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# Multifactorial influences on constipation in children with cerebral palsy: a cross-sectional study of diet, motor function, and spasticity

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## ABSTRACT

**Objective:** Constipation is an important problem in cerebral palsy (CP) and its exact cause is not known. The aim of this study was to investigate constipation and related factors in children with cerebral palsy.

**Material and Methods:** This cross-sectional study was conducted with 68 children with CP between October 2024 and January 2025. Socio-demographic data, Gross Motor Function Classification System (GMFCS) scores, Functional Independence Measure for Children (WeeFIM), Modified Ashworth Scale (MAS), 24-hour food intake records, anthropometric measurements, and Bristol Stool Scale evaluations were collected.

**Results:** It was found that constipation complaints increased with higher GMFCS scores, while constipation complaints decreased with improved WeeFIM scores and increased carbohydrate intake (p=0.013; p=0.040; p=0.031, respectively). Additionally, constipation severity worsened as spasticity in the right and left adductor muscles increased (p=0.001; p=0.002, respectively). Malnutrition, as indicated by the upper mid-arm circumference z-score and Body Mass Index z-scores, was associated with increased constipation (p=0.019; p=0.040, respectively). Sixty-four point seven percent (64.7%) of the mothers reported using dried apricots to alleviate constipation in their children.

**Conclusion:** Managing constipation in CP requires a multidisciplinary approach, integrating nutritional counseling, motor rehabilitation, and spasticity control. This study highlights the need for comprehensive interventions, moving beyond diet modifications to include physical therapy and functional independence strategies for effective constipation management in CP.

**Keywords:** Cerebral palsy, Constipation, Diet, Spasticity, Malnutrition

## INTRODUCTION

Cerebral palsy (CP) is a neurodevelopmental disorder resulting from brain damage that occurs prenatally, during birth, or in early childhood, leaving lasting effects on muscle control, movement, and posture. CP, which is seen in approximately 1 to 4 in 1000 live births worldwide, is considered one of the most common motor disorders in childhood (1). While motor dysfunctions caused by CP significantly affect the quality of life, gastrointestinal problems such as constipation, which are common in these individuals, further reduce the quality of life (2).

Constipation is a complex condition characterized by issues such as decreased bowel movements, difficulty with defecation, and painful defecation in children with CP. Constipation, which usually has a multifactorial aetiology, is directly related to factors such as dietary habits, motor dysfunctions and spasticity (3). These problems impact children's physical and psychosocial health and lead to difficulties in daily activities (2).

Dietary habits play a critical role in the development of constipation. Deficiencies in fibre consumption, inadequate fluid intake, and feeding difficulties increase the incidence of constipation (4). Children with CP are reported to have specific dietary needs and often experience difficulty consuming solid foods. Inadequate fiber intake has been observed to exacerbate constipation by increasing stool hardness, which negatively affects bowel movements (1).

Motor function limitations make defecation processes difficult by negatively affecting intestinal motility. Constipation is more



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common in children with low levels of gross motor function and limited independent movement worsens this situation (5). In addition to motor dysfunctions, spasticity also increases the risk of constipation by making it difficult to control intestinal muscles (6). It has been observed that as spasticity severity increases, bowel movements slow down, and stool stays in the intestine longer, becoming harder (7).

Constipation management in children with CP requires a multidisciplinary approach. A combination of high fibre diets, increased physical activity and medical treatments is very important in this process (8).

Although several studies address nutritional or constipation issues in children with CP, studies that combine these factors and associate them with functional independence levels are insufficient. Therefore, this study aimed to investigate constipation and its related factors in children with CP.

## MATERIALS and METHODS

### Ethical dimension of the research

This cross-sectional study was conducted with 68 children with CP between October 2024 and January 2025. Since the participants did not have sufficient cognitive capacity for consent, their parents were informed in detail about the purpose and procedures of the study and their written informed consent was obtained.

### Sample calculation

Based on 56 people who applied to the centre between June and September 2024 and met the inclusion criteria, the sample size was determined as 49 with 95% reliability and 5% margin of error. Within the scope of the study, 72 participants were reached and 4 participants wanted to leave the study and as a result, 68 participants completed the study. The conditions for participation in the study were determined as being diagnosed with cerebral palsy between the ages of 3-15 years and accepting to participate voluntarily.

### Data collection tools

Socio-demographic data, Gross Motor Function Classification System (GMFCS) scores, Functional Independence Measure for Children (WeeFIM), Modified Ashworth Scale (MAS), 24-hour food intake records, anthropometric measurements, and Bristol Stool Scale evaluations were collected.

Gross motor functions of the participants were measured with the Gross Motor Function Classification System (GMFCS) developed by Palisano et al. (9). The system consisting of 5 grades was used to determine the degree of independence of motor skills of children and young people in activities of daily living.

Functional independence of children was measured with the WeeFIM scale adapted into Turkish by Tur et al. (10 ).This scale is a standardised tool used to assess functional independence of children in activities of daily living. This scale covers basic life activities such as how effectively children can eat, drink, dress, bathe and use the toilet on their own. The scale contains 18 items in total and each item assesses the child's ability to perform an activity independently with a scoring system from 1 to 7.

The Modified Ashworth Scale is widely used in the clinic to determine hip adductor muscle spasticity. This measurement method measures the resistance of the muscle during passive movement of the involved limb. The MAS was developed by adding a '1+' value to the assessment range of the Ashworth Scale between 0 and 4 and is one of the most widely used methods for spasticity assessment (11-13).

For food consumption records, food consumption records for the last 24 hours were obtained from the mothers. In addition, the participant mothers were asked what they consumed in case of constipation in their children.

Body weight of the participants was measured with a scale, and height and upper mid-arm circumference were measured with a non-flexible tape measure. For anthropometric measurements, body mass index (BMI) z-score, height-for-age (HFA) z-score and mid-upper arm circumference (MUAC) z-score were calculated according to World Health Organization (WHO) data (14).

Bristol scale was used for constipation measurements and mothers were asked to select the defecation option they observed in their children. According to the options, 1 was ranked as the most severe constipation and 7 as liquid stools (15).

### Statistical analysis

The data were analysed using IBM Statistical Package for the Social Sciences, version 22.0 (SPSS Inc., Armonk, NY, IBM Corp., USA). Food consumption records were evaluated using BeBIS 8.2 software. Descriptive statistics were presented as arithmetic mean, standard deviation, frequency and percentage. Histograms and Q-Q plots were used to assess whether the values for normal distribution, skewness, and kurtosis were within ±1.00. Analysis of variance and Kruskal-Wallis tests were used to determine differences between independent groups. Variance homogeneity was assessed using the Levene test, and Bonferroni test were applied for multiple comparisons. Additionally, Pearson and Spearman correlation tests were used to examine the linear relationship between variables. A p-value of <0.050 was considered statistically significant.

## RESULTS

In this study, which was conducted with a total of 68 participants, general information of children with CP is given in table I. The mean age of the children was 8.44±3.66 years. Among the

**Table I: General information**

| Variable | Values |
|---|---|
| Age* | 8.44±3.66 (6-11) |
| Birth weight* | 2353.68±1060.65 (1650-3000) |
| Gender† | |
| Famale | 32 (47.1) |
| Male | 36 (52.9) |
| Type of birth† | |
| Vaginal delivery | 29 (42.6) |
| C-section | 39 (57.4) |
| Number of sibling† | |
| None | 5 (7.4) |
| 1 | 15 (22.1) |
| 2 | 40 (58.8) |
| 3 | 5 (7.4) |
| 4 | 1 (1.5) |
| 5 | 2 (2.9) |
| Father's education status† | |
| Illiterate | 2 (2.9) |
| Primary education | 29 (42.6) |
| High school | 14 (35.3) |
| University | 13 (19.1) |
| Mother's education status† | |
| Illiterate | 5 (7.4) |
| Primary education | 33 (48.5) |
| High school | 23 (33.8) |
| University | 7 (10.3) |
| Family income status† | |
| Income exceeds expenses | 3 (4.4) |
| Income and expenditure equal | 32 (47.1) |
| Income less than expenditure | 33 (48.5) |
| GMFCS† | |
| Grade-I | 29 (42.6) |
| Grade-II | 4 (5.9) |
| Grade-III | 14 (20.6) |
| Grade-IV | 11 (16.2) |
| Grade-V | 10 (14.7) |

***:** *mean±SD (min-max),* **†:** *n(%),* ***GMFCS:*** *Gross motor function classification system*

**Table II: Distribution of GMFCS levels, food consumption, WeeFIM and adductor spasticity according to Bristol Stool Scale Score**

| Variable | mean±SD | r/rs* | p |
|---|---|---|---|
| Bristol Stool Score by GMFCS | | | |
| Grade I (n=29) | 3.83±1.65 | | |
| Grade II (n=4) | 5.50±1.73[a] | | |
| Grade III (n=14) | 3.79±1.12 | - | 0.013† |
| Grade IV (n=11) | 2.73±1.49[b] | | |
| Grade V (n=10) | 2.70±1.70[b] | | |
| Total Score (n=68) | 3.57±1.65 | | |
| Nutrient components | | | |
| Energy | 1208.63±359.29 | 0.224 | 0.067‡ |
| Carbonhydrat | 130.00±55.89 | 0.262 | 0.031‡ |
| Protein | 45.47±15.27 | 0.162 | 0.186‡ |
| Lipid | 54.39±16.39 | 0.085 | 0.488‡ |
| Fiber | 13.16±7.21 | 0.163 | 0.186‡ |
| Antioxidant | 1.65±1.57 | -0.014 | 0.908‡ |
| Water | 1675.91±651.72 | -0.103 | 0.405‡ |
| WeeFIM score | | | |
| Self-care | 11.06±13.12 | 0.055 | 0.656‡ |
| Sphincter control | 5.65±7.43 | 0.157 | 0.202‡ |
| Transfers | 7.74±10.72 | 0.107 | 0.383‡ |
| Locomotion | 8.57±6.94 | 0.036 | 0.771‡ |
| Communication | 12.35±10.23 | 0.064 | 0.605§ |
| Social cognition | 10.35±7.71 | 0.256 | 0.035§ |
| Total score | 16.47±12.78 | 0.249 | 0.040‡ |
| Adductor spasticity | | | |
| Right | 1.53±1.49 | -0.401 | 0.001‡ |
| Left | 1.46±1.43 | -0.368 | 0.002‡ |

***:** *Correlation coefficients between the Bristol Stool Scale Score and the related variables,* **†:** *One-Way ANOVA test,* **‡:** *Spearman correlation test,* **§:** *Pearson correlation test,* **a/b:** *Different superscript letters indicate statistically significant differences between groups,* ***GMFCS:*** *Gross Motor Function Classification System,* ***WeeFIM:*** *Pediatric Functional Independence Measure*

participants, 47.1% were female and 52.9% were male. Primary school was the highest level of education completed by 42.6% of fathers and 48.5% of mothers. The family income of 48.5% of the participants was less than their expenses.

The distribution of GMFCS grades, food consumption, WeeFIM and adductor spasticity of the participants according to Bristol Stool Scale Score is given in table II. Accordingly, it was found that constipation complaints of CP patients increased with increasing GMFCS grades. It was found that GMFCS grade 2 had a significantly higher Bristol score compared to grades 4 and 5, thus grades 4 and 5 had significantly higher severity of constipation than grade 2. (p=0.013). In the relationship between the participants' food consumption and Bristol Scale score, a weak positive significant relationship was found between carbohydrate intake and Bristol Scale score (p=0.031). In addition, no significant relationship was found between the amount of fibre consumed and the amount of liquid consumed and the Bristol Scale score (r=0.163; p=0.186). A correlational analysis between the Bristol Stool Scale Score and WeeFIM scores in individuals with cerebral palsy revealed low but statistically significant positive correlations with social cognition (r = 0.256, p = 0.035) and total functional independence scores (rs = 0.249, p =0 .040), suggesting that increased functional abilities are modestly associated with improved bowel function and reduced constipation. A moderate statistically significant negative correlation was observed between adductor spasticity and the Bristol Stool Scale Score, indicating that higher spasticity in the right (rs= –0.401, p = 0.001) and left (rs = –0.368, p = 0.002) adductors was associated with lower stool scores and thus increased constipation severity.

In evaluations based on MUAC z-scores, those with severe malnutrition (< -2 SD) were found to have significantly higher right and left adductor spasticity than those in the low-normal range (-1 SD to 0 SD) (p=0.002 and p=0.006, respectively). Constipation severity was found to be significantly lower in those with high/possible overnutrition (>+2 SD) compared to those in the normal (0 SD to +1 SD) and severe malnutrition (< -2 SD) groups (p=0.019).

**Table III: The relationship between MUAC, HFA and BMI z-scores and bristol stool scale, adductor spasticity**

| | Adductor spasticity | | | | Bristol Stool Scale | |
|---|---|---|---|---|---|---|
| | Right | | Left | | | |
| | mean±SD | p | mean±SD | p | mean±SD | p |
| MUAC Z-SCORE | | | | | | |
| Severe malnutrition (< -2 SD) | 2.70±1.06[a] | 0.002* | 2.70±0.82[a] | 0.006† | 2.90±1.37[b] | 0.019* |
| At risk of malnutrition (-2 SD to -1 SD) | 1.67±1.51 | | 2.00±1.67 | | 3.33±2.16 | |
| Low-normal range (-1 SD to 0 SD) | 0.80±1.15[b] | | 0.90±1.12[b] | | 4.00±1.89 | |
| Normal (0 SD to +1 SD) | 2.00±1.41 | | 1.71±1.38 | | 3.48±1.25[b] | |
| Mildly elevated (+1 SD to +2 SD) | 2.33±1.50 | | 2.00±1.50 | | 3.00±1.00 | |
| High / Possible overnutrition (>+2 SD) | 0.00±0.00 | | 0.00±0.00 | | 7.00±0.00[a] | |
| HFA Z- SCORE | | | | | | |
| Severe malnutrition (< -2 SD) | 2.11±1.40[a] | 0.044† | 2.07±1.30[a] | 0.041† | 3.71±1.51 | 0.863† |
| At risk of malnutrition (-2 SD to -1 SD) | 1.75±1.45 | | 1.55±1.43 | | 3.65±2.13 | |
| Low-normal range (-1 SD to 0 SD) | 0.67±0.87[b] | | 0.56±0.73[b] | | 3.44±1.42 | |
| Normal (0 SD to +1 SD) | 1.78±1.72 | | 1.78±1.64 | | 3.33±1.32 | |
| Mildly elevated (+1 SD to +2 SD) | 0.00±0.00 | | 0.50±0.71 | | 2.50±0.71 | |
| BMI Z- SCORE | | | | | | |
| Severe malnutrition (< -2 SD) | 1.45±1.53 | 0.422* | 1.59±1.53 | 0.471* | 3.18±1.65 | 0.040* |
| At risk of malnutrition (-2 SD to -1 SD) | 1.31±1.54 | | 1.25±1.48 | | 4.19±2.10 | |
| Low-normal range (-1 SD to 0 SD) | 1.91±1.70 | | 2.09±1.58 | | 4.45±1.29[a] | |
| Normal (0 SD to +1 SD) | 2.27±0.79 | | 1.91±0.54 | | 3.18±0.98 | |
| Mildly elevated (+1 SD to +2 SD) | 2.67±0.58 | | 0.67±1.15 | | 1.67±0.58[b] | |
| High / Possible overnutrition (>+2 SD) | 1.80±1.64 | | 2.00±1.41 | | 3.40±0.55 | |

***:** *Kruskal Wallis,* **†:** *One Way ANOVA test,* **a/b:** *Different superscript letters indicate statistically significant differences between groups,,* ***MUAC:*** *Mid-upper Arm Circumference,* ***BMI:*** *Body Mass Index,* ***HFA:*** *Height for Age*

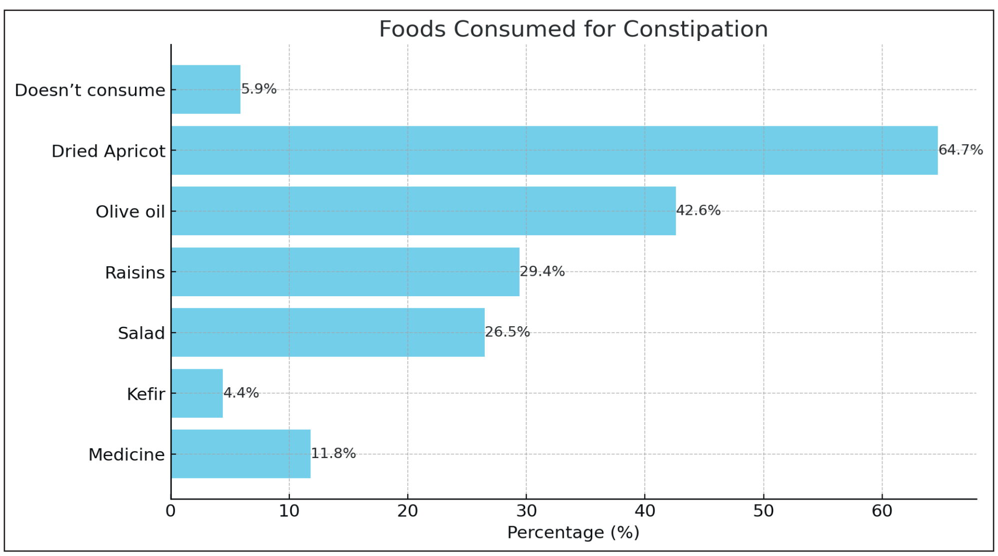


**Figure 1:** Food consumed for constipation

According to HFA z-scores, right and left adductor spasticity was significantly higher in those with severe malnutrition (< -2 SD) compared to those in the low-normal range (-1 SD to 0 SD) (p=0.044 and p=0.041, respectively).

In evaluations based on BMI z-scores, constipation severity was found to be significantly higher in those with mildly elevated (+1 SD to +2 SD) compared to the low-normal range (-1 SD to 0 SD) (p=0.040).

Information about the alternative methods used by the families of the participants against constipation complaints is shown in figure 1. Accordingly, 64.7% of the mothers stated that they consumed dried apricots, 42.6% olive oil and 29.4% raisins when their children complained of constipation.

## DISCUSSION

Our study found that constipation complaints increased with higher GMFCS grades in children with CP. The difference between GMFCS grade 2 and grades 4 and 5 was significant (p=0.013), indicating that children with higher GMFCS grades experienced more severe constipation. As GMFCS grades rise from one to five, decreased mobility, increased muscle tone and spasticity, and feeding difficulties may exacerbate constipation complaints. Particularly, the differences between grade 2 and grades 4 and 5 are notable, with constipation complaints being less severe in grade 2. These findings align with similar studies in the literature, highlighting that loss of motor function significantly impacts constipation in children with CP.

As the participants' social and functional independence scores increased, their Bristol scale scores also increased, indicating a decrease in constipation complaints. This finding was also supported by Günaydın and Tuncer (5) who found a significant negative relationship between functional independence and constipation (18). This suggests that psychological factors related to functional independence and social independence with increased mobility may help reduce constipation (18,19).

Constipation and adductor spasticity are distinct conditions that significantly impact quality of life. Constipation is marked by infrequent or difficult bowel movements, while adductor spasticity involves involuntary contraction of the thigh adductor muscles. Research suggests a potential link between these conditions, especially in neurodegenerative disorders. Enteric neurodegeneration, affecting gastrointestinal nerves, has been linked to constipation in aging populations (20). Spasticity, including adductor spasticity, can be influenced by non-neural factors such as soft tissue changes and muscle fatigue (21). A proposed mechanism involves age-related changes in vagal afferents, sensory nerves that innervate the gastrointestinal tract, leading to distortions in the reflex loop and contributing to both gastrointestinal and motor symptoms (22,23). In this study, a significant negative correlation was found between increased adductor spasticity and Bristol scale scores, indicating that higher adductor spasticity is associated with more severe constipation.

Our findings show a significant relationship between carbohydrate consumption and Bristol scale score. In the literature, constipation is frequently linked to diet, particularly carbohydrate intake, as carbohydrates—especially those rich in fibre—have significant effects on intestinal health (24). However, in our study, while total carbohydrate intake was associated with defecation frequency, no significant relationship was found between fibre consumption and Bristol scale scores. This discrepancy suggests that the effect of fibre on constipation management may be influenced by factors such as the type and quality of fibre consumed or individual variability in the gut microbiome (25,26). In particular, the fermentation capacity of dietary fibre and its interaction with the gut microbiota may play a key role in modulating fibre's effect on constipation. These interactions may explain why fibre intake alone did not result in significant changes in Bristol scale scores in our study. Furthermore, other dietary and lifestyle factors, such as physical activity, may have contributed to the observed results, highlighting the complex relationship between diet and constipation. However, no significant association was found between fluid intake and constipation in this study. Previous studies in healthy adults without constipation showed that decreased fluid intake led to reduced defecation frequency, with similar findings observed in studies of individuals with cerebral palsy (27, 28). This suggests that fluid intake may influence constipation, but other variables could mediate this effect in individuals with specific health conditions.

The relationship between MUAC z-score, HFA z-score and BMI z-score, which are the parameters by which malnutrition is measured in patients with CP, and constipation was analysed and it was found that constipation became more severe as weight gain increased according to MUAC z-score and BMI z-score. Similar results were found in a study conducted by Budokhane et al. (29) on CP patients in North Africa. In addition, it has been reported that inadequate food intake decreases intestinal transit time and is associated with constipation (30). Furthermore, it was found that adductor spasticity increased with increasing weakness according to MUAC z-score and HFA z-scores. Scarpato et al. (31) reported that malnutrition led to a decrease in muscle mass and impaired muscle function. This may lead to increased spasticity in adductor muscles.

Among the mothers who participated in the study, 64.7% used dried apricots, 42.6% used olive oil and 29.4% used raisins for constipation. Similarly, in Ghana, Capsicum frutescens L. and Citrullus lanatus were used as a solution to children's constipation complaints (32). In a study conducted among cancer patients in Türkiye, 39.4% used dried apricots and 28.8% used olive oil supplements for constipation (33). These food preferences are influenced by the diversity of endemic plants in the regions where they live and the presence of foods commonly consumed in Türkiye. This suggests that local flora is a determining factor in traditional medicine practices and daily diets.

## CONCLUSION

In conclusion, the importance of a multidisciplinary approach in managing and treating constipation in children with CP is emphasised. Rehabilitation programmes that promote functional and social independence, along with nutritional counselling, may play a key role in reducing symptoms. The findings may guide pediatricians and healthcare professionals in developing more comprehensive and individualised follow-up plans. Future studies should further examine these relationships with larger samples and explore additional contributing factors. A better understanding of structural and psychological influences will support the development of more effective management strategies. Raising awareness and educating parents and carers remains vital to improving children's quality of life.

### Limitations of the study

This study associated constipation with various factors in children with CP but has methodological limitations. The cross-sectional design precludes causal conclusions and the small sample size and limited geographical coverage reduce generalisability. The reliance on mothers' reports and a 24-hour dietary record leads to potential bias. Furthermore, the assessment of spasticity only in the adductor muscles may not reflect its overall effect on gastrointestinal function.

Despite these limitations, the study provides valuable information by combining dietary intake, motor function and spasticity. The use of validated scales and nutritional status indicators improves data reliability and clinical interpretation, making the study suitable for interdisciplinary care.

## Ethics committee approval

This study was conducted in accordance with the Helsinki Declaration Principles. Ethical approval was obtained from Inonu University Health Sciences Non-Interventional Clinical Research Ethics Committee in accordance with the Declaration of Helsinki (Ref. No: 2024/5887).

## Contribution of the authors

***Toğuç A:*** Constructing the hypothesis or idea of research and/or article, Planning methodology to reach the conclusions, Organizing, supervising the course of progress and taking the responsibility of the research/study, Taking responsibility in necessary literature review for the study, Taking responsibility in the writing of the whole or important parts of the study, Reviewing the article before submission scientifically besides spelling and grammar. ***Aydın H:*** Taking responsibility in patient follow-up, collection of relevant biological materials, data management and reporting, execution of the experiments, Taking responsibility in logical interpretation and conclusion of the results, Biological materials, taking responsibility of the referred patients. ***Fidan Z:*** Taking responsibility in patient follow-up, collection of relevant biological materials, data management and reporting, execution of the experiments, Providing personnel, environment, financial support tools that are vital for the study.

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## Conflict of interest

The authors declare that there is no conflict of interest.

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