

The Effectiveness Of Pilates Exercises On Sitting And Standing Balance In Children With Cerebral Palsy

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Abstract.

The main problem of this research is the balance disorder of sitting and standing in children with cerebral palsy. This disorder occurs because of brain damage during the non-progressive growth and development of children, thus limiting the daily activities of children with cerebral palsy. The purpose of this study was to evaluate the effectiveness of the Pilates exercises method on sitting and standing balance in children with cerebral palsy. This type of research is an experiment with a pre test – post test one group design which was carried out for a period of 16 weeks. The research subjects were children with cerebral palsy who met the inclusion criteria as many as 33 people. The study was carried out at the Education Foundation for Children with Disabilities in Makassar, South Sulawesi, Indonesia and at a children's physiotherapy clinic in Makassar, from February to July 2022. The results of the Paired t test statistical test obtained p value = 0.002 for sitting balance and for standing balance p = 0.002 0.083 which means there is no difference in standing balance before and after giving Pilates exercises.

Keywords: *Pilates exercises, balance sitting, and standing, cerebral palsy*

I. INTRODUCTION

Impaired balance sitting and standing in children with cerebral palsy occurs due to brain damage during the growth and development of children which is non-progressive, thus limiting daily activities and independence [1], [5],[16]. This balance is influenced by the strength of the erector spine and abdominal muscles that control the trunk[1],[2]. The balance of sitting and standing is the first pillar of postural control. If the trunk muscle tone is low it causes balance and mobility problems[3], and if there is spasticity in the legs it will affect lower body mobility and inhibit motor development to stand and walk independently[4] Of all cases of newly diagnosed childhood disability about 57% are related to cerebral palsy[5]. Approximately 70% to 80% of children with cerebral palsy are usually spasticity[2]. Children with spastic diplegia show characteristics such as decreased proprioception, reduced joint range of motion, impaired coordination, and body alignment seen in walking patterns such as decreased walking speed and rhythm [6]. In addition, diplegic cerebral palsy has decreased neuromotor perceptual function, slow anticipatory responses, and inaccurate preparation of activation [8]. Impaired trunk muscle activity occurs due to increased coactivation of agonist and antagonist muscles and lack of muscle strength, [9],[13], so that the postural control of sitting is disturbed and significantly affects the motor development of children [11],[12]. Postural control of children with cerebral palsy involves controlling and orienting the body to achieve balance stability [14]. Trunk stability is very important to maintain balance when changes occur during movement [10], [17]. When the trunk is stable, the upper and lower limbs can be used freely for activities, but children with cerebral palsy show symptoms of hypotonicity, weakness of trunk muscles, increased muscle tone of the upper and lower extremities, loss or delay of postural reflexes and loss of body stability so that children have difficulty sitting such as playing while sitting, eating and living activities. everyday When in a wheelchair[15]

At the Makassar City Education Foundation for Disabled Children, the bobath method is generally used and the Pilates method has never been applied. To date, studies analyzing pilates exercises in children with cerebral palsy have been lacking and interventions used in the clinic for cerebral palsy generally target the extremities, but with impaired trunk control. Only a few studies have focused on trunk control exercises

in the cerebral palsy population. Research on this usually uses games and virtual to train trunk[20]. Various physiotherapy intervention methods that can be used in cases of cerebral palsy include bobath exercises, perceptual motor programs, neurosensomotor, passive stretching, core stability, trunk mobilization, bobath exercises and massage [9], [11],[13],[15], [16], [17].Pilates Exercises are effective in improving balance and gross motor function in cerebral palsy diplegia [4], [19] and according to A. N. Dos Santos, S. S. Serikawa, and N. A. C. F. Rocha (2016) stated that Pilates can be an alternative rehabilitation technique to improve strength and postural control. 20].By understanding the effectiveness of the Pilates method on sitting and standing balance, children with cerebral palsy can help physiotherapists determine the appropriate treatment modality and which will provide the most effective benefits in a rehabilitation program specifically for children with cerebral palsy. Therefore, the aim of this study was to evaluate the effectiveness of the Pilates exercises method on sitting and standing balance in children with cerebral palsy during the 16-week intervention period.

II. METHODS

The design of this study was an experimental one-group design pre-test-post-test which was carried out for 16 weeks. All children with cerebral palsy were screened so that 33 people were netted with the inclusion criteria of research subjects, namely: a. Cerebral palsy patients aged 1 - 7 years b. Unbalanced sitting c. Unbalanced establishment and d. Obtain parental consent to participate in the study.This research was conducted from February to July 2022. A total of 33 children with diplegia are at the Education Foundation for Children with Disabilities in Makassar, South Sulawesi, Indonesia and the Child Development Clinic in Daya, Makassar. During this research, there were no research subjects who dropped out.

Research procedure as follows:

1. Preparation of research administration, namely research ethics, research licensing, research schedule and research materials. This research has received ethical approval from the Health Research Ethics Committee of the Makassar Health Polytechnic with Ethical Approval Recommendation No. 111 / KEPK-PTKMS / III/2022 dated March 31, 2022.
2. Pre-test
Measurement of balance sitting using a sitting level of scale [22] and standing using a pediatric balance scale [23], [24] which was recorded on the measurement form.
3. Research Implementation
Before applying pilates exercises, passive exercises are given to both arms and legs and trunk mobilization as preliminary exercises. The research subjects were 33 children with cerebral palsy who were given Pilates exercises at a dose: 1 time/day, 3 times a week and 12 times for each study subject with a treatment time of 45 minutes for each child.
4. Implementation of Post test
After the treatment on the research subjects, measurements of sitting and standing balance were carried out and the results were recorded on the measurement form of the physiotherapy examination form used in the Makassar Health Polytechnic Physiotherapy Study Program.After all the data from the sitting and standing balance measurements were collected, data analysis and statistical tests were carried out using a paired t test. The level of significance for all statistical tests was set at $p < 0.05$.

III. RESULT AND DISCUSSION

1. Characteristics of research subjects

The characteristics of the research subjects in the treatment group can be seen by age and gender in the table below:

Table 1. Distribution of data on sex and age of research subjects

Gender				Age (years)			
Male		Female		1 – 4		5 – 8	
f	Percentage	f	Percentage	f	Percentage	f	Percentage

20	60,61	13	39.39	22	66.67	11	33,33
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In table 1. There are more men with a percentage of 60.61 4% and more age at 1-4 years as much as 66.67%.

2. Sitting and standing balance

Table 2. Statistical test results for Pilates exercises

Balance index	before Treatment	after treatment	p value
Sitting balance	3.6970 ± .95147	4.2727 ± 1.15306	0,002*
Standing balance	1.6667 ± .47871	.7576 ± .50189	0,083**

* Significant ** Not significant (Paired t test)

Table 2 shows that in the Pilates group for sitting balance, p value = 0.002 (p <0.05) which means there is a difference before and after the intervention and in standing balance, p = 0.083, which means there is no difference in standing balance before and after treatment. pilates exercises.

DISCUSSION

The purpose of this study was to evaluate the effect of the Pilates exercises method on sitting and standing balance in children with cerebral palsy. The results of the study found a significant improvement in sitting balance after being given pilates exercises (table 2) and not significant in standing balance. The results of this study are similar to the statement of R. Sharma, J. Sharma, and V. Bharadwaj (2018), that Pilates exercise is useful for increasing muscle strength and postural control while standing in children with cerebral palsy [24] and Pilates exercise helps stabilize the segment. spine by activating the abdominal muscles, increasing joint stability and increasing neuromuscular efficiency [26]. In addition, pilates exercises are more effective in improving balance and gross motor function in children with cerebral palsy with diplegia than conventional therapy alone [25], so it can be used as a rehabilitation technique for children with cerebral palsy who show mild deficits in motor structure and a high functional level, especially if the goal is to improve muscle strength and postural control during standing [20] Pilates aims to improve core stability, develop balance and flexibility, work to build muscle strength and body control, and improve muscle control without causing tension.

Balance is necessary for exploring and interacting with the environment and has been described as an anchor for directional movement and functional activity in children with cerebral palsy [20]. The increase in sitting balance that occurs in research subjects because Pilates stimulates the trunk muscles in defending the body against gravity so that there is an increase in the number of sarcomeres and muscle fibers (actin and myosin filaments needed in muscle contraction), with the formation of new muscle fibers. Muscle strength can increase which affects the trunk to maintain body alignment. The response that occurs activates the agonist and antagonist muscles synergistically, especially the trunk stabilizing muscles which respond to the vestibular muscles which become activated to contract, causing muscle responses and system adaptation in maintaining sitting balance. Balance is influenced by visuals and head control so that in doing Pilates the correct alignment must be considered [20]. Previous studies reported that information coming from the body and the environment can be transmitted simultaneously to the neck and trunk to allow coordination between head and extremity movements, including neck muscle movements [27]. One of the functions of the neck muscles is to coordinate the position of the body and head with respect to the surrounding environment and provide a stable base of support for the visual and vestibular systems during postural control [27].

IV. CONCLUSION

We believe that Pilates exercises are effective in increasing trunk muscle strength so that they can improve sitting and standing balance in children with cerebral palsy. We suggest that randomized controlled trials with larger samples should be carried out to confirm our findings.

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Research limitations

We could not control the activities undertaken by the study subjects after obtaining pilates exercises.

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