Nutritional Status and Factors Affecting Children with Developmental Disorders: A Survey in Special Education Centers in Northern Vietnam

Bui Thu Hien*[1], Nguyen Thi Ngoc Anh[2], Nguyen Thi Thanh Hoan[3], Pham Thi Hong Mai[4]

* Corresponding author
[1] Email: anhngocnguyen2012001@gmail.com .
[2] Email: thanhhoan1805.ht@gmail.com
[3] Email: monica@omegahealth.com.my
[4] Email: maiph.ftu@gmail.com

Group of Nutritionists and Parents,
Thap Den Xanh Community - Together with autistic children. Dawn Bridge Malaysia Organization

ABSTRACT: *This study evaluated the nutritional status of 150 children aged 3 to 6 years with developmental disorders, including autism and attention deficit hyperactivity disorder (ADHD), attending six special education centers in Northern Vietnam. The results showed a higher rate of malnutrition, with underweight malnutrition being the most common, accounting for 13.3% of evaluated children, followed by stunting malnutrition at 1.3%, and wasting malnutrition at the lowest rate of 0.7%. Notably, the rate of overweight children is very low, only 0.7%. The study also identified various factors influencing the nutritional status of these children, including oral health problems, difficulty chewing and swallowing, oral-tongue motor coordination disorders, picky eating, and gastrointestinal issues. A concerning finding was the relatively high proportion of children facing challenges related to chewing and swallowing, oral-motor coordination disorders, and selective eating. This underscores the urgency of implementing timely and appropriate intervention strategies. To address these challenges effectively and comprehensively, the study emphasizes the need to strengthen cross-sectoral collaboration across the fields of Healthcare, Education, and Nutrition to develop integrated solutions capable of meeting the specific needs of this group of children. The study underscores the need to strengthen cross-sectoral collaboration, particularly in Healthcare, Education, and Nutrition, to develop integrated solutions that can effectively meet the specific needs of this group of children.*

KEYWORDS: Developmental disorders, nutrition, Oral-motor coordination disorders, multidisciplinary cooperation, comprehensive care.

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1. Introduction

During the 9th session of the 8th National Assembly in Vietnam, the Law on the Protection, Care, and Education of Children was enacted, emphasizing the need to address the specific requirements of children, particularly those with developmental disorders such as autism, ADHD, and intellectual disability. Children with autism spectrum disorder often encounter various nutritional challenges, encompassing issues such as digestive disorders, dietary and eating behavior concerns, malnutrition, food allergies, and potential negative interactions between medication and nutrition. At present, there is a noticeable gap in research within Vietnam that comprehensively evaluates the nutritional status of this particular group, along with the examination of factors influencing nutrition and the potential impact of nutrition on the quality of education within special needs centers.

This research is designed to assess the nutritional status and identify influencing factors affecting the nutritional well-being of children with developmental disorders, including autism, ADHD, and intellectual developmental delay, within the age range of 3 to 6 years. The study will focus on selected special education centers in Northern Vietnam. The findings of this research will serve as a fundamental basis for proposing effective measures and solutions to enhance nutritional care for children with developmental disorders in special education centers. Moreover, the study aims to heighten awareness among teachers, caregivers, and parents regarding the pivotal role of nutrition in the well-being of children with developmental disorders. By doing so, it endeavors to create favorable conditions for the consistent improvement of both the physical and intellectual health of this particular group within special education centers.

2. Research Methods

2.1. Research subjects

In this study, we conducted an examination of 150 children aged 3-6 with developmental disorders. These children were selected from six specialized education centers located in six provinces spanning various regions in Northern Vietnam. Specifically, the centers in Bac Ninh, Hanoi, Hung Yen, Hai Duong, Thai Binh, and Vinh Phuc were chosen due to the keen interest expressed by school administrators and parents in recognizing the pivotal role of nutrition in the care of these children. The research, which took place from June to September 2023, actively involved 150 parents and teachers. The primary objective was to delve into the intricate relationship between nutrition and the holistic well-being of children with developmental disorders within specialized educational centers.

2.2. Methodology of Investigation

Designing Assessment and Nutrition Consultation Forms: Building upon the findings from the research on the nutritional status and factors influencing the nutritional well-being of children aged 3-6 with developmental disorders in special education centers in Northern Vietnam, we developed a comprehensive nutritional survey form tailored for research purposes.

Conducting Nutrition Assessment and Consultation at Special Education Centers: Prior to commencing nutrition assessments and consultations at special education centers, we collaborated closely with the school's management to elucidate the purpose and content of the survey to the teachers. Subsequently, nutrition experts and assessors conducted assessments and consultations for parents of children attending the center. During this process, efforts were made to explain, guide, and encourage parents to provide accurate and objective information.

Data Analysis: In the phase of data analysis, a meticulous approach was employed. This involved selecting survey forms that contained complete and necessary information, while eliminating those that were incomplete, unclear, or exhibited inconsistencies in content. Forms that did not meet the predefined survey requirements were also excluded from the analysis. This rigorous selection process ensured that the data used for analysis were reliable and aligned with the study's objectives.

2.3. Procedure for Evaluating Nutritional Status and Consultation

We conducted a nutritional status assessment based on weight and height measurements. We performed weighing and measuring to determine the weight and height indices of children at the center, utilizing proper techniques. The nutritional status of the children was evaluated using Z-Scores in comparison to the reference population provided by the National Center of Health Statistics (NCHS).

Table 1: Nutritional status assessment of children determined by Z-Score compared to the NCHS

Z-Score	Evaluation
<-3SD	Wasting malnutrition children, level II
<-2SD	Wasting malnutrition children, level I
-2SD ≤ Z-Score ≤2SD	Normal nutritional status
>2SD	Overweight
>3SD	Overweight children level I
>4SD	Overweight children level II

Assessing children's picky eating: Definition and Evaluation Criteria (by the Ministry of Health). *Early signs of anorexia and picky eating in children:*

- Children do not finish their meal or mealtimes are prolonged (more than 1 hour).
- Children breastfeed or eat less than usual.
- Children keep food in their mouths for an extended period and refuse to swallow.
- Children do not eat certain foods such as meat, fish, eggs, milk, vegetables,fruits.
- Children refuse to eat and run away when they see food.

Children have nausea reactions when they see food.

Assessment of Portion size & Quantity, Types, and Frequency of Food Consumption: 24-Hour Recall Method. Investigators conducted 24-hour dietary recall surveys using the pre-designed nutritional assessment forms to gather information about the child's food intake, the quantity of food consumed, and the frequency of food consumption. We conducted these surveys with both the parents who directly cared for the child at home and the teachers directly caring for the child at the special education center.

Collect information related to medical conditions that affect nutritional status: Some other information related to nutritional status such as pregnancy history, family situation, economic conditions, diseases disorders, or other disorders,...

Assessment of medication/food supplement usage in children: We conducted surveys and assessments to determine the quantity, type, and frequency of usage of nutritional supplements or prescribed medications that the child has been using or had used in the past four weeks.

Assessment of other nutrition-related issues: We observed and assessed any signs related to nutritional status: hair loss, pale skin and mucous membranes, dermatological problems,...

2.4. Data Processing Approach: Verifying and Synthesizing Child's Weight and Height Results, Along with the Findings from Parental Surveys on the Child's Diet

- Create statistical tables based on research indicators.
- Calculate parameters according to statistical probability to analyze and evaluate research results.
- Data processed on computer using Microsoft excel 2010.

Determining the Child's Age:

Children 3 years old: from the time the child turns 36 months old to 47 months and 29 days.

Children 4 years old: from the time the child turns 48 months old to 59 months and 29 days.

Children 5 years old: from the time the child turns 60 months old to 71 months and 29 days (children under 5 are under 60 months).

Children 6 years old: from the time the child turns 72 months old to 84 months and 29 days.

3. Results

3.1. Nutritional Status of Children Aged 3-6 in Selected Special Education Centers in Northern Vietnam

Results from Table 2 shows that:

Approximately 13.3% of special needs children, on average, present with underweight malnutrition.

An average of 1.3% of special needs children are affected by stunting malnutrition.

Only 0.7% of special needs children, on average, exhibit wasting malnutrition.

Similarly, an average of 0.7% of special needs children is overweight.

The results extracted from Table 2 provide a comprehensive overview of the nutritional status assessment among children with developmental disorders. Notably, approximately 13.3% of special needs children exhibit underweight malnutrition, signaling a significant area of concern that necessitates targeted interventions to ensure optimal growth and development within this group.

The average rate of 1.3% for stunting malnutrition suggests that this condition is not overly concerning. However, further detailed exploration of contributing factors will be undertaken in the next section (4.3) to gain a more in-depth understanding and identify appropriate improvement strategies.

Encouragingly, malnutrition is minimal, averaging only 0.7%. This result indicates that, in general, children with developmental disorders in the study group have maintained appropriate weight-for-height ratios, contributing to overall physical and mental well-being. However, it is still essential to pay attention to specific cases experiencing this condition to gain a profound understanding of contributing factors.

Similarly, the average rate of 0.7% for overweight and obesity in the surveyed children is relatively low but requires continuous monitoring. Although not an immediate concern, addressing underlying contributing factors and implementing preventive measures is crucial to avoid any negative impacts of obesity on the health of this group of children.

3.2. Factors Influencing Nutritional Status

Results extracted from Table 3 highlight the following trends: The majority of children encounter difficulties in chewing and swallowing, reaching the highest average value of 89.3% across the six surveyed centers. Picky eating is prevalent in more than half of the children,

Table 2: The nutritional status of children aged 3-6 in Six Special Education centers in Northern Vietnam

Center Name	Number of Assessed Children	Underweight Malnutrition		Stunting Malnutrition		Wasting Malnutrition		Overweight		Obesity	
		Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
Bac Ninh Integration Support Education	30	3	13,3	0	0	1	3,3	0	0	0	0
Cau Vong Xanh - Hanoi	20	3	15	0	0	0	0	0	0	0	0
Phuc Hung- Hung Yen	20	2	20	1	5	0	0	0	0	0	0
Special Education Research Institute - Hai Duong	30	5	16,7	0	0	0	0	1	3.3	0	0
Thien Than Nho - Thai Binh	20	4	20	0	0	0	0	0	0	0	0
Khai Tri - Vinh Phuc	30	3	10	1	3,3	0	0	0	0	0	0
Average	150	20	13,3	2	1,3	1	0,7	1	0,7	0	0

Table 3: Factors Affecting the Nutritional Status of Children in the Six Special Needs Centers

Center Name	Number of Assessed Children	Picky eating		Digestive disorders		Chewing and swallowing disorders		Allergies (food/milk)	
		Quantity	%	Quantity	%	Quantity	%	Quantity	%
Integration Support Education - Bac Ninh	30	20	66,7	11	36,6	25	83,3	0	0
Cau Vong Xanh - Hanoi	20	12	60	3	15	18	95	1	5
Phuc Hung - Hung Yen	20	15	75	4	20	17	85	0	0
Special Education Research Institute - Hai Duong	30	21	70	7	23,3	29	96,7	3	10
Thien Than Nho - Thai Binh	20	9	45	6	30	19	95	0	0
Khai Tri - Vinh Phuc	30	16	53,3	9	30	26	86,7	2	6,7
Average	150	93	62.0	40	26,7	134	89,3	6	4.0

averaging at 62.0%. The average prevalence of children experiencing digestive disorders is 26.7%, while food allergies exhibit the lowest occurrence at 4.0% across the surveyed six centers.

The findings extracted from Table 3 provide a deeper insight into the factors influencing the nutritional status of children with developmental disorders. The data indicate a notable challenge in chewing and swallowing, with the average prevalence reaching a high of 89.3% across the six surveyed centers. Picky eating behaviors are another prominent concern, affecting over half of the children, with an average prevalence of 62.0%. The study also illuminates the prevalence of digestive disorders, indicating a relatively high rate that requires careful attention and comprehensive treatment, averaging at 26.7% in the surveyed children. Conversely, food allergies exhibit a lower prevalence, with an average commonality of only 4.0% at the surveyed centers. Although this rate is relatively low, it warrants attention due to potential impacts, even hazards, on the health of the children. The detailed influence of these factors, along with other relevant contributors to the nutritional status of children with developmental disorders, will be presented in the following section.

3.3. The Correlation Between Nutritional Status and Contributing Factors

3.3.1. Dental and chewing problems affect picky eating in children with developmental disorders

The survey results revealed that, on average, 89.3% of children with developmental disorders, assessed at six centers, encountered issues related to food chewing and swallowing. These problems stemmed from various causes, including oral health conditions that led to difficulties in chewing and swallowing. Examples of such conditions included lazy chewing due to toothache, gingivitis, and the impact of existing sensory processing disorders in children. These factors contributed to challenges like choking during swallowing and lazy chewing in children with developmental disorders.

3.3.2. Picky eating

Picky eating was observed in 62% of children with developmental disorders who participated in the study. This behavior is closely linked to sensory processing disorders in these children, encompassing difficulties in processing sensory inputs related to taste, smell, hearing, vision, and touch. Such challenges make children hypersensitive to factors like color, shape, texture, flavor, and food hardness, ultimately leading to food selectivity. Children may limit their food choices to a specific set of items or even refuse to eat altogether. The study's findings strongly indicate a significant association between sensory processing difficulties and food selectivity in children with developmental disorders.

3.3.3. Impact of accompanying digestive conditions

The results revealed that, on average, 26.2% of children with developmental disorders experienced digestive issues. Within this group, common gastrointestinal disorders included gastroesophageal reflux disease, manifesting in symptoms such as belching, heartburn, sore throat, and loss of appetite. Other children faced digestive challenges due to factors like congenital megacolon, gastric surgery, cleft palate, or chronic conditions such as constipation, diarrhea, food allergies, and lactose intolerance. These conditions were significant contributors to feeding and swallowing disorders in children with developmental issues.

The presence of comorbid gastrointestinal disorders

not only heightened the healthcare burden but also had the potential to impede progress in ameliorating developmental disorders at specialized centers due to the effects of illness. Various risk factors, such as inappropriate diets, sensory processing disorders, and behavioral issues, increased susceptibility and severity of these gastrointestinal diseases.

Addressing gastrointestinal comorbidities and associated risk factors is crucial for improving the overall health and enhancing learning effectiveness for children in specialized centers.

3.3.4. Allergy and food tolerance

Food allergies, often associated with cow's milk, eggs, peanuts, and seafood, can result in various gastrointestinal issues, including vomiting, regurgitation, diarrhea, and abdominal pain. These issues directly influence the eating habits of some children who fear experiencing abdominal discomfort during meals. Moreover, some children suffer from lactose intolerance, leading to symptoms such as bloating, flatulence, abdominal pain, diarrhea with acidic stool, and perianal redness. These symptoms not only significantly affect their psychological well-being but also impact their taste perception during meals.

3.3.5. Utilizing Adjunctive Medications, Food and Health Supplement

Certain psychotropic drugs, commonly employed in the treatment of developmental disorders (e.g., Risperdal, Ritalin), may give rise to conditions that affect the digestive system. These conditions include anorexia, dizziness, drowsiness, fatigue, sleep disorders, and weight gain. Additionally, the excessive use of functional foods, vitamins, and minerals has been associated with issues such as constipation and indigestion in children.

3.3.6. Quality of Food and Structure of Daily Meals

For various reasons such as the living environment, busy parents, indulgence in children's interests, and incorrect awareness of nutrition, children's diets often lack balance in key nutritional sources, including starch (carbohydrates), protein, fat (lipids), vitamins, and minerals. This imbalance can result in an excess or deficiency of energy, leading to a nutrient imbalance and, in turn, contributing to vitamin and mineral deficiencies.

3.3.7. Implementation of Special Diets

Applying certain diets, restricting various types of food, and implementing incorrect dietary plans can contribute to children becoming pickier eaters as the range of acceptable foods narrows. During such times, children may lack essential micronutrients due to these dietary restrictions.

Currently, several diets are recommended for children with developmental disorders, including the Keto diet, Mediterranean diet, Gluten-Free diet, Casein-Free diet, and more. Among these interventions, the Gluten-Free Casein-Free (GFCF) diet stands out as the most commonly recommended approach for children dealing with developmental disorders like autism and ADHD. This dietary strategy is widely endorsed by nutrition experts globally, particularly in managing developmental disorders in children with autism, drawing from their extensive experience with this specific demographic. As a result, the research team has chosen to advocate for the adoption of the GFCF diet for dietary control in the context of children with developmental disorders.

3.3.8. Participate in Regular Physical Activities

Participating in either too little or too much physical activity, including sports such as swimming, soccer, running, and walking, can significantly impact children's picky eating behaviors. Adequate physical activity plays a crucial role in increasing metabolism and triggering the release of the hormone dopamine, which, in turn, enhances their appetite and promotes healthier eating habits.

On the contrary, excessive physical activity can lead to fatigue, causing children to lose their appetite and contributing to picky eating. When children are not sufficiently physically active, their bodies may become sluggish, metabolism can suffer, and muscle mass may not develop as needed. These factors also have an impact on their taste preferences and eating patterns.

3.3.9. Inappropriate Milk Consumption

Many parents think that their children should drink as much milk as possible - a serious mistake that leads to malnutrition, picky eating, and eating disorders in children. Drinking too much milk causes lactose overload, and bloating, affecting main meals, and has a high risk of hindering iron absorption, leading to iron deficiency anemia.

3.3.10. Consequences of Sensory Processing Disorders

In this children with development disorder, sensory processing disorder significantly contributes to eating challenges by impacting their ability to process sensory information related to eating. Eating involves the simultaneous utilization of all five senses, and children with sensory processing disorders may experience hypersensitivity to attributes like texture,

smell, taste, temperature, or color, leading to sensory overload during meals, emotional outbursts, and food rejection.

4. Discussion

4.1. Discussion and Comparative Analysis with Previous Studies

The research results sound a crucial alarm regarding the nutritional status of children with developmental disorders, underlining the urgent need for timely nutritional intervention to both improve and prevent malnutrition in these children. In the initial study [1] conducted in Vietnam, it was identified that the rate of malnutrition in children under 5 years old stands at 8.6%. Notably, the rate of overweight in children aged 5 to 10 is significantly high, reaching 35.4%. Various factors, such as the child's gender, caregiver's age, method of delivery, and the type of care received at centers, demonstrated significant correlations with the nutritional status of autistic children ($p < 0.05$).

4.2. Proposed solutions

4.2.1. Improve the Current Nutritional Status

We need the coordination of families, schools, and nutritionists to change the eating situation of children with developmental disorders at the center:

Education about behavior, sensory disorders, jaw muscle movement, psychological therapy,... to improve picky eating in children.

Implement a healthy nutritional diet in children's meals by eliminating harmful food items and incorporating nutritious and health-safe foods, which include:

Eliminating artificial additives, colors, and preservatives from food.

Removing sugar and artificial sweeteners.

Reducing trans fats.

Limiting foods with pesticide residues and genetically modified foods.

Opting for organic food sourced from completely natural and clearly identified origins.

Regarding meal structure, a meal needs all 4 essential groups of substances: carbohydrate, protein, fat, vitamins and minerals.

The GFCF diet is a means to reduce autism symptoms, behavioral issues, and digestive difficulties in this group of children. Therefore, the research team of this project also chose the GFCF diet to introduce and provide guidance on its implementation to teachers and parents of children with developmental disorders within the scope of this project.

Develop timely vitamin and mineral supplementation protocols in cases of deficiencies.

Consider using nutritional supplements for children with poor appetite, malnutrition, or underweight. Prioritize organic products and those compliant with the GFCF diet.

Supplement medications and certain dietary support products to improve the developmental disorders of children.

Create a healthy, enjoyable, and appealing eating environment for children.

4.2.2. Conduct Regular Check-ups, Evaluate, and Collaborate with Experts and Parents at the Special Education Center

Organizing monthly assessments, check-ups, and nutritional consultations. Reassessing the effectiveness of interventions after 2-3 months to plan the next steps.

Monitoring changes in the child's condition through feedback from parents and intervention teachers at the center.

Exchanging updated nutritional and medical knowledge and resources with specialists and parents.

Addressing questions and providing solutions for parents to address their child's condition.

4.2.3. Proposing the Establishment of a Comprehensive Nutrition Care Model for Evaluation at the Integration Education Support Center in Bac Ninh

Step 1: Implementing Multidisciplinary Screening and In-Depth Evaluation

Step 2: Classifying Participating Children in the Project According to Their Cognitive Development and Health Status

Step 3: Formulating a Comprehensive Personalized Nutrition-Education-Health Intervention Plan for Each Child

Step 4: Consistently Assessing Progress

Step 5: Conducting Training to Improve Awareness and Nutrition Care Skills

Step 6. Establishing an Online Support System

Step 7. Fostering Intersectoral Collaboration

The project's goal is to create a nurturing and comprehensive environment, providing conditions for holistic development, ensuring physical and mental health for these children through innovative and creative approaches.

5. Conclusion

The research findings on the nutritional status of children with developmental disorders in selected special education centers in Northern Vietnam underscore a heightened prevalence of malnutrition that demands attention. Among various malnutrition types, underweight malnutrition is most prevalent, affecting 13.3%, followed by stunting malnutrition

(1.3%), with wasting malnutrition being the least common (0.7%). Overweight children have the lowest prevalence at 0.7%.

The nutritional challenges faced by these children are influenced by factors such as oral health issues, chewing and swallowing difficulties, picky eating, digestive disorders, food allergies, and oral-motor disorders. A considerable number of children encounter difficulties related to chewing and swallowing (89.3%), picky eating (62.0%), digestive disorders (26.7%), food allergies (4.0%), and oral-motor disorders, underscoring the imperative for timely nutritional interventions.

The research proposes comprehensive solutions to enhance the nutritional well-being of children with developmental disorders, emphasizing collaboration among families, schools, and nutrition experts. The approach involves strategies for behavior management, sensory regulation, treating concurrent medical conditions, and enhancing awareness and skills for parents. Dietary improvements focus on eliminating harmful factors, introducing suitable nutritional supplements, and adhering to GFCF diets. The recommendation also suggests regular check-ups, assessments, and ongoing collaboration among experts, parents, and educators, ensuring a comprehensive and personalized intervention plan. Finally, the proposal supports establishing a comprehensive nutrition care model, emphasizing multidisciplinary screening, continuous assessment, ongoing training, and intersectoral collaboration to create an environment conducive to the holistic development and health of children with developmental disorders.

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