

# Epileptic Seizures and Nutritional Status in Children with Cerebral Palsy: Unraveling the Interconnections

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## Abstract

**Objective:** This cross-sectional study explores the complex relationship between nutritional status and the prevalence of epileptic seizures in children with cerebral palsy (CP).

**Methods:** Conducted between September and October 2024 at a private physiotherapy and rehabilitation center in Türkiye, the study included 58 participants aged 3-15 years diagnosed with CP. The research focused on evaluating socio-demographic data, health information, and detailed 24-hour food consumption patterns alongside anthropometric measurements and the Gross Motor Function Classification System.

**Results:** Our findings reveal a significantly higher risk of epileptic seizures in children born via cesarean section compared to vaginal delivery ( $p=0.014$ ). No significant direct correlation was identified between the specific components of food consumed and the occurrence of epileptic seizures. However, children with epilepsy demonstrated dietary preferences that were higher in energy, carbohydrates, and saturated fats, potentially affecting their overall nutritional status and exacerbating existing health conditions. Furthermore, malnutrition, particularly marked by lower Mid-Upper Arm Circumference Z-scores in children experiencing seizures, suggests a potential worsening of their seizure condition and general health ( $p=0.022$ ). Additionally, higher incidences of chewing difficulties and swallowing disorders were observed in children with seizures compared to those without.

**Conclusion:** This study underscores the necessity for specialized nutritional strategies to address malnutrition, improve health, and manage seizures in children with CP, emphasizing the role of balanced dietary intake over diets high in energy and fats.

**Keywords:** Epileptic seizures, nutrition, malnutrition, cerebral palsy

## INTRODUCTION

Cerebral palsy (CP) encompasses a group of disorders that impair individuals' ability to move, maintain balance, and posture.<sup>1</sup> This condition results from non-progressive brain damage or malformation occurring during fetal development, at birth, or in the early years of life and it is characterized as a lifelong neurological disorder.<sup>2,3</sup> According to the Centers for Disease Control and Prevention, the incidence of CP is reported to be 3.6 per thousand live births.<sup>4</sup> Individuals with CP often experience a range of associated conditions, including epilepsy, intellectual disability, and difficulties with feeding and swallowing.<sup>5</sup>

The relationship between epileptic seizures and nutrition in children with CP is complex and multifaceted. Epilepsy, which is a common comorbidity in CP, may significantly affect the nutritional status of the child.<sup>6</sup> Seizures may lead to malnutrition and other nutritional deficiencies by preventing nutrient intake and absorption.<sup>2</sup> In addition, some antiepileptic drugs used to manage epilepsy in children with CP may have negative effects on appetite, digestion, and nutrient absorption.<sup>7</sup>

On the other hand, malnutrition may also contribute to the development and severity of epileptic seizures in children with CP.<sup>8</sup> Malnutrition, which is common in this population, may increase the frequency and severity of seizures by leading to electrolyte imbalances, vitamin deficiencies and other metabolic disorders that may decrease the seizure threshold.<sup>6</sup> Meeting the nutritional needs of children with CP is critical for improving their general health and well-being.<sup>1,8</sup> In this study, we aimed to investigate the relationship between epilepsy and nutrition in children with CP.

## METHODS

This is a cross-sectional study conducted in a private physiotherapy and rehabilitation centre in Türkiye. The study was conducted between September and October 2024. Ethical approval was obtained from the İnönü University Clinical Research Ethics Committee (decision no: 2024/6331, date: 11.09.2024) in accordance with the Declaration of Helsinki. Participants and their mothers were informed about the study, and their written consent was obtained. The inclusion criteria were being diagnosed with CP between the ages of 3-15 years and voluntarily agreeing to participate in the study.

Within the scope of the research, 65 children diagnosed with CP were reached, and 7 of these participants declared that they did not agree to participate in the research left. As a result, 58 participants completed the study. Socio-demographic information, health information, 24-hour food consumption record, Gross Motor Function Classification System (GMFCS), and anthropometric measurements of the participants were obtained through face-to-face interviews. The presence of epileptic seizures was determined from the diagnoses in the medical reports.

GMFCS is an assessment system that classifies gross motor functions of children with CP at five levels. In this scale classification developed by Palisano et al.,<sup>9</sup> grade 1 refers to independent movement, grade 2 refers to partially assisted movement, grade 3 refers to the need for assisted walking, grade 4 refers to wheelchair use, and grade 5 refers to severe motor function limitations.

The 24-hour food consumption record was taken by recording the foods consumed by the children in the last 24 hours in accordance with the observations of the mothers of children with CP.

Anthropometric measurements, including height and Mid-Upper Arm Circumference (MUAC), of the children were taken with a non-flexible tape measure. Body weights were measured using a scale. Body mass index (BMI) Z-score, height-for-age (HFA) Z-score, and MUAC Z-score were calculated according to the World Health Organization Child Growth Standards.<sup>10</sup>

### Statistical Analysis

Data were analysed using IBM Statistical Package for the Social Sciences 22.0 software (IBM Corporation, New York, USA), and food consumption records were evaluated using BeBIS 8.2 package program (BeBIS software, İstanbul, Türkiye). Descriptive data were expressed as arithmetic mean, standard deviation, number,

### MAIN POINTS

- This study investigates the relationship between nutritional status and epileptic seizures in children with cerebral palsy (CP).
- Children with epilepsy have been found to consume diets with higher energy, carbohydrate and fat content, which may adversely affect their nutritional health.
- Malnutrition, particularly low Mid-Upper Arm Circumference Z-scores, is linked to worsening seizure conditions.
- The study results highlight the need for specific nutritional strategies to address malnutrition and improve seizure management in children with CP, and emphasize the importance of balanced diets rather than high-energy and fat-laden intake.

and percentage. The normal distribution of the data was evaluated using histograms, Q-Q graphs, and skewness and kurtosis values within the range of  $\pm 1.00$ . The Pearson chi-square test was used to analyze categorical variables. T-tests and t-tests were used to determine the differences between independent groups. The statistical significance level was accepted as  $p < 0.05$ .

## RESULTS

This study was conducted on 58 children with CP. The presence of epileptic seizures and general information about the participants are presented in Table 1. The mean age of children with epileptic seizures was  $7.83 \pm 3.54$  years, while the mean age of children without epileptic seizures was  $8.46 \pm 3.63$  years. A significant correlation was found between the type of birth of the participants and the presence of seizures ( $p = 0.014$ ). However, no significant relationship was found between gender, number of siblings, maternal and paternal education level, family income level, GMFCS, and the presence of seizures ( $p > 0.05$ ).

Information on the relationship between food consumption and the presence of epileptic seizure is shown in Table 2. Accordingly, no significant relationship was found between the presence of epileptic seizure and food components ( $p > 0.05$ ).

Information on the relationship between malnutrition scores and the presence of epileptic seizures is given in Table 3. MUAC Z-score was found to be lower in participants who reported epileptic seizures. No significant relationship was found between HFA Z-score and BMI Z-score values ( $p > 0.05$ ).

Information on epileptic seizures and nutritional problems is presented in Figure 1. Accordingly, 47.8% of the participants with epileptic seizures had chewing difficulties and 34.8% had swallowing disorders. In children with CP who did not have seizures, 31.4% had chewing difficulties and 17.1% had swallowing disorders.

## DISCUSSION

CP is a complication that can develop before, during, and after birth. The birth process in these patients brings many risks. In this study, no significant relationship was found between the birth weight of the participants and the presence of epileptic seizures.

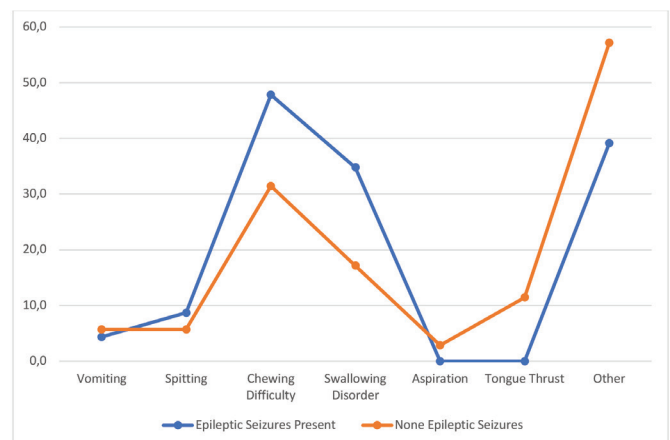


Figure 1. Nutritional problems according to the presence of epileptic seizures

**Table 1.** Distribution of general information according to the presence of epileptic seizures

		Epileptic seizures present (n=23)		None epileptic seizures (n=35)		Test	p
		Mean	SD	Mean	SD		
Age		7.83	3.54	8.46	3.63	-0.654 <sup>t</sup>	0.516
Birth weight		2472.17	879.69	2394.00	1110.15	352 <sup>U</sup>	0.422
Gender	<b>n</b>			<b>n</b>			
	<b>%</b>			<b>%</b>			
Gender	Woman	11	18.97	17	29.31	0.003 <sup>χ²</sup>	0.956
	Male	12	20.69	18	31.03		
Type of birth	Vaginal delivery	5	8.62	19	32.76	6.061 <sup>χ²</sup>	0.014
	Cesarean section	18	31.03	16	27.59		
Number of sibling	None	2	3.45	4	6.90	2.282 <sup>χ²</sup>	0.809
	1	7	12.07	7	12.07		
	2	12	20.69	20	34.48		
	3	2	3.45	2	3.45		
	4	0	0.00	1	1.72		
	5	0	0.00	1	1.72		
Father's education status	Primary education	8	13.79	14	24.14	4.351 <sup>χ²</sup>	0.226
	High school	6	10.34	15	25.86		
	University	9	15.52	6	10.34		
Mother's education status	Primary education	8	13.79	20	34.48	5.653 <sup>χ²</sup>	0.130
	High school	9	15.52	13	22.41		
	University	6	10.34	2	3.45		
Family income status	Income exceeds expenses	0	0.00	2	3.45	2.666 <sup>χ²</sup>	0.264
	Income and expenditure equal	14	24.14	15	25.86		
	Income less than expenditure	9	15.52	18	31.03		
GMFCS	Grade 1	9	15.52	15	25.86	2.012 <sup>χ²</sup>	0.733
	Grade 2	0	0.00	2	3.45		
	Grade 3	4	6.90	7	12.07		
	Grade 4	5	8.62	5	8.62		
	Grade 5	5	8.62	6	10.34		

<sup>t</sup>: Independent t-test statistic, <sup>U</sup>: Mann-Whitney U test statistic, <sup>χ²</sup>: Chi-square test statistic, p<0.05.  
GMFCS: Gross Motor Function Classification System, SD: Standard deviation

**Table 2.** The relationship between the participants' food consumption and the presence of epileptic seizures

		Epileptic seizures present		None epileptic seizures		Test	p
		Mean	SD	Mean	SD		
Food consumption	Energy	1304.54	430.85	1220.13	364.12	0.803 <sup>t</sup>	0.425
	Carbonhydrat	138.13	47.25	131.10	62.85	0.458 <sup>t</sup>	0.649
	Protein	48.20	19.27	46.60	14.48	0.360 <sup>t</sup>	0.720
	Lipid	61.46	19.71	54.44	15.68	1.506 <sup>t</sup>	0.138
	Saturated fat	24.92	7.93	21.93	6.71	1.542 <sup>t</sup>	0.129
	Fiber	15.27	9.55	12.27	5.85	326 <sup>U</sup>	0.224
	Antioxidant	2.01	2.20	1.54	1.36	0.915 <sup>t</sup>	0.367
	Glisemic index	146.70	58.01	133.11	103.90	0.570 <sup>t</sup>	0.571
	Water	1871.41	795.49	1646.94	562.79	1.259 <sup>t</sup>	0.213

<sup>t</sup>: Independent t-test statistic, <sup>U</sup>: Mann-Whitney U test statistic, p<0.05.  
SD: Standard deviation

**Table 3.** The relationship between the presence of epileptic seizures and malnutrition scores

	Z-score	Epileptic seizures				Test	p
		Available		None			
		n	%	n	%		
<b>MUAC Z-score</b>	<(-2 SD)	4	6.90	5	8.62	13.145 <sup>z</sup>	<b>0.022</b>
	(-2 SD)-(-1 SD)	1	1.72	5	8.62		
	(-1 SD)-median	3	5.17	12	20.69		
	Median-(1 SD)	12	20.69	7	12.07		
	(1 SD)-(2 SD)	1	1.72	6	10.34		
	>(2 SD)	2	3.45	0	0.00		
<b>HFA Z-score</b>	<(-2 SD)	9	15.52	13	22.41	3.597 <sup>z</sup>	0.463
	(-2 SD)-(-1 SD)	8	13.79	10	17.24		
	(-1 SD)-median	1	1.72	7	12.07		
	Median-(1 SD)	3	5.17	4	6.90		
	(1 SD)-(2 SD)	2	3.45	1	1.72		
	>(2 SD)	0	0.00	0	0.00		
<b>BMI Z-score</b>	<(-2 SD)	8	13.79	15	25.86	3.458 <sup>z</sup>	0.630
	(-2 SD)-(-1 SD)	4	6.90	7	12.07		
	(-1 SD)-median	5	8.62	4	6.90		
	Median-(1 SD)	4	6.90	6	10.34		
	(1 SD)-(2 SD)	0	0.00	2	3.45		
	>(2 SD)	2	3.45	1	1.72		

<sup>z</sup>: Chi-square test statistic, p<0.05.

MUAC: Mid-Upper Arm Circumference, HFA: Height-for-age, BMI: Body mass index, SD: Standard deviation

However, the mode of delivery was found to be associated with epileptic seizure, and the risk of it was significantly higher in children born by caesarean section. Ehrenstein et al.<sup>11</sup> analysed 277,435 births and reported that prolonged gestation was a risk factor for early epilepsy, and caesarean section may be associated with the risk of epilepsy. In addition, Li et al.<sup>12</sup> reported that the risk of epilepsy in preterm delivery was 2.16 times as high as in full-term delivery. The literature supports the findings of this study and suggests that complications related to labour may increase the risk of epilepsy.

When the effect of epileptic seizures on children's dietary preferences was analysed, no significant relationship was found between the food components consumed by the participants and epileptic seizures. However, it was observed that children with epilepsy preferred a diet with higher energy, carbohydrate, saturated fat, and a high glycaemic index. These dietary habits may lead to inadequate intake of some nutrients. Furthermore, although children with epileptic seizures are younger on average, their higher energy, carbohydrate, and saturated fat intake suggests that these children have unhealthy eating habits.

In a study, it was reported that unbalanced macro and micronutrient intake increased lack of seizure control in patients with epilepsy, and that high calorie intake and low vegetable consumption increased the likelihood of seizure.<sup>13</sup> Hameed and Aghdam<sup>14</sup> emphasised that sugar craving may be associated with epileptic seizures, and this condition is also associated with agitation. Szałwińska et al.<sup>15</sup> reported that irregular eating habits and lack of physical activity observed in adults with epilepsy, increased the risk of cardiovascular disease.

These findings indicate that the dietary habits of children with epilepsy should be improved. In particular, adoption of balanced and varied dietary patterns instead of diets containing high energy and saturated fat may improve the general health status of children and may help control seizures.

The relationship between epilepsy and malnutrition stands out as an important problem, especially in developing countries. Rogathe et al.<sup>16</sup> reported that epilepsy was not associated with malnutrition in a study conducted in Africa. On the other hand, Crepin et al.<sup>17</sup> reported that epilepsy was associated with malnutrition due to socio-cultural factors and anti-epileptic drugs. In another study, low-protein diets, micronutrient deficiencies, and socio-cultural attitudes were reported to contribute to malnutrition in individuals with epilepsy.<sup>18</sup> In this study, children with CP who had epileptic seizures experienced significant malnutrition compared to those who did not. It is thought that the different results in the literature are related to socio-economic reasons, age, gender and the drugs used. Soltani et al.<sup>19</sup> emphasised that patients with epilepsy were at risk of inadequate nutrient intake and needed special diets to protect their health and better control epileptic attacks.

In this study, nutritional problems among individuals diagnosed with CP were analysed in detail by comparing individuals with and without epileptic seizures. While, vomiting, spitting and aspiration complaints were similar in both groups, chewing difficulty and swallowing disorder were found at higher rates in individuals with epileptic seizures. These findings suggest that the risk of malnutrition is higher in children with CP who are also diagnosed with epilepsy compared to those without epilepsy. In addition, mothers whose children are malnourished prefer meals containing

higher levels of carbohydrates and fats to meet the energy needs of their children.<sup>20</sup> This explains the high energy, carbohydrate, and saturated fat intake in children with epileptic seizures.

### Study Limitations

While this study reveals the relationship between nutritional status and epileptic seizures in children with CP, it also has some limitations. The cross-sectional nature of the study limits the establishment of causal relationships, and the generalizability of the findings is restricted by the small sample size and single-centre design. In addition, parent-reported food consumption data carry the risk of recall bias.

### CONCLUSION

The presence of epileptic seizures in children with CP increases the risk of malnutrition by negatively affecting their eating habits and nutritional status. Special nutrition programmes are needed to regulate the eating habits of these children and to protect their health. Special nutrition programmes and nutrition interventions for children with epilepsy can make significant contributions to improving the quality of life.

### Ethics

**Ethics Committee Approval:** Ethical approval was obtained from the İnönü University Clinical Research Ethics Committee (decision no: 2024/6331, date: 11.09.2024) in accordance with the Declaration of Helsinki.

**Informed Consent:** Participants and their mothers were informed about the study, and their written consent was obtained.

### Footnotes

#### Authorship Contributions

Surgical and Medical Practices: H.A., Concept: H.T., Design: H.T., Data Collection or Processing: H.A., Analysis or Interpretation: H.T., Literature Search: H.T., H.A., Writing: H.T.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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