

## EFFECTS OF EXERCISE THERAPY WITH THE BOBATH METHOD ON BALANCE IN A CHILD WITH SPASTIC DIPLEGIC CEREBRAL PALSY: A CASE REPORT

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### ABSTRACT

The overall birth prevalence of cerebral palsy is about 2 per 1000 live births. Weakness in balance control is one of the most common problems encountered in children with CP. One of the most widely used physiotherapy approaches for children with CP is Bobath therapy. Exercise with the Bobath method can improve postural control and balance in children with CP. This study aims to determine the effect of exercise therapy with the Bobath method for balance in a child with spastic diplegic cerebral palsy. This study using a single-subject research conducted on a child with a diagnosis of spastic diplegic cerebral palsy who was given exercise therapy using the Bobath method 4 times a week for 4 weeks. Measurement of balance using the Pediatric Balance Scale (PBS) which was carried out before exercise therapy was given (A1), follow-up (A2), and evaluation of the final outcome (A3). The results showed that the patient had an increase in the PBS score, which means that there was an increase in functional balance. The conclusion of this study is that exercise therapy with the Bobath method which has been carried out 4 times a week for 4 weeks improves functional balance in a child with a diagnosis of spastic diplegic cerebral palsy.

Keywords: Cerebral Palsy, Balance, Bobath Method

### BACKGROUND

Population-based studies from around the world report that estimates of the prevalence of Cerebral Palsy (CP) range from 1.5 to more than 4 per 1,000 live births or children of a given age range. The overall birth prevalence of CP is approximately 2 per 1000 live births (Stavsky et al., 2017).

CP is a neuromotor disorder that affects the development of movement, muscle tone and attitude. The underlying pathophysiology is injury to the developing brain in the prenatal to neonatal period. CP motor disorders are often accompanied by impaired sensation, perception, cognition, communication, behavior, seizures and secondary musculoskeletal problems (Patel et al., 2020). CP diplegia is the most common classification of CP. One of the causes of diplegic spastic CP is hypoxia which causes interference with white matter infarcts in the periventricular area. It affects mainly the lower extremities.

The etiology of CP can occur in the prenatal (75%), perinatal (6-8%) and postnatal (10-18%). The classification of clinical features in CP is spastic, athetoid, ataxia, atony, and mixed. While the topographic classification in CP is diplegia is the most common form (30-40%), hemiplegic (20-30%), quadriplegic (10-15%) which in each type is spastic (Jan S. Tecklin, 2015).

Weakness in balance control is one of the most common problems encountered in children with CP. CP originating from brain lesions results in loss of motor control and abnormalities in muscle tone, causing an imbalance between agonist and antagonist muscle movements, coordination problems, sensory abnormalities, and weakness. Thus the control of static and dynamic balance will be disturbed which results in limitations in motor development (Lazzari et al., 2017). Balance control is important for most functional abilities, one of which is helping children reduce unexpected balance disorders, such as slipping, tripping, and self-induced instability during movement (Kavlak et al., 2018).

One of the most widely used physiotherapy approaches for children with CP is Bobath therapy. Bobath therapy has 3 main principles: facilitation, stimulation and inhibition. It is known that Bobath therapy has a positive effect on postural control and balance disorders by a method based on these 3 principles (Tekin et al., 2018). The Bobath concept emphasizes observing and analyzing the performance of the patient's current functional skills and identifying clear therapeutic goals. The aim of the approach is to influence muscle tone, improve postural alignment with specific handling techniques, work for better active participation and exercise specific and relevant functional skills. According

to a study conducted by Kavlak et al in 2018 bobath therapy is considered appropriate to treat any motor control disorder in the CP spectrum (Kavlak et al., 2018). In addition, research conducted by (Arı & Kerem Günel, 2017) states that an exercise program based on the Bobath method can improve functional balance as indicated by an increase in the Pediatric Berg Balance Scale (PBBS) score.

The purpose of this study was to determine the effect of exercise therapy using the Bobath method for balance in a child with spastic diplegic cerebral palsy.

## METHOD

This study was conducted using single-subject research with an ABA design approach. This design is to find out the benefits of exercise therapy using the Bobath method for balance in children with cerebral palsy: Case Report. The ABA research design can be seen in the image below.

A1 → B1 → A2 → B2 → A3

Description:

- A1: Baseline is a balance check using the Pediatric Balance Scale (PBS).
- B1: Giving intervention in the form of exercise therapy with the bobath method 4x/week in the first week and the second week.
- A2: Follow-up, Follow-up is a re-examination with the PBS instrument after the intervention (B1) is carried out at the end of the 2nd week.
- B2: Giving intervention in the form of exercise therapy with the bobath method 4x/week in the 3rd and 4th weeks.
- A3: Evaluation of the final results with the PBS instrument conducted at the end of the study.

The location of the research was carried out at the Pediatric Neurodevelopmental Therapy Center (PNTC) clinic, Tohudan, Colomadu, Karanganyar, Central Java. The time for the study is November 01, 2021 to November 27, 2021. The study was conducted on a 5-year-old pediatric patient with a clinical diagnosis of Cerebral Palsy Spastic Diplegia.

The study stage begins with a baseline in the form of an initial examination conducted on November 1, 2021 by measuring balance using the Pediatric Balance Scale (PBS). The operational definition of an intervention consists of:

a. Independent Variable

The independent variable used in this study is exercise therapy with the Bobath method. Bobath method is a physiotherapy approach that is most often used in children with cerebral palsy which has 3 main principles: facilitation, stimulation and inhibition. Exercise with the bobath method can improve postural control and balance in children with cerebral palsy. The explanation of the exercises given is described as follows:

- 1) Crawl practice  
In this exercise the position of the child is prone lying, the therapist is in front and behind the child. Handling therapy which is in front is on the head and to move the child's hands, for the therapist behind is on both legs of the child. Help the child to crawl properly and correctly.
- 2) Squat to standing exercise  
In this exercise the position of the child is squatting with both hands in front, the therapist is behind the child. Instruct the child to stand up, then the therapist supervises and corrects when the child is wrong in doing the squatting to standing motion so that the child does the squat to stand movement correctly. Pelvic fixation when the child is not standing upright in order to stand upright.
- 3) Standing exercise  
In this exercise, the child is standing with the therapist behind or beside the child. Instruct the child to stand up straight. When standing, fix the pelvis and instruct to straighten the knee. Release the fixation when the child is standing properly.
- 4) Standing exercise on the balance board  
In this exercise the position of the child is standing in front of the swaying board and the position of the therapist behind the child by fixing the pelvis. Instruct the child to climb onto the balance board by raising the legs

alternately. Hold for a few seconds while standing on the balance board and occasionally release the pelvic fixation when the child is in a stable and upright position on the swaying board.

5) Walking practice

In this exercise, the child is in a standing position, the therapist is behind the child with handling at the child's pelvis. Facilitate the child when walking to walk steadily and correctly. Release the fixation on the pelvis when the child is walking steadily and correct gait when walking with the wrong movement.

b. Dependent variable

The dependent variable in this study is the Pediatric Balance Scale (PBS). PBS is a modification of the Berg Balance Scale (BBS). This measurement instrument has 14 items with a scale value of 0 – 4 (the scale is based on the quality and time required to complete the test) which is used to assess the functional balance of children with mild to moderate motor impairment. This measuring device can detect the presence of balance disorders in children and is also used to monitor progress in the therapeutic program. Patients are assessed when doing something according to criteria, including: sitting position to standing, standing to sitting, transfer, standing without assistance, sitting without assistance, standing with eyes closed, standing with both feet together, standing with one foot in front of the foot. others, stand on one leg, rotate 360o, turn to look behind, pick up objects from the floor, put feet on stools, and reach for objects with outstretched arms.

PBS has a test-retest reliability value (ICC: 0.998) with a high interrater indicating ICC (3.1) = 0.997 (Franjoine et al., 2003). The interpretation of the final results of measurements using PBS is as follows:

- a) 56 – 41 = Independent
- b) 40 – 21 = Requires assistant/assistance
- c) < 20 = Requires wheelchair assistance

**Table 1. Crawl Exercise Dose**

No	Week	Frequency	Intensity	Time	Type
1	1 <sup>st</sup>	4x/week	25 reps	-	Crawl practice
2	2 <sup>nd</sup>	4x/week	25 reps	-	Crawl practice
3	3 <sup>rd</sup>	4x/week	25 reps	-	Crawl practice
4	4 <sup>th</sup>	4x/week	25 reps	-	Crawl practice

**Table 2. Squat to Standing Exercise Dose**

No	Week	Frequency	Intensity	Time	Type
1	1 <sup>st</sup>	4x/week	10 resp	Hold 10 seconds in standing position	Squat to standing exercise
2	2 <sup>nd</sup>	4x/week	10 reps	Hold 10 seconds in standing position	Squat to standing exercise
3	3 <sup>rd</sup>	4x/week	15 reps	Hold 10 seconds in standing position	Squat to standing exercise
4	4 <sup>th</sup>	4x/week	15 reps	Hold 10 seconds in standing position	Squat to standing exercise

**Table 3. Standing Exercise Dose**

No	Week	Frequency	Intensity	Time	Type
1	1 <sup>st</sup>	4x/week	1 set	15 minutes	Standing exercise
2	2 <sup>nd</sup>	4x/week	1 set	20 minutes	Standing exercise
3	3 <sup>rd</sup>	4x/week	1 set	30 minutes	Standing exercise
4	4 <sup>th</sup>	4x/week	1 set	30 minutes	Standing exercise

**Table 4.** Standing Exercise on the Balance Board

No	Week	Frequency	Intensity	Time	Type
1	1 <sup>st</sup>	4x/week	10 resp	Hold 10 seconds while standing on balance board	Standing exercise on the balance board
2	2 <sup>nd</sup>	4x/week	10 reps	Hold 10 seconds while standing on balance board	Standing exercise on the balance board
3	3 <sup>rd</sup>	4x/week	15 reps	Hold 10 seconds while standing on balance board	Standing exercise on the balance board
4	4 <sup>th</sup>	4x/week	15 reps	Hold 10 seconds while standing on balance board	Standing exercise on the balance board

**Table 5.** Walking Practice Dose

No	Week	Frequency	Intensity	Time	Type
1	1 <sup>st</sup>	4x/week	5 reps, 5 meters distance	-	Walking practice
2	2 <sup>nd</sup>	4x/week	5 reps, 5 meters distance	-	Walking practice
3	3 <sup>rd</sup>	4x/week	8 reps, 5 meters distance	-	Walking practice
4	4 <sup>th</sup>	4x/week	8 reps, 5 meters distance	-	Walking practice

The following is an intervention using the Bobath method:

- 1) Tools and Materials
  - a) Balance board
  - b) Meterline
  - c) Masking tape
- 2) Procedure
 

As the beginning of therapy, the subject was given neurosensory with the aim of organizing sensory before exercise. The exercise using the Bobath method begins with crawling exercises, squatting to standing exercises, standing exercises, standing exercises on a balance board, and walking exercises according to the intervention dose.
- 3) Scoring
 

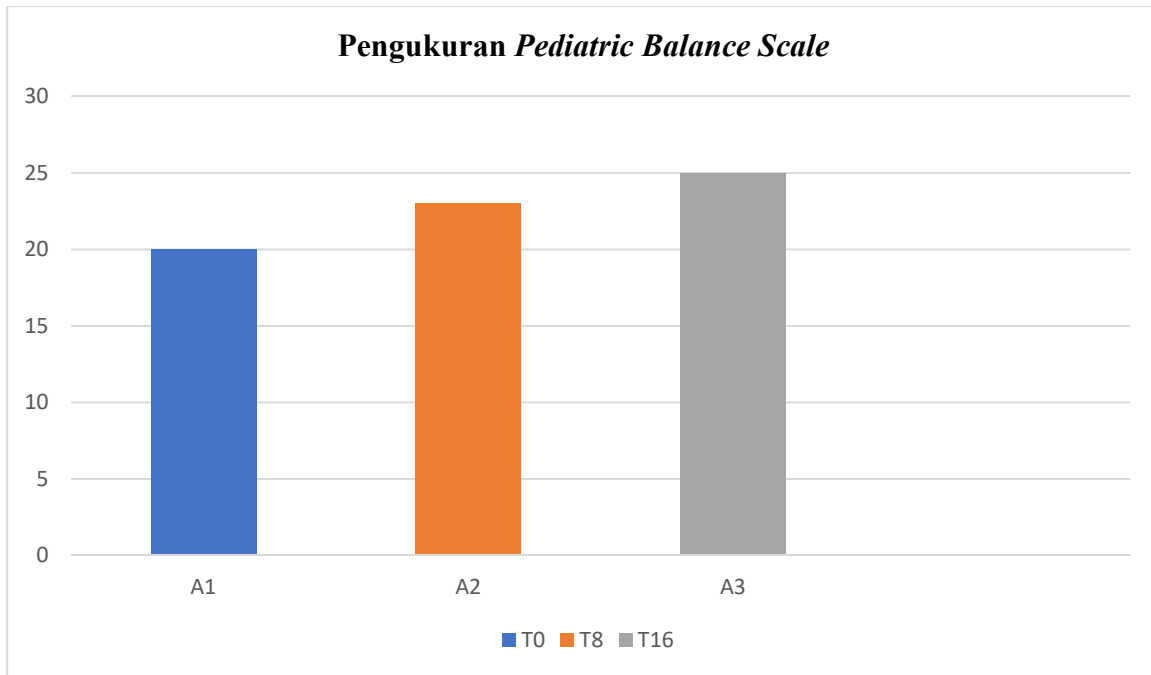
Assessment of balance ability using the Pediatric Balance Scale (PBS) measurement instrument.

Data analysis and processing in this study used a statistical approach in the form of a progressive picture. The outcome in this study was the ability to balance in children with spastic diplegic cerebral palsy as measured using PBS. The presentation of the results in this study uses a table. Table illustrating the effect of exercise therapy with the bobath method to balance children with diplegic spastic cerebral palsy.

The data analysis process is required in every condition with components that need to be considered, namely changed variables, changes in stability, emerging effects, and overlapping data. The baseline measurement (A1) was carried out once to see the patient's ability to balance. The second phase (B1) in this study is the provision of interventions carried out 4x/week in the first week and the second week. At the end of the second phase, after the 8th session of therapy, a follow-up (A2) was carried out using the PBS instrument to determine the progress of the intervention given. The next phase (B2) is the provision of interventions that are carried out 4x/week in the 3rd and 4th weeks. The last phase is the evaluation of the final outcome of therapy (A3) which is carried out to identify the success of the intervention using the PBS instrument.

## REASULT AND DISCUSSION

After doing exercise therapy using the Bobath method in patients with cerebral palsy aged 5 years for 4 weeks with 16 therapy sessions carried out 4 times a week, then measurements were made on the 8th and 16th therapy using PBS.



**Figure 1.** Pediatric Balance Scale Measurement Results

Based on exercise therapy with the Bobath method which has been given 16 times for 4 weeks. At the follow-up and final evaluation using PBS, it was found that the patient had an increase in the PBS score which meant that there was an increase in functional balance.

Balance is a necessary ability to explore and interact with the environment. Balance is likened to an anchor for directed movement and functional activity in children with CP (Kavlak et al., 2018). The problem with CP is the presence of spasticity which will affect postural muscle tone abnormalities. Tonus abnormalities will affect attitude, movement, joint range of motion and balance (Anwar et al., 2021). Children with CP also have limitations in static and dynamic postural control such as sitting, standing, and walking (Kavlak et al., 2018).

Exercise with the Bobath method has 3 main principles: stimulation, facilitation, and inhibition. Stimulation is an effort to strengthen and increase muscle tone through proprioceptive and tactile exercises such as standing on a balance board. This exercise is useful for improving reactions in children, maintaining the position and movement patterns that are affected by the force of gravity automatically.

Facilitation is an effort to facilitate automatic reactions and perfect motor movements in normal muscle tone. In this technique, the patient must perform exercises actively and the therapist acts as an assistant. The goal is to improve normal postural tone, maintain and restore the quality of normal tone, facilitate intentional or necessary movements in daily activities.

Inhibition is an attempt to inhibit and reduce muscle tone with the Inhibitory Pattern Reflex technique. Changes in postural and patterned tone lead to more normal movement by inhibiting abnormal movement patterns into normal postures (Zanon et al., 2017).

Exercise with the Bobath method also emphasizes how a movement is produced and how the movement is learned repeatedly (Task-specific repetitive movements) so that active movement exercises from the patient are needed (Squire et al., 2008). Active exercise can increase the interaction between the cerebral cortex, basal ganglia, brain stem, and cerebellum which play an important role in postural control which will affect the regulation of motion and balance (Wong & Ghosh, 2002).

## CONCLUSION AND SUGGESTION

Based on the results of research that has been carried out, exercise therapy using the Bobath method that has been carried out on a child with a diagnosis of spastic cerebral palsy diplegi 4 times a week for 4 weeks, the results are an increase in several PBS assessment items, including: sitting to standing, standing with the two feet are close together, standing with 1 foot in front of the other foot, turning to look behind, and placing the foot on the stool so that there is an increase in the final score of the PBS assessment which means there is an increase in functional balance in the child.

The research time in this article is not long so that in future research it is advisable to conduct research for a long time so that the final results are more clearly visible. In addition, the researcher suggests using more than one item to measure the balance so that more accurate results are obtained.

## REFERENCE

- Anwar, S., L. S. S., & Syakib, A. (2021). Intervensi Kinesio Taping Dan Bobath Exercises Terhadap Peningkatan Keseimbangan Berdiri Dan Penurunan Spastisitas Tungkai Pasien Cerebral Palsy Di Sekolah Luar Biasa Dan Yayasan Pendidikan Anak Cacat Makassar. *Buletin Penelitian Sistem Kesehatan*, 24(4), 245–251. <https://doi.org/10.22435/hsr.v24i4.3407>
- Ari, G., & Kerem Günel, M. (2017). A Randomised Controlled Study to Investigate Effects of Bobath Based Trunk Control Training on Motor Function of Children with Spastic Bilateral Cerebral Palsy. *International Journal of Clinical Medicine*, 08(04), 205–215. <https://doi.org/10.4236/ijcm.2017.84020>
- Franjoine, M. R., Gunther, J. S., & Taylor, M. J. (2003). Paediatric Balance Scale. In *Pediatric Physical Therapy* (Vol. 15, Issue 2, pp. 114–128). Pediatric Physical Therapy.
- Jan S. Tecklin. (2015). *Pediatric Physical Therapy Fifth Edition*. Lippincott Williams & Wilkins.
- Kavlak, E., Unal, A., Tekin, F., & Altug, F. (2018). Bobath terapisinin serebral palside denge üzerindeki etkisi. *Cukurova Medical Journal*, 43(4), 975–981. <https://doi.org/10.17826/cumj.375565>
- Lazzari, R. D., Politti, F., Belina, S. F., Collange Grecco, L. A., Santos, C. A., Dumont, A. J. L., Lopes, J. B. P., Cimolin, V., Galli, M., & Santos Oliveira, C. (2017). Effect of Transcranial Direct Current Stimulation Combined With Virtual Reality Training on Balance in Children With Cerebral Palsy: A Randomized, Controlled, Double-Blind, Clinical Trial. *Journal of Motor Behavior*, 49(3), 329–336. <https://doi.org/10.1080/00222895.2016.1204266>
- Patel, D. R., Neelakantan, M., Pandher, K., & Merrick, J. (2020). Cerebral palsy in children: A clinical overview. *Translational Pediatrics*, 9(1), S125–S135. <https://doi.org/10.21037/tp.2020.01.01>
- Squire, L., Berg, D., Bloom, F., Lac, S. Du, Ghosh, A., & Spitzer, N. (2008). Fundamental Neuroscience 3rd Edition. In *Elsevier* (3rd ed.). Elsevier. <https://doi.org/10.1201/9781315373034>
- Stavsky, M., Mor, O., Mastrolia, S. A., Greenbaum, S., Than, N. G., & Erez, O. (2017). Cerebral palsy-trends in epidemiology and recent development in prenatal mechanisms of disease, treatment, and prevention. *Frontiers in Pediatrics*, 5(February), 1–10. <https://doi.org/10.3389/fped.2017.00021>
- Tekin, F., Kavlak, E., Cavlak, U., & Altug, F. (2018). Effectiveness of Neuro-Developmental Treatment (Bobath Concept) on postural control and balance in Cerebral Palsied children. *Journal of Back and Musculoskeletal Rehabilitation*, 31(2), 397–403. <https://doi.org/10.3233/BMR-170813>
- Wong, R. O. L., & Ghosh, A. (2002). Activity-dependent regulation of dendritic growth and patterning. *Nature Reviews Neuroscience*, 3(10), 803–812. <https://doi.org/10.1038/nrn941>
- Zanon, M., Porfirio, G., Riera, R., & Martimbianco, A. (2017). *Neurodevelopmental Treatment Approach for Children with Cerebral Palsy* (p. 20). John Wiley & Sons, Ltd. <https://doi.org/10.1002/14651858.CD011937>