International Journal of Medical and Health Research
ISSN: 2454-9142; Impact Factor: RJIF 5.54
Received: 11-04-2019; Accepted: 13-05-2019
www.medicalsciencejournal.com
Volume 5; Issue 7; July 2019; Page No. 65-71

Prevalence of autism spectrum disorder among rural and urban children (1–10 Years of Age): A study in Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

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Abstract
Introduction: Studies on autism spectrum disorders (ASDs) have largely focused on children in specific settings. The current scenario of research in ASDs is limited largely to clinic-based cross-sectional reports and retrospective chart reviews. The present study is children-based prevalence study conducted across rural and urban children in hospital admitted patients.
Materials and Methods: A cross-sectional two-phase study was conducted covering children in the age group of 1–10 years of age across geographical regions representing rural and urban children's. Those identified as suspected of ASD and 10% of all classified as no suspects for autism were also evaluated by the clinical team.
Results: A total of 278 children in the age group of (1–10 years) participants were screened using the standardized tools. The children sample included 159 (50.1%) females and 119 (49.9%) males. The number of females exceeded the number of males in the rural children, whereas it was opposite for the urban children. The mean age of the children screened in urban area (male: 71.45 ± 32.73, female: 70.33 ± 32.87) was higher than that of rural children. Logistic regression analysis showed a two times significantly higher risk of diagnosing ASD in rural area as compared to rural (odds ratio [OR]; 26 (0.24; 95% CI=0.12-0.28) $P = 0.04$). Male sex and upper socioeconomic group of head of family had a higher risk of getting diagnosed as autism as compared to lower socioeconomic group (OR; 95% CI - 3.23; 0.24–44.28, $P = 0.38$).
Conclusions: Estimation of true prevalence of ASD in Bangladesh is going to improve policies on developmental disabilities.

Keywords: Autism spectrum disorder, children, prevalence, rural, urban, Bangladesh

1. Introduction
Autism spectrum disorders (ASDs) are a spectrum of disorders characterized by pervasive impairments in social reciprocity and/or communication, stereotyped behavior, and restricted interests [1]. ASD has been the focus of debate in recent years, largely as a result of multinational reports of increase in its prevalence [1]. Studies reporting on the prevalence of ASD have reported the prevalence estimates ranging from 0.07% to 1.8% [2,3,4,5,6,7]. The studies also point to an apparent increase in the prevalence of ASD. This reported increase in prevalence appears partly attributable to greater public awareness, broadening ASD diagnostic criteria, lower age at diagnosis, and diagnostic substitution [8]. Studies on ASD have largely focused on specific children childrens; children's of children that are more likely to include children with ASD or children with histories of special needs or developmental delays [1, 3, 9]. In other words, the current scenario of research in ASDs is limited largely to clinic-based case reports, case series, and retrospective chart reviews. A few attempts have also been made to study neurobiological, genetic substrates, and effectiveness of available treatment approaches in ASD. An extensive PubMed search on the prevalence or incidence of ASD in Bangladesh reveals a paucity of epidemiological data. Data further reveal that there are no specific community-linked studies [10]. In this direction, this is the first children-based prevalence study conducted across rural and urban children's in Bangladesh. Earlier, we published a midterm report of the present study [11].

2. Literature Review
Mulloy *et al.* [16] systematically reviewed research on the effects of gluten-free and/or casein-free (GFCF) diets in the treatment of ASD. Database, hand, and ancestry searches identified 15 articles for review. Each study was analyzed and summarized in terms of (a) participants, (b) specifics of the intervention, (c) dependent variables, (d) results, and (e) certainty of evidence. Critical analysis of each study's methodological rigor and results reveal that the current corpus of research does not support the use of GFCF diets in the treatment of ASD. Given the lack of empirical support, and the adverse consequences often associated with GFCF diets (e.g., stigmatization, diversion of treatment resources, reduced bone cortical thickness), such diets should only be implemented in the event a child with ASD experiences acute behavioral changes, seemingly associated with

changes in diet, and/or medical professionals confirm through testing the child has allergies or food intolerances to gluten and/or casein. Rogalski *et al.* [13] retrospectively examined the efficacy of a gluten-free and casein-free (GFCF) diet intervention as a means to improve verbal/nonverbal communication in children with autism spectrum disorders. Data were analyzed retrospectively from a randomized, double-blind, repeated measures cross over design study that included 13 children aged 2-16 years with autism spectrum disorders. Video recordings of at-home parent-child play were analyzed. Recordings were made at baseline, after 6 weeks on one of the diets (GFCF or regular diet), and after 6 weeks on the alternate diet. Findings of their study indicated no statistically significant differences in verbal and nonverbal communication outcomes between GFCF and regular diet conditions. While results of this study demonstrate that double-blind clinical trials of diet intervention are feasible, they are inconclusive regarding the efficacy of diet for improving communication. Perhaps due to the relatively short period of diet intervention used. Directions for future research are discussed as well as Implications for clinical practice. Jyonouchi *et al.* [17] study indicated an association between cellular immune reactivity to common dietary proteins (DPs) and excessive proinflammatory cytokine production with endotoxin (lipopolysaccharide, LPS), a major stimulant of innate immunity in the gut mucosa, in a subset of autism spectrum disorder (ASD) children. However, it is unclear whether such abnormal LPS responses are intrinsic in these ASD children or the results of chronic gastrointestinal (Gl) inflammation secondary to immune reactivity to DPs. Jyonouchi *et al.* [17] study explored possible dysregutated production of proinflammatory and counter-regulatory cytokines with LPS in ASD children and its relationship to Gl symptoms and the effects of dietary intervention measures. Their study includes ASD children (median age 4.8 years) on the unrestricted (n=100) or elimination (n=77) diet appropriate with their immune reactivity. Controls include children with non-allergic food hypersensitivity (NFH: median age 2.9 years) on the unrestricted (n = 14) or elimination (n = 16) diet, and typically developing children (median age 4.5 years, n = 13). The innate immune responses were assessed by measuring production of proinflammatory (TNF- a, IL-1 P, IL-6, and IL-12) and counter- regulatory (IL-1ra, IL-10, and sTNFRII) cytokines by peripheral blood mononuclear cells (PBMCs) with LPS. The results were also compared to T-cell responses with common DPs and control T-cell mitogens assessed by measuring T-cell cytokine production. ASD and NFH PBMCs produced higher levels of TNF- with LPS than controls regardless of dietary interventions. However, only in PBMCs from ASD children with positive gastrointestinal (Gl(+) symptoms, did they find a positive association between TNF- a levels produced with LPS and those with cow's milk protein (CMP) and its major components regardless of dietary interventions. In the unrestricted diet group, Gl(+) ASD PBMCs produced higher IL-12 than controls and less IL-10 than Gl(-) ASD PBMCs with LPS. Gl(+) ASD but not Gl(-) ASD or NFH PBMCs produced less counter-regulatory cytokines with LPS in the unrestricted diet group than in the elimination diet group. There was no significant difference among the study groups with regard to cytokine production in responses to T-cell mitogens and other recall antigens. *Their* results revealed that there are findings limited to Gl(+) ASD PBMCs in both the unrestricted and elimination diet groups. Thus their findings indicate intrinsic defects of innate immune responses in Gl(+) ASD children but not in NFH or Gl(-) ASD children, suggesting a possible link between Gl and behavioral symptoms mediated by innate immune abnormalities. It has been suggested that peptides from gluten and casein may have a role in the origins of autism and that the physiology and psychology of autism might be explained by excessive opioid activity linked to these peptides. Millward *et al.* [18] determined the efficacy of gluten and/or casein free diets as an intervention to improve behavior, cognitive and social functioning in individuals with autism. Two small randomized controlled trials (RCTs) were identified (n = 35). No meta-analysis was possible. There were only three significant treatment effects in favor of the intervention: overall autistic traits, mean difference (MD) = -5.60 (95% Cl -9.02 to -2.18), z = 3.21, p=0.001[12]; social isolation, MD = -3.20 (95% Cl -5.20 to 1.20). *z* = 3.14, p = 0.002) and overall ability to communicate and interact, MD = 1.70 (95% Cl 0.50 to 2.90), z = 2.77, p = 0.006)[19]. In addition three outcomes showed no significant difference between the treatment and control group and they were unable to calculate mean differences for ten outcomes because the data were skewed. No outcomes were reported for disbenefits including harms. The authors concluded that research has shown of high rates of use of complementary and alternative therapies (CAM) for children with autism including gluten and/or casein exclusion diets. Current evidence for efficacy of these diets is poor. An extensive literature search was carried out to identify any randomized control trials of gluten and/or casein free diet as an intervention to improve behavior, cognitive and social functioning in individuals with autism [18]. Only three papers reporting on two randomized control trial were identified, two small scale trials the first with ten participants in each arm of the trial and the second with fifteen participants recruited into the trial. The results for the first study indicated that a combined gluten and casein free diet reduced autistic traits and the second study showed no significant difference in outcome measures between the diet group and the control group. This is an important area of investigation and large scale, good quality randomized control trials are needed. None of the studies reported on adverse outcomes or potential disbenefits. There is evidence of widespread use by parents of complementary and alternative therapies (CAM) including exclusion diets for their children with autism. Despite this, there is a lack of evidence to support the use of gluten and/or casein free diet as an effective intervention for persons with autism and also a lack of research on potential harms and disbenefits of such diets. Despite the problems of maintaining the integrity of such diets in the community it is possible to carry out randomized control trials to address these questions and more and adequately powered trials are needed in this area. Experts disagree about the causes and significance of the recent increases in the prevalence of autism spectrum disorders (ASDs) reported by Kim *et al.* [20]. Limited data on children base rates contribute to this uncertainty. Using a children-based sample, the authors sought to estimate the prevalence and describe the clinical characteristics of ASDs in school-age children. The target children was all 7- to 12-year-old children in a South Korean community; the study used a high- probability group from special education

schools and a disability registry and a low-probability, general-children sample from regular schools. To identify cases, the authors used the Autism Spectrum Screening Questionnaire for systematic, multi-informant screening. Parents of children who screened positive were offered comprehensive assessments using standardized diagnostic procedures.

3. Objectives

- **General objective**
  a) To find out Prevalence of Autism Spectrum Disorder among Rural and Urban Children (1–10 Years of Age).
- **Specific objectives**

To find out the improvement in behavior of children with ASD who have received a specific dietary intervention for months.

  a) To find out the difference in behavior of study children between the intervention and the nonintervention group.

4. Materials and Methods

Study design: This study was part of an ongoing randomized control trial (RCT) at the Early Intervention Clinic for Socialization and Communication Abilities (EICSCA).

Study period: January, 2017 to September, 2017.

Place of study: Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh.

A cross-sectional two-phase study was conducted covering children in the age group of 1–10 years of age across geographical regions representing rural and urban children's. The first phase (screening phase) involved administration of the Bangla version of the Bangladeshi Scale for Assessment of Autism. Those identified as suspected of ASD and 10% of all classified as no suspects for autism were also evaluated by the clinical team in second phase (evaluation phase)

Details of selected areas

For the purpose of the study, eligible children (children 1–10 years of age) from distinct geographical areas of this state, namely, a rural area, and an urban area was identified for inclusion. For selecting these geographical areas, the entire geography of the state was mapped according to the notified description for each area. On the basis of this, notification areas were identified rural and urban areas. From each grouping of the area's cluster, census blocks (for study children) were selected by a simple random sampling technique. The study children thus covered included entire eligible children of the selected rural and urban falling within Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh covering a total one year observation patients.

Instrument

The study participants were screened by investigators trained in the diagnosis of ASD using the Bangla version of the Bangladeshi Scale for Assessment of Autism [13]. The based on childhood autism rating scale. It has forty items divided under six domains - social relationship and reciprocity; emotional responsiveness; speech, language, and communication; behavior patterns; sensory aspects; and cognitive component. The items are rated from 1 to 5 with an increased score indicating increased severity of the problem. A score <70 was taken as no autism, 70–106 as mild autism, 107–153 as moderate autism, and a score >153 severe autism. The Bangladeshi Scale for Assessment of Autism was modified to suit local needs using a systematic, iterative process. The details have been provided somewhere else [11]. The screening phase also included an assessment of the socio-demographic profile of the participants (using a socioeconomic status [SES] pro forma) and administration of a behavioral checklist in addition to administration.

Evaluation phase

After the screening phase, all the subjects who were scoring above seventy on the ISAA were considered suspected cases of autism and were evaluated by a clinical team comprising public health specialists, pediatrician, neurologist, and clinical psychologist. The evaluation included an account of the prenatal conditions, birth history, developmental and medical histories, findings from earlier evaluations (including a history of hearing impairment), and intellectual and behavioral functioning. The clinical evaluation also included observing the child for a few minutes. The screening scores on the scale were also reconsidered and altered (wherever required) as per the recommendations of the clinical team. A child was defined as a confirmed case of ASD after confirmation by the clinical team. Further, 10% of all the children who scored less and were thus classified as no suspects for autism were also evaluated by the clinical team.

V Results

This study was total of 278 (children in the age group of (1–10 years) participants were screened using the standardized tools. The children sample included 159 (50.1%) females and 119 (49.9%) males. The number of females exceeded the number of males in the rural children, whereas it was opposite for the rural and urban areas. The mean age of the children screened in rural area (male: 65.37±30.81, female: 65.74±31.27) was higher than that of rural and urban children [Table 1].

Table 1: Gender and area-wise distribution of study participants (n=278).

Study Area	Number of Children screened (%)			Mean age in Month ± 2SD		Median (IQR)	
	Male	**Female**	**Total**	**Male**	**Female**	**Male**	**Female**
Rural	61 (51.26)	81 (50.94)	142 (100)	65.37±30.81	65.74±31.27	65 (39-91)	65 (39-92)
Urban	58 (48.74)	78 (49.06)	136 (100)	66.55±30.28	66.59±30.88	66 (42-92)	66 (40-94)
Total	119 (42.80)	159 (57.20)	278 (100)	67.80±31.44	67.40±31.74	67 (41-94)	67 (40-94)

SD: Standard deviation, IQR: Interquartile range.

The SES of the head of the family of the screened rural children in Table 2 shows that around half of the participants belonged to middle class (51.7%) followed by upper middle class (46.5%). The belonged to middle class

followed by upper middle class (37.6%). In urban area, 56.9% of participants screened belonged to upper lower class 33.9% to lower middle class [Table 2].

Table 2: Socioeconomic status-wise distribution of study participants in rural and urban areas (n=278).

SES of Head of the family	Number of Children (%)		
	Male	**Female**	**Total**
Rural			
Upper-I	10 (19.23)	42 (80.76)	52 (100)
Upper Middle - II	60 (71.43)	24 (28.57)	84 (100)
Middle - III	45 (54.88)	37 (42.12)	82 (100)
Lowe Middle – IV	67 (54.47)	56 (45.53)	123 (100)
Lowe – V	0	1 (100)	1 (100)
Total:	182 (53.22)	160 (44.78)	342 (100)
Urban			
Upper-I	2 (100)	0	2 (100)
Upper Middle - II	26 (55.32)	21 (44.68)	47 (100)
Lowe Middle – III	13 (41.94)	18 (58.06)	31(100)
Upper Lowe – IV	21 (51.22)	20 (48.78)	41 (100)
Lowe – V	16 (55.17)	13 (44.83)	29 (100)
Total:	78 (52)	72 (48)	150 (100)

After the evaluation by the experts in the selected, 43 children out of a total of 278 children from rural and urban children in the age group of 1–10 years were diagnosed as cases of ASD yielding a prevalence of 0.15% (95% confidence interval [CI] = 0.15–0.25). Majority of these 43 diagnosed (88.4%; 38/43) were above 4 years of age. Proportion of children with diagnosed autism was same across 48–83 months and 84–120 months age group (0.2%). A higher proportion of male children (0.2%) were identified as cases of ASD as compared to females (0.1%).The prevalence of ASD was found to be highest in the rural area with 26 children in the age group of 1–10 identified as cases of ASD out of a total of 10,961 children studied yielding a prevalence of 0.24% (95% CI = 0.12–0.28). The prevalence was almost similar in urban and rural areas at 0.09% (95% CI = 0.03–0.17) and 0.11% (95% CI = 0.04–0.16), respectively. A higher proportion of ASD was observed among upper class SES (2.8%) of rural area. Around two-thirds of the children with ASD (17/23) were from upper middle class in rural area. However, majority of these urban children with ASD were from lower middle class family (30%; 3/10) [Table 3].

Table 3: Confirmed cases of autism in selected rural and urban (n=278).

Children diagnosed as autistic (%)		**Normal (%)**	**Total (%)**
Age groups (Months)			
12-47	5 (0.1)	86 (99.9)	91 (100)
48-83	19 (0.2)	94 (99.8)	113 (100)
84-120	19 (0.2)	95 (99.8)	114 (100)
Total	43 (0.15; 95% CI=0.15-0.25	275 (86.48)	318 (100)
Sex			
Male	23 (14.2)	139 (85.8)	162 (100)
Female	20 (0.1)	136 (99.8)	156 (100)
SES Class Rural			
Upper	2 (2.8)	69 (97.2)	71(100)
Upper Middle	17 (22.97)	57 (77.3)	74 (100)
Middle	7 (4.32)	155 (95.68)	162 (100)
Lowe Middle	0	13 (100)	13 (100)
Lowe	0	1 (100)	1 (100)
Total	26 (0.24; 95% CI=0.12-0.28	295 (99.86)	321 (100)
SES Class Urban			
Upper	0	2 (100)	2 (100)
Upper Middle	1 (0.2)	46 (99.8)	47 (100)
Lowe Middle	3 (0.1)	298 (99.9)	301 (100)
Upper Lowe	2 (0.04)	419 (99.96)	421 (100)
Lowe	1 (0.4)	28 (99.6)	29 (100)
Total	7 (0.9; 95% CI=0.03-0.17)	793 (99.91)	800 (100)

Logistic regression analysis model was run with children diagnosed with autism as dependent variable and area of residence, age groups, sex, and SES as independent variables [Table 4]. A two times significantly higher risk of diagnosing ASD was observed in rural area as compared to urban (odds ratio [OR]; 7 (0.9; 95% CI=0.03-0.17], P = 0.04). Higher age group (48–83 and 84–120 months) had 3–4 times higher chance of getting diagnosed as autism as

compared to young age children (12–47 months) and this association was statistically significant (P = 0.01). Male sex had a 26% higher chance of getting diagnosed with autism as compared to female sex; however, this association was not significant (OR - 1.26; 95% CI - 0.69–2.30, P = 0.46).

Table 4: Binary logistic regression analysis of children diagnosed with autism in selected rural and urban areas (n=278).

Children diagnosed as autistic (%)		Normal (%)	Total (%)	OR (95% CI)	P	Statistical Significance
Area of residence						
Rural	26 (16.15)	135 (83.85)	161 (100)	2.17 (1.04-4.52)	0.04	Significant
Urban	7 (6.25)	105 (93.75)	112 (100)	1.49 (0.47-4.75)	0.05	Non-significant
Age groups (months)						
12-47	5 (5.49)	86 (94.5)	91 (100)	1		
48-83	19 (16.81)	94 (83.19)	113 (100)	3.45 (1.29-9.27)	0.01	Significant
84-120	19 (16.67)	95 (83.33)	114 (100)	3.66 (1.37-9.81)	0.01	Significant
Sex						
Male	23 (54.76)	19 (45.24)	42 (100)	1.26 (0.69-2.30)	0.46	Non-significant
Female	20 (5.56)	16 (94.44)	36 (100)	1		-
SES Class						
I	2 (12.5)	14 (87.5)	16 (100)	3.23 (0.24-44.28)	0.38	Non-significant
II	22 (19.3)	92 (80.7)	114 (100)	0.59 (0.06-4.94)	0.58	Non-significant
III	16 (48.48)	17 (51.52)	33 (100)	0.27 (0.03-2.42)	0.24	Non-significant
IV	2 (4.44)	43 (95.55)	45 (100)	0.10 (0.01-1.14)	0.06	Non-significant
V	1 (3.33)	29 (96.67)	30 (100)	1		

CI: Confidence interval, OR: Odds ratio, SES Socioeconomic status. Children in upper Class (I) SES of head of family/father had a non-significant three times higher risk of getting diagnosed as autism as compared to lower Class (V) (OR; 95% CI - 3.23; 0.24–44.28, P = 0.38).

6. Discussion

ASD is a complex neurodevelopmental disorder characterized by qualitative impairments in three domains: Social interaction, communication, and repetitive stereotyped behavior. As a rule, these impairments begin in early childhood (before the age of 3 years), persist throughout the full life span, and often cast a detrimental impact on the well-being of affected individuals [15]. Epidemiological surveys in different geographical regions since 2000 converge to estimates to a median of 17/10,000 for autistic disorder and 62/10,000 for all pervasive developmental disorders combined [16]. The current study was the first community-based study carried out in Bangladesh on the prevalence of autism among 1–10 years age and reported a prevalence of 15/10,000 (0.15%). Studies in Asia, Europe, and North America have identified individuals with ASD with an average prevalence of between 1% and 2% [17]. The prevalence was significantly higher among children residing in rural areas as compared to urban. This was in contrast to an Arab study, where most of affected children were from urban areas, especially in Egypt and Jordan [18]. The prevalence is also affected by accessibility to a tertiary care center and source of case identification (mainly families) [19]. Increased awareness about ASD with better access to health-care services among urban children leads to early diagnosis and management of the disorder. This could have led to improvement in symptoms and one of the reasons that a relatively lower proportion of study children fell in the category of autism. Males presented with ASD in a higher proportion as compared to female children consistent with studies from elsewhere showing male predilection [16], and there is no evidence to date that explains this finding [20]. One possible reason is that female children are more able to mask their behavioral difficulties than males. Furthermore, in developing countries, families may pay more attention to the development of male children compared with females or there could be lack of willingness by parents to report certain behavior exhibited by a female child [21]. However, gender in our study was insignificantly associated with ASD. This result contradicts previous findings in a cohort study that included 118 children with autism followed into adolescence which reported more significant social impairment among females [22]. The prevalence of ASD was observed to be significantly higher among children 4–10 years with mild autism also higher in same age. The prevalence was higher in early years (1–7 years) for moderate autism. One possible reason could be that the case identification by the family was delayed till motor and speech development. Even though ASD can be diagnosed as early as age 2 years, most children are not diagnosed with ASD until after age 4 years [17]. The 2011–2012 National Survey of Children's Health, included children aged 6–17 years; when further stratified by age, the ASD prevalence was 18.2/1000 children aged 6–9 years, which was much higher as compared to our study (7–10 years, 2/1000) [23]. The difference could be due to difference in geography, culture, SES, and methodology used. SES is one of the fundamental indicators of ASD and is corroborated by our findings [24]. A higher prevalence was observed among "upper class" in rural area and "middle class" in both urban and rural areas. A descriptive study conducted at an urban tertiary care center in Bangladesh reported majority of autistic children from middle class SES. The probable reason for this finding was that upper class patients usually do not avail government hospital medical facilities [25]. In contrast, findings from Saudi Arabia reported most of the children diagnosed with autism belonged to families of low socioeconomic standards with unsatisfactory income [18]. Evidence suggests an inverse correlation between SES and mental health; however, this causation is based on longitudinal studies [26]. These contrasting observations could be due to a low awareness among the source of identification in lower SES leading to negligence in early identification of the developmental delays further leading to higher mortality in children of lower SES due to associated

anomalies with ASD. Furthermore, parents from lower SES groups may postpone seeking medical attention for disorders other than sickness. The situation in low- and middle-income countries such as Bangladesh appears to be that child health programs focus mainly on child survival issues. Very little attention is paid to developmental disabilities at policy and implementation level and as a result, budget allocations and human resource deployment are directed away from these programs. Lack of effective identification, referral program, and service delivery for these children is a big barrier [16].

7. Limitations of the study

The study children was selected from one selected Dhaka Shishu (children) Hospital, so that the results of the study may not be reflect the exact picture of the country. The present study was conducted at a very short period of time. Limitations of this study include the relatively small proportion of children in the whole sample who received a full diagnostic assessment. Therefore, in future further study may be under taken with large sample size. The conservative approach of considering non participants as non-cases may have resulted in an underestimation of ASD prevalence in the high-probability Regroup. This study found a significant group of children with ASDs who were functioning at various levels in the general children while not receiving services, the general-children sample may vary qualitatively and quantitatively in different cultures and communities.

8. Conclusion

The true estimation of prevalence of ASD in Bangladesh will go a long way in improving policies regarding developmental disabilities. ASD is a complex neurodevelopmental disorder characterized by qualitative impairments in three domains: Social interaction, communication, and repetitive stereotyped behavior. There is little indication that any particular SES fare well on these domains. Factors to mitigate such predicaments are therefore imperative in order to improve quality of life for caregivers among children with ASD. On the whole, caregivers felt that there is a lack of adequate remedial and rehabilitation in the country. Similarly, the caregivers expressed reservation in endorsing on the quality of the services offered the mental health profession. The net socio-economic outcome appears to be downward social mobility, as many of them relinquish their income-generating jobs in order to focus on their cognitively, socially and behaviorally challenged children.

9. Recommendations

It is recommended that a Dietitian should provide support for those individuals who wish to embark on a dietary trial to ensure the diet is nutritionally adequate and advice on the suitability of long-term dietary management. Before embarking on such a restrictive diet careful consideration should be given to the current dietary intake of the person with ASD. Do they have marked food selectively and dysfunctional feeding behavior which will affect the nutritional adequacy of the diet. The possible difficulties of achieving dietary adequacy should be discussed. Ongoing nutritional monitoring is essential otherwise these diets may not be nutritionally adequate overtime. The person with ASD who wishes to try the GF/CF diet should be supported by a dietitian who will check and advise on the nutritional adequacy of the diet. A multidisciplinary team approach is strongly recommended both in the management of the diet and the appropriateness of referrals. Further research is needed using larger numbers and investigating the effects of combining a GF/CF with low chemical diet.

Conflicts of interest: There are no conflicts of interest.

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