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Distribution of Blood Group Type and Rhesus Factor Among Autism Spectrum Disorder Patients

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ABSTRACT

Background: Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition influenced by genetic, immunological, and environmental factors. The potential association between ABO blood groups, Rhesus (Rh) factor, and ASD remains underexplored, particularly in Iraq.

Objective: To investigate the distribution of blood groupe type and rhesus factor among autism spectrum disorder Patients.

Patient and Methods: A cross-sectional study was conducted from March 2025 to January 2026 in Diyala, Anbar, and Basra. A total of 72 patients diagnosed with ASD were included using a convenience sampling method. Data were collected through structured questionnaires completed by parents either via direct interview or electronic forms. Variables assessed included socio-demographic characteristics, blood group type, Rh factor, maternal health, pregnancy-related factors, and family history.

Results: The majority of patients were male (75%) and aged 5–10 years (43.1%). Blood group A (36.1%) and O (34.7%) were most common among patients, while Rh positivity was predominant (92.4%). Maternal distribution showed blood group O (45.5%) and Rh positivity (92.4%) as most frequent. Rh incompatibility was observed in 9.7% of cases, with only one mother reporting anti-D immunoglobulin administration. More than half of the patients (51.4%) had a positive family history of autism. Associated disorders were reported in 81% of cases, most commonly speech delay and epilepsy.

Conclusion: The study revealed a predominance of blood groups A and O, and Rh-positive status among ASD patients. While no definitive causal relationship was established, these findings highlight potential biological associations that warrant further large-scale studies. Greater attention to maternal health, perinatal factors, and family history is recommended for early detection and risk assessment. It is recommended that future studies with larger sample sizes and control groups be conducted to better clarify the potential role of blood groups and Rh factor in Autism Spectrum Disorder and to support early risk identification strategies.

INTRODUCTION

Many symptoms and functional limitations are associated with autism spectrum disorder (ASD), including mild and severe forms. ASD is a neurodevelopment disorder characterized by difficulties in social interactions, communication, and repetitive behaviors. Common symptoms include delayed speech, poor eye contact, difficulties in forming relationships, and repetitive actions. The severity of symptoms varies, with some individuals requiring substantial support in daily functioning[1]. Recent global estimates indicate that the prevalence of ASD has markedly increased, with the latest CDC data reporting that approximately 1 in 36 children are currently diagnosed with ASD(2). This rise has been attributed to better diagnostic practices, increased awareness, and possible environmental influences [2]. In Iraq, however, population-based studies remain limited, and the true prevalence of ASD is still underreported [3].

The etiology of ASD is multifactorial, involving a complex interplay between genetic, biological, environmental, and immunological factors [4]. Genetic susceptibility plays a significant role, with recent studies identifying over 1,000 genes associated with ASD, including variants affecting synaptic development and neural connectivity [4][14]. Nevertheless, environmental influences also contribute, particularly those acting during fetal and perinatal development. Examples include maternal infections, toxic exposures, nutritional deficiencies, and perinatal complications [4][12].

In addition to these, several perinatal and maternal factors have been reported as potential risk modifiers for ASD. These include delivery mode, maternal metabolic disorders, gestational complications, and perinatal hypoxia [11][12] . A recent meta-analysis revealed a significant association between cesarean delivery and an increased risk of ASD, suggesting that perinatal influences may play a critical role in neurodevelopmental vulnerability [13].

While significant strides have been made in understanding ASD's genetic and environmental contributors, the potential role of blood groups and Rh factors remains underexplored, particularly in diverse populations. Blood groups and Rh factors, determined by antigens on red blood cells, are crucial in transfusion medicine and have been implicated in various health conditions [5][6].The ABO blood group system and Rh factor (positive or negative) influence susceptibility to diseases like cardiovascular diseases, infections, and autoimmune disorders. However, the potential link between blood group/Rh factor and ASD remains largely unexplored. Given the established role of blood groups and Rh factor in influencing immune responses and fetal compatibility, exploring their potential association with ASD could uncover novel insights into the disorder's pathogenesis.

Recent studies have further investigated the potential associations between blood group incompatibilities and ASD risk. Ravi, Mendonca [7] identified a significant link between Rh and ABO blood group incompatibilities and an increased risk of ASD, suggesting that maternal-fetal blood type mismatches may contribute to neurodevelopmental risks. Additionally, Geier et al[8] found a significant association between maternal Rh-negativity and an elevated risk of ASD, indicating that immune responses related to Rh incompatibility could influence neurodevelopmental vulnerabilities. However, other studies have presented conflicting findings. Zandi et al. [9] found no significant evidence supporting a connection between maternal-fetal blood group incompatibilities and ASD risk.

Moreover, some studies have reported variations in ABO blood group distribution among ASD patients, with certain research suggesting a higher prevalence of blood group A or blood group B compared to neurotypical controls [10] .These findings highlight the importance of examining blood group antigens and Rh status as potential biological markers in ASD risk assessment.

Despite increasing research attention, the roles of blood groups, Rh factor, and perinatal influences in ASD pathogenesis remain underexplored, particularly in Middle Eastern populations. Limited data from Iraq emphasize the need for further studies to clarify these associations, which may aid in developing strategies for early detection, risk stratification, and better understanding of ASD pathophysiology [3],[5],[6].

THEORETICAL BACKGROUND OF AUTISM SPECTRUM DISORDER.

Autism Spectrum Disorder (ASD) is widely understood as a complex neurodevelopmental condition with multifactorial etiology. Over the years, several theories have been proposed to explain the underlying causes of ASD, encompassing genetic, neurodevelopmental, immunological, environmental, and epigenetic factors. The genetic theory of ASD suggests that inherited or de novo genetic mutations play a significant role in the disorder. Research has identified several candidate genes associated with ASD, including SHANK3, MECP2, CHD8, and NRXN1, which are involved in synaptic development and neural communication. Twin studies and familial aggregation further support the heritability of ASD, with concordance rates reaching up to 90% in monozygotic twins [15]. The neurodevelopmental theory posits that ASD arises from abnormalities in early brain development. Neuroimaging studies have shown increased brain volume in certain regions during infancy, along with atypical connectivity in the prefrontal cortex and other areas involved in social behavior and cognition. These structural and functional abnormalities may contribute to the core symptoms of ASD [16]. Another important perspective is the immune and neuroinflammatory theory, which emphasizes the role of immune system dysregulation. Elevated levels of pro-inflammatory cytokines such as IL-6, TNF-α, and microglial activation have been detected in individuals with ASD, indicating the presence of chronic neuroinflammation. Maternal immune activation during pregnancy has also been implicated as a potential risk factor for ASD [17]. The environmental theory proposes that exposure to environmental risk factors during critical periods of development may increase the likelihood of ASD, especially in genetically susceptible individuals. Examples include prenatal exposure to toxins (e.g., pesticides, heavy metals), maternal infections, nutritional deficiencies (such as folate), and perinatal complications [18]. Finally, the epigenetic theory offers a bridge between genetics and environmental influences. Epigenetic modifications, such as DNA methylation and histone modification, can regulate gene expression without altering the DNA sequence. These changes may be triggered by environmental exposures and have been observed in individuals with ASD, further supporting a multifactorial model of disease [19].In summary, the etiology of ASD is best explained through an integrative model that acknowledges the interaction between genetic predisposition, environmental exposures, immune responses, and epigenetic regulation. This multifaceted understanding supports the ongoing search for biological markers—such as blood group types—that could offer insights into risk stratification or early detection of ASD.

BIOLOGICAL AND GENETIC FACTORS IN AUTISM SPECTRUM DISORDER.

Autism Spectrum Disorder (ASD) is increasingly recognized as a biologically based condition involving complex interactions between genetic, neurological, and cellular processes. A growing body of evidence supports the role of both inherited and de novo mutations in contributing to ASD development.

More than 1,000 genes have been implicated in ASD, but several high-confidence genes have emerged from genetic association studies and genome-wide sequencing. These include CHD8, SCN2A, SHANK3, and NRXN1, which are involved in synapse formation, chromatin remodeling, and neuronal signaling [20]. Mutations in these genes may disrupt neurodevelopmental processes during critical periods of brain maturation. Copy number variations (CNVs) also contribute significantly to ASD, particularly deletions or duplications at chromosomal regions such as 16p11.2 and 15q11–13 [21]. These structural alterations can lead to abnormal expression of key neurodevelopmental genes. Neurologically, individuals with ASD often show atypical patterns of brain growth and connectivity. Studies using structural MRI have demonstrated early brain overgrowth during infancy followed by plateau or deceleration in later stages [22]. Diffusion tensor imaging (DTI) and functional MRI (fMRI) studies have further revealed altered white matter integrity and disrupted connectivity in areas involved in social cognition, such as the prefrontal cortex and temporoparietal junction [23][24]. In addition, imbalances in excitatory and inhibitory neurotransmission—particularly involving glutamate and GABA—have been observed in ASD. These imbalances may result in abnormal neural circuitry development, affecting sensory processing and behavior [25]. From a cellular perspective, abnormalities in synaptic pruning, neuronal migration, and dendritic spine morphology have also been identified in postmortem studies of ASD brains. These findings further reinforce the idea that ASD is rooted in early disruptions of brain development [26]. Overall, the biological and genetic landscape of ASD is highly heterogeneous. However, converging evidence points to shared molecular pathways involving synaptic function, gene regulation, and neural connectivity. These insights underscore the importance of investigating additional biological markers—such as blood group antigens—that may be associated with ASD risk or severity.

OVERVIEW OF BLOOD GROUPS AND RH FACTOR.

The human blood group system is a classification based on the presence or absence of specific antigens on the surface of red blood cells. The most clinically significant and widely studied systems are the ABO system and the Rhesus (Rh) factor, both of which play essential roles in transfusion medicine, pregnancy outcomes, and immunohematology [27]. The ABO system includes four main blood types: A, B, AB, and O. These are determined by the presence or absence of A and B antigens on the red blood cell surface, which are encoded by alleles at the ABO gene locus. Individuals with type A have A antigens, those with type B have B antigens, type AB individuals have both, and type O lacks both antigens [28]. The Rh system is primarily defined by the presence or absence of the D antigen. Individuals who possess the D antigen are classified as Rh-positive (Rh^+), while those who lack it are Rh-negative (Rh^-). The RHD and RHCE genes are responsible for encoding Rh antigens, and variations in these genes contribute to Rh status [29]. These blood group antigens are inherited in a Mendelian fashion and are stable throughout life. Beyond their significance in transfusion and hemolytic disease of the newborn, recent studies have explored potential associations between blood groups and various health conditions, including cardiovascular disease, infections, cancer, and neurodevelopmental disorders [30][31] . Some hypotheses suggest that blood group antigens may influence disease susceptibility through their interaction with the immune system, cell adhesion, and inflammation. For example, individuals with blood group O have been found to have lower risks for thromboembolic disorders, whereas blood group A may be linked to a higher risk for certain cancers and infectious diseases [32]. Given their biological roles and widespread genetic distribution, blood groups are now being examined as potential biomarkers for complex disorders—including Autism Spectrum Disorder (ASD). Although the exact mechanisms remain unclear, exploring such associations could contribute to early detection strategies and better understanding of the disease pathophysiology.

OBJECTIVES

1. Clarify the relationship between blood type and Rh abnormalities in patients with autism.
2. Assess the Rh factor status in ASD patients.
3. Evaluate maternal blood group and Rh factor patterns.
4. Examine family history and associated comorbidities in ASD patients.

SUBJECTS AND METHODS

This study is a cross-sectional study conducted in Diyala , Anbar, and Basra from 6th of March 2025 to the end of 31 of Jan 2026. The study included 72 autistic patients who were selected by a convenience sample mainly from their centers in Diyala, Anbar , Basra, and other governorates. A structured questionnaire and data extraction checklist were used to collect data on the relationship between autism spectrum disorder, blood type, and Rh factor. Data for the questionnaire were collected in two ways: the first was through a direct interview with the patient's parents, and the second was through sending an electronic questionnaire to specialized centers, with the information completed by the patient's parents. The collected data were organized, coded, and entered into Google Sheets. Descriptive statistical methods were applied, and the results were presented as frequencies and percentages. Data were displayed in the form of tables, bar charts, and pie charts to demonstrate the distribution of socio-demographic characteristics, blood groups, Rh factor, maternal and pregnancy-related factors, and family history among patients with Autism Spectrum Disorder (ASD). No scoring system was applied; the analysis was limited to descriptive statistics. The survey instructions clearly stated that only participants (Children's parents) who agreed to the instructions were eligible to participate in the survey. All participants read and agreed to the statement before participating in the survey. To remove any doubts regarding the ethics statement, we also clearly explained the purpose of the study to the children's parents and assured them that all information was private and confidential. We also obtained approval from the college for data collection and completion of the research.

RESULT

This chapter presents the results of the current study in a structured manner. The findings are organized into three main sections: socio-demographic characteristics, child-related findings, and maternal-related characteristics. A total of four tables and eight figures are used to illustrate the data distribution. The socio-demographic characteristics of the 72 patients diagnosed with Autism Spectrum Disorder (ASD) who were included in this study As shown in **figure. (1)** that illustrates the distribution of the 72 ASD patients according to their current age, The highest number of cases was reported in the 5–10 years age group (31 cases), followed by 10–15 years (17 cases) and 20–25 years (16 cases). The lowest number was found in both 1–5 years and 15–20 years (4 cases each).

The chi-square value was 35.86 with 4 degrees of freedom, and the p-value was 0.000003, which indicates a highly statistically significant association between age group and the number of cases. the distribution of patients according to gender among the 72 ASD cases included in the study. Males constituted the majority with 54 cases, whereas females accounted for 18 cases as presented in **Figure(2)**. The expected number for each group was 36. The chi-square value was 18 with 1 degree of freedom, and the p-value was 0.00002, indicating a statistically significant difference, with a clear male predominance.

The distribution of cases according to governorate show that the highest number of cases was reported in Basra (22 cases), followed by Anbar (16 cases) and Diyala (14 cases), while Baghdad recorded 11 cases and Nineveh 5 cases as in **Table (1).** The lowest frequency (1 case for each) was observed in Dhi Qar, Kirkuk, Sulaymaniyah, Karbala, and Babylon **(Figure 3)** .The expected number for each governorate was 7. The calculated chi-square value was 79.29 with 9 degrees of freedom, and the p-value was 0.0000000000002, indicating a highly statistically significant difference in the distribution of cases among governorates. These findings summarize the basic socio-demographic profile of the studied patients and set the stage for the subsequent analyses. Understanding the possible relationship between blood group types, Rhesus (Rh) factor, and Autism Spectrum Disorder (ASD) is essential to explore whether these biological markers can play a role in the occurrence or early detection of autism. In this section, we present the distribution of blood groups and Rh factors among the studied patients and analyze their potential association with ASD. Blood group A was the most frequent with 26 cases, followed by blood group O with 25 cases, while blood group B and AB were 12 and 9 cases, respectively as in **Figure (4) and (5).** The expected frequency for each group was 18. The calculated chi-square value was 12.78 with 3 degrees of freedom, and the p-value was 0.0051, indicating a statistically significant difference in the distribution of blood groups among patients. The distribution of the Rh factor among the studied sample of 72 patients diagnosed with Autism Spectrum Disorder (ASD). **Figure (5).** Among these cases, a total of 66 patients (92.4%) were found to have an Rh-positive blood type, whereas only 6 patients (7.6%) had an Rh-negative blood type. **Figure (6)** shows the distribution of maternal blood groups among the mothers of the studied patients (n = 72). Blood group O was the most common (33 cases), followed by A (22 cases), B (13 cases), and AB (4 cases).

The expected number for each group was 18. The chi-square value was 25.67 with 3 degrees of freedom, and the p-value was 0.00001, indicating a statistically significant difference. **Figure (7)** shows the distribution of the maternal Rh factor among the studied sample (n = 72). The majority of mothers had a positive Rh factor, with 66 mothers (92.4%), while 6 mothers (7.6%) had a negative Rh factor.

The distribution of Rh compatibility between the mothers and the patients among the studied sample (n = 72).as **Figure (8)** shows Compatibility was found in 40 cases, incompatibility in 7 cases, and 25 cases were unknown. The expected number for each category was 24. The chi-square value was 22.75 with 2 degrees of freedom, and the p-value was 0.00001, showing a statistically significant association. Out of the total 72 cases, only 1 mother (1.5%) reported receiving the anti-D injection, while 43 mothers (59.1%) reported not receiving it, and 28 mothers (39.4%) stated that they did not know whether they received it or not, as shown in **Figure (9).**

AS shown in **Table (2),**the distribution of patients according to their age at the time of ASD diagnosis among the studied sample (n = 72). The majority of patients, 55 cases (76%), were diagnosed before the age of 5 years. Diagnosis between 5–10 years was reported in 13 cases (18%), while 2 cases (2.7%) were diagnosed between 10–15 years. Only 1 case (1.3%) was diagnosed between 15–20 years, and another 1 case (1.3%) between 20–25 years. The distribution of patients according to their place of birth among the studied sample (n = 72). The majority of patients, 67 cases (93.9%), were born in a hospital, whereas only 5 cases (6.1%) were delivered at home as in **Figure (10).**

As demonstratesd in **Figure (11),** the distribution of patients according to the type of delivery among the studied sample (n = 72). Out of the total cases, 41 patients (57.6%) were delivered through normal vaginal delivery, while 31 patients (42.4%) were delivered via cesarean section. **Table (3)** demonstrates the distribution of patients according to the presence of other associated disorders and blood-related diseases among the studied sample (n = 72). Out of the total patients, 59 cases (81%) reported having other associated disorders, while 13 cases (18%) had no additional disorders. Regarding blood-related diseases, only 2 patients (2.7%) were affected, whereas 70 patients (97%) had no blood disorders.

Table (3) summarizes the distribution of patients according to several maternal and pregnancy-related factors among the studied sample (n = 72). Regarding pregnancy complications, only 8 mothers (11%) reported having complications, while 64 mothers (88%) had none. Concerning maternal diseases during pregnancy, 17 mothers (23%) had a disease, whereas 55 mothers (76%) had no reported illnesses. As for medications taken during pregnancy, 14 mothers (19%) reported using medications, while 58 mothers (80%) did not. Finally, 12 mothers (16%) reported a previous miscarriage, whereas 60 mothers (83%) had no history of miscarriage. **Figure (12)** shows the distribution of patients according to the presence of autism cases in the family among the studied sample (n = 72). A positive family history was reported in 37 cases, while 35 cases had no family history. The chi- square value was 0.0556 with 1 degree of freedom, and the p-value was 0.8137, indicating no statistically significant association between family history and the studied cases. **Figure (13)** illustrates the distribution of autism cases in the family by relation among patients who reported a positive family history (n = 37). Of these, 12 cases (32.4%) were on the maternal side, 12 cases (32.4%) on the paternal side, and 13 cases (35.1%) had relatives affected on both sides.

DISCUSSION

This chapter discusses the main findings of the study and compares them with previously published literature. The discussion is structured according to the study objectives, focusing on the relationship between blood group, Rh factor, perinatal risk factors, comorbidities, family history, and autism spectrum disorder (ASD). Understanding these associations is essential for early detection, prevention strategies, and improved management of ASD. In this study, the most common blood group among ASD patients was A (36.1%), followed by O (34.7%), B (16.7%), and AB (12.5%). Furthermore, 92.4% of ASD patients were Rh-positive.These findings are partially consistent with studies reporting higher frequencies of blood groups O and A among ASD patients compared to controls [42][43]. Similarly, other research suggested potential immunogenetic links between blood group antigens and neurodevelopmental disorders, possibly influencing fetal brain development [44]. However, some studies found no significant association between ABO blood groups and ASD risk [45]. Such discrepancies may arise from differences in sample size, study design, and population genetics, suggesting that the relationship between blood groups and ASD remains inconclusive. Regarding Rh factor, the results showed that a majority of ASD patients were Rh-positive (92.4%), while 7.6% were Rh-negative. Additionally, Rh incompatibility between mother and patient was observed in 9.7% of cases. Similar findings have been reported by previous studies, proposing that maternal-fetal Rh incompatibility may play a role in immune activation during pregnancy, potentially affecting fetal neurodevelopment [46][47]. Nevertheless, other studies reported no significant correlation between Rh incompatibility and ASD risk [48].

The analysis examined several perinatal and maternal factors, Place of birth: 93.9% of patients were delivered in hospitals, compared to 6.1% at home. Type of delivery: 57.6% had vaginal deliveries, while 42.4% were delivered via cesarean section. Maternal factors: 11% of mothers experienced complications, 23% had illnesses during pregnancy, 19% used medications, and 16% had a miscarriage history. Recent studies have highlighted that perinatal complications, cesarean delivery, and maternal illnesses may increase the likelihood of ASD development [49][50]. Prenatal infections, gestational diabetes, and maternal obesity have also been identified as significant contributors to ASD risk [51]. Despite these associations, it is important to note that ASD is a multifactorial disorder. Environmental factors, genetic predispositions, and prenatal exposures likely interact to influence the risk, and no single factor alone can explain ASD development [52].

Although this study did not directly assess parental awareness levels, global literature highlights its importance in early detection and intervention. Studies demonstrate that when parents are more aware of early ASD symptoms, children are diagnosed earlier, leading to better outcomes through timely therapies [53][54]. Raising awareness among parents and healthcare providers is therefore critical for early management. In this study, 81% of ASD patients had at least one comorbid condition, such as speech delay, ADHD, or epilepsy. These findings are consistent with multiple reports suggesting that ASD often coexists with other neurodevelopmental and psychiatric disorders [55][56].

The high prevalence of comorbidities complicates both diagnosis and treatment, emphasizing the need for a multidisciplinary approach in managing ASD cases. The study found that 51.4% of ASD patients reported a positive family history. Among these, 32.4% were from the maternal side, 32.4% from the paternal side, and 35.1% from both. These results strongly support the genetic contribution to ASD. Twin and family studies have reported ASD heritability rates as high as 50%–90% [57][58]. Recent genomic studies have identified numerous susceptibility loci associated with ASD, emphasizing the role of polygenic inheritance [59]. Given these findings, genetic counseling and screening may be beneficial for families with a positive history of ASD.

This study demonstrates that ASD is likely the result of a complex interaction between genetic predispositions, immunogenetic markers (such as blood group and Rh factor), perinatal exposures, and family history. While the results highlight potential associations, they are not conclusive due to the limited sample size and retrospective nature of the study. Future research should include larger multicentred studies and genomic analyses to clarify causal relationships and identify biomarkers that could aid in early diagnosis and targeted interventions.

LIMITATIONS OF THE STUDY

1. The study was conducted with a small sample size (72 patients), which limits the ability to generalize the findings to the wider Iraqi population.
2. The study design was cross-sectional, so it cannot establish a causal relationship between blood group, Rh factor, and ASD.
3. A convenience sampling method was used, which may introduce selection bias and reduce the representativeness of the sample.
4. There was no control group of neurotypical children, which restricted the ability to directly compare blood group and Rh distribution between ASD and non-ASD populations.
5. Some information was obtained from parent-reported questionnaires, which may be subject to recall bias or inaccurate reporting.
6. The study included several Iraqi governorates, but the largest number of cases came from Diyala, Anbar, and Basra, which may limit the ability to fully reflect the distribution across all regions of Iraq.
7. Limited data were available regarding genetic testing and detailed immunological factors, which could provide a deeper understanding of ASD etiology.

CONCLUSION

The study “Association of Blood Group Type and Rhesus Factor with Autism

Spectrum Disorder Among Patients" found that :

- The majority of ASD patients were males, representing 75% of the studied sample.
- Most patients were aged 5–10 years, making this the most affected age group.
- Blood group A (36.1%) and O (34.7%) were the most common among ASD patients.
- Rh-positive status was predominant (92.4%), while Rh-negative was rare
- Maternal blood groups were mostly O (45.5%), with Rh positivity in 92.4% of mothers.
- Rh incompatibility was present in 9.7% of cases, but anti-D immunoglobulin administration was reported only in one case.
- More than half of patients (51.4%) had a positive family history of autism
- A large proportion of patients (81%) had associated comorbidities, such as speech delay, epilepsy, or ADHD.
- The study found no definitive causal relationship, but highlighted possible biological associations that require further research.

RECOMMENDATION

TO THE MINISTRY OF HEALTH IN IRAQ :

- Establish specialized training programs for pediatricians, psychiatrists, and general practitioners to improve early detection and management of Autism Spectrum Disorder (ASD)
- Enhance maternal and child health services by integrating screening for blood group
- and Rh incompatibility during pregnancy follow-up
- Launch awareness campaigns for families about the importance of early diagnosis and intervention in ASD cases.

TO MEDICAL CENTERS AND HOSPITALS :

- Ensure that all mothers with Rh-negative blood type receive appropriate follow-up and Anti-D immunoglobulin administration when indicated.
- Improve record-keeping systems for maternal and neonatal blood groups to support future research and clinical care.
- Provide counseling sessions for families with a positive history of autism to support early risk identification.

TO UNIVERSITIES AND RESEARCHERS :

- Conduct larger, multicenter, and controlled studies across different Iraqi governorates to clarify the role of blood group and Rh factor in ASD.
- Explore genetic, immunological, and environmental interactions in ASD pathogenesis to build a more comprehensive understanding.
- Promote collaborative research between pediatrics, obstetrics, psychiatry, and immunology specialists.

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TABLES

Table 1. Distribution of ASD patients according to residential governorates (n=72).

Governorate	(O)Number of cases	E	O-E	(O-E)2	(O-E)2/E
Basra	22	7	15	225	32،14285714
Anbar	16	7	9	81	11،57142857
Diyala	14	7	7	49	7
Baghdad	11	7	4	16	2،285714286
Nineveh	5	7	-2	4	0،5714285714
Dhi Qar	1	7	-6	36	5،142857143
Kirkuk	1	7	-6	36	5،142857143
Sulaymaniyah	1	7	-6	36	5،142857143
Karbala	1	7	-6	36	5،142857143
Babylon	1	7	-6	36	5،142857143
Total	72				**79،28571429**

Table 2. Distribution of Patients According to Age at Diagnosis.

Age (years)	Count	N (%)
0–5	55	76%
5–10	13	18%
10–15	2	2.7%
15–20	1	1.3%
20–25	1	1.3%

Table 3. Distribution of Patients According to Associated Disorders and Blood Diseases.

Variable	Response	Count	N (%)
Other disorders of the affected person	Yes	59	81%
	No	13	18%
Blood diseases	Yes	2	2.7%
	No	70	97%

Table 4. Distribution of Maternal and Pregnancy-Related Factors.

Variable	Response	Count	N (%)
Pregnancy complications	Yes	8	11%
	No	64	88%
Maternal diseases	Yes	17	23%
	No	55	76%
Medications taken during pregnancy	Yes	14	19%
	No	58	80%
Mothers previous miscarriage	Yes	12	16%
	No	60	83%

FIGURES

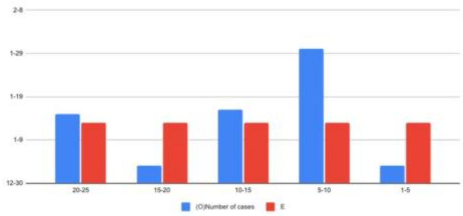

Figure 1. Current age distribution of Autism Spectrum Disorder patients (n=72).

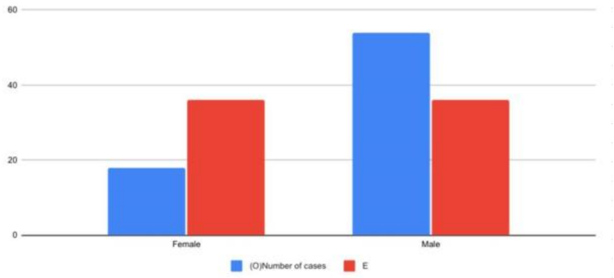

Figure 2. Gender distribution among ASD patients.

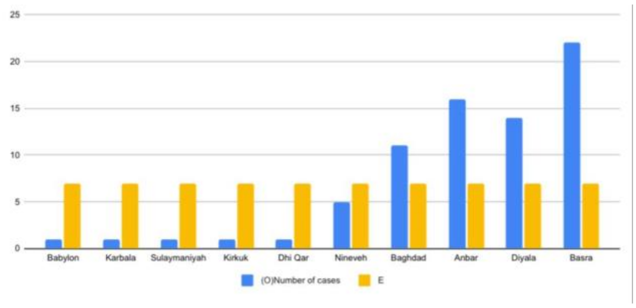

Figure 3. Distribution of ASD patients according to residential governorates (n=72).

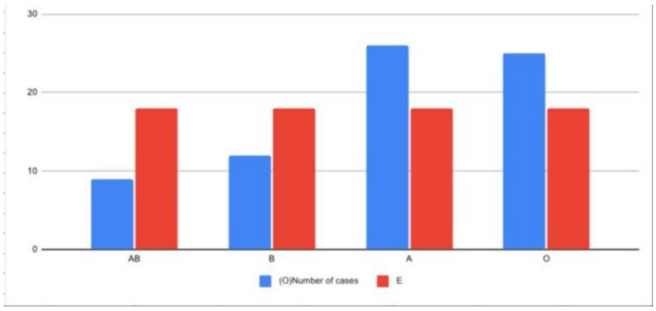

Figure 4. Distribution of Blood groups among ASD patients

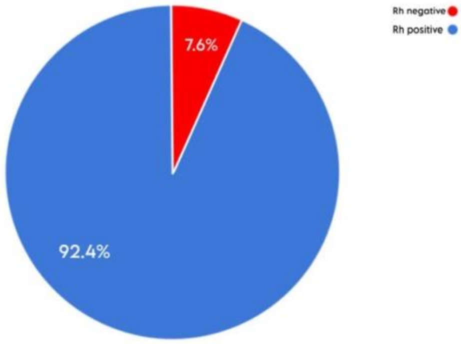

Figure 5. Distribution of Rh Factor Among ASD Patients.

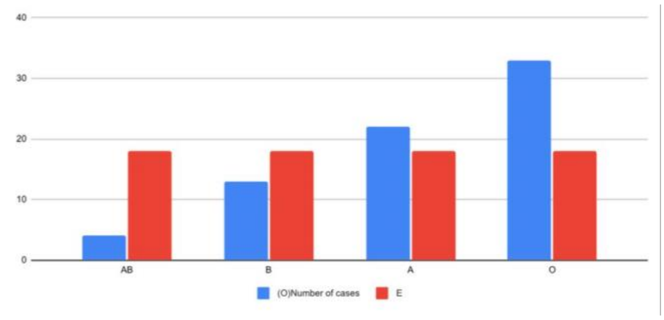

Figure 6. Distribution of Maternal Blood Groups among the studied sample.

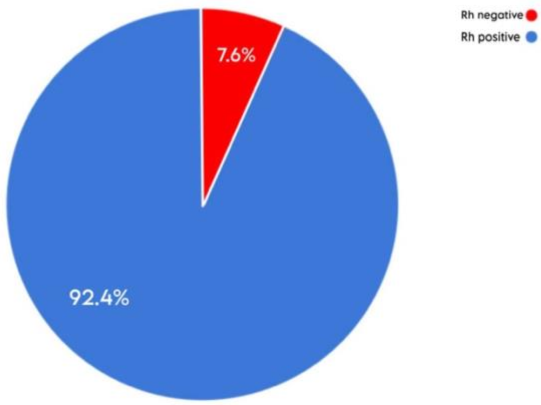

Figure 7. Distribution of maternal Rh factor among the studied sample.

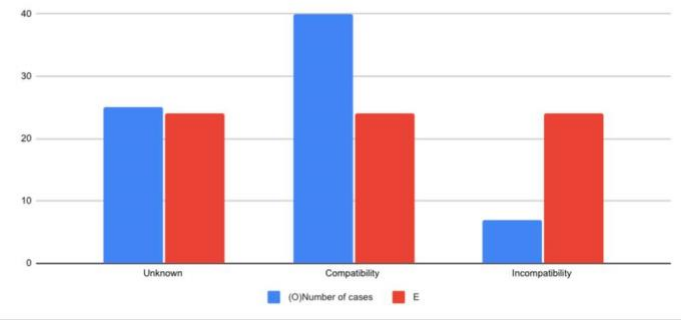

Figure 8. Rh Compatibility Between Mother and Patient

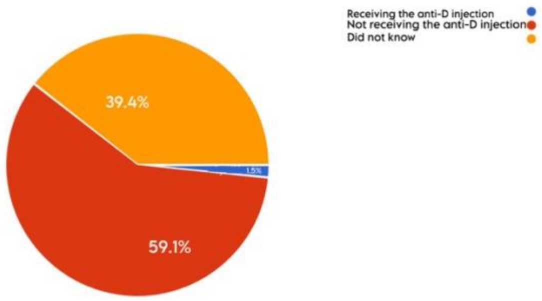

Figure 9. Administration of Anti-D Immunoglobulin among Mothers

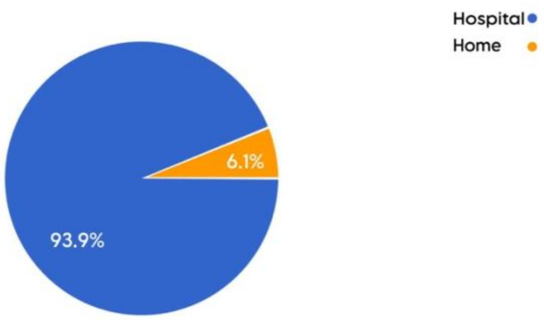

Figure 10. Distribution of patients according to place of birth

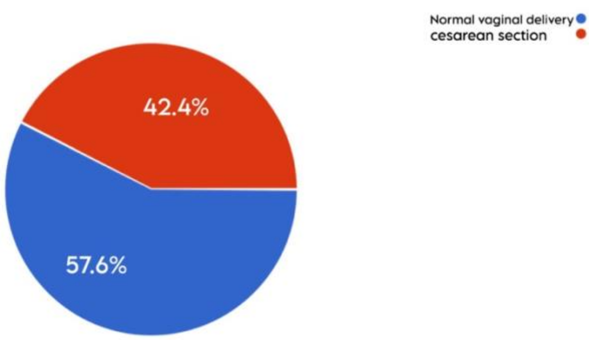

Figure 11. Distribution of patients according to type of delivery.

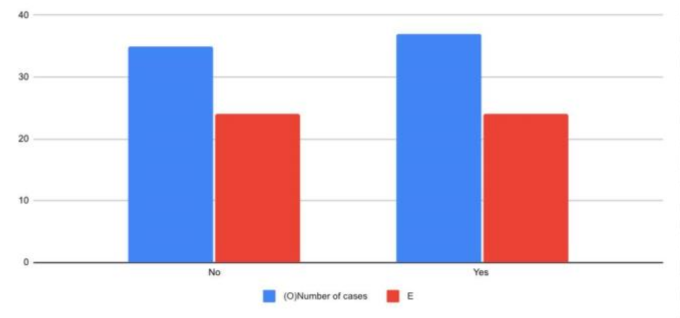

Figure 12. Distribution of patients according to family history of autism.

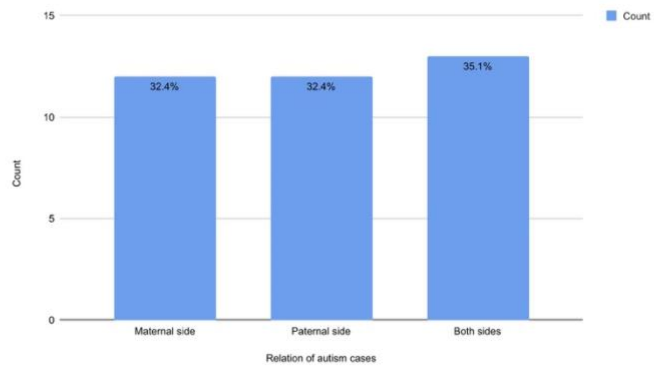

Figure 13. Distribution of autism cases in the family according to relation