Assessment of Nutritional Status and Lifestyle Patterns in Individuals with Disabilities Residing in Mumbai.

SUBMITTED BY
PURVA PRAMOD NANGARE

Under the guidance of:
DR. PRIYA SUNDARRAJAN

SUBMITTED TO
DEPARTMENT OF INTEGRATIVE NUTRITION & DIETETICS

Nagindas Khandwala College of Commerce, Arts and Management Studies, Mumbai - 400064

Academic Year 2023 - 2024

In partial fulfillment of the requirements for the degree of
Master of Science - Integrative Nutrition & Dietetics - Sem IV

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Malad Kandivli Education Society's

Nagindas Khandwala College of Commerce, Arts and Management Studies (Autonomous)

CERTIFICATE

This is to certify that Ms. Purva Pramod Nangare has successfully completed the Dissertation as a part of the M.Sc. in Integrative Nutrition & Dietetics syllabus titled Assessment of Nutritional Status and Lifestyle Patterns in Individuals with Disabilities Residing in Mumbai under the guidance of Dr. Priya Sundarrajan, Professor, Department of Life Science and Biochemistry, St. Xavier's College, Mumbai, during the Academic Year 2023-2024.

19/4/2024

(Signature of the research guide)

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Date: 19/04/2024.

College Seal

DECLARATION

I wish to state that the work embodied in this dissertation titled Assessment of Nutritional Status and Lifestyle Patterns in Individuals with Disabilities Residing in Mumbai is my contribution. The dissertation is carried out under the guidance of Dr. Priya Sundarrajan, Professor Department of Life Science and Biochemistry, St. Xavier's College, Mumbai, in the academic year 2023-2024. The data mentioned in the thesis has been obtained after genuine work. Data obtained from the other sources has been duly acknowledged. The results embodied in this thesis have not been submitted to any other university for any other degree.

Name and Sign of the student

PLACE: Mumbai

DATE: 20th April 2024.

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Name and Sign of the student

INDEX

LIST OF ABBREVIATIONS

Sr No.	Abbreviation used	For
1	Down Syndrome	DS
2	Autism Spectrum Disorder	ASD
3	Attention Deficit Hyperactivity Disorder	ADHD
4	Cerebral Palsy	CP
5	Intellectual Disability	ID
6	Body Mass Index	BMI
7	Mid-Upper Arm Circumference	MUAC
8	Food Frequency Questionnaire	FFQ
9	Dietary Approaches to Stop Hypertension	DASH
10	Dutch Healthy Diet Food Frequency Questionnaire	DHD
11	Polyunsaturated Fatty Acids	PUFA’s
12	Mild Cognitive Impairments	MCI
13	Dietary Record	DR
14	Disability-Adjusted Life Years	DALY’s
15	World Health Organization	WHO
16	People with Mobility Disability	PWMD
17	Socio Ecological Model	SEM
18	Carbohydrates	CHO
19	Healthy Eating Index	HEI

INDEX OF TABLES

11	Carbohydrates consumption of 16-18 years and >18 years old males and females	57
12	Protein consumption of 16-18 years and >18 years old males and females	58
13	Fats consumption of 16-18 years and >18 years old males and females	60

INDEX OF FIGURES

1. ABSTRACT

The current study examined the nutritional health and lifestyle habits of people with disabilities aged 15 to 30 living in Mumbai. This study would involve 100 people with impairments such as Autism Spectrum Disorder, Down Syndrome, Cerebral Palsy, Intellectual Disability, and Attention Deficit Hyperactivity Disorder (ADHD). Anthropometric data (height, weight, body mass index), dietary patterns (24-hour diet recall, food frequency questionnaires), and parental responses to the Food Frequency Questionnaire (FFQ) were used to assess the relationship between consumption patterns and health effects. Furthermore, different disability categories were compared regarding anthropometric measures, nutritional intake, and energy demands. Finally, the study emphasizes the need to address specific dietary issues that individuals with disabilities experience. Early intervention and ongoing support in treating dietary deficits and supporting optimum health outcomes are crucial.

2. INTRODUCTION

There is a worldwide movement towards better eating and more balanced nutrition. A healthy physical body, motor and cognitive growth, and social development all require adequate nourishment. As a result, while adequate nutrition is essential for everyone, it is necessary for children since it is directly related to reaching full growth potential and optimal body composition, increasing health and well-being, and minimizing the risk of chronic diseases in the future. Individuals with disabilities require adequate calories, carbs, protein, lipids, vitamins, and minerals to support the growth and maintenance of body processes. Individual dietary requirements vary based on age, gender, body size, and physiological status. Every nutrient has a distinct purpose in the human body (Ogbonna *et al.*, 2019). Food is frequently characterized as essential for children with disabilities to develop strength and improve, or as challenging and uncomfortable if the child has a disability. Nutritional status has a substantial impact on overall health and quality of life in children with disabilities; both malnutrition and overnutrition result in greater healthcare expenditures and poor involvement in school and social activities (Penagini *et al*., 2015). Sedentary behavior and overeating are also issues among these youngsters. Disabled children, in particular, require more healthy nourishment than non-disabled children (Senevirathna & Liyanage., 2020).

Childhood disability and malnutrition are two critical public health concerns with a considerable influence on health outcomes, quality of life, and survival (Jahan *et al*., 2019). It is a serious clinical and socially significant disorder. Disability is a complex phenomenon or impairment that might be cognitive, developmental, intellectual, mental, physical, sensory, or any combination of these (WHO., 2023). Early malnutrition has been demonstrated to have a harmful influence on disabled children (Mathur *et al*.,2007). All of them were associated with poor diet, irregular eating patterns,

lack of physical activity, sleep disturbances, and other genetic characteristics (Opoku *et al*., 2022). Malnutrition is widespread in children with impairments, according to anthropometric data, and it worsens with age and degradation of mental ability.

For children with disabilities, it is challenging to survive and flourish (Ogbonna *et al*., 2019). In extreme situations, parents of children with disabilities may feel guilty or feel personal responsibility for disease caused by genetics, stressful pregnancy experiences, or alcohol addiction (Maulik *et al*., 2007). Children with autism, cerebral palsy, Down syndrome, dyslexia, blindness, attention deficit hyperactivity disorders, and other impairments require particular care. Furthermore, they may sometimes suffer panic attacks, terminal illness, developmental delays, moderate learning disabilities, and severe cognitive impairments. Family and caregivers of children with disabilities are more likely to rely on food. Patients and caregivers may not know how to teach their children to eat themselves or properly feed them. This makes it difficult for parents and children to eat less since women are responsible for the home and must balance their children's demands with all other critical tasks. Food is also a gender problem in Indian culture (Ogbonna *et al*., 2019).

Feeding and mealtime behavior issues such as food rejection, food selectivity, mealtime aggressiveness, pica, and inadequate feeding skills are widespread in these children. It significantly impacted nutritional status in these children's biochemical and anthropometric parameters, and socioeconomic level differences also impacted biochemical parameters. Swallowing problems, gastroesophageal reflux, poor appetite, food aversion, coughing, choking, vomiting during eating, insufficient nutrient intake, constipation, allergies, vision & hearing impairment, oral health problems, constipation, thyroid diseases all influence the nutritional status of challenged children.

Because feeding issues restrict these children's food consumption. As a result, nutritional therapy for individuals with a disability is important and effective in correcting intake deficiencies.

3. REVIEW OF LITERATURE

3.1 Importance of assessing dietary habits in individuals with disabilities

Disability is a wide word that includes impairments, activity constraints, and participation limitations. Disability occurs when people with a health condition such as Cerebral Palsy (CP), Down Syndrome, Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), or Intellectual Disability (ID) are combined with environmental and personal factors (such as unfavorable attitudes, inaccessible public spaces and transportation, and a lack of social supports). Individuals with disabilities' experiences and health needs are influenced by a variety of factors, including sex, age, gender identity, sexual orientation, religion, race, ethnicity, and financial status (WHO.,2024).

Malnutrition is one of the world's culprits, preventing children from achieving optimal health, and has serious consequences, including death, particularly in low and middle-income countries like India (Sarkar *et al*., 2016). Individuals with intellectual disabilities are more likely to have poor diets., but there is insufficient information to understand how these populations express their nutritional problems (Humphries *et al*., 2009). Thus, their carers typically have to make decisions about many areas of their daily lives. Individuals who rely too much on others for their food may suffer from malnutrition, obesity, poor intake of certain micronutrients, and low hydration consumption, among other issues (Rapp *et al*., 2000). Chronic food-related health problems, such as obesity, diabetes, and stunted growth, are relatively common among individuals with intellectual disabilities (Ptomey & Writtenbrook., 2015).

Individuals with long-term physical disability are more likely to be obese because it can be difficult for them to maintain a healthy diet, medication side effects can cause obesity, mobility issues can

limit their options, and physical activity can exacerbate disability-related complications like fatigue, pain, and spasticity (Salem *et al.*,2014). Obesity is known to pose major health hazards, such as Diabetes Mellitus, Cardiovascular disease, and cancer (National Task Force on the Prevention and Treatment of Obesity.,2000). Hence, Body Mass Index (BMI) is important for this individual with disabilities (WHO.,2000).

Nutritional Status	**BMI (kg/□□)**
Underweight	<18.5
Normal weight	18.5-22.9
Overweight	23-24.9
Obese I	25-29.9
Obese II	>30

Figure 1 WHO Asian-BMI Classification adapted from (Girdhar et al.,2016)

The review of the study covered the importance of dietary therapies for treating Attention deficit hyperactivity disorder (ADHD). The study emphasizes how common ADHD is in kids and teens, how bad it is for their health, and how much it costs the public and medical system. It implies that to lessen these effects, dietary changes may be utilized as co-adjuvant therapies to medication. The risk of ADHD is positively connected with unhealthy eating patterns such as "junk food," "processed," and "Western-like,". In contrast, it is inversely correlated with healthy eating patterns such as the Mediterranean diet and Dietary Approaches to Stop Hypertension. The review also addresses the possible advantages of particular dietary supplements, like PUFAs, magnesium, and vitamin D, in easing the symptoms of ADHD. (Pinto *et al.*, 2022).

According to a study published in the Journal of Applied Research in Intellectual Disabilities by (Gast et al., 2021), the average food quality of people with intellectual disabilities was lower than

that of people without impairments in the Netherlands. The study evaluated the quality of the participants' diets using the Dutch Healthy Diet Food Frequency Questionnaire (DHD) and discovered that those with intellectual disabilities consumed fewer critical nutrients, such as fiber, fruits, vegetables, and polyunsaturated fatty acids (PUFAs). These findings emphasize the importance of assessing eating behaviors in people with disabilities to correct nutritional deficits and improve overall health. Due to their increased risk of acquiring chronic health disorders, evaluating dietary patterns is a crucial part of providing healthcare for people with disabilities. While several instruments have been created to evaluate eating patterns in this demographic, additional study is required to create instruments that are accessible and culturally sensitive to a wider range of people. It is possible to encourage good eating habits and lessen health disparities in people with disabilities by addressing their dietary habits.

3.2 ASSESSMENT OF DIETARY HABITS IN INDIVIDUALS WITH DISABILITIES

3.2.1 Challenges in assessing dietary habits in Individuals with disabilities

Assessing eating habits presents particular difficulties for many people with impairments. To support this population's general health and well-being, it is essential to understand and evaluate their food intake. Studies on the difficulties in evaluating eating habits in people with disabilities have been done in several articles, which has helped to clarify the details of this process.

1. Cognitive Impairments- In Korea, food intake-related cognitive impairment is a major issue among individuals with disabilities, particularly those suffering from dementia. Studies on people over the age of 50 have examined the association between food consumption and cognitive performance. An investigation discovered that specific foods improve rational ability and that dietary patterns are linked to brain health. The study found that persons who consumed cooked white rice, whole grains, fruits, milk, and dairy products had a decreased prevalence of mild cognitive impairment (MCI). This demonstrates that eating habits are critical for maintaining mental health (Kim & Yun, 2018).

   Interventions concentrating on food quality, micronutrient supplementation, and breastfeeding promotion improved cognitive results, according to (Roberts *et al*. 2022), systematic evaluation of studies on nutritional interventions on preschool-age children. The review found that these treatments had an important impact on early childhood cognitive development and may have long-term benefits for overall growth and cognitive function.

2. Physical Limitations- Some disabled people may have physical restrictions that make it difficult to eat particular foods or follow dietary guidelines. This may affect the precision of dietary evaluations and complicate the process of determining the nutrients they require (Rimmer *et al*., 2005).

   Neuro-impairments such as muscle weakness, stiffness, and difficulties with coordination have a major impact on the daily lives of children with cerebral palsy. These limits influence their ability to engage in activities on their own, resulting in activity boundaries. Restrictions on participation provide difficulties in social situations as well. The study highlights the necessity of comprehensive therapies to raise social involvement and functional ability in kids with cerebral palsy (Beckung & Hagberg., 2002).

3. Sensory Impairments- A study done in Canada by (Nadon *et al*., 2011), discovered a strong link between eating disorders and sensory processing difficulties in kids with autism spectrum disorders (ASD). Mealtime behavior problems and selective eating patterns have been related to hypersensitivity to sensory stimulation. The study emphasizes the need to treat sensory processing issues to improve eating experiences and overall well-being.

4. Communication Skills- Individuals with disabilities may not be able to communicate well, and it might be difficult to appropriately measure their eating habits. This may cause miscommunications or insufficient information while analyzing their food consumption.

   The study highlights that students with autism spectrum disorder (ASD) need to have excellent communication methods. They draw attention to communication difficulties, which can vary from minor to serious, as well as the necessity of taking individual characteristics into account. They suggest several methods, such as direct instruction, telling stories, peer-mediated interventions, visual aids, and positive

reinforcement. They also promote the necessity of continual evaluation of communication goals and procedures as well as cooperation between educators, families, and professionals. Understanding each student's unique communication style allows teachers to support adolescents in realizing their greatest potential (Koegel & Ashbaugh., 2017).

5. Socio-economic factors- According to a study conducted by (Ramadass *et al*., 2018), there is a considerable percentage of the Indian population that suffers from a disability. The study also discovered a relationship between sociodemographic variables like age, gender, socioeconomic status, degree of education and training, and disability. The study also emphasized the detrimental effects of impairment on social interactions, mental and physical health, and general life satisfaction. The findings underscore the importance of targeted interventions, policy measures, and assistance programs for improving the quality of life for individuals with disabilities in India.

   Another study conducted in North Carolina found considerable health disparities between adults with developmental impairments, and other disabilities, and those without disabilities. They found that these individuals were more likely to report poor health, obesity, lack of physical activity, inadequate fruit and vegetable consumption, and faced barriers in accessing healthcare services (Havercamp *et al*., 20004).

3.2.2. Tools and methods for assessing dietary habits

The health and well-being of individuals with disabilities are greatly influenced by their dietary choices. Given their multiple health issues, cognitive challenges, physical restrictions, and communication difficulties, food habits might be difficult to assess in this population. A precise assessment of eating patterns is needed to identify nutrition deficiencies, implement effective

interventions, and monitor the success of diet changes. To evaluate eating patterns in individuals with disabilities, several instruments and techniques have been created and implemented.

1. 24-Hour Dietary Recall and Dietary Record (DR)- The 24HR Dietary Recall and DR are fully open-ended surveys that gather a wide range of specific data regarding the amount of food ingested during a given time frame. One day's recall on the 24HR is usually completed in 20-30 minutes and is conducted like an in-depth interview. A three-dimensional food model, standard measurement cups and spoons, common-sized containers (such as bowls, cups, and glasses), and two-dimensional resources such as photographs can all be used to estimate the amounts of each food. One benefit of 24HR is that it places a comparatively light strain on participants. All information, however, is ultimately subject to the recall bias of the interviewers and their ability to minimize it, as well as the memory of the respondents.

   DR minimizes dependence on a subject's memory by gathering data through the participants' self-record at the moment of meal consumption. However, before doing the survey, respondents need to be taught to collect correct data. As a result, respondents must be highly motivated, and a significant responsibility is placed on them.

2. Food Frequency Questionnaire (FFQ)- It is a sophisticated version of the Dietary History Method checklist that inquires about the frequency and amount of food consumed by participants during a designated time frame. This questionnaire, which includes approximately 100-150 foods, can be completed in 20-30 minutes on an individual or parent's behalf or during an interview with the researcher. This method makes determining long-term food intake simple, cost-effective, and quick. Because nutrition can be

influenced by a person's race, culture, choice, economic condition, etc., FFQs should be designed specifically for each study group and research purpose (Shim *et al*.,2014).

3. The Food Record- All foods, drinks, and dietary supplements that a research study participant ingested over a certain period are listed in detail in a food record. As participant burden usually results in a deterioration in the quality of information recorded if additional days are recorded, the first 3-4 days of intake are often documented. The accuracy of reporting is significantly improved by participant training. A motivated and literate population is necessary for the usage of food records. In the past, reactivity has been defined as a problem with record keeping, i.e., altering customary eating habits to make food that is deemed "healthy" easier to record or to make it more socially desirable (Bailey., 2021).

4. Diet History- According to a study conducted by (Thompson and Subar., 2017), a dietary history is any dietary evaluation in which the respondent is asked to describe their previous diet.

3.2.3 Considerations for cultural and individual differences

In the present global food policy debate on sustainability and health, healthy diets are viewed as crucial to minimizing all types of malnutrition (Scoot., 2017). To achieve sustainability goals, it is assumed that individual food decisions will result in dietary patterns (Lindgren *et al*.,2018).

The unique eating habits of a social group or geographic area are the outcome of material and cognitive factors known as cultural food practices. Children mostly pick up food habits from their parents. Social groupings (e.g., families, schools, and peers) are the source of knowledge regarding meal schedules and structure, where food can be consumed (at the table, with others, etc.), and how to eat (Monterrosa *et al*.,2020). Exposure to knowledge and verbal conversation regarding eating habits are examples of direct learning processes (Kelly *et al*., 2016). Food acceptability is greatly influenced by cuisine or the flavors, combinations, and seasonings of food, and it influences how adolescents develop their eating preferences (Mennella *et al*.,2010).

In Individual differences, it was indicated that families with lower socio-economic positions are linked to obesity (Utter *et al*., 2010). In all populations, this review found a correlation between higher obesity rates and lower socioeconomic levels as mentioned in Figure 2. Families supporting children with and without intellectual disabilities were compared, and it was shown that families with intellectual disabilities were more likely to be in poor condition, had a higher tendency to become deprived, and had less potential to get out of poverty.(Emerson *et al*., 2010).

Figure 2 Factors causing or influencing overweight and obesity adapted from (Taggart and Cousins.,2014).

There might be problems with overprotection preventing people and kids from venturing out on their own, which lowers their levels of physical exercise and social interaction. Alternatively, they could face unfavorable societal perceptions when they use recreational centers, play sports with other children, or make friends with peers who are not disabled. This may result in the person's social discrimination, reduce their physical activity, and hurt their self-esteem (Sisirak and Marks., 2014).

3.3 IMPACT OF DISABILITY ON DIETARY HABITS

3.3.1 Influence of disability on food choices and eating patterns

Due to its implications for the general health and well-being of individuals with disabilities, the effect of disability on food habits is an important topic of research. The most prevalent mental health illnesses in the world, anxiety, and depression, are major contributors to impairment. The functioning and general well-being of a large percentage of the population are impacted by subclinical symptoms of anxiety and depression, even in the absence of formal diseases (Friedrich.,2017). Review studies have indicated that adopting the Mediterranean diet, which consists of eating a lot of fruits, vegetables, nuts, and legumes; moderate amounts of chicken, eggs, and dairy products; and only infrequent quantity of red meat, is associated with a lower risk of getting depression (Lassale *et al*., 2019). However, the nature of these correlations is complicated by the evident possibility of a causal connection between food and mental health as shown in Figure 3.

High-refined carbohydrate consumption raises the risk of diabetes and obesity in many individuals with disabilities. The term "glycemic index" refers to the relative ranking of carbohydrates in meals based on how quickly they are swallowed, absorbed, and metabolized, ultimately influencing insulin and blood sugar levels. Diets strong in refined carbs and sugary foods, or with a high glycemic index and load, can have major consequences on both mental and physical health difficulties (Firth *et al*., 2020).

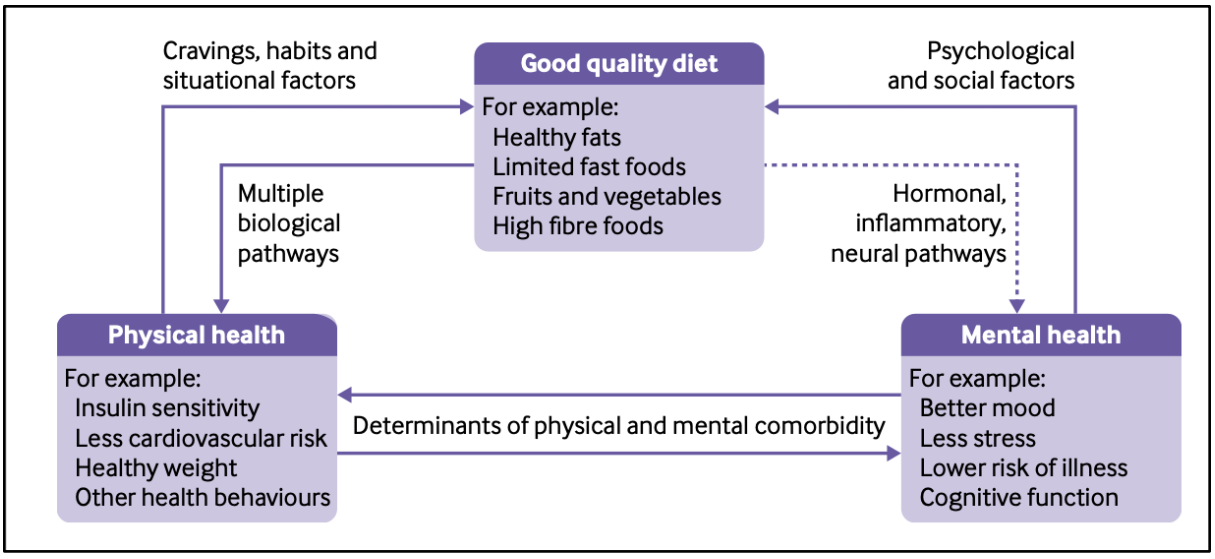


Figure 3 Hypothesis on the relationship between diet, physical and psychological health adapted from (Firth *et al.*,2020)

The choice of food may have an impact on the diversity, abundance, or function of the microbiome throughout a person's lifetime, in addition to genetic factors and antibiotic exposure. For example, a weakened mucus layer with or without increased epithelial permeability may cause neurocognitive effects of the Western diet and potentially mediated functions of low-grade systemic immune activations (Firth *et al.*, 2020).

A study done by (Noble *et al.*,2017) looked at the connection between mental retardation and alterations in the gut flora as well as Western food consumption. The study highlights the prevalence of the Western diet, its high fat, sugar, and processed food content, and its connection to diseases including obesity and neurodegenerative disorders. The term "leaky gut" refers to this breakdown of the gut barrier function that is brought on by insufficient fiber, excessive intake of artificial sweeteners, saturated fats, or processed carbohydrates, all of which are linked to unhealthy gut flora. Dietary choices can lead to dysbiosis, an imbalance in the microbial community, and significantly impact the gut microbiome, a complex population of bacteria. In

addition to increasing the permeability of the gastrointestinal tract, lower-grade inflammation, and decreased metabolism, dysbiosis can have adverse effects on one's health. On the other hand, a diet rich in fiber, polyphenols, and unsaturated fatty acids, such as the Mediterranean diet, may promote gut microbial taxa that can alter food sources for substances to reduce inflammation.

3.3.2 Nutritional deficiencies and health implications

Malnutrition and disability have several sites of overlap and are closely related subjects. Demographic trends toward greater rates of disability and developmental delay are frequent in nations with high levels of malnutrition and food scarcity. There are numerous significant domains of overlap and impact: Many different types of disability can be brought on by or made worse by malnutrition, and vice versa. (Groce *et al*.,2014). Figure 4 presents a concept framework to illustrate the key mechanisms involved.

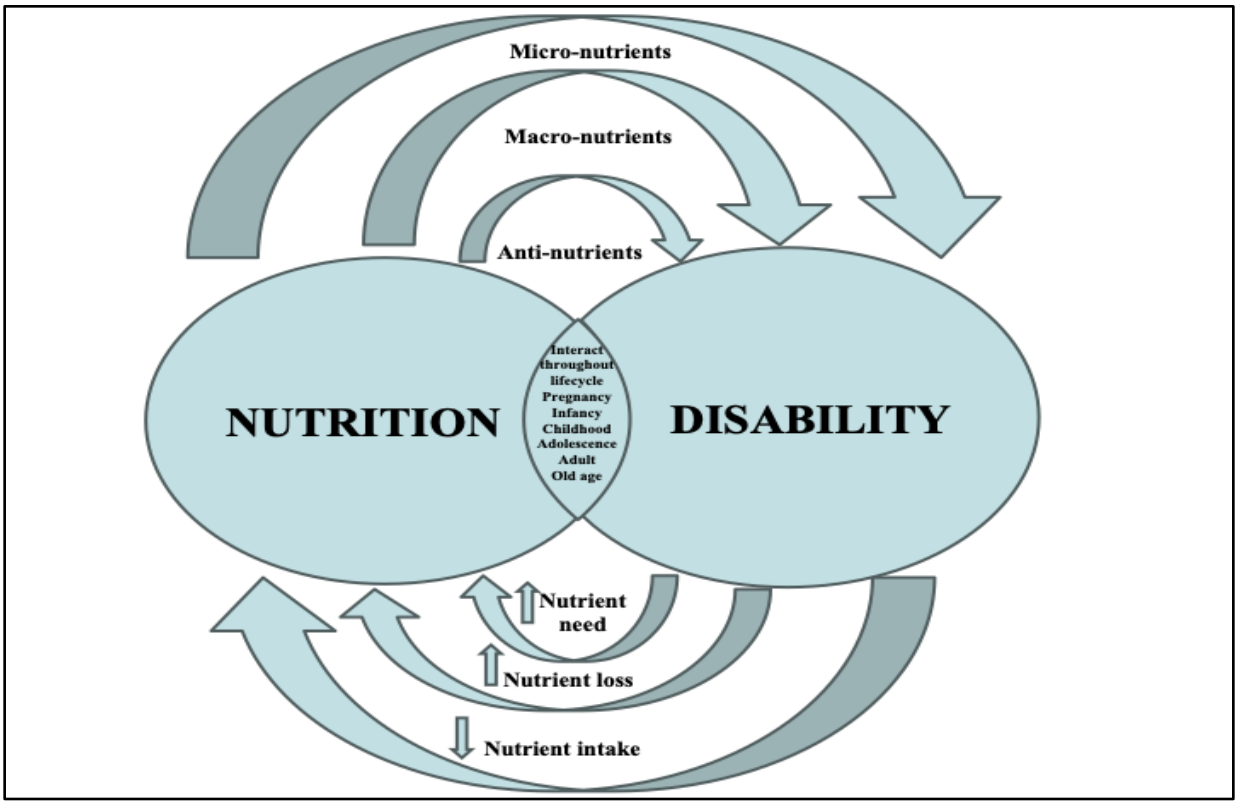


Figure No. 4 The relationship of malnutrition and disability to each other adapted from (Kerac et al.,2014).

The micronutrients like Calcium and Vitamin D are also linked to disabilities. A lack of one of them during pregnancy increases the likelihood of preterm birth, which is linked to a host of problems and unfavorable long-term effects such as cerebral palsy and impairments in cognition, vision, and hearing. One of the main causes of poor cognitive development globally is iodine deficiency, with the issue being particularly severe if the lack happens early in pregnancy (Groce *et al*.,2014). Iron deficiency is also frequent and can cause cognitive and behavioral problems by affecting the structure and function of the fetal brain (Cao *et al.*,2013). Additionally, there is strong evidence about how iron shortage affects neuro-disabilities in individuals. Infants given iron supplements have shown short-term benefits, indicating that side effects may be avoided, countered, or both. The review does, however, caution that iron therapy may not fully restore the

risk of iron-associated impairment to normal levels: “Infants with iron deficiency anemia are developmentally at risk in the short term and continue to be so in the long term despite iron therapy” (Walker *et al*.,2007).

Physical, neurological, and cognitive impairments are linked to a broader mix of malnutrition in mothers, both in terms of macro- and micronutrients. One result of inadequate early nutrition in girls is suboptimal pelvic growth (Konje and Ladipo., 2000), and risk factors for birth asphyxia, fetal harm, and obstructed labor all of which are significant contributors to cerebral palsy (Ezegwui *et al*.,2012). Impaired cognitive function, an elevated stress response, and an elevated risk of schizophrenia were among the long-term impacts (Roseboom *et al*.,2011).

Infants and young children who are underweight (low weight for age) or stunted (low height for age) show symptoms of malnutrition and are more likely to test positive for impairment (Gottlieb *et al*.,2005-06). Deficiencies in macronutrients and micronutrients increase the risk of cognitive, sensory, and physical disability (Kerac *et al*.,2014). As a case study of micronutrient-associated impairment, each year, vitamin A deficiencies cause between 250,000 and 500,000 cases of blindness in children (WHO, 2024). Several B vitamins are linked to disabled conditions, Lower extremity poly-neuropathy is one of the symptoms of beriberi, a vitamin B1 (thiamine) deficiency (Chisolm *et al*.,2013). A lack of vitamin B3 (niacin) causes pellagra, which has agitation and confusion as neurological symptoms (Steffen.,2012). Underweight or wasting are common indications of childhood macronutrient malnutrition, which also affects immune system performance hence it makes the kid more susceptible to illness (Katona *et al*.,2008).

Obesity raises the possibility of disorders in metabolism and heart attack, the third biggest cause of disability-adjusted life years (DALYs) globally. In addition to increasing the risk of hip fractures

and other broken bones, malnutrition and undernutrition in elderly individuals can induce physical mobility problems, making it difficult for them to collect or cook meals for themselves. In adults, this can lead to a change in eating habits and other disabilities (Murray *et al*.,2012).

Anti-nutrients can harm people at any age. In times of limited food availability, adults and children consume unusual meals that they do not know how to cook properly, leaving chemicals that can damage the nervous system unremoved. Cassava bitters are the most well-known source of cyanide. It is usually removed with appropriate techniques, such as washing, drying, grinding, and cooking. If this isn't done, peripheral polyneuropathy may develop permanently (WHO.,2006).

Approximately 90% of children in Bangladesh with cerebral palsy experience eating difficulties, which can lead to malnutrition, deterioration of health, and, in rare cases, early death (Adams *et al*.,2012). Certain children with disabilities might require extra nutrition to manage the health issues related to their condition. A child with a physical impairment, for example, maybe more prone to develop wounds, which can get severely inflamed owing to immobility or poor nursing. For fast recovery and infection management, a healthy diet is essential. Families with low incomes can find it difficult to meet these higher nutritional needs or might not have easy access to the dietary supplements they need (Groce *et al*.,2014).

While undernutrition is typically the main cause for concern when it comes to children with disabilities, some of them also worry about growing overweight. For example, fewer movements may be required for children with specific physical limitations, which may increase their risk of weight gain (Olusanya., 2010). Some children who have intellectual or mental health difficulties, certain genetic abnormalities, or eating disorders may be more likely to become overweight (Groce *et al*.,2014).

3.4 INTERVENTIONS AND SUPPORT FOR IMPROVING DIETARY HABITS

3.4.1 Nutrition education & counseling

Nutrition education and counseling are critical for improving individuals with disabilities' health and well-being. When it comes to giving their children the right nutrition and dietary advice, parents of disabled children frequently confront particular difficulties. According to research, specialized nutrition education and counseling programs can significantly improve the nutritional status and general health of individuals with disabilities.

The majority of typical nutritious meals, such as eggs, fish or poultry, fruits, and dark green leafy vegetables, were discovered to be absent from Indian adolescents' plates, while 1% and 5% of them were found to regularly consume junk food and fried food, respectively (Sethi *et al*.,2019). Children and teenagers have been shown to consume less fruit and vegetables and more energy-dense, low-nutrient meals like sugary drinks, deep-fried snacks, and sweets as a result of urbanization (Sireesha *et al*., 2017). It was frequently noted in their local food environment that these unhealthy items were easily accessible and available in food outlets (Svastisalee *et al*.,2016).

Parents play a significant role in forming their children's eating habits, which are formed in their early years and continue throughout adulthood (Thakur and Mathur.,2022). A study was conducted in South Africa, by (Oldewage *et al*., 2015), and it was discovered that children with highly educated parents consumed noticeably more fruits, vegetables, and other healthful meals, as well as minerals like dietary calcium and total protein. In another study conducted by (Grosso *et al*.,2013), the increased level of parental education was strongly linked to a child's consumption

of low-nutritious food and beverages i.e. soft drinks, meat, or snacks. The parent's higher level of education may also indicate that they are wealthier and have the means to purchase pricey but nutrient-dense foods like dairy, meats, and fruits and vegetables.

Many families with a kid with a disability face issues when it comes to nutrition. It's possible that parents, carers, and service providers don't know how to teach their impaired children to feed themselves or how to feed themselves. Living with family often limits the amount of nutrient-dense food and drink that can be offered, especially in low-resource households. Children with Down syndrome, who are more likely to choke and develop pneumonia, or those with cerebral palsy, who may need modified seating or location to regulate muscle spasms, should pay extra attention to this (Groce *et al*.,2014).

According to (Rosi *et al*.,2019) a study conducted in Indonesia, 67% of parents believed that children with hyperactive autism should eat a gluten-free, casein-free diet. On the other hand, negative opinions resulted from some parents' ignorance of the food. According to the study, health professionals community nurses in particular should collaborate with nutritionists to offer routine check-ups and health education regarding the GFCF diet. Peers, family, parents, and the neighborhood should also be taken into consideration when including them in educational activities. This will change the eating habits of children and their families, which will have a positive effect on the food environment at home (Bundhan *et al*.,2018).

3.4.2 Accessibility to Healthy Food Options

Individuals with disabilities are more prone than others to experience food insecurity. Generally speaking, the main reasons for this inequality are seen to be lower earnings and higher relative expenses. According to some researchers, people with mobility disabilities (PWMD) may find it

harder to prepare or receive food (Schwartz.,2020). Obesity is more common in adults with physical and other limitations than in the general population. Individuals with mobility problems are more prone to be poor and physically inactive (Steinmetz., 2002). Individuals with disabilities have more environmental obstacles, such as transportation expenses and wheelchair accessibility (Rimmer *et al*.,2005). Furthermore, women with physical limitations have reported various environmental barriers to grocery shopping, such as the high cost of healthful items and the difficulty of shopping (Hall *et al*.,2003).

Food banks and food pantries are frequently used by those who are food insecure to obtain food, yet research indicates that pantry users only eat small portions of fruits, vegetables, and fiber (Robaina *et al*.,2013). While individuals with food security have access to more nutrient-rich and healthier alternatives, the majority of their calories are derived from calorie-dense, nutrient-poor meals such as refined carbohydrates and foods high in sugars and cholesterol. As a result, rather than consuming insufficient calories, one may consume empty calories (Drewnowski and Specter.,2004).

The socioecological model (SEM) as mentioned in Figure 5 is an idea framework, as described by Centres for Disease Control and Prevention it is a discussion of the main multilevel strategies for enhancing food security and nutritional status. Food security will be improved more efficiently if initiatives for nutrition and the environment are implemented in a way that promotes multi-level interaction. A support network of friends, family, and social media is established in addition to working one-on-one with the individuals. Low-income housing communities have employed multilevel ways to enhance the intake of fruits and vegetables (Ziso *et al*.,2022).

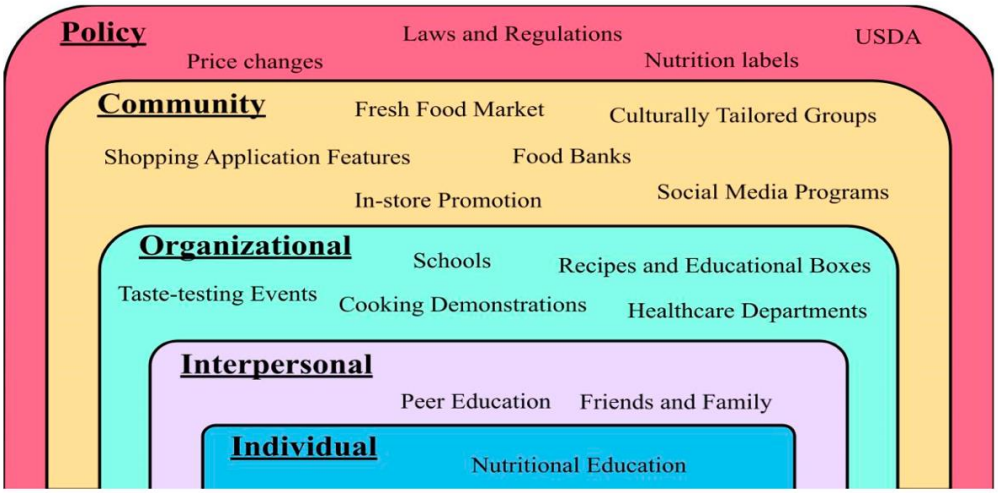


Figure 5 Multilevel approaches to increase the consumption of healthy food in low-income groups based on the SEM adapted from (Ziso et al.,2022).

According to (Mojtahedi *et al*.,2008) study, environmental factors and physical limitations make it difficult for individuals with mobility disabilities to get nutrient-dense dietary options in urban and suburban areas. Physical obstacles, transport options, the cost of healthy food, availability of local produce, and proximity to a grocery store are some factors that restrict access to wholesome foods.

Another study has been carried out in England by (Caton *et al*.,2012), on the knowledge, accessibility, and challenges to healthy living for individuals with intellectual disabilities. Ten support staff members and twenty individuals were interviewed for the study. The results showed that although both people understood the importance of healthy habits, their adoption was hampered by financial stress, a lack of support from the healthcare system, and restricted access to healthcare services. But there were also identified facilitators, like having access to health promotion programs, having friends and family support, and having open communication with medical specialists.

Enhancing these eating settings can lead to more individuals having access to healthful food options, which will improve diet quality and lower the risk of chronic disease in these groups. For this reason, it's critical to create practical plans to enhance the nutritional status and quality of the diets of high-risk groups to prevent chronic diseases linked to food (Ziso *et al*.,2022).

3.4.3 Support for meal planning and preparations

Due to a variety of physical, cognitive, or sensory problems, meal planning and preparation can be difficult for individuals with disabilities. The research on assisting individuals with disabilities with meal preparation and planning highlights the value of specialized treatments, assistive technology, and parental or caregiver support to improve quality of life and independence. Physical, economic, cultural, interpersonal, and individual traits interact in diverse ways to influence the social environment's effect on healthy eating awareness. Younger participants had higher odds of using self-regulation techniques and being aware of healthy eating habits (Gaspar *et al*.,2016).

Although most children and adolescents understand the importance of eating healthy foods, they often struggle to implement this knowledge into their daily lives, suggesting a problem with self-control. This is most likely the case when food is tempting and they are around peers who encourage or even force them to make unhealthy food choices (Matos *et al*.,2012). In a study conducted by (Gans *et al*.,2018), multilevel techniques have demonstrated that taste tests and nutrition education, which includes giving people healthful recipes, are the primary factors that promote fruit and vegetable consumption.

In addition to providing nourishing recipes, some investigations have focused on improving participants' ability to prepare affordable food, which further decreased their food insecurity by

encouraging home cooking and decreasing eating out, increasing the overall number of fruits and vegetables in the diet (Trude *et al*.,2018). Making healthier eating choices has also been made possible by culturally appropriate nutrition education that incorporates family time and exercise. In addition, all handouts, recipes, and visual aids are provided in the participant's original tongue with these methods (Gato *et al*.,2016). By improving motor skills, patient compliance, and raising health information and positive attitudes towards eating, the study demonstrates that learning to cook can enhance nutrition outcomes and overall well-being.

3.5 STRATEGIES FOR PROMOTING HEALTHY EATING IN INDIVIDUAL WITH DISABILITIES

3.5.1 Community-based programs and resources

Individuals with disabilities, as well as those living in poor or rural locations, may have limited access to health and social programs aimed at improving the individual's nutrition. However, many of these initiatives can be changed or adjusted to better suit this population's needs. To make their programs accessible to individuals with disabilities, community developers and providers must be provided with the resources they require (Rimmer.,2011).

Children with disabilities may not use community-based health or nutrition programs as much because of obstacles to getting there (expensive or inadequate transportation, inaccessible premises) (Groce *et al*.,2014). This research approach is crucial for gathering information about the kinds of courses and materials that will benefit the general public as well as for facilitating participant comfort and openness during community educator interviews (Ziso *et al*.,2022).

Furthermore, schools offer numerous child nutrition programs, and children with impairments are less likely than their peers to attend school at any age. As a result, students with impairments not only fall behind their peers in terms of academic achievement, but they also do not benefit from school-based nutrition programs. In the worst-case scenario, some families or communities may treat disabled children unequally while prioritizing non-disabled siblings' access to food and healthcare facilities. Additionally, the number of institutions and orphanages housing disabled children is disproportionately high, and food schemes frequently ignore these facilities. Often poor diet served in institutions is a further source of worry. It may be more dangerous for children with disabilities, even if it affects all institutionalized children.

Therefore, disability is frequently viewed as a specialized topic and is not mainstreamed into health, nutrition, and child development practitioner education. Professionals in the health sector should receive pre- and post-service training on the relationship between nutrition and disability. This will raise awareness of children with disabilities and special nutritional needs and encourage the support of inclusive practices and programs. To ensure that children and individuals with disabilities receive the same life-saving interventions as other children, nutrition initiatives must be broadened to meet their needs (Groce *et al*.,2014).

There were some good initiatives taken by the communities while helping the individuals with disability. This strategy was applied in the chosen studies to alter environmental factors to raise the consumption of nutrient-dense foods. Much research has looked at how cooking and gardening might lower metabolic risk and improve the quality of diets. These studies set up classrooms for adolescents from low-income families. The sessions included gardening, with an emphasis on “hands-on” learning methods that encouraged students to plant, cultivate, and harvest organic fruits and vegetables (Flores *et al*.,2020). In addition to the fruit and vegetables grown in the

garden, there was also a variety of educational classes on nutrition and cooking. These elements encouraged the consumption of fruits and vegetables as well as preparation of healthy meals and snacks. A useful strategy to introduce children and other family members to new cuisines has been the introduction of fresh vegetables into juices or other meals via creative food preparation. Every week, new components are introduced, and participants were thrilled to put them in their smoothies since they knew their kids would be fascinated by them. (Gato *et al.*,2016).

3.5.2 Policy implications for improving access to nutritious foods

Environmental and policy improvements that support healthy eating are required to lower the consumption of high-energy, low-nutrient foods. According to research, the three primary areas that involve attention are cost, nutrition facts labels, and availability of healthier ready meals (Bersamin *et al.*,2019). To improve food security and nutrition quality, policy changes are also needed in school programs aimed at integrating students into traditional eating systems with high levels of nutrients. More access to healthy ready meals has been linked to a large rise in fruit and vegetable intake (Beresford *et al.*,2001). Furthermore, cheaper healthy snack prices lead to higher consumption of these goods (Bersamin *et al.*,2019). Fruit and vegetable intake climbed two to four times when prices were lowered by 50% for high school students (Brownson *et al.*,2006). When the price of low-fat snacks was cut by 50%, sales of them increased by 93% (French *et al.*,2001).

Future nutrition programs and policies, as well as disability policy and general public health, must recognize and account for the link between malnutrition and disability. By doing this, a lot of the present issues can be turned into chances that can help both facets of healthcare. It will take resources and well-thought-out action plans for this to occur. This would provide significant reciprocal advantages. Nutrition programs may act as entry points to services for people with

disabilities, and there are a lot of possibilities that disability programs will serve as an entry point into nutritional services. Children and adults with disabilities will benefit from nutrition treatments for all ages. In particular, the inclusion of children at a higher risk of malnutrition in current nutrition programs should be taken into account by nutritionists, healthcare professionals, and community service providers. They should also expand or adapt community-based care models and make contact with establishments that shelter some individuals with disabilities to provide effective and inclusive nutrition.

Children and adults with disabilities should also be included in the general food security and therapy programs so that they have better access to nutrition based on equality and fundamental rights. The integration of disability issues into nutrition programs, policies, and services is necessary because children and adults with disabilities frequently need extra nutritional interventions tailored to their specific impairments. This allows for the joint management of malnutrition and disability in everyday life as well as during emergency food security crises.

Much work still needs to be done, even though some international institutions, policymakers, and other community members are starting to understand the need to better integrate nutrition and disability. The following are recommended as important next steps:

1. The international community, which includes governments, policymakers, multilateral donors, and practitioners, must guarantee political and financial commitment to address nutrition and disability as a single problem.

2. Improved statistics are required to comprehend the connections between nutrition and disability. To facilitate comparisons between the disabled and their peers who are not disabled, this also provides disaggregated data.

3. Improved access to nutrition services is required for all expecting and nursing women and those experiencing challenges.

4. Early malnutrition screening should be enhanced to make it more accessible to people with disabilities and their families, especially as disability should be included in all early intervention nutrition, health, and development programs.

5. Disability-specific services are necessary for certain disabled adults and children. These services should target and address the needs of individuals with disabilities, families, and caregivers. When available, these services should include community-based and professional special rehabilitation services.

6. Adults and children with disabilities should participate in health care and nutrition training, as well as developmental specialists (Groce *et al.*,2014).

3.5.3 Empowerment and self-determination in dietary choices.

Individuals with disabilities have benefited greatly from empowerment since it has given them greater power over their lives, informed policy and service delivery, and helped us see the obvious namely, that people should be respected for who they are, not “despite” a disability. Advances in the empowerment of handicapped people have been radically improving our sector, even if much more work has to be done to change society’s views towards issues related to disability (Dan.,2020).

In comparison to the general population, many persons with disabilities are unable to participate in different types of health services such as regular physical activity, good nutrition, social activities, and regular access to medical care or preventive measures due to the limited availability of these kinds of service or programs (Centres for Disease Control and Prevention., 2006). Efforts to promote health that are geared towards those with disabilities can significantly improve lifestyle choices (Rimmer *et al*.,2002), lower medical expenses (Ravesloot *et al*.,2005), and enhance quality of life.

The essential element of health empowerment is to educate the disabled about their rights as consumers and how they can be actively involved in healthcare support programs and services that are available through their communities (Block *et al*.,2005). Three main categories of work comprise empowerment health for individuals with impairments.

1. Handling related conditions (such as taking the medicine regularly to reduce the discomfort).
2. Lowering or avoiding chronic and secondary illnesses by practicing specific health-related behaviors (eg. Greater physical activity).
3. Removing environmental obstacles that prevent participation (such as planning transportation)

To meet these three basic requirements, and to ensure that programs and services are made accessible for people with disabilities, the Community should work together with healthcare providers and individuals. For instance, pain is frequently reported as a significant secondary ailment by people with disabilities (Schrader *et al*.,2004). A successful program would give the participant the information and abilities to safely and successfully create a pain management plan

that suits their needs. A plan incorporating exercise, proper posture and seating, medicine, and relaxation techniques, among others, could be developed.

The foundation of empowerment health is the challenges each individual perceives for themselves. Rather than presenting predetermined solutions or only support from a healthcare professional, empowerment health focuses on assisting the individual in overcoming obstacles by developing problem-solving abilities. Empowerment health endeavors to enhance an individual's self-efficacy by imparting effective problem-solving and barrier-overcoming tactics. This establishes the confidence of individual people in their ability to efficiently deal with problems associated with health (Schrader and Lawless.,2004). More training programmes on disability awareness and sensitivity, as well as reducing barriers to participation are urgently needed in addition to the urgent need for increasing access to built environments.

Providing information about the needs of individuals with disabilities to health professionals' training programs is a key strategy for improving accessibility. The use of individual first terminology and the therapy of all individuals with dignity and respect for each other's diversity is necessary to improve comfort in various health promotion settings for people with disabilities (Rimmer *et al*.,2008). Improving the accessibility of accessibility alternatives for those with disabilities can lead to increased accessibility to community-based health promotion services.

We have discussed different methods of evaluating nutritional status and dietary habits in people with disabilities living in Mumbai during this literature review. We have also analyzed research on specific disability groups, factors influencing their nutritional status, and the availability of healthcare services. Nutrition was found to be insufficient in certain disability groups, highlighting

the importance of enhanced nutritional care and focused interventions in addressing the unique issues that individuals with disabilities experience in Mumbai.

3.6 AIM AND OBJECTIVES

To assess the nutritional requirements of individuals with disabilities using anthropometric parameters

1. To determine the nutritional status of individuals with disabilities by assessing their food intake.
2. To suggest balanced nutrition to individuals which can impact their well-being.
3. To study the nutritional challenges of individuals with disabilities.

4. METHODOLOGY

The present study assessed the nutritional status and lifestyle patterns of individuals with disabilities aged 15-30 years residing in Mumbai City.

4.1 STUDY DESIGN

It was a cross-sectional type of study where we collected data from many different individuals at a single point in time. The study used a survey research design, which involves asking questions to obtain data about people's opinions, behaviors, or traits.

4.2 AREA OF THE STUDY

Collaboration and organization were contacted to collect the sample in Mumbai, which are as follows:

1. Veruschka Foundation.
2. ADAPT Skill Development Centre.
3. Punarvas Education Society.
4. Shishukalyan Kendra School for Mentally Challenged Children.

4.3 INCLUSION CRITERIA

1. Individuals with the age of 15 and above up to 30 years.
2. Individuals who were available during the period of data collection.
3. Individuals residing in Mumbai City.

4.4 EXCLUSION CRITERIA

1. Individuals below the age of 15 years and above the age of 30 years.
2. Individuals who are not available during the period of data collection.
3. Individuals residing outside the Mumbai City.

4.5 SAMPLING METHOD

The method adopted for sampling was convenience sampling, which is a method that involves selecting participants based on their availability. It can also include participants who are willing to participate.

4.6 SIZE OF SAMPLE

The population of this study would be 100 Individuals with Disabilities such as Autism Spectrum Disorder, Down's Syndrome, Cerebral Palsy, Intellectual Disability, and Attention Deficit Hyperactivity Disorder (ADHD). The population of Individuals with Disability was coded as:

Down's Syndrome-1; Autism Spectrum Disorder-2; Attention Deficit Hyperactivity Disorder-3; Cerebral Palsy-4; Intellectual Disability-5.

4.7 METHODS USED FOR DATA COLLECTION

The questionnaire interview approach was used to collect anthropometric data (height, weight, and BMI) as well as eating habits (24-hour diet recall and food frequency questionnaires).

4.7.1 A semi-structured demographic sheet was used to gather data on age, gender, and socio-economic status. Before the study began, parents gave their informed consent.

4.7.2 Anthropometry Measurements

Weight method:- To measure weight, follow these steps

1. Position yourself in the center of the platform by standing on the Omron Karada Scan Body Composition Monitor HBF-375 digital scale.
2. Depending on the unit of measurement you choose, the weight on your scale will be shown in pounds or kilograms.
3. Before using the scale, make sure it is properly calibrated to ensure accurate results.

Height

1. Method- First, have the individual place their feet against a wall or other level surface to determine their height. The shoulder should be width apart.
2. Place the stadiometer against the subject's head, with the top of the device on the subject's crown.
3. Use the stadiometer's scale to determine the person's height. Make sure you read the height to the nearest inch or centimeter.

Body mass index (BMI)

1. The Body Mass Index (BMI) is a method for calculating a person's weight depending on their height. This method determines an individual's weight category.

2. The Body Mass Index (BMI) was assessed as

$$\frac{Weight\ (kg)}{Height\ (m^2)}$$

3. Using the left arm for the measurements, the circumference of the midupper arm was measured to the nearest 0.1 cm with a flexible nonstretched tape.

4.8 DIETARY PATTERNS

4.8.1 Food Frequency Questionnaire (FFQ) and 24-Hour Diet Recall

To assess the frequency and type of food consumed by the participants to better understand their eating patterns, and to report on their food consumption the previous day, parents were asked to complete the Food Frequency Questionnaire. The FFQ was classified according to the increasing frequency of usage.

Never-1; Monthly-2: Once a week-3; Twice a week-4; Daily-5

4.9 STATISTICAL ANALYSIS

1. Microsoft is a commonly used spreadsheet program that includes basic statistical calculations and data reading features.

2. SPSS is a statistical package for the social sciences. It is a popular and comprehensive statistical tool for risk analysis. It includes a wide range of statistical tests and techniques

used in research across several fields of science. The statistical tests that were used are as follows

3. To compare means between three or more independent groups, ANOVA, or an analysis of variance, shall be used. ANOVA is useful when there are more than two groups and want to see whether there are any statistically significant variations between the means. A p-value < 0.05 indicates a significant difference in means between the two groups. A p-value greater than 0.05 indicates no significant difference between the means of the two groups.

4. The one-sample t-test compares a single sample's mean to known or hypothesized population values. It helps to determine whether the sample mean deviates significantly from the population mean to which it is being compared. For anthropological data, the cutoffs are used as the population mean, while for dietary data, the EARs are used as the population mean. A p-value of <0.05 indicates a significant difference between the means of the two groups. A p-value greater than 0.05 indicates no significant difference between the means of the two groups.

5. The mean is the average of a collection of numbers, whereas the standard deviation is the degree to which data deviates from the mean. The mean is calculated by adding all of the values and dividing by the total number of values. The standard deviation is computed by summing the squares of the differences, dividing by the number of values minus one, and then calculating the square root.

6. The frequency with which a given value or category appears as a fraction or percentage of the total number.

5. RESULT AND DISCUSSION

The study was conducted on individuals with disabilities in Mumbai where 100 participants between 15-30 years old participated. Estimating their nutritional status and eating habits is essential to maintain general health and good quality of life. A few health problems that can result from poor nutrition are stunted growth and development, weakened immunity systems, or diminished brain function. Their nutritional condition may also become more complicated for people without disabilities since they may encounter particular difficulties in obtaining and understanding nutrition-related information.

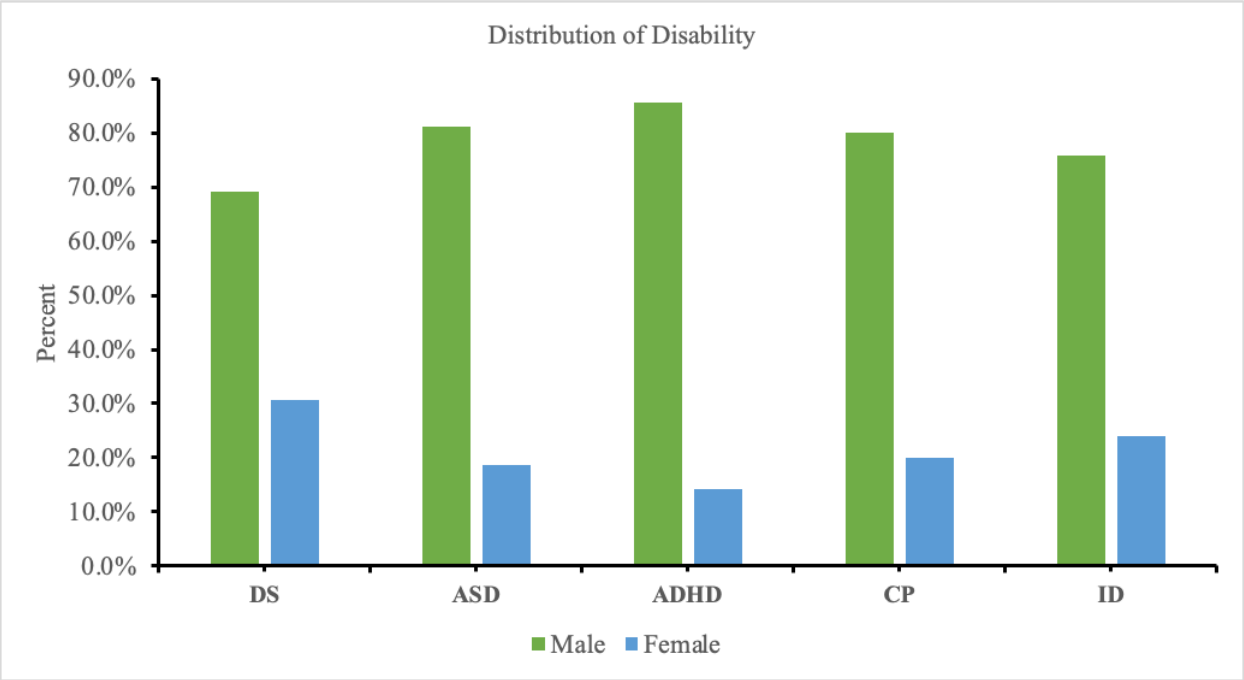
5.1 Distribution of disability

The study was done on 100 individuals with different types of disabilities. The disabilities that were found in this population were Down Syndrome (DS), Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), Cerebral Palsy (CP), and Intellectual Disability (ID). Among them 77% of individuals were male and 23% of individuals were females. The following distribution is given in the Table 1 and figure 6.

Table 1 Distribution of Disability

	Male (n=77)		Female (n=23)		Total (n=100)	
	N	%	N	%	N	%
Down Syndrome	9	69.2	4	30.8	13	13
Autism Spectrum Disorder	13	81.3	3	18.8	16	16
Attention Deficit Hyperactivity Disorder	6	85.7	1	14.3	7	7
Cerebral Palsy	8	80	2	20	10	10
Intellectual Disability	41	75.9	13	24.1	54	54

Figure 6 Distribution of Disability



5.2 POPULATION ACCORDING TO BODY MASS INDEX (BMI) AND MID-UPPER ARM CIRCUMFERENCE (MUAC)

Based on height and weight the BMI was calculated within 100 individuals who participated in the study and it was found that in terms of overweight and obesity, males have a little greater frequency according to BMI, but females have a slightly higher prevalence according to MUAC. Underweight is more common when evaluated by MUAC rather than BMI, particularly among females. Normal weight is the most common group, based on both measures. However, there may be differences in weight status between BMI and MUAC suggesting that both methods could evaluate different aspects of body composition. Hence the following distribution is mentioned in Table 4.

The following distribution is mentioned in the table no.2

Table 2 Distribution according to BMI and MUAC

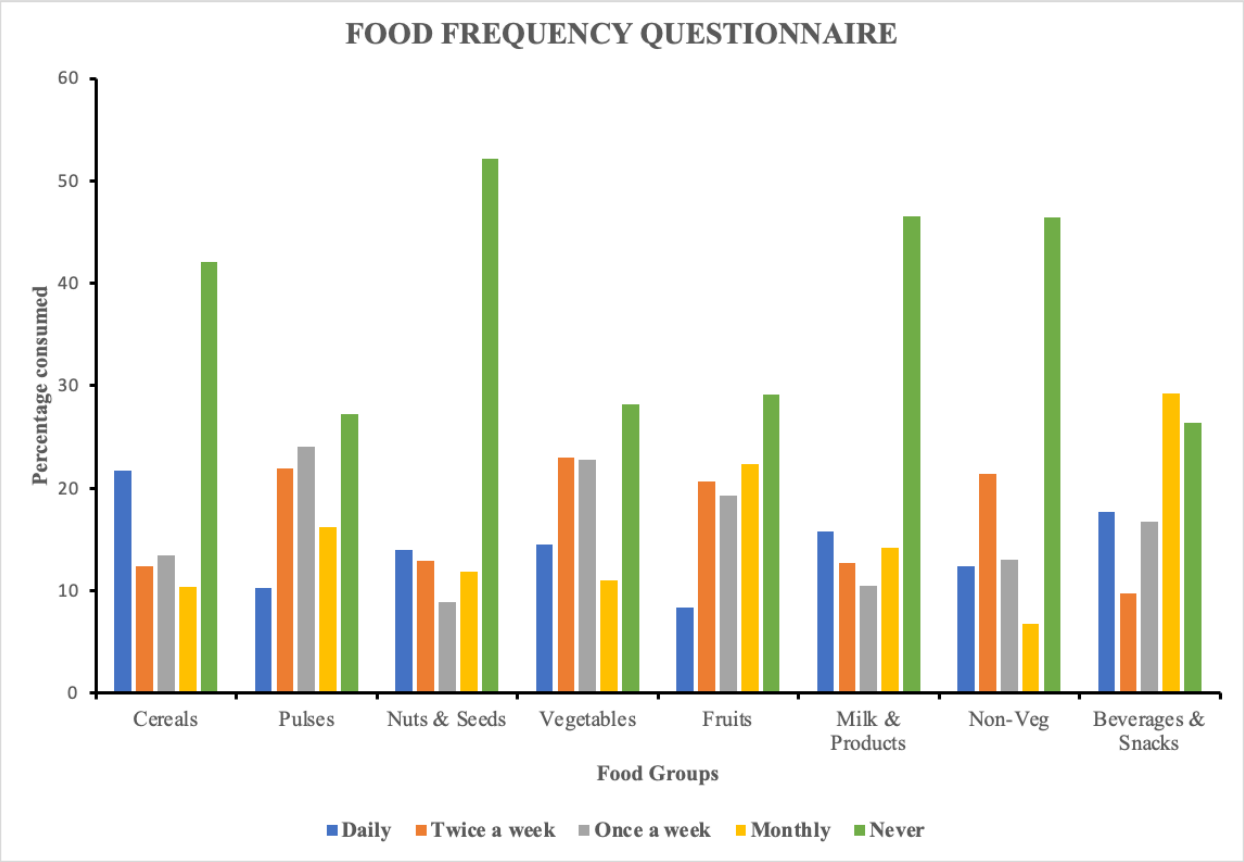
	BMI			MUAC		
	(n)		%	(n)		(%)
	Male	Female	Total	Male	Female	Total
Underweight	31	4	35	42	9	51
Normal weight	22	3	25	16	6	22
Overweight	10	0	10	15	3	18
Obese	14	16	30	4	5	9
Total	77	23	100	77	23	100

A study was carried out in Mangalore by (Hedge *et al*.,2019) to look into the link between food choices and nutritional status in children with special needs. The study had a sample size of 100 exceptional children and 53 parents. Information on children's demographics, dietary patterns, and exercise habits was collected in a self-administered survey that included measurements of height, body mass index, and BMI. The findings revealed that 86% of people were underweight. 12% of persons were normal weight, and 2% were significantly overweight, therefore there was no obese child present.

5.3 FOOD FREQUENCY QUESTIONNAIRE

The Food Frequency Questionnaire is a method for gathering dietary information based on a specific food list to assess normal dietary trends and understand the relationship between patterns of intake and health impacts. The Food Frequency Questionnaire (FFQ) proved to be an effective tool in this study as well.

Figure 7 Food Frequency Questionnaire



Based on food frequency data, it was observed that 21.7% of individuals consume cereals daily like rice, wheat, and refined flour whereas 42.1% of individuals were observed not consuming cereals like jowar, bajra, ragi, and oats. Similarly, consumption of pulses like matki, moong, urad dal, toor dal were consumed by only 10.3% of individuals daily, while 27.2 % of individuals did

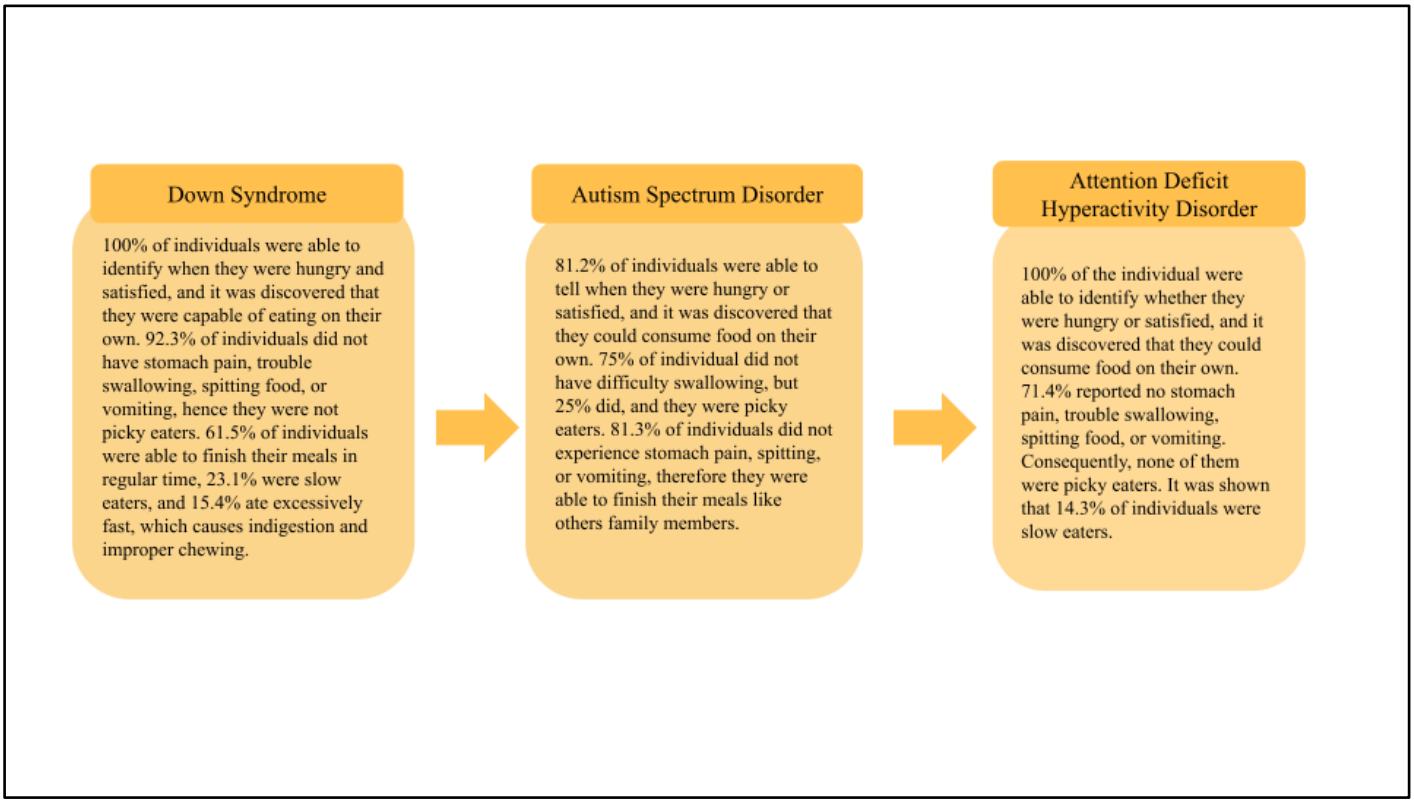
not consume pulses like rajma, masoor dal, and chavli. Only 14% of individuals were consuming nuts and seeds daily like almonds, cashews, and sesame seeds, the majority of individuals 52.2% were not consuming nuts and seeds. Similarly, vegetables like cabbage, cauliflower, drumstick, lady finger, and fenugreek were consumed by only 14.5% of individuals regularly, while 28.2% did not consume any kind of vegetables. The most common fruits like apples, bananas, oranges, and guava were consumed regularly only by 8.4%, while 29.1% never consumed any kind of fruit. The consumption of cow's milk and paneer was 15.8%, whereas 46.5% did not consume it. The consumption of chicken, eggs, and fish was found to be consumed by only 12.4% of individuals, while 21.4% of individuals were consuming twice a week mostly on Wednesdays and Sundays, while 46.4% of individuals never consume non-vegetarian food items. Consumption of beverages and snacks like tea, coffee, cold drinks, milkshakes, chips, pizza, noodles, and ready-to-mix soup were consumed by 17.7% of individuals daily while 26.4% of individuals did not consume these foods.

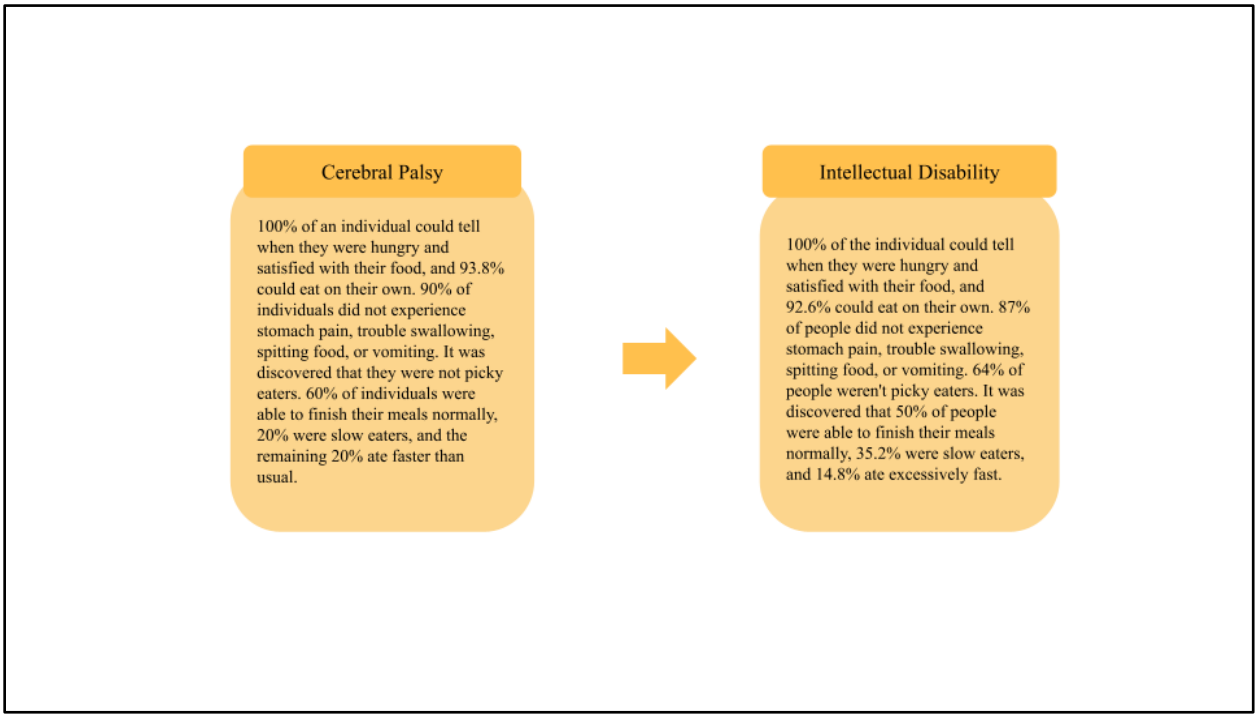
In Mangalore, a study similar to this was conducted by (Hedge *et al.*,2019) to assess the relationship between special children's nutritional status and eating habits. The study discovered that a significant number of children with special needs had unhealthful eating patterns, which included consuming little fruits, vegetables, and dairy. Also, the researchers discovered that a large percentage of children with special needs were obese or overweight. In addition, the study showed a significant correlation between dietary practices and nutrient status. It was more common for malnourished or overweight/obese children to have bad eating habits.

5.4 LIFESTYLE PATTERNS IN INDIVIDUAL WITH DISABILITIES

A lifestyle assessment survey was conducted for all individuals where their parents or caregivers were asked to provide details of eating habits and overall routine. It was observed that 72% of individuals had disability certificates while 28% of individuals did not have disability certificates, hence the awareness was observed within the parents. Therefore, as mentioned in Figure 8 these were the lifestyle patterns observed in the study.

Figure 8. Lifestyle patterns in Individuals with disabilities





In this study, it was shown that 57% of individuals did not take any medication, whereas 43% did, such as thyroid and homeopathy medicine. It was found that 70.8% of people had siblings, but they were all normal. It was shown that 79.7% of the participants in this study had a low socioeconomic status, whereas 20.3% had a higher socioeconomic status. There were no responses to blood testing across the disability.

A study was undertaken in India by (Siddiqi *et al.*,2018) to analyze the eating habits and meal times of Autism Spectrum disorder children. They found that about 38% of children needed more food, while 30% were capable of eating alone. Only half of the children could detect when they were hungry, and 43% of parents reported that their children took more than half an hour to eat their meals. It was reported that 43% of individuals vomited during their mealtime.

5.5 COMPARISON BETWEEN DISABILITY AND THEIR BODY ANALYSIS

The comparison was carried out in this study with the 100 participants. The ANOVA test was used to evaluate the resources of 3 or more groups in this study. In this analysis, ANOVA has been applied to assess whether a significant difference exists between all types of disability concerning anthropometrics including height, body weight, BMI, and MUAC. Each parameter's p-value indicates whether or not statistically significant variations between the various types of disabilities have been detected. When the p-value is below a significance level of usually 0.05, it confirms adequate evidence to reject this null hypothesis and prove that the comparison groups have significant differences in their characteristics.

Types of Disability	Height (cm) Mean ± SD	Weight (kg) Mean ± SD	BMI (kg/□^{2}) Mean ± SD	MUAC (cm) Mean ± SD
Down Syndrome (n=13)	159 ± 15.6	57 ± 15.3	22 ± 5.6	24 ± 4.9
Autism Spectrum Disability (n=16)	166 ± 14.6	65 ± 14.6	23 ± 4.6	26 ± 6.4
Attention Deficit Hyperactivity Disorder (n=7)	162 ± 12.9	59 ± 16.7	22 ± 5.6	27 ± 5.6
Cerebral Palsy (n=10)	160 ± 16.8	57 ± 15.3	23 ± 9	25 ± 3.6

Intellectual Disability (n=54)	169 ± 13.3	56 ± 16.3	20 ± 6.6	25 ± 4.7
F value	1.961	0.876	1.3120	0.441
p-value	0.107	0.482	0.271	0.779

Table 3 Comparison Between Disability and Body Analysis

In this study, as mentioned in Table 5 all the p-values appear to be above 0.05, indicating no significant differences seen across the different forms of disability. As a result, the evidence is insufficient to conclude that there are major variations in these characteristics.

5.6 COMPARISON BETWEEN THE GENDERS OF INDIVIDUAL WITH DISABILITIES AND THEIR NUTRIENT INTAKE (MACRONUTRIENTS)

5.6.1 Comparison between the genders of Individuals with Down Syndrome

To check nutrient intake by 24-hour diet recall, a comparison between individuals with Down Syndrome for males and females is presented in the table below. Whether the intake of nutrients, such as energy, carbohydrates, proteins, and fats had a significant difference between them has been determined using average and standard deviation. In comparison to females, it was observed that males consumed a little more kilocalories, carbohydrates, proteins, and fat. The large standard deviations in energy and nutrient consumption indicate major variation within the sample, which might be attributed to individual food habits, and metabolic variations.

Table 4 Comparison between genders of Down Syndrome (DS)

Down Syndrome (n=13)	Energy (kcals) Mean ± SD	CHO (grams) Mean ± SD	Protein (grams) Mean ± SD	Fats (grams) Mean ± SD
Males (n=9)	949 ± 322	120.1 ± 45.2	28.9 ± 16.2	38.6 ± 15.5
Females (n=4)	859 ± 190	115.5 ± 30.2	24.4 ± 4.48	30.5 ± 9.01

To assess the nutritional intake and anthropometry of children and adolescents with Down Syndrome, a study was conducted in North Greece by (Grammatikopoulou *et al*.,2008). The study finding found that they were consuming a lower amount of energy than typically developed children. In addition, the subjects' macronutrient intake varied, with higher fat consumption and lower carbohydrate consumption compared to the reference values. According to the study, based on body mass index (BMI), a significant proportion of the population was overweight or obese.

5.6.2 Comparison between the genders of Individuals with Autism Spectrum Disorder

To estimate their nutritional intake on a 24-hour food recall, the following table compares males and females with autism spectrum disorder. The mean and standard deviation were calculated to assess whether nutritional consumption, including calories, carbohydrates, proteins, and fats, differed substantially among them. Individuals with ASD, like those with Down syndrome, have varying energy and macronutrient intakes, with males typically ingesting more calories and macronutrients than females.

Table 5 Comparison between genders of Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder (n=16)	Energy (kcals) Mean ± SD	CHO (grams) Mean ± SD	Protein (grams) Mean ± SD	Fats (grams) Mean ± SD
Males (n=13)	970 ± 248	129.9 ± 39.7	25.4 ± 8.8	37.4 ± 10.5
Females (n=3)	835 ± 167	109.4 ± 39.5	24.4 ± 1.30	31.9 ± 1.43

A study was conducted in India by (Siddiqi *et al*.,2019), to assess the food habits and anthropometric measurements of children with autism spectrum disorder (ASD). according to the data, they had poor consumption of fruits, vegetables, and dairy items. In contrast, their diets contained more carbs and fats. The study also discovered a significant frequency of overweight and obesity among subjects, indicating a poor nutritional state.

5.6.3 Comparison between the genders of Individuals with Attention Deficit Hyperactivity Disorder (ADHD)

The following table summarises male and female intakes to assess the nutrition intake 24 hours after food is withdrawn for males and females with Attention Deficit Hyperactivity Disorder. The mean and standard deviation were determined to see whether nutritional intake, which included calories, carbs, proteins, and fats, varied significantly among them. Since the sample consisted primarily of males and only one female participant, no mean or standard deviation has been established for this study. Compared to females, males with ADHD often consume higher amounts of calories, carbohydrates, protein, and fat. It's important to remember that the sample size for females is quite small (n=1), which restricts how broadly the results can be applied to this group.

Table 6 Comparison between genders of Attention Deficit Hyperactivity Disorder (ADHD)

Attention Deficit Hyperactivity Disorder (n=7)	Energy (kcals) Mean ± SD	CHO (grams) Mean ± SD	Protein (grams) Mean ± SD	Fats (grams) Mean ± SD
Males (n=6)	786 ± 192	103 ± 25.8	22.4 ± 4.4	30.7 ± 10.7
Females (n=1)	533	67.7	16.7	20.8

A study was carried out by (Howard *et al*.,2011) to understand the relationship between food habits and ADHD in teenagers. The study discovered a strong correlation between elevated symptoms of ADHD and particular Western diet components, such as a high intake of fast food, soft drinks, and refined grains. Conversely, reduced symptoms related to ADHD were linked to a healthy eating pattern that included more fruits, vegetables, whole grains, seafood, and legumes. The results imply that nutrition may contribute to the onset or aggravation of ADHD symptoms in teenagers. The study emphasizes how critical it is to support a balanced diet as part of an all-encompassing strategy for controlling ADHD.

5.6.4 Comparison between the genders of Individuals with Cerebral Palsy (CP)

Based on a 24-hour meal recall, the Cerebral Palsy chart below compares the dietary consumption of males and females. To find out if there were any significant differences in the nutritional intake of calories, carbohydrates, proteins, and fats, the mean and standard deviation were calculated. Compared to girls, guys with cerebral palsy often consume greater amounts of energy. While women only ingested 50% of the carbohydrates, men consumed the correct amount. Comparing male and female consumption, the male population consumed more protein. It was shown that men consumed more fats than women did.

Table 7 Comparison between genders of Cerebral Palsy (CP)

Cerebral Palsy (n=10)	Energy (kcals) Mean ± SD	CHO (grams) Mean ± SD	Protein (grams) Mean ± SD	Fats (grams) Mean ± SD
Males (n=8)	983 ± 541	107.9 ± 32.6	24.9 ± 9.0	49.3 ± 45.9
Females (n=2)	651 ± 82	58.2 ± 18.4	32.3 ± 6.85	31.5 ± 3.81

The study was conducted by (Jahan et al.,2023) and aimed to investigate the nutritional status, feeding behaviors, and food intake of children with cerebral palsy in rural Bangladesh. Movement and posture are affected by cerebral palsy, a neurological condition that frequently makes it difficult to eat and maintain proper nutrition. They were not consuming enough calories, protein fats, or micronutrients from their diet. The feeding trend showed a significant number of caregivers had trouble feeding the kids due to factors like chewing issues and low appetites. Nutritional assessment revealed a significant incidence of malnutrition among these participants.

5.6.5 Comparison between the genders of Individuals with Intellectual Disability (ID)

The Intellectual Disability table below is based on a 24-hour meal recall and contrasts male and female food intake. The estimated mean and standard deviation were used to determine if there were any noteworthy variations in the nutritional intake of calories, carbs, proteins, and fats. In this group, the various categories of participants involved were slow learners and individuals with learning disability. Males consumed slightly more calories than females, as indicated by the table below. Males consumed more carbs than females, but females consumed the appropriate quantities. Their intake of fat and protein was roughly comparable.

Table 8 Comparison between the genders of Intellectual Disability (ID)

Intellectual Disability (n=54)	Energy (kcals) Mean ± SD	CHO (grams) Mean ± SD	Protein (grams) Mean ± SD	Fats (grams) Mean ± SD
Males (n=41)	842 ± 268	120.8 ± 105.8	23.5 ± 8.8	36.5 ± 12.6
Females (n=13)	818 ± 213	101.9 ± 28.7	22.9 ± 8.0	34.4 ± 11.1

A study was conducted by (Ptomey *et al*.,2013), to assess the food quality of overweight and obese individuals with intellectual and developmental disabilities using the Healthy Eating Index-2005 (HEI-2005). The study discovered that the food quality of overweight or obese people with intellectual and developmental disabilities was poor, as shown by their low HEI-2005 scores. Males consumed more carbs, proteins, and fat than females, with a mean Healthy Eating Index-2005 score of 46.5 and 46.8 respectively, showing no significant differences. As a result, individuals were more likely to suffer from poor diet quality and nutritional deficiencies, which might lead to the development of diabetes, cardiovascular disease, cancer, and other health concerns.

5.6.6 Comparison between the disability and their nutrient intake (Macronutrients)

The comparison was carried out in this population to check their nutrient intake according to 24-hour diet recall. ANOVA was used in this analysis to determine whether nutrient intake including energy, carbohydrates, protein, and fats varied significantly amongst all the different types of disability. There were no significant differences in the macronutrients between the groups indicating a high level of malnutrition and not eating a healthy diet, as shown in Table 9 below.

Table 9 Comparison Between the Disability and their Nutrient Intake (Macronutrients)

Types of Disability	Energy (kcals) Mean± SD	CHO (grams) Mean ± SD	Protein (grams) Mean ± SD	Fats (grams) Mean ± SD
Down Syndrome (n=13)	921 ± 283	118.7 ± 39.9	27.5 ± 13.6	36.1 ± 14
Autism Spectrum Disorder (n=16)	945 ± 236	126.1 ± 39.2	25.2 ± 7.8	36.4 ± 9.6
Attention Deficit Hyperactivity Disorder (n=7)	750 ± 200	97.9 ± 27.1	21.6 ± 4.5	29.3 ± 10.5
Cerebral Palsy (n=10)	916 ± 498	97.9 ± 36.1	26.4 ± 8.8	45.7 ± 41.2
Intellectual Disability (n=54)	836 ± 254	116.3 ± 93.3	23.3 ± 8.6	36 ± 12.2
F value	0.943	0.328	0.8640	1.05400
p-value	0.443	0.859	0.489	0.384

Individuals with disabilities frequently experience a variety of challenges in reaching appropriate nutrient intake, such as physical limits, sensory sensitivities, and limited access to nutritious meals. A review conducted by (Rimmer & Yamaki.,2013), and it was found that environmental factors such as food instability and lack of accessibility have an impact on dietary behaviors among

individuals with disabilities, emphasizing the importance of interventions that address these barriers.

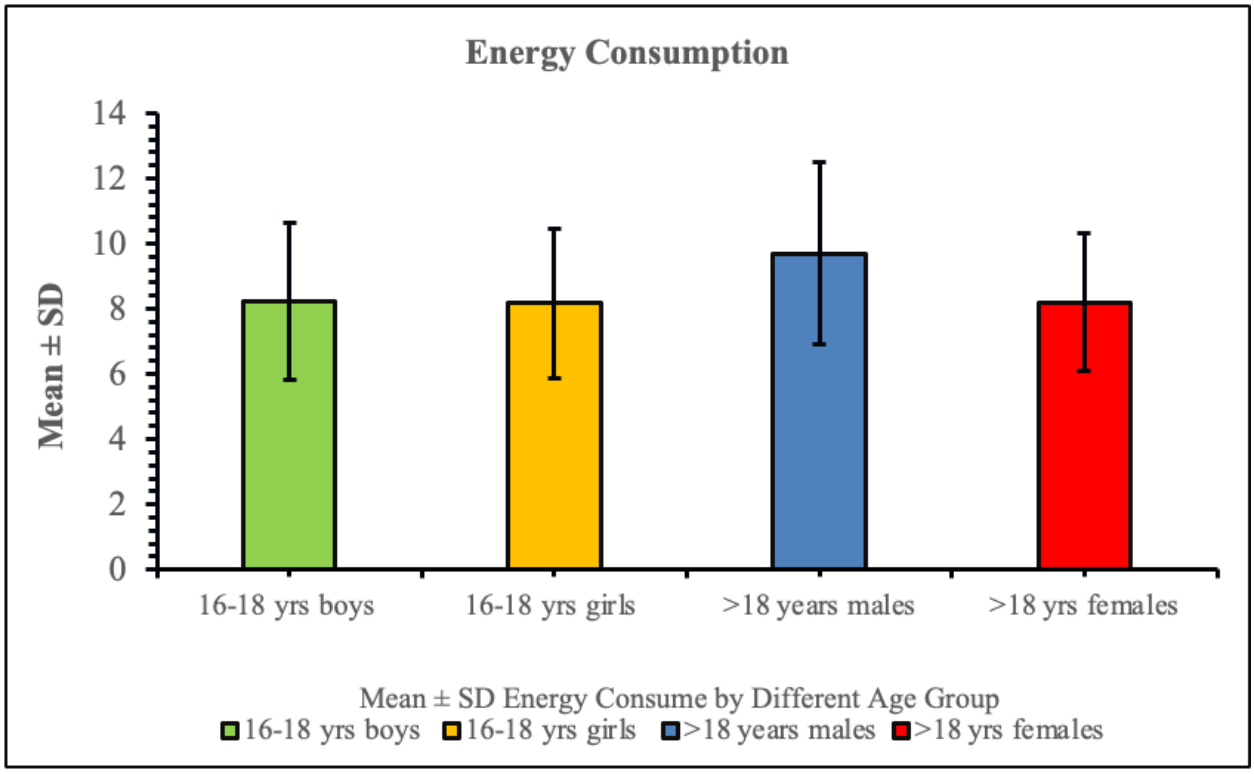
5.7 COMPARISON OF NUTRIENT INTAKE & EAR WITHIN THE AGE GROUP

Energy intake is an important component of nutritional evaluation since it represents the number of calories consumed by individuals to satisfy their physiological demands. In this study, Table 12 we look at energy intake data from various age and gender categories, concentrating on mean energy intake, Estimated Average Requirement (EAR) values, and the implications for nutritional adequacy.

Table 10 Energy Consumption of 16-18 years and > 18 years old males and females.

	Energy kcals Mean ± SD	**EAR**	**t-value**	**p-value**
Male (16-18 years)	824 ± 241	3320	58.7	0.000
Female (16-18 years)	817 ± 229	2500	-15.014	0.000
Male (>18 years)	969 ± 280	2110	-23.205	0.000
Female (>18 years)	820 ± 211	1630	-20.001	0.001

Figure 9 Energy Consumption by Different Age Groups.



As mentioned in Figure 9, when comparing energy intake and EAR in 16-18-year-old boys, the energy value was 824 kcals ± 241, and females had mean and SD values of 817 kcals ± 229. When a comparison was carried out in males >18 years the mean and SD values were found to be 969 kcals ± 280, whereas for females were found to be 820 kcals ± 211 respectively which indicates considerably lower than the EAR value ($p<0.05$)

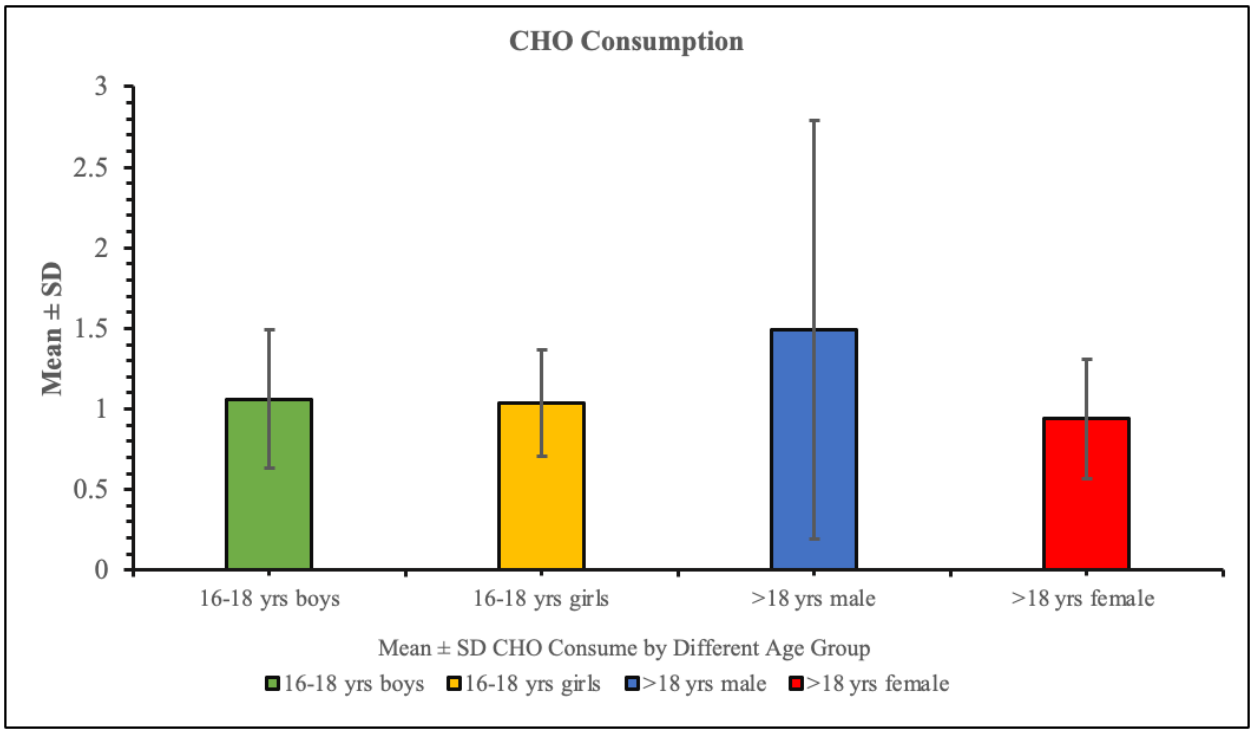
A study by (Rimmer *et al*.,2010), examined the individuals with disabilities deal with a variety of problems, such as reduced levels of physical activity, reactions to medications, or difficulty assessing food to acquire adequate energy. This might lead to a reduction in energy consumption and potentially an insufficient energy intake.

Assessing dietary intake, particularly concerning macronutrients like carbohydrates, is critical for understanding nutritional patterns and improving general health. Table 8. explains carbohydrate consumption and its EAR value through dietary guidelines.

Table 11 Carbohydrates Consumption of 16-18 years & >18 years old males and females.

	CHO grams Mean ± SD	EAR	t-value	p-value
Male (16-18 years)	106.3 ± 43	100	0.836	0.324
Female (16-18 years)	104.4 ± 33.8	100	0.708	0.704
Male (>18 years)	149.2 ± 130.6	100	1.963	0.084
Female (>18 years)	94.9 ± 37.1	100	-0.496	0.778

Figure 10 Carbohydrates Consumption by Different Age Groups



A comparison of carbohydrate intake and EAR levels has been carried out for the 16-18 year old males, as indicated by Figure 10. It was observed that the given Mean and SD value is 106.3 g ± 43 when compared to the EAR value, similarly in the female group, it was observed that the Mean

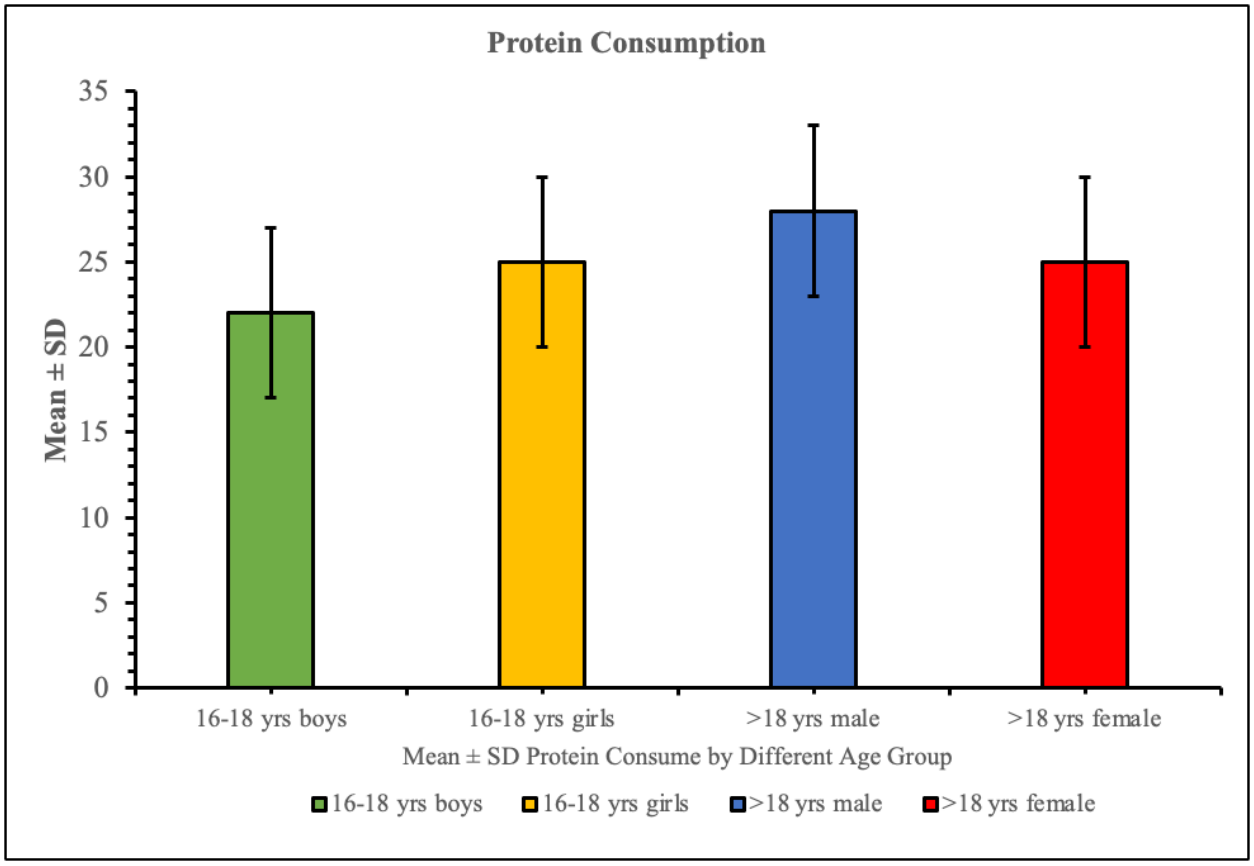
and SD values are 104.4 g ± 43. A similar comparison was carried out in males >18 years, it was observed that the Mean and SD value were 149.2 g ± 130.6, while in females it was observed that the Mean and SD value were 94.9 g ± 37.1 which indicates that the carbohydrates are insignificant compared to the EAR value ($p>0.05$).

Although there were no statistically significant differences in the amount of carbohydrates consumed, it is still crucial to consider the kind of carbohydrates consumed and the needs of individuals with disabilities regarding glycemic control (Firth *et al*.,2020). The study showed that they consume more unfueled calories, such as soft drinks, chips, soup, and ready milkshakes to mix which are usually filled with added sugar and fat. The nutrient intake of protein was also carried out in this study, it was observed that protein intake was much less consumed by these individuals as mentioned in Table 12.

Table 12 Protein Consumption of 16-18 years and >18 years old males and females.

	Protein grams Mean ± SD	**EAR**	**t-value**	**p-value**
Male (16-18 years)	22.4 ± 7.7	45	-15.103	0.000
Female (16-18 years)	25.3 ± 8.8	37	-1.659	0.004
Male (>18 years)	28.3 ± 11.7	43	-10.93	0.000
Female (>18 years)	25.3 ± 4.9	36	-10.825	0.008

Figure No.11 Protein Consumption by Different Age Groups



A comparison of protein intake and EAR was carried out between the 16 to 18-year-old male age group, as described in Figure 11. It was observed that the given Mean and SD value is 22.4g ± 7.7, similarly, in females, it was observed that the Mean and SD values are 25.3 g ± 8.8 when compared to the EAR value. Similarly, a comparison was carried out in >18 years males and females, it was observed that the Mean and SD values are 28.3 g ± 11.7 and 25.3 g ± 4.9 respectively, which indicates that the protein intake was comparatively lower than the EAR value ($p<0.05$)

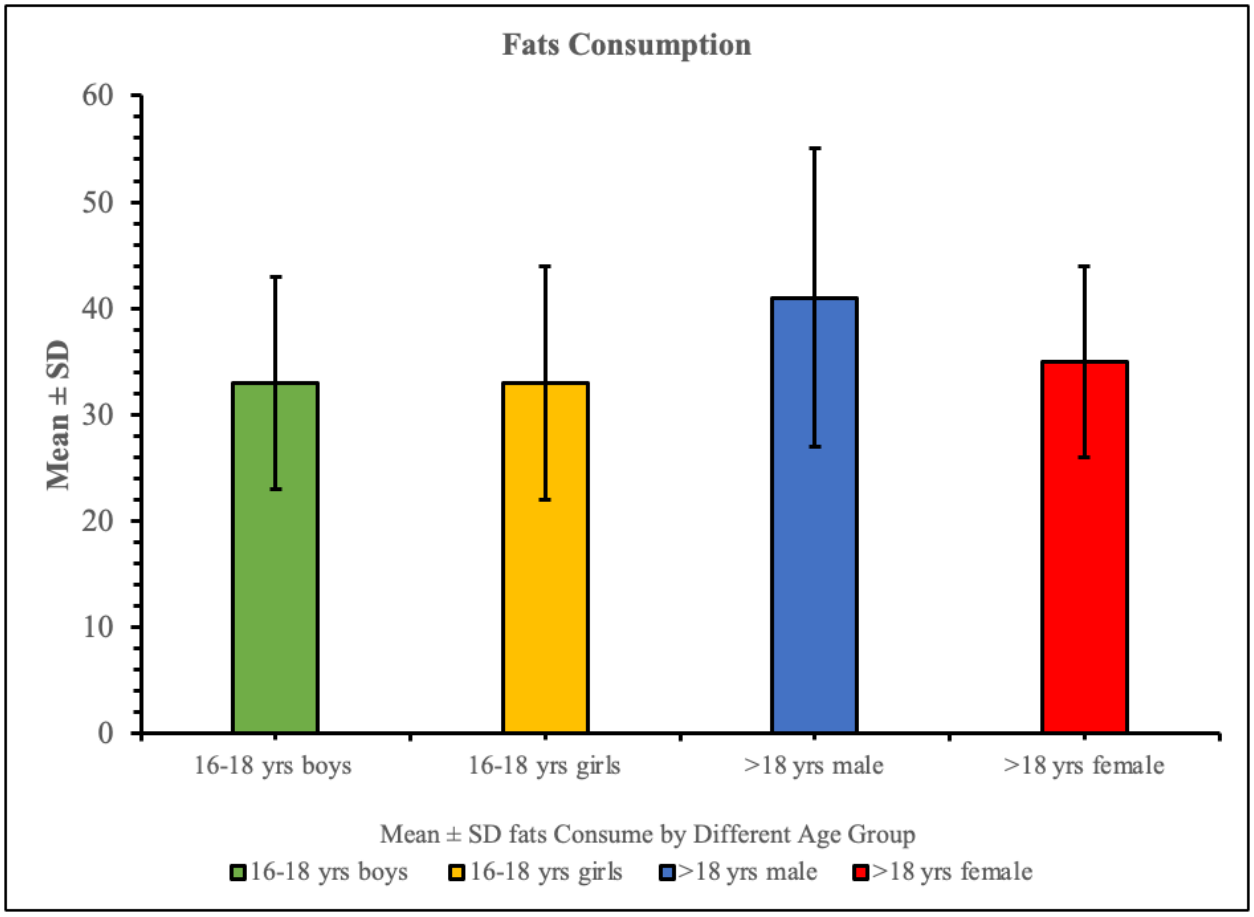
Protein intake deficiencies can be particularly harmful since these macronutrients are necessary for sustaining muscle mass, tissue repair, and overall health. Given that cerebral palsy patients may be more vulnerable to muscle loss or loss of lean body mass, it is crucial to eat them at levels that support muscle preservation and function (Gauthier et al., 2008).

Fats are vital macronutrients that serve a variety of important roles in the human body. They provide energy to the body and help to create cell membranes, neural tissue, and hormones. Fats are also stored in fat cells if they are not consumed for energy or utilized as building blocks. In this study, Table 15 examines fat intake data from various age and gender groups, focusing on mean fat intake, Estimated Average Requirement (EAR) values, and the implications for nutritional adequacy.

Table 13 Fats Consumption of 16-18 years & >18 years old males and females.

	Fats grams Mean ± SD	**EAR**	**t-value**	**p-value**
Male (16-18 years)	33.8 ± 10.8	40	-4.902	0.000
Female (16-18 years)	33 ± 11.4	35	0.256	0.624
Male (>18 years)	41.2 ± 14.1	25	4.863	0.000
Female (>18 years)	35.9 ± 9.3	20	5.41	0.019

Figure No. 12 Fats Consumption by Different Age Groups



The fat intake and EAR were compared in the 16-18 years old age group, it was observed in the given figure 12 that the given Mean and SD value is 33.8 g ± 10.8 which is comparatively equal to the EAR value, similarly in females the Mean and SD value is 33g ± 11.4 it was observed comparatively excessive than the EAR value. A comparison of males >18 years was also carried out it was observed that the Mean and SD values were significant at 41.2 g ± 14.1 and for females, it was seen as 35.9g ± 9.3 which was more excessive than the EAR value.

The results of the study on excessive fat intake may have major implications for the disabled community, as obesity and health-related problems are prevalent among this population.

According to a study conducted by (Hsieh et al.,2014), it was observed, that individuals with disabilities had higher rates of obesity when compared to individuals without disabilities.

6.LIMITATION AND FUTURE PROSPECTS

- In the present study, the sample size was limited because of the restricted time. The restriction can make it more difficult to generalize the result in large populations.
- In this study, 24-hour food recall and food frequency testing are useful tools for analyzing eating patterns, but most parents find it difficult to provide complete nutrition to their children.
- Utilizing the Omron Karada Scan Body Composition Monitor HBF-375 digital scale yields insightful information on body composition. BMI, Fats, and visceral fat percentages in this group did not emerge because the subjects were unable to hold the handle and stand correctly. Therefore the BMI was calculated manually for all the participants.
- The study evaluated body composition and macronutrient intake, however, it did not include biochemical characteristics like lipid profiles, micronutrient levels, or indicators of metabolic health. By including these variables, we may be able to learn more about the participants' metabolic and nutritional health.
- With the same group of individuals and their disabilities, we can collect more data and get more information.
- If biochemical parameters are available it can be analyzed to get a better understanding of what micronutrients they are lacking and what types of allergies they suffer from.
- Despite efforts to assess and understand their lifestyle patterns and nutritional status, it is clear that longitudinal studies or intervention studies can be carried out, to increase access to nutritious food and promote healthy eating behaviors in these populations.

- Based on the current study and further analysis we can also recommend individualized or group meal plans to these populations and to support and empower them to make contributions to society.

7. SUMMARY AND CONCLUSION

The current study was conducted in Mumbai to determine the nutritional status and lifestyle patterns in individuals with disabilities such as Down Syndrome (DS), Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), Cerebral Palsy (CP), and Intellectual Disability (ID).

Participants, aged 15 to 30, were measured using anthropometric measurements such as height, weight, BMI, MUAC, meal frequency questionnaires, and 24-hour diet recall. The study found that people with disabilities struggled to maintain adequate nutrition due to physical issues, sensory issues, and lack of access to healthy food.

The main findings of the study are as follows. A large proportion of individuals with disabilities had poor eating habits, with little or no fruit, vegetables, cereals, pulses, or dairy products consumed. A significant proportion of participants were overweight or obese, suggesting potential problems with food quality and energy efficiency. The eating habits of individuals with disabilities vary from person to person. Some people with disabilities had difficulty swallowing or were picky eaters.

Furthermore, different disability types were compared regarding anthropometric measurements, gender-wise nutrient intake, and macronutrient intake between the disability and energy requirements. While there were no significant differences in anthropometric parameters or macronutrient intake between disability types, it was clear that many participants were not meeting their nutritional requirements.

Finally, the findings show that tailored interventions taking into account the specific needs and limitations of individuals with disabilities are important. Nutrition education programs, improvements to food accessibility, and guidance for caregivers with meal planning and preparation are examples of such interventions.

The study also emphasizes the importance of early intervention and ongoing support in addressing nutritional deficiencies and promoting optimal health outcomes for individuals with disabilities. In the case of individuals with disabilities, these challenges can be addressed to improve their general well-being and quality of life. Additional research and collaborations between researchers, educators, medical professionals, and community organizations to address dietary difficulties among individuals with disabilities. Collaborating across diverse fields could enable comprehensive approaches and encourage the integration of nutrition education into numerous settings, such as educational institutions, healthcare facilities, and community groups.

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9.APPENDIX

The structured demographic data was provided to parents to understand the basic information about their children and to evaluate their socioeconomic status, and level of education.

Demographic data

Name-

Gender- Male/ Female/ Transgender

Age-

Disability -

Comorbidities -

Motor deficits -

Gastrointestinal difficulties -

Address -

Father’s name -

Father’s occupation -

Mother’s name -

Mother’s occupation -

Siblings -

Family income -

School attended - Highest Education- SSC/ H.SC/ Diploma/ Graduate/ Post-graduate/ Others please mention

Anthropometric measurements

Height (cm)-

Weight (kg)-

BMI (kg/m_2)-

Mid Upper Arm Circumference (cm)-

APPENDIX-II

You are being invited to participate in a research study conducted by **Purva Nangare** from Lifeness Science Institute (Nagindas Khandwala College, Malad). The purpose of this study is to assess the nutritional status and dietary habits of individuals with disabilities. Before deciding whether or not to participate, it is essential for you to understand the nature of the study, its objectives, procedures, potential risks, benefits, and your rights as a participant. Please take the time to read this consent form carefully and ask any questions you may have before agreeing to participate.

Study Objectives:

The main objectives of this research study are as follows:

1. To determine the nutritional status of individuals with disabilities by assessing their food intake.

2. To suggest balanced nutrition to individuals which can impact their well-being.

3. To study the nutritional challenges of individuals with disabilities.

Procedures:

If you agree to participate in this study, you will be asked to:

1. Provide demographic information such as age, gender, and highest education.

Complete a questionnaire related to your ward's dietary habits, including food preferences, meal patterns, and any specific dietary restrictions or allergies.

3. Undergo a nutritional assessment which may include measurements such as height, weight, body mass index (BMI), waist circumference, and blood pressure.

4. Allow the researcher to access your medical records related to your disabilities for research purposes only.

Risks and Benefits:

There are minimal risks associated with participating in this study. The procedures involved are non-invasive and commonly performed in routine clinical practice. The potential benefits of this study include understanding the nutritional status and dietary habits of individuals with disabilities, which may help develop to improve their overall health and well-being.

Confidentiality:

All information collected during this study will be treated as strictly confidential. Your personal identifying information will be kept separate from any research data and will only be accessible to the researcher and authorized personnel. Any published results will be presented in aggregate form, ensuring that individual participants cannot be identified.

Voluntary Participation and Withdrawal:

Participation in this study is entirely voluntary, and you have the right to withdraw at any time without providing a reason. Your decision to participate or withdraw will not affect your current or future medical care or any other benefits you are entitled to receive.

Contact Information:

If you have any questions or concerns about this study, please feel free to contact: Ms. Purva Nangare, email: purvanangare02@gmail.com.

Consent form:

I have read and understood the information provided in this consent form. I have had the opportunity to ask questions, which have been answered satisfactorily. I voluntarily agree to participate in this research study and understand that I am free to withdraw at any time without penalty.

Participant's/ Parent/ Caregiver Signature: _____

Date: _____

Researcher's Signature: _____

APPENDIX III

Kindly tick on the given columns

FOOD GROUP	**DAILY**	**TWICE A WEEK**	**ONCE A WEEK**	**MONTHLY**	**NEVER**
CEREALS					
Bajra					
Jowar					
Ragi					
Poha					
Murmura					
Rice					
Barley					
Wheat					
Semolina					
Vermicelli					
Oats					
PULSES					

Chana dal					
Urad dal					
Chavli					
Valpapdi					
Mung dal					
Moong dal					
Laal masoor					
Masoor dal					
Matki					
Rajma					
Toor dal					
NUTS & SEEDS					
Almonds					
Cashew					
Groundnut					
Pista					

Walnuts					
Dates					
Raisins					
Chia seeds					
Flax seeds					
Sunflower seeds					
Safflower seeds					
Sesame seeds					
Coconut dry/fresh					
VEGETABLES					
Amaranth leaves					
Cabbage					
Cauliflower					
Fenugreek					

Lettuce					
Spinach					
Lady finger					
Parwar					
Bitter gourd					
Bottle gourd					
Cucumber					
French beans					
Colocasia leaves					
Tinda					
Brinjal					
Capsicum					
Tomato					
Carrot					
Gavar					
Beetroot					

Potato					
Sweet potato					
Onion					
FRUITS					
Apple					
Banana					
Custard apple					
Grapes					
Cherries					
Mango					
Muskmelon					
Orange					
Papaya					
Pear					
Pineapple					
Pomegranate					

Watermelon					
MILK & PRODUCTS					
Cow milk					
Buffalo milk					
Packaged milk					
Cheese					
Curd					
Paneer					
Khoa					
POULTRY & MEAT					
Egg yolk					
Egg white					
Egg whole					
Chicken					
Mutton					

BEVERAGES & PACKAGED FOODS					
Tea					
Coffee					
Cold drinks					
Biscuits					
Wafer/chips					
Pasta/noodles					
Ready to mix soup					
Cake/ pastries					
Pizza					

APPENDIX IV

1. What time did you get up yesterday?
2. water intake-
3. Do you take any medicine or supplements before/after the meal?
4. Able to indicate when they are hungry? Yes/No
5. Able to indicate when they are full? Yes/No
6. Able to consume food on its own? Yes/No
7. Like consuming liquid or solid food? Liquid, Solid food, Both
8. Difficulty in swallowing? Yes/No
9. Tendency to spit out the food? Yes/No
10. Tendency to vomit food? Yes/No
11. Is your child a fussy eater? Yes/No
12. Do they experience frequent stomach pain? Yes/No
13. What is the consumption of your child like? Normal/ Less/ Excessive
14. Does your child finish the food within normal times? Slow/ Normal/ Fast

	NAME OF THE RECIPE	AMOUNT CONSUMED IN HOUSEHOLD MEASURE OR WEIGHT	INGREDIENTS USED
MORNING			
BREAKFAST			
LUNCH			
EVENING			
DINNER			
BEFORE BED			