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Effectiveness of Higher Function Practice on Balance and Function among the Patients with Cerebral Palsy

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled **Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy** Submitted by **Jerifa Akter Dola,** for the partial fulfillment of the requirement for the degree of Bachelor of Science in Physiotherapy.

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DECLARATION

This work has not previously been accepted in substance for any degree and isn't concurrently submitted in candidature for any degree. This dissertation is being submitted in partial fulfillment of the requirements for the degree of B.Sc. in Physiotherapy.

I confirm that if anything is identified in my work that I have done plagiarism or any form of cheating that will directly awarded me fail and I am subject to disciplinary actions of authority. I confirm that the electronic copy is identical to the bound copy of the thesis.

In case of dissemination the finding of this project for future publication, research supervisor will highly concern, it will be duly acknowledged as graduate thesis and consent will take from the physiotherapy department of Saic College of Medical Science and Technology (SCMST).

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ACRONYMS

- **ADLs**: Activities of Daily Living
- **BMI**: Body Mass Index
- **CNS**: Central Nervous System
- **CP**: Cerebral Palsy
- **CRP**: Centre for Rehabilitation of the Paralyzed
- **FIM**: Functional Independence Measure
- **GMFCS**: Gross Motor Function Classification System
- **HFP**: Higher-Function Practice
- **NDT**: Neuro-Developmental Therapy
- **PNF**: Proprioceptive Neuromuscular Facilitation
- **RCT**: Randomized Controlled Trial

ABSTRACT

Introduction: Cerebral palsy (CP) is a primary cause of motor disability in children, often affecting balance and functional independence, which impacts daily activities and quality of life. This study examines the efficacy of higher-function practice, a task-specific training intervention, in improving these outcomes in children with CP. **Purpose:** To investigate the effectiveness of higher-function practice combined with conventional physiotherapy for children with CP. **Objective:** To evaluate the impact of higher function practice on balance and functional independence in children with CP. **Methodology:** A single-blind randomized controlled trial was conducted at Firoza Bari Disabled Children's Hospital, Dhaka. Participants aged 4–12 years with GMFCS levels II–IV were randomly assigned to an experimental group (higher-function practice + standard care) or a control group (standard care only). Balance and Functional Independence Measure (FIM) scores were assessed pre- and post-intervention. **Data Analysis:** SPSS version 25 was used for statistical analysis. Paired t-tests and independent t-tests evaluated changes within and between groups. **Results:** The experimental group showed significantly greater improvements in balance (mean increase: 3.50 ± 0.82 to 7.80 ± 0.90) and FIM scores (61.30 ± 7.58 to 74.80 ± 7.72) compared to the control group (balance: 3.60 ± 0.85 to 4.50 ± 0.76; FIM: 57.20 ± 4.83 to 58.50 ± 4.70). **Conclusion:** Higher-function practice effectively enhances balance and functional independence in children with CP, improving their quality of life. It is a cost-effective intervention suitable for resource-limited settings, warranting further research for long-term benefits and scalability.

Key Words: *Cerebral Palsy, Higher-Function Practice, Balance, Functional Independence, Rehabilitation*

CHAPTER- I	INTRODUCTION

1.1 Background

Cerebral palsy (CP) is the most common form of motor handicap of childhood and comprises deficit of movement, posture and functional independence resulting from non progressive brain damage in perinatal period (Novak et al. 2019, p. 705). It affects 1.5 to 4 per 1,000 live births worldwide and regional differences are very dependent on differential availability of healthcare infrastructure and availability. Such variations are very pronounced in low and middle income countries like Bangladesh where the healthcare system is fraught with difficulties in offering the specialized treatment for the children with CP (Rosenbaum et al. 2014, p. 7).

For example, children with CP may have a range of motor impairments from problems with maintaining balance and posture to gross motor impairments that are markedly limited (Long et al. 2024, p. 23). These deficits are not only physical but they also have an adverse effect on their participation in daily activities, psychosocial development, and overall quality of life (Hashad et al. 2024, p. 25). Children with an impairment in balance, mobility, and functional independence find it hard to perform activities of daily living (ADLs), social interaction or achieve autonomy (Wright et al. 2020, p. 113). Thus, the interventions aimed at overcoming these challenges should not be based on traditional physiotherapy alone, and therefore are developed with targeted approaches that aim to improve motor function, balance, and increase functional independence (Novak et al. (2019)).

The absence of therapeutic methods, such as general physiotherapy and static exercises, to satisfy the real world functional needs of children with CP (Himmelmann & Uvebrant. 2018, p. 45).. While these methods can somewhat help, most of the focus on the isolation of motor skills does not prepare the children with the capacity to cope in the context of the complex and dynamic environment (Hashad et al. 2024, p. 25).

However, this gap in rehabilitation strategies prompts the search for new interventions that correspond with neuroplasticity principles, involved in the improvement motor and cognitive functioning (Novak et al. 2019, p. 705).

As a result, higher function practice that is also referred to as task specific training has emerged as a promising intervention for addressing these needs (Long et al. 2024, p. 23). The approach taken is based on the repetitive practice of using purposeful activities that are directly related to the problems encountered by children with CP (Himmelmann & Uvebrant. 2018, p. 220). Based in neuroplasticity, this concept reflects on the brain's capacity for neuroplasticity and reorganize and adaption via persistent, targeted activity so that motor learning and functional independency could be polished (Hashad et al. 2024, p. 25). Considering that CP is characterized by impairments across physical, cognitive, and behavioral domains (Wright et al. 2020, p. 113), this dual focus on motor and cognitive functions makes higher function practice particularly valuable in the rehabilitation of CP.

According to the theoretical foundation of higher-function practice, there are higher-function practice would be based on the neuroplasticity that repetitive and purposeful activities would train neural pathways and increase motor control (Novak et al. 2019, p. 705). This principle is important for children with CP because it spell out the possibility for improving functional abilities through prolonged and meaningful participation in task specific activity (Hashad et al. 2024, p. 25). Through higher function practice, children can continue to develop their motor skills while developing problem solving, and decision making skills—filling that gap between physical rehabilitation and cognitive development (Wright et al. 2020). This holistic approach leads to the physical outcome of the child not just gaining but also acquiring the cognitive tools to deal with everyday challenges (Long et al. 2024, p. 23).

Higher function practice differs from conventional physiotherapy that tends to separate out movement and isolation of motor movements (Novak et al. 2019, p. 705), rather it is functional tasks that others perform such as walking reaching climbing stairs on uneven surface etc. of the functional task of therapy sessions.

By training in real life scenarios, this intervention speeds up translating the learnt skills to home, school, and community environments achieving greater independence and participation (Himmelmann & Uvebrant. 2018, p. 45).. Since real life applicability is such an important thing for children with CP, this emphasis directly increases their capacity to connect to their environment, thereby helping them to feel more autonomous and improve their quality of life (Rosenbaum et al. 2014, p. 7).

Maintaining balance is one of the most important motor impairments of children with CP and is crucial for mobility and also might cause fall (Himmelmann & Uvebrant. 2018, p. 45).. Balance deficits in children with cerebral palsy are caused by a combination of muscle weakness, spasticity, as well as impaired postural control to execute even the simplest movements (Long et al. 2024, p. 23). Comorbidities including poor coordination, sensory processing dysfunctions, and cognitive difficulties all further increase these impairments, thus hampering a child's capacity for stability and safe mobility (Novak et al. 2019, p. 705).

The intervention that uses usually conventional interventions involves the static and dynamic training exercises for the improvement of the postural control (Hashad et al. 2024, p. 25). However, these approaches haven't generalized to addressing all the facets of balance impairments in CP (Long et al. 2024, p. 23). Often times, traditional methods are performed in controlled environments and are not sufficient in preparing children to survive the difficulties of a real world setting (Rosenbaum et al. 2014, p. 7). The limitation demonstrated the need for more comprehensive and dynamic therapeutic approaches (Himmelmann & Uvebrant. 2018, p. 45). These gaps are addressed by higher function practice; task specific exercises that mirror real life situations (Long et al. 2024, p. 23).

Therefore, activities that involve picking up objects from the floor, walking on uneven surfaces, etc. are not only difficult to the child's balance but also help promote their functional independence (Hashad et al. 2024, p. 25). These exercises attempt to recreate the demands of daily life, to prepare children to perform and master skills to do so in their environment (Novak et al. 2019, p. 705). Moreover, this is not only improving motor coordination but also improves confidence, which in turn reduces the risk for fall, and is therefore greatly contributing to the child’s safety and mobility (Himmelmann and Uvebrant 2018).

Children with CP must have a functional independence, a critical outcome that directly impacts children’s ability to perform ADLs, social and educational activities (Wright et al. 2020, p. 113). Higher function practice has been shown to have great capacity to enhance functional independence by focusing on practical, goal directed tasks (Novak et al. 2019, p. 705). This approach, in contrast to generalized physiotherapy which does not have specificity, targets the skills required to achieve autonomy in real world contexts (Long et al. 2024, p. 23). Further, the integration of cognitive engagement in physical tasks further enables the child to problem solve and adapt to changing environment to become more resilient and self efficacious (Hashad et al. 2024, p. 25).

Other than physical improvements, higher function practice has benefits that also extend to psychological and social dimensions (Rosenbaum et al. 2014, p. 7). When children take part in task specific training, they tend to have increased self esteem, decreased need reliance on caregivers, and more involvement in community activities (Novak et al. 2019, p. 705). Therefore, these outcomes help to present a more complete sense of well-being and thus the wider ramifications of this strategy for the enhancement of life quality in children with CP (Wright et al. 2020, p. 113).

In particular, higher function practice is applicable to low resource settings like Bangladesh where accessibility of more advanced rehabilitation technologies and specialized interventions is limited (Himmelmann & Uvebrant. 2018, p. 45)..

However, traditional rehabilitation methods are commonly so expensive or logistically unfeasible that many children with CP do not receive sufficient support (Rosenbaum et al. 2014, p. 7). Alternative, less expensive, and more adaptable practice, so long as it is higher function, can be delivered in community and home based settings and allowable for a significantly larger population (Novak et al. 2019, p. 705).

Thus, higher function practice aligns with the needs of resource constrained environments (Hashad et al. 2024, p. 25), by stressing task specific activities which require little resources. The adaptability ensures that underserved children can still receive effective therapeutic interventions to improve the functional independence and quality of life of children (Long et al. 2024, p. 23). In addition to this, caregivers' involvement in the delivery of higher-function practice improves its feasibility and sustainability by creating a supportive environment for ongoing rehabilitation (Wright et al. 2020, p. 90).

Higher function practice is emerging as a way of improving functional outcomes for children with CP (Novak et al. 2019, p. 705). Task specific training has been shown to result in substantial increase in balance, mobility and functional independence in participants (Hashad et al. 2024, p. 25). These results strongly support the inclusion of higher function practice in rehabilitation protocols, especially children with moderate to severe motor impairments (Himmelmann & Uvebrant. 2018, p. 45). This approach has the potential to change the therapeutic landscape for CP by integrating this approach into standard care, providing a more targeted and effective treatment solution as CP tackles is currently facing (Wright et al. 2020, p. 113).

Complex challenges of cerebral palsy go far beyond the motor impairments, to the overall quality of life and the autocracy of cerebral palsy affected children (Rosenbaum et al. 2014, p. 7). The transformative higher function practice presented here stands in the approach to CP rehabilitation as a task specific, neuroplasticity driven method focusing on the physical as well as cognitive dimensions of impairment (Novak et al. 2019, p. 705).

Thus, this intervention is based on real world application and serves as a bridge, linking therapy and daily living towards children's greater independence and participation in their environment (Hashad et al. 2024, p. 25). In particular, in resource limited settings, its cost effectiveness and adaptability make it ideal due to its ability to help address, the numerous challenging aspects of CP management (Long et al.; 2024). Higher-function practice has the promise to enhance functional independence, improve quality or life, and to empower children with CP to achieve their full potential (Wright et al. 2020, p. 113).

1.1 Rationale:

Cerebral palsy (CP) is a prevalent motor disability in children, severely impacting balance, movement, and independence in daily activities. Traditional physiotherapy often focuses on isolated motor skills, neglecting task-specific challenges and real-world functional needs. As a result, children with CP face significant limitations in participating in social, educational, and family environments, underscoring the need for innovative approaches. Higher-function practice, a task-specific intervention grounded in neuroplasticity, addresses these gaps by emphasizing repetitive, purposeful activities that integrate motor and cognitive functions. Unlike conventional methods, it incorporates real-world tasks, such as walking and navigating uneven surfaces, facilitating better translation of therapy gains into daily life. This approach enhances both postural control and functional independence while fostering problem-solving and decision-making, contributing to overall development. The intervention is particularly relevant in resource-limited settings like Bangladesh, where access to advanced rehabilitation tools is limited. Higher-function practice requires minimal resources, making it scalable and cost-effective for community-based or home settings. Despite its potential, research on its efficacy in low-income regions remains limited. This study aims to evaluate the impact of higher-function practice on balance and functional independence among children with CP, addressing gaps in rehabilitation strategies and providing evidence for integrating this approach into resource-constrained rehabilitation programs.

1.2 Research question:

Is higher-function practice effective on balance and functional independence among the patients with cerebral palsy?

1.1 Aim of the study:

The aim of the study was to investigate the effectiveness of higher function training in improving balance and function in patients suffering from cerebral palsy.

1.2 Objectives:

- **General objective:**

  To compare the effectiveness of higher function practice and usual physiotherapy intervention for improving balance and functional independence in children with cerebral palsy at Firoza Bari Disabled Children Hospital, Dhaka.

- **Specific objectives:**

1. To determine the sociodemographic profile of the participants
2. To assess the pre and post intervention balance level of the patients with cerebral palsy.
3. To evaluate the pre and post functional independence using the functional independence measure (FIM) of the patients with cerebral palsy.
4. To compare the outcomes between the experimental group receiving higher function practice and the control group receiving usual physiotherapy intervention.

1.3 Research Hypothesis

Null hypothesis (Ho):

Implementing higher-function practice results in a significant improvement in balance and functional independence among children with cerebral palsy.

$$\mu_1 - \mu_2 \neq 0 \text{ or } \mu_1 \neq \mu_2$$

Alternative hypothesis (Ha):

Higher-function practice does not result in a significant improvement in balance and functional independence among children with cerebral palsy.

$$\mu_1 - \mu_2 = 0 \text{ or } \mu_1 \geq \mu_1$$

Here,

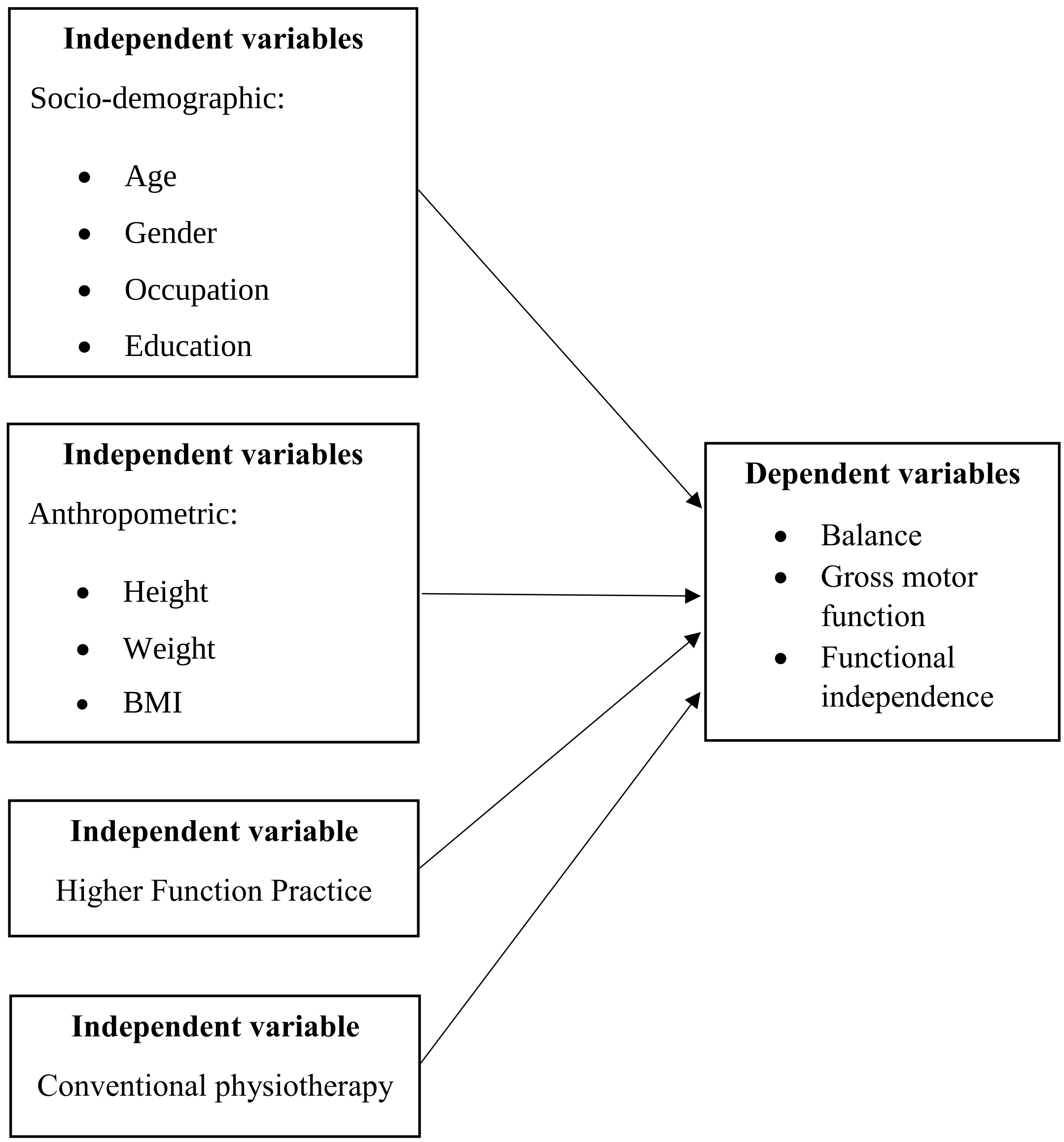
Ho = Null hypothesis

Ha = Alternative hypothesis

μ_1 = Mean of population 1

μ_2 = Mean of population 2

1.7 List of variables:



1.8 Operational definition of variables:

Cerebral Palsy (CP): A non-progressive neurological disorder caused by brain damage during the prenatal, perinatal, or postnatal period, characterized by impairments in movement, posture, and functional independence.

Higher-Function Practice: A task-specific, neuroplasticity-driven intervention involving repetitive, purposeful activities designed to improve motor and cognitive functions and enhance functional independence.

Functional Independence Measure (FIM): A standardized tool used to assess participants' ability to perform activities of daily living (ADLs) independently, scored from 18 (total dependence) to 126 (complete independence).

Gross Motor Function Classification System (GMFCS): A five-level classification system used to categorize the severity of motor impairments in children with CP, ranging from Level I (mild) to Level V (severe).

Standard Care: Routine physiotherapy and occupational therapy practices provided to children with CP, focusing on general motor skills and postural control.

Balance: The ability to maintain postural stability during static or dynamic activities, measured through tasks assessing postural alignment, weight distribution, and recovery from external disturbances.

Task-Specific Training: A rehabilitation approach emphasizing the practice of real-world functional tasks, such as walking, climbing stairs, and reaching, to promote motor learning and functional skill acquisition.

Nutritional Status: The physical condition of a participant determined by Body Mass Index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m^2), and categorized as underweight, healthy weight, or overweight.

CHAPTER- II LITERATURE REVIEW

Cerebral palsy (CP) is a leading cause of motor disability in children, affecting movement, posture, and independence due to irreversible brain damage occurring before, during, or shortly after birth (Novak et al. 2019, p. 705). The condition impacts approximately 1.5 to 4 per 1,000 live births worldwide, with prevalence rates varying based on healthcare accessibility and infrastructure. These disparities are particularly evident in low- and middle-income countries (LMICs) like Bangladesh, where access to specialized rehabilitation services remains limited (Rosenbaum et al. 2014, p. 7). This lack of appropriate therapeutic interventions further exacerbates functional impairments and mobility challenges, reducing opportunities for children with CP to gain independence.

Motor impairments in CP can range from mild difficulties in balance and coordination to severe limitations in gross motor function (Long et al. 2024, p. 23). Beyond physical disabilities, CP also affects cognitive, emotional, and social development, restricting children's ability to participate in everyday activities (Hashad et al. 2024, p. 25). Many children with CP struggle with essential tasks such as walking, maintaining balance, or performing self-care activities, which in turn impacts their ability to interact socially and achieve autonomy (Wright et al. 2020, p. 113). Addressing these challenges requires more than conventional physiotherapy, as more targeted interventions are needed to enhance balance, mobility, and functional independence (Novak et al. 2019, p. 705).

Traditional rehabilitation approaches, including passive stretching and general physiotherapy, may offer some benefits but are often insufficient in preparing children with CP for real-world challenges (Himmelmann & Uvebrant 2018, p. 45). These conventional methods primarily focus on isolated muscle movements rather than on integrating motor skills into functional activities, limiting their overall effectiveness in improving everyday mobility (Hashad et al. 2024, p. 25). To address these gaps, researchers have explored rehabilitation techniques that align with neuroplasticity principles, allowing for improvements in both motor and cognitive function through targeted, task-specific training (Novak et al. 2019, p. 705).

One such intervention, known as higher function practice or task-specific training, has emerged as a more effective alternative to traditional therapy (Long et al. 2024, p. 23). This approach prioritizes repetitive, goal-oriented tasks that simulate real-life challenges, directly addressing the functional difficulties faced by children with CP (Himmelmann & Uvebrant 2018, p. 220). Grounded in the concept of neuroplasticity, higher function practice enhances the brain's ability to adapt and reorganize, strengthening neural pathways through repeated and meaningful activity (Hashad et al. 2024, p. 25). Since CP impacts not only motor abilities but also cognitive and behavioral functions, this dual-focus approach ensures a more comprehensive rehabilitation strategy (Wright et al. 2020, p. 113).

The fundamental principle of higher function practice suggests that purposeful and repetitive tasks reinforce neural networks, leading to greater motor control and functional gains (Novak et al. 2019, p. 705). By engaging in activities that mimic daily tasks, children with CP can improve their coordination while simultaneously developing critical thinking and problem-solving skills (Hashad et al. 2024, p. 25). This approach effectively bridges the gap between physical rehabilitation and cognitive development, empowering children with CP to become more independent in both movement and decision-making (Wright et al. 2020, p. 113). Through consistent engagement in real-life scenarios, children acquire not only better motor function but also the cognitive skills necessary to navigate everyday challenges (Long et al. 2024, p. 23).

Unlike conventional physiotherapy, which often isolates movement patterns for training, higher function practice integrates real-world activities such as walking on uneven terrain, reaching for objects, and climbing stairs into therapy sessions (Novak et al. 2019, p. 705). By practicing movements in a realistic context, this approach enhances the transferability of learned skills to home, school, and social environments, ultimately fostering greater independence (Himmelmann & Uvebrant 2018, p. 45). This real-life applicability is particularly crucial for children with CP, as it not only improves their ability to interact with their surroundings but also promotes autonomy and a better quality of life (Rosenbaum et al. 2014, p. 7).

Maintaining balance is one of the most important motor impairments of children with CP and is crucial for mobility and also might cause fall (Himmelmann & Uvebrant. 2018, p. 45).. Balance deficits in children with cerebral palsy are caused by a combination of muscle weakness, spasticity, as well as impaired postural control to execute even the simplest movements (Long et al. 2024, p. 23). Comorbidities including poor coordination, sensory processing dysfunctions, and cognitive difficulties all further increase these impairments, thus hampering a child's capacity for stability and safe mobility (Novak et al. 2019, p. 705).

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Higher function practice is emerging as a way of improving functional outcomes for children with CP (Novak et al. 2019, p. 705). Task specific training has been shown to result in substantial increase in balance, mobility and functional independence in participants (Hashad et al. 2024, p. 25). These results strongly support the inclusion of higher function practice in rehabilitation protocols, especially children with moderate to severe motor impairments (Himmelmann & Uvebrant. 2018, p. 45). This approach has the potential to change the therapeutic landscape for CP by integrating this approach into standard care, providing a more targeted and effective treatment solution as CP tackles is currently facing (Wright et al. 2020, p. 113).

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CHAPTER- III	METHODOLOGY

3.1 Study design:

The study design was a Randomized Controlled Trial (RCT). This design was best for comparing the effectiveness between higher function training and conventional physiotherapy among the patients with cerebral palsy.

3.2 Study area:

The research was conducted at the Firoza Bari Hospital Unit in Dhaka, Bangladesh. This institution is well-regarded for its expertise in neurological and motor disability rehabilitation, offering specialized care for children with CP.

3.3 Study place:

The study was conducted at Saic College of Medical Science and Technology (SCMST) at Mirpur, Dhaka.

3.4 Study period:

The study period was one year. (September 2023 to August 2024).

3.5 Study population:

The study population consisted of children aged 4–12 years diagnosed with cerebral palsy. Participants were selected to represent a range of functional abilities as classified by the Gross Motor Function Classification System (GMFCS) levels II to IV. These levels indicated moderate to severe motor impairments without the inclusion of children with the most severe physical limitations (level V) or the mildest impairments (level I). The selection criteria ensured a homogeneous and representative sample, enabling meaningful comparisons of the intervention's impact within a targeted population of children with significant functional challenges.

3.6 Sample size:

k = $\frac{n_2}{n_2} = 1$

$n_1 = \frac{\left(\sigma_1^2 + \sigma_2^2 / K\right)\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{\Delta^2}$

$n_1 = \frac{(1.48^2 + 1.48^2/1)\,(1.96+1.04)^2}{1.39^2}$

$n_1 = 15$

$n_2 = K \times n_1 = 15$

Here,

$\Delta = \mu_2 - \mu_1$ = absolute difference between two means

σ_1 , σ_1 = variance of mean 1 and 2

n_1 = sample size for group 1

n_2 = sample size for group 2

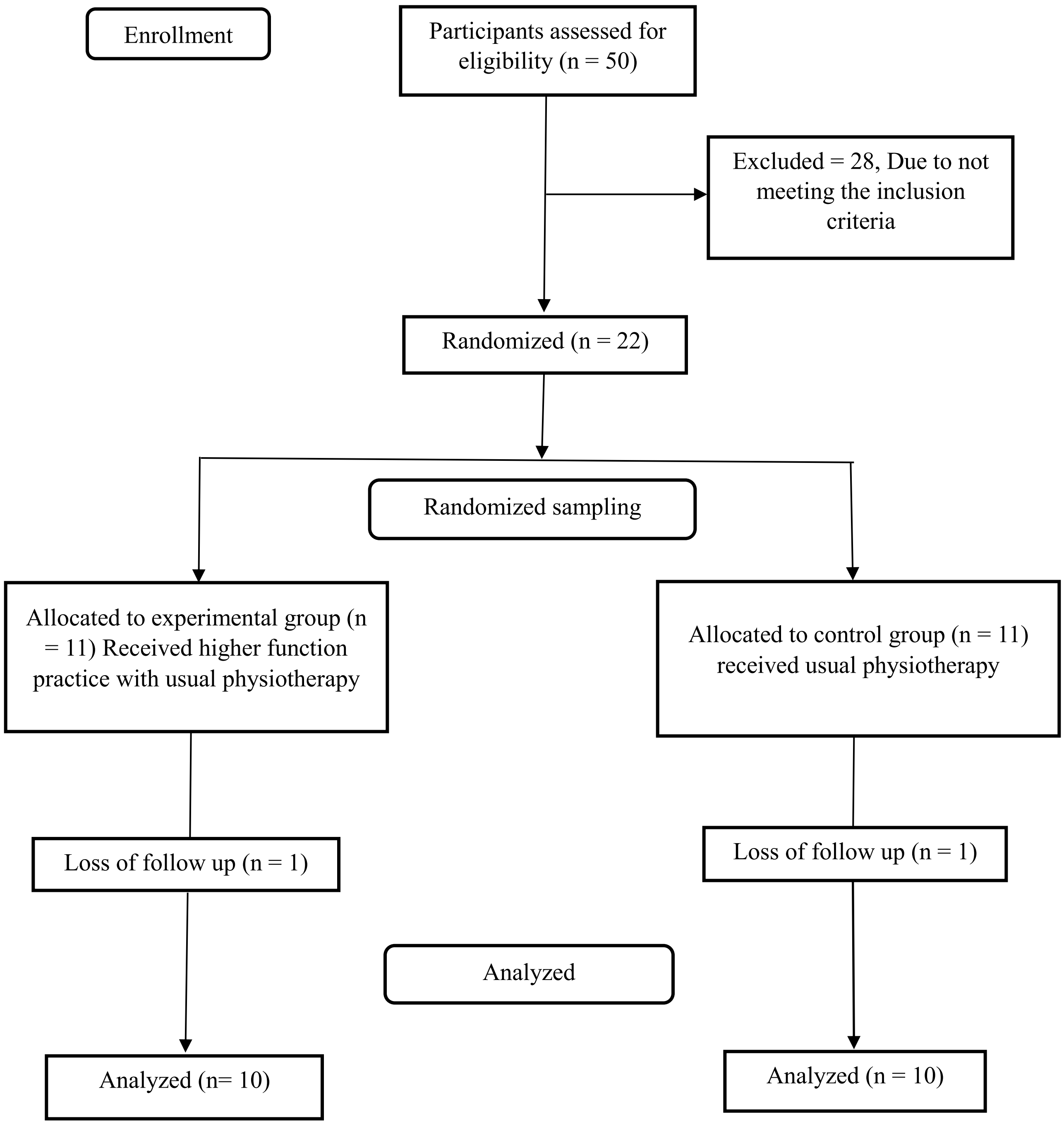
α = probability of type I error (usually 0.05)

β = probability of type II error (usually 0.2)

z = critical Z value for a given α or β

k = ratio of sample size for group 2 to group 1

3.7 CONSORT (Consolidated Standards of Reporting Trials) flow chart:



3.8 Sampling technique:

A simple random sampling technique was utilized to allocate participants to one of two study groups:

1. **Experimental group**: Participants in this group received higher-function practice sessions in addition to standard physiotherapy care.
2. **Control group**: Participants in this group received standard physiotherapy care only.

Randomization was performed using a system of numerical identifiers (e.g., E1, E2, E3 for the experimental group; C1, C2, C3 for the control group) to minimize selection bias. Equal numbers of participants were assigned to each group to ensure balanced comparisons and reliable statistical analysis of the outcomes

3.9 Eligibility criteria:

1. **Age**: Studies on therapeutic interventions for children with cerebral palsy often focus on participants aged 4–12 years to ensure interventions are age-appropriate and developmental stages are comparable (Karadağ-Saygı & Giray, 2019, p. 88).
2. **Diagnosis**: Inclusion of participants with a confirmed diagnosis of cerebral palsy ensures homogeneity in the study sample and aids in analyzing intervention efficacy (Matsuda et al., 2018, p. 90).
3. **Functional Classification**: Participants classified within GMFCS levels II–IV are typically included in studies focusing on moderate to severe motor impairments, as these levels are more likely to benefit from specific interventions (Lerner et al., 2017, p. 99).
4. **Medical Stability**: Ensuring participants are medically stable is a common criterion to minimize risks and enhance the reliability of therapeutic outcomes (Carvalho et al., 2017, p. 112).
5. **Cognitive Ability**: Children who can comprehend and follow simple instructions are often included in studies to ensure meaningful participation and engagement in therapy (Bleyenheuft et al., 2017, p. 990).
6. **Caregiver Involvement**: Active caregiver participation is crucial in cerebral palsy interventions, as it promotes adherence and consistency in therapeutic protocols (Roostaei et al., 2016, p. 45).

Exclusion Criteria

1. **Cognitive or Behavioral Impairments**: Severe impairments that hinder therapy participation are frequently grounds for exclusion, as they can impact study outcomes (McGinley et al., 2012, p. 75).
2. **Concurrent Experimental Therapies**: Exclusion of participants undergoing other experimental therapies avoids confounding factors that may affect results (Van Hedel et al., 2016, p. 77).

3. **Comorbidities**: Significant additional conditions like epilepsy or progressive neurological disorders are typically exclusion criteria to focus solely on the effects of the intervention (Livingstone et al., 2024, p. 89).
4. **Caregiver Limitations**: Caregivers' inability or unwillingness to support the child throughout the study duration is a standard exclusion criterion, ensuring consistency in participant engagement (Tatla et al., 2013, p. 80).

3.9 Methods of data collection:

3.9.1 Technique of data collection:

Face-to-face formal interview technique was used to collect data from the selected patient's caregiver with cerebral palsy.

3.9.2 Instrument of data collection:

A pretested structured questionnaire was used as the instrument for data collection, comprising several parts. The first part included questions on patient identification, such as age, gender, type of cerebral palsy, and GMFCS level. The second part focused on sociodemographic information, including parental education, income, residence, and birth details. The third part addressed health and medical variables, such as medical history, comorbidities, and nutritional status. The fourth part contained questions on functional independence, assessed using the FIM. The fifth part evaluated balance and postural control using the Balance Scale. The sixth part gathered data on adherence to higher-function practice, caregiver involvement, and participant feedback on the intervention.

3.11 Tools for data collection:

In this particular study, a written questionnaire, weight machine, height measure tape were used.

3.12 Procedure of data collection:

The study was conducted in four phases. In the pre-intervention assessment, participants underwent baseline evaluations using the FIM and GMFCS scales to establish initial functional independence and motor ability, along with the collection of demographic and clinical data for profiling. During the intervention phase, the experimental group received higher-function practice sessions focusing on task-specific activities, such as walking, reaching, and navigating uneven surfaces, conducted for 45–60 minutes per session, 5 days a week over 8 weeks, while the control group received standard care involving general physiotherapy and occupational therapy without task-specific training. A mid-intervention assessment was conducted at the 4-week mark to monitor progress, ensure adherence to protocols, and make necessary adjustments. The post-intervention assessment at the end of the 8-week period utilized the same tools as the baseline assessment to measure changes in functional independence and balance. All sessions were delivered by trained physiotherapists under the supervision of senior clinicians, with data recorded by blinded assessors to minimize bias and ensure objectivity.

3.13 Intervention:

3.11.1 Experimental Group Treatment Protocol

Treatment Options	Duration
Goal directed motor training: 1. Single leg standing practice 2. Staring practice 3. Stepping practice on a stepping board 4. Standing on a standing frame 5. Jumping on trampoline 6. Conventional physiotherapy	2 weeks

3.11.2 Control Group Treatment Protocol

Treatment Options	Duration
1. Positioning, Active facilitatory movement 2. Postural Control 3. Strengthening Exercise 4. Weight-bearing practice 5. Weight shifting practice 6. Balance practice 7. Co-ordination practice 8. Proprioceptive exercise 9. Bridging exercise 10. Gross motor function practice 11. Transitional movement practice 12. Gait training 13. Higher function practice	2 weeks

3.14 Management of data:

At the end of each day, the collected questionnaires were checked for any errors or inconsistencies. The necessary corrections were made. The recorded data were coded accordingly into the SPSS-25 version of the program.

3.15 Data analysis:

Data were analyzed by SPSS version 25 using descriptive analysis for sociodemographic variables. Independent samples t-test was used to assess pre-test and post-test intervention between groups and Paired t-test was used to assess pre-test and post-test intervention within the group. Microsoft Excel 2021 was used for the bar diagram and chart.

3.16 Ethical consideration:

Strict adherence to ethical guidelines is paramount in this study. A formal project proposal has been submitted to the Department of Physiotherapy at Saic College of Medical Science and Technology (SCMST), and approval has been obtained from the Institutional Review Board (IRB) of SCMST to conduct the study. This study follows the guidelines set forth by the World Health Organization (WHO) and Bangladesh Medical Research Council (BMRC), ensuring the confidentiality of participant information at all times. Permission to collect data has been obtained from the study area authorities. Participants will be fully informed about the aims and objectives of the study before consenting to participate. Written consent will be obtained from each participant, and the process will be explained verbally as well. Participants will be assured of the confidentiality of their information, which will only be shared with the research supervisor. Participants will be informed of their rights, including the option to withdraw from the study at any time without consequences. To protect anonymity, participant names and addresses will not be used; instead, participation numbers will be assigned in all notes and transcripts. It will be made clear that information gathered may be presented in presentations, seminars, or written papers, but in a way that ensures no identification of individuals and poses no harm to them. Participants will be assured of their right to discuss any concerns related to the study with senior authorities. The ethical standards upheld in this study aim to protect participant welfare while maintaining the integrity and confidentiality of the research process

CHAPTER- IV RESULT

The purpose of this study was to evaluate the effectiveness of Higher Function Practice (HFP) in improving balance and functional independence in children with cerebral palsy (CP). This section presents the findings derived from quantitative analyses, comparing the experimental group, which received HFP alongside conventional physiotherapy, to the control group, which received standard physiotherapy alone.

The results provide statistical evidence supporting the impact of HFP on motor function, balance, and overall functional independence. Baseline characteristics of participants were analyzed to ensure comparability between groups, followed by assessments of Functional Independence Measure (FIM) scores, Gross Motor Function Classification System (GMFCS) levels, and other relevant health-related variables. The outcomes of the study were assessed using paired t-tests and independent sample t-tests, allowing for both within-group and between-group comparisons.

The findings demonstrate significant improvements in the experimental group, particularly in functional independence, as measured by FIM scores, with a notable increase post-intervention. While improvements in gross motor function (GMFCS scores) were observed, they were less pronounced, suggesting that HFP primarily enhances task-specific functional abilities rather than broader motor skill development. Additionally, the study explored socioeconomic influences on rehabilitation outcomes, as well as the potential for HFP to serve as an effective, resource-efficient intervention in low-resource settings like Bangladesh.

This chapter details these findings, offering a data-driven understanding of how HFP contributes to improving mobility, independence, and quality of life in children with CP. Statistical significance and effect sizes are discussed in relation to existing literature, emphasizing the implications of these findings for future rehabilitation strategies.

Table no 1: Baseline Characteristics of participants:

Variable	Experimental Group		Control Group	
	n	%	n	%
Gender				
Boy	4	40.0	5	50.0
Girl	6	60.0	5	50.0
Involved Limb				
Hemiplegic	4	40.0	4	40.0
Quadriplegic	4	40.0	3	30.0
Triplegic	2	20.0	-	-
Diplegic	-	-	3	30.0
Age				
Mean ± SD	7.68 ± 1.67		5.46 ± 2.91	

The study demonstrates that higher-function practice significantly improves functional independence in children with cerebral palsy. The experimental group, with a mean age of 7.68 ± 1.67 years, showed a notable FIM score increase of 13.5 points (61.30 ± 7.58 to 74.80 ± 7.72), compared to a 1.3-point increase in the control group (57.20 ± 4.82 to 58.50 ± 4.70), with a statistically significant difference ($p < 0.001$). Limb involvement varied, with triplegic cases exclusive to the experimental group and diplegic cases only in the control group. GMFCS scores remained stable in the experimental group, indicating the intervention's primary impact on task-specific functional independence rather than gross motor function.

Table no 2: Descriptive statistics of FIM and GMFCS scores:

Outcome	Group	Pre-Treatment (Mean ± SD)	Post-Treatment (Mean ± SD)	Change
FIM	Experimental	61.30 ± 7.587	74.80 ± 7.729	13.5
	Control	57.20 ± 4.826	58.50 ± 4.696	1.3
GMFCS	Experimental	3.80 ± .632	3.80 ± .632	0
	Control	2.80 ± .632	3.40 ± .516	0.6

Table 4.2 illustrates the descriptive statistics for Functional Independence Measure (FIM) and Gross Motor Function Classification System (GMFCS) scores in both experimental and control groups. The scores were recorded pre- and post-treatment, highlighting the changes observed in each group.

Functional Independence Measure (FIM)

In the experimental group, the mean pre-treatment FIM score was 61.30 ± 7.587, indicating moderate functional independence among participants. Following the intervention, the mean post-treatment score increased significantly to 74.80 ± 7.729, resulting in a mean change of 13.5 points. This substantial improvement underscores the effectiveness of the intervention in enhancing the functional independence of participants. The large change in FIM scores reflects the positive impact of targeted higher-function practice on activities of daily living.

Conversely, the control group exhibited a mean pre-treatment FIM score of 57.20 ± 4.826, which was slightly lower than the experimental group. Post-treatment, the mean score rose marginally to 58.50 ± 4.696, yielding a minimal mean change of 1.3 points. The limited improvement in the control group suggests that standard care alone had little effect on improving functional independence during the study period.

Gross Motor Function Classification System (GMFCS)

For GMFCS scores, the experimental group displayed a mean pre-treatment and post-treatment score of 3.80 ± 0.632, with no observed change over the course of the intervention. This stability suggests that while functional independence (measured by FIM) improved significantly, gross motor function did not demonstrate measurable progress during the study period.

In the control group, the mean pre-treatment GMFCS score was 2.80 ± 0.632, slightly better than the experimental group. Post-treatment, the mean score increased to 3.40 ± 0.516, reflecting a mean change of 0.6 points. Although this change indicates some progress in gross motor function, it was limited and does not approach the functional gains observed in the experimental group.

Table no 3: Descriptive statistics of Health-related variables:

Outcome	Group	Min	Max	Mean	Std. Deviation
Age guardian	Experimental	24	40	27.00	4.922
	Control	23	32	28.20	3.084
Family income	Experimental	15000	60000	30600	13376
	Control	20000	40000	27500	7168
Height (m)	Experimental	1.05	1.40	1.121	0.11
	Control	0.08	1.45	1.06	0,19
BMI	Experimental	7.56	15.95	11.55	2.77
	Control	8.96	26.28	14.19	5.005

Table 4.3 summarizes the health-related variables for the experimental and control groups, including guardian age, family income (in Bangladeshi Taka, Tk), height, and BMI.

Age of Guardians

In the experimental group, the age of guardians ranged from 24 to 40 years, with a mean age of 27.00 ± 4.922 years. In the control group, guardian ages ranged from 23 to 32 years, with a slightly higher mean age of 28.20 ± 3.084 years. The narrower range and lower variability in the control group indicate a more homogeneous age distribution compared to the experimental group.

Family Income

Family income in the experimental group ranged from Tk 15,000 to Tk 60,000, with a mean income of Tk 30,600 ± Tk 13,376. In the control group, incomes ranged between Tk 20,000 and Tk 40,000, with a lower mean of Tk 27,500 ± Tk 7,168. The broader range and higher variability in the experimental group suggest a more diverse socio-economic background among participants.

Height

Participants in the experimental group had heights ranging from 1.05 to 1.40 meters, with a mean height of 1.121 ± 0.11 meters. In the control group, heights ranged more broadly, from 0.08 to 1.45 meters, with a mean height of 1.06 ± 0.19 meters. This greater variability in the control group suggests differences in growth and developmental factors among participants.

Body Mass Index (BMI)

BMI in the experimental group ranged from 7.56 to 15.95, with a mean BMI of 11.55 ± 2.77, reflecting underweight to healthy weight categories. In the control group, BMI values ranged from 8.96 to 26.28, with a higher mean BMI of 14.19 ± 5.005. The greater variability in BMI in the control group may indicate differences in nutritional status and growth-related conditions.

Table no 4: Paired t-test of FIM Scale within group of Experimental Group and Control Group

Variable	Experimental		Control	
	t	P value	t	P value
FIM	-36.224	0.000	-8.510	0.000

(*= < 0.05, ** = < 0.01, ***= < 0.001)

The results of the paired t-test analysis for the Functional Independence Measure (FIM) scores within the experimental and control groups demonstrate significant improvements in both groups, as indicated by the p-values (p = 0.000). In the experimental group, the t-value of -36.224 reflects a substantial improvement in FIM scores following the intervention, highlighting the effectiveness of higher-function practice in enhancing functional independence. Similarly, the control group also showed a statistically significant improvement in FIM scores, with a t-value of -8.510, indicating that standard care contributed to some degree of functional progress. However, the much larger t-value in the experimental group underscores a more pronounced improvement in functional independence compared to the control group. These findings strongly suggest that higher-function practice is a more effective intervention for improving FIM scores among children with cerebral palsy.

Table no 5: Independent sample t test on evaluation of FIM questionnaire in between two groups Experimental Group and Control Group before and after treatment

Variable		Experimental	Control	*t*	*p*-value
		Mean ± SD			
FIM	Before	61.30 ± 7.58	57.20 ± 4.82	1.442	0.157
	After	74.80 ± 7.72	58.50 ± 4.6	5.700	0.000

(*= < 0.05, ** = < 0.01, ***= < 0.001)

The results of the independent sample t-test comparing FIM scores between the experimental and control groups before and after treatment provide significant insights. Before treatment, the mean FIM score was slightly higher in the experimental group (61.30 ± 7.58) compared to the control group (57.20 ± 4.82). However, this difference was not statistically significant (t = 1.442, p = 0.157), indicating that both groups started from comparable baseline levels of functional independence.

After treatment, the experimental group demonstrated a significantly greater improvement in FIM scores (74.80 ± 7.72) compared to the control group (58.50 ± 4.6), with a t-value of 5.700 and a highly significant p-value (p = 0.000). These findings underscore the superior efficacy of higher-function practice in enhancing functional independence compared to standard care, highlighting its potential as a more impactful intervention for children with cerebral palsy.

Table no 6: Independent sample t test on evaluation of GMFCS questionnaire in between two groups Experimental Group and Control Group before and after treatment

Variable		Experimental	Control	*t*	*p*-value
		Mean ± SD			
GMFCS	Before	3.80 ± 6.33	3.80 ± 6.33	0.000	1.000
	After	2.80 ± 0.632	3.40 ± 0.516	-2.324	0.032

(*= < 0.05, ** = < 0.01, ***= < 0.001)

The independent sample t-test results for the Gross Motor Function Classification System (GMFCS) scores before and after treatment show notable differences between the experimental and control groups. Before treatment, both groups had identical mean GMFCS scores (3.80 ± 6.33), with a t-value of 0.000 and a p-value of 1.000, indicating no initial difference in motor function severity between the groups.

After treatment, the experimental group demonstrated a reduction in mean GMFCS scores to 2.80 ± 0.632, while the control group showed a lesser reduction to 3.40 ± 0.516. This difference was statistically significant (t = -2.324, p = 0.032), suggesting that the experimental group, which received higher-function practice, experienced a greater improvement in motor function compared to the control group receiving standard care. These results highlight the potential of task-specific interventions to enhance motor function in children with cerebral palsy.

List of Figure

Child birth date

Among the participants, 12 children were born after 42 weeks, 7 were born after 38 weeks, and only 1 child was born before 38 weeks. This indicates that post-term births were the most common in this group.

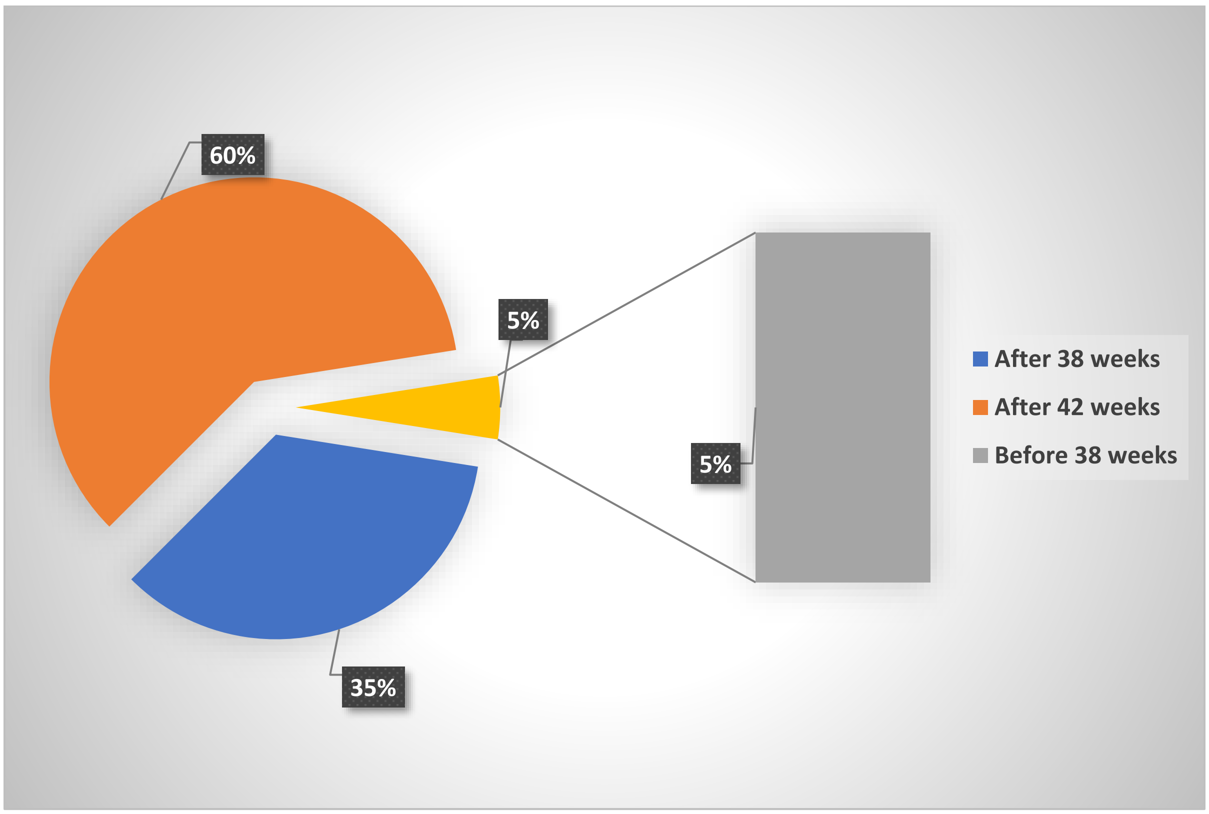


Figure no 1: Child birth date

Delivery place

Among the participants, 13 deliveries took place in a hospital, while 7 occurred at home. This suggests that the majority of deliveries were conducted in a medical facility.

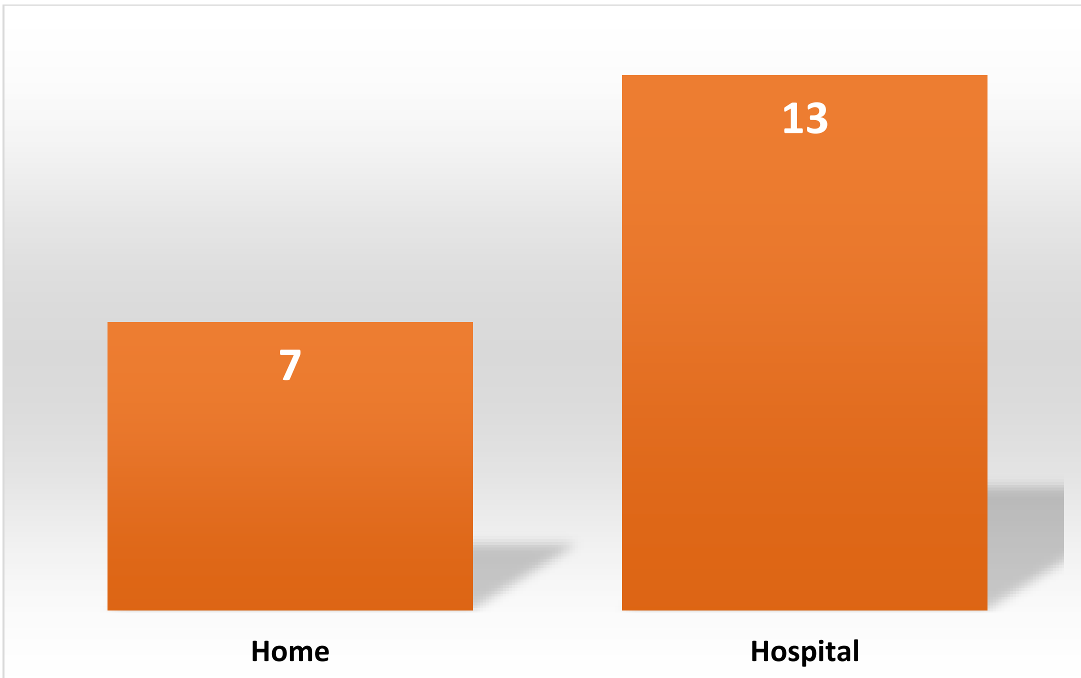


Figure no 2: Delivery place

Delivery type

Among the participants, 14 underwent normal vaginal delivery (NVD), while 6 had cesarean sections. This indicates that the majority of deliveries were through the vaginal route.

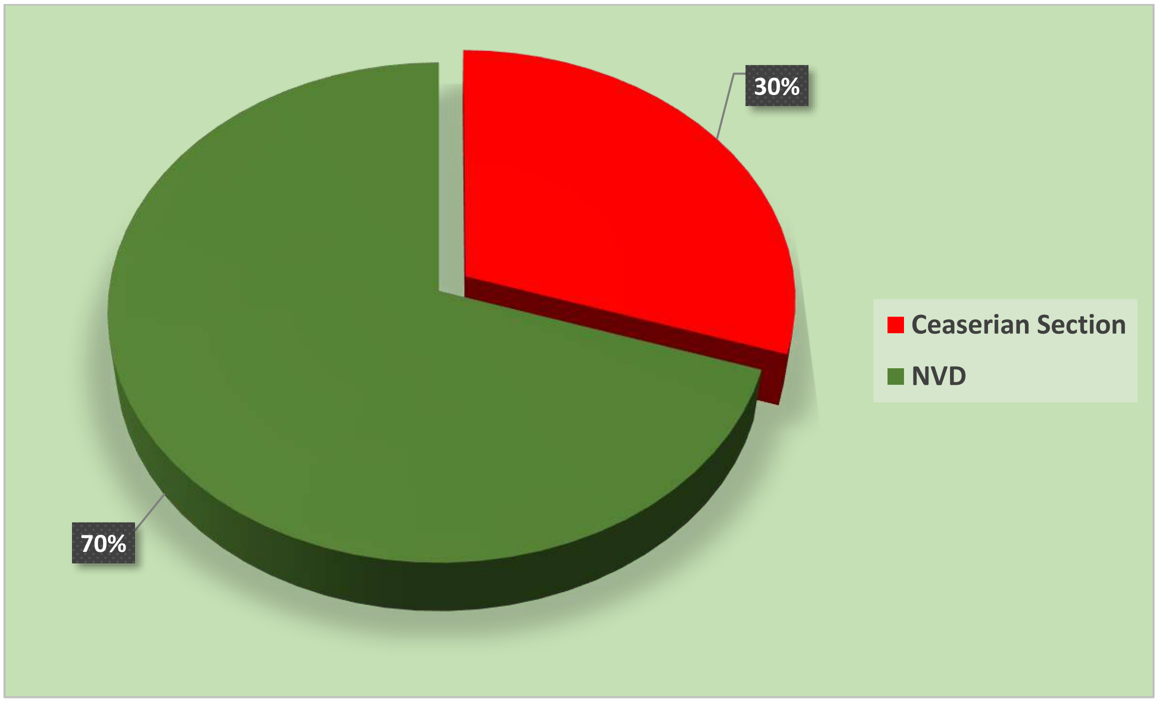


Figure no 3: Delivery type of child

Duration of labour pain

The data shows that 11 participants experienced labor pain for less than 12 hours, while 9 participants had labor pain lasting more than 12 hours. This suggests a relatively balanced distribution between shorter and longer durations of labor pain among the participants.

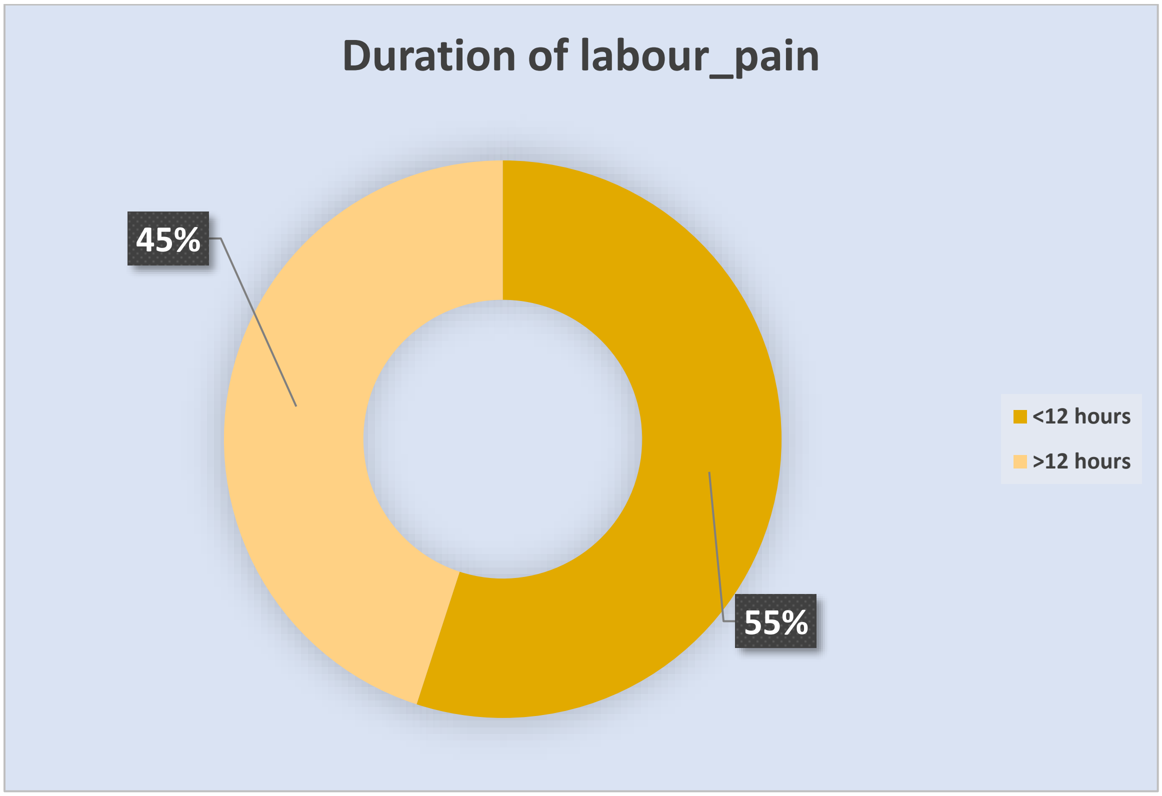


Figure no 4: Duration of labour pain during birth

Childs cry after birth

Among the participants, 15 children did not cry immediately after birth, while 5 children cried after birth. This distribution indicates that a significant majority of the cases involved children who did not cry immediately, which could be a focus for further investigation or analysis.

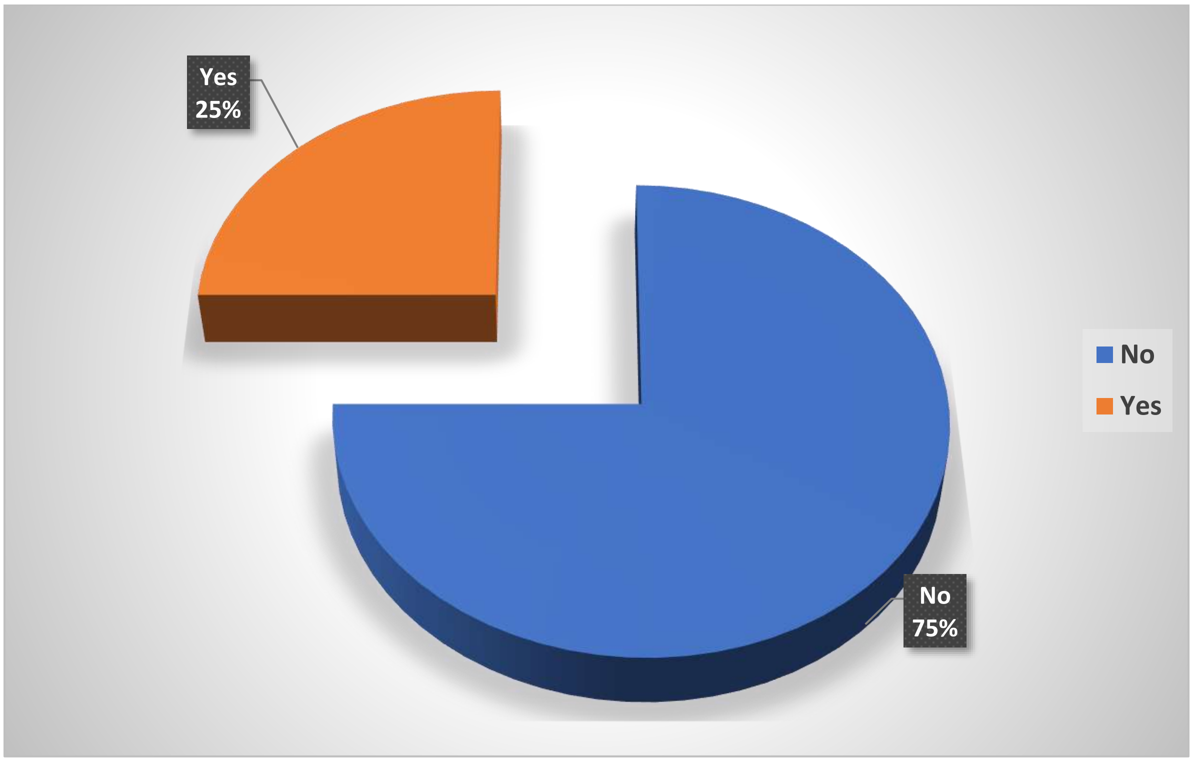


Figure no 5: Childs cry after birth

Involvement

Among the research participants, the majority (8 individuals) are hemiplegic, followed by 7 quadriplegic participants. Diplegic individuals account for 3 participants, while triplegic participants are the least represented, with only 2 individuals. This distribution highlights hemiplegia as the most prevalent condition among the group.

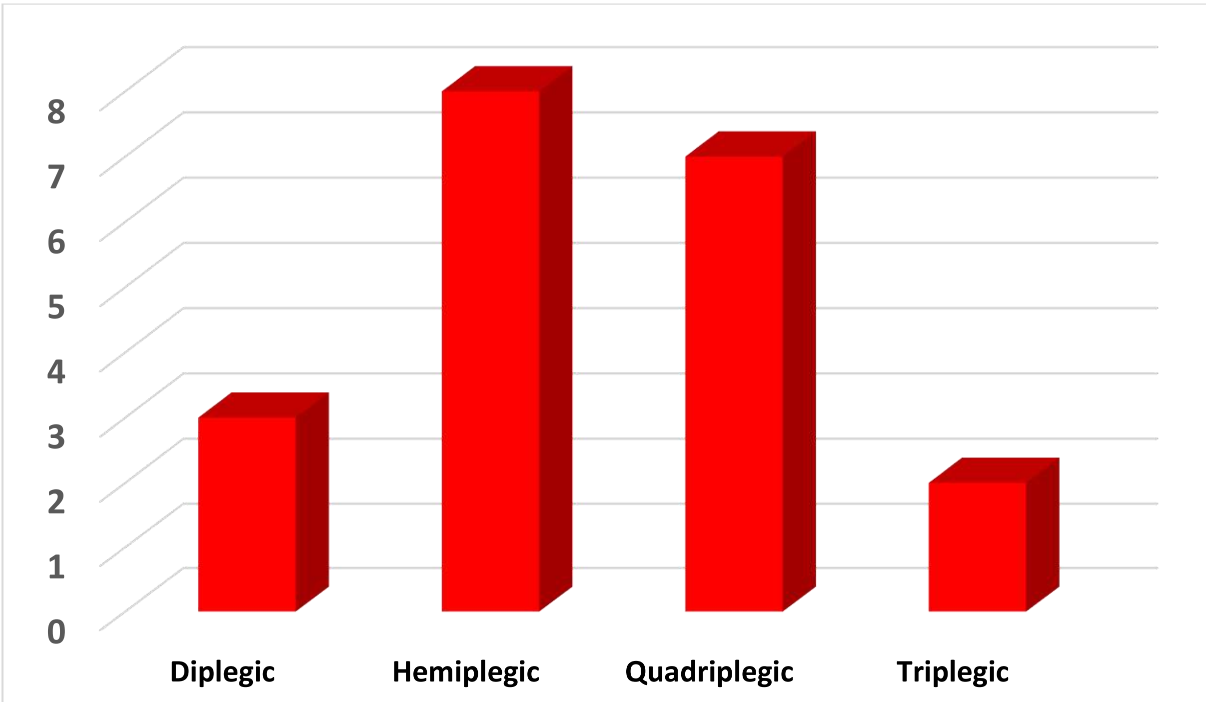


Figure no 6: CP type

Nutritional Status

The BMI status distribution highlights significant nutritional challenges among the participants. While 8 children fall within the healthy weight category, the majority (11 out of 20) are classified as underweight or severely underweight, reflecting notable undernutrition and growth concerns. Only 1 participant is overweight, indicating that overnutrition is not a predominant issue. These findings emphasize the need for targeted nutritional and therapeutic interventions to address the undernutrition prevalent in this population. Ensuring balanced nutrition is critical for improving health outcomes in children with cerebral palsy.

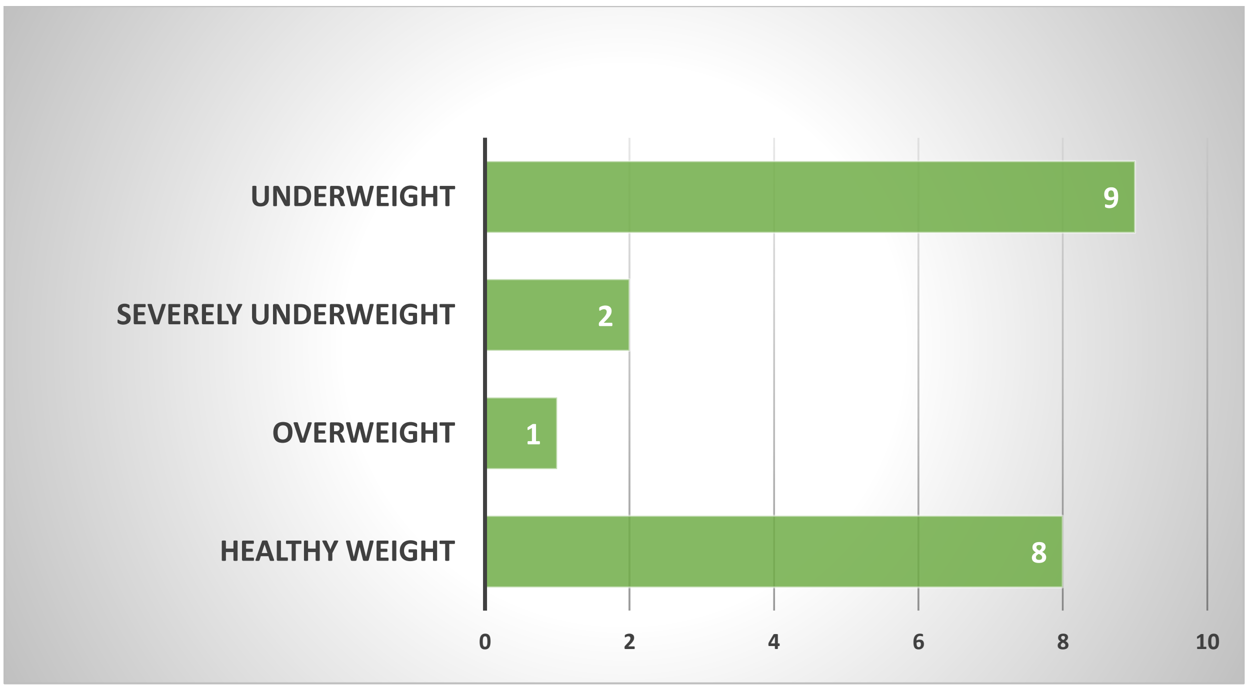


Figure no 7: Nutritional Status

CHAPTER V	DISCUSSION

The study revealed a well-distributed sample with gender parity between the experimental and control groups; boys made 40% and 50% of the experimental and control groups respectively. This is in line with worldwide prevalence rates of cerebral palsy (CP), which exhibit almost equal distribution among sexes (Novak et al. 2019, p. 705). While triplegic cases were unique to the experimental group (20%), limb involvement analysis showed an equal proportion of hemiplegic and quadriplegic cases in both groups (40%), and diplegic cases exclusive of the control group (30%). As they affect the functional results and response to therapeutic interventions, the variations in limb involvement are noteworthy (Himmelmann & Uvebrant. 2018, p. 45).. For example, quadriplegic cases usually show more severe motor deficits than diplegic cases, which would help to explain the baseline difficulties of the experimental group.

Notable are the socioeconomic traits, which include a greater proportion of rural residence in the experimental group (90% vs. 60%). Previous studies have shown that rural participants sometimes have trouble getting rehabilitation services due to less specialised facilities and transportation difficulties (Mohanty et al., 2020). The experimental group showed notable increases in functional outcomes despite these obstacles, so highlighting the scalability of higher-function practice in low-resource environments. From 61.30 7.58 to 74.80 7.72 (mean change: 13.5 points), the notable improvement in FIM scores in the experimental group highlights the effectiveness of more higher-function practice in enhancing functional independence. The task-specific approach of the intervention fits results of Novak et al. (2019), who underlined that children with CP benefit from repeated, intentional activities aiming at daily living skills by means of motor learning and neural adaptation. The great effect size noted in this study reflects similar results from Wright et al. (2020), who showed that real-world functional tasks greatly improve outcomes over generic treatment.

By means of a mean change of 1.3 points, the control group—which received standard physiotherapy—showed a very little increase in FIM scores. This slow development is in line with criticisms of conventional methods, which sometimes concentrate on isolated movements without including functional tasks, so failing to convert gains into practical activities (Hashad et al. 2024, p. 25). The differences between the two groups emphasize how better higher-function practice is in closing this distance.

Although the experimental group showed significant progress according to the FIM results, GMFCS scores showed less marked change. While the control group showed a modest decline in scores from 2.80 ± 0.632 to 3.40 ± 0.516, the experimental group kept a stable mean score of 3.80 ± 0.632 before and after the intervention. This consistency in GMFCS corresponds with earlier studies showing that, in comparison to functional measures like FIM (Novak et al. 2019, p. 705), gross motor function—as defined by GMFCS—is less suited for short-term interventions.

The minor decline in the control group could be a reflection of the progressive character of motor disabilities in CP left unaddressed by focused interventions (Wright et al. 2020, p. 113). Higher-function practice resulted in notable functional gains (as shown by FIM improvements), but its limited influence on GMFCS scores suggests that gross motor function improvements require either a longer intervention duration or complementary therapies, such robotic-assisted training or strength conditioning, to yield measured progress (Long et al. 2024, p. 23).

The socioeconomic traits of the participants draw attention to possible confounders in therapeutic results. Comparatively to the control group (Tk 20,000–40,000), the experimental group showed greater variability and a wider income range (Tk 15,000–60,000). Although better access to healthcare and better adherence to rehabilitation guidelines usually correspond with higher incomes, the results imply that higher-function practice may be successful across several socioeconomic levels. This is consistent with research by Ferguson et al. (2019, p. 112), which underlined the need of scalable, low-resource interventions in guaranteeing equity in CP management.

Commonly found in low-resource environments, nutritional differences are reflected in the lower mean BMI in the experimental group (11.55 ± 2.77) when compared to the control group (14.19 ± 5.005). As Kuper et al. (2021, p. 77) show, malnutrition aggravates motor problems and slows down recovery. Notwithstanding these difficulties, the experimental group showed notable functional improvements, which emphasises the resilience of higher-function practice in addressing functional independence, even in populations with limited resources nutrally. Future research should include nutritional support to improve the success of therapeutic interventions much further.

For FIM scores inside every group, the paired t-test analysis produced convincing proof of the value of more advanced practice. With a t-value of -36.224 (p = 0.000), the experimental group showed a rather significant improvement. These results complement those of Novak et al. (2019), who observed strong functional improvements in children with CP from neuroplasticity-driven interventions stressing task specificity. Though with much less scale, the t-value of -8.510 (p = 0.000) in the control group also showed statistically significant improvements. This highlights the limitations of standard physiotherapy in attaining significant independence while reflecting its little advantages in preserving functional status. Himmelmann and Uvebrant (2018, p.56) also observed similar trends whereby their generalized approach causes traditional physiotherapy to often plateau in effectiveness.

Higher-function practice's efficacy was further confirmed by the independent t-test comparisons of FIM scores between the experimental and control groups both before and after treatment. Pre-treatment scores matched each other (p = 0.157), so guaranteeing a fair baseline. But post-treatment the experimental group clearly outperformed the control group (t = 5.700, p = 0.000). These results underline, especially in improving daily living skills, the advantage of task-specific training over general treatment.

With a statistically significant post-treatment difference (t = -2.324, p = 0.032), the GMFCS results also showed the relative efficacy of higher-function practice in enhancing gross motor function. But as Wright et al. (2020, p. 89) suggest, the modest change in GMFCS scores points to further interventions perhaps required to maximise gross motor outcomes.
The results of this study fit a growing body of data confirming the efficiency of task-specific interventions in CP control. For instance, Novak et al. (2019, p. 99) underlined that by aiming at neuroplasticity, higher-function practice produces better results in

functional independence than more conventional approaches. Wright et al. (2020), p.90 underlined similarly that task-specific interventions target both motor and cognitive domains, so facilitating better application of skills into daily life. The limited effect on GMFCS scores, however, contrasts with studies like Long et al. (2024, p.88) which showed observable gross motor changes with longer intervention lengths or combined treatments. This disparity emphasises the need of customising intervention strategies to handle functional as well as motor outcomes holistically.

Limitations:

Small Sample Size: The limited number of participants reduces the generalizability of the findings.

Short Intervention Period: The eight-week duration may not capture long-term or gross motor function improvements.

Limited Gross Motor Impact: Significant functional gains were observed, but gross motor function changes (GMFCS) were minimal.

Uncontrolled External Factors: Variations in caregiver support, environment, and nutrition may have influenced outcomes.

No Long-Term Follow-Up: The study did not evaluate the sustainability of improvements over time.

CHAPTER VI CONCLUSION & RECOMMENDATION

Conclusion: This study evaluated the effectiveness of higher-function practice in improving balance and functional independence in children with cerebral palsy (CP). The findings demonstrate that higher-function practice, a task-specific, neuroplasticity-driven intervention, significantly enhances functional independence compared to standard care, as evidenced by the substantial improvements in Functional Independence Measure (FIM) scores in the experimental group. This approach translates therapeutic gains into practical benefits by integrating purposeful, repetitive activities that mimic real-life scenarios, addressing both motor and cognitive abilities such as problem-solving and decision-making.

Unlike traditional physiotherapy, which isolates motor skills, higher-function practice emphasizes task-specific training tailored to daily living needs. The experimental group's significant improvement in FIM scores highlights the transformative potential of this intervention, while the minimal gains observed in the control group underscore the limitations of standard care in achieving meaningful functional outcomes. However, gross motor function, measured by the Gross Motor Function Classification System (GMFCS), showed stabilization rather than significant improvement in the experimental group, suggesting the need for complementary interventions, such as strength training or assistive technologies, to achieve broader motor gains.

While the study underscores the importance of higher-function practice in CP rehabilitation, it also highlights the need for a multi-modal approach to address motor and functional challenges comprehensively. Despite its strengths, including the targeted task-specific focus, the study's small sample size and short intervention duration limit the generalizability and long-term applicability of its findings. Further research with larger cohorts and extended intervention periods is recommended to fully explore the potential of higher-function practice in improving both functional independence and gross motor function in children with CP.

Recommendations

1. **Extend Intervention Duration**: Future studies should implement longer intervention periods to assess the potential for higher-function practice to achieve improvements in gross motor function (GMFCS scores) and evaluate the sustainability of functional independence gains over time.
2. **Increase Sample Size**: Conduct research with larger and more diverse participant groups to enhance the generalizability of findings and ensure statistically robust conclusions.
3. **Incorporate Multi-Modal Therapies**: Combine higher-function practice with complementary interventions, such as strength training, robotic-assisted therapy, or sensory integration, to address gross motor function and enhance overall outcomes.
4. **Integrate Nutritional Support**: Address the impact of undernutrition, observed in participants with lower BMI, by incorporating nutritional assessments and interventions into rehabilitation programs for children with cerebral palsy.
5. **Long-Term Follow-Up**: Include follow-up assessments after the intervention to evaluate the persistence of functional and motor improvements, as well as the intervention's impact on quality of life.
6. **Socioeconomic Support Programs**: Develop strategies to address barriers related to socio-economic disparities, such as caregiver education programs, community-based care initiatives, and subsidized therapy for low-income families.
7. **Standardize Home-Based Therapy**: Create structured, accessible home-based therapy protocols to extend the benefits of higher-function practice to children in rural and low-resource areas.

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Appendix- A

গবেষণা প্রশ্নাবলী

"সেরিব্রাল পালসি রোগীদের মধ্যে ভারসাম্য এবং কার্যকারিতার উপর উচ্চতর কার্যকারিতা অনুশীলনের কার্যকারিতা।"

রোগীদের তথ্য

সাক্ষাৎকারের তারিখ: মোবাইল নম্বর: .... রোগীর আইডি:

অংশগ্রহণকারীর নাম:

রোগীদের ঠিকানা: গ্রাম: ডাকঘর: পি. এস: জেলা:

পার্ট-1: সামাজিক-জনসংখ্যা সংক্রান্ত তথ্য

QN	প্রশ্ন	প্রতিক্রিয়া
1.1	রোগীর বয়স	....
1.2	রোগীর লিঙ্গ	1 = ছেলে 2 = মেয়ে
1.3	ভাইবোন	
1.4	যত্নের অভিভাবকের বয়স	....
1.5	যত্ন অভিভাবকের শিক্ষা	1= নিরক্ষর 2 = প্রাথমিক 3= এসএসসি 4= এইচএসসি

		5 = স্নাতক
1.6	ধর্ম	1= মুসলিম 2 = হিন্দু 3 = অন্যান্য
1.7	লিভিং এরিয়া	1 = গ্রামীণ 2 = শহুরে
1.8	পারিবারিক ধরন	1 = পারমাণবিক 2 = বর্ধিত
1.9	পারিবারিক আয় (বিডিটিতে)	....

পর্ব-2: বিষয় সম্পর্কিত তথ্য

QN	প্রশ্ন	প্রতিক্রিয়া
2.1	আপনার সন্তানের জন্ম কখন?	1= 38 সপ্তাহের আগে 2= 38 সপ্তাহ পর 3= 42 সপ্তাহ পর
2.2	প্রসবের স্থান	1= বাড়ি 2 = হাসপাতাল
2.3	ডেলিভারির ধরন	1= NVD (সাধারণ যোনি ডেলিভারি) 2 = সিজারিয়ান বিভাগ 3 = ফোরসেপ ডেলিভারি 4 = অন্যান্য যন্ত্র বিতরণ

2.4	প্রসব বেদনার সময়কাল কত ছিল?	1= 12 ঘন্টার কম 2= 12 ঘন্টার বেশি
2.5	আপনার সন্তান কি জন্মের পরই কেঁদেছিল?	1= হ্যাঁ 2 = না
2.6	অঙ্গের সম্পৃক্ততা	1= মনোপ্লেজিক 2= ডিপ্লেজিক 3 = চতুর্মুখী 4= ট্রিপ্লেজিক 5= হেমিপ্লেজিক
2.7	উচ্চতা	.........মি
2.8	ওজন	.... .কেজি
2.9	বিএমআই	.... কেজি/মি^{2}

প্রাক ডেটা

পার্ট-3: FIM স্কেল

FIM স্কেল

1	মোট সহায়তা বা অবস্থানে অস্থায়ী
2	সর্বাধিক সহায়তা প্রয়োজন (শিশু 25% কাজ করে)
3	পরিমিত সহায়তা প্রয়োজন (শিশু 50% কাজ করে)
4	ন্যূনতম সহায়তা প্রয়োজন (শিশু 75% কাজ করে)
5	প্রয়োজনীয় তত্ত্বাবধান
6	পরিবর্তিত স্বাধীনতা (অস্বাভাবিক আন্দোলনের ধরণ বা গতিশীলভাবে সমর্থনের ভিত্তি থেকে সরানো যায় না)
7	সম্পূর্ণ স্বাধীনতা (সম্পূর্ণ গতিশীল আন্দোলন এবং 30 সেকেন্ডের জন্য ভারসাম্য বজায় রাখতে সক্ষম)

	শুরুর অবস্থান	প্রাক পরীক্ষার স্কোর	পোস্ট পরীক্ষার স্কোর
1.	প্রবণ সুপাইন ঘূর্ণায়মান		
2.	সুপাইন প্রবণ ঘূর্ণায়মান		
3.	সুপাইন থেকে বক্সে বসা		
4.	ব্রিজিং		
5.	বক্সে বসে আছে		
6.	বক্স বসা থেকে দাঁড়ানো সরানো		
7.	আড়াআড়ি পায়ে বসা		

পার্ট-4: GMFCS

4.1। মধ্যে ২য় এবং 4 ম জন্মদিন	o লেভেল 1 • বাচ্চাদের মেঝে দুটি হাত দিয়ে বসা অবজেক্ট ম্যানিপুলেট বিনামূল্যে. • বসা এবং দাঁড়ানো মেঝেতে এবং বাইরে চলাচলগুলি প্রাপ্তবয়স্কদের সহায়তা ছাড়াই সঞ্চালিত হয়। • কোনো সহায়ক গতিশীলতা যন্ত্রের প্রয়োজন ছাড়াই শিশুরা গতিশীলতার পছন্দের পদ্ধতি হিসেবে হাঁটে।
	o লেভেল 2 • বাচ্চারা মেঝেতে বসে কিন্তু ভারসাম্য বজায় রাখতে অসুবিধা হতে পারে যখন উভয় হাতই বস্তুর হেরফের করতে মুক্ত থাকে। • বসা মধ্যে এবং বাইরে আন্দোলন প্রাপ্তবয়স্কদের সহায়তা ছাড়া সঞ্চালিত হয়. • শিশুরা একটি স্থিতিশীল পৃষ্ঠের উপর দাঁড়ানোর জন্য টান। • শিশুরা হাত এবং হাঁটুর উপর দিয়ে হামাগুড়ি দেয় পারস্পরিক প্যাটার্ন, আসবাবপত্র সম্মুখের ক্রুজ অধিষ্ঠিত এবং একটি সহায়ক গতিশীলতা ডিভাইস ব্যবহার করে হাঁটুন

	গতিশীলতার পছন্দের পদ্ধতি।
	০ লেভেল 3 • শিশুরা প্রায়শই মেঝেতে বসে থাকে " Wsitting " (বাঁকা এবং অভ্যন্তরীণভাবে ঘোরানো পোঁদ এবং হাঁটুর মধ্যে বসে) এবং বসা অনুমান করার জন্য প্রাপ্তবয়স্কদের সহায়তার প্রয়োজন হতে পারে। • শিশুরা তাদের পেটের উপর হামাগুড়ি দেয় বা হাত ও হাঁটুতে হামাগুড়ি দেয় (প্রায়শই পারস্পরিক পায়ের নড়াচড়া ছাড়াই) তাদের স্ব-গতির প্রাথমিক পদ্ধতি । • শিশুরা একটি স্থিতিশীল পৃষ্ঠে দাঁড়ানোর জন্য টানতে পারে এবং অল্প দূরত্বে ক্রুজ করতে পারে। • শিশুরা একটি সহায়ক গতিশীলতা ডিভাইস এবং স্টিয়ারিং এবং বাঁক নেওয়ার জন্য প্রাপ্তবয়স্কদের সহায়তা ব্যবহার করে বাড়ির ভিতরে অল্প দূরত্বে হাঁটতে পারে।
	০ লেভেল 4 • বাচ্চাদের মেঝে বসানোর সময়, কিন্তু সারিবদ্ধতা বজায় রাখতে অক্ষম
	সমর্থনের জন্য তাদের হাত ব্যবহার না করে ভারসাম্য। • বাচ্চাদের প্রায়ই বসার এবং দাঁড়ানোর জন্য অভিযোজিত সরঞ্জামের প্রয়োজন হয়। • স্ব-গতিশীলতা অর্জন করা হয় রোলিং, পেটে হামাগুড়ি দিয়ে বা পারস্পরিক পায়ের নড়াচড়া ছাড়াই হাত ও হাঁটুতে হামাগুড়ি দিয়ে।

	o লেভেল 5 • শারীরিক প্রতিবন্ধকতা নড়াচড়ার স্বেচ্ছায় নিয়ন্ত্রণ এবং অ্যান্টিগ্র্যাভিটি মাথা এবং ট্রাঙ্ক ভঙ্গি বজায় রাখার ক্ষমতাকে সীমাবদ্ধ করে। মোটর ফাংশনের সমস্ত ক্ষেত্র সীমিত। • বসা এবং দাঁড়ানোর কার্যকরী সীমাবদ্ধতাগুলি অভিযোজিত সরঞ্জাম এবং সহায়ক প্রযুক্তি ব্যবহারের মাধ্যমে সম্পূর্ণরূপে ক্ষতিপূরণ পায় না। • V স্তরে, শিশুদের স্বাধীন চলাফেরার কোন উপায় নেই এবং তাদের পরিবহন করা হয়। • কিছু শিশু ব্যাপক অভিযোজন সহ পাওয়ার হুইলচেয়ার ব্যবহার করে স্ব-গতিশীলতা অর্জন করে।
4.2 4 ম থেকে 6 ম এর মধ্যে জন্মদিন (যদি রোগীদের বয়স 4-6 হয়, প্রশ্ন এড়িয়ে যান। নং, 4.1)	o লেভেল 1 • শিশুরা হাতের সাহায্যের প্রয়োজন ছাড়াই একটি চেয়ারে প্রবেশ করে এবং বাইরে যায় এবং বসে থাকে। • শিশুরা মেঝে থেকে এবং চেয়ার বসা থেকে দাঁড়ানো পর্যন্ত সাপোর্টের জন্য বস্তুর প্রয়োজন ছাড়াই সরে যায়। • শিশুরা বাড়ির ভিতরে এবং বাইরে হাঁটাচলা করে এবং সিঁড়ি বেয়ে উঠে। • দৌড় এবং লাফ দেওয়ার উদীয়মান ক্ষমতা।
	o লেভেল 2 • শিশুরা দুটি হাত দিয়ে চেয়ারে বসে বস্তুর হেরফের করতে পারে। • শিশুরা মেঝে থেকে দাঁড়ানো এবং চেয়ার থেকে দাঁড়ানো অবস্থায় চলে যায় কিন্তু প্রায়শই তাদের বাহু দিয়ে ধাক্কা দিতে বা উপরে টানতে একটি স্থিতিশীল পৃষ্ঠের প্রয়োজন হয়।

	• শিশুরা বাড়ির ভিতরে এবং বাইরের স্তরের পৃষ্ঠে স্বল্প দূরত্বের জন্য কোনও সহায়ক গতিশীল যন্ত্রের প্রয়োজন ছাড়াই হাঁটে। • শিশুরা রেলিং ধরে সিঁড়ি বেয়ে উঠে কিন্তু দৌড়াতে বা লাফ দিতে পারে না।

	o লেভেল 3 • শিশুরা নিয়মিত চেয়ারে বসে থাকে কিন্তু হাতের কার্যকারিতা বাড়াতে তাদের পেলভিক বা ট্রাঙ্ক সাপোর্টের প্রয়োজন হতে পারে। • শিশুরা তাদের বাহু দিয়ে ধাক্কা দিতে বা উপরে টানতে একটি স্থিতিশীল পৃষ্ঠ ব্যবহার করে বসে থাকা চেয়ারের ভিতরে এবং বাইরে চলে যায়। • শিশুরা সমতল পৃষ্ঠে একটি সহায়ক গতিশীলতা যন্ত্র নিয়ে হাঁটে এবং একজন প্রাপ্তবয়স্কের সহায়তায় সিঁড়ি বেয়ে উঠে। • অমসৃণ ভূখণ্ডে দীর্ঘ দূরত্ব বা বাইরে ভ্রমণ করার সময় শিশুদের প্রায়শই পরিবহন করা হয়।
	o লেভেল 4 • শিশুরা একটি চেয়ারে বসে থাকে তবে ট্রাঙ্ক নিয়ন্ত্রণের জন্য এবং হাতের কার্যকারিতা সর্বাধিক করার জন্য অভিযোজিত আসনের প্রয়োজন হয়। • শিশুরা তাদের বাহু দিয়ে ধাক্কা দিতে বা টেনে তোলার জন্য প্রাপ্তবয়স্ক বা স্থিতিশীল পৃষ্ঠের সহায়তায় বসে চেয়ারের ভিতরে এবং বাইরে চলে যায়। • শিশুরা ওয়াকার এবং প্রাপ্তবয়স্কদের তত্ত্বাবধানে অল্প দূরত্বে হাঁটতে পারে তবে অসম পৃষ্ঠে বাঁক নিতে এবং ভারসাম্য বজায় রাখতে তাদের অসুবিধা হয়। • শিশু সম্প্রদায়ের মধ্যে পরিবহন করা হয়. শিশুরা পাওয়ার হুইলচেয়ার ব্যবহার করে স্ব-গতি অর্জন করতে পারে।
	o লেভেল 5 • শারীরিক প্রতিবন্ধকতা নড়াচড়ার স্বেচ্ছায় নিয়ন্ত্রণ এবং অ্যান্টিগ্র্যাভিটি মাথা এবং ট্রাঙ্ক ভঙ্গি বজায় রাখার ক্ষমতাকে সীমাবদ্ধ করে। • মোটর ফাংশনের সমস্ত ক্ষেত্র সীমিত। বসা এবং দাঁড়ানোর কার্যকরী সীমাবদ্ধতাগুলি অভিযোজিত সরঞ্জাম এবং সহায়ক প্রযুক্তি ব্যবহারের মাধ্যমে সম্পূর্ণরূপে ক্ষতিপূরণ পায় না • V স্তরে, শিশুদের স্বাধীন চলাফেরার কোন উপায় নেই এবং তাদের পরিবহন করা হয়। • কিছু শিশু ব্যাপক অভিযোজন সহ পাওয়ার হুইলচেয়ার ব্যবহার করে স্ব-গতিশীলতা অর্জন করে।

4.3। 6 ম থেকে 12 তম মধ্যে জন্মদিন (যদি রোগীদের বয়স 6-12 হয় , প্রশ্ন এড়িয়ে যান । না, 4.3)	o লেভেল 1 • শিশুরা বাড়ির ভিতরে এবং বাইরে হাঁটাচলা করে এবং সীমাবদ্ধতা ছাড়াই সিঁড়ি বেয়ে উঠে। • শিশুরা দৌড়ানো এবং লাফানো সহ মোট মোটর দক্ষতা সম্পাদন করে কিন্তু গতি, ভারসাম্য এবং সমন্বয় হ্রাস পায়।
	o লেভেল 2 • শিশুরা বাড়ির ভিতরে এবং বাইরে হাঁটাচলা করে, এবং একটি রেলিং ধরে সিঁড়ি বেয়ে উঠতে পারে কিন্তু অসম পৃষ্ঠ এবং বাঁকগুলিতে হাঁটতে এবং ভিড় বা সীমাবদ্ধ জায়গায় হাঁটতে সীমাবদ্ধতা অনুভব করে। • দৌড়ানো এবং লাফ দেওয়ার মতো মোট মোটর দক্ষতা সম্পাদন করার জন্য শিশুদের সর্বোত্তম ক্ষমতা থাকে।
	o লেভেল 3 • শিশুরা একটি সহায়ক গতিশীল যন্ত্রের সাহায্যে বাড়ির ভিতরে বা বাইরে একটি সমতল পৃষ্ঠে হাঁটে। • শিশুরা রেলিং ধরে সিঁড়ি বেয়ে উঠতে পারে। • উপরের অঙ্গগুলির কার্যকারিতার উপর নির্ভর করে, শিশুরা একটি হুইলচেয়ারকে ম্যানুয়ালি চালিত করে বা অমসৃণ ভূখণ্ডে দীর্ঘ দূরত্বে বা বাইরে ভ্রমণ করার সময় পরিবহন করা হয়।
	o লেভেল 4 • শিশুরা 6 বছর বয়সের আগে অর্জিত কার্যকারিতার মাত্রা বজায় রাখতে পারে বা বাড়িতে, স্কুলে এবং সম্প্রদায়ে চাকার গতিশীলতার উপর বেশি নির্ভর করতে পারে। • শিশুরা পাওয়ার হুইলচেয়ার ব্যবহার করে স্ব-গতিশীলতা অর্জন করতে পারে।

	o লেভেল 5 • শারীরিক প্রতিবন্ধকতা নড়াচড়ার স্বেচ্ছায় নিয়ন্ত্রণ এবং অ্যান্টিগ্র্যাভিটি মাথা এবং ট্রাঙ্ক ভঙ্গি বজায় রাখার ক্ষমতাকে সীমাবদ্ধ করে। • মোটর ফাংশনের সমস্ত ক্ষেত্র সীমিত। বসা এবং দাঁড়ানোর কার্যকরী সীমাবদ্ধতাগুলি অভিযোজিত সরঞ্জাম এবং সহায়ক প্রযুক্তি ব্যবহারের মাধ্যমে সম্পূর্ণরূপে ক্ষতিপূরণ পায় না। • V স্তরে, শিশুদের স্বাধীন চলাফেরার কোন উপায় নেই এবং তাদের পরিবহন করা হয়। • কিছু শিশু ব্যাপক অভিযোজন সহ পাওয়ার হুইলচেয়ার ব্যবহার করে স্ব-গতিশীলতা অর্জন করে।

পার্ট-5: কার্যকরী লেবেল – বিশ্লেষণ

এলাকা	**স্কোর**
সেল্ফ কেয়ার	
19. খাওয়া	
20. গ্রুমিং	
21.স্নান	
22. ড্রেসিং-অপার বডি	
23. ড্রেসিং-লোয়ার বডি	
স্ফিঙ্কটার নিয়ন্ত্রণ	
24.পায়খানা	
25. মূত্রাশয় ব্যবস্থাপনা	
26. অন্ত্র ব্যবস্থাপনা	

স্ব-যত্ন সাবটোটাল	
স্থানান্তর	
27. স্থানান্তর: চেয়ার/হুইলচেয়ার	
28. স্থানান্তর: টয়লেট	
29. স্থানান্তর: টব/ঝরনা	
লোকোমোশন	
30. গতিবিধি: হাঁটা/হুইলচেয়ার/হামাগুড়ি	
31. Locomotion: সিঁড়ি	
গতিশীলতা সাবটোটাল	
যোগাযোগ	
32. বোধগম্যতা	
33. অভিব্যক্তি	
সামাজিক জ্ঞান	
34.সামাজিক মিথস্ক্রিয়া	
35.সমস্যা সমাধান	
36.স্মৃতি	
কগনিশন সাবটোটাল	

Informed consent Form

Please Read It Carefully

Title: Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy

Assalamualaikum,

I am Jerifa Zahid Dola, a student of B.Sc. in physiotherapy, 4th year 2018-19 session, at Saic College of Medical Science & Technology, affiliated with the University of Dhaka under the faculty of Medicine. I am conducting a research program entitled **"Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy**". In this study, I would like to find out the effectiveness of higher function practice on balance and function in CP patients.

I would like to request some information regarding your sociodemographic, functional independence, and medical information-related questions. Please note that this academic research project will take approximately 20-30 minutes to complete. Participating in this study will not affect your current or future treatment in any way. It is important to mention that the information collected will only be used for academic research purposes, and all your provided data will be kept confidential. In the case of any report or publication, we will ensure that your identity remains anonymous.

If you have any questions regarding the study or your rights as a participant, please feel free to contact the investigator Jerifa Zahid Dola or the research supervisor of Shahid Afridi, Lecturer, SCMST, Mirpur, Dhaka.

Do you have any questions before I start?

So, may I have your consent to proceed with the interview?

Yes	No

Participant Signature……………………………..Date……………….

Supervisor Signature……………………………..Date……………….

Contact No……………………….

Research Questionnaire

""Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy."

Patients Information

Date of interview: Mobile No: ………………………

Patients ID:

Name of participant:

Patients address: Village: Post Office:

P. S: District:

Part-1: Socio-demographic Information

QN	Question	Response
1.1	Patients Age	…………………….
1.2	Patients Gender	1 = Boy 2 = Girl
1.3	Siblings	
1.4	Age of the care guardian	……………………..
1.5	Education of the care guardian	1= Illiterate 2= Primary 3= SSC 4= HSC 5= Graduation
1.6	religion	1= Muslim 2= Hindu 3= Others

1.7	Living area	1 = Rural 2 = Urban
1.8	Family type	1 = Nuclear 2 = Extended
1.9	Family income (in BDT)	………………….

Part-2: Topic Related Information

QN	Question	Response
2.1	When did your child born?	1= Before 38 weeks 2= After 38 weeks 3= After 42 weeks
2.2	Place of delivery	1= Home 2= Hospital
2.3	Type of delivery	1= NVD (Normal Vaginal Delivery) 2= Caesarian section 3= Forceps delivery 4= Other instrumental delivery
2.4	What was the duration of labor pain?	1= Less than 12 hours 2= More than 12 hours
2.5	Did your child cry just after birth?	1= Yes 2= No
2.6	Involvement of limb	1= Monoplegic 2= Diplegic 3= Quadriplegic 4= Triplegic 5= Hemiplegic
2.7	Height	…………m
2.8	Weight	…………Kg
2.9	BMI	…………Kg/m^2

Pre Data

Part-3: FIM Scale

FIM Scale

1	Total assistance or unplaceable in position
2	Maximum assistance required (child does 25% of work)
3	Moderate assistance required (child does 50% of work)
4	Minimum assistance required (child does 75% of work)
5	Required supervision
6	Modified independence (abnormal movement patterns or not able to dynamically moved from the base of support)
7	Complete independence (full dynamic movement and able to maintain balance for 30 second)

	Starting position	**Pre test score**	**Post test score**
1.	Rolling supine to prone		
2.	Rolling prone to supine		
3.	Moving from supine to box sitting		
4.	Bridging		
5.	Sitting on box		
6.	Moving from box sitting to standing		
7.	Sitting on cross leg sitting		

Part-4: GMFCS

4.1. Between 2nd and 4th Birthday	o Level 1 • Children floor sit with both hands free to manipulate objects. • Movements in and out of floor sitting and standing are performed without adult assistance. • Children walk as the preferred method of mobility without the need for any assistive mobility device.
	o Level 2 • Children floor sit but may have difficulty with balance when both hands are free to manipulate objects. • Movements in and out of sitting are performed without adult assistance. • Children pull to stand on a stable surface. • Children crawl on hands and knees with a reciprocal pattern, cruise holding onto furniture and walk using an assistive mobility device as preferred methods of mobility.
	o Level 3 • Children maintain floor sitting often by "W-sitting" (sitting between flexed and internally rotated hips and knees) and may require adult assistance to assume sitting. • Children creep on their stomach or crawl on hands and knees (often without reciprocal leg movements) as their primary methods of self mobility. • Children may pull to stand on a stable surface and cruise short distances. • Children may walk short distances indoors using an assistive mobility device and adult assistance for steering and turning.
	o Level 4 • Children floor sit when placed, but are unable to maintain alignment and

	balance without use of their hands for support. • Children frequently require adaptive equipment for sitting and standing. • Self mobility for short distances (within a room) is achieved through rolling, creeping on stomach, or crawling on hands and knees without reciprocal leg movement.
	o Level 5 • Physical impairments restrict voluntary control of movement and the ability to maintain antigravity head and trunk postures. All areas of motor function are limited. • Functional limitations in sitting and standing are not fully compensated for through the use of adaptive equipment and assistive technology. • At Level V, children have no means of independent mobility and are transported. • Some children achieve self-mobility using a power wheelchair with extensive adaptations.
4.2. Between 4th and 6th Birthday (If patients age range is 4-6, skip Ques. No,4.1)	o Level 1 • Children get into and out of, and sit in, a chair without the need for hand support. • Children move from the floor and from chair sitting to standing without the need for objects for support. • Children walk indoors and outdoors, and climb stairs. • Emerging ability to run and jump.
	o Level 2 • Children sit in a chair with both hands free to manipulate objects. • Children move from the floor to standing and from chair sitting to standing but often require a stable surface to push or pull up on with their arms.

	• Children walk without the need for any assistive mobility device indoors and for short distances on level surfaces outdoors. • Children climb stairs holding onto a railing but are unable to run or jump.
	o Level 3 • Children sit on a regular chair but may require pelvic or trunk support to maximize hand function. • Children move in and out of chair sitting using a stable surface to push on or pull up with their arms. • Children walk with an assistive mobility device on level surfaces and climb stairs with assistance from an adult. • Children frequently are transported when travelling for long distances or outdoors on uneven terrain.
	o Level 4 • Children sit on a chair but need adaptive seating for trunk control and to maximize hand function. • Children move in and out of chair sitting with assistance from an adult or a stable surface to push or pull up on with their arms. • Children may at best walk short distances with a walker and adult supervision but have difficulty turning and maintaining balance on uneven surfaces. • Children are transported in the community. Children may achieve selfmobility using a power wheelchair.
	o Level 5 • Physical impairments restrict voluntary control of movement and the ability to maintain antigravity head and trunk postures. • All areas of motor function are limited. Functional limitations in sitting and standing are not fully compensated for through the use of adaptive equipment and assistive technology • At Level V, children have no means of independent mobility and are transported. • Some children achieve self-mobility using a power wheelchair with extensive adaptations.

4.3. Between 6th and 12th Birthday (If patients age range is 6-12, skip Ques. No,4.3)	o Level 1 • Children walk indoors and outdoors, and climb stairs without limitations. • Children perform gross motor skills including running and jumping but speed, balance, and coordination are reduced.
	o Level 2 • Children walk indoors and outdoors, and climb stairs holding onto a railing but experience limitations walking on uneven surfaces and inclines, and walking in crowds or confined spaces. • Children have at best only minimal ability to perform gross motor skills such as running and jumping.
	o Level 3 • Children walk indoors or outdoors on a level surface with an assistive mobility device. • Children may climb stairs holding onto a railing. • Depending on upper limb function, children propel a wheelchair manually or are transported when travelling for long distances or outdoors on uneven terrain.
	o Level 4 • Children may maintain levels of function achieved before age 6 or rely more on wheeled mobility at home, school, and in the community. • Children may achieve self-mobility using a power wheelchair.
	o Level 5 • Physical impairments restrict voluntary control of movement and the ability to maintain antigravity head and trunk postures. • All areas of motor function are limited. Functional limitations in sitting and standing are not fully compensated for through the use of adaptive equipment and assistive technology. • At level V, children have no means of independent mobility and are transported. • Some children achieve self-mobility using a power wheelchair with extensive adaptations.

Part-5: Functional label – Analysis

Area	Score
SELF CARE	
19.Eating	
20.Grooming	
21.Bathing	
22.Dressing-Upper Body	
23.Dressing-Lower Body	
SPHINCTER CONTROL	
24.Toileting	
25.Bladder management	
26.Bowel management	
Self care subtotal	
TRANSFERS	
27.Transfers: Chair/Wheelchair	
28.Transfers: Toilet	
29.Transfers: Tub/Shower	

LOCOMOTION	
30.Locomotion: Walk/Wheelchair/Crawl	
31.Locomotion: Stairs	
Mobility subtotal	
COMMUNICATION	
32.Comprehension	
33.Expression	
SOCIAL COGNITION	
34.Social interaction	
35.Problem solving	
36.Memory	
Cognition subtotal	

Appendix- B

Institutional Review Board (IRB) Permission Letter

SCMST-BPT/IRB/.08-24/051

Date: 5th June, 2024
To
Jerifa Zahid Dola
4th Year Student of B.Sc. in Physiotherapy
Mirpur-14, Dhaka-1216, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy"** by ethics committee.

Dear Jerifa Zahid Dola

Congratulations.
The Institutional Review Board (IRB) of SCMST has reviewed and discussed your application to conduct the above-mentioned dissertation, with yourself, as the principal investigator. The Following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English and Bangla version)
3	Information sheet & consent form.

The purpose of the study is to determine the Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy. The study involves face to face interview by using semi-structured questionnaire to find out the Effectiveness of Higher Function Practice on balance and function among the patients with cerebral palsy that may take 30 to 40 minutes to fill in the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 28th September 2023 at SCMST.
The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring during the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,

10. 06.24.

Dr. Abul Kasem Mohammad Enamul Haque
Principal, SCMST &Chairman, Institutional Review Board (IRB)
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Appendix- C

Permission letter for data collection

BANGLADESH COUNCIL FOR CHILD WELFARE-BCCW

বাংলাদেশ শিশু কল্যাণ পরিষদ-বাশিকপ

Registered with Department of Social Services, # 201(1962)/ Foreign Donation Registration # 499
22/1 Topkhana Road, Dhaka-1000, Phone : 02223384257, 02223389760
E-mail: shishukallyanparishad@gmail.com, Website : www.bccw-bd.org

ফা-ভি-০৮/বাশিকপ২০০৬(প্রশাসন)-অংশ-২-প-৫০১ — তারিখ : ৩১-১০-২০২৪

বরাবর
জারিফা জাহিদ দৌলা
শিক্ষার্থী, বিএসসি ইন ফিজিওথেরাপী বিভাগ
সাইক কলেজ অব মেডিকেল সায়েন্স অ্যান্ড টেকনোলজি
সাইক টাওয়ার, এম-১/৬, মিরপুর # ১৪
ঢাকা-১২১৬।

বিষয় : ডাটা কালেকশনের অনুমতি প্রসঙ্গে।
সূত্র : আপনার ২৭ অক্টোবর ২০২৪ইং তারিখের প্রেরিত পত্র।

উপর্যুক্ত বিষয়ে সূত্রোল্লিখিত পত্রের বর্ণনা মতে আপনাকে বাংলাদেশ শিশু কল্যাণ পরিষদ পরিচালিত ফিরোজা বারি প্রতিবন্ধী শিশু হাসপাতালে **"Effectivencss of Higher Function Practice on balance and function among the patients with cerebral palsy"** উপর ডাটা কালেকশনের জন্য সম্মতি জ্ঞাপন করা হলো। এক্ষেত্রে প্রতিষ্ঠানের পক্ষ থেকে কোনরূপ ভাতা বা সম্মানী প্রদান করা হবে না এবং প্রতিষ্ঠান কর্তৃক নির্ধারিত সময় ও নিয়ম নীতি অবশ্যই মেনে চলতে হবে। এতদসংশ্লিষ্ট যাবতীয় বিষয়ে পরবর্তী কার্যক্রম সম্পাদনের জন্য মিসেস ইয়াসমিন আরা ডলি, পরিচালক, বাশিকপ-এর সাথে (**02223384257**-Ex-107) যোগাযোগ করার অনুরোধ জানানো হলো।

ধন্যবাদান্তে

মোহাম্মদ [illegible] আলম
সাধারণ সম্পাদক, বাশিকপ

<u>অনুলিপি</u>

১. মিসেস ইয়াসমিন আরা ডলি, পরিচালক, বাশিকপ এবং চীফ ফিজিওথেরাপিস্ট ও ট্রেনিং কো-অর্ডিনেটর, ফিরোজা বারি প্রতিবন্ধী শিশু হাসপাতাল।
২. অফিস কপি

Appendix- D

Gant Chart

Activities/ months	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	June 24	July 24	Aug 24
Proposal presentation												
Introduction												
Literature review												
Methodology												
Data collection												
Data Analysis												
Result												
1st progress presentation												
Discussion												
Conclusion And Recommendation												
2nd progress presentation												
Communication with supervisor												
Final submission												