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The Relationship of Gastrointestinal Disorders to Malnutrition in Children with Cerebral Palsy in the WKCP Community (Wahana Keluarga Cerebral Palsy) Yogyakarta, Indonesia

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ABSTRACT

Background: One of the causes of malnutrition that often occurs is gastrointestinal disorders. The existence of anatomical and physiological abnormalities in the gastrointestinal tract is the main cause. This study aimed to assess the relationship between gastrointestinal disorders and the incidence of malnutrition in children with cerebral palsy in the WKCP community Yogyakarta, Indonesia. **Methods:** A cross-sectional analytic observational study involving 20 cerebral palsy subjects who met the inclusion and exclusion criteria. The data collection technique is by consecutive sampling. The type of data used in the research uses a questionnaire gastrointestinal symptoms rating scale (GSRS). Data status anthropometry has also been collected. Data analysis using SPSS with chi-square. **Results:** The mean age of the subjects was 8.9 ± 4.1 years. The male gender (60%) is greater than the female. The comparison of good nutritional status and malnutrition is not much different, namely 55%:45%, respectively. The percentage of children experiencing severe gastrointestinal symptoms is 25%. The most common gastrointestinal disorders are constipation (65%) and upper dysmotility disorders (60%). In the results of this study, there was no relationship between gastrointestinal disorders and the incidence of malnutrition ($p=0.069$). **Conclusion:** In this study, there was no significant relationship between gastrointestinal disorders and malnutrition in children with cerebral palsy. However, gastrointestinal disorders increase the morbidity and mortality of children with cerebral palsy, so it must be an important concern.

1. Introduction

Cerebral palsy is a chronic motor disease caused by non-progressive (static) disturbances in the developing brain. The incidence of cerebral palsy in this world is 2 to 2.5 per 1000 live births. In developing countries, the prevalence of cerebral palsy increases between 1.5 and 5.6 per 1000 live births.^{1,2} Risk factors for cerebral palsy can occur before, during, or after birth. Before birth, the condition of the mother with diabetes mellitus (17.6%), prolonged premature rupture of membranes (11.9%), maternal bleeding (10.4%), and preeclampsia (4.7%) were common influences. In conditions during and after birth,

hypoxic-ischemic encephalopathy (28.5%), infections, especially of the nervous system (16.3%), hyperbilirubinemia (12.7%), cerebrovascular disorders (8.8%), meconium aspiration (6.2%), and intracranial hemorrhage (8.7%) contributed to the incidence of cerebral palsy in children.³ Impaired motor function is the main symptom of cerebral palsy, followed by other symptoms such as sensory, cognitive, communication, behavioral disturbances, epilepsy, and disorders of the muscles and bones.⁴ The nutritional status of children with cerebral palsy is a very serious problem that needs to be treated early. In some developing countries, there are several factors that influence the

inability to intake adequate nutrition, problems with eating, and motor disturbances that will influence status malnutrition in children with cerebral palsy. Research in Saudi Arabia showed an incidence of malnutrition of 56.4%, with a factor that influences the incidence of malnutrition as age less than 5 years, anemia, cognitive impairment, and inadequate food intake.⁵ Research in Indonesia shows the incidence of malnutrition is 46.7%, with risk factors that are influenced based on the topography of the cerebral palsy condition.⁶ Several other factors as well influence malnutrition as a gastrointestinal disorder.

Gastrointestinal disorders are one of the problems that are often experienced by children with cerebral palsy. A study in Italy reported that malnutrition (52%) was affected by gastrointestinal disorders such as gastroesophageal reflux disease (82%) and chronic constipation (64%).⁷ Different studies in Brazil showed that there was no significant relationship between body weight for age (-3.29) and gastrointestinal disorders. However, there is a significant relationship between height for age (-4.05) and gastroesophageal reflux disease. Gastrointestinal disorders that occur are dysphagia (82.5%), gastroesophageal reflux disease (40%), and constipation (60%).⁸ The existence of data that is still controversial indicates that gastrointestinal disorders may still influence malnutrition in children with cerebral palsy. One assessment of gastrointestinal disorders using the questionnaire gastrointestinal symptoms rating scale (GSRS). GSRS has been used to assess gastrointestinal disorders in children with autism in America.⁹ However, no studies have used GSRS to assess gastrointestinal disorders in children with cerebral palsy. Education This study aims to assess the relationship between gastrointestinal disorders related to abdominal pain, reflux, symptoms of upper dysmotility, constipation, and diarrhea using the questionnaire gastrointestinal symptoms rating scale (GSRS), which has been validated in Indonesian in influencing malnutrition in children with cerebral palsy.¹⁰

2. Methods

This research is an observational analytic study using a cross-sectional design method in children aged 3-18 years who have been diagnosed with CP and are members of the WKCP (wahana keluarga cerebral palsy) in June-August 2021. Sample selection was carried out by a consecutive sampling method. The sample size was 20 subjects. The inclusion criteria were children aged 3-18 years who had been diagnosed with CP, were members of the WKCP, and their parents had consent and signed informed consent. Exclusion criteria were a history of chronic diseases such as food allergies/cow's milk, autoimmune disease, congenital heart disease, or previously known hematologic disorders, children with GMFCS V, and children using additional tools in the gastrointestinal tract such as gastrostomy and jejunostomy. This research has obtained ethical feasibility from the Universitas Muhammadiyah Yogyakarta ethics committee with number 162/EC-KEPK FKIK UMY/V/2021.

Subject research is a child who has been diagnosed with CP, is a member of the WKCP, and has been given an explanation to their parents and provided informed consent. After the parents filled in the research data, the research subjects were asked to complete the data via Google form, which contains basic data and the GSRS questionnaire. Anthropometric data were measured using body weight and height/length. Nutritional status was determined using the cerebral palsy growth chart developed by Brooks et al. (2011) based on the GMFCS level. This study uses BMI/age for children aged 5-18 years and using body weight/length for children aged 3-5 years. The criteria from the Brooks chart are malnutrition at <5 percentile, good nutrition: at the 5-95 percentile, and overnutrition at ≥95 percentile. The questionnaire gastrointestinal disorders used in this study were the gastrointestinal symptoms rating scale (GSRS), which is used to assess the symptoms that are often experienced by respondents. The GSRS instrument has 15 questions to find out gastrointestinal symptoms, which are measured based

on the intensity, frequency, and duration of the respondent's experience of gastrointestinal symptoms. Questionnaire This study uses a Likert scale for ratings from never for answers with no symptoms to answers always for symptoms that are felt all the time and until it interferes with activities. Assessment of scores in research is never (0) sometimes (1) often (2) always (3). Categorical for mild symptoms, a total score of 0-15 is obtained, and for severe symptoms, a score of 16-45 is obtained. A questionnaire validity test has been carried out, and reliability by researchers Afifah et al. with test results reliability obtained Cronbach alpha value of 0.750.

The collected data were processed and analyzed descriptively and analytically. Descriptive analysis or univariable analysis describes the characteristics of research subjects by presenting a statistical measure of the number. Data is categorical in the form of nutritional status, which is divided into good and bad nutrition, and questionnaire GSRS is divided into mild and severe symptoms. The next analysis is in the form of analysis bivariable, which analyzes the relationship between variables using test statistics chi-square. This analysis was to look for the relationship between gastrointestinal disorders and malnutrition. If there was an expected cell value <5, Fisher's exact test was used. The significance of the statistical test results was

determined based on the value of $p < 0.05$. Data analysis was carried out using the SPSS for Windows version 20.0 program.

3. Results

This study obtained subjects 20 CP children with GMFCS levels 1-4 that have met the research criteria. The mean age in this study was 8.9 ± 4.1 years. The highest age distribution in the study was 5-10 years (45%), followed by teenagers, namely 10-18 years (35%), and toddlers aged 3-5 years (20%). The male gender (60%) is more than the female (40%). In terms of education, the average child in this study attended school (40%) from primary school to junior high school, and 1 (5%) decided to homeschool. However, there are still children who are not in school (35%) due to various factors and children who are not yet in school (20%) at the age of five. The risk factor for cerebral palsy in this study was asphyxia post-birth (30%), infection (15%), hydrocephalus (10%), and brain hemorrhage (5%). Almost more than half (85%) of children are still taking routine anti-seizure drugs, and only (15%) are not taking their regular medication. Children's nutritional status based on body weight and height/length showed 11 (55%) were good nutrition and 9 (45%) were malnutrition.

Table 1. Characteristics of research data.

Data characteristics	Total
Child age (Mean±SD)	8.9 ± 4.1
Gender of children, n (%)	
Female	8 (40%)
Male	12 (60%)
Nutritional status (weight/Age)	
Normal	11 (55%)
Malnutrition	9 (45%)
Children's education	
No School	7 (35%)
School	8 (40%)
Not in school yet (age < 6 years)	4 (20%)
Homeschooling	1 (5%)
Risk factors for cerebral palsy	
Asphyxia	(30%)
Infection	(15%)
Hydrocephalus	(10%)
Brain Bleeding	(5%)
Take anti-seizure medication	
Yes	17 (85%)
No	3 (15%)

Based on the questionnaire, GSRS showed 5 (25%) severe symptoms and 15 (75%) mild symptoms. There are 5 symptoms that can be classified based on questionnaire GSRS namely abdominal pain (abdominal pain and nausea), esophageal disorders (reflux and heartburn), upper dysmotility disorders (abdominal sounds, belching, and increased passing of gas), diarrhea (consistency of liquid stools,

frequency of bowel movements more than 3x/day, and can't hold defecation), and constipation (the presence of defecation difficulties, hard stool consistency, and no discharge). Results questionnaire, there were children with 3 (15%) abdominal pain, 3 (15%) reflux, 12 (60%) upper dysmotility disorders, 13 (65%) constipation, and 4 (20%) diarrhea.

Table 2. Gastrointestinal disorders in children with cerebral palsy.

Symptoms	0	1	2	3
Stomach pain	15 (85%)	0(0%)	2(10%)	1(5%)
Reflux	17(85%)	2(10%)	1(5%)	0(0%)
Upper dysmotility disorder	8(40%)	0(0%)	8(40%)	4(20%)
Constipation	7(35%)	2(10%)	7(35%)	4(20%)
Diarrhea	16(80%)	0(0%)	2(10%)	2(10%)

The relationship between gastrointestinal disorders and the incidence of malnutrition is shown in Table 3. The results of the analysis using chi-square showed

that there was no significant relationship between gastrointestinal disorders and nutritional status based on body weight and height/length (p=0.069).

Table 3. Relationship between gastrointestinal disorders and malnutrition.

Gastrointestinal symptoms	Nutritional status		P value*
	Malnutrition	Good nutrition	
Severe symptoms	4 (20%)	1 (5%)	0.069
Mild symptoms	5 (25%)	10 (50%)	

*Fisher exact test.

4. Discussion

Impaired growth and nutrition are the most common problems in children with cerebral palsy.¹¹ The presence of gastrointestinal disorders such as dysphagia, gastroesophageal reflux disease, and constipation are suspected comorbidities that play a role in cerebral palsy.⁸ In this study, it was found that the average age of the children participating in the study was 8.9 ± 4.1 . The male gender (60%) in this study subject is greater than the female (40%). This is in accordance with the data obtained that the incidence of cerebral palsy is higher in men than women (ratio 1.33:1).² Some literature states that high estrogen and progesterone in women play a role in reducing brain injury and protecting against ischemic events in brain injury.¹²

The biggest risk factor for cerebral palsy is asphyxia (30%) post-born. This is in accordance with meta-analysis reports showing the incidence of cerebral palsy was 20.3% (95% CI: 16.0–24.5, I2 = 76.3%) in RCT studies and 22.2% (95% CI: 8.5–35.8, I2 = 65.1%) in observational studies the two types show a relationship between asphyxia and the incidence of cerebral palsy.¹³ In other studies also mentioned a relationship between the incidence of cerebral palsy with hypoxic-ischemic encephalopathy, neonatal sepsis, and intracranial hemorrhage with $p < 0.001$.³ The subjects of this study also saw that children who attended school (40%) were bigger than those who did not attend school (35%). In the study, Gillies et al. reported that 47% of cerebral palsy children underwent an intellectual exam and found that 30% of children had scores within normal limits.

The proportion of good intellectuals is greater in children with hemiplegia (>40%) than in those with tetraplegia (<10%). Severe motor symptoms will affect cognitive function in children with cerebral palsy.¹⁴ About 85% of children with cerebral palsy are still taking anti-seizures. This is in accordance with research reports which state that the presence of comorbid epilepsy (51.7%) causes cerebral palsy children to consume anti-seizure drugs still, and approximately 13.7% use anti-seizure polytherapy.¹⁵

Gastrointestinal disorders are one of the problems that are often experienced by children with cerebral palsy. In this study, the assessment of gastrointestinal disorders using the questionnaire GSRS. Data result questionnaire it was found that cerebral palsy children who experienced mild symptoms (75%) were greater than severe symptoms (25%). The study also reported that the most common symptoms experienced were constipation (65%), upper dysmotility disorder (60%), diarrhea (20%), and abdominal pain and reflux (15%). Veugelers et al. (2010) reported that the incidence of constipation in children with cerebral palsy was around 57%. This is due to a decrease in water intake (87%) and fiber (53%) influence incidence of constipation.¹⁶ In another study, the incidence of constipation channel gastrointestinal problems that often occur are dysphagia, gastroesophageal reflux, and constipation, respectively 82.5%, 40.0%, and 60.0%.⁸ The GSRS questionnaire was also used by Harris et al. in conducting research on gastrointestinal disorders in children with autism.⁹ We found 9(45%) children who were malnourished and 11(55%) children who were in good nutrition based on measurements of body weight, height/length, and BMI. Similar results are not much different from research in Italy which shows BMI/child age cerebral palsy with a percentile < 5 of 52%. these results are suspected because children with disorders/disabilities in the nerves will experience progressive weight loss. It is suspected that there is a loss of fat mass due to the formation of reduced muscle mass due to decreased physical activity.

In our study, there was no significant association between gastrointestinal

disorders and the incidence of malnutrition in children with cerebral palsy, with $p=0.067$. This is similar to the study of Caramico et al., who reported that there was no significant relationship between gastrointestinal disorders and malnutrition. However, there is a significant relationship between gastroesophageal reflux disease and stunting ($p: 0.03$). This is thought to be because soft foods are more difficult to swallow. Lack of intake of energy, protein, saturated fatty acids, vitamins, and minerals is the main cause of malnutrition in children with cerebral palsy.⁸ Besides that, many other factors influence the incidence of malnutrition in children with cerebral palsy. Research by Johnson et al. reported that the physical condition of children who were unable to walk (OR 13.8, 95% CI 3.8-50.1, $p<0.001$) and low socioeconomic factors (OR 1.6, 95% CI 1.0-2.5, $p=0.03$) were also suspected. Influence malnutrition condition. Other studies have also reported cerebral palsy children with levels of GMFCS IV, and V was more frequently malnutrition (OR] 5.64; 95% confidence interval CI 2.27–14.0) and short (OR 8.42; 95% CI 2.90–24.4) compared to levels GMFCS I-III.¹⁷ In another study, there were difficulties in the feeding process, such as difficulty swallowing ($p=0.0006$). Stiffness in the jaw to bite (0.001), eating only soft or liquid porridge ($p=0.0231$), and eating more than 30 minutes ($p=0.0381$). The limitation of this research is the small number of research subjects. In addition, the researchers also did not assess other suspected risk factors that influence condition malnutrition in children with cerebral palsy.

5. Conclusion

In this study, there was no significant relationship between gastrointestinal disorders and the incidence of malnutrition in children with cerebral palsy.

6. References

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