



The Differences in the Effectiveness of Pilates Exercises and Bobath Exercises on Sitting and Standing Balance in Children with Cerebral Palsy

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Abstract: This study aimed to analyze the effectiveness of Bobath and Pilates exercises on sitting and standing balance in children with cerebral palsy. It utilized a quasi-experimental study design with a two-group pre-test-post-test design. The study included 66 children with cerebral palsy, aged 1-7 years, who were randomly divided into two groups: 33 children received Pilates exercises, and 33 children received Bobath training. The intervention was conducted once a day, three times a week, for 45 minutes over a 16-week period. The results of the paired t-test statistics indicated that Pilates exercises significantly improved sitting balance ($p = 0.002$) but had no significant effect on standing balance ($p = 0.083$). On the other hand, Bobath exercises significantly improved both sitting balance ($p = 0.001$) and standing balance ($p = 0.023$). Independent t-test results for sitting balance yielded ($p = 0.039$), and for standing balance ($p = 0.034$). In conclusion, there were significant differences in both sitting balance and standing balance between the group that underwent Pilates exercises and the group that received Bobath exercises in children with cerebral palsy.

Keywords: Bobath; Cerebral palsy; Pilates

Introduction

The problem this research is the impaired balance of sitting and standing in children cerebral palsy, this occurs due to brain damage during non-progressive growth and development, resulting in limited daily activities and independence due to poor postural control, decreased area of joint motion and muscle contractures (Farjoun et al., 2022; Tekin et al., 2018) muscle weakness, altered nerve control and inadequate body position (Monica et al., 2021).

Postural control of children with cerebral palsy involves controlling and orienting the body to achieve balance stability (Güçhan et al., 2020). Balance is influenced by the strength the erector spine and abdominal muscles that enforce and control the trunk (Belizón-Bravo et al., 2021; Moura et al., 2017). If the trunk muscle tone is low it causes balance and mobility problems (Kim et al., 2016) and if there is leg spasticity

in children with cerebral palsy it will affect the movement of the legs and feet. hinder the development of standing and walking independently (Abd-Elfattah et al., 2022).

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 the trunk muscles, increased muscle tone of the upper and lower extremities, loss or delay of postural reflexes and loss of body stability, have difficulty sitting, playing in a sitting position, functional hand movements such as eating and activities of daily living such as sitting in a wheelchair (Shin et al., 2017).

About 57% of diagnosed cases of childhood disability are related to cerebral palsy (Horber et al., 2020) and 2 and 3 per 1000 deliveries (Gbonjubola et al., 2021). About 1 in 500 newborns can develop cerebral palsy with an estimated prevalence of 17 million people

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worldwide who define it as the most common motor disability during childhood (Vinolo-Gil et al., 2021).

The Bobath method is commonly used, but the Pilates method has not yet been implemented. To date, there have been very few studies analyzing the effects of Bobath exercises and Pilates exercises on children with cerebral palsy and the interventions used generally target the extremities, but trunk disorders have been neglected and few studies have focused on trunk exercises in the legs, cerebral palsy population. This research usually uses games and virtual to train trunk (Akbas et al., 2019).

Pilates Exercises are effective in improving balance and gross motor function in cerebral palsy diplegia (Abd-Elfattah et al., 2022; Sari et al., 2016) and according to dos Santos et al. (2016) stated that Pilates can be an alternative rehabilitation technique to improve strength and postural control, improve balance and gross motor function in children with cerebral palsy diplegia.

Bobath exercises improve motor function skills, the level of independence in activities of daily living, and also balance abilities in children with cerebral palsy (Besios et al., 2018; Kavlak et al., 2018), are also effective in gross motor learning, improve muscle tone, reflexes and reaction patterns and movement (Trisnowiyanto et al., 2020).

Understanding the effectiveness of the Bobath and Pilates methods on sitting and standing balance in 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 cerebral palsy. Therefore, the aim of this study was to analyze the different effects of Bobath exercises and Pilates exercises on sitting and standing balance in children with cerebral palsy during the 16-week intervention period.

This research is important because it can help clinicians and parents choose the most effective therapeutic approaches appropriate for children with Cerebral Palsy and has clinical significance in designing therapy programs for children with Cerebral Palsy. This research is important because it can help clinicians and parents choose the most effective therapeutic approaches appropriate for children with Cerebral Palsy and has clinical significance in designing therapy programs for children with Cerebral Palsy.

Method

This study is a quasi-experimental study with a pre-test – post-test two group design with a period of 16 weeks. Children with cerebral palsy with gross motor function classification (GMFCS) III-IV. All children with cerebral palsy were screened according to the inclusion

criteria of research subjects so that 66 people were obtained. Then randomly divided into Pilates exercises and Bobath exercises groups. The inclusion criteria of research subjects are: a) Cerebral palsy patients aged 1-7 years. b) Unbalanced sitting and standing and c. Obtained approval from parents to participate in the study. This study was conducted from February to July 2022. A total of 66 children with diplegia during this study, none of the children from either group dropped out. The research procedure is carried out starting from: a) Preparation for research administration, namely research ethics, research licensing, research schedules and research materials.

b) Pre-Test
Measurement of balance sitting with a sitting level of scale (Triandari et al., 2018) and standing using a pediatric balance scale (Franjoine et al., 2022; Sharma et al., 2018) recorded on the measurement form.

c) Research Implementation
Before applying Pilates exercises and Bobath exercises, passive movements in both arms and legs were given and trunk mobilization as preliminary exercises. The research subjects were 66 people randomly divided into two groups. Group I as many as 33 children with cerebral palsy were given Pilates exercises and group II as many as 33 children with cerebral palsy were given Bobath exercises. Treatment of each child with a dose: 1 time / day, 3 times a week with treatment time for each child 45 minutes for 16 weeks.

d) Implementation of the Post Test
After treatment on research subjects, measurements of sitting and standing balance were carried out.

Data Analysis

Data analysis and statistical tests were performed using paired t test and independent t test. The level of significance for all statistical tests was set at $p < 0.05$.

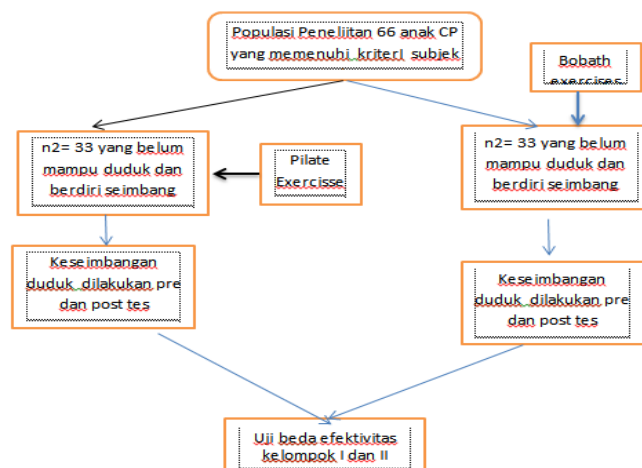


Figure 1. Research flow

Result and Discussion

Characteristics of Research Subjects

Table 1. Characteristics of Research Data

Pilates group	Bobath group	
Gender		
Male	24 (72.73%)	20 (60.61%)
Female	9 (27.27%)	13(39.39 %)

Sitting and Standing Balance in the Pilates and Bobath Exercises Group

Table 2. Results of pre-treatment and post-treatment in the Pilates and Bobath Groups

Balance index	Before treatment	After treatment	p Value
Pilates group			
Sitting balance	3.6970 ± .95147	4.2727± 1.15306	0.002*
Standing balance	1.6667 ± .47871	.7576 ± .50189	0.083**
Bobath group			
Sitting balance	3.4242± .79177	3.7273 ± .94448	0.001*
Standing balance	1.4545 ± .50565	1.6061± .60927	0.023*

Sitting and Standing Balance between Groups

Table 3. Results between Post Treatment in the Pilates and Bobath

Balance index	Pilates group	Bobath group	p Value
after treatment			
Sitting balance	4.2727±1.15306	3.7273±.94448	0.039*
Standing balance	1.7576 ± 1.7576	1.6061 ±.60927	0.034*

*Significant (Independent t- test)

This study aims to compare the effects of the Pilates exercises method and the Bobath exercises method on the sitting and standing balance of children with cerebral palsy. The results showed a significant improvement in sitting balance after being given Pilates exercises and Bobath exercises (table 2). Standing balance was also significant after being given Bobath but in pilates exercises it was not significant for standing balance. The findings of this study corroborate previous findings by various authors who also concluded that there was no significant difference in gross motor skills (Park et al., 2017).

Bobath exercises in children with cerebral palsy improve motor skills, the level of independence in activities of daily living, and balance their abilities (Kavlak et al., 2018; Sari et al., 2016) are also effective in gross motor learning, improve muscle tone, reflexes and patterns of reactions and movements (Besios et al., 2018; dos Santos et al., 2016).

This happens because bobath increases proprioceptive input and reduces spasticity, facilitates normal motor development and increases in activities of

daily living, improves posture and movements performed with abnormal muscle tone (Kim et al., 2016).

Kavlak et al. (2018) stated that the increase in gross motor skills in children with cerebral palsy affects balance which allows children to walk more comfortably and quickly, use their limbs better in their daily activities, because balance is needed to explore and interact with the environment, and has been described as the basis for the functional activity of children with cerebral palsy. In addition, bobath can improve motor skills and the development of cerebral palsy diplegia (Abd-Elfattah et al., 2022) and more effective than conventional treatment (Senturk et al., 2021), another study stated that Bobath-based rehabilitation improves lying and rolling, sitting, crawling and kneeling, and standing, walking skills in spastic cerebral palsy children (Tomruk et al., 2016).

The independent t-test (Table 3) shows that there is a difference between Pilates and Bobath exercises on the balance of sitting and standing in children with cerebral palsy. The results of this study are in accordance with the research of Tekin et al. (2018) who concluded that Bobath improved gross motor function in children with cerebral palsy in four dimensions, namely laying, rolling, sitting, crawling, kneeling, and standing, but walking, running, and jumping did not improve significantly. Besios et al. (2018) stated that Bobath can significantly increase the excitability of alpha motor neurons in central nervous system disorders. With this increase, the motor learning process can be formed as well as the adaptation process and plasticity in the nerves that can help restore movement activities in cerebral palsy patients.

The study of Tekin et al. (2018) states that doctors and researchers working with diparetic and hemiparetic Cerebral Palsy should focus more intensively on the Bobath program to improve motor development, postural control skills, balance and functional independence of daily activities (Kavlak et al., 2018) and 8 weeks of Neurodevelopmental Treatment-based postural control and balance training effectively improve motor function and functional independence in diparetic and hemiparetic cerebral palsy (Tekin et al., 2018).

In the treatment of children with cerebral palsy, the Bobath method provides a direct improvement in the equilibrium and righting reactions which will affect the normal postural reflex mechanism which will be the main support for functional movement (Senturk et al., 2021).

Based on the research of Arı et al. (2017) concluded that the addition of trunk exercise with the Bobath approach in children with cerebral palsy positively affects motor function (Çubukçu et al., 2020). It is recommended that treatment with Bobath in people

with cerebral palsy be carried out according to the right duration and as early as possible for better recovery (Besios et al., 2018).

This study shows that Pilates is effective on sitting balance in children with cerebral palsy. These results are similar to the statement of Sharma et al. (2018), that Pilates exercise is useful in increasing muscle strength and postural control while standing in children with cerebral palsy and Pilates exercise helps stabilize the spinal segment by activating the abdominal muscles, increasing joint stability and increasing neuromuscular efficiency (Panhan et al., 2018).

In addition, pilates exercise is more effective in improving balance and gross motor function in children with cerebral palsy with diplegia compared to conventional therapy (Abd-Elfattah et al., 2022), so it can be used as a rehabilitation technique for children with cerebral palsy who have mild motor deficits and high functional levels, especially if the goal is to improve muscle strength and postural posture during standing (dos Santos et al., 2016).

Abd-Elfattah et al. (2022) stated that Pilates exercise combined with certain physical therapy programs improved gross motor function and balance compared to physical therapy alone and was effective on spinal muscles to improve neuromuscular efficiency. In addition, Pilates has been shown to increase blood circulation, relax muscles, increase attention, concentration, breathing, sleep quality and body energy, and increase individual endurance (Senturk et al., 2021). Ten weeks of Pilates exercise was effective in increasing sensory interaction, reducing fatigue and balance in multiple sclerosis outpatients (Tomruk et al., 2016).

The results of this study were not effective on standing balance in children with cerebral palsy. Park et al. (2017) concluded that Bobath exercises in cerebral palsy for 1 year at a dose of 35 minutes per day, 2-3 times per week were significantly effective in reducing spasticity but did not improve gross motor function (Park et al., 2017) and another study stated that rehabilitation Bobath-based increases the ability to lie down and roll over, sit, crawl and kneel, and stand, walk skills in children with cerebral palsy (Çubukçu et al., 2020). Therefore, it is recommended that this study be added to the research time to obtain better results on the balance of the stand.

Bobath therapy involves the use of movement, exercises, and stimulation to stimulate the nervous system and muscles that may be impaired in children with cerebral palsy. This helps improve coordination and motor control in children with CP (Lee, 2021).

Pilates exercises facilitate the Multifidus muscles, which are local muscles attached directly to the spine, control proper movement and provide stability between the vertebrae transverse abdominis and internal

obliques are other local muscles located in the deep layers of the abdomen that provide stability by connecting the pelvis and bones ribs to spinal fascia. Local muscles contract before global muscles to maintain proximal stability, thus providing support to global muscle action. In addition to these muscles, the multifidus, pelvic floor muscles, and diaphragm form a local muscle system in the lower back to provide trunk stability (Tekin et al., 2018). Therapeutic interventions that focus on proprioceptive training can improve trunk control in children with spastic CP, so children with CP must be given exercises like this to improve trunk control when sitting and standing (Monica et al., 2021).

Conclusion

Bobath is effective in improving sitting and standing balance in Cerebral Palsy children, while Pilates is only effective in improving sitting balance.

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Author Contributions

The main author, Suharto, contributed to conducting research, compiling research reports, and compiling research articles. The second author, Sri Saadiyah Leksonowati, contributed to the data collection and analysis process and the third author, Suriani, assisted in conducting the research and writing research articles. All authors have read and agree to the published version of the manuscript.

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Conflicts of Interest

There is no conflict of interest in this study.

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