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A cross-sectional study determining the relationship between eating and drinking skills and functional independence levels of patients with cerebral palsy

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Ethics Committee Approval
Ethics Committee approval was taken from the Ethics Committee of Health Sciences University Kocaeli Derince Training and Research Hospital (date: February 13, 2020; number: 2020-2). All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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

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Abstract

Background/Aim: In cerebral palsy (CP), drinking/eating disorders are considered common. To evaluate these disorders, a very detailed and lengthy evaluation is required. Few tools are available to identify children who need to be evaluated. This study determined whether the functional independence level of children with CP is sufficient to predict their drinking/eating skills and to determine the relationship between this functional level and these skills.
Methods: A total of 105 children with CP aged 4–8 years participated in a cross-sectional study in our outpatient clinic. Functional classification was assigned using the Gross Motor Function Classification System and Manuel Ability Classification System (GMFCS and MACS, respectively). For a functional assessment of daily life, the Pediatric Evaluation of Disability Inventory (PEDI) was performed by asking a relative of the child. The Eating and Drinking Abilities Classification System (EDACS) level was added to the study after asking the caregivers of the patients for eating/drinking evaluations.
Results: According to the current results, we found a negative correlation between EDACS and PEDI scores. As the EDACS grade increased, the PEDI subscale and total scores decreased in a statistically significant manner ($P < 0.001$), while the GMFCS and MACS scale increased statistically ($P < 0.001$). As the PEDI subscale and total scores increased, the levels of GMFCS and MACS decreased in a statistically significantly ($P < 0.001$).
Conclusions: The performances of children with CP in terms of activities of daily living are closely related to their performance in eating/drinking activities. If children are independent in their mobility, social functions, and daily self-care, they are also more independent in terms of eating/drinking.

Keywords: Cerebral palsy, Eating and Drinking Abilities Classification System, Gross Motor Function Classification System, Manuel Ability Classification System, Pediatric Evaluation of Disability Inventory

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Introduction

Cerebral palsy (CP) is defined as some non-progressive, permanent but unchanged movement or posture and motor function disorders due to lesions or abnormalities of the immature/developing brain [1,2]. The resulting activity restrictions impact both gross and fine motor movements, drinking and eating, and speech and communication [3–5]. A simple functional capacity grading system has been used by clinicians and researchers over the past two decades [3]. The development of functional scales, such as the Gross Motor Function Classification and Manuel Ability Classification Systems (GMFCS and MACS, respectively) for CP has revolutionized the way we define gross motor and manual abilities in these patients [6,7]. Daily living instrumental activities constitute the broader activities necessary for independent living, including social tasks and community mobility. For rapid diagnosis and treatment, children with disabilities are examined over their daily activities using three areas: (1) mobility, (2) self-care and (3) social function [8]. The Pediatric Evaluation of Disability Inventory (PEDI) examines the tasks that children can perform in their daily lives [9].

Nutritional difficulties are an important component of the pathogenesis of malnutrition in children with CP and can cause an increase in the risk of growth retardation. One of the main measures of health in children is physical growth. Malnutrition causes a decrease in brain function and respiratory muscle strength, immune function impairment, growth retardation, impaired blood circulation, and poor wound healing [10–12]. People with CP have difficulties in closing their lips when swallowing, which contributes to escape of the food bolus and malnutrition and prevents assessment of effective food intake [10,11]. Prevention, diagnosis, and early treatment of nutritional problems in children with CP have been considered, and their importance in preventing acute and chronic negative consequences has been investigated. The assessment methods for investigating the detailed feeding/swallowing and nutrition for all children with CP are too lengthy and complex to be routinely completed. Early detection of feeding/swallowing problems or malnutrition in children using a valid screening tool can be beneficial for comprehensive evaluation and treatment [13]. The Eating and Drinking Abilities Classification System (EDACS) was recently developed to categorize eating and drinking abilities in CP patients and is similar to other functional classification systems [14,15]. EDACS describes all drinking/eating abilities of children and young people with CP from 3 to 5 years of age at different levels using the basic features of efficiency and safety in nutrition. EDACS focuses on a person's normal drinking, chewing, biting, and swallowing performance in addition to coordination of these activities with breathing. Details of food and liquid tissues that can be managed without choking or aspiration have been described at different ability levels [16].

When the literature is reviewed, no comprehensive study examining the relationship between eating/drinking, daily living functions, and participation in these activities in children with CP can be found. This study investigated the association between the levels of activities of daily living of children with CP, the level of participation in these activities, and the EDACS classification levels that classify their performance in eating/drinking activities. In this respect, our study will contribute to the literature concerning this topic.

Materials and methods

Before the study, ethics committee approval was obtained from Health Sciences University Kocaeli Derince Training and Research Hospital (2020-2). Power analysis was done before the study. At least 93 children with CP were included in the study to test the statistical significance of a correlation of at least 0.30 between their abilities in daily living activities and their eating and drinking skills classification system (EDACS) scores at the 85% power and 5% error level. One hundred five children with CP between the ages of 4 and 8 who were admitted to our outpatient clinic between February and March 2020 with GMFCS grades 1–5 and MACS grades 1–5 were included in the study. Written consent for participation in the study was obtained from the person caring for the patient before the study. Demographic data of the patients were recorded. History taking and neurological examinations of the patients were performed by experienced physiatrists. Functional classification was based on both GMFCS and MACS results. For functional assessment of daily life, PEDI was performed by asking the patient’s caregiver. For the evaluation of eating and drinking function, EDACS level was also recorded by asking the patient’s caregiver.

Measurement

Gross Motor Function Classification System (GMFCS)

GMFCS is a standardized classification system developed by Palisano et al. [17, 18] in 1997 and expanded in 2007 for classifying the gross motor functions of children with CP. It is a standardized method that classifies gross motor function at five levels, especially motor function differences in terms of sitting and walking in children with CP [17, 19, 20]. The groups were determined as <2, 2–4, 4–6, 6–12, and 12–18 years old [18].

Manuel Ability Classification System (MACS)

MACS was developed by Eliasson et al. [21]. MACS specifies details related to hand function in daily activities of children with CP. MACS defines five levels. The determination of levels is according to the child’s capability to hold objects by herself/himself and the need for help and adaptation in performing daily life’s manual activities. The MACS assessment also highlights the differences between the two close levels to facilitate matching the desired level with the patient [21]. The MACS was designed to be used in children aged 4–18 and as a mini MACS in children between 1 and 4 years [9]. It is valid in Turkish (ICC: 0.89-0.96) and has been proven to be reliable (Spearman’s rho: 0.91–0.98) [22].

Pediatric Evaluation of Disability Inventory (PEDI)

PEDI is a comprehensive clinical evaluation scale developed and used in 1992 by Haley et al. [8] to determine children's functional performance and capability from six months to 7.5 years old. It is a scale used to find the presence of functional deficits or delays in the clinic and its area and degree(if any). Erkin et al. [23] conducted a Turkish validity (Cronbach alpha >0.98 and intraclass correlation coefficient

[ICC] > 0.96) and reliability (Spearman rho > 0.86) study with 573 healthy children aged between six months and 7.5 years. PEDI is one of the most appropriate functional scales for all children with physical disability and/or both physical and cognitive impairment. PEDI consists of three main scales: (1) modifications, (2) caregiver assistance, and (3) functional skills. Each of these scales consists of 197 items addressing social function, mobility, and self-care to evaluate a child's daily activities in terms of both ability and performance. PEDI has two main sub-sections: (1) functional skills and (2) caregiver assistance [8, 24, 25].

Eating and Drinking Abilities Classification System (EDACS)

EDACS was created to classify CP children's eating and drinking functions and determine whether they can perform safe and effective eating and drinking abilities [14]. A Turkish translation and cultural adaptation study was done by Kerem Günel et al. [26]. This system has five different levels that categorize a patient's abilities ranging from level 1, which is independent eating and drinking, to level 5, which indicates maximum challenges to eating and drinking. This system is divided into three levels that categorize a patient's need for nutritional assistance: (1) fully dependent, (2) assistance required, or (3) independent [27].

Statistical analysis

IBM SPSS Statistics version 17.0 software (IBM Corporation, Armonk, NY, USA) was used for data analyses. The Kolmogorov–Smirnov test determined the normal distributions of metric discrete variables. A Levene test was used to examine the assumption of homogeneity of variances. Descriptive statistics were expressed as median (25^{th}–75^{th}) percentile or number of cases and % of total cases where appropriate. Degrees of association between examined scales (namely, EDACS, PEDI, GMFCS and MACS) were evaluated by Spearman's ranked-order correlation analysis. Whether the differences among EDACS stages in terms of PEDI, GMFCS, and MACS scores were statistically significant or not was evaluated by Kruskal–Wallis test. In order to determine the stage difference, a Dunn–Bonferroni multiple comparison test was used after obtaining a statistically significant P-value based on the Kruskal–Wallis test. A *P*-value < 0.05 was considered statistically significant.

Results

Descriptive statistics regarding the demographic and clinical characteristics of the cases are given in Table 1. Table 2 contains descriptive statistics for all scales used in the study.

According to the current results, as EDACS levels increased, the PEDI subscale and total scores decreased in a statistically significant manner, while the levels of the GMFCS and MACS scales increased significantly (*P* < 0.001). As the PEDI subscale and total scores increased, the levels of GMFCS and MACS decreased in a statistically significant manner (*P* < 0.001). Also, as the GMFCS level increased, the MACS level increased significantly (*P* < 0.001) as shown in Table 3.

Table 1: Demographical and clinical characteristics of cases and caregivers

	n = 105
Age (years)	5 (4–7)
Gender	
Girls	46 (43.8%)
Boys	59 (56.2%)
Diagnosis	
Diplegic	45 (42.9%)
Total	50 (47.6%)
Hemiplegic	8 (7.5%)
Dyskinetic	1 (1.0%)
Ataxic	1 (1.0%)
Orthesis	
Safo	72 (68.6%)
Ankle afo	3 (2.9%)
Dafo	2 (1.9%)
Caregiver	
Mother	97 (92.4%)
Father	6 (5.7%)
Other	2 (1.9%)
Caregiver's age (years)	34.5 (30–39)
No. of children	2 (2–3)
Caregiver's education	
Primary school	26 (24.8%)
Secondary school	65 (61.9%)
University	14 (13.3%)

The metric discrete variables are shown as median (25^{th}–75^{th}) percentiles; otherwise the number of cases and percentages were used for categorical data.

Table 2: Descriptive statistics for examined questionnaires

	n = 105
EDACS	2 (1–3)
1	47 (44.8%)
2	30 (28.5%)
3	13 (12.4%)
4	15 (14.3%)
PEDI	
Self-care	27 (17–44.5)
Mobility	24 (10–44.5)
Social	30 (17.5–49)
Overall	85 (50–131.5)
GMFCS	3 (2–4)
1	15 (14.3%)
2	31 (29.5%)
3	19 (18.1%)
4	20 (19.0%)
5	20 (19.0%)
MACS	2 (2–3)
1	14 (13.3%)
2	45 (42.9%)
3	25 (23.8%)
4	12 (11.4%)
5	9 (8.6%)

Descriptive statistics were expressed as median (25^{th}–75^{th}) percentiles or number of cases and %, where appropriate. EDACS: The Eating and Drinking Abilities Classification System, PEDI: The Pediatric Evaluation of Disability Inventory, GMFCS: Gross Motor Function, MACS: Manuel Ability Classification System.

Table 3: The results of correlation analyses among examined questionnaires

	Self-care	Mobility	Social	Overall	GMFCS	MACS
EDACS						
r	−0.518	−0.450	−0.426	−0.499	0.545	0.660
P-value †	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PEDI Self-care						
r		0.802	0.841	0.952	−0.679	−0.732
P-value †		<0.001	<0.001	<0.001	<0.001	<0.001
PEDI Mobility						
r			0.666	0.893	−0.754	−0.620
P-value †			<0.001	<0.001	<0.001	<0.001
PEDI Social						
r				0.904	−0.571	−0.595
P-value †				<0.001	<0.001	<0.001
PEDI Overall						
r					−0.731	−0.704
P-value †					<0.001	<0.001
GMFCS						
r						0.659
P-value †						<0.001

r: Coefficient of correlation, † Spearman's ranked-order correlation analysis. EDACS: The Eating and Drinking Abilities Classification System, PEDI: The Pediatric Evaluation of Disability Inventory, GMFCS: Gross Motor Function, MACS: Manuel Ability Classification System.

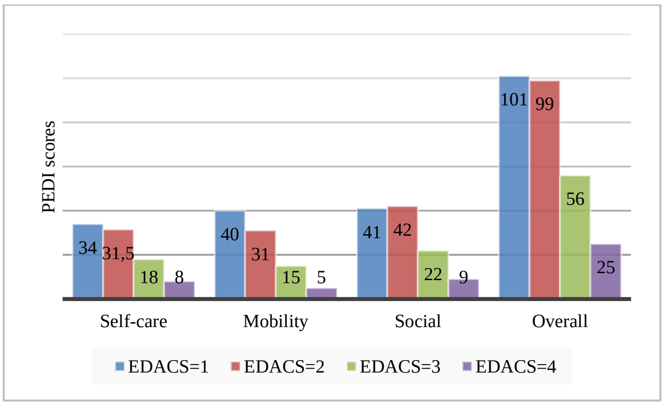
Table 4 contains the PEDI subscale and total scores of the cases according to their EDACS levels and comparisons made regarding whether a change in terms of GMFCS and MACS occurred. A statistically significant change in PEDI self-care subscale scores according to EDACS level (*P* < 0.001) and the situation causing this difference was found; the self-care scores of the patients with EDACS 3 and 4 were lower than those with EDACS 1 (*P* = 0.005 and *P* < 0.001, respectively). In addition, patients with EDACS 4 had statistically significantly lower self-care scores than subjects with EDACS 2 ($P < 0.001$) as shown in Figure 1.

Table 4: The comparisons among EDACS grade in terms of other examined questionnaires

	EDACS	Descriptive statistics	*P*-value †
PEDI Self-care	1	34.0 (25.0–49.0)	<0.001 [a,b,c]
	2	31.5 (20.3–45.3)	
	3	18.0 (12.0–23.0)	
	4	8.0 (4.0–12.0)	
PEDI Mobility	1	40.0 (16.0–51.0)	<0.001 [a,b,c]
	2	31.0 (12.8–44.3)	
	3	15.0 (8.0–27.0)	
	4	5.0 (1.0–10.0)	
PEDI Social	1	41.0 (23.0–52.0)	<0.001 [a,b,c,d]
	2	42.0 (25.0–52.5)	
	3	22.0 (16.0–27.0)	
	4	9.0 (7.0–20.0)	
PEDI Overall	1	101.0 (78.0–153.0)	<0.001 [a,b,c,d]
	2	99.0 (79.0–145.0)	
	3	56.0 (36.5–69.0)	
	4	25.0 (13.0–45.0)	
GMFCS	1	2.0 (2.0–3.0)	<0.001 [a,b,c]
	2	2.0 (2.0–4.0)	
	3	4.0 (3.0–4.5)	
	4	5.0 (5.0–5.0)	
MACS	1	2.0 (1.0–2.0)	<0.001 [a,b,c,d]
	2	2.0 (2.0–3.0)	
	3	3.0 (3.0–4.0)	
	4	5.0 (4.0–5.0)	

Descriptive statistics were expressed as median (25^{th}–75^{th}) percentiles, † Kruskal–Wallis test, a: EDACS 1 versus 3 ($P < 0.05$), b: EDACS 1 versus 4 ($P < 0.001$), c: EDACS 2 versus 4 ($P < 0.01$), d: EDACS 2 *versus* 3 ($P < 0.05$). EDACS: The Eating and Drinking Abilities Classification System, PEDI: The Pediatric Evaluation of Disability Inventory, GMFCS: Gross Motor Function, MACS: Manuel Ability Classification System.

Figure 1: PEDI mobility subscale scores according to EDACS levels



PEDI: The Pediatric Evaluation of Disability Inventory, EDACS: The Eating and Drinking Abilities Classification System

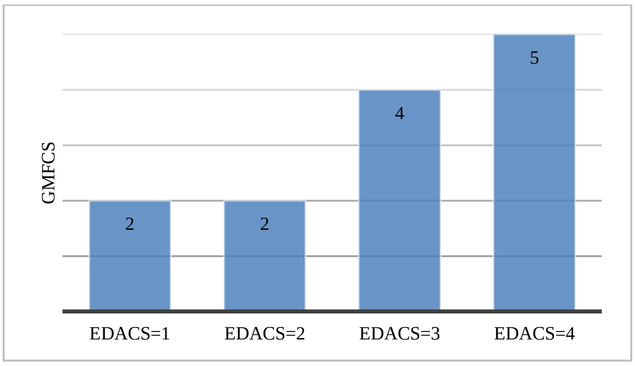
A statistically significant change in PEDI mobility subscale scores according to EDACS level ($P < 0.001$) was found, and this difference most likely occurred because the mobility scores of the patients with EDACS 3 and 4 were lower than those with EDACS 1 ($P = 0.030$ and $P < 0.001$, respectively). In addition, the mobility scores of the patients with EDACS 4 were significantly lower than those with EDACS 2 ($P = 0.003$) as shown in Figure 1.

A statistically significant change in PEDI social subscale scores according to EDACS level ($P < 0.001$) was found because the social subscale scores of patients with EDACS 3 and 4 were lower than those with EDACS 1 ($P = 0.027$ and $P < 0.001$, respectively). In addition, the social subscale scores of the patients with EDACS 3 and 4 were significantly lower than those with EDACS 2 ($P = 0.022$ and $P < 0.001$, respectively) as shown in see Figure 1.

A statistically significant change in PEDI total scale scores according to EDACS level ($P < 0.001$) was noted because the total scale scores of the patients with EDACS 3 and 4 were lower than those with EDACS 1 ($P = 0.007$ and $P < 0.001$, respectively). Also, according to the cases with EDACS 2, the total scores of the cases with EDACS 3 and 4 were statistically significantly lower ($P = 0.049$ and $P < 0.001$, respectively) as shown in Figure 1.

A statistically significant change in GMFCS scores according to EDACS level was found ($P < 0.001$) because the GMFCS scores of patients with EDACS 3 and 4 were higher than those with EDACS 1 ($P = 0.020$ and $P < 0.001$, respectively). In addition, the GMFCS scores of patients with EDACS 4 were statistically significantly higher than those with EDACS 2 ($P < 0.001$) as shown in Figure 2.

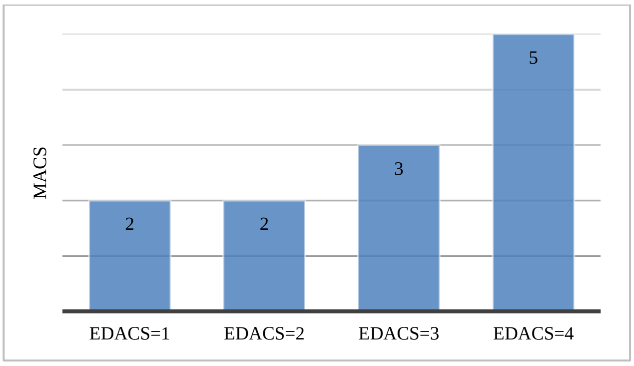
Figure 2: GMFCS scores according to EDACS levels



GMFCS: Gross Motor Function, EDACS: The Eating and Drinking Abilities Classification System

A statistically significant change in MACS scores according to the EDACS grade ($P < 0.001$) was noted because the MACS scores of the EDACS 3 and 4 patients were higher than those with EDACS 1 ($P < 0.001$ and $P < 0.001$, respectively). In addition, the MACS scores of patients with EDACS 3 and 4 were statistically significantly higher than those with EDACS 2 ($P = 0.014$ and $P < 0.001$, respectively) as shown in Figure 3.

Figure 3: MACS scores according to EDACS levels



MACS: Manuel Ability Classification System, EDACS: The Eating and Drinking Abilities Classification System

Discussion

It is estimated that some degree of difficulty eating or drinking is seen in 27% to 90% of people with CP [3]. This study found a statistically significant relationship between the CP children's performances in eating and drinking activities and their performances in terms of daily living activities. Namely, according to EDACS classification, children in Stage 1 (children who can eat in a safe and effective manner) had higher PEDI total scores. A more child who was more independent in terms of eating and drinking functions was found to have more successful performances in terms of social functions, mobility, and daily self-care. A study conducted by Goh et al. Reported a strong relationship between EDACS and three areas of PEDI [28].

When we examined the subgroups of PEDI, a positive correlation was found between EDACS classification and PEDI self-care scores, indicating that the more successful the child is in self-care, the more successful she/he can be in terms of eating and drinking functions. Learning to be independent in children with CP can be difficult due to developmental delays and physical impairments [29]. Since poor performance in self-care also affects eating and drinking performances, children with self-care problems will experience nutritional disorders and growth and development retardation.

According to EDACS, we found a decrease in eating/drinking functions in children with reduced motor skills. It has been observed that both motor and eating/drinking skills are correlated. In this case, in cases in which the motor skills of children with CP are low, we should definitely not ignore their eating/drinking functions and nutritional status. In previous studies, it has been shown that gross motor function limitations and eating/drinking performances are closely related for children with cerebral palsy [30–33]. In our study, we found that GMFCS and EDACS levels have a close relationship to dysphagia and gross motor function. Children with GMFCS levels IV to V have a significantly higher risk for dysphagia than children with GMFCS level I [28]. Selley et al. [33] stated that children with low gross motor function have nutritional problems and have a long feeding period during the day need to change their nutrient content and consistency and that specially designed seating and auxiliary devices should be used during feeding. Due to these problems, it was observed that the level of participation and variety of activities of the child and his/her family in indoor and outdoor environments is low. In a study by Benfer et al. [34] examining oropharyngeal dysphagia in children < 3 years old with CP, it was found that dysphagia severity was highly correlated with the GMFCS level. However, Benfer emphasized that dysphagia can be seen in children with CP who have a mild GMFCS level, and all children with CP must be examined regarding dysphagia regardless of the GMFCS level. In our study, in agreement with previous studies, the GMFCS levels of children with low EDACS levels were also low. Although no studies addressing the correlation between PEDI mobility and EDACS are available, many literature studies showing the relationship between PEDI mobility and GMFCS levels have been published [35, 36]. In our study, children with CP with insufficient mobility functions functioned as a worse level than both GMFCS and EDACS classification system indicated.

In the literature, no comprehensive studies have examined the relationship between eating/drinking function and activity participation in children with CP. In our study, the EDACS classification level was poor in those who were insufficient in the PEDI social area section. The EDACS 1 level child had a higher performance in the social field, while the performance of a child with EDACS 5 was less. In fact, children with severe motor impairment are more affected cognitively. The participation of children who have weak cognitive and motor skills is also low in the social area. In addition, EDACS levels will also deteriorate as these children have excessive dysfunction in the muscles around the mouth, salivation dysfunction, and chewing problems. In our study, we found a correlation between PEDI total score and other GMFCS and MACS levels. In a previous study, children with MACS and GMFCS levels I or II scored higher than children with MACS and GMFCS levels III–IV in self-care and mobility areas based on the PEDI, and significant differences between all classification levels were found. Stepwise multiple regression analysis showed that the strongest predictor of self-care skills (66%) and mobility skills (76%) were MACS and GMFCS, respectively. A strong correlation was found between age and mobility among children classified as GMFCS level I, between children classified as MACS level I or II, and between age and self-care abilities [37].

Previous studies have shown that those with good hand function are also good at self-care activities [35, 38]. Therefore, children whose EDACS level is worsening will also have a bad MACS level. In several cross-sectional studies, MACS has been associated with self-care in children with CP. These longitudinal studies provide information about the rate of self-care development in children with CP based on the manual skill classification level [38, 39]. Self-care is based on a complicated interaction of factors such as manual skills, skeletal integrity, muscle function, sensory integration, somatosensory functions, vision, visual motor skills, motivation to explore the environment, cognition, and cultural influences [40].

The limitation of our study is that the inter-rater reliability of the Turkish version of EDACS was not determined. Further studies should be conducted concerning this issue.

Conclusion

Our study showed that the inadequacy in daily living activities also causes eating and drinking disorders. We recommend that EDACS be used by clinicians in order to easily determine the eating/drinking functional levels of children with CP and to provide information about interventions to prevent nutritional deficiencies. Functional eating/drinking skills of children with CP are closely related to the levels of motor function, daily living skills, and social functions.

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References

1. Sadowska M, Sarecka-Hujar B, Kopyta I. Cerebral Palsy: Current Opinions on Definition, Epidemiology, Risk Factors, Classification and Treatment Options. Neuropsychiatr Dis Treat. 2020;6:1505–18.
2. Richards CL, Handb FM. Cerebral palsy: definition, assessment and rehabilitation. Clin Neurol. 2013;111:183-95.
3. Paulson A, Vargus-Adams J. Overview of Four Functional Classification Systems Commonly Used in Cerebral Palsy. Children. 2017Apr 24;4(4):30.
4. Gormley ME. Treatment of neuromuscular and musculoskeletal problems in cerebral palsy. Pediatr Rehabil. 2001 Jan-Mar;4(1):5-16.
5. Wimalasundera N, Stevenson V L. Cerebral palsy. Pract Neurol 2016;16:184–94.
6. Rethlefsen SA, Ryan DD, Kay RM. Classification Systems in Cerebral Palsy. Orthop Clin North Am. 2010 Oct;41(4):457-67.
7. Richards C L, Malouin F. Cerebral palsy. Pediatric Neurology 2013; Part I:183–95.
8. Haley SM, Coster WJ, Ludlow LH, Haltiwanger JT, Andrellos PJ. Pediatric Evaluation of Disability Inventory (PEDI): development, standardization, and administration manual. Boston: PEDI Resarch Group; 1992.
9. Kim K, Kang JY, Jang DH, Relationship Between Mobility and Self-Care Activity in Children With Cerebral Palsy. Ann Rehabil Med. 2017;41(2):266-72.
10. Sadowska M, Sarecka-Hujar B, Kopyta I. Cerebral Palsy: Current Opinions on Definition, Epidemiology, Risk Factors, Classification and Treatment Options. Neuropsychiatr Dis Treat. 2020;16:1505–18.
11. Caramico-Favero DCO, Guedes ZCF, Morais MB. Food intake, nutritional status and gastrointestinal symptoms in children with cerebral palsy. Arq Gastroenterol. 2018 Oct-Dec;55(4):352-7.
12. Erkin G, Culha C, Ozel S, Kirbiyik EG. Feeding and gastrointestinal problems in children with cerebral palsy. Int J Rehabil Res. 2010 Sep;33(3):218-24.
13. Bell KL, Benfer KA, Ware RS, Patrao TA, Garvey JJ, Arvedson JC, et al. Development and validation of a screening tool for feeding/swallowing difficulties and undernutrition in children with cerebral palsy. Dev Med Child Neurol. 2019;61:1175–81.
14. Sellers D, Mandy A, Pennington L, Hankins M, Morris C. Development and reliability of a system to classify the eating and drinking ability of peoplewith cerebral palsy. Dev Med Child Neurol. 2014;56:245–51.
15. Benfer KA, Weir KA, Bell KL, Ware RS, Davies PS, Boyd RN. The eating and drinking ability classification system in a population-based sampleof preschool children with cerebral palsy. Dev Med Child Neurol. 2017 Jun;59(6):647-54.

16. Sellers D, Bryant E, Hunter A, Campbell V, Morris C. The Eating and Drinking Ability Classification System for cerebral palsy: A study of reliability and stability over time. J Pediatr Rehabil Med. 2019;12(2):123-31.
17. 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.
18. Palisano R, Rosenbaum P, Bartlett D, Livingston M. Content validity of the expanded and revised Gross Motor Function Classification System. Dev Med Child Neurol.2008 Oct;50(10):744-50.
19. Wood E, Rosenbaum P. The gross motor function classification system for cerebral palsy: a study of reliability and stability over time. Dev Med Child Neurol. 2000 May;42(5):292-6.
20. Rosenbaum PL, Walter SD, Hanna SE, Palisano RJ, Russell DJ, Raina P,et al. Prognosis for gross motor function in cerebral palsy: creation of motor development curves. JAMA. 2002 Sep 18;288(11):1357-63.
21. Eliasson AC, Krumlinde Sundholm L, Rösblad B, Beckung E, Arner M, Öhrvall AM, et al. The Manual Ability Classification System (MACS) for children with cerebral palsy: scale development and evidence of validity and reliability. Dev Med Child Neurol. 2006;48:549-54.
22. Akpinar P, Tezel CG, Eliasson AC, Icagasioglu A. Reliability and cross-cultural validation of the Turkish version of Manual Ability Classification System (MACS) for children with cerebral palsy. Disabil Rehabil. 2010;32(23):1910-6.
23. Erkin G. Aybay C, Elhan A, Şirzai H, Özel S. Validity and reliability of the Turkish translation of the Pediatric Evaluation of Disability Inventory (PEDI) Disabil Rehabil. 2007;29:1271-9.
24. Tsai PY, Yang TF, Chan RC, Wong TT. Functional investigation in children with spina bifida-measured by Pediatric Evalutation of disabişlity inventory (PEDI). Child's Nerv Syst 2002;18:48-53.
25. Nichols DS, Case-Smith J. Reliability and validity of the Pediatric Evaluation of Disability Inventory. Ped Physi Thera. 1996;8(1):15-24.
26. Kerem Günel M, Özal C, Seyhan K, Serel Arslan S, Demir N, Karaduman A. EDACS [internet] [Erişim tarihi: 30.06.2019]. Erişim adresi: https://www.sussexcommunity.nhs.uk/get-involved/research/chailey-research/edacs-request.
27. Sellersa D, Bryanta E, Huntera A, Campbella V, Christopher M. The Eating and Drinking Ability Classification System for cerebral palsy: A study of reliability and stability over time. J Pediatr Rehabil Med. 2019;12(2):123-31.
28. Goh YR, Choi JY, Kim SA, Park J, Park ES. Comparisons of severity classification systems for oropharyngeal dysfunction in children with cerebral palsy: Relations with other functional profiles. Res Dev Disabil. 2018 Jan;72:248-56.
29. Burgess A, Boyd RN, Zıvıanı J, Ware RS, Sakzewskı L. Self-care and manual ability in preschool children with cerebral palsy: a longitudinal study. Dev Med Child Neurol. 2019;61:570–8.
30. Benfer K, Weir K, Bell K, Davies P, Ware RS, Boyd R. Subtypes of oral motor dysfunction in feeding and its relationship with gross motor skills in young children with cerebral palsy. Dev Med Child Neurol. 2012;54:21.
31. Benfer KA, Weir KA, Boyd RN. Clinimetrics of measures of oropharyngeal dysphagia for preschool children with cerebral palsy and neurodevelopmental disabilities: a systematic review. Dev Med Child Neurol. 2012;54(9):784–95.
32. Parkes J, Hill N, Platt MJ, Donnelly C. Oromotor dysfunction and communication impairments in children with cerebral palsy: a register study. Dev Med Child Neurol. 2010;52:1113–9.
33. Selley WG, Parrott LC, Lethbridge PC, Flack FC, Ellis RE, Johnstone KJ, et al. Objective measures of dysphagia complexity in children related to suckle feeding histories, gestational ages and classification of their cerebral palsy. Dysphagia. 2001;16(3):200–7.
34. Benfer KA, Weir KA, Bell KL, Ware RS, Davies PS, Boyd RN. Oropharyngeal dysphagia and gross motor skills in children with cerebral palsy. Pediatrics. 2013;131(5):1553-62.
35. Kuijper MA, van der Wilden GJ, Ketelaar M, Gorter JW. Manual ability classification system for children with cerebral palsy in a school setting andits relationship to home self-care activities. Am J Occup Ther. 2010 Jul-Aug;64(4):614-20.
36. Vargus-Adams JN, Martin LK, Maignan SH, Klein AC, Salisbury S. The GMFM, PEDI, and CP-QOL and perspectives on functioning from children with CP, parents, and medical professionals. J Pediatr Rehabil Med. 2011;4(1):3-12.
37. Öhrvall Am, Elıasson Ac, Löwıng K, Ödman P, Sundholm LK. Self-care and mobility skills in children with cerebral palsy, related to their manual ability and gross motor function classifications. Dev Med Child Neurol. 2010;52 (11):1048-55.
38. Gunel MK, Mutlu A, Tarsuslu T, Livanelioglu A. Relationship among the Manual Ability Classification System (MACS), the Gross Motor Function Classification System (GMFCS), and the functional status (WeeFIM) in children with spastic cerebral palsy. Eur J Pediatr 2009;168:477-85.
39. Bourke-Taylor H. Melbourne Assessment of UnilateralUpper Limb Function: construct validity and correlation with the Pediatric Evaluation of Disability Inventory. Dev Med Child Neurol. 2003;45:92–6.
40. Burgess A, Boyd RN, Ziviani J, Ware RS, Sakzewski L. Longitudinal Self-Care in Cerebral Palsy Andrea Burgess et al. Dev Med Child Neurol. 2019;61:570–8.

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