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Prevalence of gastrointestinal manifestations among autism spectrum disorder children: A retrospective study

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ABSTRACT

Objective: To review the prevalence of Gastrointestinal symptoms among children in King Salman Armed Forces (KSAF) hospital-Saudi Arabia, Tabuk. *Materials and methods:* This study was a retrospective study, which conducted among autism children who visited King Salman armed forces hospital-Saudi Arabia, Tabuk from January 2016 to December 2020. All patients who aged from 2 to 14 years and diagnosed to have autism by DSM-5 criteria and by the assessment card were included in the study. All data was analyzed using the SPSS version 23.0 program (SPSS Inc, Chicago, IL). *Results:* The sample was 91 children diagnosed as ASD, 60.4% of them were ≥7 years, and 39.6% were < 7 years, 73.6% were males. Regarding autism symptoms; 44% delayed speech, 27.5% excessive movement, 4.4% convulsions, 15.4% other symptoms and 8.8% nothing. Most of them (81.3%) suffered at least one gastrointestinal symptom. GI symptoms were selective eating, diarrhea, diarrhea number per day, constipation, difficulty in defecation or pain during defecation, from large stools, a low stool frequency, defecating on himself, blood in stool, having very foul-smelling stools, and the presence of undigested pieces of food in the stool with the prevalence of 73.6%, 28.6%, 24.2%, 41.8%, 29.7%, 30.8%, 36.3%, 23.1%, 6.6%, 52.7% and 35.5% respectively. *Conclusion:* The prevalence of GI manifestations among autism children was 81.3% which was a relatively high when compared with the pervious similar studies. Selective eating, having very foul-smelling stools and constipation were the most common GI symptoms.

Keywords: Prevalence, Gastrointestinal, Autism Spectrum Disorder, Saudi Arabia.

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a critical neuro-developmental ailment that prejudices a child`s capacity to talk and have interaction with others. It additionally consists of limited repetitive behaviors, pastimes and activities. These problems reason extensive deficiency in communal, working and different regions of functioning (Main et al., 2012). Symptom of ASD usually

starts to manifest at early childhood period at 2-3 years old and last for life (Smallwood et al., 2016). Young age at the time of diagnosis, insufficient awareness of physician to this disorder, wide range of symptoms and presentations, may contribute to difficulty and delayindiagnosis of ASD up to 5 years (Smallwood et al., 2016; Stachnik & Gabay, 2010).

Although the incidence of autism has increased remarkably in recent years, most of the research on this topic has been carried out in western countries. However, few reports have been published in developing countries. As known autism is regarded as a neurodevelopmental disorder but the co-morbidity with gastrointestinal and immune systems suggest a common pathophysiological mechanism affecting these three systems (Hussein et al., 2011). However, Gastrointestinal (GI) manifestations are one of the greatest repeated glitches among autistic children (Al-Salehi et al., 2009). The greater focus on gastrointestinal symptoms among ASD patients is based on its possible impact on child behaviors (Al Shirian & Al Dera, 2015).

More Research is needed to ascertain the prevalence of GI symptom among ASD patient to provide evidence based clinical algorithms to help guiding physician in evaluation and treatment of ASD patient with GI symptom and continued monitoring and observation are needed also to document the changes over time. Herein we aimed to review the prevalence of gastrointestinal symptoms among children in KSAF hospital-Saudi Arabia, Tabuk.

2. MATERIALS AND METHODS

This study was a retrospective study, which conducted among autism children who visited King Salman armed forces hospital-Saudi Arabia, Tabuk from January 2016 to December 2020. All patients who aged from 2 to 14 years and diagnosed to have autism by DSM-5 criteria and by the assessment card were involved in the study. However those who diagnosed with confirmed metabolic OR genetic disorders and/or those with structural brain abnormality were excluded.

Collected data included: the demographics of parents, MRN number, age, sex, anthropometric measurement, nutritional history, gastro-intestinal symptom (mouth ulcer, odynophagia, dysphagia, hematemisis, retching, bloating, belching, reflux, nausea, vomiting, abdominal pain or distension, abnormal bowel habit, gaseousness, food intolerance, abnormal appetite, melena, hematochezia, tenesmus, incontinence, perianal abscess, fistula or tag), extra gastrointestinal symptoms, behavioral aspect and family history.

Statistical analysis

Data was entered into an electronic database. All data was analyzed using the SPSS version 23.0 program (SPSS Inc, Chicago, IL). Frequencies for all categorical variables were presented in tables. Socio-demographic variables of the participants were estimated using descriptive statistics, including frequency counts and percentages for categorical variables. Also the prevalence of autism and gastrointestinal symptoms and prevalence of different child behaviors were expressed in frequency counts and percentages.

3. RESULTS

The clinic sample consisted of 91 children with a clinical diagnosis of ASD. Most of them 55 (60.4%) were seven years old or more, the remaining 36 (39.6%) were less than 7 years old. About three thirds of them 67 (73.6%) were males. Most of their mothers 64 (70.3%) were thirty-five years old or more, while 27 (29.7%) were less than thirty-five years old. Regarding the mother's education level; 38 (41.8%) were university level, 40 (44%) were high school or less, 11 (12.1%) were diplom level and 2 (2.2%) were postgraduate. Regarding mother's work; the majority of them 61 (67%) weren't working, 18 (19.8%) were students and 12 (13.2%) were working.

The majority of their fathers 62 (68.1%) were forty years old or more, the remaining 29 (31.9%) were less than forty years old. Regarding the father's education level; 52 (57.1) were high school or less, 30 (33%) were university level, 7 (7.7%) were diplom level and 2 (2.2%) were postgraduate. Regarding father's work; 66 (72.5%) weren't professional workers, 18 (19.8%) weren't working and 7 (7.7%) were professional workers. Concerning the family's monthly income level; 33 (36.3%) were more than ten thousands Saudi Riyal among, 27 (29.7%) were ten thousands and 31 (34.1%) were less than ten thousands. Most of them 63 (69.2%) delivered with normal vaginal delivery (NVD), and 28 (30.8%) the remaining was with the cesarean one. In the first six months, most of them 63 (69.2%) were fed with breast and artificial feedings, 16 (17.6%) were with breast feeding only and 12 (13.2%) were with artificial feeding only. Regarding the breastfeeding duration; approximately half of them 46 (50.5%) were less than six months and 45 (49%) were more than six months. The age of the child at the beginning of weaning was from six to twelve months in 34 (37.4%), more than twelve months in 27 (29.7%), from four to six months in 25 (27.5%) and less than four months in 5 (5.5%). About two-thirds of them 57 (62.6%) were aged three years or more when they diagnosed with autism, and 34 (37.4%) were less than three years old (Table 1).

Table 1 The demographic features of parents and their children:

	Description (n=91)
Child's age	
< 7	36 (39.6)
7 or more	55 (60.4)
Sex	
Male	67 (73.6)
Female	24 (26.4)
Mother's age	
< 35	27 (29.7)
35 or more	64 (70.3)
Mother's education level	
High school or less	40 (44)
Diplom	11 (12.1)
University	38 (41.8)
Postgraduate	2 (2.2)
Mother's work	
Not working	61 (67)
Student	18 (19.8)
Working	12 (13.2)
Father's age	
< 40	29 (31.9)
40 or more	62 (68.1)
Father's education level	
High school or less	52 (57.1)
Diplom	7 (7.7)
University	30 (33)
Postgraduate	2 (2.2)
Father's job	
Not working	18 (19.8)
Professional workers	7 (7.7)
Non-Professional workers	66 (72.5)
The family's monthly income level	
< 10K	31 (34.1)
10K	27 (29.7)
> 10K	33 (36.3)
Baby birth type	
NVD	63 (69.2)
CS	28 (30.8)
Feeding type in the first six months	
Breast feeding only	16 (17.6)
Artificial feeding only	12 (13.2)
Mixed	63 (69.2)
Breastfeeding duration (in months) approx.	

< 6	46 (50.5)
6 or more	45 (49.5)
The age of the child at the beginning of weaning (give him foods other than milk)	
< 4 m	5 (5.5)
4-6 m	25 (27.5)
6-12 m	34 (37.4)
> 12 m	27 (29.7)
Child's age when diagnosed with autism	
< 3	34 (37.4)
3 or more	57 (62.6)

Regarding autism symptoms; 40 (44%) were diagnosed with delayed speech, 25 (27.5%) were diagnosed with excessive movement, 4 (4.4%) were diagnosed with convulsions, 14 (15.4%) were diagnosed with other symptoms and 8 (8.8%) were diagnosed with nothing (figure 1). Regarding autism family history; 73 (80.2%) said they hadn't family history of autism, 13 (14.3%) had and 8 (8.8%) said that they may be had. Regarding the family history of chronic diseases of the stomach, intestines or colon; 46 (50.5%) hadn't, 32 (35.2%) had and 13 (14.3%) may be had. 68 (74.7%) took medications continuously. Most of them 75 (82.4%) hadn't special diet for autism, the remaining 16 (17.6%) had. The majority of them 75 (82.4%) watched TV before the age of two (Table 2).

Table 2 Autism symptoms among children

Has your child been diagnosed with one of the following?	
Excessive movement	25 (27.5)
Delayed speech	40 (44)
Convulsions	4 (4.4)
Others	14 (15.4)
Nothing	8 (8.8)
Is there anyone else in the family who suffers from autism (brothers, sisters, cousins, aunts, uncles or their sons)	
Yes	13 (14.3)
No	73 (80.2)
Maybe	5 (5.5)
Is there anyone in the family suffering from chronic diseases of the stomach, intestines or colon? (parents, brothers, sisters, uncles, aunts, maternal aunts, or their children)	
Yes	32 (35.2)
No	46 (50.5)
Maybe	13 (14.3)
Does the child take any medications continuously?	
Yes	23 (25.3)
No	68 (74.7)
Is the child on a special diet for autism?	
Yes	16 (17.6)
No	75 (82.4)
Was the child watching TV before the age of two?	
Yes	75 (82.4)
No	16 (17.6)

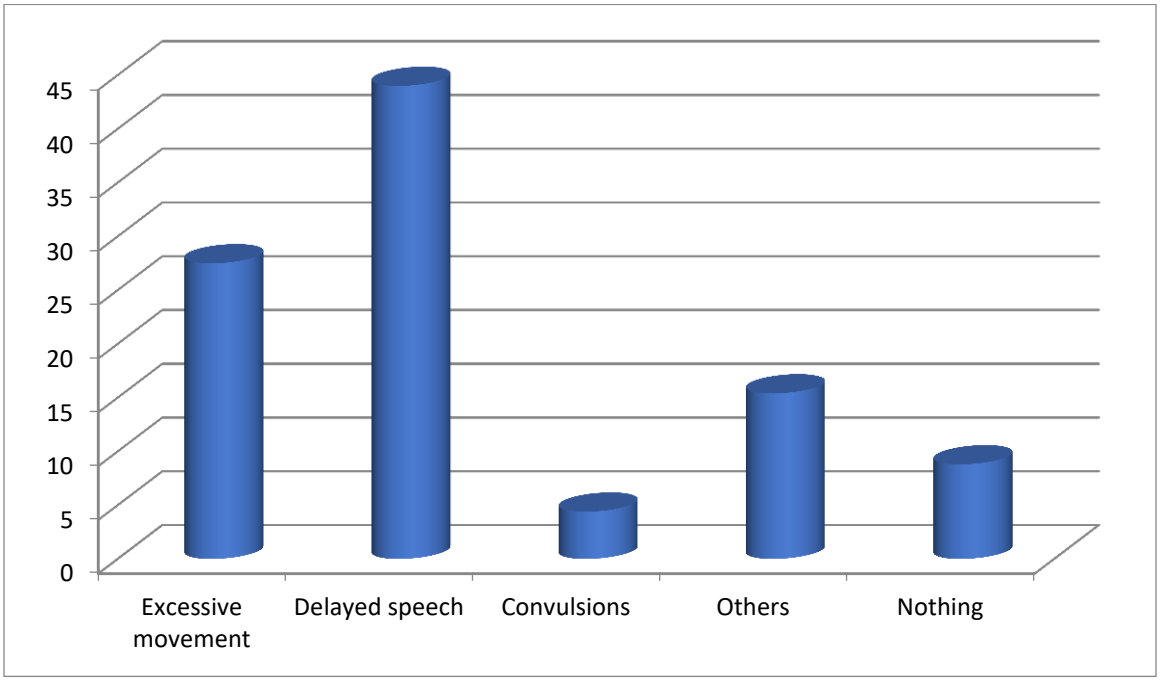

Figure 1 autism symptoms among the studied autitic children

Regarding currently suffering, or had during the past six months of mouth ulcer, difficulty swallowing, vomiting, vomiting blood, flatulence, increase in the size of abdomen, abdominal pain, a significant weight gain and a significant weight loss were 19 (20.9%), 13 (14.3%), 19 (20.9%), 0 (0%), 49 (53.8%), 17 (18.7%), 30 (33%), 42 (46.2%), 21 (23.1%), and 29 (31.9%) respectively. Baby's appetite during the current period or the past six months was normal in 42 (46.2%), increased in 26 (28.6%) and decreased in 23 (25.3%). Concerning the gastrointestinal manifestations symptoms; the currently suffering or had during the past 6 months from selective eating, diarrhea, diarrhea number per day, constipation, difficulty in defecation or pain during defecation, from large stools, a low stool frequency, defecating on himself, blood in stool, having very foul-smelling stools, and the presence of undigested pieces of food in the stool were 67 (73.6%), 26 (28.6%), 22 (24.2%), 38 (41.8%), 27 (29.7%), 28 (30.8%), 33 (36.3%), 21 (23.1%), 6 (6.6%), 48 (52.7%) and 38 (35.5%) respectively. Generally, Most of them 74 (81.3%) suffered at least one gastrointestinal symptom (Table 3). Regarding the child behavior; currently suffering, or had during the past six months from self-aggressive behavior, aggressive behavior towards others, obsessive behavior, decreased baby sleep and a certain food allergy were 32 (35.2%), 33 (36.3%), 21 (23.1%), 30 (33.3%) and 10 (11%) respectively. Most of the questionnaire forms 76 (83.5%) were filled with the child mothers, 7 (7.7%) with their fathers and 8 (8.8%) with both of them (Table 4).

Table 3 Gastrointestinal Symptoms among autism children

Is your child currently suffering, or has during the past 6 months, from mouth ulcers?	
Yes	19 (20.9)
No	72 (79.1)
Is your child currently suffering, or has during the past 6 months, difficulty swallowing?	
Yes	13 (14.3)
No	78 (85.7)
Is your child currently suffering, or has in the past six months, been vomiting (vomiting)	
Yes	19 (20.9)
No	72 (79.1)
Is your child currently suffering, or has had during the past six months, vomiting blood?	

Yes	0 (0)
No	91 (100)
Is your child currently suffering or has suffered during the past 6 months from flatulence?	
Yes	49 (53.8)
No	42 (46.2)
Is your child currently suffering, or has had during the past six months, from nausea?	
Yes	17 (18.7)
No	74 (81.3)
Is your child currently suffering, or has suffered during the past six months, from an increase in the size of the abdomen?	
Yes	30 (33)
No	61 (67)
Is your child currently suffering, or has suffered during the past six months, from abdominal pain?	
Yes	42 (46.2)
No	49 (53.8)
Is your child currently suffering, or has during the past six months, a significant increase in weight?	
Yes	21 (23.1)
No	70 (76.9)
Is your child currently suffering, or has suffered during the past six months, from a significant weight loss?	
Yes	29 (31.9)
No	62 (68.1)
Baby's appetite during the current period or the past six months	
Normal	42 (46.2)
Increased	26 (28.6)
Decreased	23 (25.3)
Does your child currently suffer, or has during the past six months, suffered from selective eating (choosing certain types of food and refusing others)?	
Yes	67 (73.6)
No	24 (26.4)
Does your child currently suffer or have had during the past 6 months from diarrhea (the stools are liquid or close to liquid)	
Yes	26 (28.6)
No	65 (71.4)
Does your child currently suffer or have had during the past 6 months from diarrhea (the number of bowel movements 3 or more in a day)	
Yes	22 (24.2)
No	69 (75.8)
Does your child currently suffer or have suffered during the past six months from constipation?	
Yes	38 (41.8)

No	53 (58.2)
Is your child currently suffering, or has during the past six months, difficulty in defecation or pain during defecation?	
Yes	27 (29.7)
No	64 (70.3)
Is your child currently suffering, or has had during the past six months, from large stools?	
Yes	28 (30.8)
No	63 (69.2)
Is your child currently suffering, or has during the past six months, had a low stool frequency (two or fewer bowel movements per week)	
Yes	33 (36.3)
No	58 (63.7)
Is your child currently suffering, or has suffered in the past six months, from defecating on himself (if he has mastered poo control)	
Yes	21 (23.1)
No	48 (52.7)
Not trained	22 (24.2)
Is your child currently suffering, or has during the past 6 months, blood in the stool?	
Yes	6 (6.6)
No	85 (93.4)
Is your child currently suffering, or has had during the past six months, from having very foul-smelling stools?	
Yes	48 (52.7)
No	43 (47.3)
Is your child currently suffering, or has during the past 6 months, the presence of undigested pieces of food in the stool?	
Yes	35 (38.5)
No	56 (61.5)
Any symptoms of the digestive system	
Yes	74 (81.3)
No	17 (18.7)

Table 4 Children behavior

Is your child currently suffering, or has during the past six months, suffered from self-aggressive behavior (self-injury)?	
Yes	32 (35.2)
No	59 (64.8)
Is your child currently suffering, or has suffered during the past six months, from aggressive behavior towards others (hurting others)?	
Yes	33 (36.3)
No	58 (63.7)
Is your child currently suffering, or has during the past six months, obsessive behavior?	

Yes	21 (23.1)
No	70 (76.9)
Baby sleep during the current period or for the past six months	
Normal	57 (62.6)
Increased	4 (4.4)
Decreased	30 (33)
Does your child currently suffer or have suffered during the past six months from a certain food allergy?	
Yes	10 (11)
No	81 (89)
Who filled out this questionnaire?	
Mother	76 (83.5)
Father	7 (7.7)
Both of them	8 (8.8)

4. DISCUSSION

A potential relationship between autism and gastrointestinal (GI) disorders has been the subject of much discussion and controversy. Reports of this association go back to the 1970s when nutrition was thought to be involved in the pathophysiology of autism. Herein we conducted a similar study that concerning to review the prevalence of gastrointestinal symptoms among children in King Salman armed forces hospital-Saudi Arabia, Tabuk.

In most reported studies, the frequency of GI tract symptoms among children with ASD ranges from 9% to 93% depending on the method (retrospective and prospective studies) compared with 9%–37% for children without ASD (Buie et al., 2010; Black et al., 2002; Levy et al., 2007; Horvath & Perman, 2002; Edelson, 2021; Holingue et al., 2015; McElhanon et al., 2014; Korterink et al., 2015). Regarding our results we reported that 81.3% of our participants suffered from at least one gastrointestinal symptom, these results matched with a study by Horvath & Perman (2002) who observed clinical symptoms from the GI tract in 84.1% of children with ASD. Also a recent study conducted by Edelson (2021) reported most participants had at least one reported gastrointestinal symptom (93.2%) and had more than one gastrointestinal symptom (88.1%). Additionally, a review of the literature conducted by Holingue et al., (2015) reported lower prevalence where it was 46.8%. However, a study by McElhanon et al., (2014) based on a review of hospital documents, showed that GI tract diseases were diagnosed equally frequent in children with ASD and in a control population (9% vs 9%). One possible reason for the variant prevalence can be due to methodological differences such as how GI symptoms are measured in the different studies. This may also reflect the overall variability of the rates of functional gastrointestinal symptoms in children across different ethnic and socio-economic groups (Korterink et al., 2015).

Regarding the gastrointestinal symptoms we found that, flatulence (53.8%), very foul-smelling stools (52.7%), abdominal pain (46.2%) and constipation (41.8%) were the most prevalent symptoms and only 28.6% suffered from diahrrea. Our results matched with Holingue et al., (2015) who reported that excessive gaseousness, abdominal bloatedness and flatulence were the most common GI symptoms among ASD children. We also were in line with (Wasilewska & Klukowski, 2015) who reported that commonest GI indications comprise flatulence (60%), inflating (38%), abdominal discomfort (37.8%), diarrhea (28%), burping (25%), gastro esophageal reflux complaints (16%), and constipation (10%). Additionally, The GI symptoms described in the literature are nonspecific and have included chronic diarrhea, constipation, foul smelling stools, gaseousness, abdominal bloating, abdominal pain, vomiting, and belching (Horvath & Perman, 2002). Furthermore a meta-analysis study conducted by McElhanon et al., (2014) which disclosed that Children with ASD have a history of GI symptoms of severe diarrhea, constipation, and abdominal pain. The occurrence of gastrointestinal ailments in children with ASD is questioned as a possible link between gastrointestinal disorders and the sternness of ASD symptoms. Behavioral traits that are thought to represent gastrointestinal problems are common in children with ASD (Wasilewska et al., 2015). Common motor behaviors characteristic of this cluster of children include self-harm, increased repetitive / stereotypical movements, abnormal posture, or knock / convulsions. Abdominal pain and abdominal discomfort in children with ASD may indicate motor agitation, which affects the child's general condition and manifests as irritability, opposition, and sleep disorders (Buie et al., 2010). Children with abdominal pain are more likely to have these mental illnesses, anxiety, interactive difficulties, or other mental symptoms (Wasilewska et al., 2015).

Our results reported that the prevalence of child behavior current or during the last six months was as following; 36.3% aggressive behavior towards others, 35.2% self-aggressive behavior (self-injury), 23.1% obsessive behavior, 33% decreased in baby sleep and 11% a certain food allergy. In a study by Gorrindo et al., (2012) the most common GI dysfunction symptoms were sleeping complaints and food bigotry nonetheless not with petulance or ferociousness (Gorrindo et al., 2012). Sleep problems are integral components of both the GI system and ASD. Additional digestive symptoms of the digestive tract include difficulty falling asleep and difficulty falling asleep, found in 44-83% of children with ASD (Wasilewska & Klukowski, 2015; Schreck et al., 2004). Horvath and Perman (2002) stated sleep disturbances and nocturnal awakenings in 52% of children with ASD have gastrointestinal manifestations. These results matching with ours where 33% of our participants reported decreased in baby sleep hours.

The present study had several limitations important to be addressed in future studies. As with other retrospective studies, these limitations include recall bias, missing data, ability to only extract data that was collected previously, temporal ambiguity about the onset of GI problems relative to the onset of autism symptoms, and lack of standardized definitions for GI problems. Another limitation is the lacking of a control group and a few numbers of participants is also considered. Last, participants included in this study were selected based on having at least one GI symptom, so the results may not be representative of the general population of those with ASD. A recommendation for future researchers interested in making meaningful comparisons across the patient and control groups is to develop well-designed protocols using standardized definitions and criteria for each GI symptom or disorder.

5. CONCLUSION

The prevalence of GI manifestations among autism children was 81.3% which was a relatively high when compared with the pervious similar studies. Selective eating, having very foul-smelling stools and constipation were the most common GI symptoms. Aggressive behavior towards others, self-aggressive behavior and decreased baby sleep were the most common children symptoms among our population.

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Informed consent

Informed consent was obtained from all participants included in the study.

Ethical approval

The work was approved from the research ethics committee of Majmaah University, with ethical approval number (KSAFH-REC-2019-270).

Author Contributions

All the authors contributed evenly with regards to data collecting, analysis, drafting and proofreading the final draft.

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Conflict of Interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are presented in the paper.

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