NUTRITIONAL STATUS AND ITS ASSOCIATED FACTOR AMONG CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) IN BIRATNAGAR METROPOLITAN CITY

by

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A dissertation submitted to the Department of Nutrition and Dietetics, Central Campus of Technology, Tribhuvan University, in partial fulfilment of the requirements for the degree of B.Sc. Nutrition & Dietetics.

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Approval Letter

This *dissertation* entitled ***Nutritional status and its associated factor among children with Autism Spectrum Disorder (ASD) in Biratnagar Metropolitan City*** presented by **Bisheshta Khanal** has been accepted as the partial fulfillment of the requirements for the **B.Sc. degree in Nutrition and Dietetics.**

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Abstract

A cross-sectional descriptive study was conducted among children aged 2–13 years with Autism Spectrum Disorder(ASD) attending selected autism care centres in Biratnagar, Nepal, to assess their nutritional status and associated factors. Data were collected from 57 parents and caregivers using structured and pretested questionnaires, while anthropometric measurements were taken from 92 children. Information on socio-demographic characteristics, maternal factors, child health, feeding behaviour, and dietary intake was obtained. Feeding behaviour was assessed using the Brief Autism Mealtime Behaviour Inventory (BAMBI), and dietary intake was evaluated through a 24-hour dietary recall and Food Frequency Questionnaire (FFQ). Anthropometric indicators such as weight, height, mid-upper arm circumference (MUAC), and body mass index (BMI) were interpreted using WHO growth standards. Data analysis was performed using SPSS version 20 and MS Excel 2019.

The findings showed that 71.74% of the children were male, indicating a higher prevalence of ASD among boys. Food selectivity was observed in 59.65% of participants, with vegetables being the most commonly rejected food group, followed by fruits, meat, dairy products, and certain food textures. Feeding difficulties were prevalent, with 54.39% experiencing moderate and 7.02% severe challenges, while 57.89% had poor appetite. Dietary assessment revealed excessive intake of energy, protein, and fat across most age groups, whereas iron intake was inadequate among younger children aged 2–6 years. These results indicate nutritional imbalance, highlighting the need for targeted nutritional counselling and behaviour-based feeding interventions.

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List of Abbreviations

ASD	Autism spectrum disorder
BAMBI	Brief Autism Mealtime Behavior Inventory
BMI	Body Mass Index
BAZ	BMI for Age z-score
CDD	Childhood Disintegrative Disorder
FAO	Food and Agriculture Organization
FFQ	Food Frequency Questionnaire
HAZ	Height for Age z-score
MUAC	Mid-Upper Arm Circumference
NIN	National Institution of Nutrition
PDD-NOS	Pervasive Developmental Disorder not otherwise specified
RDA	Recommended Dietary Allowance
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
WAZ	Weight for Age z-score
WHO	World Health Organization

Part I

Introduction

1.1 General Introduction

Autism spectrum disorder (ASD) begins in childhood as developmental disabilities caused by abnormalities in the brain. Generalized enlargement of grey and white matter cerebral volumes is present at 2 years of age. Increased rate of brain growth occurs in the latter part of the first year of life (Hazlett, 2005) . The ASDs are part of a broader category of pervasive developmental disorders (PDDs), affecting over 500,000 individuals in the United States. (West, 2009)

Children with ASDs have unusual ways of learning, paying attention, or reacting to different sensations. They like to repeat certain behaviors and do not want change in their daily activities. They are hypersensitive to sensory stimuli (tastes, smells, sounds, sights) and withdraw from what is perceived as distressing or painful. People with ASDs have problems with social and communication skills. Up to 40% of persons with an ASD do not speak. Rather than conversing in a dialogue fashion, they may repeat back what has been said (echolalia) (Escott-Stump, 2021).

In 2021, according to the study in GBD , 1 in 127 individuals were autistic with prevalence and health burden persisting across the lifespan. Autism spectrum disorder was most common among children and adolescents younger than 20 years, for whom it ranked within the top ten causes of non-fatal health burden. (Collaborators, 2025).

In 2023, according to WHO it is estimated that worldwide about 1 in 100 children has autism . This estimate represents an average figure, and reported prevalence varies substantially across studies. Some well-controlled studies have, however, reported figures that are substantially higher. The prevalence of autism in many low- and middle-income countries is unknown. (World Health Organization, 2023).

Based on statistics from the U.S. Department of Education and other government agencies, autism is growing at a startling rate of 10-17% per year (Clinic, 2025).

Factors such as increased awareness, changes in diagnostic criteria, inclusion of adults and females, acknowledgement of making as well as reduced stigma are the attributing factors for increased prevalence rate over the year. (Guy-Evans, 2024)

While the exact causes of ASD remain unknown, research indicates that both genetic and environmental factors contribute significantly to its development. Studies have identified genetic mutations and prenatal environmental exposures as potential risk factors. (Holly Hodges, 2020).

ASD is a neurodevelopmental disorder characterized by deficits in social communication and the presence of restricted interests and repetitive behaviors. Recent changes to the diagnostic criteria occurred with the transition to the new diagnostic manual (DSM-5) and will likely impact prevalence, which currently stands at 1 in 59 children in the US. ASD is a neurobiological disorder influenced by both genetic and environmental factors affecting the developing brain. Research continues to reveal factors that correlate with ASD risk and these findings may guide further etiologic investigation, but no final causal pathway has been elucidated. Clinical evaluation begins with developmental screening of the general pediatric population to identify at-risk children, followed by referral to a specialist for a definitive diagnosis and comprehensive neuropsychological assessment. Children with ASD should also be screened for common co-morbid diagnoses. While no clear biomarkers or diagnostic measures exist, clinical genetic testing is recommended as part of the initial medical evaluation. Further medical work up or subspecialist referrals may be pursued based on specific patient characteristics. (Holly Hodges, 2020).

About Autism Centre

The Metropolitan Autism Service Centre in Biratnagar was established by Biratnagar Metropolitan City to provide free support services for children with autism. The centre offers therapies such as speech therapy, physiotherapy, psychiatric services, and basic educational activities, with all essential expenses, including meals and transportation, covered by the health department. The center operates from 9:00 AM to 3:00 PM and serves children diagnosed with autism in the local area.

Anmol Special Education Centre is a specialized educational institution located in Biratnagar-03, Nepal, established to support children with special needs, including autism spectrum disorder. The center provides a structured learning environment along with developmental and educational support tailored to the individual abilities of children. It focuses on enhancing communication, learning skills, and

overall development through special education practices. The center serves as an important community-based facility for children requiring additional educational and behavioral support.

1.2 Statement of the Problem and Justification

Nutritional factors significantly influence brain development, and deficiencies can impair cognitive function and overall health (Georgieff, 2007) Children with Autism Spectrum Disorder (ASD) often exhibit selective eating behaviors, leading to nutrient deficiencies and growth concerns (DeMand, 2015) . Malnutrition, including underweight and stunting, is common, though research on ASD-related growth patterns remains inconsistent (Hyman, 2012).

Gastrointestinal issues, such as constipation and bloating, frequently affect autistic children and may worsen ASD symptoms (Hsiao, 2014) . In Nepal, autism awareness and diagnosis are limited, leading to delayed interventions and poor nutritional knowledge, which increase health risks (Shrestha, 2014) and (Yassen, 2020) . This study aimed to assess the nutritional status, mealtime behaviours, and gastrointestinal issues in ASD children in Biratnagar city, addressing the research gap in Nepal.

1.3 Objectives of the Study

1.3.1 General Objective

To assess the nutritional status of children with Autism Spectrum Disorder (ASD) and also identify the factor influencing their dietary patterns and behavior.

1.3.2 Specific Objective

To assess the anthropometry of children with autism using various anthropometric measurements (height, weight and MUAC).

To assess the dietary patterns of children with ASD in terms of frequency of food intake, food variety and adherence to a balanced diet.

To examine the influence of sensory processing issues (such as hypersensitivity or hyposensitivity to certain foods) on food preferences and intake in children with ASD.

To investigate the effect of social and environmental factors, such as school meal programs and peer interactions, on the eating behaviors and nutritional intake of children with ASD

1.4 Conceptual Framework

1.4.1 Conceptual Framework of Research Design

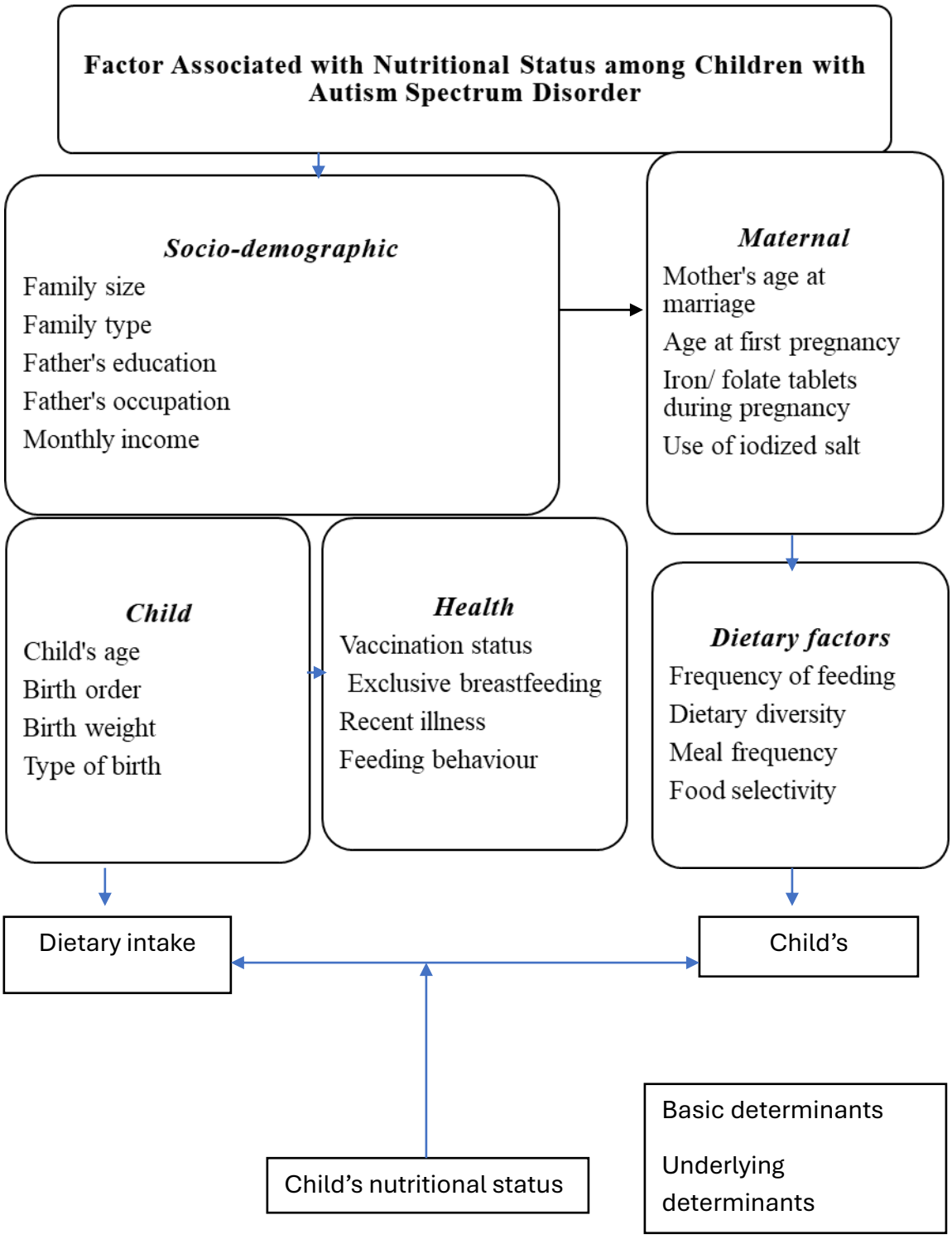
Figure 1 Conceptual framework of research design

Characteristics of children with Autism Spectrum Disorder	Socio-economic and demographic factors: Age of children Sex of children Ethnicity of children Parent's education level Parent's age Parent's occupation Monthly household income Gestational age Birth weight Number of children Birth order Duration in the center
	Parental factors: Parenting style Parental feeding practice
	Lifestyle factors: Child eating behviour Dietary intake Body weight status

1.4.2 Causative Framework

Figure 2 Conceptual framework of this study

Source: UNICEF (1990) Conceptual Framework.



Part II

Literature Review

2.1 Autism Spectrum Disorder

Autism spectrum disorder (ASD) involves a range of disorders that generally manifest during the preschool years, marked by challenges in social communication and interaction, as well as restricted and repetitive behaviours, interests, and hobbies. (American Psychological Association, 2025) Complex disorders such as verbal and non-verbal communication and social interaction disorders are common in children with Autism Spectrum Disorder(ASD). Previously this condition was separated into 5 classifications namely Childhood Autism, Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) Rett's Syndrome, Childhood disintegrative disorder, and Aspeger Syndrome. However, these terms are now known as Autism Spectrum Disorder(ASD). Handling for people with ASD requires more attention and the role of parents in supporting their development. (Matthew J. Maenner,2023) Boys seem to be affected more than girls, with a sex ratio of 1/5. Usually, the majority of these children are diagnosed at the age of 4 years. In general, children with more marked symptoms are diagnosed earlier than those with more subtle features. Its functional consequences make it quite a public health problem. Research now agrees that early intervention can achieve the best long-term results, which may change the developmental outcome of children and limit the disabling impact of some symptoms.

According to Diagnostic and Statistical Manual of Mental Disorders published by the American Psychiatric Association, there are five main sub-types of autism:

a) Autistic Disorder (Autism, childhood autism, early infantile autism) - symptoms at more intense level (Vijayalakshmi, 2017)

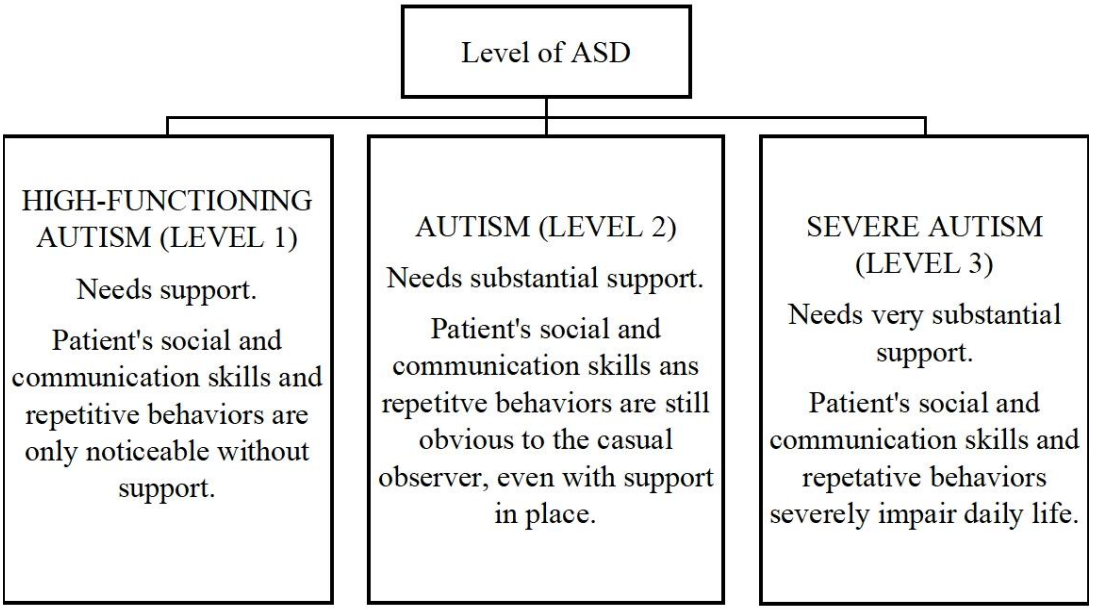
b) Asperger Syndrome (Asperger's disorder or simply Asperger's) – milder level, very intelligent, much harder time socially, and have problem with communicating, repetitive motions, under developed motor skills, low functioning (Vijayalakshmi, 2017)

c) Childhood Disintegrative Disorder (CDD) dementia infantile, disintegrative psychosis or Heller's syndrome)-rarest and most severe, children develop 7 normally and then quickly lose many social, language, and mental skills, usually between ages 2 and 4, ability to interact with other children and will lose an interest in play, problem with the motor skills (Vijayalakshmi, 2017)

d) Pervasive Developmental Disorder (PDD-NOS or atypical autism) – it is more severe than Asperger's syndrome, but not as severe as autistic disorder. They need the same interventions and help that autistic children require and the differences between PDD-NOS and autism are minor (Vijayalakshmi, 2017)

e) Rett's Syndrome is rare and relatively little-known type of autism and it only happens with girls. The problems with muscle atrophy, and tend to do repetitive hand motions. Almost they are always mentally retarded to some degree. These girls are very low functioning and will need care for most of their lives (Vijayalakshmi, 2017)

Autism Spectrum Disorder can be classified into three levels:



(Vijayalakshmi, 2017)

The survival of people with ASD is related to the mother's education level, which affects the mother's behavior and attitude towards her child, and is an

important factor in improving family nutrition. The mother's education level and the nutritional status of ASD have a significant relationship, which is supported by one of the researchers. It is said that mothers who have a high level of education are more likely to receive information related to nutrition for ASD. Parenting is an important role for the development and nutritional status of ASD children. According to one study, there is a relationship between parenting and the nutritional status of ASD children in the city. People with ASD have limitations in terms of behavior, so eating parenting must be given more attention because it will affect the growth, development, and nutritional tatus of ASD children. Parenting is closely related to parents' knowledge of the nutrition needed by people with ASD. Knowledge, especially related to balanced nutrition, has a significant effect on the nutritional status of people with ASD. This can be influenced because parental knowledge related to balanced nutrition has an impact on the quality of food and the nutritional content of food consumed, so to improve the quality of nutritional status in people with ASD, knowledge of balanced nutrition has an important role. Knowledge of balanced nutrition and nutritional status of ASD has a significant relationship , which is supported by one study. Parents who have good balanced nutrition knowledge must also be supported by sufficient socio-economic so that parents can realize their knowledge. The quality and quantity of food consumed by the family comes from parental income, so that the nutritional status of people with ASD is affected by parental income. This statement is supported by one researcher who said that there is a significant relationship between socioeconomics and nutritional status in ASD children. Parents with low income tend to have poor nutritional status, this statement is associated with one of the arguments that parents with low income often face problems in providing and providing nutritious food. Therefore, income greatly affect the choice of food and the greater the income, the greater the chances of people with ASD getting a quality life. (Citra Ramadhanty, 2024)

2.2 Prevalence

In recent years, the incidence of autism has increased. In 2021, the Centers for Disease Control reported that the prevalence of autism in the U.S. in 2018 was 1 in 44 children. This represents a significant increase from the rates reported in Scientific American for 2016 (1 in 68, although other sources assert an even higher prevalence of 1 in 54 by age 8), 2008 (1 in 88), and 2000 (1 in 150). This increasing prevalence of autism, originating in the early 1990s, is a worldwide phenomenon, not limited to the United States. Current hypotheses indicate that the increase is primarily attributed to heightened awareness and diagnosis of autism,

rather than a significant surge in the general prevalence of the condition. Autism is more prevalent among infants with older parents, a demographic increasingly widespread now, and in those born prematurely, who have higher survival rates than in earlier periods.

No definitive etiology of autism has been established; however, early detection is crucial for enhancing results. While a cure for autism is unavailable, symptoms can be treated and may diminish somewhat in adulthood, while they do not completely vanish. The Global Health Data Exchange aggregated autism prevalence estimates for individuals of all ages across all countries globally. The nations with the lowest autism prevalence were industrialized countries in Europe. France exhibited the lowest autism prevalence, recorded at 69.3 per 10,000 individuals, equivalent to 1 in 144 people. Portugal had 70.5 per 10,000, equivalent to 1 in 142. However, by reviewing the data from 2019, Nepal had 295.24 per 10,000 which is equivalent to 1 in 34. (Review, 2025)

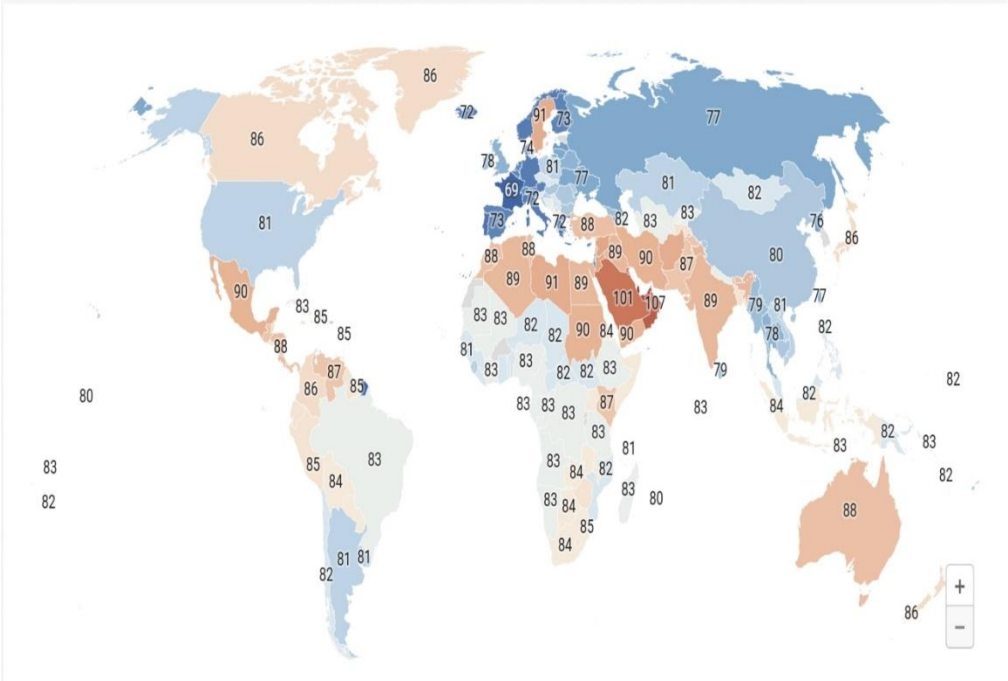


Figure 3 Map of Autism rate around the world

Based on figures from 2025, Qatar has the highest rate of autism (151 per 10,000 people), which is equal to 1 in 66. On the other hand, France has the lowest rate of autism (69 per 10,000 people), which is equal to 1 in 144. Nepal, on the other hand, is ranked 72nd, with an 83/10,000 number, which is equal to 1 in 120. (Pandas, 2025)

2.3 Nutritional status of Autistic Children

Research on the nutritional status of children with autism has shown mixed and sometimes conflicting results. Some studies suggest that autistic children are more likely to be overweight or obese. For example, (L., 2010) and (G., 2012) found that children with autism had a higher risk of obesity. Similarly, (Hediger, 2008) observed that autistic boys were significantly heavier and had a higher BMI than average. (Hyman, 2012) also noted that children with ASD between the ages of 2-5 were more likely to be overweight or obese compared to their peers.

On the other hand, other studies highlight concerns about undernutrition among children with ASD. (Sadowska, 2011) found that 30% of children with autism had low body weight, while (Bauset, 2013) reported that autistic children tended to have a lower BMI than their peers. Similar findings were reported by (Al-Farsi, 2011) , who studied 100 autistic children aged 3-5 and found that 3.9% were underweight, 3.1% were wasted, and 2.3% were stunted. Interestingly, they also found that malnutrition was more common in boys (12.4%) than in girls (8.4%). More recently, (Eow, 2021) reported that among autistic children, 9.3% were underweight, 8.0% were stunted, 4.0% were experiencing wasting or thinness, and 21.5% were overweight or obese. These findings suggest that children with autism can experience both overnutrition and undernutrition, highlighting the need for a balanced approach to their dietary and nutritional care.

2.4 Children's Eating Behaviour that Influences Nutrient Intake

Between 46% and 89% of children with ASDs exhibit nutritional challenges . This is particularly concerning because ASDs now present as a public health problem. Common feeding concerns reported include

difficulty accepting new foods and resisting novel experiences that extends to tasting, trying new foods (neophobia), and throwing foods (P.G. Williams, 2000)

difficulty with transition to textures, especially during infancy, leading to late acceptance of solid foods

restricted or selective intake based on food category, colour, texture, consistency, appearance, taste, smell, brand, packaging, and food temperature

difficulty with mealtime presentations, e.g., specific plate and cutlery or positioning of food on a plate

increased sensory sensitivity (tactile) leading to rejecting foods because of aversion to temperature, texture, or other food characteristics or restricting intake to food of preferred, tolerable, and manageable textures (Yolanda Martins, 2008)

disruptive mealtime behaviours such as not staying seated at mealtimes or not eating with the family

persistently wanting the same foods or that food be made in a certain way; pica behaviour.

Although children with ASDs are often labelled as "picky eaters", this habit was not associated with a lack of appetite. Children with ASDs more likely accept foods of low texture and higher energy density.

Interestingly, (Linda G. Bandini, 2017)highlighted the facts that not only did children with ASDs eat notably fewer types of foods, they were offered fewer foods, and the absolute number of foods they refused and foods refused as a percentage of those offered were more than those in healthy children, particularly for vegetables. Even among adults with intellectual disabilities, those with autism had more severe feeding and mealtime challenges such as food selectivity and refusal than did those without autism (Citra Ramadhanty, 2024).

2.5 Nutritional intake of Autistic Children

Although children with ASDs eat a considerably smaller variety of foods, authors report no overall differences in their total calories, carbohydrates, or fat intakes (Johnson, 2008) , suggesting that their satiety mechanisms are not impaired. Protein intake was adequate, lower, or quite similar to that of typically developing children (Emond, 2010), and non-dairy protein intake was increased in children with ASDs (Michelle H Zimmer 2012) . Children with ASDs reportedly ate fewer vegetables and more energy-dense foods (Evans, 2012) . In contradiction to anecdotal reports of high carbohydrate consumption, fiber intake was inadequate in a considerable number of children with ASDs (Ayse Humeyra Bicer, 2013).

ASDs had inadequate intakes of calcium, iron, zinc, vitamin A, vitamin D, vitamin E, riboflavin, vitamin C, vitamin B-12, folic acid, and choline. Vitamin B-6 intake was either significantly higher or not met by children with ASDs. Children with ASDs were reportedly found to consume fewer vegetables, salads,

and fresh fruit in a study by (Emond, 2010), which used prospective dietary data from a population-based sample, and (Evans, 2012) found that children with ASDs had a greater number of nutrients with inadequate intakes compared with typically developing children. This is also reflected by deficient concentrations of vitamin A (plasma) , vitamin C (plasma) , folate (serum) , biotin (WB) , calcium (RBC and serum) , zinc (plasma) , and iron in children with ASDs. (Sabri Hergüner, 2012)

We believe that dietary data may be inaccurate due to parental bias because it is possible that parents who consented to participate in the research studies may have been more concerned about nutrition and feeding behaviours in their children such that their dietary patterns might be different from the general population of children with ASDs.

2.6 Medical Complications in Children with Autism

Autism Spectrum Disorder (ASD) frequently coexists with various medical illnesses that might exacerbate the issues faced by individuals. Several significant comorbid conditions encompass:

Attention Deficit Hyperactivity Disorder (ADHD) is present in approximately 35.3% of autistic children and 21.1% of autistic adults, exacerbating challenges related to attention and impulse regulation. Anxiety and Depression: Approximately 17.1% of children and 26% of adults with autism have anxiety, manifesting as social anxiety or panic attacks. Depression is significantly prevalent, impacting 7.5% of children and 20.2% of adults, characterized by persistent sadness and diminished interest in everyday activities.

Gastrointestinal issues: Gastrointestinal issues are common in individuals with autism, affecting approximately 21% to 70% of this population. Prevalent issues encompass chronic constipation, stomach discomfort, and gastric reflux, which may impact nutritional consumption and psychological well-being. Epilepsy: Seizure disorders represent a considerable issue, affecting around 5% of children and 12.1% of adults enrolled in Medicaid. These seizures frequently necessitate meticulous therapy to mitigate potential cerebral damage, common among those undergoing communicative regression. Comprehending and managing these co-occurring problems is essential for improving the quality of life for individuals with autism and customizing appropriate support measures to their specific requirements.

Table 1 Medical Complication among individual with ASD

Condition	Prevalence among individuals with ASD	Impact on Daily life
ADHD	35.3% of children, 21.1% of adults	Affects attention, impulse control
Anxiety/ Depression	17.1% children, 26% adults	Leads to social challenges and isolation
Gastrointestinal	21% - 70%	Causes discomfort affecting behaviour
Epilepsy	5% children, 12.1% adults	Requires monitoring and treatment

(Clinic, 2025 FEB 25)

2.7 Autism in Nepal

There are no reliable estimate for Nepal as autism is not known to many people. There is a lack of awareness amongst people and diagnosis on this is weak. It is estimated that there are about 2,50,000-3,00,000 Person with Autism (PWAs) in Nepal. Among them about 60,000-90,000 PWAs are severely affected. (Clinic, 2025 FEB 25)

According to Autism Care Nepal Society, there may be between 150,000 and 300,000 autistic individuals in Nepal. Yet the 2021 Census counted only 4,886 out of 29.1 million people. That's like seeing only a few stars in a sky full of them.

The World Health Organization (WHO) estimates that 1 in 160 children globally are autistic. So why are so few reported in Nepal? Because most cases go undiagnosed, especially outside cities. According to the World Bank's 2021 report in rural areas, where 81 per cent of Nepal's population lives, a child who doesn't speak or avoids eye contact might be labelled "lazy" or "cursed". Many families don't seek help, not out of neglect, but out of fear.

A 2019 study in Frontiers in Psychiatry found 60 per cent of parents avoided seeking support due to gossip or belief in traditional healing. One story shared by Autism Care Nepal Society shows this reality. A mother noticed her son wasn't speaking like other toddlers, but could recognise bulbs and numbers. Relatives told her," Boys talk late." He didn't respond to his name but reacted to music. A

visiting therapist from India introduced the word "autism". It was new to the family. Online searches matched his behaviours. The parents eventually travelled abroad to confirm the diagnosis. "It felt like they were describing someone else's child," the mother said. But with years of therapy, her son now expresses emotions and needs. "Understanding changed everything."

That understanding, however, is complex. Nepal has just 150 psychologists and even fewer trained therapists (Nepal Health Research Council, 2022) . Most hospitals don't screen for autism. Schools? Only 1 per cent of the 35,000 are inclusive (Ministry of Education, 2023). And therapy costs of $15 to $40 per session are unaffordable for families where 25 per cent live on less than $1.90 per day. (K.C., 2025)

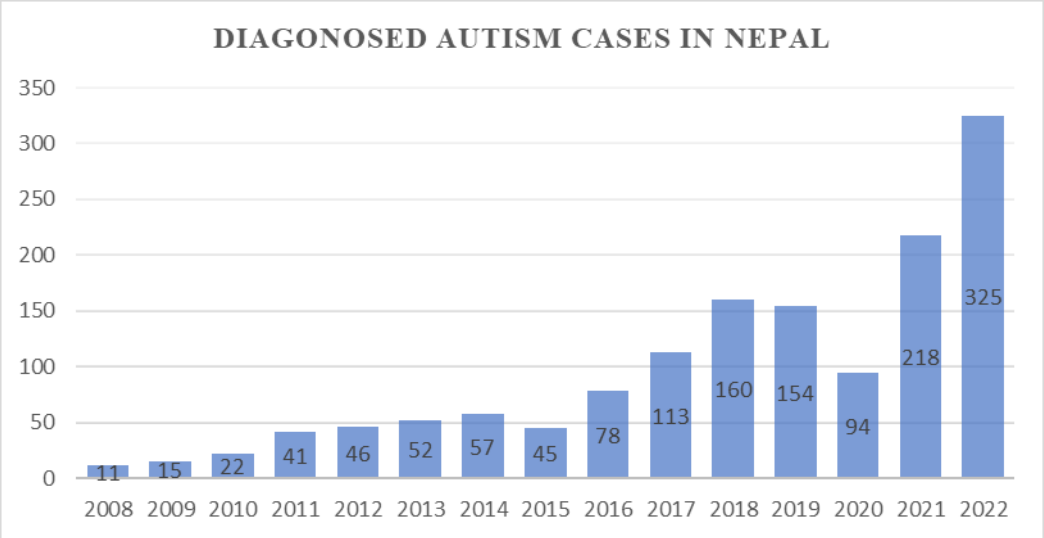


Figure 4 Diagnosed autism cases in Nepal (Koirala, 2023)

2.8 Assessment of Nutritional Status

Nutritional assessment is a methodical approach of gathering, confirming, and analysing data required to identify nutrition-related problems, the related etiologies, the magnitude of the problem, as well as the symptoms and indicators displayed by the nutrition- related problem. The purpose of the nutrition assessment is to establish individual nutritional needs, document baseline nutritional parameters, identify nutritional risk factors and specific nutritional deficits, and identify medical, psychosocial, and socioeconomic factors that may affect the recommendation and administration of nutrition support therapy.

(Whelan, 2018) Assessment of nutritional status can be done using the following two methods:

1. The direct method of nutritional survey, which works with people and assesses the objective criteria. The direct method can be summarized as ABCD steps (Gibson, 2005)

Anthropometric method

Biochemical method

Clinical examination

Dietary evaluation method

2. The indirect method of nutritional survey, which makes use of community health indicators that take dietary factors into account. The indirect methods of nutritional survey are: (Derrick, 1966)

Ecological variables including agricultural crop production, food balance sheet, health and educational services.

Socio economic factors such as family size, occupation, per capita income, population density, education, customs and social habits.

Vital health statistics particularly mortality and morbidity related to protein energy malnutrition, school-age child stunting and wasting, anaemia, goitre, diarrhea, measles and parasitic infestation.

2.9 Anthropometric Method of Nutritional Assessment

Anthropometry is the most widely applicable, affordable, and non-invasive approach for determining the size, proportions, and composition of the human body (WHO, 1995). The anthropometric measures vary with age, sex, race, and level of nutrition. Additionally, these measurements can provide information on past nutritional histories, which cannot be obtained with the same confidence using other assessment techniques. In some cases, they can detect moderate and severe degrees of malnutrition, but the methods cannot be used to identify specific nutrient deficiency states (Gibson, 2005)

2.9.1 Anthropometric Indicators

The most used anthropometric indicators are listed as follows:

2.10.1 Height for Age

Height-for-age (H/A) is a measure of linear cumulative growth that evaluate long-term nutritional deficiencies and/or chronic or recurrent illnesses. It is more commonly employed as a population indicator than for tracking individual growth (WHO, 2006). The term "length-for-age" refers to children under 2 years old; "H/A" refers to children over 2 years old. (Cogill, 2003)

Table 2 Classification of stunting according to height-for-age index (H/A), expressed as a Z-score (WHO, 2006)

Definition	Index
Normal/ Not stunted	>-2 z-score
Moderate stunting	-3 z-score ≤H/A < -2 z-score
Severe stunting	< -3 z-score

2.10.2 Weight for Height

Weight-for-height is a measurement that does not require age information and compares body weight to height. It is typically employed as a measure of current nutritional status and helps identify at-risk children and monitor short-term changes in nutritional status. W/H can also be utilized to provide markers of obesity on the other end of the spectrum. (WHO, 2006)

Table 3 Classification of underweight according to weight-for-height

index (W/H), expressed as a Z-score (WHO, 2006)

Definition	Index
Obesity	≥ 3z-score
Overweight	+2.01 to +3 z-score
Normal	>-2 z-score
Moderately wasted	-3 z-score ≤H/A < -2 z-score
Severely wasted	< -3 z-score

2.10.3 Mid-upper Arm Circumference

The mid-upper arm circumference (MUAC) assesses both fat stores and muscle mass by measuring the diameter of the upper arm and is predominantly utilized for children. MUAC is the suggested nutritional status indicator in cases when it is challenging to gather information on age, height, and weight (WHO and UNICEF, 2009).Table 4 Interpretation of cut-off points of MUAC based on colour(WHO and UNICEF,2009)

Colour	Cut off points	Interpretation
Red	<115 mm	Severely acute malnutrition
Yellow	115 mm to <125 mm	Moderate acute malnutrition
Green	>125 mm	Well-nourished

2.10.4 Body Mass Index (BMI)

Body mass index (BMI) is a measure used to define overweight and thinness. BMI is the ratio weight (in kg) / recumbent length or standing height (in m^2). The index varies with age for children and teens, thus it must be read in relation to BMI-for-age reference charts even though there is some room for utilizing BMI for adolescents (Cogill, 2003). Table classifies BMI expressed in Z-score.

Table 5 Classification of BMI expressed as z-score (WHO and UNICEF, 2009)

Index	Definition
Severely thin	Below -3 SD
Moderately thin	-3 SD to -2 SD
Normal	-2 SD to 1 SD
Overweight	+1 SD to +2 SD
Obese	+2 SD to +3 SD
Severely obese	Above +3SD

SD: Standard Deviation

2.11 Dietary Method of Nutritional Assessment

Food and nutrient intakes can be estimated by quantitative and qualitative methods. A qualitative study gives information on the types of foods consumed, food preparation methods, food preferences, cultural influences, and attitudes toward foods whereas a quantitative survey provides data on the quantity of various foods consumed by individuals and/or populations. There is no one diet evaluation technique that is perfect. As a result, it is advised that, depending on the type and purpose of information needed, a combination of both techniques be employed (WHO, 2004).

2.12 Individual Dietary Survey

This method is used to obtain information on the past and present food and nutrient intakes of an individual (Den Hartog *et al.*, 2006). Some of the methods are described below:

a) 24-hr recall

In a 24-hour recall, the subject is asked to estimate how much food and liquid they ingested over the preceding 24 hours. This approach is helpful frequently for comparing dietary recommendations with nutrients intakes. The primary drawback of recalls is that they are rarely an accurate representation of normal consumption (CFNI., 2004)

b) Food frequency questionnaire

The food frequency questionnaire (FFQ) measures regular dietary intakes, making it the best approach currently available for investigations on the connection between food and illness. The core element of the food-frequency approach is that exposure periods should be longer than short ones, with the typical long-term diet (consumed over weeks, months, or years) being a more significant exposure time. The advantage of this approach is that it can offer more accurate data on typical intake than a few days' worth of diet records or recalls. However, the approach has a drawback in that it could not offer information on precise quantities or portion sizes (CFNI., 2004)

2.13 Dietary diversity score

The Dietary Diversity Score (DDS) is a qualitative measure of food consumption that reflects the number of different food groups consumed over a given reference period. Developed by the Food and Agriculture

Organization (FAO), the DDS is a key tool for evaluating the nutritional quality and adequacy of a diet. It involves counting the consumption of diverse food groups, including grains, legumes, vegetables, fruits, meats, and dairy products, among others.

The utility of the DDS in nutritional studies is underscored by its simplicity and ease of implementation, which does not necessitate detailed knowledge of the nutrient composition of foods or precise nutrient intake measurements. It is a reliable method for assessing variation in diet, which is closely associated with nutrient intake adequacy. A higher DDS generally indicates a more diverse diet, often correlating with a higher likelihood of meeting essential nutrient requirements (FAO, 2010)

2.14 Nutritional Requirements

The quantities of energy and nutrients required by the body to sustain normal physiological processes, promote growth and development, and avoid deficiencies are referred to as nutritional requirements. These requirements differ based on age, sex, body composition, physical activity, and physiological conditions like pregnancy or illness. (WHO, 2004). The Recommended Dietary Allowance (RDA) is defined as the average daily intake level sufficient to meet the nutrient requirements of nearly all (97–98%) healthy individuals in a specific life stage and gender group. (National Academy of medicine,2006). RDA values are derived from the Estimated Average Requirement (EAR) with an added safety margin to account for individual variability. (National Academy of Sciences, 2006).

RDA includes guidelines for macronutrients and micronutrients and is widely used for dietary planning, nutritional assessment, and public health policy formulation. (FAO, 2001). However, RDA values are intended for healthy populations and may not reflect individual or disease-specific nutritional needs (WHO,2007).

Part III

Materials and Methods

3.1 Research Design and Methodology

Research methodology is the main part of any research. The overall foundation of research is based on the methods applied for the research. There are various methods research in the sociology like as participation observation, cross-cultural comparisons survey research, interviews, archival research, media analysis and historical analysis etc. One or more methods can be applied in research methodology.

3.2 Study Area

The study was conducted in Biratnagar metropolitan autism centre, Anmol special care, Om Sai School Biratnagar and other local children in Biratnagar metropolitan City. All these organizations are located inside Biratnagar City.

3.3 Study Population

The population under this study were children and adolescents 2-13 years of age who have been diagnosed to have ASD and who visit the autism care centre for various forms of therapy.

3.4 Selection Criteria

Inclusion criteria:

a. Children who have been diagnosed to have ASD

b. Children who are between the ages of (2-13) years

Exclusion criteria

a. Children with severe illness that may impact nutrient intake or utilization

b. Children whose caretakers deny participation in the study.

3.5 Study Design

A cross-sectional, descriptive observational study will be conducted among the children with ASD. The study will consist of the survey with the help of structured questionnaires followed by anthropometric measurements, dietary assessment, behaviour change and food choice.

3.6 Sampling Technique

Study was carried out by using the Census technique. It is the process of collecting information about each member of a given population. For core study, total number of children with age group ranging from 2 to 13 years was taken under study. There were altogether 92 children during study.

3.7 Sample Size

A total of 92 children and adolescents who visited different organizations for various forms of therapy during the study period were selected for the study using a purposive sampling technique.

3.8 Research Instruments

a. Weighing machine: Weighing machine manufactured by Microlife Pvt. Ltd., with a capacity of 180kg and having the least count of 0.1 kg (1 piece) was used.

b. Stadiometer: Stadiometer was used to measure height with a capacity of 197 cm and has the least count of 0.1cm.

c. MUAC tape: For measuring mid-upper arm circumference (2 piece).

d. A structured and pretested set of questionnaires.

e. Measuring cups of 250 ml, 125 ml, 80 ml, 60 ml and 30 ml.

3.8 Study Variables

a. Study variables were categorized into two groups: dependent variable and independent variable. The dependent variable of the study was the nutritional status of autistic children as indicated by stunting, wasting and underweight. Whereas, independent variables of the study were:

b. Socio-economic and demographic variables: family size and type, parent's education level and occupations, head of household, total income and food enough for family.

c. Child characteristics: age, sex, birth order, breastfeeding status, age gap between their siblings, birth weight, birthplace and morbidity status.

d. Child care practices: initial and final breastfeeding periods, colostrum feeding, breastfeeding frequency, knowledge of breastfeeding time, pre-lacteal feeds, bottle-feedings, complementary feeding practices, etc

e. Health and immunization practices: vaccinations of children, iron and folate intake, knowledge of malnutrition

f. Maternal characteristics: age at marriage, age during first delivery, pregnancy-related factors: vaccinations, iron and folate intake, intake of extra food during pregnancy or lactation, knowledge about child malnutrition

g. Feeding behaviour and challenges: food selectivity, mostly rejected foods, aversion to texture or smells and frequency of feeding difficulties

h. Caregiver involvement: responsible for meal preparation, structured meals and their confidence in managing child's diet

i. Dietary intake: 24-hours dietary recall and food frequency questionnaire

j. BAMBI questionnaire: information about the eating behaviour and nutritional intake of children with ASD.

3.9 Data Collection Techniques

The data collection process for this study took place in two stages. In the first stage, I reached out to school administrators and parents to introduce the study, explain its objectives, and seek their cooperation. Parents were then asked to complete a semi-structured questionnaire. Only after obtaining informed consent did I proceed to the second stage, which involved taking anthropometric measurements of the children.

The following techniques were used for data collection:

a. A general Questionnaire: A set of questionnaires will be asked to the caretakers regarding the socio-demographic and socio-economic backgrounds, details about child caring and feeding practices, appetite and gastrointestinal symptoms and knowledge related to nutritional management of ASD.

b. Anthropometric Measurements: To assess the nutritional status of the children, three types of anthropometric measurements were taken. Each

measurement was recorded three times, and the average was used for analysis to ensure accuracy and reliability. The procedures were carried out with care to make the children feel comfortable throughout the process:

Weight: Weight was measured with the help of a portable digital scale placed on a flat, stable surface. Children were requested to remove their shoes and socks and to wear light clothing so that the measurement would be as accurate as possible. They were then guided to stand still on the scale, with one foot on each side and arms resting naturally at their sides. Once the scale reading stabilized, the weight was noted in kilograms.

Height: Height was measured with a portable standardized stadiometer. For the height measurement, participants were asked to remove footwear and any hat or hair ties. They were requested to stand on the flat board facing the interviewer, heels against the backboard with their feet together and knees straight. They were asked to look straight ahead and not tilt their head up, making sure that their eyes are at the same level as their ears. Height was recorded in centimeters (Cogill, 2003).

MUAC: MUAC was assessed using a standard measuring tape designed for this purpose. The measurement was always taken on the child's left arm. After gently uncovering the arm, the midpoint between the shoulder and elbow was identified. With the child's arm relaxed and straight, the tape was placed around the midpoint and fitted snugly without compressing the skin. The reading was then taken in centimeters.

c. Dietary assessment: A food frequency questionnaire (FFQ) and the 24-hour diet recall technique were used to examine diets. Based on the frequency of intake of a specified food list for a week, the FFQ was used to assess the typical dietary pattern, understand the quality of the diet, and predict obesity outcomes. Participants were asked to recollect their food intake in the preceding 24 hours for the 24-hour food recall (the previous day). Measuring cups were used to quantify the amount of food consumed. The amount of nutrients consumed was determined using the gram equivalents of various items.

d. Brief Autism Mealtime Behavior Inventory (BAMBI): The Brief Autism Mealtime Behavior Inventory (BAMBI) is a standardized tool used to assess feeding difficulties in children with Autism Spectrum Disorder(ASD). The updated version contains 18 items rated on a five-point Likert scale (*1 = Never/Rarely* to *5 = At Almost Every Meal*). It

evaluates three main domains: limited food variety, food refusal, and autism-related mealtime behaviours, making it a practical measure for identifying and understanding feeding challenges (Lukens & Linscheid, 2008).

e. Dietary Assessment: A food frequency questionnaire (FFQ) and the 24-hour diet recall technique were used to examine diets. Based on the frequency of intake of a specified food list for a week, the FFQ was used to assess the typical dietary pattern, understand the quality of the diet, and predict obesity outcomes. Participants were asked to recollect their food intake in the preceding 24 hours for the 24-hour food recall (the previous day). Measuring cups were used to quantify the amount of food consumed. The amount of nutrients consumed was determined using the gram equivalents of various items.

3.10 Pretesting

Pretesting was done on 10 ASD children and their caretakers for the practicability and viability of the tool. The questionnaire was developed first in English and reviewed by the supervisor of the research. The draft sets of questionnaires and anthropometric instruments were pretested among the ASD children from the study site itself. This helped to achieve accuracy and clarity in the questionnaire, understand interviewing techniques as well as aid in standardization procedures for anthropometry. After pre-testing all the ambiguous, misleading and wrongly interpreted questions were omitted and questionnaires were revised per the findings of pretesting.

3.11 Validity and Reliability of the Study Tools

Every research is not totally reliable and valid. The biasness of the respondents may produce wrong data during structured and unstructured questionnaire. It is the job if the research to illuminate wrong data as possible. The researcher should use own knowledge to decide the people, located and time for the questionnaire. Should respect the sentiments of the recipient and should not force him/her for answer. The questions should have been asked in polite form which will help to generate accurately data. Researcher has been used all the tools and techniques of data collection methods in well mannered way. The validity and reliability of the data may be measured by cross questioning. Participatory observation researcher would use full effort to make the data reliable and valid by meeting the targeted person.

3.12 Ethical Consideration

Ethical approval for the study was obtained from the Central Campus of Technology. Prior to data collection, verbal consent was obtained from the parents or caretakers of the study participants after clearly explaining the objectives and purpose of the research. Participants were assured that their involvement was voluntary and that they could withdraw from the study at any time without any consequences. Privacy and confidentiality of all information collected were strictly maintained at every stage of the study.

3.13 Informed Content

Informed consent will be obtained from all respondents before they participate in the study. This process will include a detailed explanation of the study's purpose and the respondents' rights, emphasizing confidentiality and voluntary participation. The caretakers of the participants will sign a consent form, which will be drafted in line with ethical guidelines and standards.

3.14 Plan for Data Management and Analysis

The collected information will be analyzed and interpreted in tables, charts and figures. Data analysis will be done using SPSS version 20 and MS-Excel version 2019 for comprehensive evaluation. Quantitative data will first be cleaned, coded, and then entered in SPSS. Similarly, qualitative data will be transcribed and coded by assigning labels to various categories for further analysis.

Part IV

Result and Discussion

A total of 92 people participated from anthropometric measurement within them 57 participated to this research. Participants consist of the parents/ caretakers of both girls and boys. Participants were selected at random from 3 different autism centers. These centers names are Anmol Special Education Centre, Biratnagar Metropolitan Autism Centre and Satya Om Sai School. The survey was conducted between the dates of March 2025 and June 2025. All participants were previously diagnosed with ASD by the pediatricians, child neurologist, or a child psychiatrist. All the parents were voluntarily participated in this study. The data was analyzed in Ms. Excel 2019 and IBM SPSS 22. The results are demonstrated under the following heading:

4.1 Socio-economic and Demographic Characteristics

Table 4.1(a) shows that out of 57 participants in the study, the age of the study participants ranged from 2 to 13 years. The distribution of the children according to age group showed that 19 (33.3%) children were aged 2–5 years, while the majority, 38 (66.7%) children, belonged to the 6–13 years age group. This indicates that a larger proportion of the autistic children included in the study were of school-going age. Out of 52 participants, 66.67% informant was mother and 29.82% was father as well as 3.51% informant was other family member.

Table 4.1 (a) Socio-demographic characteristics of the study population (n=57)

Variables	Frequency	Percentage
Age group		
2-5	19	33.33
6-13	38	66.7
Informant		
Mother	38	66.67
Father	17	29.82
Other	2	3.51

As seen in Table 4.1 (b), The study shows that 66.67% (38) children were from nuclear family while remaining, 33.33% (19) lived in joint family. It was an observed pattern that people nowadays are living in a nuclear pattern due to occupation as well as education purpose. The break down in family size of children's household was as follows, household with 3-4 members had a highest percentage 34 (59.65%) while below 5 had 23 (40.35%). The majority of children were from permanent household type i.e. 33 (57.89%) and 24 (42.11%) were living temporary in rented house.

Table 4.1 (b) Socio-economic and demographic characteristics of the study population (n=57)

Variables	Frequency	Percentage
Types of family		
Nuclear	38	66.67
Joint	19	33.33
Family size	34	59.65
3-4 members		
5-8 members	23	40.35
Household types		
Permanent	33	57.89
Temporary	24	42.11

From table 4.1(c), Regarding the educational status of parents, more than half of the fathers (54.39%) had completed education corresponding to secondary education level while 28.07% were in . A smaller proportion (14.04%) of fathers were in category primary, and only 3.51% were in category illiterate. Similarly, among mothers, the largest groups were those in categories primary and secondary, each accounting for 38.60% of the total respondents, followed by 22.81% in category . These results indicate that most fathers had attained a

moderate level of education, whereas mothers were more evenly distributed between the lower and middle educational levels. The majority of the respondents' families (50.88%) belonged to the highest income above 30,000, while 38.60% were in the middle-income category i.e 20,000-30,000. Only a small proportion (10.53%) of the families fell under the lowest income category i.e below 20,000. This suggests that more than half of the participants came from relatively higher-income households, with fewer families in the lower-income group.

Table 4.1 (c) :Socio-demographic characteristics of study population (n=57)

Variables	Frequency	Percentage
Father's education level		
Primary	8	14.04
Secondary	31	54.39
University	16	28.07
Illiterate	2	3.51
Mother's education level		
Primary	22	38.60
Secondary	13	22.81
University	6	10.53
Illiterate	16	28.06
Mother's occupation		
Housewife	42	73.68
Job holder	15	26.32
Income category		
Below 20,000	6	10.53
20,000-30,000	22	38.60
Above 30,000	29	50.88

4.2 Child Characteristics

According to Table 4.2 of the study, out of 57 participants, 66 (71.74%) were male and 26 (28.26%) were female. This data indicates that the majority of the participants were male, while female participants represented a smaller proportion of the study population.

Table 4.2: Child characteristics of the study population (n=57)

Variables	Frequency	Percentage
Gender		
Male	66	71.74
Female	26	28.26

4.3 Maternal Description

As shown in Table 4.3 (a), among 57 participants, The majority of respondents (49.13%) got married between the ages of 21 and 25 years, followed by 33.33% who were married between 15 and 20 years of age. A smaller proportion (14.04%) got married between 26 and 30 years, while only 3.51% married between 31 and 35 years. This indicates that most participants entered marriage during their early twenties, which reflects a common trend of early adult marriage in the study population. The findings revealed that the majority of respondents (43.86%) experienced their first pregnancy between the ages of 26 and 30 years. This was followed by 38.60% who had their first pregnancy between 21 and 25 years, while 17.54% became pregnant between 15 and 20 years of age. These results indicate that most participants had their first pregnancy during their mid to late twenties, suggesting a tendency toward delayed childbearing compared to very early pregnancy.

Table 4.3 (a): Maternal description of the study population (n=57)

Variables	Frequency	Percentage
Marriage age group (years)		
15-20	19	33.33
21-25	28	49.13
26-30	8	14.04
31-35	2	3.51
First pregnancy of mother (age in years)		
15-20	10	17.54
21-25	22	38.60
26-30	25	43.86

From table 4.3 (b), out of 57 participants, the majority of respondents (96.49%) reported that they had taken iron tablets during pregnancy, while only 3.51% had not. This shows a high level of iron supplementation compliance among the participants, indicating good awareness or access to maternal health services. The majority of respondents (84.21%) reported that they were aware of malnutrition, while only 15.79% stated that they did not know about it. This indicates a generally high level of awareness regarding malnutrition among the participants, suggesting that most respondents were familiar with the concept and its potential health impacts.

Table 4.3 (b): Maternal description of the study population (n=57)

Variables	Frequency	Percentage
Iron tablet		
Yes	55	96.49
No	2	3.51

Know malnutrition		
Yes	48	84.21
No	9	15.79

As shown in Table 4.3 (c), Regarding food intake during pregnancy, 47.37% of the respondents reported that they consumed *less* food than usual, while 40.35% stated that they ate *more* during pregnancy. Only 12.28% indicated that they maintained their *usual* level of food intake. These findings suggest that a considerable proportion of women reduced their food consumption during pregnancy, which may reflect misconceptions, cultural practices, or inadequate nutritional awareness during this period. The results showed that more than half of the respondents (54.39%) consumed 3 to 4 meals per day. Additionally, 31.58% reported eating more than four meals daily, while 14.04% consumed fewer than three meals per day. These findings indicate that the majority of participants followed a meal pattern of at least three meals per day, although a notable proportion reported higher meal frequency, which may reflect increased nutritional needs or individual eating habits. All respondents (100%) reported using iodized salt in their households. This indicates complete adoption of iodized salt among the study population, reflecting strong awareness or availability of iodized salt and aligning with public health efforts to prevent iodine deficiency disorders.

Table 4.3 (c): Maternal description of the study population (n=57)

Variables	Frequency	Percentage
Food consumed in pregnancy		
More than usual	23	40.35
Less than usual	27	47.37
As usual	7	12.28
Meals per day		
Less than 3	8	14.04
Between 3-4	31	54.39

More than 4	18	31.58
Salt type		
Iodized	57	100

4.4 Birth Description of the Study Population

As seen in table 4.4 (a), among the participants, the majority of births (73.68%) were normal vaginal deliveries, while 26.32% were caesarean sections. This indicates that most deliveries in the study population occurred naturally, with a smaller proportion requiring surgical intervention. The majority of the children had normal birth weight (3.0–3.9 kg), accounting for 74.08% of the total sample. However, 18.52% of the children were born with low birth weight (2.0–2.9 kg), indicating a substantial proportion at risk of growth and developmental challenges. A smaller proportion (7.40%) had high birth weight (≥4.0 kg). These findings suggest that while most children had normal birth weight, nearly one-fifth experienced low birth weight, which may contribute to increased vulnerability to nutritional and growth problems among children with autism.

Table 4.4 (a) Birth description of the study population (n=57)

Variables	Frequency	Percentage
Child delivered		
Public hospital	21	36.84
Private hospital	36	63.16
Birth type		
Caesarean sections	15	26.32
Normal	42	73.68
Birth weight		
2.0–2.9 (Low birth wt)	10	18.52
3.0-3.9(Normal birth wt)	40	74.08
≥4.0 (High birth wt)	4	7.40

4.5 Health and Immunization of Study Population

From table 4.5 (a) ,When caregivers were asked how they recognized illness in their children, most reported noticing an increase in body temperature, which was identified by half of the respondents (50.00%). Some caregivers recognized illness through a combination of signs, such as irritability, laziness, and fever (21.43%). Others noticed changes in behaviour, describing their child as lazy (17.86%) or irritable (10.71%) when unwell. This suggests that caregivers tended to rely more on visible physical signs of illness, while subtle behavioural changes were less commonly recognized. Most caregivers reported seeking treatment for their child from healthcare facilities or pharmacies, with 51 out of 57 respondents choosing this option. However, a smaller proportion of caregivers (6 respondents) reported visiting a Jhakri (traditional healer) for treatment. This finding suggests that while the majority of families rely on modern medical services for managing illness in children with autism, traditional healing practices are still used by some caregivers.

Table 4.5(a) Health and immunization of study population (n=57)

Variables	Frequency	Percentage
Illness recognition		
Irritability	3	10.71
Lazy	5	17.89
Body temperature	14	50.00
All	6	21.43
Treatment place		
Health care/ Pharmacy	51	89.47
Jhakri	6	10.53

4.6 Nutrition Status Assessment of Study Population

According to 4.6 (a), When caregivers talked about their child's nutrition, many felt that their child was doing well and had no nutritional problems. However, a considerable number shared that their child had experienced nutritional deficiencies, which may be linked to the feeding difficulties, food selectivity, and poor appetite often seen in children with autism. A few caregivers were not sure

about their child's nutritional status, suggesting that nutritional problems may sometimes go unnoticed without proper assessment and guidance.

Table 4.6 (a), Nutrition status assessment of study population (n=57)

Variables	Frequency	Percentage
Yes	16	28.07
No	37	64.91
Don't know	4	7.02
Deficiency Specify		
Vitamin	6	42.86
Vitamin D and Iron	2	14.29
Vitamin B12	4	28.57
Others	2	14.29

Table 4.6 (b) states, Most caregivers noticed that their child's weight had either increased or stayed the same over time. Nearly half of the caregivers reported weight gain, while many felt that there had been no major change in their child's weight. Only a few caregivers observed weight loss, which may reflect feeding difficulties, poor appetite, or recent illness. A small number of caregivers were unsure about weight changes. This shows that while weight gain is common among children with autism, some children remain at risk of undernutrition and need regular growth monitoring. The assessment of appetite among the participants revealed that the majority (57.89%) reported a poor appetite, while 38.60% indicated a good appetite and only a small proportion (3.51%) reported a very good appetite. These findings suggest that a significant number of participants experience reduced appetite, which may have implications for their overall nutritional status.

Table 4.6 (b), Nutrition status assessment of study population (n=57)

Variables	Frequency	Percentage
Weight changed		
Weight loss	4	7.02
Weight gain	27	47.37
No change	24	42.11
Don’t know	2	3.51
Appetite		
Good	22	38.60
Poor	33	57.89
Very good	2	3.51
Meals per day		
1-2	4	7.02
3	4	7.02
3+	45	78.95
Irregular	4	7.02

4.7 Feeding Behaviours and Challenges of Study Population

Among the participants, 59.65% exhibited food selectivity, while 40.35% did not. This indicates that a majority of the participants tend to prefer specific foods, which may influence dietary variety and overall nutrient intake.

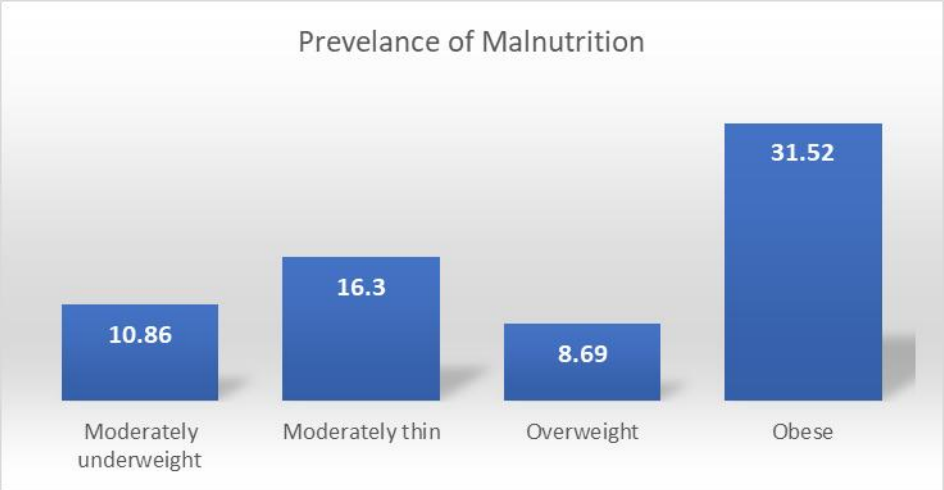
Table 4.7 Feeding behaviours and challenges of study population

Variables	Frequency	Percentage
Yes	34	59.65
No	23	40.35
Food rejection		

Vegetable	Yes	28	49.12
	No	29	50.88
Fruits	Yes	32	56.14
	No	25	43.86
Meat	Yes	36	63.16
	No	21	36.84
Dairy	Yes	39	68.42
	No	18	31.58
Grains	Yes	50	87.72
	No	7	12.28
Texture	Yes	43	75.44
	No	14	24.59
Others	Yes	48	87.27
	No	5	9.09
	Don’t know	2	3.64
Aversions	Yes	8	14.04
	No	23	54.39
	Don’t know	24	96.49
Feeding difficulty			
Daily		11	19.30
Weekly		11	19.30
Occasionally		31	54.39
Never		4	7.02

4.8 Prevalence of Malnutrition

Anthropometric indices are the major tools for the assessment for nutritional status of children. Deviation of anthropometric indices from the reference standard of those indices was the evidence of malnutrition (Shrestha, 2014). The indices obtained were weight for age(underweight), height for age(stunting), weight for height(wasting), BMI for age (thin and overweight) to assess the prevalence of nutritional status of autistic children in different school and centres located in Biratnagar.



The overall magnitudes of malnutrition among the study population were 10.86% and 16.3% for moderately underweight and moderately thin respectively as shown in Figure. Similarly, 8.69% of autistic participants were found to be overweight and 31.52% were obese. In a study among autistic children in Oman (Al-Farsi et al., 2011a) the prevalence of underweight were found to be 3.9%. In the present study, more autistic children were found to have a higher BMI for their age and were overweight and obese. Several studies have revealed that the prevalence of obesity and overweight is significantly greater among children with autism compared to the general population (Curtin et al., 2005; Memari et al., 2012; Kamal et al., 2019). The higher prevalence of obese suggest that overnutrition was more prevalent than undernutrition (Eow et al., 2021)

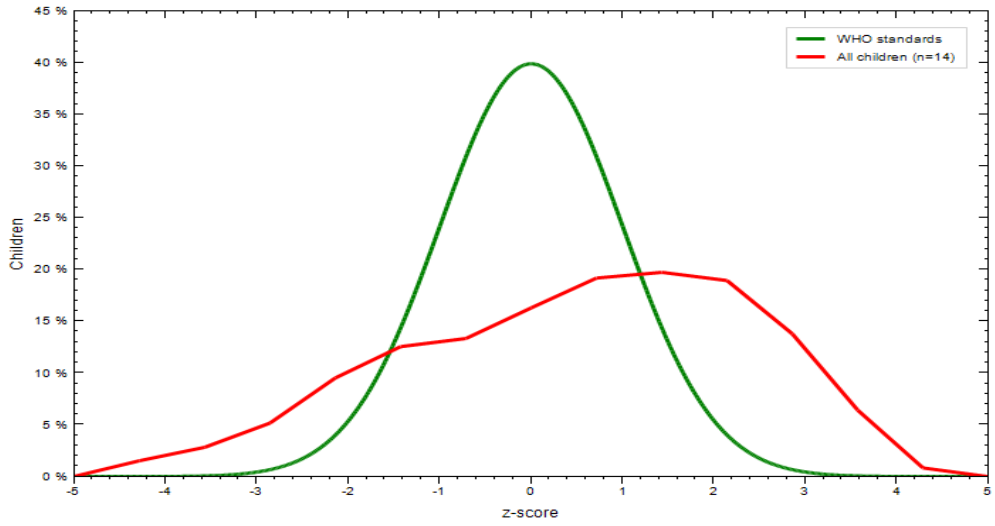
4.9 Nutritional Status in Comparison with WHO Standard

4.9.1 Nutritional Status of 2 to 5 Year Autistic Children

Distribution of underweight, stunting and BMI-for-age among autistic children 2 to 5 years of age based on WHO standards are shown in the figures below respectively.

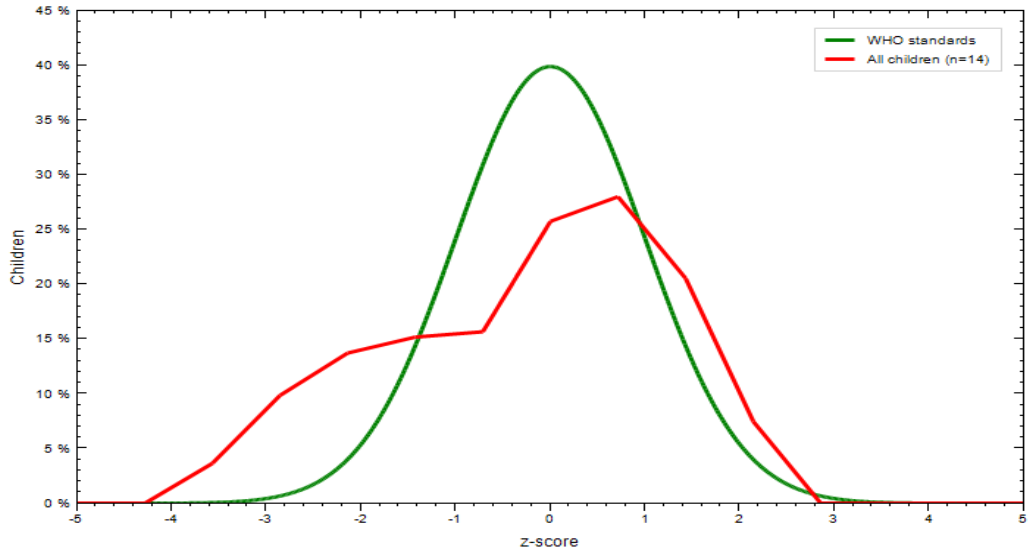
Weight for height

The mean weight-for-height z-score of children aged 2–5 years was found to be +1.43, which is above the WHO reference standard. This indicates that most children in this age group have adequate weight relative to their height, with some tending towards higher weight. The distribution curve is slightly shifted to the right of the WHO standard, suggesting a low prevalence of wasting (<5%) and generally good nutritional status.



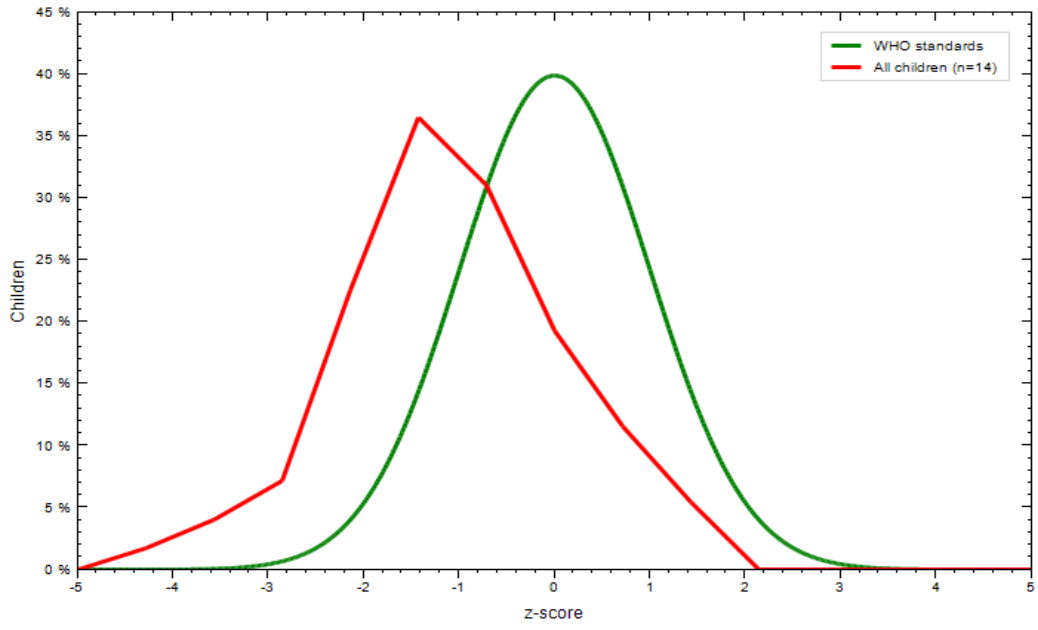
Weight for age

The mean weight-for-age z-score was +0.59, indicating that the average weight of children is above the WHO reference median. The curve is slightly shifted to the right, suggesting that most children have normal or above-normal weight for their age. The prevalence of underweight appears to be very low (<5%), indicating overall adequate nutrition.



Height for age

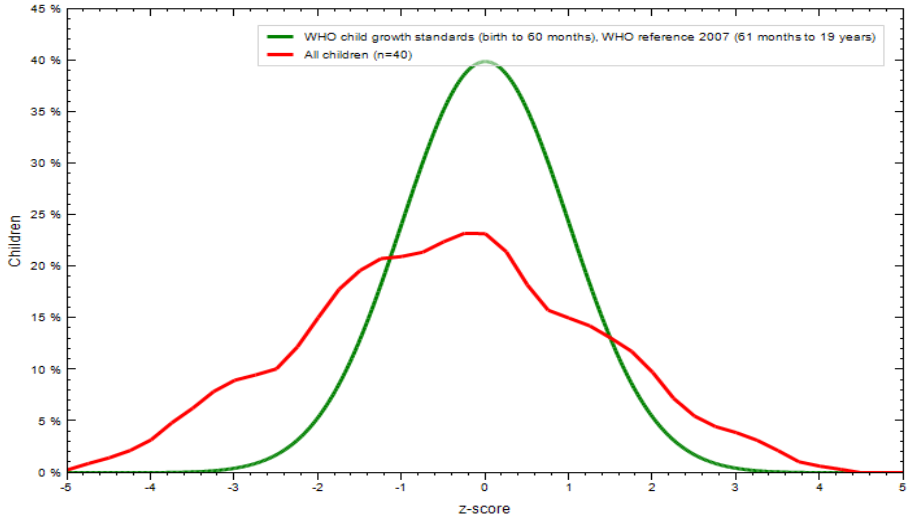
The mean height-for-age z-score was −0.57, which is slightly below the WHO reference but still within the normal range. This indicates that children are marginally shorter compared to the standard population. The slight leftward shift of the curve suggests a small proportion of stunting (around 5–10%), reflecting mild chronic nutritional influence.



4.9.2 Nutritional Status of 6 to 13 Year Autistic Children

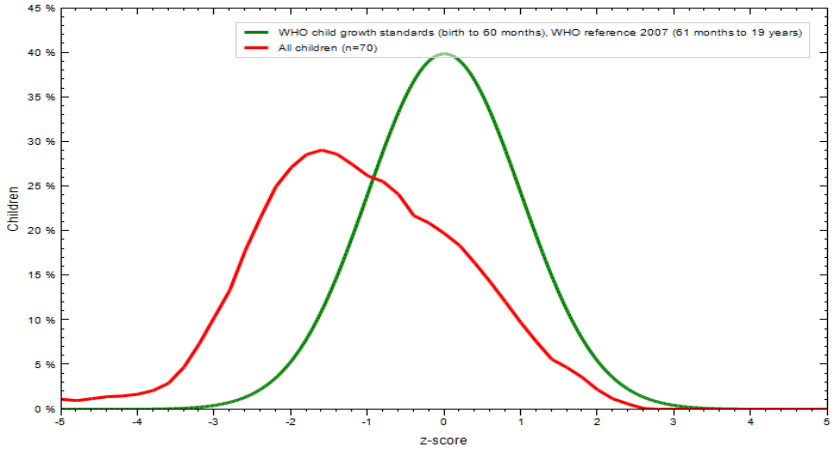
Weight for age

The mean weight-for-age z-score of children aged 6–13 years was found to be −0.49, which is slightly below the WHO reference standard. This indicates that, on average, children in this age group have marginally lower weight for their age. The distribution curve shows a slight shift towards the left, suggesting a mild prevalence of underweight (around 5–10%) among the study population.



Height for age

The mean height-for-age z-score was +0.11, which is very close to the WHO reference standard. This indicates that the children generally have normal height for their age. The distribution curve is almost aligned with the WHO standard, suggesting minimal or no significant prevalence of stunting (<5%) in this age group.



4.10 Food frequency questionnaire

As shown in Table, among cereal products, rice was regularly consumed by 98% of the participants in the study population while 26% and 21.2% consumed wheat and maize/millet/barley and its products respectively. The regular consumption of daal was found to be 90.4%. About 41.3% of children regularly consumed green leafy vegetables while 8.7% said they dislike them. A majority (64.4%) of children consumed fruits regularly which is higher than the consumption of vegetables. The study showed that the regular consumption of milk was very high i.e. 76% whereas 14.4% said that they disliked milk and wouldn't eat it. The consumption of different kinds of meat was found to be low with the majority of the participants only consuming it rarely. The regular consumption of eggs was found to be 41.3% while 28.8% said they disliked eggs. Majority of the respondents consumed processed/fast foods with 17.3% consuming it regularly, 54.8% consuming it frequently and 26% consuming it on a rare basis.

Table 4.10 (a) Distribution of food intake (n=57)

Variables	Regular	Frequent	Rare	Never
Rice	55 (98%)	1 (1%)	1 (1%)	-
Wheat	15 (26%)	17(30.8%)	17(30.8%)	8 (12.5%)
Maize/millet/barley	13 (21.2%)	16 (27.9%)	17 (30.8%)	11(17.3%)
Daal	51 (90.4%)	4 (6.7%)	2(2.9%)	-
Grams/beans/peas	4 (6.7%)	20 (35.6%)	25 (45.2%)	8(12.5%)
Green leafy vegetables	23 (41.3%)	17 (31.7%)	10 (18.3%)	5 (8.7%)
Other vegetables	31 (55.8%)	15 (26.9%)	8 (12.5%)	3 (4.8%)
Roots and tubers	8 (14.4%)	14 (24%)	19 (32.7%)	16 (28.8%)
Fruits	37 (64.4%)	9 (15.4%)	6 (11.5%)	5 (8.7%)
Milk	43 (76%)	3 (4.8%)	3 (4.8%)	8 (14.4%)
Curd	6 (10.6%)	8 (12.5%)	17 (30.8%)	26 (46.2%)
Ghee/butter	37 (67.3%)	4 (7.7%)	5 (8.7%)	11 (16.3%)

Paneer/cheese	2 (3.8%)	6 (11.5%)	21 (37.5%)	28 (47.1%)
Chicken	3 (5.8%)	17 (29.8%)	21 (36.5%)	16 (27.9%)
Fish	-	2 (3.8%)	14 (25%)	41 (71.2%)
Red meat	1 (1%)	4 (6.7%)	23 (41.3%)	29 (51%)
Egg	23 (41.3%)	13 (24%)	3 (5.8%)	18 (28.8%)
Processed food	10 (17.3%)	31 (54.8%)	15 (26%)	1 (1.9%)

4.11 Dietary Intake

Below table shows that the mean energy intake among children aged 2–3 years was 120.78% of the RDA, which was significantly higher than the recommended value (p = 0.019). Protein and fat intakes were also significantly excessive, contributing 154% and 201.45% of the RDA respectively ($p < 0.01$). In contrast, mean iron intake was below the RDA (80.31%), and the difference was statistically significant ($p < 0.001$), indicating inadequate iron intake in this age group.

Table 4.11 (a): Nutrient intake by 2-3 years old autistic children (n=57)

Nutrients	Mean intake ± SD	RDA	% of RDA	t-value	P-value
Energy (kcal/day)	1340.62± 214.00	1110	120.78	3.048	0.019*
Protein (g/day)	19.25 ± 1.04	12.5	154.00	18.445	0.000*
Fat (g/day)	50.36 ± 16.35	25	201.45	4.387	0.003*
Iron (mg/day)	6.42 ± 0.25	8	80.31	-17.473	0.000*

As shown in Table, children aged 4–6 years consumed significantly higher amounts of energy (124.22% of RDA), protein (173.33% of RDA), and fat (187.22% of RDA) compared to the recommended allowances ($p < 0.001$). Iron intake was slightly lower than the RDA (91.67%) and the difference was statistically significant (p = 0.036), suggesting a mild risk of iron inadequacy.

Table 4.11 (b): Nutrient intake by 4-6 years old autistic children (n=57)

Nutrients	Mean intake ± SD	RDA	% of RDA	t-value	P-value
Energy (kcal/day)	1378.89 ± 198.62	1110	124.22	5.743	0.000*
Protein (g/day)	21.67 ± 3.93	12.5	173.33	9.907	0.000*
Fat (g/day)	46.81 ± 11.01	25	187.22	8.404	0.000*
Iron (mg/day)	7.33 ± 1.24	8	91.67	-2.276	0.0036*

Table 4.10 (b) indicates that children aged 7–9 years had a markedly higher intake of all assessed macronutrients. Energy intake exceeded the RDA by 56.76%, while protein and fat intake reached 229.33% and 237.33% of the RDA respectively, with all differences being statistically significant ($p < 0.001$). Mean iron intake was also significantly higher than the RDA (117.36%, $p < 0.001$), indicating adequate to excess iron consumption.

Table 4.11 (c). Nutrient intake by 7-9 years old autistic children (n=57)

Nutrients	Mean intake ± SD	RDA	% of RDA	t-value	P-value
Energy (kcal/day)	1740±231.01	1360	156.76	11.570	0.000*
Protein (g/day)	28.67±1.53	16	229.33	44.715	0.000*
Fat (g/day)	59.33±17.10	25	237.33	8.520	0.000*
Iron (mg/day)	9.39±0.50	11	117.36	11.747	0.000*

According to Table , children in the 9–12-year age group showed the highest excess intake of macronutrients. Mean energy intake was 166.89% of RDA, while protein and fat intake were 234% and 270.70% of RDA respectively, all of which were statistically significant ($p < 0.001$). Iron intake was also significantly above the recommended level (117.71%, $p < 0.001$), suggesting adequate iron intake in this age group.

Table 4.11 (d). Nutrient intake by 9-12 years old autistic children (n=57)

Nutrients	Mean intake ± SD	RDA	% of RDA	t-value	P-value
Energy (kcal/day)	1852.50± 252.99	2220	166.89	10.167	0.000*
Protein (g/day)	29.25± 1.36	32	234.00	42.765	0.000*
Fat (g/day)	67.67± 20.01	35	270.70	7.387	0.000*
Iron (mg/day)	9.42± 0.51	16	117.71	9.530	0.000*

Table presents nutrient intake for children aged 13 years and above. Due to the presence of only one participant in this age group, statistical tests could not be performed. However, the observed intake values indicate substantially higher consumption of energy (194.59% of RDA), protein (240% of RDA), and fat (374.40% of RDA), while iron intake was slightly above the RDA (112.50%).

Table 4.11 (e): Nutrient intake by ≥13 years old autistic children (n=57)

Nutrients	Mean intake ± SD	RDA	% of RDA
Energy (kcal/day)	2160± 82.9	2860	194.59
Protein (g/day)	30± 7.32	45	240.00
Fat (g/day)	93.6± 12.4	45	374.40
Iron (mg/day)	9± 0.72	22	112.50

Overall, the tables demonstrate excess intake of energy, protein, and fat across all age groups, while iron inadequacy was observed in younger children (2–6 years) and adequate intake in older age groups.

4.12 BAMBI Questionnaire

According to the analysed data, mealtime behaviours among the study children varied across different BAMBI scale items. Regarding food refusal behaviours, 28.6% of children rarely cried or screamed during meals, while an equal proportion (28.6%) often did so. Similarly, turning the face or body away from food also showed a comparable pattern, with 28.6% of children rarely avoiding food and 21.4% often doing so. In relation to expelling food or spitting behaviours, children showed moderate levels, with 35.7% spitting rarely, while 28.6% reported often spitting out food. Closing the mouth tightly when food was presented occurred most commonly at lower frequencies, with 28.6% of children rarely closing their mouths, while 21.4% often did so.

Table 4.12 (a) Mealtime behaviour

Mealtime behaviour	Never (%)	Rarely (%)	Seldom (%)	Occasionally (%)	Often at almost every meal (%)
Food refusal					
Crying, screaming	17.5	19.3	12.3	17.5	33.3
Turning face, body	17.5	7.0	21.1	35.1	19.3
Expel out food	29.8	14.0	17.5	31.6	7.0
Showing disruptive behaviour	35.1	24.6	15.8	14.0	10.5
Closing mouth tightly	31.6	15.8	7.0	36.8	8.8
Features of autism					
Remains seated	26.3	26.3	7.0	15.8	24.6
Shows aggressive behaviour	40.4	31.6	14.0	10.5	3.5
Shows self-injurious behaviour	42.1	17.5	7.0	29.8	3.5
Flexible about mealtime routines	28.1	10.5	31.6	19.3	10.5

Refuses food that requires a lot of chewing	24.6	10.5	5.3	15.8	43.9
Limited variety					
Willing to try new foods	38.6	19.3	5.3	19.3	17.5
Dislikes certain foods	19.3	5.3	14.0	47.4	14.0
Prefers same food	17.5	15.8	8.8	35.1	22.8
Prefers crunchy foods	12.3	8.8	7.0	29.8	42.1
Accepts or prefers a variety of food	19.3	5.3	14.0	47.4	14.0
Prefers to have food served in a particular way	19.3	28.1	10.5	17.5	24.6
Prefers only sweet food	29.8	5.3	21.1	22.8	21.1
Prefers food prepared in a particular way	15.8	28.1	21.1	7.0	28.1

A considerable proportion of children demonstrated seating difficulties. Only 7.1% never remained seated, whereas 35.7% seldom remained seated throughout meals. Aggressive behaviour such as hitting or kicking was primarily low, with 35.7% of children never exhibiting aggression and another 28.6% only rarely doing so. Self-injurious behaviour was also minimal, with 28.6% seldom and 28.6% often showing such behaviours.

Flexibility regarding mealtime routines varied. Children showed a high tendency toward either full flexibility or full inflexibility, with 28.6% rarely flexible and 21.4% often flexible with mealtime changes. Refusal of foods requiring extensive chewing showed mixed responses, where 35.7% of children rarely refused such foods, whereas 28.6% often refused them.

Limited Food Variety and Food Selectivity

Food selectivity characteristics appeared prominent. About 28.6% of children rarely tried new foods, and the same proportion (28.6%) seldom tried new foods. Similarly, 28.6% of children often displayed picky-eating behaviour, refusing foods they disliked. Preference for the same food at every meal was also notable, with 28.6% of children rarely preferring the same food, but another 28.6% often preferring it. Crunchy foods were commonly appreciated, with 28.6% of children often preferring crunchy food items, and 21.4% seldom doing so. Acceptance of a variety of foods showed that 35.7% of children rarely accepted a variety, while 28.6% seldom did so. Regarding food presentation features, 28.6% of children rarely required food to be presented in a certain way, while 21.4% seldom required it. Sweet food preference appeared prominent: 28.6% of children rarely preferred only sweet foods, but 21.4% often and 21.4% seldom preferred them. Food preparation preferences also varied; 28.6% of children rarely preferred food prepared in a certain way, while an equal proportion (28.6%) often required specific preparation.

4.12 (b) Features of Autism Expressed During Mealtimes

Features	Total Problematic (4+5)%
Problems with crispy food	71.9
Not accepting food variety	61.4
Refusal to chew food	59.6
Prefers only same food	57.9
Turns face/ body from food	54.4
Crying/ screaming at meal	50.9
Closes mouth tightly	45.6
Prefers only sweet food	43.9
Problem with food presentation	42.1
Difficulty staying seated	40.4

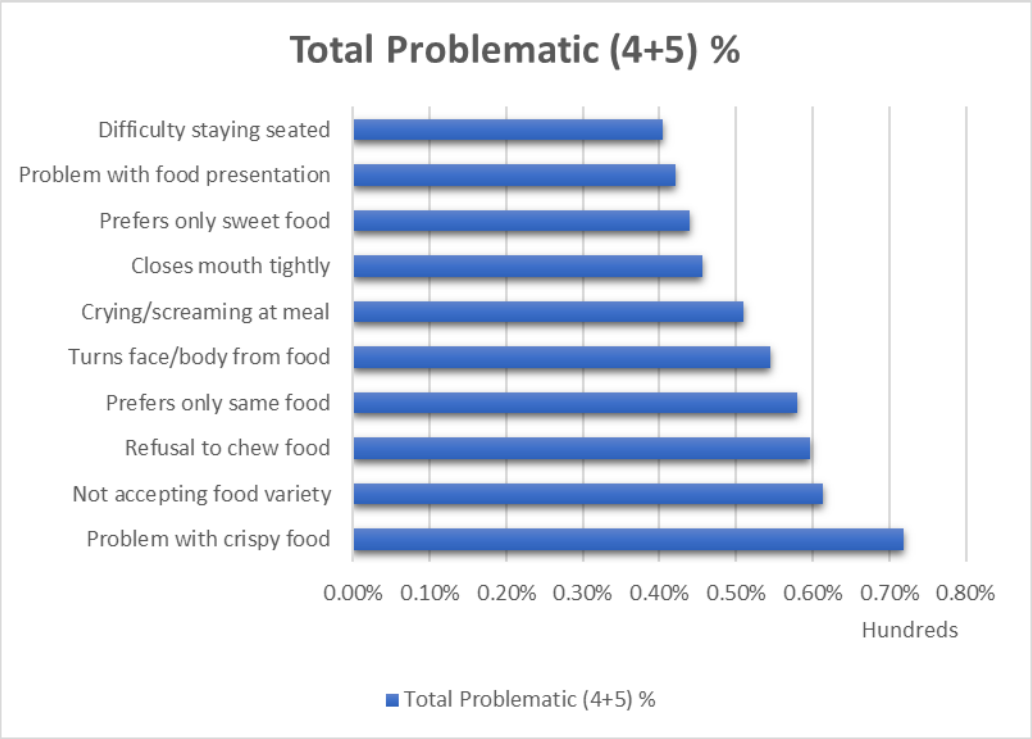


Figure 5 Features of Autism children

4.13 Factors Affecting Malnutrition

Malnutrition was assessed by underweight, stunting and thinness/obesity. The factors associated with these categories were assessed separately using the chi-square test as shown below.

4.13.1 Factors Affecting Underweight and Over Weight

This study assessed factors affecting weight-for-age (WAZ) among children with autism spectrum disorder (ASD). The findings indicate that malnutrition in autistic children is influenced by a combination of parental education, dietary patterns, feeding behaviours, infant feeding practices, household income, and caregiver knowledge. These findings are consistent with previous research highlighting the complex and multifactorial nature of nutritional problems in children with autism.

Father's education was significantly associated with WAZ status ($\chi^2 = 15.537$, $p = 0.016$). Children whose fathers had secondary or university education were more likely to have normal WAZ, whereas underweight was more common among children of fathers with primary education or illiteracy. Similar findings have been reported in studies indicating that educated parents are better able to manage feeding difficulties, seek professional advice, and provide nutritionally balanced diets to children with ASD (Sharp et al., 2013). Parental education improves awareness of food selectivity, sensory issues, and appropriate dietary management in autism.

Dietary frequency, particularly fruit, root, and rice consumption, showed significant associations with WAZ. Fruit frequency was significantly associated with WAZ ($\chi^2 = 10.605$, $p = 0.031$), with normal WAZ more common among children consuming fruits frequently or regularly. This finding aligns with (Bandini, 2010), who reported low fruit and vegetable intake among children with autism due to food selectivity, contributing to imbalanced diets and abnormal weight outcomes. Roots ($\chi^2 = 9.748$, $p = 0.008$) and rice frequency ($\chi^2 = 7.585$, $p = 0.023$) were also significantly associated with WAZ. Autistic children often prefer carbohydrate-rich foods such as rice, which may meet energy needs but lack micronutrient diversity, leading to malnutrition when consumed excessively or without dietary balance.

Feeding behaviour, particularly texture rejection, showed a significant association with WAZ ($\chi^2 = 6.213$, $p = 0.045$). Children who rejected food textures were more likely to have abnormal WAZ. Sensory-based feeding problems are widely reported in autism and can significantly limit dietary variety (Cermak, 2010). Appetite status also showed a borderline significant association with WAZ ($\chi^2 = 9.400$, $p = 0.05$), where poor appetite was linked to underweight. Appetite disturbances in ASD may be related to gastrointestinal discomfort, sensory sensitivities, or behavioural feeding challenges.

A strong association was found between nutrient deficiency/weight loss and WAZ ($\chi^2 = 19.688$, $p = 0.003$). All children with recent weight loss were underweight. Previous studies have documented high prevalence of micronutrient deficiencies such as vitamin D, vitamin B12, and iron among children with autism due to restricted diets, which negatively affect growth and weight gain (Adams, 2011)

Infant feeding practices also showed significant relationships with WAZ. Pre-lacteal feeding was significantly associated with abnormal WAZ ($\chi^2 = 8.540$, $p = 0.014$). Both breastfeeding duration ($\chi^2 = 23.083$, $p = 0.027$) and breastfeeding initiation time ($\chi^2 = 21.828$, $p = 0.039$) were significantly associated with WAZ,

with better outcomes observed among children breastfed for at least six months and initiated within one hour of birth. Early feeding problems have been shown to predict later feeding difficulties in children with ASD (Schreck, 2006).

Household income adequacy was significantly associated with WAZ ($\chi^2 = 5.825$, $p = 0.05$). Underweight was more common among children from households with insufficient income. Families of children with autism often face additional financial burdens related to therapy and special dietary needs, which may compromise food quality and quantity (Mandell, 2010). Meal frequency was also significantly associated with WAZ ($\chi^2 = 12.893$, $p = 0.012$), highlighting the importance of regular and adequate meals.

Finally, caregiver knowledge about malnutrition showed a significant association with WAZ ($\chi^2 = 7.970$, $p = 0.019$). Children of caregivers who had knowledge about malnutrition were more likely to have normal WAZ. Previous intervention studies have shown that caregiver education improves feeding practices and nutritional outcomes in children with autism (Sharp, 2010).The present study concludes that malnutrition among children with autism is multifactorial. Weight-for-age status is significantly influenced by parental education, dietary diversity, feeding behaviours, appetite, micronutrient deficiencies, infant feeding practices, household income, meal frequency, and caregiver knowledge. Autism-specific challenges such as food selectivity, sensory sensitivities, and appetite disturbances interact with socioeconomic and caregiving factors, increasing vulnerability to both underweight and abnormal weight gain. Addressing malnutrition in children with autism therefore requires integrated, family-centred, and autism-specific nutritional interventions.

Table 4.13.1 (a) : Factors associated with underweight and over weight among autistic children

WAZ status	Over weight	Normal	Underweight	Total	X2	P value
Father education						
Primary	0	5 (62.50)	3(37.50)	8	15.537	0.016*
Secondary	6 (19.35)	23 (74.19)	2(6.45)	31		
University	5 (31.25)	11 (68.75)	0	16		

Illiterate	1 (50.00)	0	1 (50.00)	2		
FRUITS FREQUENCY						
Frequent	5 (16.67)	20 (66.67)	5 (16.67)	30	10.605	0.031*
Regular	3 (14.29)	17 (80.95)	1 (4.76)	21		
Rare	4 (66.67)	2 (33.33)	0	6		
ROOTS FREQUENCY						
Frequent	6 (13.04)	34 (73.91)	6 (13.04)	46	9.748	0.008**
Regular	6 (54.52)	5 (45.45)	0	11		
RICE FREQUENCY						
Frequent	9 (16.98)	38 (71.70)	6 (11.32)	53	7.585	0.023*
Regular	3 (75.00)	1 (25.00)	0	4		
TEXTURE REFECTION						
Yes	6 (13.95)	33(76.74)	4 (9.30)	43	6.213	0.045*
No	6(42.86)	6(42.86)	2 (14.29)	14		
DEFICIENCY						
VIT	1 (16.67)	5 (83.33)	0	6	19.688	0.003**
VIT D	2 (100)	0	0	2		
VIT B12	1 (25)	3(75)	0	4		
WT LOSS	0	0	2 (100)	2		
Appetite						

Poor	4 (18.18)	17 (77.27)	1 (4.55)	22	9.400	0.05
Good	6 (18.18)	22(66.67)	5 (15.15)	33		
Very good	2 (100)	0	0	2		
Pre- lacteal						
Yes	8 (15.69)	37 (72.55)	6 (11.76)	51	8.540	0.014*
No	4 (66.67)	2 (33.33)	0	6		
Breastfeeding						
12 months	1 (50)	1 (50)	0	2	23.083	0.027*
24 months	3 (75)	1 (25)	0	0		
4 months	2(100)	0	0	2		
5 months	0	3 (100)	0	3		
6 months	5 (15.15)	22 (66.67)	6 (18.18)	33		
7 months	0	2 (100)	0	2		
9 months	1 (9.09)	10(10.90)	0	11		
Breastfeeding initiation time						
1 hr	8 (25)	21 (65.6)	3 (9.38)	32	21.828	0.039*
1 months	0	2 (100)	0	2		
2 hr	1 (12.5)	6 (75)	1 (12.50)	8		
25 min	0	3 (100)	0	3		
30 min	1 (14.29)	6 (85.71)	0	7		
After 8-9 hr	2 (100)	0	0	2		
After 9 days	0	1 (3.33)	2 (66.67)	3		
Income enough						

Yes	10 (23.81)	30 (71.43)	2 (4.76)	42	5.825	0.05
No	2 (13.33)	9 (60)	4 (26.67)	15		
Meals per day						
More than usual	5 (62.5)	3 (37.5)	0	8	12.893	0.012*
Less than usual	5 (16.13)	24 (77.42)	2 (6.45)	31		
As usual	2 (11.11)	12 (66.67)	4 (22.22)	18		
Know malnutrition						
Yes	9 (18.75)	36 (75)	3 (6.25)	48	7.970	0.019*
No	3 (33.33)	3 (33.33)	3(33.33)	9		

4.13.2 Factors Affecting Stunting and Tall

Height-for-age (HAZ) reflects chronic nutritional status and long-term growth patterns. In children with autism spectrum disorder (ASD), linear growth can be affected by prolonged feeding difficulties, selective eating, gastrointestinal issues, and suboptimal infant feeding practices. The present study identified several dietary, behavioural, socioeconomic, and early-life feeding factors significantly associated with HAZ status.

Processed Food Consumption and HAZ

A statistically significant association was observed between processed food consumption and HAZ status ($\chi^2 = 12.768$, $p = 0.012$). Children with lower frequency of processed food intake showed a higher proportion of normal HAZ, while increased exposure was associated with higher rates of stunting and tall stature. This finding suggests that reliance on processed foods may displace nutrient-dense traditional foods essential for linear growth.

Previous studies have shown that children with autism often prefer processed and packaged foods due to taste, texture, and predictability, which may lead to inadequate intake of micronutrients such as zinc, iron, and calcium—key nutrients for skeletal growth (Bandini, 2010; Sharp, 2013). Chronic consumption of energy-

dense but nutrient-poor foods may therefore contribute to impaired height gain in autistic children.

Food Rejection, Selectivity, and Growth

Although fruit rejection and general food selectivity were not statistically significant, higher proportions of stunting were observed among children who rejected fruits and exhibited food selectivity. This trend is clinically relevant in autism, where sensory sensitivities commonly limit dietary variety. Research consistently reports that autistic children with strong food rejection behaviours consume fewer fruits, vegetables, and protein sources, increasing the risk of chronic undernutrition and stunting (Cermak, 2010). Even when statistical significance is not achieved, such patterns indicate underlying nutritional vulnerability.

Milk Products and Protein-Rich Foods

Significant associations were found between paneer frequency ($\chi^2 = 12.958$, $p = 0.044$) and curd frequency, highlighting the importance of dairy-based protein and calcium sources in linear growth. Children consuming paneer more frequently showed better HAZ outcomes. Similarly, whole legumes ($\chi^2 = 17.367$, $p = 0.002$) and roots frequency ($\chi^2 = 10.936$, $p = 0.004$) were strongly associated with HAZ. These foods are staple sources of plant protein, iron, zinc, and energy, which support sustained growth. Prior research emphasizes that restricted intake of legumes and traditional staples among autistic children contributes to chronic growth faltering (Adams, 2011)

Legumes, Beans, and Cereals

Beans frequency ($\chi^2 = 12.883$, $p = 0.012$) and wheat consumption ($\chi^2 = 11.438$, $p = 0.022$) were significantly associated with HAZ. Children with regular intake of these foods had a higher prevalence of normal height-for-age. Cereals and legumes provide sustained energy and essential amino acids necessary for bone growth. Studies suggest that carbohydrate-based diets lacking adequate protein diversity may negatively impact height gain, especially in children with ASD who already have higher metabolic and gastrointestinal challenge. (Hyman, 2012).

Weight Change and Chronic Growth

Weight change showed a strong association with HAZ ($\chi^2 = 16.990$, $p = 0.009$). Children with stable or appropriate weight gain were more likely to have normal HAZ, whereas those with weight loss showed increased stunting or abnormal

growth patterns. This finding confirms the interrelationship between acute and chronic malnutrition, where repeated weight loss episodes can impair linear growth over time.

Household Income and Growth

Household income was significantly associated with HAZ ($\chi^2 = 18.569$, $p = 0.005$). Children from higher-income households exhibited better height outcomes. Families of children with autism often face increased financial burden due to therapy costs and specialized care, which may reduce resources available for nutritious foods (Mandell, 2010). Economic constraints can therefore contribute to chronic undernutrition and stunting.

Infant Feeding Practices

Early feeding practices showed strong relationships with HAZ. Pre-lacteal feeding was significantly associated with stunting ($\chi^2 = 11.924$, $p = 0.003$), with children who received pre-lacteal feeds showing poorer growth outcomes. Similarly, breastfeeding continuation duration showed borderline significance. Early feeding disruptions have been linked to later feeding difficulties and growth problems in autistic children (Schreck, 2006). Exclusive breastfeeding supports immune development, gut health, and nutrient absorption, all of which are critical for linear growth.

Birth Type

Mode of delivery showed a significant association with HAZ ($\chi^2 = 6.288$, $p = 0.043$). Children born via caesarean section showed higher proportions of abnormal HAZ. Emerging evidence suggests that caesarean delivery may influence gut microbiota composition, which in turn affects nutrient absorption and growth (Neu & Rushing, 2011). Gut health issues are particularly prevalent in children with autism, amplifying this effect. Overall, the findings indicate that chronic malnutrition (stunting) among children with autism is influenced by dietary diversity, protein intake, feeding behaviour, early infant feeding practices, and socioeconomic factors. Autism-related feeding challenges, combined with environmental and economic constraints, place these children at higher risk of impaired linear growth.

Table 4.12.2(a) : Factors associated with stunting and tall among autistic children

WHZ status	Normal	Stunting	Tall	Total	X2	P value
Family size						
3	2 (40)	3 (60)	0	5	14.859	0.05
4	16 (72.73)	4 (18.18)	2 (9.09)	22		
5	7 (70)	2 (20)	1(10)	10		
6	2(33.33)	1 (16.67)	3 (50)	6		
8	4 (100)	0	0	4		
Father education						
Primary	2 (33.33)	1 (16.67)	3 (50)	6	13.493	0.036*
Secondary	18 (69.23)	5 (19.23)	3 (11.54)	26		
University	11 (78.57)	3 (21.43)	0	14		
Illiterate	0	1 (100)	0	1		
White meat frequency						
Frequent	5 (71.43)	0	2 (28.57)	7	13.904	0.031*
Regular	21 (72.41)	5 (17.24)	3 (!0.34)	29		
Rare	1 (20)	4 (80)	0	5		
Never	4	1	1	6		

	(66.67)	(16.67)	(16.67)			
Ghee frequency						
Frequent	10 (58.82)	3 (17.65)	4 (23.53)	17	10.698	0.098
Regular	6(85.71)	1 (14.29)	0	7		
Rare	7 (46.67)	6 (40)	2 (13.33)	15		
Never	8 (100)	0	0	8		
Paneer frequency						
Frequent	1 (33.33)	0	2 (66.67)	3	13.388	0.037*
Regular	3 (50)	3 (50)	0	6		
Rare	23 (67.65)	7 (20.59)	4 (11.76)	34		
Never	4 (100)	0	0	4		
Food rejection veg						
No	20 (86.96)	2 (8.70)	1 (4.35)	23	8.862	0.012*
Yes	11 (45.83)	8 (33.33)	5 (20.83)	24		
Deficiency						
Vit	5 (83.33)	1 (16.67)	0	6	22.815	0.001**
Vit d, iron	0	2 (100)	0	2		

Vit b12	4 (100)	0	0	4		
Others	0	0	2 (100)	2		
Weight change						
Weight loss	1 (33.33)	0	2 (66.67)	3	13.776	0.032*
Weight gain	18 (72)	6 (24)	1 (4)	25		
No changes	12 (66.67)	3 (16.67)	3 (16.67)	18		
Don’t know	0	1 (100)	0	1		
Appetite						
Poor	17 (85)	2(10)	1 (5)	20	12.128	0.016*
Good	14 (56)	6 (24)	5 (20)	25		
Very good	0	2 (100)	0	2		
Breastfeeding knowledge						
12 months	0	1 (100)	0	1	19.928	0.068
24 months	3 (100)	0	0	3		
4 months	0	2 (100)	0	2		
5 months	3 (100)	0	0	3		
6 months	19 (65.52)	4 (13.79)	6 (20.69)	29		
7 months	2 (100)	0	0	2		
9 months	4 (57.14)	3 (42.86)	0	7		
Bottle feed						
Yes	19	7	1	27	4.914	0.086

	(70.37)	(25.93)	(3.70)			
No	12 (60)	3 (15)	5 (25.00)	20		
Breastfeeding inititation						
1 hr	17 (70.83)	6 (25)	1 (4.17)	24	27.146	0.007**
1 month	2 (100)	0	0	2		
2 hr	6 (75)	1 (12.50)	1 (12.50)	8		
25 min	1 (33.33)	0	2 (66.67)	3		
30 min	4 (80)	1 (20)	0	5		
After 8-9 hrs	0	2 (100)	0	2		
Exclusive breastfeeding						
Yes	11 (57.89)	7 (36.84)	1 (5.26)	19	5.352	0.069
No	20 (71.43)	3 (10.71)	5 (17.86)	28		
Income enough						
Yes	24 (70.59)	8 (23.53)	2 (5.88)	34	5.25	0.072
No	7 (53.85)	2 (15.38)	4 (30.77)	13		
Birth order						
1	18 (72)	5 (20)	2 (8)	25	11.672	0.020*

2	12 (70.59)	4 (23.53)	1 (5.88)	17		
3	1 (20)	1 (20)	3 (60)	5		
Meals per day						
Less than 3	2 (33.33)	4 (66.67)	0	6	11.871	0.018*
3-4	17 (65.38)	6 (23.08)	3 (11.54)	26		
More than 4	12 (80)	0	3 (20)	15		

4.11.3 Factor Affecting Undernutrition (Wasting) or Overnutrition (Overweight)

Weight-for-height (WHZ) reflects acute malnutrition, identifying current undernutrition (wasting) or overnutrition (overweight). Children with autism spectrum disorder (ASD) are particularly vulnerable to abnormal WHZ due to feeding selectivity, appetite disturbances, sensory sensitivities, and caregiving practices. The present study demonstrates that family characteristics, parental education, dietary patterns, feeding behaviour, appetite, illness, and infant feeding practices significantly influence WHZ status.

Family Size and WHZ

Family size showed a statistically significant association with WHZ ($\chi^2 = 14.859$, $p = 0.05$). Larger family sizes were associated with a higher prevalence of wasting, while smaller families showed more overweight or normal WHZ. This may be due to resource dilution in larger households, where attention, time, and food resources may be insufficient to meet the specific dietary needs of a child with autism. Previous studies have reported that children with developmental disabilities living in larger families are at increased risk of undernutrition due to competing caregiving demands (Black, 2013).

Father's Education

Father's education was significantly associated with WHZ ($\chi^2 = 13.493$, $p = 0.036$). Wasting was more prevalent among children whose fathers had lower educational levels, while normal WHZ was more common among children of

fathers with secondary or higher education. Educated parents may be more aware of nutritional needs, illness management, and appropriate feeding strategies for children with autism. Similar findings have been reported by (Sharp, 2013), who emphasized the role of parental education in preventing malnutrition in autistic children. White meat frequency showed a significant association with WHZ (χ^2 = 13.904, p = 0.031). Children with irregular or low intake of white meat were more likely to be wasted, indicating the importance of high-quality protein for maintaining body weight. Protein deficiency can rapidly lead to wasting, particularly in children with feeding difficulties.

Paneer frequency was also significantly associated with WHZ (χ^2 = 13.388, p = 0.037). Children with higher paneer consumption were more likely to have normal WHZ. Dairy-based protein sources are critical in autistic children who often reject meat due to texture or smell. Ghee frequency did not show a statistically significant association, but higher consumption was linked to overweight, suggesting that excessive fat intake without dietary balance may contribute to overnutrition.

Food Rejection and Feeding Behaviour

Vegetable food rejection was significantly associated with WHZ (χ^2 = 8.862, p = 0.012). Children who rejected vegetables had higher rates of wasting and overweight. This highlights the dual burden of malnutrition in autism, where limited food variety can lead to either insufficient intake or reliance on energy-dense foods. Research consistently shows that sensory-based food rejection in autism limits nutrient intake and disrupts energy balance (Bandini, 2010; Cermak, 2010).

Micronutrient Deficiency and Weight Loss

A very strong association was observed between nutritional deficiency and WHZ (χ^2 = 22.815, p = 0.001). All children with recent weight loss were wasted, indicating acute malnutrition. Children with vitamin D, iron, and B12 deficiencies also showed abnormal WHZ patterns. Previous studies have reported high prevalence of micronutrient deficiencies in autistic children due to restricted diets, which predispose them to wasting and poor weight gain (Adams, 2011).

Weight Change and Appetite

Weight change was significantly associated with WHZ (χ^2 = 13.776, p = 0.032). Children experiencing weight loss had a higher prevalence of wasting, while those with stable weight were more likely to have normal WHZ. Appetite status was

also significantly associated with WHZ ($\chi^2 = 12.128$, $p = 0.016$). Poor appetite was linked to wasting, whereas very good appetite was associated with overweight. Appetite disturbances in autism may arise from gastrointestinal discomfort, behavioural issues, or sensory sensitivities, directly influencing energy intake.

Infant Feeding Practices

Breastfeeding initiation time showed a strong association with WHZ ($\chi^2 = 27.146$, $p = 0.007$). Children who were breastfed within one hour of birth had better WHZ outcomes compared to those with delayed initiation. Early breastfeeding supports immune development and reduces infection-related weight loss Although exclusive breastfeeding and breastfeeding duration did not reach statistical significance, children who were breastfed appropriately tended to have better WHZ outcomes. Early feeding difficulties have been shown to predict later feeding problems and growth disturbances in children with autism (Schreck, 2006).

Birth Order and Meals per Day

Birth order was significantly associated with WHZ ($\chi^2 = 11.672$, $p = 0.020$), with higher-order children showing increased wasting. This may be related to reduced caregiver attention and food allocation. Meals per day also showed a significant association ($\chi^2 = 11.871$, $p = 0.018$). Children receiving fewer meals per day had higher rates of wasting, emphasizing the importance of meal frequency in preventing acute malnutrition in autistic children who often eat small quantities per sitting. The findings indicate that acute malnutrition among children with autism is strongly influenced by feeding behaviour, dietary protein intake, appetite, illness-related weight loss, infant feeding practices, and family characteristics. Autism-specific challenges such as food rejection and sensory sensitivities interact with socioeconomic and caregiving factors, leading to both wasting and overweight.

Table 4.12.3(a) : Factors associated with overnutrition or undernutrition among autistic children

Haz Status	Normal	Wasting	Overweight	Total	X2	P-value
Processed food						
Regular	23 (82.1)	5 (17.86)	0	28	12.768	0.012*
Rare	15 (75)	5 (25)	0	20		
Never	4 (44.44)	3 (33.33)	2 (22.22)	9		
Fruits rejection						
Frequent	20 (62.5)	10 (31.25)	2 (6.25)	32	5.081	0.079
Regular	22 (88)	3 (12)	0	25		
Curd frequency						
Frequent	3 (42.86)	3 (42.86)	1 (14.29)	7	8.158	0.086
Regular	26 (86.67)	4 (13.33)	0	30		
Rare	13 (65)	6 (30)	1 (5)	20		

Paneer frequency						
Frequent	2 (50)	2 (50)	0	4	12.958	0.044*
Regular	6 (66.67)	1 (11.11)	2 (22.22)	9		
Rare	31 (77.5)	9 (22.5)	0	40		
Never	3 (75)	1 (25)	0	4		
Roots frequency						
Frequent	37 (80.43)	9 (19.57)	0	46	10.936	0.004**
Regular	5 (45.45)	4 (36.36)	2 (18.18)	11		
Whole daal frequency						
Frequent	37 (77.08)	11 (22.92)	0	48	17.367	0.002**
Regular	4 (57.14)	2 (28.57)	1 (14.29)	7		
Rare	1 (50)	0	1 (50)	2		
Beans frequency						

Frequent	2 (33.33)	4 (66.67)	0	6	12.883	0.012*
Regular	29 (85.29)	5 (14.71)	0	34		
Rare	11 (64.71)	4 (23.53)	2 (11.76)	17		
Millet frequency						
Frequent	1 (33.33)	1 (33.33)	1 (33.33)	3	9.402	0.052
Regular	19 (79.17)	5 (20.83)	0	24		
Rare	22 (73.33)	7 (23.33)	1 (3.33)	30		
Wheat frequency						
Frequent	8 (61.54)	4 (30.77)	1 (7.69)	13	11.438	0.022*
Regular	33 (82.50)	7 (17.50)	0	40		
Rare	1 (25)	2 (50)	1 (25)	4		
Food rejection						

grain						
Yes	39 (78)	9 (18)	2 (4)	50	5.434	0.066
No	3 (42.86)	4 (57.14)	0	7		
Food selectivity						
Yes	24 (70.59)	10(29.41)	0	34	4.678	0.096
No	18 (78.26)	3 (13.04)	2 (8.70)	23		
Weight change						
Weight loss	4 (100)	0	0	4	16.990	0.009**
Weight gain	21 (77.78)	6 (22.22)	0	27		
No change	17 (70.83)	6 (25)	0	24		
Don’t know	0	1 (50)	1 (50)	2		
Income						
Don’t know	4 (100)	0	0	4	18.569	0.005**
Less than 20,000	1 (50)	0	1 (50)	2		

20,000-30,000	13 (59.09)	8 (36.36)	1 (4.55)	22		
Above 30,000	24 (82.76)	5 (17.24)	0	29		
Bf continue						
1.5 months	1 (50)	1 (50)	0	2	18.256	0.051
2 yrs	2 (100)	0	0	2		
3 months	2 (100)	0	0	2		
3 years	1 (25)	1 (25)	2 (50)	4		
3.5 years	5 (100)	0	0	5		
4 years	0	2 (100)	0	2		
Pre lacteal						
Yes	41 (80.39)	9 (17.65)	1 (1.96)	51	11.924	0.003**
No	1 (16.67)	4 (66.67)	1 (16.67)	6		
Breastfeeding knowledge						
12 months	1 (50)	0	1 (50)	2	24.168	0.019*

24 months	1 (25)	3 (75)	0	4		
4 months	2 (100)	0	0	2		
5 months	3 (100)	0	0	3		
6 months	26 (78.79)	7 (21.21)	0	33		
7 months	2 (100)	0	0	2		
9 months	7 (63.64)	3 (27.27)	1 (9.09)	11		
Exclusive breastfeed						
Yes	21 (80.77)	3 (11.54)	2 (7.69)	26	5.372	0.068
No	21 (67.74)	10 (32.26)	0	31		
Birth type						
Cs	14 (93.33)	0	1 (6.67)	15	6.288	0.043*
normal	28 (66.67)	13 (30.95)	1 (2.38)	42		

Part V

Conclusions and Recommendations

5.1 Conclusions

The present cross-sectional study assessed the nutritional status and feeding-related factors among 57 children with Autism Spectrum Disorder (ASD) aged 2–15 years in Biratnagar Metropolitan City.

The study findings revealed that feeding and eating difficulties were highly prevalent among children with ASD, which may adversely affect their nutritional status.

More than half of the children (57.89%) were reported to have poor appetite, while 38.60% had good appetite and only 3.51% had very good appetite, indicating a high risk of inadequate dietary intake.

Although the majority of children (78.95%) consumed three or more meals per day, 7.02% consumed only 1–2 meals and another 7.02% had irregular meal patterns, suggesting that meal frequency alone does not ensure adequate nutrition.

Food selectivity was observed in 59.65% of the children, indicating that most children preferred limited food items, which can compromise dietary diversity and nutrient adequacy.

Food rejection was common, particularly for, Vegetables (50.88%), Fruits (43.86%),Meat (36.84%), Dairy products (31.58%), Grains (12.28%), Foods with specific textures (24.56%)

Food aversion was reported in a large proportion of children, with 85.96% showing some degree of aversion, while only 14.04% had no aversion to foods.

Feeding difficulties were frequent, with 54.39% of children experiencing moderate feeding difficulties and 7.02% experiencing severe feeding difficulties, highlighting significant challenges during mealtimes.

The findings indicate that poor appetite, food selectivity, food rejection, and feeding difficulties are major factors influencing the dietary patterns and potential nutritional status of children with ASD.

The study emphasizes the need for early nutritional assessment, caregiver education, and multidisciplinary feeding interventions to improve dietary intake and nutritional outcomes among children with ASD.

5.2 Recommendations

For the work, it can be recommended that the nutritional status and its associated factor study can be best by taking the large sample size and large area. Based on the results of the present study following recommendations could be made to improve the nutritional status of autistic children in the survey area.

Surveys of this nature should be carried out at regular intervals so that they will assist the stakeholder to formulate plans and policies for the betterment of nutritional status.

Similar cross-sectional, descriptive or longitudinal surveys can be conducted to determine the magnitude and distribution of malnutrition and other probable causes of malnutrition in ASD children.

The pattern of food eating was studied but the dietary diversity score was not studied so the dietary diversity score with energy value needs to be studied in future.

At last, apart from anthropometric indices other indices should also be used for assessing malnutrition accurately.

Part VI

Summary

This study assessed the nutritional status and associated factors among children with ASD in Biratnagar Metropolitan City, Nepal. Autism Spectrum Disorder is a neurodevelopmental condition characterized by impairments in social communication, repetitive behaviours, and sensory sensitivities, which often influence feeding behaviour and nutritional intake. Limited data on the nutritional status of children with ASD in Nepal highlights the need for localized research to guide appropriate nutritional interventions. A cross-sectional descriptive study was conducted among children aged 2–13 years diagnosed with ASD and attending selected autism care centres in Biratnagar. The study included 92 children for anthropometric assessment, while 57 parents/caregivers participated in interviews using structured and pretested questionnaires. Data collection covered socio-demographic characteristics, maternal factors, child health history, feeding behaviour, and dietary intake. Feeding behaviour was assessed using the BAMBI, while dietary intake was evaluated through 24-hour dietary recall and FFQ. Anthropometric measurements such as weight, height, MUAC, and BMI were interpreted using WHO growth standards. Data analysis was performed using SPSS version 20 and MS Excel 2019.The findings revealed that 71.74% of children were male, indicating a higher prevalence of ASD among boys. Food selectivity was observed in 59.65% of children, with vegetables being the most commonly rejected food group, followed by fruits, meat, dairy products, and specific food textures. Feeding difficulties were prevalent, with 54.39% experiencing moderate and 7.02% experiencing severe feeding challenges, while 57.89% of children had poor appetite. Dietary assessment showed that energy, protein, and fat intake exceeded RDA across most age groups, whereas iron intake was inadequate among younger children aged 2–6 years. These findings indicate an imbalance between macronutrient excess and micronutrient deficiency, increasing the risk of both overnutrition and hidden hunger among children with ASD. The study concludes that children with ASD in Biratnagar Metropolitan City face significant feeding challenges and nutritional imbalances, influenced by behavioural, sensory, and caregiver-related factors. The results emphasize the importance of targeted nutritional counselling, caregiver education, and behaviour-based feeding interventions. Strengthening nutrition-focused support services within autism care centres can contribute to improving the growth, health, and overall well-being of children with ASD in Nepal.

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APPENDICES

Appendix-A Consent letter

मन्जुरीनामा पत्र

नमस्कार।

म विशेषता खनाल, हाल शोषण तथा आहार विज्ञान विभाग केन्द्रीय प्रविधि क्याम्पस ,हातिसार धरानमा अध्ययनरत छु। यस विषय अन्तर्गत स्थान्तक तह पूरा गर्न समावेश सर्वेक्षण तथा शोध कार्य का लागि आएको छु। मेरो सोधकार्य को विषय "**PREVALENCE OF NUTRITIONAL STATUS AND ITS ASSOCIATED FACTOR AMONG CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) IN BIRATNAGAR METROPOLITIAN CITY**" रहेको छ । यस अध्ययनका लागि तपाईंको छोराछोरीलाई सहभागी गराउन म तपाईंको यस सर्वेक्षणका केही प्रश्नहरू गर्नेछु। साथै तपाईंको बच्चाको नापतौल लिनेछु। यस अध्ययनका केही प्रश्नहरू लाई नितान्त व्यक्तिगत लाग्न सक्छ। तर तपाईंले दिनुभएका सम्पूर्ण जानकारी हरूबाट मेरो अध्ययनका लागि टेवा पुग्नुका साथसाथै बालबालिकाको सुस्वास्थ विकासका लागि मद्दत पुग्नेछ। र सो जानकारीहरू एकदमै गोप्य रहनेछ साथै तपाईंले दिनुभएका सूचना तथा तथ्याङ्क को दुरुपयोग गरिने छैन भन्ने जानकारी तपाईंलाई गर्न चाहन्छु। यो अध्ययनमा तपाईंको सहभागिता स्वेच्छिक हुनेछ र यदि तपाईंलाई कुनै पनि प्रश्नको उत्तर दिन इच्छा नभएमा तपाईंले बीचमै छोड्न पनि सक्नुहुनेछ। तर म यो आशा गर्दछु कि तपाईंलाई यस अध्ययनमा सक्रियताका साथसाथै सहभागी भई हाम्रो को कार्यमा सहयोग गर्नुहुनेछ। "यस शोधकार्यमा सहभागी हुनुभन्दा पहिले नै यो सोधकार्यको बारेमा सम्पूर्ण जानकारी गरिएको छ र म आफू स्वेच्छा ले यस कार्यमा सहभागी हुँदैछु। मेरो इच्छा नभएमा म कुनै पनि समयमा यस शोधकार्य लागि दिएको मन्जुरी पत्र फिर्ता लिन पाउँछु भन्ने विषयमा म जानकारी छु।"

यस सहकारीमा सहभागी हुनुभन्दा पहिले मैले यस मन्जुरीनामा मा हस्ताक्षर गरेको हुँ।

अभिभावकको हस्ताक्षर: .....

मिति: .....

स्थान: .....

माथि उल्लेखित सहभागीलाई यस अध्ययनको बारेमा उद्देश्यका बारे मा सम्पूर्ण जानकारी गरिएको र सहभागीबाट सबै प्रश्नहरूको स्पष्ट उत्तर प्राप्त भएको जानकारी गराउँदछु।

अन्वेसक्को नाम: .....

हस्ताक्षर:.....

मिति: .....

सम्पर्कको ठेगाना: .....

Appendix-B Ethical Letter

हामी सबैको रहर : शिक्षित, सफा, सुन्दर, सुरक्षित र सक्षम विराटनगर

विराटनगर महानगरपालिका
नगर कार्यपालिकाको कार्यालय
शैक्षिक प्रशासन महाशाखा
विराटनगर, मोरङ
कोशी प्रदेश, नेपाल

प.स. ८१।८२
च.नं.: १०४१ (५)

मिति – २०८२/०१/२६

विषय : अनुमती सम्बन्धमा ।

श्री विशेषता खनाल
स्नातक तह, आठौं सेमिष्टर,
पोषण आहार विज्ञान विभाग,
केन्द्रिय प्रविधि क्याम्पस, धरान ।

प्रस्तुत विषयमा केन्द्रिय प्रविधि क्याम्पस, धरानको पत्र तथा तपाँइले यस महाशाखामा पेश गर्नु भएको निवेदन बमोजिम यस महानगरपालिकाबाट सञ्चालित अटिजम स्याहार केन्द्र तथा अनमोल स्पेशल एजुकेसन सेन्टरसँग सम्बन्धित भइ शोधकार्य गर्नका लागि अनुमती प्रदान गरिएको छ । प्रचलित कानुन विपरित नहुने गरी तथा यस महानगरपालिकाको स्वास्थ्य महाशाखा, अटिजम स्याहार केन्द्र र अनमोल स्पेशल एजुकेसन सेन्टरसँग समन्वय गरी आफ्नो शोधकार्य गर्नहुन अनुरोध छ ।

.....
कृष्ण भट्टराई
अधिकृत आठौं २०८२/१/२६

Appendix-C Survey questionnaire (in english)

Survey title:

Date of visit: ……..

Name of the child: ……..

Date of birth: ……

Code no : …….

Age: ……

Sex: ……

Anthropometric measurements:

Height (cm)	Weight (cm)	BMI	MUAC (cm)

SECTION A: Socio- demographic information

1. Informant	☐Mother ☐ Father ☐ Other
2. Family size	
3. Family type	☐ Nuclear ☐ Joint
4. Father's education	☐ Primary ☐ Secondary ☐ University ☐ Illiterate
5. Father's occupation	
6. Mother's education	☐ Primary ☐ Secondary ☐ University ☐ Illiterate
7. Mother's occupation	
8. Monthly income of the family	☐ 20,000 ☐ 20,000-30,000 ☐ above 30,000
9. Household type	☐ Permanent ☐ Temporary
10. Is your income enough to eat?	☐ Yes ☐ No

SECTION B: Maternal description

11. At what age did you get marry?	
12. At what age you have first pregnancy?	
13. Did you have iron/ folate tablets? At which trimester?	
14. Do you know malnutrition?	
15. What amount of food did you eat during pregnancy?	☐ More than usual ☐ Less than usual ☐ As usual

16. How many times per day did you eat?	☐ <3 ☐ 3-4 times ☐ >4 times
17. What salt is used in your home?	☐ Iodized salt ☐ Normal salt ☐ Dhikke
18. Mother's height?	

SECTION C: Child description

19. a. What is the present childbirth order? b. if not first, what is the difference between an existing child and an earlier child	
20. Birth weight of the child?	
21. Type of birth?	
22.Where was your child delivered?	☐At home ☐Public Hospital ☐ Private Hospital ☐Other (specify)
23. Did you breastfed your child after birth? If yes, when did you initiate breastfeeding after birth?	
24. When did you stop breastfeeding? At what age?	
25. Did you exclusively breastfeed or are you breastfeeding your child for the first six months? If no what is the reason you can share:	☐ Yes ☐ No ☐ Not sufficient milk production ☐ medical complication ☐ Other
26.. How many times did you breastfeed your child in a day?	☐ <8 times ☐ 8-10 times ☐ 11-12 times or more
27. Did you continue or are you still breastfeeding your child? (if the child is >6 months) If no, when did you stop breastfeeding your child?	☐ Yes ☐ No ……Yrs
28. Do you know how long children are recommended to be continuously breastfed?	……..months
29. Did you feed colostrum milk (first yellow milk) to your child?	☐ Yes ☐ No
30. Did you introduce any kind of pre-lacteal feeds to your child? If yes, what type was given?	☐ Yes ☐ No ☐ Animal milk ☐ honey ☐ jaggery ☐ ghee ☐ herbal paste ☐ none

31. Did you ever bottle-feed your child? If yes, can you share the reason for the bottle feeding?	☐ Yes ☐ No
32. Do you know the preparation of litto? If yes, how?	☐ Yes ☐ No

Section D: Health and immunization

Have you gotten your child vaccinated according to schedule? If no, why did you miss it?	☐ Yes ☐ No ☐ Thought it was not necessary ☐ There was a shortage of vaccines in the centre ☐ Child cried a lot/had a fever after getting the previous one
Did your child have vitamin A and deworming tablets?	☐ Yes ☐ No
Were you vaccinated during pregnancy? If yes , which one?	☐ Yes ☐ No
How do you recognize that your child is ill?	☐ Lazy ☐ Increase in body temperature ☐ Irritability
Where do you take your child when he/ she is ill?	☐ Health centre ☐ Pharmacy ☐ Jhakri ☐ None

Section E: Nutritional Status Assessment

Has the child been diagnosed with any nutritional deficiencies?	☐Yes ☐ No ☐Don't know If yes, please specify……..
Recent changes in child's weight (past 6 months):	☐Weight loss ☐Weight gain ☐No change ☐Don't know
Child's appetite?	☐Very good ☐Good ☐Poor ☐Very poor
Number of meals per day?	☐1-2 ☐3 ☐ 3+ ☐Irregular

Section F: Feeding Behaviors and Challenges

Does the child exhibit food selectivity? (picky eating)	☐Yes ☐No
Types of food often rejected (Select all that apply)	☐Vegetables ☐ Fruits ☐ Meat ☐ Dairy ☐Grains ☐Mixed textures ☐Others
Aversion to certain food textures, colors, or smells	☐Yes ☐No
Frequency of feeding difficulties?	☐Daily ☐Weekly ☐ Occasionally ☐Never

Section G: Caregiver Involvement in Dietary Management

Primary person responsible for meal preparation	☐Mother ☐ Father ☐ Paid caregiver Others
Use of structured meal plan for the child	☐Yes ☐No
Professional guidance received for meal planning	☐Regularly ☐Occasionally ☐No
Confidence in managing child's diet	☐Very confident ☐ Somewhat confident ☐Not confident
Dietary modifications made based on child's autism symptoms	☐Yes ☐No If yes, specify……..
Monitoring of child's nutritional intake	☐Regularly ☐Occasionally ☐No

Section H: Perception and support

Belief that involvement in diet has improved child's health or behavior	☐Strongly agree ☐Agree ☐Neutral ☐Disagree ☐Strongly disagree
Adequacy of support from healthcare professionals regarding dietary management	☐Yes ☐No ☐Not sure
Types of support or resources that would help manage child's diet better: (Select all that apply)	Nutritional counseling ☐ Cooking guides ☐ Support groups ☐ Meal delivery ☐ Other: _____

Section I: Dietary intake

a. Food frequency table

Type of food	Frequent (at least once a day)	Regular (3/4 times a week)	Rare (once in a week or less)	Never
1. Cereal				
Rice/brown rice				
Wheat				
Maize/millet/barley				
2. Pulses/legumes				
Whole daal				
Grams/beans/peas				
3. GLV				
4. Other vegetables				
5. Roots and tubers				
6. Fruits				
7. Dairy products				
Milk				
Curd				
Ghee/ Butter				
Paneer/ Cheese				
8. Meat				
White meat (Chicken/ fish)				
Red meat (mutton/beef/pork)				
Egg				
9. Processed , packaged foods/ fast food				

b. 24-hour dietary recall

Timing	**Time**	**Description of food**	**Brand (if possible)**	**Quantity/ Serving size**
Breakfast				
Lunch				
Snacks				
Dinner				

Section J: BAMBI questionnaire

Dear parent/guardian, think about your child's behaviour during the meals eaten with him in the last six months Using the following scale, assign each of the following statements a value based on the frequency with which the given situation occurs at mealtime:

Never/ Rarely/ Seldom/ Occasionally/ Often at almost every meal: 1/2/3/4/5

1. My child cries or screams during meals.	1 2 3 4 5 Yes No
2. My child moves his/her face or body away from the food.	1 2 3 4 5 Yes No
3. My child remains seated at the table until the meal is finished.	1 2 3 4 5 Yes No
4. My child expels (spits) the food he/she ate.	1 2 3 4 5 Yes No
5. My child is aggressive during meals (beats, kicks, scratches others).	1 2 3 4 5 Yes No
6. My child shows self-injurious behaviour during meals (self beating, self hitting)	1 2 3 4 5 Yes No
7. My child disturbs during meals (pushing / throwing utensils, food).	1 2 3 4 5 Yes No
8. My child closes his/her mouth when he/she is presented with food.	1 2 3 4 5 Yes No
9. My child is flexible in meal routines (E.g. meal times, seating arrangement, covers).	1 2 3 4 5 Yes No
10. My child is willing to try new foods.	1 2 3 4 5 Yes No
11. My child doesn't like certain foods and doesn't eat them.	1 2 3 4 5 Yes No
12. My child refuses to eat foods that require a lot of chewing (E.g. eat only soft foods or smoothies).	1 2 3 4 5 Yes No
13. My child prefers the same foods at every meal.	1 2 3 4 5 Yes No
14. My child prefers "crispy" foods (e.g. snacks, crackers).	1 2 3 4 5 Yes No
15. My child accepts or prefers a variety of foods.	1 2 3 4 5 Yes No
16. My child prefers that the food is served to him/her in a certain way.	1 2 3 4 5 Yes No
17. My children only prefer sweet foods	1 2 3 4 5

(candies, sugary products)	Yes No
18. My child prefers food prepared in a particular way (e.g., eats mostly fried foods, cold cereals, and raw vegetables).	1 2 3 4 5 Yes No

Appendix-D Survey questionnaire (in Nepali)

Survey title:

Date of visit: ……..

Name of the child: ……..

Date of birth: ……

Code no : …….

Age: ……

Sex: ……

एन्थ्रोपोमेट्रिक मापन (should be measured in school)

उचाइ (cm)	वजन (kg)	BMI	MUAC (cm)

SECTION A: Socio- demographic information

जानकारी दिने	☐बुबा ☐ आमा ☐ अन्य
परिवार सङ्ख्या	
परिवार प्रकार	☐ आणविक (Nuclear) ☐ संयुक्त (Joint)
बुबाको शिक्षा	☐ प्राथमिक (Primary) ☐ माध्यमिक (Secondary) ☐ विश्वविद्यालय (University) ☐ अशिक्षित (Illiterate)
बुबाको पेशा	
आमाको शिक्षा	☐ प्राथमिक (Primary) ☐ माध्यमिक (Secondary) ☐ विश्वविद्यालय (University) ☐ अशिक्षित (Illiterate)
आमाको पेशा	
परिवारको मासिक आम्दानी	☐ 20,000 ☐ 20,000--300,000 ☐ ३00,000 माथि
घरेलु प्रकार	☐ स्थायी (Permanent) ☐ अस्थायी (Temporary)
तपाईको खाना खानको लागि पर्याप्त छ?	☐ छ ☐छैन

SECTION B: Maternal description

तपाईको विवाह कुन उमेरमा भएको हो ?	
कुन उमेरमा पहिलो पटक गर्भवती हुनुभयो ?	
के तपाईँले आइरन फोलिक एसिड खानुभयो र कति महिनामा	
के तपाईंलाई कुपोषण थाहा छ?	
तपाईँले गर्भवस्थामा कति मात्रामा खाना खानुभयो	☐पहिलेभन्दा ज्यादा ☐ पहिले भन्दा कम ☐ पहिले जस्तै
तपाईले दिनमा कति पटक खाना खानुभयो?	☐ <3 चोटी ☐ 3-4 चोटी ☐ >4 चोटी
तपाईंको घरमा कुन नुन प्रयोग गरिन्छ?	☐ आयोडिनयुक्त नुन ☐ सामान्य नुन ☐ धिक्के
आमाको उचाइ?	

SECTION C: Child description

तपाईँको यस बच्चा कुन क्रमको हो यदि पहिलो होइन भने पहिलो र यस बच्चामा कति उमेरको भिन्नता छ	
बच्चाको जन्म को वजन?	
जन्म को प्रकार?	
तपाईंको बच्चा कहाँ जन्मियो?	☐घर ☐सार्वजनिक अस्पताल ☐ निजी अस्पताल ☐अन्य (निर्दिष्ट गर्नुहोस्)
के तपाईंले आफ्नो बच्चालाई जन्मपछि स्तनपान गराउनुभयो? यदि हो भने, तपाईंले स्तनपान कहिलेदेखि सुरु गर्नुभयो?	
तपाईंले स्तनपान कहिले छोड्नुभयो? कुन उमेर?	
के तपाईंले विशेष रूपमा स्तनपान गराउनुभएको थियो वा तपाईँले आफ्नो बच्चालाई ६ महिनासम्म स्तनपान गराउनुभयो? यदि गराउनु भएको थिएन भने किन?	☐ हो ☐ होइन ☐ पर्याप्त दूध उत्पादन नभएको ☐ चिकित्सा जटिलता ☐ अन्य
दिनमा कति पटकसम्म स्तनपान गराउनुहुन्थ्यो?	☐ <८ पटक ☐ 8-10 बार ☐ 11-12 बार या अधिक

बच्चालाई कुन उमेरसम्म स्थानपान गराउनुभयो?	
के तपाईंलाई थाहा छ बच्चालाई कुन उमेरसम्म स्तनपान गराउनुपर्छ?	..... महिना
के तपाईंले आफ्नो बच्चालाई कोलोस्ट्रम मिल(First yellow milk) खुवाउनुभयो?	☐ हो ☐ होइन
के तपाईंले कुनै पनि प्रकारको पूर्व-लैक्टियल (Pre-lacteal) परिचय दिनुभयो? यदि दिनुभयो भने कुन प्रकारको?	☐ हो ☐ होइन ☐ पशु दूध ☐ शहद ☐ गुड़ ☐ घी ☐ हर्बल पेस्ट ☐ केही पनि छैन
के तपाईंले कहिल्यै आफ्नो बच्चालाई बोतलबाट खुवाउनुभयो? खुवाउनुभयो भने के कारणले?	☐ हो ☐ होइन
के तपाईंलाई लिटोको तयारी थाहा छ? यदि छ भने, कसरी?	

Section D: Health and immunization

के तपाईंले आफ्नो बच्चालाई तालिका अनुसार खोप लगाउनुभएको छ? यदि लगाउनुभएको छैन भने किन?	☐ हो ☐ होइन ☐ मैले जरुरी ठानिन ☐खोपको व्यवस्था थिएन ☐ बच्चा धेरै रोयो/ पहिले खोप लगाए पछाडि ज्वरो आएको थियो
तपाईंको बच्चाले भिटामिन ए र जुकाको औषधि खाएको छ?	☐ हो ☐ होइन
के तपाईंले गर्भावस्थामा खोप लगाउनुभएको थियो? यदि लगाउनुभएको थियो भने, कुन चाहिँ?	☐ हो ☐ होइन
तपाईंको बच्चा बिरामी छ भनेर तपाईं कसरी थाह पाउनुहुन्छ?	☐ अल्छी ☐ शरीरको तापक्रम मा वृद्धि ☐ चिडचिडापन
यदि तपाईंको बच्चा बिरामी छ भने तपाईं उसलाई कहाँ लिएर जानुहुन्छ?	☐ स्वास्थ्य केन्द्र ☐ फार्मेसी ☐ झाँक्री ☐ केही पनि छैन

Section E: Nutritional Status Assessment

के बच्चालाई कुनै पोषणको निदान गरिएको छ?	☐हो ☐ होइन ☐, थाहा छैन यदि हो भने, कृपया निर्दिष्ट गर्नुहोस्.....
बच्चाको तौलमा हालैको परिवर्तन (पछिल्लो ६ महिना)	☐वजन घट्ने ☐वजन वृद्धि ☐परिवर्तन छैन ☐थाहा छैन
बच्चाको भोक?	☐धेरै राम्रो ☐ राम्रो ☐नराम्रो ☐धेरै नराम्रो
प्रति दिन खाना को संख्या?	☐1-2 ☐3 3 ☐ 3+ ☐अनियमित

Section F: Feeding Behaviors and Challenges

के तपाईंको बच्चाले खाना छानेर खान्छ? (Picky eater)	☐हो ☐होइन
खानाका प्रकारहरू अक्सर अस्वीकार गरिन्छ (ती सबै चयन गर्नुहोस्	☐तरकारी खेती ☐ फल ☐ मासु ☐ डेरी ☐दाना ☐मिश्रित बनावट ☐अन्य
केही खाद्य बनावट, रङ, वा गन्ध आउँछ	☐हो ☐होइन
खाना खुवाउने कठिनाइहरूको आवृत्ति?	☐दैनिक ☐साप्ताहिक कहिलेकाहीं ☐ ☐कहिल्यै

Section G: Caregiver Involvement in Dietary Management

भोजन तयारीको लागि जिम्मेवार प्राथमिक व्यक्ति	☐आमा ☐ बुबा ☐ भुक्तान गरिएको हेरचाहकर्ता ☐अन्य
बच्चाको लागि संरचित भोजन योजनाको प्रयोग	☐हो ☐होइन
खाना को योजना को लागि व्यावसायिक मार्गदर्शन प्राप्त	☐नियमित रूप देखि ☐कभी-कभी ☐नहीं
बच्चाको आहार व्यवस्थापनमा आत्मविश्वास	☐धेरै आत्मविश्वासी ☐ केही हदसम्म आत्मविश्वासी
अटिजमका लक्षणहरू को आधारमा गरिएको शैतानी परिमार्जनहरू ?	☐हो ☐होइन यदि हो भने, निर्दिष्ट गर्नुहोस्.....
बच्चाको पोषण सेवनको अनुगमन	☐नियमित रूपमा ☐कहिलेकाहीं ☐छैन

Section H: Perception and support

खानपानमा संलग्नताले बच्चाको स्वास्थ्य अथवा व्यवहारमा सुधार आउन सक्छ?	☐दृढतापूर्वक सहमत ☐सहमत ☐असहमत ☐दृढतापूर्वक असहमत
आहार व्यवस्थापनसम्बन्धी स्वास्थ्यकर्मीहरूको सहयोग पर्याप्त छ कि छैन?	☐ हो ☐ होइन ☐ निश्चित छैन
बालबालिकाको आहार राम्रोसँग व्यवस्थापन गर्न सहयोग गर्ने प्रकारका समर्थन वा स्रोतहरू: (आवश्यक परे सबै चयन गर्नुहोस्)	☐ पोषण परामर्श ☐ पकाउने मार्गदर्शिका ☐ समर्थन समूहहरू ☐ खाना आपूर्ति सेवा ☐ अन्य: ____

Section I: Dietary intake

क. खाना सेवनको आवृत्ति तालिका

खाद्य प्रकार	बारम्बार (कम्तिमा दिनमा एक पटक)	नियमित (हप्तामा ३/४ पटक)	कहिलेकाहीं (हप्तामा एक पटक वा कम)	कहिल्यै नगर्ने
१. अन्न				
चामल/ब्राउन चामल	☐	☐	☐	☐
गहुँ	☐	☐	☐	☐
मकै/कोदो/जौं	☐	☐	☐	☐
२. दाल/कलेजो वर्ग				
पुरै दाल	☐	☐	☐	☐
चनादाल/बोडी/केराउ	☐	☐	☐	☐
३. हरियो पातलो साग (GLV)	☐	☐	☐	☐
४. अन्य तरकारीहरू	☐	☐	☐	☐
५. कन्दमूल (जस्तै: आलु, पिदालु आदि)	☐	☐	☐	☐
६. फलफूलहरू	☐	☐	☐	☐
७. दूधजन्य पदार्थहरू				
दूध	☐	☐	☐	☐
दही	☐	☐	☐	☐
घ्यू	☐	☐	☐	☐
पनीर/चिज	☐	☐	☐	☐
८. मासु				
सेतो मासु (कुखुरा/माछा)	☐	☐	☐	☐
रातो मासु (खसी/सुँगुर)	☐	☐	☐	☐
अण्डा	☐	☐	☐	☐

९. प्रशोधित, प्याक गरिएको खाना/फास्ट फूड	☐	☐	☐	☐

ख. २४-घण्टे आहार विवरण

समय	समय	खानेकुराको विवरण	ब्रान्ड (यदि सम्भव छ)	परिमाण / सर्भिङ साइज (कति)
बिहानको खाजा				
दिउँसोको खाना				
खाजा (बीचमा)				
रातिको खाना				

Section J: BAMBI questionnaire

Dear parent/guardian, think about your child's behaviour during the meals eaten with him in the last six months Using the following scale, assign each of the following statements a value based on the frequency with which the given situation occurs at mealtime.

कहिले पनि / विरलै / धेरै कम/ कहिलेकाँही / प्राय हरेक खानामा: 1/2/3/४५

खाना खाँदा मेरो बच्चा रुन्छ वा चिच्याउँछ ।	1 2 3 4 5 हो होइन
मेरो बच्चाले आफ्नो शरीर अथवा अनुवार खानाबाट टाढा सार्छ।	1 2 3 4 5 हो होइन
मेरो बच्चा टेबुलमा बसिरहेको छ जब सम्म खाना समाप्त हुँदैन।	1 2 3 4 5 हो होइन
मेरो बच्चाले आफूले खाएको खाना निकाल्छ ।	1 2 3 4 5 हो होइन
मेरो बच्चा खाना खाने समयमा आवेशमा आउँछ (टोक्ने ,चिथर्ने ,लात हान्ने)	1 2 3 4 5 हो होइन
मेरो बच्चाले खाना खाने समयमा आफूलाई हानि पुर्याउने व्यवहार गर्छ। जस्तै आफूलाई कुट्ने ,आफूलाई टोक्ने	1 2 3 4 5 हो होइन
मेरो बच्चाले खाना खाँदा डिस्टर्ब गर्छ (ठेल्ने भाडा फाल्ने खानेकुरा फाल्ने)	1 2 3 4 5 हो होइन
मेरो बच्चाले खाना खुवाउने समयमा मुख बन्द गर्छ	1 2 3 4 5 हो होइन
मेरो बच्चा खानाको दिनचर्यामा लचिलो छ (उदाहरणका लागि। खाना खाने समय, बस्ने व्यवस्था, आवरण)।	1 2 3 4 5 हो होइन
मेरो बच्चा नयाँ खाना खान इच्छुक छ।	1 2 3 4 5 हो होइन

मेरो बच्चालाई केहि खानाहरू मन पर्दैन र तिनीहरूलाई खाँदैनन्।	1 2 3 4 5 हो होइन
मेरो बच्चाले खाद्य पदार्थ खान अस्वीकार गर्दछ जसलाई धेरै च्युइंग चाहिन्छ (E.g. eats only soft foods and smoothies)	1 2 3 4 5 हो होइन
मेरो बच्चाले हरेक दिनमा उही खाना मन पराउँछ .	1 2 3 4 5 हो होइन
मेरो बच्चाले "क्रिस्पी" खाद्य पदार्थहरू मन पराउँछ (उदाहरणका लागि स्न्याक्स, क्रैकर्स)	1 2 3 4 5 हो होइन
मेरो बच्चा स्वीकार्छ वा विभिन्न प्रकारका खाना मनपर्छ	1 2 3 4 5 हो होइन
मेरो बच्चाले उसलाई एक निश्चित तरिकामा खाना खुवाउन मन पराउँछ ।	1 2 3 4 5 हो होइन
मेरा छोराछोरीले मीठा खानेकुरा मात्र रुचाउँछन् (candy, sugary products)	1 2 3 4 5 हो होइन
मेरो बच्चाले एक विशेष तरिका मा तयार खाना मनपर्छ (e.g., eats mostly fried foods, cold cereals, and raw vegetables).	1 2 3 4 5 हो होइन

Appendix-E: Photo Gallery

Figure 1: Interview with parent

Figure 2: Attended health camp at centre

Figure 3: Portrait with students

Figure: Measurement of MUAC