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Investigation of The Effect of Gross Motor Function Level on Mental Health and Quality of Life In Individuals with Spastic Diparetic Cerebral Palsy

Spastik Diparetik Serebral Palsili Çocuklarda Kaba Motor Fonksiyon Seviyesinin Mental Sağlık ve Yaşam Kalitesi Üzerine Etkisinin İncelenmesi

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ABSTRACT

This study aimed to investigate the impact of gross motor function levels on mental health and quality of life in individuals with spastic diparetic Cerebral Palsy (CP). A total of 37 individuals with spastic diparetic CP, aged 13–18 years, were included in this cross-sectional study. Gross motor functional impairment was assessed using the Gross Motor Function Classification System (GMFCS). Mental health was evaluated via the Revised Child Anxiety and Depression Scale (RCADS), and quality of life was measured using the Cerebral Palsy Quality of Life Questionnaire for adolescents (CPQOL-teen). No statistically significant differences were observed among individuals at GMFCS levels I, II, and III regarding Social Phobia, Panic Disorder, Major Depressive Disorder, Separation Anxiety Disorder, Obsessive-Compulsive Disorder, or Total Internalizing Scale scores ($p>0.05$). However, significant differences were found in Generalized Anxiety Disorder and Total Anxiety Scale scores ($p<0.05$). Additionally, CPQOL scores did not differ significantly between groups based on GMFCS levels ($p>0.05$). The findings suggest that gross motor function level does not significantly affect quality of life or most mental health parameters in individuals with diparetic CP, with the exception of anxiety-related outcomes.

Anahtar Kelimeler: Cerebral Palsy, Diparetic, Mental Health, Quality of Life

ÖZ

Bu çalışma, spastik diparetik Serebral Palsili (SP) bireylerde kaba motor fonksiyon seviyesinin ruh sağlığı ve yaşam kalitesi üzerindeki etkisini incelemeyi amaçlamaktadır. Kesitsel tipteki bu çalışmaya, 13-18 yaş aralığında spastik diparetik SP tanılı 37 birey dâhil edilmiştir. Kaba motor fonksiyonel bozukluğun şiddeti Kaba Motor Fonksiyon Sınıflandırma Sistemi (GMFCS), ruh sağlığı Çocuklarda Yenilenmiş Anksiyete ve Depresyon Ölçeği (RCADS), yaşam kalitesi ise Serebral Palsi Yaşam Kalitesi Ölçeği (CPQOL)-ergen formu ile değerlendirilmiştir. GMFCS seviye I, II ve III olan bireylerin Sosyal Fobi, Panik Bozukluk, Majör Depresif Bozukluk, Ayrılık Kaygısı Bozukluğu, Obsesif-Kompulsif Bozukluk ve Toplam İçselleştirme Ölçeği sonuçları arasında istatistiksel olarak anlamlı bir fark saptanmamıştır ($p>0,05$). Ancak Yaygın Anksiyete Bozukluğu ve Toplam Anksiyete Ölçeği puanlarında gruplar arasında anlamlı fark gözlenmiştir ($p<0,05$). Ayrıca, GMFCS seviyelerine göre gruplar arasında CPQOL sonuçları açısından istatistiksel olarak anlamlı bir fark bulunmamıştır ($p>0.05$). Diparetik SP'li bireylerde kaba motor fonksiyon seviyesinin, anksiyete dışındaki ruh sağlığı parametreleri ve yaşam kalitesi üzerinde belirgin bir etkisi olmadığı sonucuna varılmıştır.

Keywords: Serebral Palsi, Diparetik, Ruh Sağlığı, Yaşam Kalitesi

The study was approved by the Bingöl Scientific Research and Publication Ethics Committee (Approval number: 24/14; Approval Date: 18.07.2024).

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INTRODUCTION

Cerebral Palsy (CP) is defined as a group of lifelong conditions caused by non-progressive brain lesions occurring in early childhood, affecting the development of movement and posture (1). These motor deficits are frequently accompanied by secondary impairments, including cognitive, speech, hearing, visual, and behavioral disorders, as well as epilepsy (2). Among its clinical presentations, diparetic CP is characterized by a greater involvement of the lower extremities compared to the upper extremities (3).

Individuals with CP are at a higher risk for mental health problems due to various social and physical risk factors. Physical factors such as reduced physical activity, sleep disturbances, and chronic pain further elevate the risk of developing mental health disorders. . These physical risk factors for mental health disorders are commonly reported symptoms in individuals with CP (4). Despite their prevalence, the mental health needs of individuals with CP are often less visible and frequently overlooked by healthcare practitioners. Emerging evidence indicates that individuals with CP prioritize social participation over physical recovery (5, 6).

Impaired motor function and movement limitations often restrict individuals with CP from engaging in age-appropriate activities, which may lead to lower levels of well-being and quality of life (QoL) (2, 7). QoL is a multidimensional construct representing a general assessment of well-being across various life domainsand is an overall assessment of health in all areas (8). In clinical research, physical and mental health are often integrated into the concept ofhealth-related quality of life (HRQoL), where mental health problems serve as significant predictors of poorer HRQoL outcomes (5, 9).

Studies have shown that QoLand HRQoL are compromisedin individuals with CP. The degree of impairment is closely associated withthe level of independence in daily activities, the severity of motor impairment, mobility, clinical limitations, and social interactions (10). Therefore, identifying the parameters that influence QoL is crucial. In pediatric and adolescent populations, QoL is heavily influenced by functional status (11). Functional assessments are frequently utilized as proxies for QoL, under the assumption that functional status, physical/mental health, and QoL are interconnected constructs (7).

Gross motor function level, as categorized by the Gross Motor Function Classification System (GMFCS), has been associated with lower HRQoL in several studies (9, 12, 13). However, this relationship is not consistent across all sub-dimensions. While mobility is positively correlated with physical well-being, its correlation with psychosocial well-being remains inconsistent (2, 14). Although current literature suggestsa weak or insignificant relationship between motor functioning and psychosocial QoL domains, the increased risk of psychosocial problems necessitates more detailed investigations (15).

Since CP is a lifelong condition, monitoring and preserving mental health and QoL is essential for timely intervention and holistic rehabilitation in pediatric and adolescent healthcare. Given the inconsistencies in the literature regarding the relationship between gross motor function level, mental health and QoL in individuals with CP (2, 14) and the lack of studies focusing on specific CP subgroups, further research is required. Examining the relationship between gross motor function level mental health and QoL in children with CP in different CP subgroups may help to clarify this uncertainty. Therefore, this study specifically focuses on individuals with diparetic CPto describe their mental health and QoL and to examine the impactof gross motor function level/mobility on these parameters.

MATERIALS AND METHODS

Study design

This study was designed as a non-invasive, cross-sectional study to examine the effects of gross motor function levels on mental health and QoL in individuals with diparetic CP. The study protocol was approved by the Bingöl University Scientific Research and Publication Ethics Committee (Approval number: 24/14; Approval Date: 18.07.2024) and was conducted in accordance withthe Declaration of Helsinki. Prior to data collection,, written informed consent was obtained from all participants and their legal guardians.

Participants

The current study included individuals aged 3-18 years diagnosed with spastic diparetic CP. Inclusion criteria were: having the cognitive and communicative capacity to complete the evaluations, no history of orthopedic surgery within the last six months, and no Botulinum toxin (Botox) injections in the preceding 6 months. Exclusion criteria included uncontrolled seizures, musculoskeletal surgeries within the last 6 months that would impede participation and reluctance or inability to comply with the evaluation procedures. Initially, 40 participantswith spastic diparetic CP were screened, and three were excluded for notmeeting the inclusion criteria. Consequently, a total of 37 participantswere included in the finalanalyses.

Sample size and randomization

A pre-study power analysis was conducted with $\alpha=0.05$ and $1-\beta(\text{power})=0.80$. Based on a predicted difference of 2.19 units in QoL scores between individuals with spastic diparetic CP (7.31±3.01) and typically developing peers (9.50±0.90) (16) a minimum sample size of 34 subjects was required. The study population was drawn from Special Education and Rehabilitation Centers in Bingöl. Participants meeting the inclusion criteria were selected from the target population using a simple random sampling method.

Measurements

Demographic datasuch as gender, age (years), weight (kg), height (cm), body mass index (BMI), and the caregiver's education level were recorded using a structured form.

The Gross Motor Function Classification System (GMFCS): The GMFCS was used to categorize the current gross motor level and limitations of the participants (17). Functional levels in the GMFCS range from I to V (I, walks without restrictions; II, walks with limitations; III, walks using a hand-held mobility device; IV, self-mobility with limitations; V, transported in a manual wheelchair). This system is widely recognized as valid, reliable, and stable tool for assessing functional status across different age groups (18).

The Revised Child Anxiety and Depression Scale (RCADS): RCADS was used to assess mental health. The scale was developed by Chorpita et al. to measure anxiety and depression based on DSM-IV criteria and is available in child and parent forms (19). The scale consists of 6 subscales, including general anxiety disorder, separation anxiety disorder, panic disorder, obsessive-compulsive disorder, social anxiety disorder, and major depressive disorder, and a total of 47 items. Items are scored from 0 to 3, with higher scores indicating increased symptoms (19). The Turkish version has been validated for children and adolescents aged 8–17 years (20). The self-report "child form" was utilized in this study.

The Cerebral Palsy Quality of Life Questionnaire (CPQOL): CPQOL is an instrument that assesses various aspects of individuals' QoL. It is available in two versions: the CPQOL-Child for assessing the quality of life of children aged 4-12, and the CPQOL-teen for adolescents aged 13-18 (21). In our study, CPQOL-Teen, which is based on the statements of the participants, was used. The questionnaire consists 72 questions across six domains: general well-being and participation, communication, and physical health, school environment, social well-being,

and attitudes toward disability. The total score ranges from 0 to 100, where higher scores represent superior QoL (22).

Statistical analysis

Data were analyzed using SPSS 27 version. Normality was evaluated with visual (probability and histogram plots) and analytical methods (Kolmogorov-Smirnov and Shapiro-Wilk tests). Categorical variables were expressed as frequencies (n) and percentages (%), while continuous variables were presented as mean ± standard deviation or median (min-max). Since the data did not meet normality assumptions, Kruskal Wallis test was used for the comparison of three groups. In cases of statistical significance, post-hoc tests were applied to determine which pairwise comparisons caused the relevant difference. The level of significance was set at $p<0.05$.

Limitations

Our study has certain limitations, including the absence of a control group and the lack of participants representing GMFCS levels IV and V.

RESULTS AND DISCUSSION

A total of 37 adolescents with spastic diparetic CP (aged 13–18 years) were included in the study. The participants' functional levels ranged from GMFCS Level I to III. Demographic and clinical characteristics are summarized in Table 1.

Table 1. Demographic and Clinical Characteristics of Participants

Variable		X	SS
Age	Age	14,57	1,9
		n	%
Gender	Female	19	51,4
	Male	18	48,6
Psychiatric treatment history	Yes	7	18,9
	No	90	81,1
Psychiatric drug use	Yes	4	10,8
	No	33	89,2
GMFCS	Level I	17	45,9
	Level II	12	32,4
	Level III	8	21,6
CFCS	Level I	31	83,8
	Level II	3	8,1
	Level III	3	8,1

GMFCS, Gross Motor Function Classification System; CFCS, Communication Function Classification System; X, Ortalama; SS, Standart Sapma

The RCADS scores across GMFCS levels are presented in Table 2. Comparative analysis of RCADS subscales—including Social Phobia, Panic Disorder, Major Depressive Disorder, Separation Anxiety Disorder, Generalized Anxiety Disorder (GAD), Obsessive-Compulsive Disorder, Total Anxiety, and Total Internalizing Scale—revealed no statistically significant differences between GMFCS levels I, II, and III ($p>0.05$), with the exception of GAD and Total Anxiety scores ($p<0.05$). Post-hoc pairwise comparisons indicated that the significant difference in GAD scores originated from comparisons between Group 1–Group 2 and Group 1–Group 3. For the Total Anxiety Scale, a significant difference was observed specifically between Group 1 and Group 2.

The CPQOL-teen results according to GMFCS levels are detailed in Table 3. No statistically significant differences were found between the groups across any CPQOL domains based on functional levels ($p>0.05$). Additionally, Kruskal-Wallis test results showed no significant differences between groups regarding psychiatric medication use or history of psychiatric treatment.

Table 2. Revised Child Anxiety and Depression Scale Results According to Participants' Mobility Levels

	GMFCS				Difference Between Groups (Post-Hoc Tests) **
RCADS subdimensions	I Median (min-maks)	II Median (min-maks)	III Median (min-maks)	*p**	
Social phobia	8,50(1-13)	11(5-21)	10,50(3-15)	0,065	-
Panic disorder	4(0-8)	4(0-13)	6(0-18)	0,649	-
Major depressive disorder	6(2-11)	8(0-17)	8,50(2-12)	0,620	-
Separation anxiety disorder	5,50(2-12)	5(0-13)	4,50(2-12)	0,497	-
Generalized anxiety disorder	4,50(1-12)	9(2-16)	8,50(5-17)	**0,042**	I-II I-III
Obsessive compulsive disorder	2(0-9)	7(0-11)	4(0-10)	0,301	-
Total Anxiety Scale	23,50(15-49)	36(17-46)	38(15-61)	**0,035**	I-II
Total Internalizing Scale	31,50(25-60)	43(20-59)	45,50(17-70)	0,097	-

* Kruskal Wallis Testi; **, Mann-Whitney U Testi; GMFCS, Gross Motor Function Classification System; RCADS, Revised Child Anxiety and Depression Scale

Table 3. Cerebral Palsy Quality of Life Questionnaire Results According to Participants' Mobility Levels

	GMFCS			
CPQOL subdimensions	I Median (min-maks)	II Median (min-maks)	III Median (min-maks)	*p**
General wellbeing and participation	75,50 (47,02-84,14)	69,49 (46,42-82,19)	64,42 (39,28-88,09)	0,524
Communication and physical health	71,37 (28,78-79,84)	65,85 (51,56-83,87)	60,95 (49,21-82,81)	0,432
School wellbeing	81,25 (39,06-96,21)	73,56 (58,56-90,93)	67,87 (47,68-100)	0,469
Social wellbeing	92,28 (48,20-100)	85,71 (66,07-100)	85,78 (57,14-96,42)	0,314
Feelings about functioning	75 (17,1-100)	73,20 (39,20-97,10)	51,25 (15-85,5)	0,078

* Kruskal Wallis Testi; p<0,05; GMFCS, Gross Motor Function Classification System; CPQOL, Cerebral Palsy Quality of Life Questionnaire

This study investigated the impact of gross motor function levels on mental health and QoL in individuals with diparetic CP. The findings suggest that gross motor function level does not significantly influence QoL subscales or most mental health parameters, except for anxiety-related outcomes.

While previous research has highlighted significant mental health challenges in children and adolescents with CP (23, 24) the specific factors driving these issues remain under-investigated. In our study, although individuals at GMFCS Level III had higher mean scores for anxiety and depression symptoms compared to Level II, and Level II higher than Level I, these differences were not statistically significant. Notably, only anxiety-related subparameters significantly differed, with GMFCS Level I participants exhibiting higher anxiety symptoms.

This finding may be attributed to the "social comparison" phenomenon; individuals

with milder disabilities (Level I) may more frequently compare themselves with non-disabled peers, potentially leading to increased psychological distress. Supporting this, some literature suggests that mental health diagnosis rates are inversely proportional to GMFCS severity, with higher-functioning children often facing greater psychological pressure (25). Similarly, young adults at GMFCS levels III–V have been reported to perceive their mental health more positively than those at levels I–II (26). Salie et al. argued that individuals with more severe physical impairments (Levels IV–V) might adapt to their limitations relative to peers, whereas those at Levels I–III may maintain higher expectations for physical achievement, which is associated with increased anxiety and depression (27). Conversely, other studies found no such GMFCS-related differences in mental health (28).

Regarding QoL, we utilized the CPQOL-teen due to its strong psychometric properties and its ability to evaluate well-being and participation rather than just functional performance (29,30). Our results showed that while Level I participants had higher descriptive QoL scores than Level II, and Level II higher than Level III, these differences did not reach statistical significance. This aligns with several studies reporting no direct relationship between GMFCS levels and health-related quality of life (HRQoL) (23, 31-33).

However, the literature remains divided. Some researchers have found that motor severity predicts physical well-being domains but has a weak or non-existent relationship with psychosocial domains (13, 34, 35, 36). The inconsistencies in these results may stem fromdifferences in assessment tools, participant characteristics across studies, or grouping strategies. In addition, based on the knowledge that gross motor function levels may be a greater factor related to the QoL in children with more severe disorders (37), our study focused exclusively on GMFCS levels I, II, and III. The exclusion of levels IV and V (more severe impairment) may have limited our ability to detect a broader functional effect on QoL. In addition, differences in the grouping of participants may have affected this result. In our current study, GMFCS levels were considered as 3 separate groups I, II, and III, while in some studies, GMFCS levels were grouped differently (GMFCS I-III and IV-V) (23).

CONCLUSION AND RECOMMENDATIONS

In conclusion, this study demonstratesthat gross motor function level, as classified by the GMFCS, does not significantly impact the majority of mental health parameters or the overall QoL in individuals with spastic diparetic Cerebral Palsy. However, a notable exception was observed regarding anxiety; individuals with higher functional levels (GMFCS Level I) exhibited significantly higher anxiety symptoms compared to those with greater motor limitations. This finding underscores the importance of monitoring psychological well-being even in individuals with mild physical involvement.

Based on these findings, it is recommended that professionals and rehabilitation teams adopt a holistic approach that integrates mental health screenings into routine physical assessments. For future research, larger and more diverse cohorts -including participants across all functional levels (GMFCS I through V) - should be utilized. Furthermore, longitudinal studies with balanced group sizes across different GMFCS levels are necessary to better understand the long-term trajectories of mental health and QoL in this population.

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