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Musculoskeletal system problems and quality of life of mothers of children with cerebral palsy with different levels of disability

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Abstract.
OBJECTIVE: The objective of this study is to investigate musculoskeletal system problems and quality of life of mothers of children with cerebral palsy with different levels of disability.
METHODS: 100 children (37 girls and 63 boys) with cerebral palsy (CP) and their mothers were included in this study. Functional levels of children with CP were assessed by using the Gross Motor Function Classification System (GMFCS) and the Pediatric Functional Independence Measure (WeeFIM). Quality of life of mothers regarding health was assessed by using the Nottingham Health Profile (NHP). Musculoskeletal system problems of mothers were assessed by using the Neck Disability Index (NDI) and the Roland-Morris Disability Questionnaire (RMDQ).
RESULTS: No statistical significance was found when GMFCS levels of children with CP and the NHP, DASH-T, RMDQ, NDI and the BAE values of mothers were compared in an inter-group way ($p > 0.05$). When the NHP parameters and the existence of lower and arm pains of mothers were compared with their BAI, NDI, RMDQ and DASH-T scores, a statistically significant relationship was found among them ($p < 0.05$).
CONCLUSION: As functional levels of children with CP get worse, upper extremity, lower back and neck problems and anxiety levels of mothers increase and this situation negatively affects mothers' quality of life.

Keywords: Cerebral palsy, musculoskeletal, mother, quality of life

1. Introduction

Cerebral Palsy (CP) is defined as a clinical situation, which develops in early ages depending on lesion, damage or dysfunction of central nervous system, does not connect to known progressive or degenerative cerebral disorders and is characterized with posture or movement disorders in patients [1].

In addition to disorders in neuromuscular and musculoskeletal systems, learning disabilities, epilepsy, talking, seeing and hearing problems can be observed in children with CP. These accompanying situations does not only increase table of disabilities for children but also negatively affects their daily life activities and social participation [2]. Limitations in daily life activities of children with disabilities negatively affect the quality of life of their mothers. This situation varies according to functional independence level of children [3,4].

Having a disabled child brings along some special challenges in terms of that child and his/her family irrespective of his/her disability. These challenges can be grouped as psychological state, financial situation, educational situation, lifestyle, relationships with social environment and disability level of children. A mother assumes a more active role and puts more efforts to solve all these challenges [5,6]. Mothers, who considerably assume responsibilities related to their disabled

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children, are further affected by this situation. Studies demonstrate that since in families that have a disabled child, mothers assume considerable degree of responsibility for their child's care, mothers give up on other roles that they have and their participation in social activities as well as their social life decreases [7,8].

In this regard, the objective of this study is to investigate musculoskeletal system problems and quality of life of mothers of children with cerebral palsy with different levels of disability.

2. Methods

2.1. Participants

One hundred children with cerebral palsy (CP), 37 of them being girls and 63 of them being boys, in total, whose treatment (neurodevelopmental Bobath in 2 days a week and one day private education) continues in private education and rehabilitation centers in different provinces of Turkey, and their mothers were included in this study.

For this study, an informed consent form was taken from mothers and ethical principles, which are present in the Declaration of Helsinki, were abided by taking written permission from managers of rehabilitation centers (Permission certificate issue number 025).

2.2. Criteria for including in the study

These are participants' acceptance to attend the study, children's diagnosis with CP by a pediatric neurologist and care of all children, who were included in the study, being performed by their mothers.

2.3. Evaluation methods

Demographic information on children with CP, who participated in the study, and their mothers were recorded. Children with CP were evaluated by using Gross Motor Function Classification System (GMFCS), Functional Mobility Scale (FMS) and the Pediatric Functional Independence Measure (WeeFIM).

Quality of life of mothers regarding health was assessed by using the Nottingham Health Profile (NHP) and their emotional states were assessed by using the Beck Anxiety Inventory (BAE). The Neck Disability Index (NDI) and the Roland-Morris Disability Questionnaire (RMDQ) were used for neck and lower back problems of mothers. The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH-T) was used to upper extremity functionality.

2.3.1. Gross Motor Function Classification System (GMFCS)

It is a classification system, which is scored between the levels 1 and 5, that is used for determining functional level compatible with age of individuals with CP. While an individual easily ensures indoor and outdoor ambulation without requiring complimentary mobility devices in the level 1, he/she is completely dependent in terms of mobility in the level 5 [9–11].

2.3.2. Functional Mobility Scale (FMS)

It is a scale that is used for the purpose of observationally assessing walking in children with cerebral palsy. The functional mobility scale is identified in 6 levels. Besides, scoring of walking distance is done as 5, 50 and 500 meters. Level 1: A wheelchair is used; person can stand up for transfer and can take a few steps by means of a walker or anybody. Level 2: A walker is used and person does not need somebody's help. Level 3: A crutch is used and person does not need somebody's help. Level 4: One or two canes are used and person does not need somebody's help. Level 5: Person is independent on smooth surface and does not need somebody or assistance for walking. Person holds handrail while using stairs. Level 6: Person can move independently on all surfaces and in crowded places without needing anybody or assistance for walking [12].

2.3.3. Pediatric Functional Independence Scale (WeeFIM)

WeeFIM is a valid and reliable test for both disabled and non-disabled children to functional independence of disabled children between 6 months and 7 years of age. WeeFIM consists of 18 items in 6 fields such as self-care, sphincter control, mobility, locomotion, communication. Functions of children are scored from 1 to 7 such as 7: completely independent, 6: modified independent, 5: with monitoring, 4: minimum assistance, 3: slight assistance, 2: maximum assistance and 1: complete assistance in scoring of sub-items of WeeFIM. The lowest total point that can be had from the test, which is 18, refers to complete dependence in all abilities and the highest total point, which is 126, refers to complete independence in all abilities [13–15].

2.3.4. Nottingham Health Profile (NHP)

It is a scale that is used to evaluate quality of life. The Nottingham Health Profile contains 38 questions

of yes/no. It consists of 6 sub-parts such as Physical Activity (PA), pain (P), sleep (S), energy level (EL), social isolation (SI) and emotional state (ES). In estimation, the point 0 shows the state of maximum wellness and the point 100 shows that quality of life is bad [16,17].

2.3.5. Beck Anxiety Inventory (BAI)

It is a 4-point Likert self-evaluation scale developed by Beck. Validity and reliability of the form in Turkish were performed by Ulusoy et al. The total point that can be acquired from the scale varies between 0 and 63. High total point shows how high a person's anxiety is. Points between 0 and 21 demonstrate low anxiety, points between 22 and 35 demonstrate medium-level anxiety, and 36 points and above demonstrate the existence of high-level of anxiety [18,19].

2.3.6. Neck Disability Index (NDI)

It is a scale that measures disability related to cervical vertebrae diseases. A total of 10 titles are present in this form such as intensity of pain, personal care, lifting, reading, head pains, concentration, working, driving, sleeping and rest activities. The total score is between 0 (no disability) and 50 (complete disability). As the score increases, disability also increases and as the score decreases, disability decreases as well [20,21].

2.3.7. Roland-Morris Disability Questionnaire (RMDQ)

It is a valid questionnaire that assesses pain-related disability level. It consists of 24 questions with answers "yes" or "no". The total score is estimated by scoring the answers "yes" 1 point and the answers "no" 0 point. The total score varies between 0 (no disability) and 24 (serious disability) [22].

2.3.8. Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH-T)

It evaluates disability that emerges as a result of upper extremity injury, activity limitations as well as spare time activities and limitation of job participation from patients' perspective. It is scored between 0 and 100; 0 shows that there is no disability and 100 shows that there is a maximum level of disability [23].

2.4. Statistical analysis

Having examined results that we obtained from the conducted study as a result of power analysis performed, it was estimated that 95% of reliability and 95% of power were obtained. The data were analyzed with the SPSS software package v18.0. Constant variables, the average ±, standard deviation and categorical variables are given in numerical and percentage terms. The Kruskal-Wallis one way analysis of variance was used for comparing inter-group differentiations. Also, chi-squared test was used for comparing categorical variables and Spearman's correlation analysis was used for investigating inter-variable relationship.

Table 1
The demographic data of children with cerebral palsy and their GMFCS, FMS and WeeFIM levels

Child with cerebral palsy	X ± SD	Min-Max
Age (month)	105.07 ± 53.36	13–216
Height (cm)	120,23 ± 24.23	72–180
Weight (kg)	25.55 ± 13.16	6–63
Gender	n	%
Female	37	37
Male	63	63
GMFCS	n	%
Level 1	10	10.2
Level 2	13	13.3
Level 3	21	21.4
Level 4	36	36.7
Level 5	18	18.4
FMS	n	%
Level 6	13	13.3
Level 5	9	9.2
Level 4	5	5.1
Level 3	4	4.1
Level 2	21	21.4
Level 1	46	46.9
	X ± SD	Min-Max
WeeFIM	61.09 ± 29.22	18–126

GMFCS; Gross Motor Function Classification System, FMS; Functional Mobility Scale, WeeFIM; Pediatric Functional Independence Measure, Data are presented as n (%) or as X ± SD.

3. Results

The average age of children with CP, who participated in the study, is 105.7 ± 53.36 months and the average age of mothers is 35.66 ± 7.39 years (Table 1).

Looking the time of birth of children with CP, it was determined that 55 of them (55%) were born prematurely, 41 of them (41%) was born on time and 4 of them (4%) was born late. It was established that the birth of 55 children (55%) was performed in normal ways, the birth of 44 children (44%) was performed via C-section and the birth of 1 child (1%) was performed by using forceps. It was established that 45 of children (45%) were diagnosed with CP due to perinatal causes,

39 of them (39%) were diagnosed with CP due to prenatal causes and 5 of them (5%) were diagnosed with CP due to postnatal causes; having them assessed in terms of clinical medicine, it was determined that 87 of them (87%) are spastic, 6 of them (6%) are hypotonic, 3 of them (3%) have ataxic CP and 4 of them (4%) have mixed CP. Having examined children with regard to extremity distribution, it was found that 44 of them (44%) have quadriparesis, 24 of them (24%) have diparesis, 15 of them (15%) have hemiparesis, 11 of them (11%) have paraparesis, 5 of them (5%) have triparesis and one child (1%) have monoparesis. It was determined that 66 children (66%) use orthesis and 60 children (60%) underwent a surgical procedure.

It was established that in terms of functional level, 36.7% of children with CP are in level 4 and 21.4% of them are in level 3 according to GMFCS. It was found that 46.9% are in level 1 and 21.4% of them are in level 2 according to FMS. Their score averages for WeeFIM were 61.09 $\pm$ 29.22 (Table 1).

While it was found that 88 of mothers (88%) had 12 years or less educational experience and 12 of them (12%) had more than 12 years educational experience, it was determined that 93 of them (93%) are housewives, 4 of them (4%) are civil servants and 3 of them (3%) are workers. It was established that 72 mothers (72%) experience lower back-arm pains and 28 mothers (28%) did not experience any lower back-arm pains.

Having examined mothers' anxiety levels, it was found that 82% have lower degree anxiety, 60% have minimum disability and 31% have medium-level of disability according to NDI. The average value of the overall NHP score of mothers was found to be 163.16 $\pm$ 116.85 and the average DASH-T score was found to be 31.27 $\pm$ 9.56 (Table 2).

A statistical significance was not found ($p > 0.05$) when GMFCS levels of children with CP were compared with the overall NHP score and lower parameter values of mothers among the groups. Likewise, a statistical significance was not found ($p > 0.05$) when different levels of GMFCS were compared with the DASH-T, RMDQ, NDI and BAI values among the groups (Table 3).

A statistically significant relationship was found when the overall NHP score and lower parameters of mothers with children with CP such as emotional reactions (ER), pain (P), energy levels (EL), social isolation (SI), sleep (S) and physical activities (PA) were compared with the BAI, the NDI and the RMDQ scores of mothers ($p < 0.01$). A statistically significant relationship between the DASH-T scores and ER, P, PA and the overall NHP score of mothers was found at the level $p < 0.01$; a statistically significant relationship between the DASH-T scores and EL and S was found at the level $p < 0.05$. A statistically significant relationship between the FMS scores and the overall NHP score, ER and EL of children with CP was found at the level $p < 0.05$; a statistically significant relationship between the FMS scores and S was found at the level $p < 0.01$. Also, a statistically significant relationship was found between the GMFCS scores and S at the level $p < 0.05$ (Table 4).

A statistically significant relationship was found between the BAI scores of mothers and the NDI, the RMDQ and the DASH-T scores and also between the GMFCS scores of children with CP and their WeeFIM and the FMS scores ($p < 0.01$) (Table 5).

It was detected that 72 mothers (72%) have lower back and arm pains and 28 of them (28%) did not have any lower back and arm pains. When the GMFCS lev-

Table 2
The demographic data of mothers with children with CP, Their BAI, NDI, NHP and DASH-T values

Mother with child with CP	X $\pm$ SD	Min-Max
Age	35.66 $\pm$ 7.39	19–56
Weight (kg)	68.74 $\pm$ 12.71	38–110
Height (cm)	161.62 $\pm$ 6.66	149–180
	X $\pm$ SD	Min-Max
Overall BAI Score	11.41 $\pm$ 9.54	0–46
BAI	n	%
Low Anxiety	82	82
Medium-Level Anxiety	16	16
High-Level Anxiety	2	2
	X $\pm$ SD	Min-Max
Overall NDI Score	8.77 $\pm$ 6.34	0–28
NDI	n	%
Minimum-Level of Disability	60	60
Medium-Level of Disability	31	31
Intense-Level of Disability	8	8
Injury-Level of Disability	1	1
	X $\pm$ SD	Min-Max
Overall NHP Score	163.16 $\pm$ 116.85	0–434.91
NHP	X $\pm$ SD	Min-Max
ES	43.03 $\pm$ 37.19	0–100
P	31.58 $\pm$ 29.15	0–100
EL	23.35 $\pm$ 22,93	0–78.97
SI	21.60 $\pm$ 27.77	0–100
S	22.34 $\pm$ 23.38	0–100
PA	19.35 $\pm$ 15.63	0–53.40
	X $\pm$ SD	Min-Max
DASH-T	31.27 $\pm$ 9.59	22–79

BAI; Beck Anxiety Inventory, NDI; Neck Disability Index, DASH-T; Disabilities of the Arm, Shoulder and Hand Questionnaire, NHP; Nottingham Health Profile. ER; Emotional Reactions, P; Pain, EL; Energy Levels, SI; Social Isolation, S; Sleep, PA; Physical Activities. Data are presented as n (%) or as X $\pm$ SD.

Table 3
Comparison of the GMFCS levels of Children with CP with the NHP, DASH-T, RMDQ, NDI and BAI of Mothers

GMFCS	LEVEL 1		LEVEL 2		LEVEL 3		LEVEL 4		LEVEL 5		
NHP	X ± SD	Min-Max	X ± SD	Min-Max	X ± SD	Min-Max	X ± SD	Min-Max	X ± SD	Min-Max	p
Overall NHP Score	140,09 ± 154,67	0–434,91	134,68 ± 121,33	0–340,79	153.77 ± 102,07	0–355,80	175.43 ± 117,68	0–391.22	196.54 ± 105.87	25.48–392.95	0.419
ES	36.54 ± 42.35	0–100	33.47 ± 41.98	0–100	44.95 ± 38.79	0–100	44,53 ± 34.07	0–100	53.06 ± 35.67	0–100	0.546
P	32,72 ± 36.59	0–100	29.00 ± 32.58	0–100	33,21 ± 26.48	0–89,51	28.44 ± 27.17	0–94,17	39,96 ± 31.01	0–100	0.643
EL	18.97 ± 31.47	0–78,97	18.42 ± 21.31	0–62,72	20,57 ± 19,25	0–52,64	27,26 ± 23,99	0–78,97	26,94 ± 21.55	0–76.71	0.389
SI	23,24 ± 36,78	0–100	13,77 ± 20,75	0–58,11	21.18 ± 27,12	0–77,47	22,57 ± 28.05	0–100	27,30 ± 29,09	0–84,03	0.787
S	17,83 ± 23.43	0–77,63	19,04 ± 23,40	0–77,63	13,77 ± 14,95	0–61	26,66 ± 26,07	0–100	28,20 ± 24,06	0–77,63	0.132
PA	11,93 ± 15,46	0–41,86	29,97 ± 17,80	0–43,22	17,57 ± 14,90	0–53,40	21,76 ± 15.41	0–43,90	21,06 ± 15,59	0–53,40	0.411
DASH-T	34,00 ± 18,77	22–79	29,76 ± 6,55	23–45	29,71 ± 7,61	22–56	32,47 ± 9,23	22–53	31,00 ± 7,57	22–50	0.880
RMDQ	5,60 ± 7,29	0–18	7,53 ± 7,64	0–19	3,85 ± 5,35	0–17	5,63 ± 6,45	0–20	6,61 ± 7,54	0–21	0.687
NDI	11.56 ± 11,39	0–37	17,28 ± 8,45	0–31	17,73 ± 13,51	0–51	21,85 ± 14,26	0–53	21,02 ± 15,00	4–50	0.210
BAI	8.70 ± 13.62	1–46	8.84 ± 5.81	2–19	11.95 ± 10.18	2–37	12.41 ± 8.95	0–28	12.72 ± 10.13	1–34	0.356

Data are presented as X ± SD or as Min-Max, Statistically significant ($p < 0.05$).

Table 4
Relationship between mothers' NHP and lower parameters and their BAI, NDI, RMDQ, DASH-T scores and the GMFCS, FMS and WeeFIM scores of Children with CP

	GMFCS		WeeFIM		FMS		BAI		NDI		RMDQ		DASH-T	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Overall NHP Score	0.198	0.050	−0.023	0.819	0.252*	0.012	0.530**	0.0001	0.519**	0.0001	0.614**	0.0001	0.148**	0.0001
ES	0.161	0.113	−0.072	0.477	0.215*	0.034	0.515**	0.0001	0.398**	0.0001	0.461**	0.0001	0.379**	0.0001
P	0.077	0.451	0.000	0.998	0.091	0.372	0.459**	0.0001	0.482**	0.0001	0.598**	0.0001	0.460**	0.0001
EL	0.193	0.057	−0.017	0.866	0.241*	0.017	0.391**	0.0001	0.384**	0.0001	0.447**	0.0001	0.226*	0.024
SI	0.117	0.250	0.106	0.292	0.159	0.118	0.325**	0.0001	0.345**	0.0001	0.368**	0.0001	0.184	0.068
S	0.240*	0.017	−0.182	0.070	0.318**	0.001	0.321**	0.001	0.314**	0.0001	0.318**	0.0001	0.220*	0.028
PA	0.146	0.151	−0.128	0.206	0.161	0.112	0.344**	0.0001	0.388**	0.0001	0.606**	0.0001	0.260**	0.009

*Statistically significant ($p < 0.05$), **Statistically significant ($p < 0.01$).

Table 5
Relationship between mothers' BAI, NDI, RMDQ, DASH-T scores and the GMFCS, FMS and WeeFIM scores of children

	GMFCS		WeeFIM		FMS		BAI		NDI		RMDQ		DASH-T	
	r	p	r	p	r	P	r	p	r	p	r	p	r	p
WeeFIM	−0.662**	0.0001	–	–	0.567**	0.0001	−0.062	0.543	−0.116	0.250	−0.027	0.793	−0.014	0.891
FMS	0.852**	0.0001	0.567**	0.0001	–	–	0.191	0.0001	0.161	0.112	0.037	0.714	0.073	0.474
BAI	0.169	0.097	−0.062	0.543	0.191	0.059	–	–	0.540**	0.0001	0.432**	0.0001	0.425**	0.0001
NDI	0.182	0.072	−0.116	0.250	0.161	0.112	0.540**	0.0001	–	–	0.581**	0.0001	0.476**	0.0001
RMDQ	0.048	0.637	−0.027	0.793	0.037	0.714	0.432**	0.0001	0.581**	0.0001	–	–	0.454**	0.0001
DASH-T	0.086	0.400	−0.014	0.891	0.073	0.474	0.425**	0.0001	0.476**	0.0001	0.454**	0.0001	–	–

*Statistically significant ($p < 0.05$), **Statistically significant ($p < 0.01$).

Table 6
Relationship between the GMFCS levels of children with CP and the NDI, BAI, lower back and arm pain of mothers

	GMFCS									
	Level 1		Level 2		Level 3		Level 4		Level 5	
	n	%	n	%	n	%	n	%	n	%
Lower Back-Arm Pain										
Exists	5	50	11	84.6	15	71.4	26	72.2	14	77.8
Does not exist	5	50	2	15.4	6	28.6	10	27.8	4	22.2
NDI (Disability Level)										
Minimum-level	9	90	8	61.5	14	66.7	16	44.4	12	66.7
Medium-level	0	0	5	38.5	5	23.8	16	44.4	4	22.2
Intense-level	0	0	0	0	2	9.5	4	11.1	2	11.1
Injury-level	1	10	0	0	0	0	0	0	0	0
BAI (Anxiety Level)										
Low	9	90	13	100	18	85.7	27	75	13	72.2
Medium-Level	0	0	0	0	2	9.5	9	25	5	27.8
High-Level	1	10	0	0	1	4.8	0	0	0	0

Data are presented as n (%).

Table 7
Relationship between the existence of lower back-arm pain of mothers and their NHP, DASH-T, NDI, BAI and WeeFIM

	Lower back-arm pain						
	Does not exist			Exists			
	X ± SD	Median	Min-Max	X ± SD	Median	Min-Max	P
Overall NHP Score	111.269 ± 114.44	77.56	0–391.22	183.35 ± 112.18	189.25	0–434.91	0.003
ES	26.97 ± 34.40	0	0–100	49.27 ± 36.57	39.20	0–100	0.007
P	15.51 ± 22.81	0.980	0–100	37.83 ± 29.07	34.32	0–100	0.0001
EL	17.17 ± 21.42	9.31	0–64.98	25.75 ± 23.19	21.90	0–78.97	0.051
SI	17.40 ± 28.88	0	0–100	23.23 ± 27.36	15.97	0–100	0.178
S	16.37 ± 24.94	12.57	0–87.43	24.66 ± 22.50	16.10	0–100	0.008
PA	12.31 ± 14.12	10.99	0–43.90	22.08 ± 15.42	21.77	0–53.40	0.006
DASH-T	26.53 ± 5.54	26.00	22–44	33.11 ± 10.22	30.00	22–44	0.0001
RMDQ	2.28 ± 5.28	0	0–20	6.86 ± 6.70	5.00	0–21	0.0001
NDI	10.42 ± 8.79	8.00	0–34	22.50 ± 13.36	22.00	0–53	0.0001
BAI	5.85 ± 5.86	4.00	0–21	13.56 ± 9.85	10.00	1–46	0,0001
WeeFIM	66.92 ± 28.35	66.50	18–126	58.81 ± 29.43	59.00	18–122	0.201

Data are presented as X ± SD or as Min-Max. Statistically significant ($p < 0.05$), Statistically significant ($p < 0.01$).

els of children with CP were compared with the existence of lower back-arm pain of mothers, it was found that 50% of mothers of 10 children at the level 1 had lower back and arm pains and 72.2% of mothers of 36 children at the level 4 had lower back and arm pains. When the GMFCS levels of children with CP were compared with the NDI disability levels of mothers, it was found that 90% of mothers of 10 children at the level 1 had minimum disability level and 10% of mothers had an injury-level disability; 66.7% of mothers of 18 children at the level 5 had minimum level of disability and 22.2% of them had medium-level of disability. When the GMFCS levels of children with CP were compared with the BAI levels of mothers, it was found that 90% of mothers of 10 children at the level 1 had lower-level anxiety and 10% had higher-level anxiety. 85.7% of 21 mothers at the level 3 were found to have lower-level anxiety and 9.5% had medium-level anxiety (Table 6).

A statistically significant relationship was found between the existence or non-existence of lower back-arm pains of mothers with children with CP and their overall NHP score and lower parameters ($p < 0.05$). Also, a statistically significant relationship was found between the existence and non-existence of lower back-arm pains of mothers and their BAI, NDI, RMDQ and DASH-T scores ($p < 0.01$) (Table 7).

4. Discussion

It was determined as a result of our study that 72% of mothers have lower back and arm pain. According to the NDI, it was found that 60% of mothers have minimum level of disability and 31% have medium-level of disability. Also, according to the BAI, low-level anxiety symptoms were detected in 82% of mothers and medium-level anxiety symptoms were detected in 16%. According to the NDI, it was found that 35

(58.3%) of 60 mothers with minimum level of disability, 28 (90.3%) of 31 mothers with medium level of disability, 8 (100%) of 8 mothers with intense disability and one mother (100%) with an injury-level disability have lower back and arm pain. It was also found that 54 (65.9%) of 82 mothers with lower level anxiety, 16 (100%) of 16 mothers with medium-level anxiety and both 2 children with high level anxiety have lower back and arm pain. As functional levels of children with CP get worse, upper extremity, lower back-neck problems and anxiety levels of mothers increase and this situation negatively influences mothers' quality of life.

CP is described as a situation that is characterized with disorder in nervous system development. Albeit motor function disorder is a distinguishing feature of CP, the existence of mental and sensual disorder was also demonstrated in many children with CP. In addition, they also have limitations in self-care activities such as mobility, bathing, clothing and eating. Long-term dependence of children to these limitations can cause problems and troubles for the ones, who take care of these children [3,24]. Children with CP need help from some other person in self-care activities or transfer activities at home, school or in other places. These activities (lifting, transfer, carrying, pushing) are repeated many times within the day. When the level of functional dependence increases in disabled children, there occurs an excessive physical burden on mothers; this physical burden further increases in lifting, carrying and transfer activities in particular. In this regard, it was displayed in our study that mothers' experience of upper extremity, lower back and neck problems stems from disabilities of children with CP in gross motor function and functional independence [25].

Indoor and outdoor activities are restricted due to negative impacts of social and financial situations, assisting devices and architectural features and this directly affects the level of independence of children. Increasing environmental barriers cause an increase in children's level of dependence to their mothers. Leaning forward, rotation, lifting, pushing and pulling movements by mothers during care of their disabled children and their activities of bathing, clothing, carrying and feeding their children create an increasing stress on musculoskeletal systems of mothers [25].

It was determined in our study that according to the NDI, 60% of mothers have minimum level of disability and 31% have medium-level of disability and also, 72% of mothers have lower back and arm pain.

It is stated in researches conducted that mothers, who have mentally or physically handicapped children, are under higher stress and have higher anxiety levels than mothers, who do not have any disabled child [26–29]. While it is stated that psychological problems are more frequently observed in mothers with disabled children then mothers, who do not have any disabled child [29,30], it was determined that this situation negatively affects a mother's quality of life [31]. It was observed in our study that according to the BAI, 82% of mothers have low-level anxiety, 16% have medium-level anxiety and 2% have high-level anxiety, thereby negatively affecting their quality of life.

As a result, we can say that mothers with children with CP are more affected in terms of musculoskeletal system injuries and quality of life compared to mothers with healthy children. It should be known that rehabilitation of children with CP is teamwork and mothers and their children are situated at the center of this team. It should be known that mothers, who come to rehabilitation centers and clinics for rehabilitation of their children, might experience musculoskeletal problems depending on functional states of their children, might experience an increase in their anxiety levels and accordingly their quality of life would also be negatively affected and this situation might also negatively affect rehabilitation of their children. For this, it is important for mothers to be under control in medical and psychosocial terms for them to be able to provide better service of care to their children.

Conflicts of interest

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