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To Compare the Strength of Core Musculature Between Schoolchildren and Children Playing Cricket Under the Age of 16 in Jorhat Town by Using a Modified Sphygmomanometer: A Pilot Study

Chayanika Borpatra Gohain[1,*], Twinkle Pegu[1], Prasenjit Bhattacharyya[1], Santosh Kumar Rajak[1]

Abstract

Background: *The Core Musculature is the group of trunk and hip muscles that surround the spine, abdominal visera and hip. A strong core is essential for stability, posture, and overall strength. Core strengthening is crucial for reducing back pain, preventing injuries, and improving functional movement. A Modified Sphygmomanometer is used to obtain reliable, objective measurements of core muscle strength, and stability by applying resistance. Additionally, a pressure biofeedback unit can offer real-time feedback on core muscle performance, helping to improve lumbopelvic stability, and enhance overall core function.* ***Objective:*** *To compare the Core Musculature Strength of schoolchildren and children playing cricket under the age of 16 in Jorhat Town by using a Modified Sphygmomanometer.* ***Methodology:*** *A pilot study was done on two groups of children aged below 16. One group consists of 10 children who have been coached in cricket for the last 3 years at Jorhat Cricket Coaching Centre and another group consists of 10 children who have not been engaged themselves in any sports or training activity from Borbheta Public School, Jorhat. Pressure Biofeedback (Modified Sphygmomanometer) was used to measure core strength.* ***Results:*** *Of the two groups, there were 70% male and 30% female. By measuring the core strength, it shows that the children who have coached cricket for the last 3 years have stronger core than school going children ($p > 0.0001$). The mean difference between these groups is 40.90.* ***Conclusion:*** *Based on the statistical analysis, it can be concluded that a significant difference exists between the two groups. Hence, we would like to conclude that children should be given a program of core strengthening exercise as a part of extracurricular activities for better stability, posture, and strength.*

Keywords: Core Musculature, Sphygmomanometer, Children, Cricket, Core Strength

***Author for Correspondence**
Chayanika Borpatra Gohain
E-mail: chayanikaborpatra@gmail.com

[1]Researcher, Department of Physiotherapy, Assam Women's University, Jamuguri, Rowriah, Assam, India

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INTRODUCTION

The core musculature consists of the trunk and hip muscles that encircle the spine, abdominal organs, and hips. The trunk's core muscles include the thoracolumbar muscles, lumbar muscles, lateral thoracolumbar muscles, quadratus lumborum, and abdominal muscles. The hip muscles forming the core include the psoas, iliacus, gluteus maximus, gluteus medius (both anterior and posterior fibers), rectus femoris, and the hamstring group. Additionally, the external and internal rotators of the hip comprise a large group of muscles [1]. The core can be visualized as a muscular box, with the abdominals at the front, the paraspinals and gluteals at the back, the diaphragm forming the

roof, and the pelvic floor and hip girdle muscles making up the base [2].

Begmark states that trunk muscles can be divided into two types. The global system i.e. the active components (the muscles and the intraabdominal pressure (IAP)) which transfer the load directly between the thoracic cage and the pelvis and local system i.e. All muscles which have their origin or insertion at the vertebrae [3–5]. The primary function of the global system seems to be to balance the external load so that the local system can manage the force that is transferred to the lumbar spine, resulting strain on the lumbar spine should therefore only vary little when there are significant changes in the distribution of the outside load [6].

The spinal stabilizing system consists conceptually of three subsystems. The passive musculoskeletal subsystem includes the vertebrae, facet joints, intervertebral discs, spinal ligaments, and joint capsules. The active subsystem consists of the muscles and tendons surrounding the spinal column. The neural and feedback subsystem involves various force and motion sensors found in ligaments, tendons, and muscles, as well as the neural control centers. While these passive, active, and neural subsystems are structurally distinct, they are functionally interconnected (Figure 1) [7].

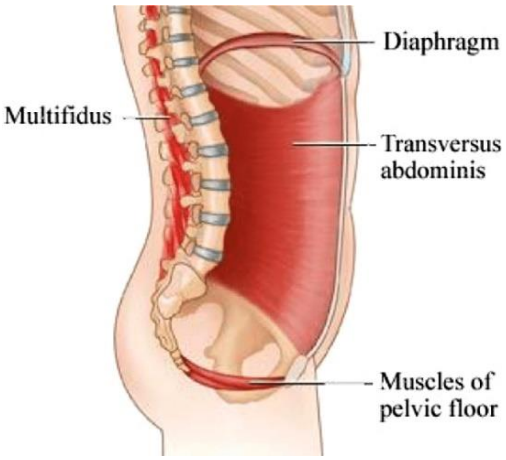

Figure 1. The spinal stabilizing system.

These muscles play a crucial role in the movement and stability of the hip and trunk. A strong core is fundamental for maintaining stability, good posture, and overall strength. Core strengthening is essential for alleviating back pain, preventing injuries, and enhancing functional movements. Numerous studies have analyzed the effects of core strength training, showing that it aids in the development of motor skills, improves balance, and reduces the risk of sports injuries. Furthermore, core training programs have been found to strengthen respiratory muscles, particularly the diaphragm, which is a key muscle for breathing [3]. The core is regarded as the central powerhouse connecting the upper and lower limbs. When a young person's core is weak, both the upper and lower extremities must compensate by exerting extra effort to produce the same force that would be generated if the core were stronger [5–8].

"CORE" FUNCTIONAL MECHANISMS

There are three interdependent functions that make up healthy antigravity postural support and spinopelvic movement control:

1. The production of IAP is fundamentally influenced by the breathing mechanism and regulation internal pressure changes.
2. The axial column's postural control mechanisms include Appropriate levels of IAP for postural support, balanced but flexible co-activation between the axial flexor and extensor muscle systems.
3. Good postural-movement control of the proximal limb girdles, especially the pelvis, since trunk flexor/extensor activation patterns are directly influenced by its control.

A healthy breathing pattern is correlated with good posture, and vice versa. Changed posture and compromised breathing patterns are almost always present together in dysfunction [9].

Physiologically, after training core musculature, a significant increase in diastolic blood pressure, vital capacity, body fat percentage, resting heart rate and also improve was found but not significance systolic blood pressure [3].

Using the abdominal drawing-in maneuver technique in conjunction with core stabilization exercise has been shown to mainly activate the deep abdominal muscles while causing minimal activity in the superficial muscles [8].

SPHYGMOMANOMETER

The sphygmomanometer is a device commonly used to measure blood pressure. It can also be used to test core muscular strength and stability. It is employed to obtain reliable, objective measurements of core muscle strength and stability by assessing the resistance applied. By measuring the pressure exerted by the abdominal and back muscles during specific core exercises, the sphygmomanometer offers valuable insights into the functionality and strength of these muscles [4]. The unit of measurement for sphygmomanometer is mmHg.

Objective

Comparing the core musculature strength of schoolchildren and children playing cricket under the age of 16 in Jorhat Town by using a Modified Sphygmomanometer.

Purpose

Various Studies across the world have advocated the use of Modified Sphygmomanometer to measure muscle strength. This study is undertaken to measure and check the difference of the core musculature strength between schoolchildren and children playing cricket under the age of 16 by using a Modified Sphygmomanometer.

METHODOLOGY

To achieve the purpose of this study, a pilot study was done on two groups of children aged below 16. One group consists of 10 children who have been coached in cricket for the last 3 years in Jorhat Cricket Coaching Centre and another group consists of 10 children who have not been engaged themselves in any sports or training activity from Borbheta Public School, Jorhat. Consent information which includes the objective of the study was sent to parents/guardians through their children. The inclusion criterion includes children between the age group of 12–16. The study excluded subjects with neuromuscular condition, any spinal injury, injuries on lower limb, and musculoskeletal injury.

PROCEDURE

The child is asked to lay on a flat surface and maintain hook-lying position (with knees 70°–90° flexion and feet flat) where the cuff of the modified sphygmomanometer was placed horizontally underneath the middle of lower back and was inflated to 40 mmHg. The child was instructed to inhale, exhale, and gently pull the belly button towards the spine to create a hollow in the abdominal area. They were asked to hold it for 10 s. The differences were noted down (Figure 2).

STATISTICAL ANALYSIS AND RESULTS

By measuring the core strength, it shows that the children who have coached cricket for the last 3 years has stronger core than school going children. On comparing the mean values of both groups, there was a significant difference of 40.90 mmHg where the mean of the children who have not been engaged themselves in any sports or training activity and children who have been coached cricket for last 3 years were respectively, 99.70 mmHg and 140.60 mmHg. After statistical analysis on graph pad software it can be concluded that there is a statistically significant difference between the two groups,

where the two tailed p-value is less than 0.0001, where the value of t 6.2001. About 95% of the confidence interval of the mean difference of both groups is from 27.04 to 54.76. Both the graph and mean difference are computed on MS excel 2021 (Figure 3).

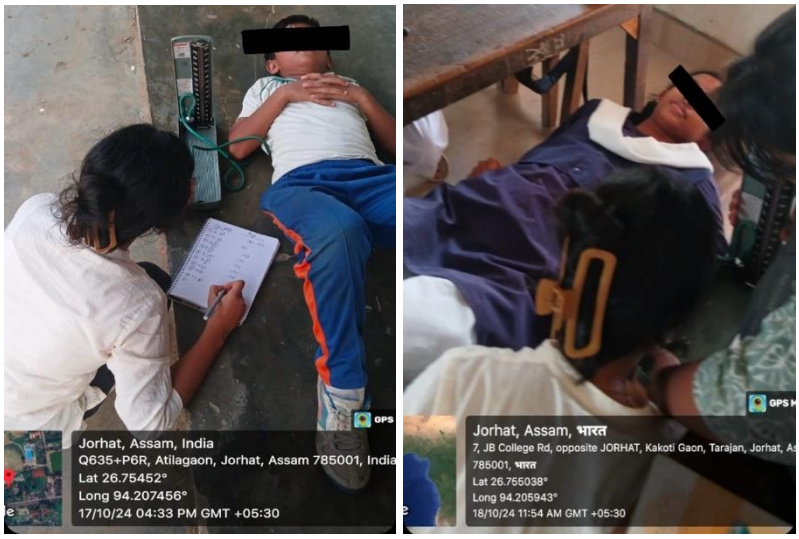

Figure 2. Measuring core musculature strength between schoolchildren and children playing cricket under the age of 16 by using a Modified Sphygmomanometer.

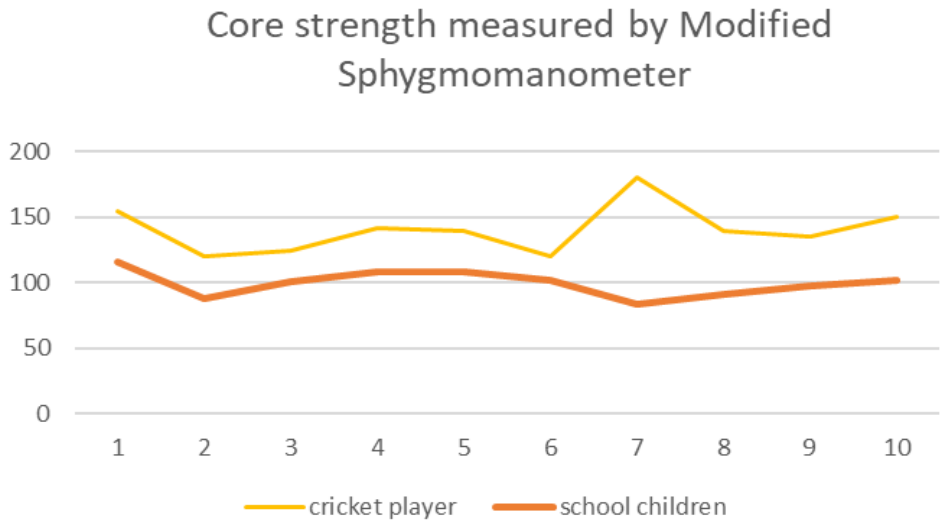

Figure 3. Comparative graph of core musculature strength by modified sphygmomanometer of both groups.

DISCUSSION

This research focused on comparing the core musculature strength of school children and children playing cricket under the age of 16 in Jorhat Town by using a Modified Sphygmomanometer.

In this pilot study, two groups of children aged below 16. One group consists of 10 children who have been coached cricket for the last 3 years in Jorhat Cricket Coaching Centre and another group consists of 10 children who has not been engaged themselves in any sports or training activity from Borbheta Public School, Jorhat were selected randomly as per inclusion and exclusion criteria.

The comparison of both groups is graphically documented in Graph 1, the mean of the children who has not been engaged themselves in any sports or training activity and children who been

coached cricket for last 3 years were 99.70 mmHg and 140.60 mmHg, respectively, where mean difference is 40.90 mmHg, which show there was a statistically significant difference between both groups measures with a p-value of 0.0001 and t-value of 6.2001 by using statistical analysis paired "t" test.

A study done by Lim et al., titled "Strength and conditioning for cricket fielding: A narrative review" published in 2022 core training encourages overhead throwing because it transfers energy from the lower extremities to the upper extremities via the trunk musculature [10]. The training of the cricket players includes different types of exercises like aerobic exercises, interval training, planks, side planks, crunches, squats, single arm plank, etc. Exercise like planks, crunches etc. helps to strengthen the core.

Dr. K. Usha Rani in a RCT titled "Effect of aerobic training and core strength training on physical fitness variables of cricket players" published in 2019 states that the core strength training group has achieved significant positive improvement on physical fitness variables in 6 weeks as compared to control group where the control group has not given any exercise intervention [11].

Tillat et al. in a systemic review with meta-analysis titled "Core training and performance: a systemic review with meta-analysis" states that trunk muscle training, along with other performance factors, such as maximal muscle strength, lower limb muscle power, linear sprint speed, and change of direction or agility, trunk and local muscle endurance, and sport-specific performance. It should come as no surprise that core training enhances balance because the core muscles encircle the lumbopelvic region's center of mass enhances the capacity to maintain the center of gravity's stability within the support base [12].

From the above-mentioned data, empirically and statistically we came to know that the children who have been coached cricket for the last 3 years have stronger core than school going children.

CONCLUSIONS

Based on the data showing notable changes, it can be concluded that a statistically significant difference exists between the two groups. Hence, we would like to conclude that children should be given a program of core strengthening exercise as a part of extracurricular activities for better stability, posture, and strength.

Disclaimer (Artificial Intelligence)

Author(s) hereby declares that NO generative Al technologies, such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of manuscripts.

Conflict of Interest

We have no potential conflict of interest.

Limitation of the Study

1. Limited studies were available.
2. Study was done in a short period of time.
3. Large population size could have been covered.

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