

The effect of functional independence levels on sleep and constipation in children with cerebral palsy

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SUMMARY

OBJECTIVE: The study aimed to examine the effect of functional independence levels on sleep behavior and constipation in children with cerebral palsy.

METHODS: This cross-sectional observational single-center study was carried out in a special rehabilitation center in Istanbul. Inclusion criteria were those aged between 4 and 18 years with Gross Motor Function Classification System III-IV-V functional independence levels. Those who had surgery concerning intestinal health, had a chronic infectious bowel disease, had congenital intestinal anomalies, had received botox treatment in the last 6 months, had uncontrolled epileptic seizures, had complained of constipation in the last 6 months, and had cardiopulmonary disease were excluded from the study. The sociodemographic characteristics of the participants and the Gross Motor Function Classification System were recorded. Pediatric Functional Independence Scale (Functional Independence Measure for Children) was used to measure the functional independence level, Pediatric Sleep Questionnaire was used to measure the level of sleep problems, and Constipation Severity Scale was used to measure constipation severity.

RESULTS: A total of 60 children who were diagnosed with cerebral palsy were included. According to Gross Motor Function Classification System, 46.7% of the cases were Level III, 35% were Level IV, and 18.3% were Level V. There was a negative moderate significant correlation between Functional Independence Measure for Children and Pediatric Sleep Questionnaire ($r=-0.303$; $p=0.019$) and between Functional Independence Measure for Children and Constipation Severity Scale ($r=-0.342$; $p=0.007$).

CONCLUSION: We described that lower functional independence levels were related to worse sleep and constipation symptoms. The results suggest that effective strategies for developing functional independence levels may be beneficial for both sleep and constipation symptoms in the concept of cerebral palsy management.

KEYWORDS: Cerebral palsy. Constipation. Sleep.

INTRODUCTION

Abnormal muscle tone, muscle weakness, constipation, sleep problems, loss of motor control, decreased range of motion, and contractures are common problems in cerebral palsy (CP)^{1,2}. Sleep problems are experienced due to improper body position, pain, muscle spasms, pressure sensation, temperature, sweating, and digestive problems. Sleep problems, which may be due to different reasons, affect the physical and emotional states of children with CP and lead to a decrease in their quality of life^{3,4}. Obrecht et al., investigated sleep disorders and their relation with impairment in gross motor function and determined that gross motor function impairment level is correlated with maintaining sleep and the need for nocturnal support⁵.

One of the comorbidities that affect the quality of life in CP is constipation⁶. Constipation is a common chronic problem in most children with CP. As digestive system problems negatively affect the quality of life, assessment and control

of constipation are critically important in patients with CP. Constipation occurs due to uncoordinated muscle contractions, impaired rectal sphincter control, and insufficient fluid intake^{6,7}. Although it is thought that the decrease in functionality may be related to constipation and there is no study investigating this relationship, there are studies that aim to increase parasympathetic activity and achieve benefits by applying different intervention methods, similar to the parasympathetic activity mechanism, which is more active at rest after increased physical activity⁸⁻¹⁰.

Although there are different studies dealing with sleep or constipation problems in CP⁵⁻¹¹, to the best of our knowledge, there was no study that addresses both together and associates them with functional independence levels. For this reason, the study aimed to examine the effect of functional independence level on sleep behavior and constipation severity in children with CP.

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METHODS

Study design

This cross-sectional observational single-center study was carried out in a special rehabilitation center in Istanbul between September 2021 and April 2022. The study was approved by the (*anonymized*) University Non-Interventional Researches Ethics Committee (2021/015) and was registered in Clinicaltrials.gov (*anonymized*). The method and purpose of the study were explained to the families who participated in the study, and the children of the families who volunteered to be included in the study were assessed. The written informed consent was obtained from all the parents/legal guardians.

Participants

In this study, 60 volunteered children diagnosed with CP, who had attended the rehabilitation center continuously and were followed by a physiotherapist, at the Private Duha Special Education and Rehabilitation Center in Istanbul were included. Inclusion criteria were those aged between 4 and 18 years with Gross Motor Function Classification System (GMFCS) III-IV-V functional independence levels. Those who had surgery concerning intestinal health, had a chronic infectious bowel disease, had congenital intestinal anomalies, had received botox treatment in the last 6 months, had uncontrolled epileptic seizures, had complained of constipation in the last 6 months, and had cardiopulmonary disease that would prevent exercise were excluded from the study.

Assessments

The assessment, including sociodemographic data, functional independence level, sleep problems level, and constipation severity, was performed with an interview technique. The GMFCS was observed and recorded.

The *GMFCS* for CP is defined as a five-level classification system, evaluating self-initiated movements with particular emphasis on sitting (trunk control) and walking. The primary criterion is that differences in motor function between the levels are clinically significant. The aim was to determine which level best represents the child's current abilities and limitations in motor function. Therefore, it focuses on the child's usual performance in home, school, and community settings. There is less focus on the quality of the movement or its potential for improvement. Level I includes children with less neuromotor impairment and the children walk without restriction. At Level II, children walk with restrictions; at Level III, children walk by holding on to a moving vehicle; at Level IV, children walk with limited self-mobility; and at Level V, children are transported

in a manual wheelchair. As a result, as the level increases, the severity of the exposure increases¹². As constipation and sleep problems are predicted to be more common in children with GMFCS III-IV-V neuromotor disorders, it was determined as an inclusion criterion.

The *WeeFIM* is used to assess the functional independence of pediatric individuals. It consists of a total of 6 subtitles and 18 items: self-care, sphincter control, mobility, locomotion, communication, and social and cognitive domains. It has scores from 1 to 7 according to the supervision/help needed or the use of assistive devices to realize the situation specified in each area. The task is scored as 1, indicating complete dependence, and 7, indicating complete independence, promptness, and safety. As the score increases, there is an increase in the level of independence. A minimum of 18 points and a maximum of 126 points are taken. Notably, 18 points represent full dependency, and 126 points represent complete independence^{13,14}.

The *PSQ* assesses sleep-related problems in children aged 2–18 years and has three sections. Part A includes behaviors observed at night and bedtime and consists of 43 questions. Part B includes behaviors observed during the day and possible problems and consists of 23 questions. Finally, part C evaluates attention deficit and hyperactivity and consists of six questions. A high score on the scale indicates the presence of sleep problems^{15,16}.

The *CSS* is a concise, easy-to-use, reliable, and valid tool for assessing constipation severity and identifying subtypes of constipation. This scale contains questions about the frequency, intensity, and strain of defecation of individuals and consists of three parts: stool obstruction, large intestine laziness, and pain. The lowest score that can be obtained from the scale is 0 and the highest score is 73. High values indicate the severity of constipation^{17,18}.

Statistical analysis

It was calculated that the sample size should be 60 cases to have a medium-level correlation ($r=0.400$) target, 90% power, and 95% confidence level for our study¹⁹.

The IBM Statistical Package for Social Sciences Version 24 (SPSS Inc., Chicago, IL, USA) statistical program was used for data analysis. Descriptive statistics (mean, standard deviation, and percentile) were given for categorical and continuous variables in the study. The normality was determined by the Shapiro-Wilk test. Pearson correlation analysis was used depending on the conformity of the data to the normal distribution. The statistical significance level was accepted as $p<0.05$.

RESULTS

A total of 60 children who were diagnosed with CP were included in the study. According to GMFCS, 46.7% of the cases were Level III, 35% were Level IV, and 18.3% were Level V. Subjects' demographic and clinical characteristics are presented in Table 1.

There was a negative moderate significant correlation between WeeFIM and PSQ and CSS ($r=-0.342$ to 0.303 ; $p<0.05$) (Table 2).

DISCUSSION

This study aimed to determine the relationship between functional independence level, level of sleep problems, and constipation severity in children with CP, and the results revealed that sleep and constipation symptom severities were lower in children with higher functional independence levels.

Related to the motor and neurological symptoms such as spasticity, epilepsy, muscle spasms, and pain, sleep disturbances are frequent in CP. Romeo et al., specified that none of these factors alone were associated with sleep disorders, but the risk of developing abnormal patterns of sleep significantly increased with their presence. Also, they identified that mental retardation and level 5 on the GMFCS were associated with sleep disturbances²⁰. In another study, it was observed that higher gross motor function impairment was found to be correlated with disorders of initiating and maintaining sleep⁵. Consistent with

the literature, we determined that sleep problems decreased as functional independence levels increased. Increasing functional independence levels encompasses multi-parameter improvements, and since it also includes parameters that are considered risk factors for sleep problems, it is thought that sleep problems also decrease as the functional independence levels increase.

Constipation is a common comorbidity related to both neurological and lifestyle factors in CP. Veugelers et al., determined that the prevalence of constipation was 57%, which was significantly higher among children with severe motor disabilities in their study group⁶. Similarly, in our study, it was found that there is a correlation between functional independence levels and constipation, indicating that constipation symptom severity decreases with the increase in functional independence levels. In CP, a higher functional independence level means a better level of mobility and a less degenerated neural mechanism that allows functionality. Therefore, considering that neural and lifestyle factors are effective in constipation, it is expected that constipation symptoms decrease as the functional independence level increases.

Possible limitations of this study include the fact that the participants were not questioned about their diet and sensory problems and the disparity in the number of participants in each GMFCS group. Studies on constipation and sleep assessments with larger and symmetrical sample sizes will contribute to the management of these problems in CP.

Table 1. Subjects' demographic and clinical characteristic parameters (n=60).

	Mean	(SD)
Age (years)	8.67	3.722
Weight (kg)	32.35	16.362
Height (cm)	127.07	21.541
WeeFIM	74.17	11.28
PSQ	28.63	3.77
CSS	50.17	6.35

WeeFIM: Functional Independence Measure for Children; PSQ: Pediatric Sleep Questionnaire; CSS: Constipation Severity Scale.

Table 2. Correlations between functional independence, sleep, and constipation assessment results.

	WeeFIM		
	r	(95%CI)	p
CSS	-0.342	-1.019 to -0.178	0.007*
PSQ	-0.303	-1.595 to -0.180	0.019*

WeeFIM: Functional Independence Measure for Children; CSS: Constipation Severity Scale; PSQ: Pediatric Sleep Questionnaire; r: Pearson analysis correlation coefficient; *statistically significant: $p<0.05$.

CONCLUSION

We described the relationship between functional independence and both constipation and sleep symptom severities. Lower functional independence level was related to worse sleep and constipation symptoms. The results suggest that effective strategies for developing functional independence levels may be beneficial for both constipation and sleep symptoms in the concept of CP management.

ETHICAL ASPECTS

The study was approved by the Hasan Kalyoncu University Non-Interventional Research Ethics Committee (2021/015) and complies with the provisions of the Declaration of Helsinki.

AUTHORS' CONTRIBUTIONS

EIG: Data curation, Investigation, Methodology, Resources, Software, Writing – original draft, Writing – review & editing. **AT:** Formal Analysis, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing.

REFERENCES

1. Hollung SJ, Bakken IJ, Vik T, Lydersen S, Wiik R, Aaberg KM, et al. Comorbidities in cerebral palsy: a patient registry study. *Dev Med Child Neurol*. 2020;62(1):97-103. <https://doi.org/10.1111/dmcn.14307>
2. Pruitt DW, Tsai T. Common medical comorbidities associated with cerebral palsy. *Phys Med Rehabil Clin N Am*. 2009;20(3):453-67. <https://doi.org/10.1016/j.pmr.2009.06.002>
3. Wayte S, McCaughey E, Holley S, Annaz D, Hill CM. Sleep problems in children with cerebral palsy and their relationship with maternal sleep and depression. *Acta Paediatr*. 2012;101(6):618-23. <https://doi.org/10.1111/j.1651-2227.2012.02603.x>
4. Newman CJ, O'Regan M, Hensey O. Sleep disorders in children with cerebral palsy. *Dev Med Child Neurol*. 2006;48(7):564-8. <https://doi.org/10.1017/S0012162206001198>
5. Obrechth A, Almedia AF, Maltauro L, Silva WDL, Zonta MB, Souza Crippa AC. The relationship between gross motor function impairment in cerebral palsy and sleeping issues of children and caregivers. *Sleep Med*. 2021;81:261-7. <https://doi.org/10.1016/j.sleep.2021.02.055>
6. Veugelers R, Benninga MA, Calis EAC, Willemsen SP, Evenhuis H, Tibboel D, et al. Prevalence and clinical presentation of constipation in children with severe generalized cerebral palsy. *Dev Med Child Neurol*. 2010;52(9):216-21. <https://doi.org/10.1111/j.1469-8749.2010.03701x>
7. Park ES, Park C, Cho S-R, Na S, Cho YS. Colonic transit time and constipation in children with spastic cerebral palsy. *Arch Phys Med Rehabil*. 2004;85(3):453-6. [https://doi.org/10.1016/s0003-9993\(03\)00479-9](https://doi.org/10.1016/s0003-9993(03)00479-9)
8. Elbasan B, Bezgin S. The effects of reflexology on constipation and motor functions in children with cerebral palsy. *Pediatr Neonatol*. 2018;59(1):42-7. <https://doi.org/10.1016/j.pedneo.2017.01.005>
9. Tarsuslu T, Bol H, Şimşek İE, Erkanat Toyran I, Cam S. The effects of osteopathic treatment on constipation in children with cerebral palsy: a pilot study. *J Manipulative Physiol Ther*. 2009;32(8):648-53. <https://doi.org/10.1016/j.jmpt.2009.08.016>
10. Orhan C, Kaya Kara O, Kaya S, Akbayrak T, Kerem Günel M, Baltacı G. The effects of connective tissue manipulation and Kinesio taping on chronic constipation in children with cerebral palsy: a randomized controlled trial. *Disabil Rehabil*. 2018;40(1):10-20. <https://doi.org/10.1080/09638288.2016.1236412>
11. Ghorbanpour Z, Hosseini SA, Akbarfahimi N, Rahgozar M. Correlation between sleep disorders and function in children with spastic cerebral palsy. *Iran J Child Neurol*. 2019;13(3):35-44. PMID: 31327967
12. Palisano R, Rosenbaum P, Walter S, Russell D, Wood E, Galuppi B. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Dev Med Child Neurol*. 1997;39(4):214-23. <https://doi.org/10.1111/j.1469-8749.1997.tb07414.x>
13. Msall ME, DiGaudio K, Duffy LC, LaForest S, Braun S, Granger CV. WeeFIM. Normative sample of an instrument for tracking functional independence in children. *Clin Pediatr (Phila)*. 1994;33(7):431-8. <https://doi.org/10.1177/000992289403300709>
14. Aybay C, Erkin C, Elhan AH, Sirzai H, Ozel S. ADL assessment of nondisabled Turkish children with the WeeFIM instrument. *Am J Phys Med Rehabil*. 2007;86(3):176-82. <https://doi.org/10.1097/PHM.0b013e31802b8f8d>
15. Chervin RD, Hedger K, Dillon JE, Pituch KJ. Pediatric sleep questionnaire (PSQ): validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness, and behavioral problems. *Sleep Med*. 2000;1(1):21-32. [https://doi.org/10.1016/s1389-9457\(99\)00009-x](https://doi.org/10.1016/s1389-9457(99)00009-x)
16. Öner P, Barut Y, Öner Ö, Üneri ÖŞ, Bodur Ş, Turgut S, et al. [Reliability and validity of Turkish translation of the pediatric sleep questionnaire]. *Klinik Psikofarmakol Bulteni*. 2009;19(4):382-95.
17. Varma MG, Wang JY, Berian JR, Patterson TR, McCrea GL, Hart SL. The constipation severity instrument: a validated measure. *Dis Colon Rectum*. 2008;51(2):162-72. <https://doi.org/10.1007/s10350-007-9140-0>
18. Kaya N, Karaman Turan N. Reliability and validity of constipation severity scale. *Türkiye Klinikleri J Med Sci*. 2011;31(6):1491-501. <https://doi.org/10.5336/medsci.2010-22198>
19. Algina J, Olejnik S. Sample size tables for correlation analysis with applications in partial correlation and multiple regression analysis. *Multivariate Behav Res*. 2003;38(3):309-23. https://doi.org/10.1207/s15327906mbr3803_02
20. Romeo DM, Brogna C, Quintiliani M, Baranello G, Pagliano E, Casalino T, et al. Sleep disorders in children with cerebral palsy: neurodevelopmental and behavioral correlates. *Sleep Med*. 2014;15(2):213-8. <https://doi.org/10.1016/j.sleep.2013.08.793>

