

Exploring Health Situation of Indian Children with Autism Spectrum Disorder Using Autism Treatment Evaluation Checklist (ATEC) in an Urban Area of Odisha: A Case Study

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ABSTRACT

Introduction: Autism or Autism Spectrum Disorder (ASD) is a complex behavioural disorder in children with uncertain aetiology. Gastrointestinal metabolites have direct impact on brain function with possible role in its causation. Data on burden of Autism in India is sparse.

Aim: The aim of the study was to determine the extent of social, communication and behavioural impairment among children suffering from ASD patients in Odisha.

Materials and Methods: A cross-sectional study design was used to assess 20 children with ASD in Odisha using an autism treatment evaluation checklist to understand the extent of social, communication and behavioural impairment in them. Of these, 72% children were diagnosed with ASD within 2 to 2.5 years of age and 38.9% patients suffered from diarrhoea together with constipation at the time of the study.

Result: There was moderate impairment in, subclasses I (Speech/ language/ communication), II (sociability), III (sensory/ cognitive awareness) and overall score but mild impairment in subclass IV (i.e., health/ physical/behaviour). Possibly, the training programme of the school had positive impact on the behaviour and the health component. Severity of scores in subclasses was less in older children. There is need for training in order to improve the communication and social interaction domain of these children.

Conclusion: This study has provided valuable insight into the health situation of children with ASD. The study has been carried out using ATEC checklist. It points towards the need for training in order to improve the communication and social interaction domain of these children. It also reinforces the necessity to carry out further studies to explore possible link of gastrointestinal metabolites in causing ASD and age related changes in ATEC score of these children.

Keywords: Body mass index, Behavioural disorder, GI disorder

INTRODUCTION

Autism or Autism Spectrum Disorder (ASD) is a complex behavioural disorder in children that either appear at birth or after a period of normal growth (regressive autism). Recent reports indicate that there are 67 million cases of ASD worldwide [1]. According to Centre for Disease Control, the prevalence of autism in USA increased from one in 150 to one in 68 children (aged 8 years) between 2000 and 2014 [2]. Among Asian countries, in South Korea the reported prevalence is approximately 1 in 38 children [3]. Improved diagnostic facilities could partly contribute to increased prevalence rates.

Even though multiple genetic (almost 10 gene) and non-genetic factors including environmental factors have been implicated, the exact causative agent is still unknown [4]. The increasing trends globally, mandate explorative studies to determine the role of some of these environmental factors. More recently, it has become apparent that gastrointestinal metabolites have direct impact on brain function and might be responsible for ASD [5].

In India, however there is no information on trends of autism. Lack of adequate diagnostic facilities; paucity of prevalence, burden of disease studies; low priority in research could be some of the challenges that will have to be addressed.

In 80-90% children with ASD, symptoms appear before the age of three and persist throughout their life span. They seem to develop normally until around 18 to 24 months of age and then they stop gaining new skills [6]. Currently the diagnosis rests on phenotypic expression like impairment in social interaction, impairment in communication and stereotyped behaviour. Available diagnostic

methods include - Observation Schedule (ADOS-G), Childhood Autism Rating Scale (CARS), Autism Diagnostic Interview-Revised (ADI-R) and Autism Treatment Evaluation Checklist (ATEC) [7]. ATEC form has been developed by Autism Research Institute and it successfully studies the treatment effect and progress made over defined period of time [8]. Remarkably, ATEC scores also correlate well with the physical symptoms.

Though, there is an universally accepted diagnostic criteria and treatment evaluation method for ASD, it is important to realise that genetic diversity, cultural and environmental differences does influence the behavioural, social communication pattern in children suffering from ASD. In India, there appears to be a paucity of information regarding the extent of social, communication and behavioural impairment among children suffering from ASD patients. Through this study we intend to throw some light on these aspects in children with ASD from the city of Bhubaneswar, in an eastern state (Odisha) of India, using the ATEC check list.

MATERIALS AND METHODS

A cross-sectional study was carried out between July 2014 and Dec 2014 among children with ASD attending 'school for speech therapy' and 'school for ASD children' at Bhubaneswar after obtaining ethical clearance from the institutional ethics committee. Out of 40 children attending these schools during this time, 20 were available for the purpose of the study. Since, these children with ASD were admitted to the school based on the diagnosis made by the respective treating paediatrician, it wasn't necessary to independently verify the diagnosis using standard diagnostic

Percentile	Mild autism	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99 Severe autism
ATEC score	0-30	31-41	42-50	51-57	58-64	65-71	72-79	80-89	90-103	104-179	180

[Table/Fig-1]: Relationship of ATEC scores and percentile distribution of severity of Autism [9].

criteria for the purpose of inclusion in the study. The inclusion criteria included children between 2 year and 20 year, non-usage of antibiotics or antifungal medication during the previous one month. Children with severe GI symptoms and enteric infections were excluded from the study. Data was gathered from caregivers of subjects using ATEC form. This one page form is designed to be completed by parents, teachers, or others who see the individual's behaviour on a regular basis and evaluate them on 77 items. It consists of four subsets scales: I) speech/language/ communication (14 items—score range from 0 to28); II) sociability (20 items— score range from 0 to 40); III) sensory/ cognitive awareness (18 items— score range from 0 to 36); and IV) health/physical (25 items— score range from 0 to 75). Total score can be calculated by adding the score of four subset scale (range of the total scores 0 to 180). Higher the subscale and total score, the more impaired is the subject. If the score closes to or equals to zero, then it becomes difficult to distinguish the child from a non-autistic one and indicate full recovery [10]. [Table/Fig-1] shows the score range and percentile levels, whereas [Table/Fig-2] indicates important benchmark of the scoring and the levels of impairment.

STATISTICAL ANALYSIS

Data was analysed using Microsoft excel 2013. Categorical data was presented using relative frequencies. Numerical data was summarised using mean, median and range. ATEC score was calculated for various subcategories using standard guidelines as mentioned above. Scatter diagram was used to visualise the relationship between BMI and ATEC scores. Categorical data were presented using bar charts wherever appropriate. Radar chart was used to display the performance in four categories under ATEC checklist.

RESULTS

Twenty children in the age group 2 to 20 years participated in the study with male and female ratio of 3:2. Of these, 72% children were diagnosed with ASD within 2 to 2.5 years of age. None of these had severe GI symptoms, though 5 patients suffered from diarrhoea together with constipation, 6 ASD patients had either diarrhoea or 6 ASD patients had constipation [Table/Fig-3].

The Median scores for each scale was computed and placed as per the percentiles to indicate severity and functional status in each of these domains as shown in [Table/Fig-1,2,4].

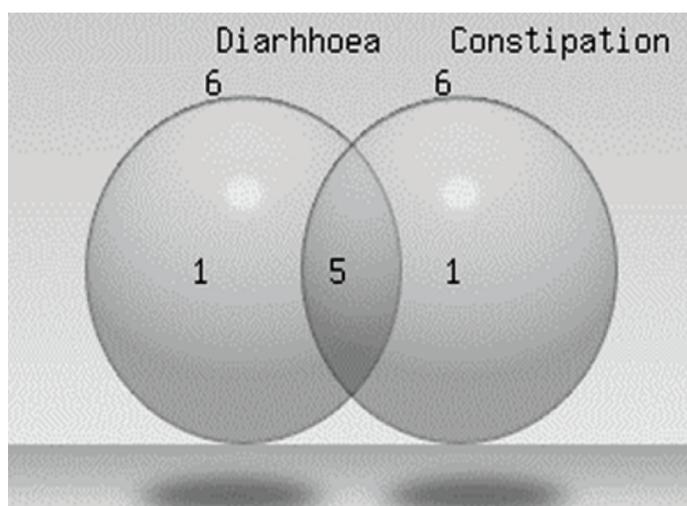
The mean value of score in each subclass and the median total score is shown in [Table/Fig-5]. Speech/language/communication, sociability and sensory/cognitive awareness scores were within the moderate and severe range, whereas health/physical/Behaviour was found to be in mild range. Average total score of autism in these subjects was found to be in moderate category.

Different subclasses scores of ASD children varied with the age [Table/Fig-6]. This indicates the possibility that the brain activity of these ASD children could be changing with rising age. Variation of subscale scores noticed in 2-4 year, 5-7 year and 8-20 years range is being shown in [Table/Fig-7]. Interestingly, subscales do not vary much within the 7-12 years range [Table/Fig-6].

Body Mass Index in Children with ASD: BMI was used to classify nutritional status of these children. BMI of majority of the ASD patients (63%) were not in the normal range. Forty seven percent of ASD children were underweight, and 15% were obese or overweight. BMI of most of these ASD patients within 1-7 year age were not in normal range.

ATEC score below 50	Upto 19 percentile. ATEC<9 fare better, Behaviour more or less normal, able to carry out two way conversations
ATEC score between 51 and 103	Between 20 and 79 percentile level. Child may lead semi-independent lives.
ATEC score >104	More than 80 percentile level. Severely autistics.

[Table/Fig-2]: Functional status of Autism as per the ATEC score and its correlation with the severity status as per percentile chart.



[Table/Fig-3]: Venn diagram showing distribution of ASD children as per the gastro intestinal symptoms

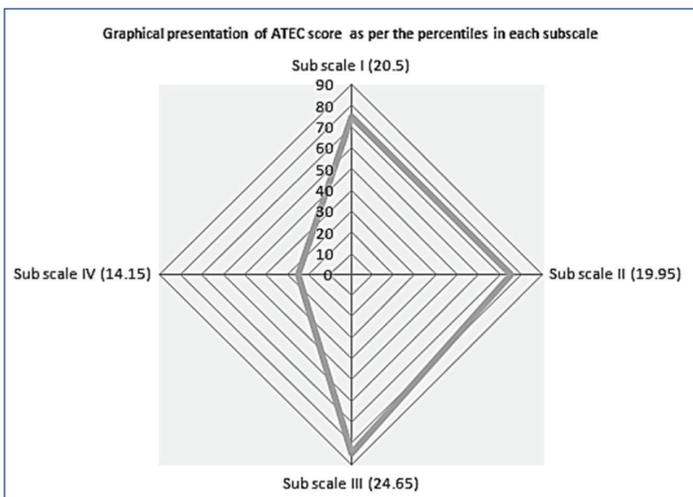
	Sub Scale I	Sub Scale II	Sub Scale III	Sub Scale IV	Composite score
Percentile	Range: 0-28	Range: 0-40	Range: 0-36	Range: 0-75	Range: 0-179
Mild					
0-9	0-2	0-4	0-5	0-8	0-30
10-19	3-5	5-7	6-8	9-12	31-41
20-29	6-7	8-10	9-11	13-15	42-50
30-39	8-10	11	12-13	16-18	51-57
40-49	11-12	12-13	14-15	19-21	58-64
50-59	13-15	14-15	16-17	22-24	65-71
60-69	16-19	16-18	18-19	25-28	72-79
70-79	20-21	19-21	20-21	29-32	80-89
80-89	22-24	22-25	22-25	33-39	90-103
90-99	25-28	26-40	26-36	40-75	104-179
Severe					

[Table/Fig-4]: Distribution of calculated ATEC outcome scores in different scales as per the percentile ranking of severity of Autism.

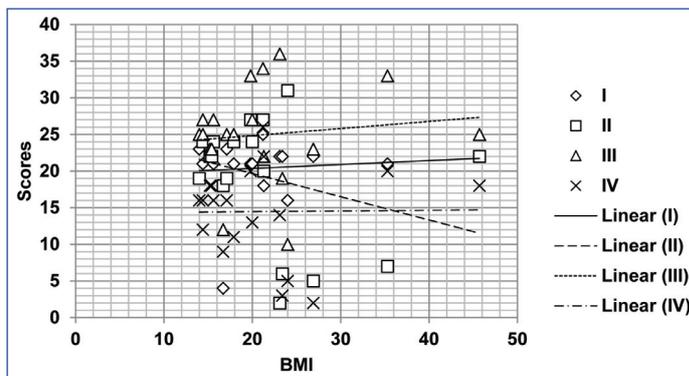
DISCUSSION

Autism is a developmental disorder, associated with difficulty in social interaction, impaired communication and repetitive behaviour. The difficulty in communication also causes social isolation. In this study multiple domain of autistic children behaviour was measured by ATEC check list. Result from this study [Table/Fig-4] indicate that the subjects had moderate impairment in, subclasses I, II, III and overall score but mild impairment in subclass IV (i.e., health/physical/behaviour). Possibly, the training programme of the school had positive impact on the behaviour and the health component.

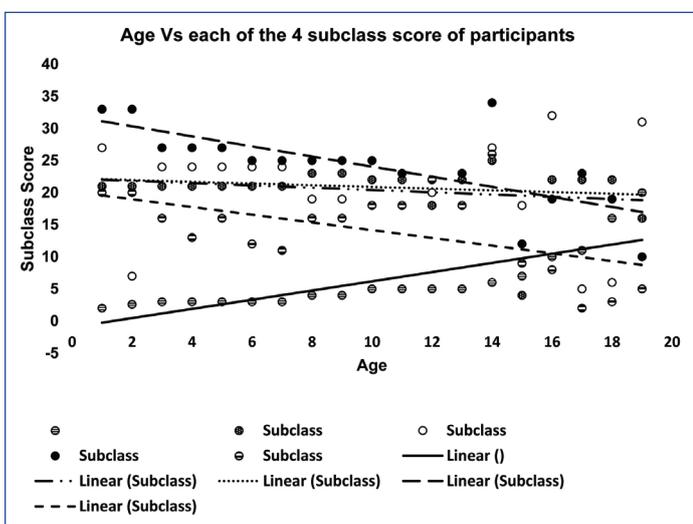
Though our study found that diarrhoea or constipation or both was common in 60% of the children with ASD, studies done



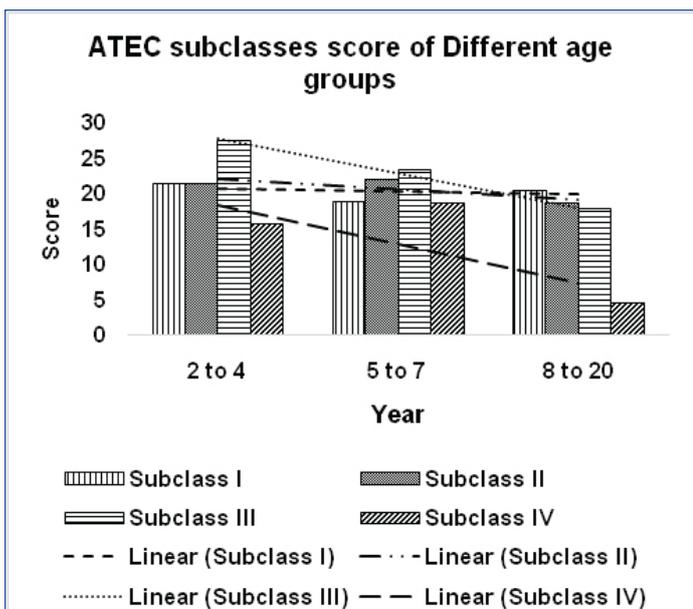
[Table/Fig-5]: Radar chart displaying relative position of ATEC scores for sub scales/subclass I to IV



[Table/Fig-8]: Relationship between BMI and Subclass 1 to IV ATEC scores for the study population



[Table/Fig-6]: Variation of Subclass I to IV scores with age of the study population



[Table/Fig-7]: Showing change of ATEC 4 subclasses score in ASD patients of 3 different age groups. [2 to 4 (n=9), 5 to 7 (n=6), 8 to 20 (n=5)]

elsewhere have reported up to 70% of children with ASD to have GI related symptoms including abdominal distension, pain, irritability, constipation, diarrhoea, feeding problem [11]. ASD are often associated with chronic inflammatory processes like nodular

lymphoid hyperplasia (NLH), enterocolitis, mucosal infiltration of immune cells in small and large intestine [12].

Recently it has been reported that some factors in gut (metabolites, micro flora etc.) may influence ASD [5]. Intra cerebroventricular (ICV) infusions of enteric bacterial metabolite propionic acid (PPA) also induce ASD-like behaviour in rat [13]. PPA can cross the blood brain barrier. Different gut metabolites, like SCFAs (n-butyrate, acetate and propionate), neuroactive peptides of food and serotonin also influence ASD [5]. This could be studied in future studies in children with ASD.

It appears from the scatter gram of age and subclass ATEC scores that the severity of scores is less in older children. Longitudinal data is needed to comment on the relationship between age and ATEC scores and this is one of the limitations of this study. Recently several studies have reported age related changes in autism [14-18]. In autistic individuals, hippocampus (part of the limbic system) is neurologically immature. Hippocampus is responsible for the processing of all sensory input including auditory information. Besides this, hippocampus has a role in learning and memory [19,20]. Age related changes of hippocampus of autistic patients may be important target for treatment. Besides this, variations of gut metabolites along with gut microbiota might also be associated with age related changes and need to be explored further.

Prevalence of ASD along with growing rate of obesity has been reported from different study sites [21]. In this study, 63% of ASD participants had their BMI within abnormal range. There is positive correlation of BMI with ATEC subclass I, III and IV and negative correlation in case of Subclass II and total ATEC score [Table/Fig-8]. However, much cannot be interpreted from this study as most non ASD children in Indian subcontinent also suffer from malnutrition. The BMI and its association with ASD need to be explored in future studies using different approach.

CONCLUSION

This study has provided valuable insight into the health situation of children with ASD and paved way for further exploratory studies. Further research will be needed to study the extent to which training will improve the communication and social interaction domain of these children. It also reinforces the necessity to carry out further studies to explore possible link of gastrointestinal metabolites in causing ASD and age related changes in ATEC score of these children.

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