

Review article

# Autism and Food Selectivity

Raksha Sharma<sup>1</sup>, Sukriti Ghimire<sup>2</sup>, Kshitiz Upadhyay Dhungel<sup>3</sup>

Think Tank Foundation  
Jorpati, Nepal

<sup>1</sup>Assistant Professor, Far western University, Kanchanpur, Nepal

<sup>2</sup>Researcher, Think Tank Foundation, Jorpati, Nepal

<sup>3</sup>Professor, Department of Physiology, Janaki Medical College, Janakpurdham, Nepal

## ABSTRACT

*Autism is a heterogeneous, neuro-developmental syndrome where patient shows various disorders, collectively known as autism spectrum disorders (ASDs). It mostly begins in infancy or during the first three years of life and has been found more in boys than in girls. The symptoms of ASD often include language regression, motor regression, and loss of bowel and bladder use. ASD also affects the feeding habit of children, with rates up to 74% as compared to normally developing children. Among different problems related to feeding, food selectivity is one of the key problems as it is directly linked with inadequate nutrition. Different factors affecting food selectivity are restrictive and repetitive behaviors, sensory modulation disorder, sensory over responsiveness, frequent illness /physical discomfort, and family preferences of food. Food selectivity among the children with ASD has been reported to be as high as 46-89% as compared to typically developing children. Enough research on linkage of food selectivity with age and other factors is yet to be confirmed. Knowledge and awareness in parents regarding autism and food selectivity may help immensely to diagnose and address feeding problems in ASD at early stage.*

**Key words:** Autism, ASD, Food Selectivity, Restrictive and Repetitive Behaviour

## INTRODUCTION

Autism is a neuro-developmental syndrome that is defined by deficits in communication, unusual restricted and repetitive behaviors which mostly begins in infancy, or during the first three years of life at the latest [1-2]. Autism is a heterogeneous condition i.e. profile of two children or adults may not be the same. Autism, believed to be the result of parental neglect is now characterized as a neuro-developmental and developmental disorder, which is classified into a class of neuro-developmental disorders, and is known as Autism Spectrum Disorders (ASDs). According to the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV), Asperger's syndrome and Pervasive Development Disorder-Not Otherwise

Specified (PDD-NOS) also fall under this spectrum [1]. The symptoms of ASD often include language regression, motor regression, loss of bowel and bladder use, and more often than not symptoms present after the age of three [3-4]. Children with ASDs can demonstrate typical behaviors like unusual attachments to objects, obsessions, compulsions, self-injurious behaviors, and stereotypes which are repetitive, nonfunctional, peculiar behaviors such as hand flapping, finger movements, rocking, or twirling [5-6]. Children with ASDs universally demonstrate deficits in social behavior i.e. they often don't appear to seek connectedness, are happy being alone, and seldom make eye contact or seek for others' attention with gestures or vocalizations [7].

ASD are complex and serious disorders and can affect many areas of life of the child, among others, feeding. The feeding problems in children with autism have been reported differently in different literatures since 1979. Feeding problems were higher in children with developmental disabilities, with rates up to 74% as compared to typically developing children [8]. Kodak and Piazza (2008) also reported feeding problems in approximately 25-35% of neuro typically developing children [9]. Matson et al., 2009 also reported similar problems in almost 60-90% of young children with autism. The most frequent feeding problems in children with ASD as mentioned by authors, includes food selectivity, food refusal, rituals, hyperactivity, problematic meal time behaviors, among others [10].

### ***Prevalence***

Today, Autism have been reported to affect 1 in 68 children has been identified with ASD according to estimates from Center for Disease Control and Prevention (CDC)'s Autism and Developmental Disabilities Monitoring (ADDM) Network. ASD is reported to occur in all racial, ethnic and socioeconomic groups. ASD is about 4.5 times more common among boys (1 in 42) than among girls (1 in 189)[11]. Studies in Asia, Europe, and North America have identified individuals with ASD with an average prevalence between 1% and 2%. Autism Spectrum Disorders are the fastest growing and longest term developmental disability in the United States [11-12]. A cohort born between 1974 and 1983 had a prevalence rate of 3.8 per 10,000 while a cohort of children born from 1984 to 1993 had a prevalence rate of 8.6 per 10,000 [13]. Similarly Yeargin-Allsopp et al. (2003) reported the prevalence of autism at 34 per

10,000 in a sample of children 3–10 years of age collected in Atlanta, Georgia (U.S.A.) from data collected during 1996 [14]. In Australia, Williams et al (2008) reported rates of autism from 2003 to 2004 for 6–12 year olds to be 9.6–40.8 per 10,000 [15].

Virtually no data exist on the population prevalence of autism in low-income countries (LIC). Studies that have been conducted in lower-middle and upper-middle income countries have produced varied results. The prevalence estimates ranges from 0.32 (China: Tao 1987) to 250 per 10,000 (China: Ren et al. 2003) and more recently 90 per 10,000 (India: Raina et al. 2017) [16]. These differences are possibly due to a variety of reasons, including the fact that autism is a spectrum condition according to American Psychiatric Association, 2013, the variety of traits; changing definitions of autism; varying levels of awareness in different countries; cultural variation in expectations and understandings of children's behavior; different methodological approaches used to assess prevalence; and the lack of availability of culturally-sensitive diagnostic tools and year of assessment [18]. The prevalence of ASD among children with developmental disorders in Egypt and Tunisia was documented as 33.6 and 11.5%, respectively [17].

The Autism Care Nepal Society website states that there is "no reliable estimate for the prevalence of autism in Nepal, as autism is not known to many people" (Autism Care Society Nepal). Data is not available from Nepal to provide Nepal-specific prevalence. However, if CDC data is projected in Nepal's current population of 28 million, about 2,00,000–3,00,000 children might be affected from autism [19]. Using Autism Quotient-10, a study was conducted in Makawanpur

district of Nepal by Heys et al. to estimate the autism prevalence in 4098 rural Nepali children aged 9–13 years. Out of that, 14 children had behaviors indicative of elevated autistic symptomatology, of which 13 also screened positive for disability [17].

### ***Diagnosis of ASD***

The diagnosis of autism often is not made until 2 to 3 years after symptoms are recognized, primarily because of concerns about labeling or incorrectly diagnosing the child. Identifying children with autism and initiating intensive, early intervention during the preschool years results in improved outcomes for most young children with autism. Early diagnosis of autism and early intervention facilitates earlier educational planning, provisions for family supports and education, management of family stress and anguish, and delivery of appropriate medical care and treatment [20]. Children can be reliably diagnosed with an ASD between two and three years of age by an experienced clinician. The criterion for an ASD diagnosis is based on The Diagnostic and Statistical Manual 5 (DSM-5) for mental health disorders. Presently, there is no medical test for an ASD. Parents are the first to identify areas of concern. If a parent and/or a medical provider have concerns, then an ASD screen is administered and completed by a trained medical provider [7].

The mean diagnostic age of ASD in Nepal is much later than the age at which a reliable diagnosis is possible, indicating the need to reduce the gap between the age at which it is possible to diagnose ASD, and the average age at which ASD is currently diagnosed [21]. A study conducted in Myanmar revealed that the mean age of diagnosis was 3.5 years old. The minimum age of diagnosis was 1 year old and the maximum was 6 years old. A higher

educational standard of the child's father, and some autism specific signs such as lack of pointing out objects of interest, and poor response to name being called, were associated with an earlier age of diagnosis of autism spectrum disorder. The presence of selective eating habits and co-morbid conditions like epilepsy and global delay, had been found to delay the age of diagnosis of ASDs [22]. Delay in recognition of symptoms, delay in health seeking and lack of awareness even in treating physicians might be the reason for advanced age at diagnosis of autism in Nepal [19].

### **Major Characteristics for diagnosis of Autism**

#### **i) Restrictive Repetitive Behaviors (RRBs)**

Restricted repetitive behaviors (RRBs) are included as one component of the diagnostic criteria for autism. It has been suggested that these dysfunctional, repetitive, and inappropriate behaviors may represent an effort to relieve stress produced by difficulty in processing sensory information. RRBs can range from lower to higher order. Lower-order RRBs include stereotypy, such as hand flapping or self-injurious behavior (eg, head banging, scratching, or biting). These behaviors can be found in children with severe developmental disabilities as well as autism. Higher-order RRBs are more exclusively found in children with autism. These behaviors encompass compulsions, insistence on sameness, and restricted interests. CWA sometimes have odd attachments to and/or unusual preoccupation with objects (eg, fascination with spinning the wheels on a toy truck or gazing at ceiling fans). They also can have a narrow range of interests and compulsively try to steer conversation to discussion of

these interests. These behaviors can restrict participation in functional activities [23-24].

## **ii) Social Functioning**

Difficulty with the development of social relationships is another diagnostic characteristic of ASD. The presence of sensory modulation disorders may further amplify these deficits. Several studies have described links between decrease in social participation and sensory modulation disorders. Lane and colleagues found a clear association between sensory processing dysfunction and impairments in communicative skills. Children with autism and sensory modulation disorders participate less frequently in activities outside the school and home settings and report enjoying those activities less than children with autism who have less prominent sensory modulation deficits [23].

## **iii) Communication problems**

Some children diagnosed with ASD remain mute throughout their lives; others may be delayed but eventually develop language as late as age five to nine years. Some children may learn to use communication systems such as pictures. Those who do speak often use language in unusual ways, some using only single words, others repeating the same phrase over and over. Some children with ASD parrot what they hear (echolalia). Some children who are only mildly affected may have only slight delays in language, or even precocious language and unusually large vocabularies, but have trouble keeping up their end of a conversation, although they often carry on a monologue on a favorite subject. Many of these children also have trouble understanding body language, tone of voice [24]. Body language of children with ASD also may be hard to interpret, since facial

expressions, movements, and gestures rarely match what they are saying. Their tone of voice also fails to reflect their feelings, and is often described as high-pitched, sing-song, or flat and robotic. On the other hand, some children with ASD have fairly good language skills and speak like little adults, failing to pick upon the way their peers speak or adjusting their manner of speech to fit their audience. Without meaningful gestures or the language to ask for things, people with ASD may scream or grab what they want, and may have a limited understanding of what others need. As they grow up, they can become increasingly aware of their difficulties in understanding others and in being understood, and as a result, may become anxious or depressed [25].

## **iv) Sensory problems**

Sensory information helps people learn from what they see, feel, or hear. When sensory input is faulty, the child's experiences of the world can be confusing. Many children with ASD are painfully aware of and sensitive to certain sounds, textures, tastes, and smells. Some children find the feel of clothes touching their skin to be almost unbearable; others cannot tolerate certain sounds, such as a ringing telephone or the vacuum cleaner. In children with ASD, the brain seems unable to balance the senses appropriately. On the other hand, some children with ASD are oblivious to extreme cold or pain, so that if such a child breaks a leg, he may not cry—yet a light touch may make the same child scream with alarm [24].

## **Feeding Problems**

Feeding problems are relatively low in typically developing children in the first years of their life, as compared to children with developmental disabilities [28]. Feeding and

mealtime behaviors in ASD may also be impacted by sensory differences. While tactile and oral defensiveness are seen in typically developing children, they are much more common in children with ASD [29]. The difficulties with sensory processing differences behavioral disorders, oral motor impairments, fine motor impairments and gastrointestinal problems common in individuals ASD may also contribute to feeding problems [30].

Kodak and Piazza (2008) reported consequences of feeding behaviors to malnutrition, dehydration, learning and behavior problems and even death. These consequences are on the severe end of the spectrum, but are nonetheless important motivators for treating feeding disorders [9]. Piazza et al. (2003) defined a feeding disorder as a condition in which a child is incapable or refuses to consume adequate quantities of food or drink to maintain nutritional status, regardless of the cause of the disorder [31]. Though feeding problems are relatively common in childhood across both normally developing children and those with some sort of developmental delay, failure to thrive (FTT) occurs in only about 3% of infants [32]. Pediatric feeding problems are known to result in poorer nutrition and growth, poorer developmental outcomes, and unwanted medical procedures. For children already compromised by communication, social and behavioral deficits, the impact of co-morbid feeding problems may be even more far reaching. The feeding problems observed in children with ASD typically fall into one of two categories: (1) food selectivity (2) Disruptive/problematic mealtime behaviors [26].

### ***Food selectivity***

Food selectivity is a common problem in children with autism spectrum disorder (ASD) and has an adverse impact on nutrient adequacy and family mealtimes [27]. Food selectivity as compared to typically developing children which has been reported to be as high as 46-89% [8]. Food selectivity can create feeding difficulties which may limit dietary intake leading to many negative side effects including, malnutrition, impaired physical development or growth, invasive medical procedures (e.g., gastrostomy tubes), hospitalization, and increased familial stress [33]. Persons with ASD, particularly those with co-occurring intellectual disability, are at increased risk for being overweight in adolescence and adulthood because of having selective eating patterns involving preferences for starches and snack foods. Eating habits which may be formed early in life are one of the factors that contribute to this risk [34]. Children with ASD are up to 40% more likely to be obese than typically developing children. In addition, adults with ASD are at high risk for developing hyperlipidemia, diabetes, coronary heart disease, and cancer [35].

Children with ASD often have feeding difficulties that may present as restricted food intake, texture based food selectivity, food refusal, and/or repetitive food choices [36]. The definition of food selectivity was categorized into three domains: food refusal, limited food repertoire, and high single frequency food intake. If a child experienced any one of the three domains, they were considered to be food selective [37]. Various studies have shown children with autism to exhibit greater selectivity when compared with typically developing children [38-41]. In children who have ASD, selective eating can

be more extreme and may extend beyond early childhood. Clinicians and parents describe children with ASD and accompanying food selectivity as only eating foods of a particular texture, color or flavor, off of a particular plate and/or with certain utensils [42]. This food selectivity poses a significant concern for parents because it has been associated with inadequate nutrition intake [37] and is often accompanied by disruptive mealtime behavior. Another possible factor is restrictive and repetitive behaviors (RRB) which can play a role in mealtime behaviors that may lead to a selective eating. For example, a child may insist on a particular utensil or dish for every meal or may only eat one type of texture, taste, scent, etc [43]. In this review, we will discuss about food selectivity in relation to different factors like restrictive and repetitive behaviors, ritualistic routine, sensory modulation disorder, sensory over responsivity, sensory dysfunction, family preferences, frequent illness or physical discomfort, age etc.

### **Food Selectivity and Age**

A review of the literature regarding typically developing children reveals that a reluctance to try new foods increases and peaks between ages 2 and 6 years, then falls away for most children after the preschool years. It is unclear in the literature, however, whether children with autism follow this pattern by adding new foods to their restricted diets or if their period of food selectivity extends beyond age 6 [42]. There are varying results on the severity of food selectivity with age, many studies show that it is a chronic problem rather than a temporary one. So, it is important to analyze the effects of food selectivity on the nutrition and health status of children [43] at varying age.

### **Food Selectivity and restrictive and repetitive behaviors:**

Restrictive and repetitive behavior can play great role in mealtime behaviors that may lead to a selective eating. Children with autism spectrum disorder may insist on certain food of certain appearance, bolus size, type of utensils for every meal [44, 9, 43]. Further, the ritualistic and repetitive behaviors of ASD, as well as the “need for sameness,” and behavioral inflexibility are likely to contribute to rigid mealtime routines. In the context of feeding and mealtime, repetitive behaviors and ritualistic routines might include demands for specific utensils and dishware, order of food presentation, insistence on food not touching, and sitting in specific places at the table [29]. The prevalence of problem eating behaviors (food selectivity, nonfunctional mealtime routines, tantrums, and noncompliance behaviors) in children with autism has been estimated to range between 46 to 89%. It is postulated that these challenging or problem eating behaviors can severely compromise nutrient intake [45]. Honoring a child’s need for sameness and inflexibility may be more effective than a straightforward approach with no allowance for some of the child’s rituals which may then have a side effect of increasing anxiety [46].

### **Food Selectivity and Sensory Modulation Disorder:**

Kuschner found that both taste and texture were contributing factors to more restrictive diets in children with autism. In addition they found that children with autism were much less accurate in identifying tastes, which had a correlation with texture acceptance suggested that food selectivity might be partially a result of sensory modulation disorders [42]. Furthermore, it has been

suggested that sensory processing problems, such as sensory sensitivity, which are common among individuals with ASD, could be possible mechanisms underlying food selectivity. Children with ASD often suffered with differences in processing sensory input, which may be the cause of their undesirable behaviors [47]. Research has suggested that 30%-100% of children with an ASD experience some type of sensory processing dysfunction [48]. More than 96% of children with ASD report hyper- and hypo sensitivities in multiple domains. Although sensory hyper- and hypo responsiveness are not unique to ASD, they appear to be more prevalent in this population than in other developmental disabilities. There is mounting evidence for disruption of the auditory and visual processing pathways and a surging interest in multisensory integration (MSI) [49].

### **Food Selectivity and Sensory over-responsivity (SOR)**

Sensory over-responsivity (SOR) also has been proposed as a factor that may contribute to food selectivity in the ASD population. Various researchers have speculated that sensory sensitivities cause an increase in food selectivity in children with an ASD [48, 50]. Children with an ASD often experience hypersensitivity in and around the mouth. These children often experience spitting, coughing, or vomiting when they try new foods. Such experiences over time can limit the amount of nutritional intake and restrict the variety of foods. Eating is an activity that may be negatively affected by sensory processing difficulties [50-51]. Children with ASD frequently demonstrate food selectivity, and it has been suggested in the literature that this may be related to both sensory modulation disorders as well, specifically

sensory over-responsivity [52]. While research on the neurological basis of SOR is new, results of a recent functional magnetic resonance imaging (fMRI) study suggest that SOR is related to hyperactivity in brain areas involved in primary sensory processing, emotion regulation, and response to threat. Other research has shown that children on the autism spectrum have more tactile and taste/smell sensitivities than children with other developmental disabilities and sensory scores are correlated with stereotyped interests and behaviors. SOR, and in particular tactile over-responsivity, in some children with ASD could be a factor that contributes to food selectivity [42]. Literature on intervention for eating problems recognizes the contribution of sensory processing to eating and suggests that it must be taken into consideration. The nature and extent to which sensory processing is related to eating problems in children with ASD still remain to be determined [52].

### **Food Selectivity and Frequent illness or Physical Discomfort**

Possible factors that may be associated with food selectivity in children with ASD are frequent illness or physical discomfort associated with reflux, constipation or food sensitivity. Diarrhea (or loose stools) is the most commonly reported gastrointestinal symptom, followed by constipation, abdominal distention, and pain [51] in ASD patient. The reported prevalence of any GI disorder in children with ASDs ranges from 9 to 91%, abdominal pain or discomfort ranges from 2 to 41%, constipation from 6 to 45%, diarrhea from 3 to 77%, and persistent diarrhea from 8 to 19% [53]. Autistic individuals with co-morbid GI abnormalities exhibit altered carbohydrate digestion [54] and hence they are forced to stick with

certain food. Similarly, food selectivity also leads to GI disorder.

### **Food Selectivity and Family preferences**

Family factors such as parental control of eating behaviors, parental stress, emotional responses and family food preferences have been proposed as possible influences on the eating habits, and subsequently nutritional status, of children with autism [55]. Martins et al, 2008 in a survey of mothers of children aged 2 to 18 years, report that mothers of children with autism perceive their children have greater control over the feeding situation, have a stronger emotional response to managing their child's eating behaviors, and need to exert more behavioral control over their child's eating than their counterparts who were mothers of typically developing children. In this study, family food preferences were found to be a significant predictor of restricted eating patterns, with more restricted family eating habits associated with more restricted child eating habits [56].

### **CONCLUSION**

Autism is a Neuro-developmental syndrome that is defined by deficits in communication and by unusual restricted and repetitive behaviors. Autism is complex and highly heritable serious disorder, which usually begins in infancy or in the first three years of life at latest. Early symptoms of autism in child includes difficulties in communicating (facial expression, movements and gestures rarely match to what they are saying) with others; sensory problems (oversensitive to certain texture, color, sound, smells, touch); social functioning (less participation in activities outside school/home setting) and repetitive and routine behavior. It causes severe effect in the life of children. Children

with Autism Spectrum Disorder (ASD) exhibit greater food selectivity as compared to typically developing children which has been reported to be as high as 46-89%. Food selectivity among other feeding problems is the key problem reported by parents of children with ASD as it has been associated with inadequate nutrition. Linkage of food selectivity to many factors viz. age, restrictive and repetitive behaviors, sensory modulation disorder, sensory over-responsivity, frequent illness/physical discomfort and family preferences of food has been reported frequently over years by several authors but only few overcoming measures has been discussed. Restrictive and repetitive behaviors of particular child during feeding should be considered for treatment because they respond well to routines. Similarly, honoring a child's need for sameness and inflexibility may be more effective than a straightforward approach with no allowance for some of the child's rituals which may then have a side effect of increasing anxiety. Dieticians consultation for incorporation of appropriate foods in the family after identifying the particular preference of the child could be used for treating feeding problem, as the family preference is also reported to affect the nutrient uptake i.e. food selectivity by the children.

### **ACKNOWLEDGEMENTS**

Authors would like to acknowledge the contribution of Ms. Banodita Acharya Dhungel, Researcher, Think Tank Foundation, Jorpati, Nepal in literature collection. We also like to express our sincere gratitude to all the members of Think Tank Foundation, Jorpati, Nepal for their help and logistic support to carry out the research. We also appreciate contribution of students of Santwona college for their help in formatting.



## REFERENCES

1. Faras H, Al Ateeqi N, & Tidmarsh L. Autism spectrum disorders. *Annals of Saudi medicine* 2012; 30(4): 295.
2. Hyman S. Autism: The Science of Mental Health: (2013).Taylor & Francis.
3. Mattila ML. Autism spectrum disorders. An epidemiological and clinical Study. *Academic dissertation . University of Oulu. Tampere: Juvenes Print* 2013 .
4. Miles J H. Autism spectrum disorders—a genetics review. *Genetics in Medicine* 2011; 13(4): 278-294.
5. Johnson CP & Myers SM. Identification and evaluation of children with autism spectrum disorders. *Pediatrics* 2007; 120(5): 1183-1215.
6. Purpura G, Costanzo V, Chericoni N, Puopolo M, Scattoni M, Muratori F et al. Bilateral Patterns of Repetitive Movements in 6-to 12-Month-Old Infants with Autism Spectrum Disorders. *Frontiers in psychology* 2017; 8:1168.
7. Lord C, Cook EH, Leventhal BL, & Amaral DG. Autism spectrum disorders. *Neuron* 2013; 28(2): 355-363.
8. Ledford JR. & Gast DL Feeding problems in children with autism spectrum disorders: A review. *Focus on Autism and Other Developmental Disabilities* 2006; 21(3): 153-166.
9. Kodak T. & Piazza C. Assessment and behavioral treatment of feeding and sleeping disorders in children with autism spectrum disorders. *Child and Adolescent Psychiatric Clinics of North America* 2008; 17(4): 887-905.
10. Matson JL, Fodstad JC, & Dempsey T. The relationship of children's feeding problems to core symptoms of autism and PDD-NOS. *Research in Autism Spectrum Disorders* 2009; 3: 759-766.
11. Christensen DL, Bilder DA, Zahorodny W, Pettygrove S, Durkin MS, Fitzgerald RT et al. Prevalence and characteristics of autism spectrum disorder among 4-year-old children in the autism and developmental disabilities monitoring network. *Journal of Developmental & Behavioral Pediatrics* 2016; 37(1): 1-8.
12. Speaks A. What is autism. Retrieved on November 2011; 17.
13. Magnusson P, & Saemundsen E. Prevalence of autism in Iceland. *Journal of Autism and Developmental Disorders* 2001; 31(2):153-163
14. Yeargin-Allsopp M, Rice C, & Karapurkar T. Prevalence of Autism in a US Metropolitan Area. *JAMA* 2003; 289(1):49-55.
15. Matson, J. L., & Kozlowski, A. M. The increasing prevalence of autism spectrum disorders. *Research in Autism Spectrum Disorders* 2001; 5(1): 418-425.
16. Raina SK, Chander V, Bhardwaj AK, et al. Prevalence of Autism Spectrum Disorder among Rural, Urban, and Tribal Children (1-10 Years of Age). *J Neurosci Rural Pract.* 2017; 8(3):368-374. doi:10.4103/jnrp.jnrp\_329\_16
17. Heys M, Gibbons F, Haworth E, Medeiros E, Tumbahangphe KM, Wickenden M. et al. The Estimated Prevalence of Autism in School-Aged Children Living in Rural Nepal Using a Population-Based Screening Tool. *Journal of autism and developmental disorders* 2018; 48(10): 3483-3498.
18. Hussein H, & Taha GR. Autism spectrum disorders: A review of the literature from Arab countries. *Middle East Current Psychiatry* 2013; 20(3): 106-116.
19. Shrestha M, & Shrestha R. Symptom recognition to diagnosis of autism in Nepal. *Journal of autism and developmental disorders* 2014; 44(6): 1483-1485.
20. Filipek PA, Accardo P, Ashwal S, Baranek G, Cook E, & Dawson, G. et al. Practice parameter: Screening and diagnosis of autism Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Child Neurology Society. *Neurology* 2000; 55(4): 468-479.
21. Shrestha R, Dissanayake C, & Barbaro J. Age of Diagnosis of Autism Spectrum Disorder in Nepal. *Journal of autism and developmental disorders* 2019.
22. Soe SM, & Linn K. Factors Associated With Age of Diagnosis Among Myanmar Children with Autism Spectrum Disorders. *International Journal of Child Development and Mental Health* 2016; 4(2): 25-38.
23. Suarez M. A. Sensory processing in children with autism spectrum disorders and impact on functioning. *Pediatric Clinics* 2012; 59(1), 203-214.
24. Turkington C, & Anan R. The encyclopedia of autism spectrum disorders: Infobase Publishing 2007.

25. Baird G, Cass H, & Slonims V. Diagnosis of autism. *Bmj* 2006; 327(7413): 488-493.
26. Johnson CR, Turner K, Stewart PA, Schmidt B, Shui A, Macklin E. et al. Relationships between feeding problems, behavioral characteristics and nutritional quality in children with ASD. *Journal of autism and developmental disorders* 2014; 44(9): 2175-2184.
27. Bandini L, Curtin C, Philips S, Anderson SE, Maslin, M, and Must A. Changes in food selectivity in children with autism spectrum disorder. *Journal of Autism Development Disorder* 2017; 47(2):439-446
28. Marí-Bauset S, Zazpe I, Mari-Sanchis A, Llopis-González A, & Morales-Suárez-Varela M. Food selectivity in autism spectrum disorders: a systematic review. *Journal of child neurology* 2014; 29(11): 1554-1561.
29. Johnson CR, Turner K, Stewart PA, Schmidt B, Shui A, Macklin E. et al. Relationships between feeding problems, behavioral characteristics and nutritional quality in children with ASD. *Journal of autism and developmental disorders* 2014; 44(9): 2175-2184.
30. Bernardo P, Riccio MP, Marino M, Poeta M, Antonio M, Staiano A et al. "Changes in Food Selectivity": Evolution towards Self-Induced Vomiting in a Boy with Autism Spectrum Disorder. *Aids* 2018; 6, 2.
31. Piazza C, Fisher WW, Brown KA, Shore BA, Patel M, Katz RM et al. Functional analysis of inappropriate mealtime behaviors. *Journal of Applied Behavioral Analysis* 2003; 36(2):187-204
32. Roth S. Feeding Problems in Individuals with Autism and Developmental Disabilities. *Barnard College* 2012.
33. O'Connor E. Treatment of Food Selectivity: An Evaluation of Video Modeling of Contingencies. *Graduate Thesis and Dissertation, University of South Florida* 2017.
34. Tanner KJ. Selective Eating in Autism Spectrum Disorder: Child and Parent Factors. *The Ohio State University* 2014.
35. Strahan B. Food Selectivity in Obese Adolescents with Autism Spectrum Disorder. *J Child Adolesc Behav* 2015; 4(268): 2.
36. Gray H, Sinha S, Buro A, Robinson C, Berkman K, Agazzi H. et al. Early History, Mealtime Environment, and Parental Views on Mealtime and Eating Behaviors among Children with ASD in Florida. *Nutrients* 2018; 10(12):1867.
37. Bandini LG, Anderson S, Curtin, C, Cermak, S, Evans, EW, Scampini, R. et al . Food selectivity in children with autism spectrum disorders and typically developing children. *The Journal of pediatrics* 2010; 157(2):259-264.
38. Curtin C, Hubbard K, Anderson SE, Mick E, Must A, & Bandini LG. Food selectivity, mealtime behavior problems, spousal stress, and family food choices in children with and without autism spectrum disorder. *Journal of autism and developmental disorders* 2015; 45(10): 3308-3315.
39. Emond A, Emmett P, Steer C, & Golding J. Feeding symptoms, dietary patterns, and growth in young children with autism spectrum disorders. *Pediatrics* 2010; 126(2): e337-e342.
40. Schreck KA, & Williams K. Food preferences and factors influencing food selectivity for children with autism spectrum disorders. *Research in developmental disabilities* 2006; 27(4): 353-363.
41. Zimmer, M. H., Hart, L. C., Manning-Courtney, P., Murray, D. S., Bing, N. M., & Summer, S. (2012). Food variety as a predictor of nutritional status among children with autism. *Journal of autism and developmental disorders*, 42(4), 549-556.
42. Suarez MA, Nelson NW, & Curtis AB. Associations of physiological factors, age, and sensory over-responsivity with food selectivity in children with autism spectrum disorders. *The Open Journal of Occupational Therapy* 2012; 1(1): 2.
43. Wohlmacher, SH. Characterizing Food Selectivity in Children with Autism *Honors Theses and Capstones* 2017;. 365<https://scholars.unh.edu/honors/365>
44. Upadhyay-Dhungel K, & Ghimire S. Food Selectivity, Mealtime behavior, Weight status and Dietary intake in Children and adolescent with Autism. *Janaki Medical College Journal of Medical Science* 2019; 7(2): 48-65
45. Lane AE, Geraghty ME, Young GS, & Rostorfer JL. Problem eating behaviors in autism spectrum disorder are associated with suboptimal daily nutrient intake and taste/smell sensitivity. *ICAN: Infant, Child, & Adolescent Nutrition* 2013; 6(3):172-180.
46. Xiang Y, Zilong Q, & Dai Z. Recent Research Progress in Autism Spectrum Disorder. *Neuroscience Bulletin* 2017; 33(2): 125-129.

47. Ayres AJ, Tickle LS. Hyper-responsivity to touch and vestibular stimuli as a predictor of positive response to sensory integration procedures by autistic children. *American Journal of Occupational Therapy* 1980; 34(6):375-381.
48. Tomchek SD, & Dunn W. Sensory processing in children with and without autism: a comparative study using the short sensory profile. *American Journal of Occupational Therapy* 2007; 61(2): 190-200.
49. Marco EJ, Hinkley LB, Hill SS, & Nagarajan SS. Sensory processing in autism: a review of neurophysiologic findings: *Nature Publishing Group* 2011.
50. Cermak SA, Curtin C, & Bandini LG. Food selectivity and sensory sensitivity in children with autism spectrum disorders. *Journal of the American Dietetic Association* 2018; 110(2): 238-246.
51. Geraghty ME, Depasquale GM, & Lane AE. Nutritional intake and therapies in autism: A spectrum of what we know: Part 1. *ICAN: Infant, Child, & Adolescent Nutrition* 2010; 2(1): 62-69.
52. Nadon G, Feldman DE, Dunn W, & Gisel EG. Mealtime problems in children with autism spectrum disorder and their typically developing siblings: A comparison study. *Autism* 2011; 15(1):98-113
53. Coury DL, Ashwood P, Fasano A, Fuchs G, Geraghty M, Kaul A. et al. Gastrointestinal conditions in children with autism spectrum disorder: developing a research agenda. *Pediatrics-English Edition* 2012; 130(2): S160.
54. Hsiao, EY. Gastrointestinal issues in autism spectrum disorder. *Harvard review of psychiatry* 2018; 22(2): 104-111.
55. Martins, Y., Young, R.L., & Robson, D.C.2008. Feeding and Eating behaviors in children with autism and typically developing children *Journal of Autism and Developmental Disorders* 38(10):1878-1887
56. Scaglioni S, De Cosmi V, Ciappolino V, Parazzini F, Brambilla P, & Agostoni C. Factors influencing children's eating behaviours. *Nutrients* 2018; 10(6): 706. .

**Correspondence to:**

Asst. Professor,  
Far western University,  
Kanchanpur, Nepal  
[rakshatuktuk@gmail.com](mailto:rakshatuktuk@gmail.com)