



Relation Between Gross Motor Function, Consumption Pattern and Macronutrient Intake with Nutritional Status Cerebral Palsy

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ARTICLE INFO

Article history:

Received: 16-06-2023

Revised: 30-06-2023

Accepted: 17-08-2023

Keywords:

Gross motor function

Consumption pattern

Macronutrient intake

Nutritional status

Cerebral palsy

ABSTRACT

Cerebral Palsy is a condition of motor disturbances caused by brain damage during child development. Globally, the incidence of CP in low- and middle-income countries is 3.4 per 1000 live births. Cerebral Palsy (CP) is defined from the word cerebral, namely the brain, and palsy which is paralysis or a paralyzed condition caused by a nerve disorder that functions to regulate the movement of the body's muscles. The purpose of this study was to analyze the description and relationship between the level of gross motor skills, diet, and intake of macronutrients with nutritional status in people with cerebral palsy. This study used a cross-sectional design, the sample was taken using a non-probability sampling technique with a purposive sampling method and a total of 59 children were obtained. This study used the Spearman Rank statistical test to analyze the relationship between independent variables and nutritional status with a significance level or probability less than equal to 0.05 for respondents using IBM SPSS 25 and Microsoft Excel. The results showed that there was a relationship between carbohydrate sources, namely rice ($p=0.000$), chicken ($p=0.000$), citrus fruits ($p=0.046$), milk ($p=0.000$), and coconut oil ($p=0.000$). However, there was no relationship between and vegetable sources (p more than 0.05). There is a relationship between intake of macronutrients and nutritional status in people with cerebral palsy. Energy ($p=0.000$), protein ($p=0.054$), fat ($p=0.025$), carbohydrates ($p=0.000$). There is no relationship between gross motor function in people with cerebral palsy (p more than 0.05). The results showed that there was no relationship between gross motor function with nutritional status on cerebral palsy. There was a relationship between rice, biscuit, bread, chicken, fish, egg, tofu, spinach, mango, orange, papaya, banana, milk, cheese, coconut oil, butter, sugar, and honey and nutritional status on cerebral palsy. However, there was no relationship between porridge, tempeh, soy sauce, water spinach, carrot, beans, broccoli, dragon fruit, and yoghurt. There is a relationship between intake of macronutrients and nutritional status in people with cerebral palsy.

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I. Introduction

Nutritional problems in Cerebral Palsy (CP) children are still quite a big problem, both in severity and magnitude. Cerebral Palsy (CP) is a condition where motor disorders occur which are caused by brain damage during a child's growth and development (Siregar, 2017). Globally, the incidence of CP in low and middle income countries reaches 3.4 cases per 1000 live births. Research on 127 children with CP in Indonesia showed that 97% of children experienced malnutrition (Jahan et al., 2021). Meanwhile, in research in Bandung, 46.7% of CP children experienced malnutrition and 3.3% experienced overnutrition (Pujasari, Rusmil, & Somasetia, 2020).

Children with CP have motor and functional abnormalities that limit mobility. Motor disorders can cause decreased function in carrying out daily activities in children with CP. The more severe the degree of gross motor function can result in stunted growth in children with CP (Pujasari et al., 2020). Studies in Columbia show that the level of gross motor skills has a direct relationship with the incidence of stunting and malnutrition in children with CP (Herrera - Anaya, Angarita - Fonseca, Herrera - Galindo, Martínez - Marín, & Rodríguez - Bayona, 2016). This is different from the results

of research in Indonesia which shows that there is no significant relationship between the level of gross motor skills and nutritional status in CP sufferers (Pujasari et al., 2020). Differences in research results regarding the relationship between gross motor skills and nutritional status in children with CP, researchers are interested in analyzing the relationship between gross motor skills and nutritional status in children with CP.

Food consumption is the main factor in meeting nutritional needs which is influenced by many factors. Food consumption that is insufficient in terms of quantity can affect an individual's nutritional adequacy (Indriasari, Kustiyah, & Hadipoetro, 2018). Up to 80% of children with developmental disorders have difficulty eating (Almuneef et al., 2019). CP sufferers often have difficulty chewing and swallowing, resulting in disruption of eating patterns and food intake. Providing an inappropriate diet can result in various kinds of nutritional problems. Research in Korea shows that the diet of CP children who have poor nutritional status tends to be unbalanced, while CP children who are obese tend to consume more high-fat foods (Kim, Choi, & Yim, 2018). Research in Medan shows that CP children have lower energy intake (80%) and lower protein intake (66.7%) (Siregar, 2017). Insufficient food intake causes the amount of energy received to be less than the body's needs for metabolism. Research conducted shows that CP children with poor nutritional status have lower energy intake (Ahmed, Kim, Han, & Yim, 2021). The aim of this study was to determine the relationship between gross motor skills, diet and macronutrient intake and nutritional status in Cerebral Palsy sufferers.

II. Method

Quantitative research uses analytical observational methods with a cross-sectional design to determine the relationship between the level of gross motor skills, diet, and macronutrient intake and nutritional status in people with cerebral palsy. The research uses primary data obtained directly by researchers from respondents. The research was carried out from October 2022 to April 2023. The research was carried out at SLB D-D1, Foundation for the Development of Disabled Children (YPAC) Jakarta. The sample in this study was 59 children with cerebral palsy at YPAC Jakarta. Samples were taken using a non-probability sampling technique with a purposive sampling method. Data analysis was carried out descriptively using IBM SPSS 25.

III. Results and Discussion

Table 1 shows that the majority of research respondents were in the age range 12–16 years (42.4%), namely 25 students. The youngest age is 5 years and the oldest age is 18 years. Based on this research, it was found that the majority of respondents had good nutritional status, namely 27 respondents (45.8%). In line with research conducted by Pujasari et al. (2020), 30 respondents (50%) of CP children had good nutritional status based on LILA.

In line with Silvana and Purba's research (2021), the majority of people with CP are men, namely 18 respondents (78%). Epidemiological studies show that men are more at risk of developing cerebral palsy than women (1.3:1) (Lie, Grøholt, & Eskild, 2010). Assessing nutritional status in people with CP using standard methods is quite difficult to carry out because there are movement disorders and inability to stand, so special methods are needed to assess growth correctly. One method that is easy to use is to use LiLA measurements. This research shows that the majority of people with CP have good nutritional status. CP children may have lower energy needs compared to healthy children in general, making it easier to meet nutritional needs (Kim et al., 2018).

Table 1. Distribution of Respondent Characteristics

Characteristics	n	%
Age		
5–11 years	22	37,3
12–16 years	25	42,4
17–18 years	12	20,3
Gender		
Boy	32	54,2
Girl	27	45,8
Nutritional Status (LILA/U)		
Malnutrition	2	3,4
Underweight	12	20,3
Normal	27	45,8
Overweight	8	13,6
Obesity	10	16,9
Gross Motor Skills		
Severe	20	33,9
Moderate	24	40,7
Good	15	25,4
Total	59	100

Based on Table 2, the research results show that there is no significant relationship between the level of gross motor skills and nutritional status with a value of $p = 0.863$. The correlation coefficient value shows that the relationship is in the same direction, meaning that the lighter the gross motor skills, the higher the nutritional status of the respondent.

Table 2. Relationship between Gross Motor Ability and Nutritional Status

Gross Motor Skills	Nutritional Status										<i>p-value</i>	<i>r</i>
	Malnutrition		Underweight		Normal		<i>Overweight</i>		Obesity			
	n	%	n	%	n	%	n	%	n	%		
Parah	2	3,4	2	3,4	8	13,6	1	1,7	7	11,9	0,863	0,225
Sedang	0	0	4	6,8	13	22	4	6,8	3	5,1		
Ringan	0	0	6	10,2	6	10,2	3	5,1	0	0		

In line with research, there is no significant relationship between the degree of gross motor function and nutritional status based on LILA ($p = 0.388$). The correlation coefficient value is unidirectional because CP children with severe gross motor skills have clinical eating and swallowing problems. The more severe the level of gross motor skills, the greater the risk of malnutrition in children with CP (Brunner, Cieri, Marco, Schroeder, & Cuestas, 2020). Nutritional disorders in children with CP can be caused by feeding problems, oromotor dysfunction, difficulty swallowing, duration of eating and needing help when eating (Pujasari et al., 2020). The severity and type of CP can affect gross motor skills, causing functional limitations in people with CP (Purnamasari, Rasidi, & Hasbiah, 2022).

Table 3 shows the staple food that is often consumed by children with CP, namely biscuits, as many as 33 people (55.9%) with good nutritional status and an average consumption of 7–21 times a week. The animal food that is frequently consumed is chicken by 39 people (45.9%) with good nutritional status and an average consumption of 3-7 times per week. Tofu is a plant food that is frequently consumed by 32 respondents (54.2%) with good nutritional status and an average consumption of 7-14 times a week. Spinach is a vegetable that is often consumed by 30 people (50.8%) with good nutritional status and on average consumed 5-7 times per week. The fruit that is frequently consumed is papaya by 19 people (32.2%) with good nutritional status and an average of 3-5 times consumption per week. Milk is often consumed by 35 respondents (59.3%) with good nutritional status and an average consumption of 7-14 times per week. 38 people (64%) consumed oil most often with an average consumption of 7–14 times per week.

Table 3. Relationship between Consumption Patterns and Nutritional Status

Food Group	Frequency of Consumption Patterns					p-value		r
	Malnutrition (n=2)	Underweight (n=12)	Normal (n=27)	Overweight (n=8)	Obesity (n=10)			
Carbohydrate								
Rice	1,00 ± 0,000	1,08 ± 0,289	1,44 ± 0,506	2,00 ± 0,000	2,00 ± 0,000	0,000*	0,684	
Porridge	1,00 ± 0,000	1,42 ± 0,515	1,30 ± 0,465	1,75 ± 0,463	1,40 ± 0,516	0,269	0,146	
Biscuit	1,50 ± 0,707	1,42 ± 0,515	1,56 ± 0,506	1,75 ± 0,463	1,70 ± 0,483	0,039*	0,270	
Bread	1,50 ± 0,707	1,00 ± 0,000	1,37 ± 0,492	1,88 ± 0,354	1,90 ± 0,316	0,001*	0,423	
Animal Protein								
Chicken	1,50 ± 0,707	2,00 ± 0,000	1,78 ± 0,424	2,00 ± 0,000	2,00 ± 0,000	0,000*	0,729	
Fish	1,50 ± 0,707	1,67 ± 0,492	1,67 ± 0,480	1,88 ± 0,354	1,90 ± 0,316	0,000*	0,456	
Egg	1,00 ± 0,000	1,67 ± 0,492	1,41 ± 0,501	1,75 ± 0,463	1,90 ± 0,316	0,003*	0,374	
Plant Protein								
Tofu	1,50 ± 0,000	1,50 ± 0,522	1,33 ± 0,480	1,88 ± 0,354	2,00 ± 0,000	0,001*	0,438	
Tempeh	1,00 ± 0,000	1,42 ± 0,515	1,30 ± 0,465	1,25 ± 0,463	1,60 ± 0,516	0,365	0,120	
Soy Sauce	1,00 ± 0,000	1,25 ± 0,452	1,30 ± 0,465	1,25 ± 0,463	1,50 ± 0,527	0,205	0,167	
Vegetables								
Spinach	1,50 ± 0,707	1,50 ± 0,522	1,81 ± 0,396	1,13 ± 0,354	1,10 ± 0,316	0,031*	–	0,281
Kangkung	1,50 ± 0,707	1,17 ± 0,389	1,74 ± 0,447	1,00 ± 0,000	1,10 ± 0,316	0,339	–	0,127
Carrot	1,50 ± 0,707	1,50 ± 0,522	1,44 ± 0,506	1,25 ± 0,463	1,50 ± 0,527	0,366	–	0,120
Beans	1,50 ± 0,707	1,33 ± 0,492	1,19 ± 0,396	1,13 ± 0,354	1,60 ± 0,516	0,870	–	0,022
Broccoli	1,00 ± 0,000	1,17 ± 0,389	1,37 ± 0,492	1,25 ± 0,463	1,50 ± 0,527	0,120	–	0,204
Fruits								
Mango	1,50 ± 0,707	1,17 ± 0,389	1,22 ± 0,424	1,13 ± 0,354	1,00 ± 0,000	0,045*	–	0,262
Orange	1,50 ± 0,707	1,08 ± 0,289	1,33 ± 0,480	1,00 ± 0,000	1,00 ± 0,000	0,402	–	0,111
Dragon fruit	1,00 ± 0,000	1,17 ± 0,389	1,07 ± 0,267	1,13 ± 0,354	1,00 ± 0,000	0,368	–	0,119
Papaya	1,50 ± 0,707	1,58 ± 0,515	1,37 ± 0,492	1,00 ± 0,000	1,00 ± 0,000	0,000*	–	0,514
Banana	1,00 ± 0,000	1,42 ± 0,515	1,26 ± 0,447	1,13 ± 0,354	1,00 ± 0,000	0,039*	–	0,270
Milk and Dairy Products								
Milk	1,50 ± 0,707	1,00 ± 0,000	1,67 ± 0,480	1,88 ± 0,354	2,00 ± 0,000	0,000*	0,682	
Yoghurt	1,50 ± 0,707	1,17 ± 0,389	1,11 ± 0,320	1,13 ± 0,354	1,50 ± 0,527	0,539	0,082	
Cheese	1,00 ± 0,000	1,00 ± 0,000	1,15 ± 0,362	1,13 ± 0,354	1,50 ± 0,527	0,004*	0,336	
Oil and Sugar								
Coconut oil	1,00 ± 0,000	1,17 ± 0,389	1,07 ± 0,267	1,50 ± 0,535	1,90 ± 0,316	0,000*	0,675	

Food Group	Frequency of Consumption Patterns					p-value	r
	Malnutrition (n=2)	Underweight (n=12)	Normal (n=27)	Overweight (n=8)	Obesity (n=10)		
Butter	1,00 ± 0,000	1,17 ± 0,389	1,07 ± 0,267	1,13 ± 0,354	1,40 ± 0,516	0,005*	0,358
Sugar	1,00 ± 0,000	1,17 ± 0,389	1,00 ± 0,000	1,38 ± 0,518	1,50 ± 0,527	0,000*	0,542
Honey	1,50 ± 0,707	1,17 ± 0,389	1,37 ± 0,492	1,75 ± 0,463	1,80 ± 0,422	0,005*	0,357

Rice has a texture that is easy to eat and contains carbohydrates which can provide large amounts of energy for the body and is good for people with CP. Rice is the largest source of energy and the source of carbohydrates most frequently consumed by Indonesian people. Carbohydrates can affect nutritional status, if excessive intake will be stored in the form of glycogen in muscle tissue and also in the form of fat stored in adipose tissue. Porridge does not have a significant relationship because 100 grams of porridge has lower calories than 100 grams of rice, biscuits and bread. Biscuits are a calorie-dense snack and have quite high energy content, besides that, children also tend to like biscuits (Pratama & Ayustaningwarno, 2015). Bread has a fairly high energy content, 100 grams of bread contains 248 kcal of energy.

Chicken is a source of protein with high energy content, apart from that, chicken also contains vitamin B6, vitamin B3, zinc, magnesium, manganese and zinc which are important for brain function and good bone growth for people with CP. Fish is a food source of protein which is rich in omega-3 fatty acids and is good for brain development functions (Kim et al., 2018). Protein and omega-3 fatty acids can restore neurological function in people with CP (Leal-Martínez et al., 2020). Based on TKPI data (2017), eggs contain 174 kcal and 14 grams of fat in 100 grams of eggs. Eggs are a source of protein which can help improve the nutritional status of children (Yanti, 2018). Consuming chicken, fish and eggs can improve the nutritional status of CP children, so they can be an alternative for CP children to reduce the risk of malnutrition.

Spinach can help maintain good nutritional status and prevent obesity¹¹. Vegetables are a source of fiber in food (Prita, Mangkurat, & Mahardika, 2021). Fiber can overcome the problem of constipation that often occurs in people with CP. Kale, carrots, green beans and broccoli contain lower calories than spinach per 100 grams. Water spinach has good fiber content to prevent constipation so it can improve digestion and reduce the risk of obesity (Stevani, Mustofa, & Wulandari, 2018). CP children tend to have digestive problems, such as constipation. Therefore, the high fiber content in papaya and bananas can help reduce the risk of constipation in people with CP.

Milk has high energy and protein content so it can improve nutritional status. Milk is a high-calorie food and has an easily digestible texture which can improve the nutritional status of children with CP. Therefore, milk can be a good alternative food choice for people with CP to reduce the risk of malnutrition. Yoghurt is considered a probiotic carrier food that can deliver significant amounts of probiotic bacteria into the body that can maintain health. Cheese contains high levels of saturated fat which can increase the risk of obesity. Cheese contains calcium and vitamin D which function for bone health (Masri, Nasution, & Ahriyasna, 2022).

Based on the results of interviews, it was found that respondents tended to consume food processed by frying. Excessive fat consumption will increase LDL cholesterol levels in the blood and cause fat accumulation in the body which can result in weight gain (Yuliantini, Sari, & Nur, 2015). Butter contains high levels of saturated fatty acids which can increase the risk of obesity. It is important to pay attention to limiting consumption of saturated fats and omega-3 fatty acids (Masri et al., 2022). Sugar contains high calories so if consumed in excess it will cause weight gain. CP children who consume excessive amounts of sweet foods can experience untreated dental caries which can affect the oral function of children with CP, thus affecting the intake they consume (Indriasari et al., 2018). Honey contains high levels of sugar and calories so if consumed in excess it can cause weight gain (Asmih, 2020). Honey has an energy content of 294 kcal and carbohydrates of 79.5 grams in 100 grams.

Table 4 shows that 26 respondents (44.1%) had sufficient energy intake with an average intake of 1540.84 kcal. The majority of respondents' protein intake was in the sufficient category, with 29 respondents (49.2%) having an average protein intake of 64 grams per day. The majority of fat intake in children with CP is sufficient with an average consumption of 55.87 grams per day. The carbohydrate intake of CP children in this study was 28 respondents in the sufficient category (47.5%) with an average consumption of 200.5 grams per day.

Table 4. Relationship between Consumption Patterns and Nutritional Status

Food Intake	Nutritional Status										Total		p value	r	
	Malnutrition		Underweight		Normal		Overweight		Obesity						
	n	%	n	%	n	%	n	%	n	%	n	%			
Energy Intake														0,000*	0,803
Low	2	3,4	10	16,9	3	5,1	0	0	0	0	15	25,4			
Normal	0	0	2	3,4	20	33,9	3	5,1	1	1,7	26	44,1			
Excess	0	0	0	0	4	6,8	5	8,5	9	15,3	18	30,5			
Protein Intake														0,000*	0,796
Low	2	3,4	8	13,6	2	3,4	0	0	0	0	12	20,3			
Normal	0	0	4	6,8	21	35,6	4	6,8	0	0	29	49,2			
Excess	0	0	0	0	4	6,8	4	6,8	10	16,9	18	30,5			
Fat Intake														0,000*	0,809
Low	2	3,4	11	18,6	2	3,4	0	0	0	0	15	25,4			
Normal	0	0	1	1,7	22	37,3	2	3,4	3	5,1	28	47,5			
Excess	0	0	0	0	3	5,1	6	10,2	7	11,9	16	27,1			
Carbohydrate Intake														0,000*	0,642
Low	1	1,7	8	13,6	2	3,4	0	0	0	0	11	18,6			
Normal	1	1,7	3	5,1	19	32,2	2	3,4	3	5,1	28	47,5			
Excess	0	0	1	1,7	6	10,2	6	10,2	7	11,9	20	33,9			

Incoming energy that is not balanced with needs over a long period of time can cause nutritional problems. In line with research by Indriasari et al. (2018), insufficient energy and macronutrient intake is related to nutritional status. Energy intake is related to mobility and activity levels, where the calculation of energy adequacy for subjects in this study is compared with the value of nutritional needs. When the body consumes more energy than it needs, the excess energy will be stored as fat in adipose tissue and result in fat accumulation which causes weight gain (Kurniasanti, 2020).

In line with research by Indriasari et al. (2018), intake of macronutrients, especially protein, can meet nutritional needs. The more frequently you consume various types of animal foods, the better your nutritional status will be because they contain protein which functions for the growth and development of the body, especially for children who are growing. Adequate protein intake is important for CP children for the growth and repair of fat and muscle tissue (Indriasari et al., 2018).

Excessive fat intake can cause fat accumulation in the body and result in weight gain and obesity (Surbakti, 2019). Fat is the largest energy reserve and is generally stored in the body in adipose tissue, so that if excessive fat intake is consumed for a long time it can result in obesity (Afiatna, 2018). Sufficient carbohydrate intake is associated with good nutritional status in children and adolescents. Leal-Martínez et al.'s (2020) research also found that low carbohydrate intake had a significant relationship with malnutrition status. Carbohydrates can affect nutritional status because carbohydrates are stored in the form of glycogen in muscle tissue and fat is stored in adipose tissue (Kurniasanti, 2020).

IV. Conclusion

Based on the result of the study, it was found that there was no relationship between gross motor skills in people with cerebral palsy ($p > 0.05$). There is a relationship between consumption frequency, namely rice, biscuits, bread, tofu, chicken, fish, eggs, spinach, citrus fruit, papaya, mango, banana, milk, cheese, coconut oil, sugar, butter and honey with nutritional status ($p \leq 0.05$). However, there was no relationship between porridge, tempeh, soy sauce, kale, carrots, green beans, broccoli, dragon fruit and yoghurt with nutritional status in people with cerebral palsy ($p > 0.05$). There is a relationship between macronutrient intake (energy, protein, fat and carbohydrates) and nutritional status in people with cerebral palsy ($p > 0.05$).

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