1.14(0.1133 to 11.5313) 0.90
Deficit in understanding of gestures	98%	96%	0.37(0.0225 to 6.2367) 0.50
Impairments in social use of eye contact	59%	60%	1.03(0.4062 to 2.6548)0.93
<b>2. Stereotyped or repetitive Behaviors</b>			
Echolalia	39%	28%	0.59(0.2194 to 1.6312) 0.31
Produce unusual noises	53%	52%	0.95(0.3818 to 2.4115) 0.93
Rocking and Swaying	80%	84%	1.28(0.3766 to 4.4028) 0.68
like things moving in circle	53%	36%	0.49(0.1929 to 1.2870) 0.15
Like moving objects	59%	52%	0.75(0.2973 to 1.8922) 0.54
Looks things closely/corner of eye	74%	52%	0.37(0.1440 to 0.9808) <b>0.04</b>
Adherence to routine //Rituals	17%	8%	0.43(0.0893 to 2.1179) 0.30
Idiosyncratic/Metaphorical language	14%	20%	1.5(0.4569 to 5.1085)0.45
<b>3. Sensory symptoms</b>			
Cover ears in noise	55%	44%	0.65(0.2592 to 1.6537) 0.37
Smells everything	45%	20%	0.30(0.1005 to 0.8952) <b>0.03</b>
Licks everything	58%	56%	0.93(0.3706 to 2.3731) 0.89
Bothered by tags on clothes	21%	8%	0.32(0.0678 to 1.5382) 0.15



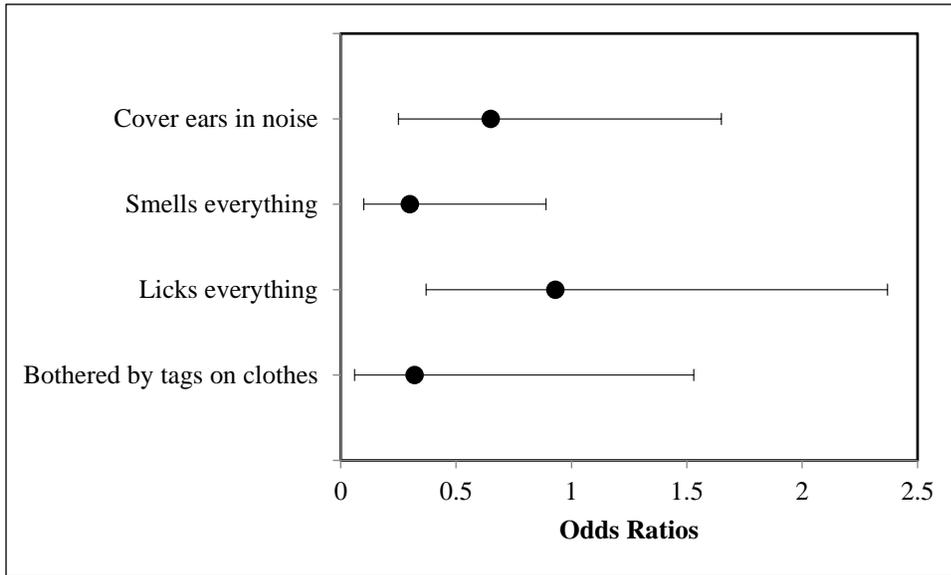


Figure 1: Forest plot showing odds ratios (OR) estimates (95% confidence interval, CI, indicated by the horizontal line) for association of deficiencies in verbal, non-verbal and social communication and social interactions with ASD girls. Figure 2: Forest plot showing odds ratios (OR) estimates (95% confidence interval, CI, indicated by the horizontal line) for association of Stereotyped or Repetitive Behaviors with ASD girls.

Figure 3: Forest plot showing odds ratios (OR) estimates (95% confidence interval, CI, indicated by the horizontal line) for association of Sensory symptoms with ASD girls.