Effectiveness of Yogasana Training on Core Strength and Postural Stability among Children with Special Needs

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***Abstract*—Background: Children with special needs often demonstrate reduced core strength and impaired postural stability due to limitations in neuromuscular coordination and sensorimotor integration. Core stability is closely associated with trunk muscle function, balance control, and central nervous system regulation (Granacher et al., 2013; Shumway-Cook & Woollacott, 2017). Yogasana-based practices may improve these parameters through combined effects on muscular strength, proprioception, and neuro-motor coordination (Streeter et al., 2012).**

Objective: The present study aimed to examine the effectiveness of yogasana training on core strength and postural stability among children with special needs.

Methods: A randomized pre-test–post-test control group design was employed. A total of 40 children with special needs were randomly assigned into an experimental group (n = 20) and a control group (n = 20). The experimental group underwent a 12-week yogasana training programme, while the control group continued routine activities. Core strength was assessed using the Plank Test and Curl-Up Test, and postural stability was assessed using the Flamingo Balance Test and Balance Beam Walk Test. Data were analysed using appropriate statistical methods, with significance set at $p < 0.05$.

Results: The experimental group showed significant improvements in core strength and postural stability compared with the control group ($p < 0.05$). Improvements were observed in plank duration, curl-up repetitions, balance time, and dynamic stability performance. No significant changes were observed in the control group.

Conclusion: Yogasana training was effective in improving core strength and postural stability among children with special needs. The observed improvements may be attributed to mechanisms involving central nervous system adaptation, enhanced proprioceptive feedback, and improved neuro-motor coordination, leading to better trunk control and balance (Latash, 2008; Voss et al., 1985). These findings support the integration of yogasana into therapeutic and educational programmes for children with special needs.

***Index Terms*—Yogasana; Core Strength; Postural Stability; Special Needs Children; Neuro-Motor Control; Balance; Proprioception**

I. INTRODUCTION

1.1 Core Strength and Functional Stability in Children with Special Needs

Children with special needs frequently present with impairments in muscle tone, postural control, and motor coordination, which can affect their ability to perform daily activities independently. Core strength, defined as the ability of the trunk muscles to stabilize the spine and pelvis, plays a fundamental role in maintaining posture, balance, and coordinated movement (McGill, 2010; Panjabi, 2006). Weakness or dysfunction in core musculature is often associated with reduced postural stability and impaired motor performance in this population. Therefore, interventions aimed at improving core strength and stability are essential for enhancing functional independence and overall physical development among children with special needs.

1.2 Role of the Brain and Neuro-Motor Control

Postural stability and core strength are regulated by complex interactions within the central nervous system. The brain, particularly the motor cortex, cerebellum, and basal ganglia, is responsible for planning, coordinating, and executing movements (Latash, 2008). The cerebellum plays a critical role in maintaining balance and fine-tuning motor activity, while the basal ganglia contribute to movement initiation and control. In children with special needs, impairments in these neural structures can lead to difficulties in motor planning, coordination, and postural control (Shumway Cook & Woollacott, 2017). Effective interventions must therefore target both muscular and neural components to improve movement efficiency and stability.

1.3 Neuromuscular Integration and Stability Mechanisms

Core stability depends on the coordinated activation of deep and superficial trunk muscles, along with continuous feedback from sensory systems. Proprioceptive input from muscles and joints is transmitted through neural pathways to the brain, where it is integrated and used to adjust motor responses (Kisner & Colby, 2012). This process, known as neuromuscular control, is essential for maintaining balance and stability. Disruptions in proprioceptive feedback or motor coordination can result in poor postural alignment and instability. Enhancing neuromuscular integration is therefore a key component in improving core strength and functional stability in children with special needs.

1.4 Yogasana as a Neuro Motor Intervention

Yogasana based practices involve controlled postures, sustained muscle engagement, and coordinated breathing, which may contribute to improved core strength and postural stability. Many yogasana postures require activation of the abdominal, back, and pelvic muscles, thereby strengthening the core musculature (McGill, 2010). At the same time, the slow and mindful execution of movements promotes enhanced body awareness and proprioceptive feedback. Through repeated practice, yogasana may facilitate improved communication between the brain and musculoskeletal system, leading to better neuromuscular coordination and postural control (Streeter et al., 2012; Saoji et al., 2019).

1.5 Brain Core Stability Integration

The effectiveness of yogasana in improving core strength and stability can be understood through the integration of brain muscle movement pathways. The brain processes sensory input and generates motor output, while continuous feedback from muscles and joints allows for adjustments in posture and movement (Latash, 2008). Yogasana practices may enhance this feedback loop by improving proprioceptive sensitivity and motor control. This integration is particularly beneficial for children with special needs, where deficits in neural coordination often contribute to instability and reduced functional capacity.

1.6 Need for the Present Study

Although previous research has demonstrated the benefits of physical activity and therapeutic exercise in improving motor function, limited studies have specifically examined the role of yogasana in enhancing core strength and postural stability among children with special needs. Furthermore, there is a need to explore the underlying neuro-motor mechanisms through which yogasana influences brain–body coordination and stability. Understanding these mechanisms can contribute to the development of effective and evidence-based interventions tailored to this population.

1.7 Purpose of the Study

Therefore, the present study aims to examine the effectiveness of yogasana training on core strength and postural stability among children with special needs, with particular emphasis on the role of neuro-motor control and brain-mediated coordination. The study seeks to provide a scientific basis for the use of yogasana as a therapeutic approach to improve physical stability, functional movement, and overall motor development in this population.

II. METHODS

2.1 Study Design

The present study employed a randomized pre-test–post-test control group design to examine the effectiveness of yogasana training on core strength and postural stability among children with special needs.

2.2 Participants

A total of 40 children with special needs (8–13 years) were recruited and randomly assigned to an experimental group (n = 20) and a control group (n = 20).

2.3 Inclusion Criteria
Participants were included if they were identified as children with special needs, were medically fit to participate in mild to moderate physical activity, were able to follow simple instructions with assistance where necessary, and obtained parental or guardian consent for participation.

2.4 Exclusion Criteria
Participants were excluded if they had severe orthopaedic, neurological, or musculoskeletal impairments that prevented safe participation, had undergone recent surgery or sustained recent injury, were already involved in structured yoga, balance, or strength training, or had medical conditions contraindicating participation in physical activity.

2.5 Intervention Programme
The experimental group underwent a structured yogasana training programme designed to improve core strength and postural stability. The intervention included selected yogasana practices emphasizing trunk stabilization, abdominal and back muscle activation, postural alignment, balance control, and body awareness. The sessions were supervised by a qualified yoga instructor trained to work with children with special needs. Demonstration, verbal instruction, and physical assistance were provided according to individual ability and functional need.
The control group did not receive any yogasana intervention and continued with routine school or therapy activities.

III. DURATION AND TRAINING SCHEDULE

The intervention was conducted for 12 weeks. Sessions were carried out on a regular basis according to the training schedule, with the duration and intensity adjusted to suit the abilities and tolerance of the participants.

Selected Yogasana:
- Tadasana
- Vrikshasana
- Trikonasana
- Virabhadrasana I
- Virabhadrasana II
- Utkatasana
- Naukasana
- Setu Bandhasana
- Bhujangasana
- Salabhasana
- Marjariasana Bitilasana
- Adho Mukha Svanasana

IV. OUTCOME MEASURES

4.1 The primary outcome variables of the study were:
- Core Strength
- Postural Stability

These variables were selected because they are closely associated with functional movement, balance, and motor coordination in children with special needs (Granacher et al., 2013).

4.2 Assessment of Core Strength
A. Plank Test
The Plank Test was used to assess core muscular endurance and strength. In this test, the participant was instructed to maintain a prone plank position for as long as possible while keeping the body aligned. The duration was recorded in seconds. This test was selected because it provides a simple and reliable measure of trunk and abdominal muscle endurance (McGill, 2010).

B. Curl-Up Test
The Curl-Up Test was used to assess abdominal muscle strength and endurance. The number of correctly performed repetitions was recorded. This test was included because abdominal strength forms an essential component of core stability (Kisner & Colby, 2012).

4.3 Assessment of Postural Stability
A. Flamingo Balance Test
The Flamingo Balance Test was used to assess static balance and postural stability. The participant was asked to stand on one leg for as long as possible, and the duration or number of balance losses was recorded. This test is commonly used to measure postural control and static balance ability (Shumway-Cook & Woollacott, 2017).

B. Balance Beam Walk Test
The Balance Beam Walk Test was used to assess dynamic postural stability. The participant was instructed to walk across a narrow beam, and

performance was evaluated based on the number of successful steps or time taken. This test was selected to measure functional balance during movement (Cook et al., 2006).

4.4 Data Collection Procedure

Pre-test measurements were recorded for both groups before the commencement of the intervention. After completion of the 12-week yogasana training programme, post-test measurements were collected using the same testing procedures and instruments. All tests were conducted under standardized conditions to ensure consistency and reliability.

4.5 Ethical Considerations

The study was conducted in accordance with ethical standards for research involving children. Institutional permission was obtained from the concerned authorities, and informed consent was secured from the parents or guardians of all participants. Care was taken to ensure the safety, comfort, and emotional well-being of the children throughout the intervention and testing period.

4.6 Statistical Analysis

Data were analysed using descriptive and inferential statistical methods. Mean and standard deviation were used to summarize the data. To determine the significance of differences between the experimental and control groups, appropriate statistical tests were applied. The level of significance was fixed at 0.05.

V. RESULTS

A. Descriptive Statistics: The pre-test and post-test mean (± SD) values of core strength and postural stability variables are presented in Table 1.

Table 1. Pre-test and Post-test Mean (± SD) of Core Strength and Postural Stability Variables

Variable	Group	Pre-test Mean ± SD	Post-test Mean ± SD
Plank Test (sec)	Experimental	18.5 ± 4.2	34.6 ± 5.1
	Control	18.9 ± 4.5	20.2 ± 4.7
Curl-Up Test (reps)	Experimental	10.8 ± 2.3	18.4 ± 2.9
	Control	11.1 ± 2.5	11.9 ± 2.6
Flamingo Balance Test (sec)	Experimental	9.6 ± 2.1	18.8 ± 2.8
	Control	9.9 ± 2.3	10.8 ± 2.4
Balance Beam Walk (score/time)	Experimental	6.2 ± 1.5	11.5 ± 1.8
	Control	6.4 ± 1.6	6.9 ± 1.7

B. Interpretation of Results: The results of the present study revealed statistically significant improvements in both core strength and postural stability variables among the experimental group when compared with the control group.

C. Core Strength: Significant improvements were observed in both the Plank Test and Curl-Up Test among participants in the experimental group. The increase in plank holding time indicates improved core muscular endurance, while the increase in curl-up repetitions reflects enhanced abdominal strength. These findings suggest that yogasana training effectively strengthened the trunk musculature.

D. Postural Stability: The experimental group demonstrated significant improvements in both Flamingo Balance Test and Balance Beam Walk performance, indicating enhanced static and dynamic balance. The increased duration in the Flamingo test reflects improved single-leg stability, while better performance in the balance beam task suggests improved coordination and postural control during movement.

E. Overall Findings: The findings indicate that yogasana training significantly improved core strength and postural stability among children with special needs. The control group did not show meaningful improvements, confirming that the observed changes were attributable to the yogasana intervention.

VI. DISCUSSION

The present study investigated the effectiveness of yogasana training on core strength and postural stability among children with special needs. The findings demonstrated significant improvements in plank performance, curl-up repetitions, and balance outcomes in the experimental group compared with the control group. These results indicate that structured yogasana practice can enhance trunk muscle function and stability, which are essential for efficient movement and functional independence in this population.

The observed improvements in core strength can be attributed to sustained activation of deep and superficial trunk muscles during yogasana practice. Postures that require isometric holding, controlled transitions, and alignment likely increased endurance of the abdominal and paraspinal musculature (McGill, 2010). Improved plank time reflects enhanced anti-extension control of the trunk, while increased curl-up performance indicates better abdominal strength and coordination. Together, these adaptations suggest improved capacity to stabilize the spine and pelvis during static and dynamic tasks.

From a neurophysiological perspective, these gains are closely linked to central nervous system adaptation. The motor cortex, cerebellum, and basal ganglia contribute to planning, timing, and coordination of movement (Latash, 2008). Repetitive, guided yogasana practice may facilitate motor learning and improve the efficiency of neural pathways responsible for trunk control. The cerebellum, in particular, refines balance and postural adjustments, which may explain the improvements observed in both static and dynamic stability tasks (Shumway-Cook & Woollacott, 2017).

Postural stability depends on continuous integration of sensory inputs from the visual, vestibular, and proprioceptive systems. The significant improvements in the Flamingo Balance Test and Balance Beam Walk indicate enhanced sensory–motor integration and better postural control. Yogasana practice likely improved proprioceptive feedback from muscles and joints, enabling more accurate adjustments in body position. This enhanced feedback loop between sensory receptors and the central nervous system is essential for maintaining equilibrium and coordinated movement (Kisner & Colby, 2012).

The role of neuro-motor control is central to understanding these findings. Children with special needs often exhibit deficits in motor planning, coordination, and timing. Yogasana involves slow, deliberate movements with sustained attention to body position, which may improve motor planning and execution. The combination of postural control, controlled breathing, and focused attention may strengthen neural circuits involved in movement regulation, leading to improved stability and coordination (Streeter et al., 2012).

Additionally, spinal and peripheral neural pathways, including ganglionic transmission, play a role in modulating muscle tone and reflex responses. Enhanced sensory input during yogasana may improve the transmission of signals through these pathways, facilitating better neuromuscular coordination. This may contribute to reduced unnecessary muscle activation and improved efficiency of movement patterns (Ulrich-Lai & Herman, 2009).

The findings also align with principles of Proprioceptive Neuromuscular Facilitation. Although PNF techniques were not directly applied, yogasana may induce similar effects through sustained stretching and controlled muscle activation. Repeated practice may promote reflex mechanisms such as autogenic inhibition, allowing muscles to relax and stabilize more effectively while maintaining alignment (Voss et al., 1985; Kisner & Colby, 2012). This mechanism may explain the concurrent improvement in strength, balance, and motor control.

Furthermore, yogasana practice may influence autonomic regulation, promote parasympathetic dominance and reduce excessive muscular tension. Reduced sympathetic activity can decrease muscle stiffness and improve movement fluidity, thereby enhancing both core stability and balance (Streeter et al., 2012; Saoji et al., 2019). This is particularly relevant for children with special needs, who may exhibit altered muscle tone or coordination difficulties.

The absence of significant improvements in the control group supports the conclusion that the observed changes were attributable to the yogasana

intervention. The structured, progressive, and supervised nature of the programme likely contributed to the effectiveness of the training.
In summary, the improvements in core strength and postural stability observed in the present study can be explained through an integrated mechanism involving central nervous system adaptation, enhanced proprioceptive feedback, improved neuro-motor control, and PNF-like neuromuscular facilitation. Yogasana appears to act at both the muscular and neural levels, strengthening trunk musculature while simultaneously improving the coordination between sensory input and motor output. These findings highlight the potential of yogasana as a holistic and effective intervention for enhancing physical function in children with special needs.

VII. CONCLUSION

The present study investigated the effectiveness of yogasana training on core strength and postural stability among children with special needs. The findings revealed significant improvements in both core strength and balance-related variables in the experimental group compared with the control group. These results indicate that yogasana practice can effectively enhance trunk muscle function, stability, and coordinated movement in this population.

The improvements observed in core strength, as reflected by increased plank duration and curl-up performance, suggest enhanced activation and endurance of trunk musculature. Similarly, the significant improvements in balance measures indicate better postural control and stability during both static and dynamic conditions. These outcomes highlight the importance of structured movement-based interventions in improving functional capabilities among children with special needs.

From a mechanistic perspective, the observed changes may be explained by the combined influence of muscular strengthening and neurophysiological adaptation. Yogasana practice promotes improved communication between the central nervous system and the musculoskeletal system, leading to enhanced motor planning, coordination, and execution (Latash, 2008). Increased proprioceptive input and neuromuscular facilitation may further contribute to improved postural alignment and movement control (Voss et al., 1985).

The absence of significant changes in the control group confirms that the improvements were attributable to the yogasana intervention. These findings support the incorporation of yogasana-based training into therapeutic, educational, and rehabilitation programmes for children with special needs. In conclusion, yogasana-based training is an effective and practical approach for improving core strength and postural stability in children with special needs. By enhancing both physical and neuro-motor components of movement, yogasana may contribute to improved functional independence and quality of life. Future research with larger samples and longer intervention periods is recommended to further validate these findings and explore long-term benefits.

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