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RELATIONSHIP BETWEEN CORE MUSCLE ENDURANCE AND FUNCTIONAL BALANCE PERFORMANCE IN YOUNG ADULTS

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ABSTRACT

Background: Core muscle endurance plays a vital role in maintaining spinal stability, postural alignment, and efficient load transfer during functional activities. Increasing sedentary behavior and reduced physical activity among young adults may impair core endurance, negatively affecting functional balance and increasing future musculoskeletal injury risk. However, limited evidence exists on the relationship between core muscle endurance and functional balance in this population.

Objective: To assess core muscle endurance using the McGill Core Endurance Battery and examine its relationship with functional balance performance measured by the Y-Balance Test.

Methods: A cross-sectional observational study was conducted on 60 healthy young adults (n = 60) aged 18–25 years. Core muscle endurance was evaluated using the McGill Core Endurance Battery, including trunk flexor endurance, trunk extensor endurance (Biering–Sørensen test), and bilateral side bridge tests. Functional balance was assessed using the Y-Balance Test, with reach distances normalized to limb length and a composite score calculated. Pearson's correlation coefficient was used to analyze the relationship between core muscle endurance and functional balance, with statistical significance set at $p < 0.05$.

Results: A strong and statistically significant positive correlation was observed between total core muscle endurance score and Y-Balance composite score ($r = 0.78$, $p < 0.001$), indicating that higher core muscle endurance was associated with better functional balance performance.

Conclusion: Greater core muscle endurance is significantly associated with superior functional balance performance in young adults. Incorporation of core endurance assessment and training may be beneficial in preventive and rehabilitative physiotherapy programs.

Keywords: Core muscle endurance, McGill Core Endurance Battery, Y-Balance Test, Functional balance, Young adults

INTRODUCTION

Core musculature consists of deep and superficial trunk muscles that provide spinal stability, maintain postural alignment, and enable efficient load transfer during movement ^[1, 2]. Core endurance, rather than maximal strength, is essential for sustaining posture and maintaining functional activities over prolonged periods ^[1]. Reduced core muscle endurance has been associated with compromised postural control and diminished balance efficiency ^[2, 3].

In recent years, young adults have increasingly adopted sedentary lifestyles characterized by prolonged sitting, extensive use of digital devices, and minimal physical activity ^[4, 5]. Sedentary behavior leads to reduced trunk muscle activation and early fatigue of core musculature ^[4]. This may negatively influence functional balance even in asymptomatic individuals and increase the risk of future musculoskeletal injury ^[5].

Most existing studies on core muscle endurance focus primarily on athletes or individuals with low back pain ^[1, 2]. There is a relative lack of research examining healthy young adults from a preventive perspective. Particularly the relationship between core muscle endurance and functional balance performance in this population remains underexplored. Early identification of deficits in core endurance may aid in injury prevention and in designing targeted physiotherapy programs. Therefore, the present study aims to determine the relationship between core muscle endurance and functional balance performance in young adults.

METHODOLOGY

Study Design: A cross-sectional observational study was conducted.

Participants: Sixty healthy young adults, aged 18-25 years, were chosen. All participants were physically independent and capable of understanding and following test instructions ^[8].

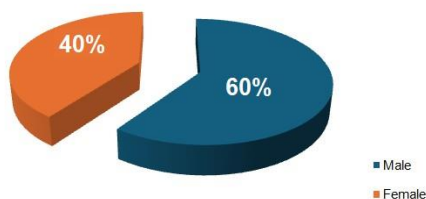
Inclusion Criteria:

- Young adults aged 18–25 years
- Both male and female participants
- Physically independent individuals with normal functional ability ^[8]

Exclusion Criteria:

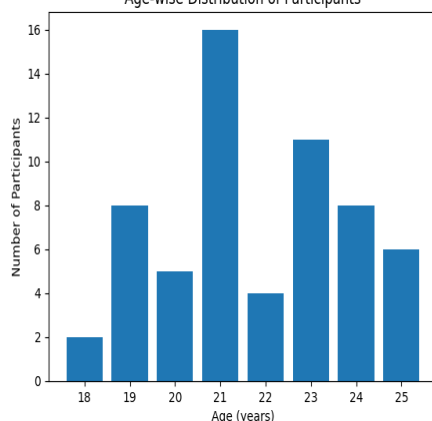
- History of low back pain or spinal injury within the past six months ^[6,7,8]
- Known cardio respiratory conditions limiting physical activity
- Neurological disorders affecting balance or motor control
- Current or recent lower limb injury or surgery
- History of vestibular disorders or balance impairments
- Participation in professional or high-level athletic training

Gender distribution



| Gender | Number of Participants |
|--------|------------------------|
| Male | 36 |
| Female | 24 |
| Total | 60 |

Age-wise Distribution of Participants



| Age (years) | Number of Participants |
|-------------|------------------------|
| 18 | 2 |
| 19 | 8 |
| 20 | 5 |
| 21 | 16 |
| 22 | 4 |
| 23 | 11 |
| 24 | 8 |
| 25 | 6 |
| Total | 60 |

PROCEDURE

Participants were screened based on the inclusion and exclusion criteria. The procedure for the tests were explained and demonstrated to the participants beforehand. Plenty of rest intervals were given between trials and the best result for each test was recorded for analysis.

OUTCOME MEASURES

Core Muscle Endurance:

The McGill Core Endurance Battery ^[9], which consists of the trunk flexor endurance test, trunk extensor endurance test (Biering-Sørensen test), and right and left side bridge tests, was used to determine core muscle endurance. Endurance time was measured in seconds, with greater endurance times reflecting greater core muscle endurance.

Functional Balance:

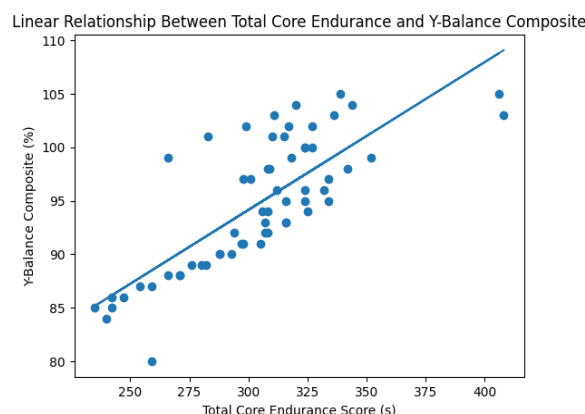
Functional balance was determined using the Y-Balance Test ^[10], which measures dynamic postural control by evaluating reach performance in three directions: anterior, posteromedial, and posterolateral. Reach distances were normalized to limb length, and a composite score was calculated to reflect overall balance function.

STATISCAL ANALYSIS

Data analysis was performed using Excel. Pearson's correlation coefficient (r) was employed to examine the relationship between core muscle endurance and functional balance performance. Statistical significance was set at $p < 0.05$.

RESULTS

Pearson's correlation analysis revealed a strong positive relationship between total core muscle endurance score and Y-Balance composite score. The correlation coefficient was $r = 0.78$, suggesting a strong linear relationship between the two variables. This relationship was statistically significant ($p < 0.001$).



Graph 1: correlation between core endurance and Y-Balance composite scores

The linear regression graph indicates a positive correlation between the total core endurance score and the Y-Balance composite score.

DISCUSSION

The results of the current study clearly indicate a strong positive correlation between core muscle endurance and functional balance performance in young adults. According to the scatter plot graph, with the improvement in core endurance, functional balance performance also increases, thus confirming that greater core muscle endurance plays a significant role in improving dynamic postural control in young adults. The results are in accordance with the existing literature, which emphasizes the significance of core muscles in maintaining postural stability and dynamic balance ^[1, 2]. Increased endurance of the trunk muscles increases the ability to maintain postural control during functional activities, thus improving balance efficiency.

The results are consistent with the existing literature, which emphasizes the significance of core stability and endurance in movement control and injury prevention ^[3, 7]. Although the dynamic balance test, such as the Y-Balance Test, has been extensively used in athletic populations ^[6, 8], the current study reinforces the significance of core endurance from a preventive perspective in healthy young adults.

However, this study also has its limitations. As a cross-sectional study, it only shows association and not causation, and the sample was limited to one geographical location. Future studies should include interventional outlook to show causation and the effects of targeted core endurance training on functional balance outcomes.

CONCLUSION

The study concludes that core muscle endurance is strongly and positively associated with functional balance performance in young adults. Higher core endurance, as assessed by the McGill Core Endurance Battery, corresponds to dynamic balance measured using the Y-Balance Test. These findings support the inclusion of core endurance assessment and training in preventive and rehabilitative physiotherapy programs to enhance balance and reduce future injury risk.

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