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Risk Factors Associated with Autism Among Children

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Abstract **Background:** Autism Spectrum Disorder (ASD) is a lifelong non-progressive, complex neurobehavioral condition that appears at early childhood, characterized by impairments in social interaction, difficulties in communicating and forming relationships with other people and in using language, combined with rigid and repetitive behaviors. **Objective:** We aimed to investigate the risk factors associated with autism. **Methods:** This cross-sectional descriptive study conducted in Khartoum State, Sudan. A sample of 100 children was selected from Autism care centers. The study tools included direct interviews, observation and questionnaire. **Result:** The study revealed that about two-thirds of autistic children were males. Most autistic children showed signs of autism after completing the first year of their life. Similar siblings with autism occurred in 9%. About one-quarter of participants had a positive family history of autism and other mental disorders. About one-fifth of autistic children were dependent on artificial milk during the first six months of their lives. Most of the respondents (90%) started watching television before age one year and more than one-third of them watched television for more than seven hours/day. Two-thirds of respondents used electronic devices before having autism and 40% of them started using electronic devices at the age one year to less than two years for more than four hours/day. **Conclusion:** ASD is more prevalent in males and it appears in early childhood. It is associated with several factors such as heredity, social and economic factors and the early use of electronic devices by children.

Key Words Autism, Children, Risk Factors, Spectrum Disorders, Sudan

INTRODUCTION

Autism Spectrum Disorder (ASD) is a life-long non-progressive, complex neurobehavioral condition that appears in early childhood, characterized by impairments in social interaction, difficulties in communicating and forming relationships with other people and in using language, combined with rigid and repetitive behaviors [1]. The symptoms typically appear during the first three years of life. It covers a large spectrum of symptoms, skills and levels of impairment. It ranges in severity from a handicap that somewhat limits an otherwise normal life to a devastating disability that may require institutional care. Children with autism have trouble communicating with other people [2]. Globally autism was estimated to affect 24.8 million people in 2015 [3]. In 2017 1.5% of children were diagnosed with autism in the developed countries [4]. The ASD is a neurological and developmental disorder that begins early in childhood and lasts throughout a person's life. It affects how a person acts and interacts with others, communicates and learns. It includes what used to be known as Asperger syndrome and pervasive developmental disorders. It is one of five disorders coming under Pervasive Developmental Disorders (PDD). According to the World Health Organization (WHO) in 2016, one child in every 160 children suffers from autism disorders, which appear in childhood and tend to persist in adolescence and adulthood. According to United Nations figures, about 1 percent of the world's population is autistic and males are four times more likely to develop autism than females.

A child with autism is very sensitive and sometimes pained by sounds, touches, smells, or sights that seem normal to others. Also, may have repetitive, stereotyped body

movements such as rocking, pacing, or hand flapping. At times they may not notice people, objects, or activities in their surroundings [2]. There is an unknown single cause but it is generally accepted that it is associated with several factors such as male gender one theory states that females, because of better innate social communication abilities, can camouflage their symptoms and mask their diagnosis. This has been observed in the naturalistic setting of recess in elementary schools, illustrated by females showing compensatory behaviors in social situations. Another hypothesis for the difference in prevalence is that females are protected against an autism diagnosis. In 2017 evidence was published that supports the concept of a female protective effect in autism. This protective effect may be seen in the siblings of females with ASD. To examine this using the big data approach, the rate of autism diagnosis in families was examined when the first child was a male vs the first child was a female. When the older sibling was a female, the recurrence rate was 1.3 times higher than if the older sibling was a male. This is consistent with other data finding that females with ASD have more genetic mutations that are also seen in family members but don't always translate to an ASD diagnosis, hence, a protective effect in females with this shared genetic burden [7]. Genetic factors exist in autism predisposition, genes are responsible for the characteristics and behaviors of autism in the general population as the rates of inheritance in autism are high. Genetics have also helped to explain why autism often co-occurs (comorbid) with other psychiatric issues and disorders. While behavioral overlap is seen between autism and disorders like schizophrenia, Attention-Deficit/Hyperactivity Disorder (ADHD) and anxiety, there have been few studies that identify a genetic overlap. A novel locus on chromosome 10 was identified through a large-scale collaboration of multiple genetic cohorts [8]. Another risk factor of developing ASD is the age of both parents which may hold a risk of having a child with autism. Researchers report that the advanced age of parents is a danger to children, as children are more likely to have autism spectrum as their mother's age compared to the progress of parents. Studies revealed that the combination of prenatal exposures and genetic factors increased autism severity scores in children [9]. Maternal illness and drugs also can be a risk factor to develop ASD, both maternal and paternal prenatal exposures to asthma-causing agents have also been shown to be linked to autism [10]. In 2017 studies replicated and showed a lower probability of having a child with autism after folic acid use during pregnancy [11]. However, a statistical technique has unraveled the role of maternal depression from maternal antidepressant use and found that the use of antidepressants itself was not sufficient to elevate the probability of having a child diagnosed with autism [12]. Moreover, the other risk factor including maternal immune activation in response to an infection, has been shown to raise the probability of having a child with autism up to two-fold. In 2017, toxoplasmosis and herpes were added to the list of possible immune events that can increase risk [13]. In addition to previous risk factors, using electronic devices exerts its effect on developing ASD. The American and Canadian Children's Association stressed that children under the age of two should not be exposed to technology and smart devices and only one hour per day for children between 3-5 years and 2 hours for those aged 6-18 years. Researchers explained that there are 10 reasons that mobile devices should be banned for children under the age of 12. Technology has also shown to be an important adjunct to intervention protocols. For example, the Smart Glass has been repurposed by other companies and is well tolerated and fun for both children and adults with autism, reducing symptoms of ASD, such as challenging behaviors and improving non-verbal communication [14,15]. Augmentative and Alternative Communication [AAC] devices have also been studied in a variety of settings over the past few years, but surprisingly, they have only been investigated for a limited range of communicative gestures, such as requesting [16]. IPads, which are used by so many families or individuals with autism, were not previously studied scientifically in terms of their use for different purposes. In a new study, a group examined if the iPad helped enhance the effectiveness of a home- based parent-delivered intervention. The use of the iPad led to short-term improvements in autism- related behaviors and an increase in certain skills; however, the amount of time kids used the iPad in conjunction with the intervention declined over time [17].

MATERIALS AND METHODS

This is a descriptive cross-sectional study using a qualitative approach conducted in Khartoum state, Sudan among autistic children in autism care centers. We included any autistic children aged

1-12 years in autism care centers in Khartoum State, Sudan whose mothers' accepted participation. We excluded autistic children coming from outside Khartoum State, or their age out of the determined age group, or whose mothers' refused participation. Therefore, we included all autistic children in autism care centers available during the study period of March-June 2018. The total number of included children was 100 participants.

We used a questionnaire as a data collection method, which was first prepared and piloted by a group of respondents to measure its convenience to them. The questions aimed to study the effect of heredity on autism occurrence in children, the role of social and economic factors linked to autism, the relationship between autism and nutrition, medicines and diseases and to trace the effect of using electronic devices in autism. After preparing the final questionnaire, it was distributed to mothers of children under study in the autism centers and collected from them after they filled it.

Data Analysis

We analyzed the collected data first manually by using the tallying method, then entered and represented in charts and histograms by using the Microsoft Excel program.

RESULTS

In this study, we noticed that about two-thirds of autistic children were males, while females represented only one-third. Furthermore, most participants' families have a moderate monthly income and only 19% of the participants live in extended families. Regarding the educational level, most autistic children's fathers and mothers are university graduates as shown in (Table 1).

In this study, we noticed that most autistic children (nearly half of them) showed signs of autism after completing the first year of their life. The majority of children under the study have the first or last order between their brothers and sisters. Moreover, most autistic children's brothers and sisters (90.8%) were not affected with autism and among those who were affected (9.2%), males were the majority (87.5%) of them. Additionally, five twins were found during the study and all of them were affected. Also, we observed that one-quarter of the respondents have relatives suffering from autism or other mental disorders and the majority of them were father's relatives. Regarding the age of the parents of the participants, we found that most of the mothers were at the age of twenty to less than forty years old when the children in the study were born. On the other hand, more than half of fathers were at the age of thirty to less than forty years when children under the study were born as shown in (Table 2).

Regarding the leisure and nutritional habits of the participants, we observed that most of the respondents (80%) were taken into picnics in a few instants. Nearly four-fifths of autistic children were breastfed, while one-fifth of them depended on artificial milk during the first six months of their lives. Obviously, surgery foods topped the list of favorite foods for participants in nearly half of them, followed by starches in nearly one-third of them, then milk and it is products in more than one-fifth of them as shown in (Table 3).

We noticed that the majority more than eighty percent of respondent's mothers didn't suffer from depression or any psychological problems during their pregnancy. Moreover, more than ninety percent of children in the study were normal and healthy when they were born. Additionally, only less than one-tenth of respondent's mothers were living with chronic diseases such as asthma and hypertension, while one-fifth of children's fathers had chronic diseases mostly diabetes mellitus. Most autistic children's mothers (more than three-quarters) did not take medications during pregnancy, except medication that was given to them during the antenatal period as routine medications and the rest of the mothers (more than one-fifth) took treatments for their chronic diseases and infections. Obviously, about one-fifth of respondent's parents were smokers as shown in (Table 4).

Regarding Watching Television (TV), we identified that most of the participants (more than ninety percent) of them were watching TV before having autism. Approximately more than half of the children in the study started watching TV before one year of age one-third of them at the age of one to two years and more than one-third of the participants were watching television more than seven hours per day. On the

Table 1: The sociodemographic features of the autistic patients from autism care centers (N = 100)

Characteristics	N (%)
Child sex	
Male	70 (70%)
Female	30 (30%)
The participants families' socio-economic status	
Low	37 (37%)
Moderate	36 (36%)
High	27 (27%)
Autistic children's fathers' educational level	
Secondary	13 (13%)
University	71 (71%)
Postgraduate	16 (16%)
Autistic children's mothers' educational level	
Secondary	10 (10%)
University	76 (76%)
Postgraduate	14 (14%)
Size of autistic children's families	
Small families	81 (81%)
Extended families	19 (19%)

Table 2: The characteristics of the autistic patients from autism care centers (N=100)

Characteristics	N (%)
Age of autistic child when autism symptoms appeared	
1-12 Months	11 (11%)
12- 24 months	46 (46%)
≥24 months	43 (43%)
Autistic child's order between his/her siblings	
The first child	30 (30%)
In the middle	21 (21%)
The last child	30 (30%)
A twin	5 (5%)
No other siblings	14 (14%)
Occurrence of autism among autistic children's siblings	
No other siblings affected	91 (91%)
Yes (Males)	8 (8%)
Yes (Females)	1 (1%)
Autistic children's relatives suffering from autism and\or other mental disorders	
No	76 (76%)
Yes, from father side	17 (17%)
Yes, from mother side	7 (7%)
The mother's age when her autistic child was born	
20-29 years	48 (48%)
30-39 years	47 (47%)
More than 40 years	5 (5%)
The father's age when his autistic child was born	
20-29 years	1 (1%)
30-39 years	60 (60%)
40-49 years	38 (38%)
50 years and more	2 (2%)

Table 3: The leisure and nutritional habits of the participants from autism care centers (N = 100)

Characteristics	N (%)
Autistic children go out to picnics	
Frequently	18 (18%)
Sometimes	80 (80%)
Never	2 (2%)
Feeding type during first six months	
Breast milk	80 (80%
Formula milk	20 (20%)
Autistic children's favorite foods	
Sugars	48 (48%)
Starches	32 (32%)
Milk and its products	27 (27%)
Meats	18 (18%)
Fruits	12 (12 %)
Snacks	8 (8%)
Soft drinks	7 (7%)
Salty food	5 (5%)
Vegetables	2 (2%)

Table 4: The health status of the parents of autistic patients from autism care centers (N = 100)

Characteristics	N (%)
Maternal psychological state during pregnancy	
Good	19 (19%)
Poor	81 (81%)
Perinatal health status of the autistic children	
Normal	92 (92%)
Abnormal	8 (8%)
Maternal chronic diseases	
Yes	8 (8%)
No	92 (92%)
Fathers' chronic diseases	
Yes	20 (20%)
No	80 (80%)
Maternal use of medications during pregnancy/breastfeeding	
Yes	21 (21%)
No	79 (79%)
Autistic children's parents and smoking	
Yes	20 (20%)
No	80 (80%)

Table 5: Watching TV and using electronic devices habits by autistic patients (N = 100)

Characteristics	N (%)
Watching TV	
Yes	90 (90%)
No	10 (10%)
Age of children when they started watching TV	
Less than 1 year	58 (58%)
1-2 year	31 (31%)
More than 2 years	11 (11%)
Number of hours/days spent by children in watching TV	
1-2 hours	20 (20%)
3-4 hours	18 (18%)
5-6 hours	21 (21%)
7 hours and more	35 (35%)
Not specified	6 (6%)
Using electronic devices before developing autism	
Yes	65 (65%)
No	35 (35%)
Age of children when they started using electronic devices	
Less than 1 year	11 (11%)
1-2 year	40 (40%)
More than 2 years	49 (49%)
Number of hours/days spent by children in watching TV	
1-2 hours	42 (42%)
3-4 hours	31 (31%)
More than 4 hours	27 (27%)

other hand, we defined that two-thirds of the participants were using electronic devices before having autism. Moreover, more than one-quarter of them were using electronic devices more than four hours per day as shown in (Table 5).

DISCUSSION

According to the results of this study, autism spectrum disorder appears in early childhood, during the first three years of life, there are many factors causing autism and not a single factor. The results showed that autism is more prevalent in males compared to that in females, maybe because females have better innate social communication abilities, they can camouflage their symptoms and mask their diagnosis, which is similar to the finding of Loomes R, Hull L, Mandy WPL (2017) in London. During the study of the effect of genetic factors on autism occurrence, five twins were found to be autistic this result is conformable with the results found by Frazier *et al.* [18] in California. When children under the study were born most mothers were at the age of twenty to less than forty years and more than half of fathers were at the age of thirty to less than forty years therefore advanced maternal and paternal ages are independently associated with ASD risk this result is similar to the result of a study done by Croen *et al.* [19]. The results showed that children living in families with low monthly income are less likely to be diagnosed with autism spectrum disorder compared to kids from moderate to high monthly income families, which is similar to the finding of Durkin *et al.* [20].

In this study most respondents were taken to picnics in a few instances due to stigma affects their families because of their child's autistic behaviors. This result is in agreement with that stressed [21]. The minority of respondent's mothers suffered from depression during pregnancy this result was in agreement with the finding of Brown *et al.* [22], that maternal depression itself was not sufficient to elevate the probability of having a child diagnosed with autism. In this study, we found that children's fathers and mothers living with chronic diseases formed the lowest percentage of the participants' children's parents. In the case of asthma, as an example, few percentages of parents were asthmatic, therefore there is a weak relation between autism and asthmatic parents, this found is similar to that of Singer et al who found that both maternal and paternal prenatal exposure to asthma has weakly linked to autism [9]. In this study, the majority of the children started watching television for many hours during the day at small ages and about half of them were using electronic devices at the age of one to less than two years before having autism. Watching television and using electronic devices for many hours during the day at small ages are strong factors in causing autism, this result was in agreement with that stressed by the American and Canadian Children's Association.

CONCLUSIONS

The study concluded that ASD is more prevalent in males compared to that in females, appears in early childhood during the first three years of a child's life and is associated with many factors like heredity, social and economic factors, and the early using of electronic devices by children. It is recommended to review screening and diagnosis procedures for autism and also to apply modern concepts in autism treatment.

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