

# Research Paper: Training Mothers to Improve Gross Motor Skills in Children With Cerebral Palsy: A Randomized Controlled Trial



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## ABSTRACT

**Objectives:** The present study examined the effect of home-based handling training of mothers on the improvement of gross motor function of children with Cerebral Palsy (CP).

**Methods:** In this randomized control trial, 42 children with CP (5-12 years old) were randomly assigned into the intervention and control groups. Data were collected using the Gross Motor Function Classification System and Gross Motor Function Measure.

**Results:** Gross motor function suggested significant improvement in the intervention group, in comparison with the control group ( $P < 0.01$ ).

**Discussion:** Handling training of mothers could be advised as a complementary and helpful intervention for gross motor function improvement in children with CP.

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## Highlights

- Training mothers of children with cerebral palsy is a part of occupational therapy intervention to improve children's gross motor functions.
- Neurodevelopmental treatment plus mother training can be more effective improving motor abilities of children with cerebral palsy.
- Proper handling and suitable positioning during activities of daily living can lead to gross motor function improvements.

## Plain Language Summary

Mothers of children with Cerebral Palsy (CP) have an essential role in their children's therapy, should they receive proper training in this regard. Mothers spend a lot of time with their children. However, care of a child with CP should not create problems for instance musculoskeletal pains for the mother. In handling the training program, mothers learn to treat their children during activities of daily living so that not only help the CP child to improve her or his motor functions but also assist themselves to care for children in a more convenient way. In this study, we provided a kind of education for mothers in our intervention group. They participated in a workshop to learn how to handle their children at home or in other settings. Children with CP were all received neurodevelopmental treatment as their ordinary occupational therapy intervention. After the study, the children whose mothers received our training program reported that their children had shown improvement with their gross motor functions compared to the control group. This finding shows that children with CP could achieve better results when their mothers have enough information about how to handle them.

### 1. Introduction

Cerebral Palsy (CP) is the most prevalent physical disability in children [1]. Its incidence is 2-4 per 1000 live births [2]. Children with CP often have postural and movement disorders as well as problems in the development of fine and gross motor functions [3]. Dysfunction in gross motor skills is among the main characteristics of CP that can affect their participation in daily life activities [3].

Gross motor function includes the ability to control head, roll, and sit and walk independently [4, 5]. Gross motor skills in children with CP can be strong predictors of self-care and social function [6]. Occupational therapists and the family of children with CP need up-to-date and accurate information about gross motor skills [7]. Occupational therapy interventions try to enhance clients' abilities to perform their daily activities. Some of the children's activities are related to their gross motor skills. They need to run and walk to gain high quality experiences.

Development in gross motor skills had been considered in most approaches, such as Neurodevelopmental Treat-

ment (NDT), conductive education and sports therapy like hippotherapy [6, 8, 9]. Sterba et al. examined horse-back riding therapy on gross motor function in children with CP [8]. They used the Gross Motor Function Measure (GMFM) as the outcome measurement. Their results indicated that this intervention may improve gross motor function in children with CP.

In approaches like NDT and hippotherapy, the techniques can be performed by therapists at clinics and because of their long-term nature, may impose a huge financial burden to the clients' families [10]. Moreover, children with disabilities need opportunities to practice their newly learned tasks. Therapists believe that home-based programs are crucial for improving children's functional and motor performance [11]. Handling training can be a part of home-based programs. Handling as a caregiving method for children with CP, facilitates self-care, mobility and social skills in them [12].

In occupational therapy, training has been identified as a type of intervention in which the occupational therapist instructs the client on how to use her skills in real life [13]. Handling training in children with CP is demonstrated to smoothing movement, correcting posture and precluding deformities and contractures [14]. It could be

conducted by therapists or parents. Primary studies have argued that this training program could be helpful to provide care for children at levels 3-5 of the Gross Motor Function Classification System (GMFCS) [15]. In other words, it is hypothesized that handling training is more helpful in children with a severe physical disability than those with mild disabilities.

Johari et al. examined the effects of handling training on fine motor skills of children with CP. The participants in the intervention group showed improvement in their skills, compared to the control group members [16]. However, data are scarce on the effects of handling training on the development of gross motor function in children with CP. Most studies have focused on the parents' emotional domains, including satisfaction with this training method or interactions between parents and their children [6, 10, 17, 18]. The present research examined the effect of home-based handling training applied by children's mothers on the gross motor function of children with CP aged 5 to 12 years.

## 2. Methods

This single blind randomized controlled trial was part of a larger study [16]. Mothers in the intervention group participated in a 5-hour training workshop including proper positioning, carrying, transferring and lifting children during Activities of Daily Livings (ADLs). There were no important changes in the applied methods after trial commencement.

We recruited children with CP and their mothers from the occupational therapy clinics affiliated to the University of Social Sciences and Rehabilitation Sciences (Figure 1). After assessing 118 children, the eligible participants were included in the study. The inclusion criteria were children with a diagnosis of CP, 5 to 12 years of age, levels III to V of Motor Function Classification System expanded and revised (GMFCS E&R) [19]. Inclusion criteria for mothers were literacy, not taking care of other persons with disabilities, and no history of participating

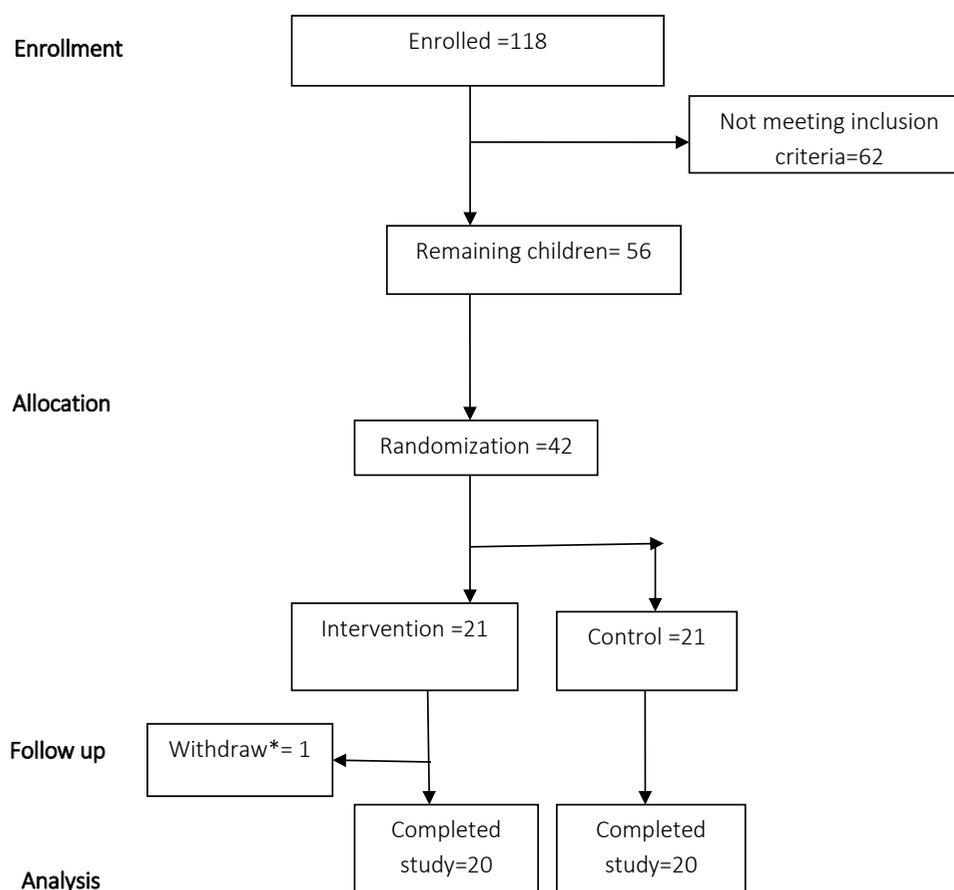


Figure 1. Study flowchart

\*Causes of withdrawal: parents' problems including the lack of time and work-related problems.

in similar training programs [see the details [16]. Finally, 42 mothers and their children participated in the study.

A research assistant randomly assigned the eligible participants ( $n=42$ ) into the intervention and control groups. The study participants were determined by drawing out a number from an envelope. When the drawn number was even, the participant was allocated to the intervention group. The number of mothers in each group was similar. All the study participants signed an informed consent. Then, the study children were assessed with respect to GMFM and GMFCS (E&R) by an occupational therapist blinded to the groups (pre-test).

Children in both groups continued receiving NDT during the study, which was conducted by 3 occupational therapists. All of the study therapists followed NDT (Bobath) approach principles in the therapy sessions and the first author had checked these principles with them prior to the intervention sessions.

To estimate the number of participants, a confidence interval of 95% and power of 80% were considered [6, 10]. Fifteen participants were needed. The GMFM was used to measure changes resulting from the intervention. GMFM is a criterion-referenced tool developed to assess children with CP. GMFM was used to assess children's rolling, crawling, sitting, standing and walking, as well as running and jumping functions. The evidence suggests that the GMFM is a valid and reliable instrument [19, 20].

GMFCS (E&R) was used to classify the children. It is a 5-level classification system that categorizes children and youth with CP, based on their gross motor ability, limitations and needs for assistive technologies and devices [19]. Children in level I are more capable than those in the other levels are and children in level V are more dependent in terms of their gross motor functions. This classification disregards judgment about the movement quality or improvement prognosis [21]. The validity and reliability of the Persian version of the GMFCS (E&R) have been examined by Dehghan et al. [22].

### Interventions

A training session was held to train mothers about the handling principles by a qualified occupational therapist (see the details [16]). Booklets were provided to the parents at the same session which included the following topics: the problems of the mothers of children with CP; normal and abnormal motor development in children

with CP; self-care; carrying; rest and sleep; leisure time; and social participation and playing with the child [23].

After initiating the proper handling by mothers at home, one of the researchers (first author) called the mothers in the intervention group once a week for 3 months (the main phase of intervention). During these phone calls, the researcher and parents tried to manage and solve the problems faced while implementing the proper handling. After the completion of intervention, all children were assessed in terms of gross motor function by the same occupational therapist assessing them at the Pre-test. After conducting the post-test, the same workshop was held for the mothers in the control group; they received a booklet of handling training as well, and if they faced problems, they were able to call to the researcher.

### Data analysis

Significance level was considered at  $P>0.05$ . The baseline measurements and demographic variables were compared using the Chi-squared test and t-statistic. There were no significant differences in any variables between the groups ( $P>0.05$ ). To identify the effects of handling training on gross motor skills, Analysis of Variance (ANOVA) and Paired Samples t-test were employed.

## 3. Results

Participant's gross motor skill ranged from 6 to 87 and the mean score of these skills was 51. Gender was the only variable with a statistically significant difference between the two groups ( $P<0.05$ ). Forty mothers and their children finished the intervention. Table 1 presents the demographic characteristics of participants at the base line. Gross motor skills significantly improved in both groups at 3 months after the intervention (Table 2); however, the one-way ANOVA results revealed that the improvement in the intervention group was significantly greater than the control group (Table 3).

## 4. Discussion

This study suggested a significant improvement in gross motor skills in both groups. It may be due to the received occupational therapy services in the two groups. Participants in both groups have been receiving NDT during the study period. NDT could impact children's motor skills [15]. Children with CP at the levels of III to V of GMFCS could reach their maximum GMFM score at 5 to 7 years of age [24]. The obtained results indicated that if the children and their family receive a proper in-

**Table 1.** Demographic data of children with CP and their mothers

Groups	No. (%)			
	Intervention	Control		
Mothers	Age, y (Mean±SD)	33.60±4.54	34.41±5.72	
	Marital status	Married: 19(95%)	Married: 18(90%)	
	Divorced: 1(5%)	Divorced: 2(10%)		
	Occupation	House holder: 8(40%)	House holder: 10(50%)	
	Part time: 8(40%)	Part time: 6(30%)		
	Full time: 4(20%)	Full time: 4(20%)		
Children	Age, y (Mean±SD)	7.39±1.79	7.45±2.54	
	Gender	Female	2(10%)	6(30%)
		Male	18(90%)	14(70%)
	Type of CP	Quadriplegia	11(55%)	12(60%)
		Diplegia	9(45%)	8(40%)
		III	6(30%)	9(45%)
	GMFCS E&R*	IV	7(35%)	5(25%)
		V	7(35%)	7(35%)
Gross motor skills	40.70±24.45	32.3±18.347		

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\* Gross Motor Function classification system expanded and revised

**Table 2.** Mean±SD of the mean scores of gross motor skills within the two groups using paired samples t-test

Group	No.	Mean±SD		t	P
		Pre-Test	Post-Test		
Intervention	20	40.70±24.45	60.10±25.57	7.46	0.001
Control	20	32.38±18.34	41.90±19.51	5.56	0.001

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**Table 3.** Mean±SD of gross motor skill of the participants in two groups, at 3 months after the intervention using ANOVA

Group	No.	Post-Test	CI (95%)		P	Effect Size
		Mean±SD	Lower	Upper		
Intervention	20	60.10±25.57	48.13	72.06	0.016	1.2
Control	20	41.90±19.51	32.76	51.03		

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tervention, they could improve their gross motor function even after this age range. Occupational therapy services working with children with disabilities focus on improving their performance and interaction with social and physical environments. Home-based programs are often used to achieve such goals [11]. Handling training focuses on the natural environments of child like home and school; thus, it can be considered as a functional and generalizable program [6].

Trained mothers by handling training, prevent secondary conditions including deformities and abnormalities. This condition can limit the children's motor skill development. In this study, the intervention group displayed statistically significant advancement in comparison with the control group. Novak et al. investigated a home-based program in children with CP [18]. The program had a positive effect on participants' motor function. However, this study lacked a control group. To eliminate this issue, they conducted a double-blind randomized controlled trial [6]. They used the Canadian Occupational Performance Measure [25] to measure the changes. Eight weeks of home-based occupational therapy program has focused on parent-selected goals. Findings revealed that home-based programs could be beneficial for children with CP. Behzadi et al. reported that home-based programs that focus on improving gross motor function can be more beneficial than NDT [26].

Handling training used in this study is different from other home-based programs in terms of considering simpler care provision for children with CP who have severe motor impairments. The interventions for children with the highest level of GMFCS are limited. Lowing et al. used goal-directed functional therapy on children with CP. The participants were classified according to GMFCS at levels I-IV. Improvements in the GMFM scores were detected after the intervention and at follow-up [27]. However, they did not include children at GMFCS Level V. Another study found that a home-based occupational therapy program including training of daily living activities, environment adaptation and parent training was promising in caring of children with CP [28].

Creating opportunities and offering adapted activities based on the child's gross motor function level and proper handling and suitable positioning during ADLs can lead to gross motor function improvements by performing exercises and making activities easier. These exercises induce abnormal reflexes inhibition, facilitating normal motor patterns and postures, and reciprocal muscular function adjustment [29]. Intervention implementing is performed based on usual daily care activities

by caregivers in the absence of home-based programs and does not impose additional works on caregivers.

Many caregivers are concerned about the correctness of program implementation. However, this program addresses their questions and eliminates their concerns. Moreover, this program increases parents' participation; the higher the parents' participation through intervention, the better the development in a child's motor function will be [6]. Children have received different interventions; controlling this issue as a confounding variable was so difficult. Setting individual programs based on the special needs of each child was an ideal situation that could not be achieved in this study.

## 5. Conclusion

The obtained results indicated that the handling training for the mothers of children with CP could significantly improve their gross motor skills. Therefore, it can be used as a complementary method of occupational therapy services.

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by ethics committee of University of Social Welfare and Rehabilitation Sciences.

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### Authors contributions

Conceptualization: Sahar Johari, Mina Ahmadi Kahjoogh, Mostafa Daemi; Methodology: Sahar Johari, Mina Ahmadi Kahjoogh; Investigation: Sahar Johari, Mina Ahmadi Kahjoogh, Fatemeh Sanei, Naser Havaei, Mostafa Daemi; Writing- original draft: Sahar Johari, Mina Ahmadi Kahjoogh; Writing-review & editing: Sahar Johari, Mina Ahmadi Kahjoogh, Fatemeh Sanei, Naser Havaei, Mostafa Daemi; and Supervision: Sahar Johari, Mina Ahmadi Kahjoogh.

### Conflict of interest

The authors declare no conflict of interest.

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