THE CORRELATION BETWEEN NUTRITIONAL STATUS WITH HYPERACTIVE BEHAVIOUR DISORDER AND LEARNING ACHIEVEMENT OF CHILDREN WITH AUTISM SPECTRUM DISORDER

N N A Alfani[1*], B Wiboworini[2], L R Kartikasari[3,4]

[1]Postgraduate Student of Nutrition Science, Sebelas Maret University, Surakarta, Central Java, Indonesia.
[2]Departement of Nutrition, Faculty of Medicine, Sebelas Maret University, Surakarta, Central Java, Indonesia.
[3]Study Program of Animal Sciences, Faculty of Agriculture, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia
[4]Postgraduate Program of Nutrition Sciences, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia
*corresponding author: nisaayu134@gmail.com

Abstract
Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder in children, one of which is caused by chronic nutritional deficiencies. Hyperactive behavior disorder is also one manifestation of food allergies in children with ASD. Hyperactive behavior disorders will be related to children's learning achievement. Therefore, research on nutrition in ASD children still needs to be done to improve the mental health of people with ASD. The aim of this study was to evaluate the correlation between nutritional status with hyperactive behavior disorder and learning achievement of children with ASD. This research was conducted with a cohort design in 3 months at 4 Surakarta's Autism Special Schools in 2019 using 38 ASD kids. Data on nutritional status used IMT / U, while data on hyperactive behavior disorders used the Abbreviated Conners Ratting Scale form and data on learning achievement used student learning reports. As many as 73.7% of children have normal nutritional status, 7.9% have poor nutritional status, and 18.4% have more nutritional status. Chi square nutritional status with impaired hyperactive behavior showed p = 0.01, which means that there is a relationship between nutritional status and disorders of hyperactive behavior. While chi square nutritional status with learning achievement shows the results of p value = 0.09 which means there is no relationship between nutritional status and learning achievement of children with ASD. There is a relationship between nutritional status and hyperactivity behavior. Thus, parents / guardians of children are expected to pay attention to the nutritional status of ASD children with hyperactive behavioral disorders to prevent future negative health effects.

Keywords: nutritional status, hyperactive behavior disorder, learning achievement, autism spectrum disorder

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental disorder in children which in recent decades has increased the prevalence of cases. In 2007, it was estimated that every 1 out of 150 children is ASD sufferers. This number increased sharply compared to 10-20 years ago, which was 15-20 cases per 10,000 children [1]. ASD is characterized by disorders of social interaction, communication disorders, and repetitive behavior [2]. Developmental disorders in ASD children are caused by nutritional deficiencies and chronic toxicity exposure and the prognosis is limited [3].

Children with ASD are often reported to experience deviant eating behaviors such as picky eaters, where they are often very picky about the types of food and situations they eat [4]. In addition, ASD sufferers also experience unusual eating behaviors such as lack of diet variations, reluctance to certain foods or very fond of certain types of food, making it difficult to accept new

foods, only choosing foods served from certain dishes or food containers [5]. This eating behavior is strongly associated with psychological problems [6]. Children with ASD are at high risk for sleep disorders and behavior, although the relationship between these disorders is not yet fully understood. But the researchers found that sleep problems were closely related to behavioral and psychological problems during the day, such as aggressive, intense, tantrum, mood disorders, and hyperactivity [7].

Psychological problems such as mood and anxiety disorders, even most psychiatric disorders are closely related to binge eating disorder (BED). BED is a condition in which a person consumes large amounts of food and he cannot stop the behavior (compulsive eating) [8]. In experimental studies in the laboratory, BED appears to be very related to negative emotions such as disappointment, sadness, and loneliness. Individuals with negative emotions seem to try to suppress and reassess unwanted emotions into other activities, in this case is by eating [9].

The behavior of picky eaters and binge eating will have an impact on a person's nutritional status. Good or optimal nutritional status will be used to optimize physical growth, brain development, work ability, and general health [10]. Nutritional status is less able to affect one's academic performance [11] and more nutritional status can increase the risk of short-term and long-term health consequences, such as complaints of muscle skeletons [12], risk factors for cardiovascular diseases such as hypertension, hyperlipidemia [13], type II diabetes, and asthma [14].

Reported nutritional status also relates to student learning achievement. Poor nutritional status can cause a child's growth to be disrupted, his body becomes smaller followed by brain development that is not optimal so that it affects his learning achievement [15]. While more nutritional status can also affect the decline in spatial memory [16], learning motivation [17], hyperactivity-impulsivity, and attention deficit [18]. There is a possibility that nutritional status is related to individual cognitive abilities [19]. Therefore, this study aims to determine the relationship of nutritional status with hyperactive behavior disorder and learning achievement of children with ASD.

2. METHODS

This study was designed with an observational cohort study design, in which the study was conducted for 3 months in 4 Special Schools for Autism (SLB) in Surakarta City, Central Java, Indonesia. The tools used in this study are tread scales and microtoise to retrieve nutritional status data, Abbreviated Conners Rating Scale for data on hyperactive behavior disorders, and report student learning outcomes for children's learning achievement data.

The sampling technique in this study was purposive sampling where sampling was carried out based on the school which provided this study (4 of the 6 Autism SLBs in Surakarta). Then, the data obtained were 56 students with ASD in the 4 SLBs. Only 38 students qualified as the subject of this study, and the rest did not meet the inclusion criteria. All selected subjects were observed for 3 months. Nutritional status data and hyperactive behavior disorders were taken 3 times, namely the first in March, the second in April, and the third in May. While the data on children's learning achievements are taken from the even semester report cards in June. This research has also been reviewed and approved by the Health Research Ethics Commission of the Faculty of Medicine UNS (KEPK FK UNS), with number 439 / UNS27.06 / KEPK / 2019.

Nutritional status data were obtained by anthropometric measurements carried out by the researchers themselves on ASD children's weight and height. After anthropometric measurements, the BMI of the child was calculated using WHO-anthro software. BMI is then compared with age based on the provisions of the Indonesian Ministry of Health (2010) in the

category and nutritional status threshold of children aged 5-18 years. Based on the BMI / U index: severe underweight (Z-score <-3SD), underweight (Z-score -3SD to <-2SD), normal (Z-score -2 to 1 SD), overweight (Z-score score> 1SD to 2SD), and obesity (Z-score> 2SD) [20]. To facilitate the analysis, the cell was merged into 3 categories, namely the underweight category (severe underweight and underweight), normal, and overweight (overweight and obese).

Hyperactive behavior disorder data was obtained from interviews of parents / guardians using the Abbreviated Conners Rating Scale form, so that subjects could be classified into 2 groups, namely no interference with hyperactive behavior if the score <13, and hyperactive behavior disorder if the score ≥ 13 [21]. For learning achievement, subjects are categorized into 2 groups, namely both for A - B, and less for C - C +.

Data is processed using Statistical Product and Service Solution 20 (SPSS 20) software. The statistical test of the data is the bivariate Chi-square test to determine the relationship between 2 variables. All reports on the results of p values are 2 sides and the cutoff is statistical significance if the value of $p < 0.05$.

3. RESULTS AND DISCUSSION

3.1 Subject Characteristics

The characteristics taken in this study were gender, age, and subject level of education. This information is shown in Table 1. Based on Table 1, most subjects (81.6%) were men (6-18 years) with the highest level of education at the elementary school level.

Table 1. Subject Characteristics

No	Characteristics	Category	N = 38	Percent (%)
1	Gender	Male	31	81.6
		Female	7	18.4
2	Aged	6 years old	5	13.2
		7 – 9 years old	6	15.8
		10 – 18 years old	27	71.1
3	Educational Level	Kindergarten	9	25.7
		Elementary school	19	59.0
		Junior high school	7	18.4
		High school	3	7.9

3.2 Distribution of data on Nutritional Status, Hyperactive Behavior Disorder, and Learning Achievement

Information on nutritional status data, hyperactive behaviour disorder, and learning achievement in the subject are shown in Table 2. Based on Table 2, most (73.7%) subjects had normal nutritional status, 68.4% had disorders of hyperactive behavior, and 52.6% had poor learning achievement.

3.3 Correlation between Nutritional Status with Hyperactive Behavior Disorders and Learning Achievement

Information on distribution of nutritional status data, hyperactive behavior disorders, and learning achievement is shown in Table 3. In general, as many as 73.7% subjects had normal nutritional status, 68.4% had a hyperactive behaviour disorder, and 52.6% had less learning achievement.

Table 2. Distribution of data on Nutritional Status, Disorders of Hyperactive Behavior, and Learning Achievement

No	Characteristics	Category	N = 38	Percent (%)
1	Nutritional Status	Underweight	3	7.9
		Normal	28	73.7
		Overweight	7	18.4
2	Hyperactive Behaviour Disorder	No	12	31.6
		Yes	26	68.4
3	Learning Achievement	Good	18	47.4
		Less good	20	52.6

Table 3. Compairing distribution of nutritional status data and hyperactive behavior disorders

		Hyperactive Behaviour Disorder		Learning Achievement		Total	Percentage (%)
		No	Yes	Good	Less		
Nutritional Status	Underweight	2	1	1	2	3	7.9
	Normal	5	23	11	17	28	73.7
	Overweight	5	2	6	1	7	18.4
Total		12	26	18	20	38	
Percentage (%)		31.6	68.4	47.4	52.6		100

Chi-square analysis showed that there was a relationship between nutritional status and impaired hyperactive behavior (p = 0.010) at a significance of 5%. Whereas with learning achievement, nutritional status does not have a significant relationship. This is shown in Table 4. The results of this study are in line with previous studies which showed that there is a relationship between nutritional status and hyperactive behavior disorder [22]. This is thought to be caused by eating disorders, such as binge eating that occurs in children with disorders of hyperactive behavior so that it will have an impact on children's physical development [22].

Table 4. Correlation between nutritional status and hyperactive behaviour disorder and learning achievement

Dependents Variable	p-value
Hyperactive behavior disorders	0.010*
Learning Achievement	0.078*

*) significant using the chi-square statistical test

For learning achievement, the results of the Chi-square analysis showed no relationship between nutritional status and learning achievement of children with ASD (p = 0.08) at a significance of 5%. The results of this study are not in line with previous studies. This may be caused by differences in nutritional intake and therapies at the children so that may differences in children's learning achievement one better than the other one [23].

4. CONCLUSION

In general, subjects had normal nutritional status (73.7%). The results showed that there was a relationship between nutritional status and hyperactivity behavior and there was no correlation

between nutritional status and learning achievement of children with ASD. Therefore, parents / guardians can pay attention to the nutritional status of children with ASD who have hyperactive behavioral disorders to prevent future health complications.

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