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Maternal risk factors associated with Autism among children in Tabuk Autism Center

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ABSTRACT

Autism is a developmental disability characterized by impairment in social interaction, abnormalities in speech, and stereotyped pattern of behaviors with onset in childhood (under 3 years old). Due to the surge in the number of children diagnosed with autism in recent decades, a wide range of studies have been done to identify the etiological risk factors of autism. It has been found that genetic and environmental factors are both involved in autism pathogenesis. In this study, a set of risk factors involved in the occurrence of autism has been collected, and some recommendations are represented to reduce the risk of this disease in children.

Keywords: Autism, risk factors, children, Tabuk Center

1. INTRODUCTION

Autism was originally described by Asperger (in 1938) and Kanner (in 1943) (Asperger et al., 2007). It is a severe neuro developmental disorder that belongs to autism spectrum disorders (ASDs), including autism, Asperger syndrome, Rett syndrome, unidentified pervasive developmental disorders, and childhood disintegrative disorder (Volkmar et al., 2009; Paris, 2015; Marjan Mohamadi et al. 2019) The most prominent clinical features of autism are extensive disabilities in social and behavioral communications, language impairment, and strong tendency toward stereotyped and repetitive patterns of behavior (Rapin , 2002; Morbidity and mortality weekly report 2010).

Prevalence estimates for autism-spectrum conditions have shown a steady increase over the past four decades. In 1978, the consensus estimates for classic autism was 4 in 10000; recently, autism-spectrum conditions affect approximately 1% of the population (Rutter, 1978, Barid et al., 2006). This massive increase is likely to reflect improved recognition, an increase in available diagnostic services, increase awareness among professionals and parents, and widening of the diagnostic criteria. (Charman, 2002, Wing & Potter, 2002)

The diagnostic criteria require that symptoms become apparent before a child is three years old. The external look of the autistic child may not indicate a disorder; diagnosis typically comes from a complete patient history, physical and neurological evaluation. Autism is characterized by impaired social interaction and verbal and non-verbal communication, and by restricted, repetitive or stereotyped behavior (American Psychiatric Association 2000). Children also have higher rates of co-morbidities including epilepsy, gastrointestinal problems, anxiety and depression, and respiratory, food and skin allergies (Gurney et al., 2006; Freitag, 2007).

Despite a lot of researches, the etiology of autism remains unknown (Freitag, 2007). There is growing body of evidence about genetic factors enrolment which is supporting autism etiology through genetic mutations (e.g., heritability and twins) (Weiss et al., 2009, Folstein & Sheidley, 2001). According to the important role of genetics in autism etiology, a lot of genes have been studied, and in some cases, opposite results obtained (Musavi et al., 2016, Nguyen et al., 2010).

Genetic studies with no conclusive results unveil the importance of environmental risk factors and their role in etiology of autism (Ronald & Hoekstra, 2011; Hallmayer et al., 2011). Hence, the interactions between susceptible genes and environmental factors have been proposed as the major mechanism of autism etiology (Herbert, 2010, Deth et al., 2008).

These environmental factors include certain foods, infectious diseases (Libbey et al., 2005), heavy metals, solvents, diesel exhaust, and phenols used in plastic products, pesticides, alcohol, smoking, and vaccines (Chakrabarti, 2001). These environmental factors have been claimed to contribute to autism or exacerbate its symptoms (Newschaffer et al., 2007, Arndt et al., 2005).

There is a positive association between autism and obstetric complications, prenatal or intra-partum use of medications, low birth weight (<2, 500g), gestational age at birth of less than 37 weeks, (Abel et al., 2013), and parental preconception chemical exposures (Gardener et al., 2011, Gardener et al., 2009). Parental characteristics, such as age and level of education, may be associated with a risk of autism (Brian et al., 2014). Despite significant research on prenatal, perinatal, neonatal, and other risk factors in autism, the causal nature of these associations is still disputed due to several current methodological limitations of studies (Bolton et al., 1992).

Other environmental factors such as mercury, vaccination and radiation have been proposed as possible causes of autism spectrum disorders (ASDs) (Herbert, 2010). Reviews of the evidence by the Centers for Disease Control and Prevention (Arndt et al., 2005), the American Academy of Pediatrics, the Institute of Medicine of the US National Academy of Sciences (Abel et al., 2013) the UK National Health Service (Gardener et al., 2011) all found no link between the vaccine MMR and autism.

The aim of this work was to determine the possible risk factors of autism through full history taking from the parents of autistic children including antenatal, natal or postnatal history, drug, medical and surgical history together with full developmental history for their autistic children.

2. PATIENTS AND METHODS

The present study was conducted through a case control study design. It enrolled 53 cases with autism diagnosed by DSM-IV-TR criteria (American psychiatric association, 1994 diagnostic and statistical manual of mental disorders, 4th edition criteria, text revised) (MMR The facts 2004; American Psychiatric Association; 1994).

The patients were 53 child 39 males (73.6%) and 14 females (26.4%). Their age ranged from 8.22 ± 2.4. They were recruited from the Autism center in Tabuk (Al- Bayan) during period September 2018 to March 2019. Seventy five healthy children comprised the control group. They were 38 males (50.7%) and 37 females (49.3%). Their ages ranged from 7.45 ± 3.46. They were recruited from King AbdelAziz School in Tabuk that were matching in age, gender, environment and habitat.

All cases were subjected to the following:

1. Detailed history taking about age, sex, residence, origin, parental consanguinity, with special emphasis on; onset or the time of diagnosis, course and duration of the disease.

• Antenatal or maternal history: age at patient's birth, history of threatened abortion, parity, chronic illness as Diabetes mellitus (DM), infections, smoking (active, passive), depression, medications (antidepressant drug), exposure to x rays, or chemical agents.

• Natal and postnatal history including, gestational age, complication during Labor or delivery, history of prematurity or intrauterine growth retardation, gestational age at birth, birth weight, perinatal problems and postnatal course especially occurrence of neonatal hypoxia, resuscitation, pallor and jaundice

• Developmental history (both mental and motor): age of sitting up without support, walking unassisted, first spoken word, combining words, accurate details of cognitive abilities, gross and fine motor functions, feeding disorders,

• Abnormal sleep patterns and history of vaccination.

• Past history including: major childhood illnesses, any previous therapies used to treat the child's condition.

• Family history for any similar conditions, any genetic diseases and other psychological or mental disorders in the family.

2. Neurological examination and Psychiatric evaluation with Confirmation of diagnosis using DSM-IV-TR criteria of autism (29, 30). i.e. impairments of language, social skills, and restricted stereotyped interest or activity.

Statistical analysis

Statistical presentation and analysis of the present study was conducted with SPSS V.20. Data was expressed as number and percent for qualitative data and mean and slandered deviation, median, minimum and maximum for quantitative data, t test, Mann-Whitney test and chi-square test were calculated for assess the difference and the association between the case and the control groups, $p < 0.05$ is considered as a statistically significant difference.

3. RESULTS

Regarding the child and parenteral characters of the studied groups, table 1 shows that; the mean age of the case group was higher (8.22 ± 2.4) than the control group (7.45 ±3.46), as well as the father's age which was (34.41 ± 6.9) in cases, (32.49 ± 6.2) for controls and mother's age was (28.0 ± 5.5) for cases and (24.61 ± 4.5) for controls.

Table 1 Child and parenteral characters of the studied groups

Items	Case (53)	Control (75)	T test	p
Age of the child				
mean± SD	8.22 ± 2.4	7.45 ± 3.46		
median	8	7	1.48**	0.139
minimum	1	1		
maximum	15	13		
Father's age				
mean± SD	34.41 ± 6.9	32.49 ± 6.2		
median	34	33	1.63	0.110
minimum	25	21		
maximum	60	50		
Mother's age				
mean± SD	28.0 ± 5.5	24.61 ± 4.5	3.82	0.000*

median	27	25		
minimum	17	18		
maximum	43	41		
Birth order				
mean± SD	2.7 ± 1.8	3.05 ± 1.8		
median	2	3	1.17**	0.238
minimum	1	1		
maximum	7	12		

*P<0.05 is statistically significant ** Mann-Whitney test was calculated

Table 2 shows that most of the children in our study were males (73.6%) in cases and (50.7%) in controls, the fathers were mostly secondary educated in case group (66.0%) while were university or higher in control group (58.7%), most of our mothers were having high level of education in both groups (49.1%) in cases and (78.7%) in controls, the parents consanguinity was present in both groups , but was higher in case group (71.7%) opposite to (56.0%) in control group, most of the parents didn't intake any treatment, didn't have family history of diseases in both groups, while a family history of neurological problems and autism were present in 5.7% and 11.3% in cases respectively, opposite to 0 % in control. There were a statistically significant difference between cases and controls in all Socio-demographic characters and family history of the participants (p<0.05).

Table 2 Sociodemographic characters and family history of the participants

Items	Case 53 (100%)	Control 75 (100%)	chi-square	p
Sex of the child:				
Male	39 (73.6)	38 (50.7)	6.8	0.009*
Female	14 (26.4)	37 (49.3)		
Father's education:				
illiterate	1 (1.9)	0 (0.0)		
Primary	4 (7.5)	3 (4.0)		
Secondary	35 (66.0)	28 (37.3)	15.45	0.001*
University and above	13 (24.5)	44 (58.7)		
Mother's education:				
Illiterate	3 (5.7)	0 (0.0)		
Primary	5 (9.4)	4 (5.3)		
Secondary	19 (35.8)	12 (16.0)	14.1	0.003*
University and above	26 (49.1)	59 (78.7)		
Parents Consanguinity:				
No	15 (28.3)	33 (44.0)	3.26	0.036*
Yes	38 (71.7)	42 (56.0)		
Parents intake of any treatment:				
No	43 (81.1)	72 (96.0)	7.52	0.006*
Yes	10 (18.9)	3 (4.0)		
Family history of any diseases:				
No	40 (75.5)	72 (96.0)	11.96	0.001*
Yes	13 (24.5)	3 (4.0)		
Family history of neurological diseases				
No	50 (94.3)	75 (100.0)	4.37	0.003*
Yes	3 (5.7)	0 (0.0)		
Family history of autism:				
No	47 (88.7)	75 (100.0)	8.90	0.003*

Yes	6 (11.3)	0 (0.0)		

*P<0.05 is statistically significant

Table 3 demonstrate the exposure to adverse conditions during prenatal period in both groups, where the mothers in case group were significantly higher the control group in their intake of drugs (22.6%), exposure to psychological stress (43.4%), suffering from Vit D deficiency (45.3%), while the mother in the control group were significantly higher in their suffering from iron deficiency anemia (62.7%) and their regular intake of folic acid (94.7%).

Table 3 Exposure to adverse conditions during prenatal period in both groups

Items	Case 53 (100%)	Control 75 (100%)	chi-square	p
Mother's smoking No Yes	 52 (98.1) 1 (1.9)	 72 (96.0) 3 (4.0)	0.45	0.499
Father's smoking: No Yes	 32 (60.4) 21 (39.6)	 47 (62.7) 28 (37.3)	0.068	0.396
Fever : No Yes	 43 (81.1) 10 (18.9)	 65 (86.7) 10 (13.3)	0.72	0.396
Health problems during pregnancy: No Yes	 48 (90.6) 5 (9.4)	 66 (88.0) 9 (12.0)	0.21	0.647
Infection with measles or German measles No Yes	 53 (100.0) 0 (0.0)	 75 (100.0) 0 (0.0)	---	---
Exposure to toxic unsanitary environment No Yes	 42 (79.2) 11 (20.8)	 60 (80.0) 15 (20.0)	0.01	0.917
Intake of any drug: No Yes	 41 (77.4) 12 (22.6)	 75 (100.0) 0 (0.0)	18.73	0.000*
Exposure to psychological stress: No Yes	 30 (56.6) 23 (43.4)	 75 (100.0) 0 (0.0)	39.67	0.000*
Suffering from iron deficiency anemia: No Yes	 30 (56.6) 23 (43.4)	 28 (37.3) 47 (62.7)	4.65	0.031*
Suffering from Vit.D deficiency: No Yes	 29 (54.7) 24 (45.3)	 52 (69.3) 23 (30.7)	2.85	0.045*
Regular intake of folic acid: No Yes	 14 (26.4) 39 (73.6)	 4 (5.3) 71 (94.7)	11.42	0.001*

*P<0.05 is statistically significant

Regarding the character of the natal period in the studied groups, Table 4 Shows; that the new born infants in the case group were having significant higher low birth weight than the control group (60.4%), (36.0%) respectively. Most of the mothers in the case group didn't know about the blood grouping or Rh for themselves and their child, while in control group most of the mothers were of blood group O positive, and their child was of A positive.

Table 4 distribution of the natal period characters among the studied groups

Items	Case 53 (100%)	Control 75 (100%)	chi-square	p
Mode of delivery:				
Caesarian delivery	11 (20.8)	17 (22.7)	0.06	0.797
Normal delivery	42 (79.2)	58 (77.3)		
Full term delivery:				
No	3 (5.7)	8 (10.7)	0.99	0.320
Yes	50 (94.3)	67 (89.3)		
Neonatal complications :				
No	36 (67.9)	59 (78.7)	1.87	0.171
Yes	17 (32.1)	16 (21.3)		
Birth weight:				
Low	32 (60.4)	27 (36.0)	7.42	0.003*
Normal	21 (39.6)	48 (64.0)		
Maternal blood group:				
A	13 (24.5)	20 (26.7)		
B	4 (7.5)	20 (26.7)		
AB	1 (1.9)	2 (2.7)		
O	12 (22.6)	33 (44.0)	42.76	0.000*
I don't know	23 (43.4)	0 (0.0)		
Maternal Rh				
Negative	27 (50.9)	12 (16.0)		
Positive	9 (17.0)	43 (57.3)	25.21	0.000*
I don't know	17 (32.1)	20 (26.7)		
Infant's blood group:				
A	7 (13.2)	27 (36.0)		
B	3 (5.7)	26 (34.7)		
AB	0 (0.0)	4 (5.3)		
O	11 (20.8)	18 (24.0)	65.68	0.000*
I don't know	32 (60.4)	0 (0.0)		
Infant Rh				
Negative	6 (11.3)	3 (4.0)		
Positive	15 (28.3)	70 (93.3)	61.02	0.000*
I don't know	32 (60.4)	2 (2.7)		

***P<0.05 is statistically significant**

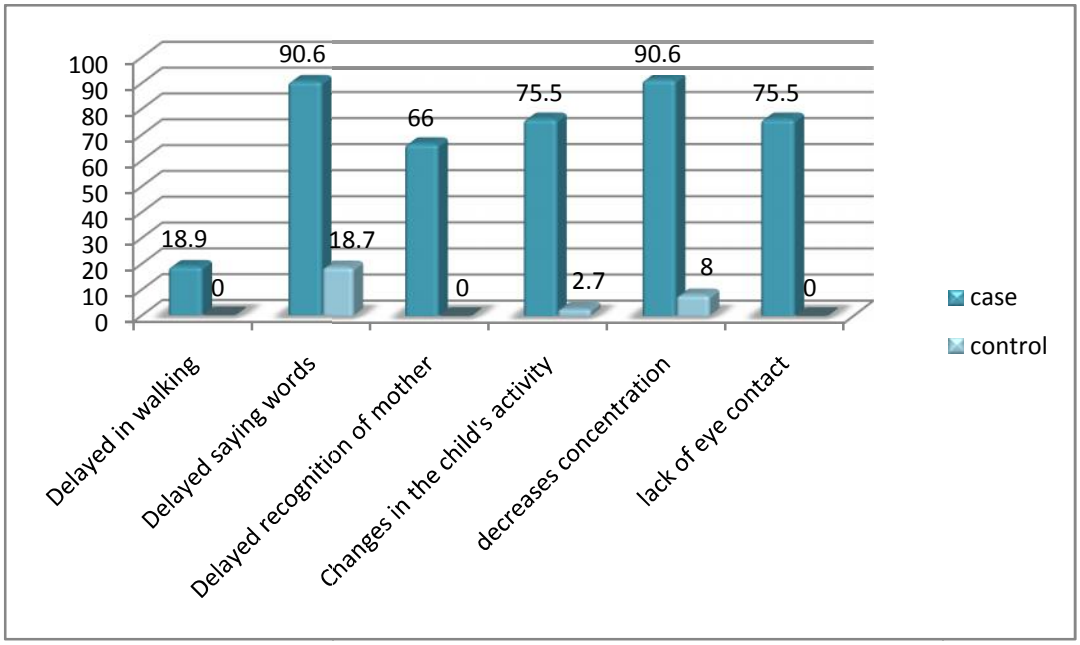
Most of the mothers in both groups were breastfeed their children (47.2%) in cases and (60.0%) in controls, while the combined feeding was significantly higher in the cases (35.8%), no difficulties were present in breast feeding for most of mothers, significant higher percent of the children in case group weren't complete their vaccination at the proper time (9.4%), while all children of the controls took their vaccination at time. The cases were suffering from health problems (43.4%), neurological problems (24.5%), following diet regimen (20.8%) and spending more long time on the electronic devices (89.9%) than the controls , p <0.05 Table 5.

Table 5 distribution of the postnatal and child period characters among the studied groups

Items	Case 53 (100%)	Control 75 (100%)	chi-square	p
Feeding: Breast feeding Artificial feeding Combined breast and artificial feeding	 25 (47.2) 9 (17.0) 19 (35.8)	 45 (60.0) 22 (29.3) 8 (10.7)	12.23	0.002*
Presence of difficulty in breast feeding: No Yes	 38 (71.7) 15 (28.3)	 50 (66.7) 25 (33.3)	0.36	0.545
Complete child's vaccination on time: No Yes	 5 (9.4) 48 (90.6)	 0 (0.0) 75 (100.0)	7.36	0.007*
Child suffers of any health problem: No Yes	 30 (56.6) 23(43.4)	 70 (93.3) 5 (6.7)	24.51	0.000*
Child suffers from neurological health problem No Yes	 40 (75.5) 13 (24.5)	 75 (100.0) 0 (0.0)	20.47	0.000*
Spending long time on electronic devices No Yes	 8 (15.1) 45 (89.9)	 36 (48.0) 39 (52.0)	14.90	0.000*

***P<0.05 is statistically significant**

Regarding the developmental milestones of the studied children, Fig.(1) demonstrate the autism children were having a delayed milestone more that the controls concerning; walking (18.9%) , saying word (90.6%), recognition of the mothers (66.0%), changes in the child activity (75.5%), decreased concentration (90.6%) and lack of eye contact (75.%%), p<0.05 for all milestones.



P<0.05 is statistically significant for all items.

Figure 1 Distribution of the studied groups according to developmental milestones

The mothers of the autism children were having higher knowledge about autism (54.7%) than controls (25.3%), think that autism child can take care of himself (64.2%) than control (2.7%), and don't mind to integrate their child with others (94.3%). While lower percent of mothers in case group believe that the autism child receive the suitable care (75.5%) opposite to (94.6%) in control group, know about the availability of centers for autism (69.8%) opposite to (93.3%), and in their believe that the community is aware about caring of the autism child (84.9%) opposite to 100.0% in controls, $p<0.05$ Table 6.

Table 6 knowledge and attitude of the parents regarding autism

Items	Case 53 (100%)	Control 75 (100%)	chi-square	p
Having knowledge about autism No To some degree Yes	 3 (5.7) 21 (39.6) 29 (54.7)	 10 (13.3) 46 (61.4) 19 (25.3)	11.75	0.002*
Attending health education cessions about autism No Yes	 28 (52.8) 25 (47.2)	 51 (68.0) 24 (32.0)	3.02	0.082
Do you think the autism child can take care of him self No maybe Yes	 10 (18.9) 9 (17.0) 34 (64.2)	 46 (61.3) 27 (36.0) 2 (2.7)	58.53	0.000*
Do you mind to integrate the autism child with others children No Yes	 50 (94.3) 3 (5.7)	 59 (78.7) 16 (21.3)	6.03	0.007*
Believing that autism child receive the suitable care of their case. No Yes	 40 (75.5) 13 (24.5)	 71 (94.6) 4 (5.4)	9.93	0.000*
Availability of centers for autism in your city No Yes	 37 (69.8) 16 (30.2)	 70 (93.3) 5 (6.7)	12.53	0.000*
Is the community aware about caring of autism child: No Yes	 45 (84.9) 8 (15.1)	 75 (100.0) 0 (0.0)	12.07	0.001*

***P<0.05 is statistically significant**

4. DISCUSSION

Autism is one of the most puzzling diseases. It is characterized by a triad of social impairment, repetitive behavior, and communication difficulties, so the child has trouble in linking words to their meaning, doesn't like changes in routines, and acts in an unusual ways(American Psychiatric Publishing; 2000).

It is a devastating condition with no known cure. The rising prevalence, together with the severe emotional and financial impact on the families, underscores the need for searching for the early-life modifiable risk factors (Kidd, 2002).

Our result pointed to the higher risk of autism among boys (76.7%) than girls (23.3%). This finding was consistent with that reported by El Bas et al., (2011) and Itzchak et al., (2010) who found that the percentage of autism was (82%, 81%) among males

compared to (18%, 19%) among females respectively. Moreover Shu et al., (2000) said that autism is more than twice as common in boys as girls. This could be because of genetic differences between both sexes.

In our study, there was statistically significant lower level of maternal education between mothers of autistic children and control group in relation to university graduation which was (49.1%, 78.7%) respectively. This is in contrary with King and Bear man (2011) their results showed that higher levels of parental education and parental economic resources were consistently associated with an increase in the likelihood of diagnosis. In our study although parental economic resources cannot be a measured variable as both cases and controls were Saudis patients and having same eligibility to free services but higher education in the mother may help her avoid the risk factors.

The median age of identification of autistic cases according to our results was 2.8 years. In contrary to Paul et al (0000) who reported that the median age of identification of autistic cases was 5.7 years, This difference can be explained in the light of a wide variation in the age which children present for diagnosis or to obtain necessary therapy. Katarzyna et al., (2006) reported that the earliest symptoms of autism often appear before a child's second birthday, but most children with autism are not diagnosed until they are in preschool or elementary school. (King & Bearman, 2011).

The possibility that autism is more common in offspring of older parents has generated considerable interest (Katarzyna et al., 2006), our study showed that there was significant high maternal age of autistic children than mothers of control group at time of delivery. Father's age at the time of delivery was higher in cases than in controls but this was statistically insignificant. Our result is consistent with Reichenberg et al., (2006) who illustrated that there was an association between advancing paternal age and risk of ASD. Offspring of 40 years men or older were 5.75 times more likely to have ASD compared with offspring of men younger than30 years, Moreover, advancing maternal age showed an association with ASD. Confirmation of such an association could have important public health implications in light of increasing trends in recent decades of maternal and paternal age among KSA community.

Our study showed that the majority of autistic parents were non-consanguineous. This is consistent with many authors (Caronna et al., 2008, Reichenberg et al., 2006) had reported that most of parents of autistic children are non-consanguineous. This is in contrast with Zahrani 2013who found that most autistic children was the product of first degree consanguineous marriage (Al-Zahrani, 2013).

Our study showed a statistically significant difference between cases and controls concerning family history of neuropsychiatric disorders, as 5.7% of autistic children had positive family history of psychiatric disease compared to 0.0% of controls. This is concordant with researchers (Baron-Cohen et al., 2006, Al-Hifthy & Ghaziuddin, 2009) that discovered that parents of autistic children are twice as likely to have had psychiatric illness and those rates of autism rose substantially if parents had suffered schizophrenia, depression or a range of other personality and psychiatric disorders.

Our results revealed that 11.3% versus 0% of families of autistic children and controls respectively had a positive family history of autism and this difference was statistically significant. This is in concordant to AL-Baz et al., (2011) results that reported family history of autism in 16% of cases versus 1% of control.

Regarding antenatal risk factors, our study showed that 43.4% of mothers of autistic patients versus 0.0% of controls were exposed to psychological trauma during pregnancy. This is in agreement with a study conducted by Ronald (2010) et al., who found associations between autism and family discord and women's self-reports of stress during pregnancy. However our result contradict the result of a recent epidemiological study (2012) which found that experiencing a stressful event, such as the death of a family member or a severe illness, during pregnancy does not increase the risk of having a child with autism.

Our results revealed insignificant results of maternal or parenteral smoking this is in contrast with a study by Al-Zahrani (2013) who stated that 33.3% of mothers of autistic children were exposed to negative smoking during pregnancy compared to only 12.8% of controls and this was statistically significant. It is worth mentioning that due to cultural basis we cannot be sure whether mothers of autistic children were smokers.

Our study showed statistically significant lower level of vitamin D between mothers of autistic children and mothers of controls. 45.3% in mothers of autistic children were having Vitamin D deficiency during pregnancy in comparison to 30.7% of controls. This is consistent with Vinkhuyzen et al., 2016; Vuillermot et al., 2017, who reported that children born to women who had low levels of vitamin D were more likely to have autism features than controls.

Our study showed a statistically significant lower percentage of mothers of autistic children who were taking folic acid supplement during pregnancy in relation to controls. 73.6% of mothers of autistic children were taking regular folic acid during pregnancy in comparison with 94.7 %in controls. This is in agreement with a study done by Stephen et al., 2017 who reported that

maternal folic acid use 4 weeks before and 8 weeks into pregnancy is associated with a reduced risk of Autism Spectrum Disorders in offspring

Our study showed statistically significant lower percentage of mothers of autistic children who were diagnosed as iron deficiency anemia 43.4% in comparison with 62.7% of controls. This is in contrary with Rebecca et al., 2014 who reported a higher risk of autism spectrum disorder with reduced maternal intake of supplemental iron.

Regarding natal and post-natal factors, In relation to birth weight and autism, our study showed a statistically significant correlation between low-birth weight and autism 60.4% and 36% for patients and controls respectively. This consistent with Al-Zahrani et al., (2013) who found that low birth weight was 35% of cases compared to 20% of controls. Birth weight is the net result of at least three factors: genetic growth potential, duration of the pregnancy, and rate of fetal growth (Ness et al., 1999). As the genetic growth potential is unknown, and our study showed no significant difference between cases and controls in relation to length of gestation, therefore this indicates that our study shows a relation between being small for gestational age due to intrauterine growth retardation and not to preterm birth is associated with an increased risk of autism. These findings are consistent with results of a recent population-based case-control study conducted in Gregay et al., 2013 which concluded that low birth weight, is strongly related to childhood autism.

Our result showed no significant difference between cases and controls regarding the mode of delivery. This is consistent with Al-Zahrani et al., 2013, but contradictory with Astudy (Gregay et al., 2013) which noted that pregnant women who have their labor started or sped up artificially are slightly more likely to have autistic children, putting an explanation that "infants destined to develop autism are less likely to send out the correct biochemical signals for normal progression of labor. Neonatal complications like respiratory distress were higher in autistic children more than controls but this was statistically insignificant. This is consistent with Al-zahrani et al., (2013) and A meta-analysis review published in 2010 (Garderer et al., 2011) that examined Over 60 perinatal and neonatal factors showed association between fetal distress and an increased risk of autism.

Our study showed a statistically significant difference regarding blood group and Rh between the mother of autistic children and mothers of the control group. Most of the mothers of autistic children were Rh –ve and were A, B, O but not AB and that was statistically significant in comparison to mothers of the control group. This is consistent with a case controlled study done by Braunschweig et al., 2008, who examined the serum reactivity to human fetal brain tissue using serum of mothers of children with autism and found reactivity to 73 kDa band only in mothers of children with autism while it is contrary with Judith et al., 2007 who found lack of association between RH status in pregnancy and autism.

Our results showed a statistically significant direct relation between the prolonged period of exposure to electronic devices and autism in cases in comparison to controls (89.5% and 52% respectively). This is consistent with a study done by Oestreicher et al., 2011, Heffler et al., 2015, who reported that too much exposure to screens especially in boys may stunt social development.

Despite significant higher percentage of mothers who completed their children vaccines in controls than the autistic children. However, 13% of mothers clarified that she noticed the symptoms of autism in her children after MMR vaccination at the age of 18 months. This is consistent with peer-reviewed, published studies that vaccines trigger immune activation events in the brains of babies that lead to autism. This is consistent with studies linking aluminum vaccine adjuvants to the rising prevalence of autism (Tomljenovic & Shaw, 2011). This is in contrary to epidemiological studies that have found no association between measles, measles, as well as mumps, vaccines (as environmental risk factors), and increased risk of autism (Volkmar et al., 2009; Xicy et al., 2006).

5. CONCLUSION

Our study showed that the following are risk factors of autism in children, male gender, high maternal age, positive family history of psychiatric disorder and autism among family members, exposure of mothers to psychological stress were associated with high risk of autism. Other risk factors include low maternal education, low birth weight, Vit D deficiency during pregnancy, reduced folic acid intake during pregnancy, Vaccinations especially MMR and exposure of the children to electronic devices for prolonged periods. These variables should be examined in future studies that use large population based birth cohorts with precise assessments of exposures and potential confounders.

Conflict of interest

No conflict of interest between the authors regarding manuscript, financial and ethical issues

Recommendations

We would like to recommend the screening of the preschoolers with National screening program (CHAT) for the early detection of cases of autism moreover, all children should be screened with standardized developmental tools at specific intervals (at the 9–18–24–30 months) for early detection of ASDs. We also recommend increasing the awareness of populations and families of the early symptoms and signs of autism.

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