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Correlation Between Core Endurance And Sprint Acceleration In Recreational College Athletes- A Correlational Study

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ABSTRACT
Background: *Sprint acceleration is a critical component of success in both individual and team sports, particularly those requiring rapid, explosive movements over short distances. Acceleration refers to the ability to increase velocity in the shortest possible time, a performance attribute heavily influenced by neuromuscular coordination, muscle power, and biomechanical efficiency. Core endurance is the capacity of the trunk muscles to maintain postural control and stability which plays a pivotal role in optimizing sprint mechanics and enhancing athletic output*
Aim: *To investigate the correlation between core muscle endurance and sprint acceleration performance among recreational college athletes*
Methodology: *A cross-sectional correlational study was conducted involving 60 recreational college athletes (20 males, 40 females), aged between 18–25 years, all within a normal body mass index (BMI) range. Participants were screened based on predefined inclusion and exclusion criteria. Core muscle endurance was assessed using the* ***prone plank test****, while sprint acceleration was measured using a* ***35-meter sprint test****. Data were statistically analyzed using* ***Spearman's correlation coefficient*** *due to non-normal distribution*
Results: *Analysis revealed a* ***weak negative correlation*** *between core endurance and sprint acceleration time (**r = -0.339**, **p = 0.01**). This indicates that athletes with higher core endurance tended to perform better in the 35-meter sprint test, albeit modestly.*
Conclusion: *The findings suggest that core endurance, as evaluated by the prone plank test, is modestly associated with sprint acceleration in recreational athletes. Incorporating core endurance training into conditioning programs may contribute to improved sprint performance and overall athletic efficiency.*
Keywords: *Core endurance; Prone plank test; Sprint acceleration; Recreational athletes*

INTRODUCTION
Sprinting, particularly in the acceleration phase, is a crucial determinant of performance in many sports requiring rapid short-distance movement, including football, basketball, rugby, and athletics. Acceleration, defined as the rate of change in velocity, is a key physical fitness component that enables athletes to generate speed quickly over short distances[1]. It is influenced by multiple factors including

muscle power, neuromuscular coordination, ground contact time, stride frequency, and biomechanical efficiency[2].

One anatomical region playing a pivotal role in athletic performance is the core—a complex of deep and superficial muscles that stabilize the trunk, including the rectus abdominis, transversus abdominis, internal and external obliques, erector spinae, multifidus, pelvic floor, diaphragm, and hip girdle musculature [3]**.**The core functions as the anatomical link between the upper and lower extremities and is vital for force transmission, balance, and injury prevention [4]**.**

Core endurance, which refers to the ability to maintain submaximal trunk muscle contraction over time, plays a crucial role in maintaining postural stability during dynamic tasks [5]**.**A fatigue-resistant core may reduce trunk sway, stabilize the pelvis, and allow for better biomechanical positioning during high-speed activities such as sprinting[6]**.**Furthermore, poor core function has been associated with altered motor control, inefficient running patterns, and an increased risk of injury[7]**.**

Numerous training studies have demonstrated that improving core endurance can positively impact agility, balance, and speed [8]**.**Athletes who undergo regular core conditioning tend to exhibit better dynamic trunk control and sprinting ability, though not all studies agree on the magnitude of this benefit[9]**.** For example, Saeterbakken et al.[10] found that core strength, core endurance, and core stability are independent neuromuscular qualities, and improvements in one do not necessarily guarantee enhancements in others.

Given this ambiguity, it is essential to empirically investigate whether core endurance correlates with sprint acceleration, particularly in non-elite or recreational populations, where such training might yield significant relative benefits. The prone plank test is a widely validated tool to assess core endurance, while the 35-meter sprint test is a standard field test for evaluating sprint acceleration [11]

The objective of this study was to evaluate the correlation between core endurance and sprint acceleration in recreational college athletes.

STUDY DESIGN

This study employed a cross-sectional correlational design to investigate the relationship between core endurance and sprint acceleration in recreational college athletes. The study was conducted over a four-week period at university-level sports facilities.

Participants

A total of 60 recreational athletes (20 males and 40 females), aged between 18 and 25 years, participated in the study. Inclusion criteria were:

- Regular participation in sports (minimum 2 times per week),
- Normal BMI range (18.5–24.9 kg/m2),
- No recent musculoskeletal or neurological injuries (within the past 6 months),
- Ability to understand and follow instructions.

Participants were excluded if they had:

- A history of recent orthopedic surgery,
- Current engagement in structured core strength training programs,
- Cardiopulmonary or metabolic conditions that could impair performance.

Prior to testing, all participants provided written informed consent. Ethical approval was obtained from the Institutional Ethics Committee of Alva's College of Physiotherapy, in accordance with the Declaration of Helsinki.

OUTCOME MEASURES

Core Endurance – Prone Plank Test

The prone plank test was selected due to its high reliability (ICC = 0.915) and validity in assessing anterior core endurance[3]**.**Participants assumed a prone position with forearms on the ground and elbows directly beneath the shoulders. They were instructed to lift their pelvis off the ground, keeping the body in a straight line from head to heels. Time was recorded with a stopwatch from the start of the hold until the participant could no longer maintain the position or dropped their hips/knees.

Sprint Acceleration – 35-Meter Sprint Test

Sprint acceleration was measured using a 35-meter linear sprint test, widely used for assessing short-distance acceleration performance [11].Timing was conducted using a handheld digital stopwatch. Participants were instructed to start in a standing position and sprint "as fast as possible" upon the examiner's signal. Two trials were performed, separated by 3 minutes of rest, and the best time was recorded.

PROCEDURE

All measurements were taken in a controlled indoor environment to ensure consistency. Participants were instructed to avoid vigorous physical activity 24 hours prior to testing. After a standardized warm-up of 5 minutes of jogging and dynamic stretches, the tests were administered in the following order:

1. Anthropometric assessments
2. Prone plank test
3. 35-meter sprint test

STATISTICAL ANALYSIS

Data were analyzed using IBM SPSS version 22.0 (SPSS Inc., Chicago, IL). The Kolmogorov–Smirnov test was used to assess the normality of the data. Due to non-normal distribution, Spearman's rank-order correlation was applied to determine the relationship between core endurance and sprint acceleration. Statistical significance was accepted at $p < 0.05$ with a confidence interval of 95% and a power of 80%.

RESULTS

Participant Characteristics

A total of 60 recreational college athletes (20 males and 40 females) participated in this study. The demographic and physical characteristics of the participants are presented in Table 1. The mean age was 20.24 ± 1.76 years, with a mean BMI of 20.59 ± 3.38 kg/m2. The average core endurance (measured via prone plank test) was 39.28 ± 13.81 seconds, and the mean sprint acceleration time (measured over 35 meters) was 9.45 ± 0.86 seconds.

Table 1:- Descriptive analysis

Variables	Minimum	Maximum	Mean	SD
Age	18	24	20.24	1.760
Gender	1	2	1.67	.473
Height	145	187	161.95	9.804
Weight	37	89	55.90	12.785
BMI	14	29	20.59	3.387
Prone plank	12	73	39.28	13.816
Sprint acceleration	8	11	9.45	.862

The results indicated a negative weak correlation between core endurance and sprint acceleration (r= - 0.339, p=0.001), The analyzed data were tabulated, and the results were interpreted as follows (Table 2), Graph 1 figure shows that there was a negative weak correlation between core endurance and sprint acceleration.

Table 2:- Relationship Between Core Endurance and Sprint Acceleration

Variables	r value	P value
Core endurance and sprint acceleration	-0.339	0.01

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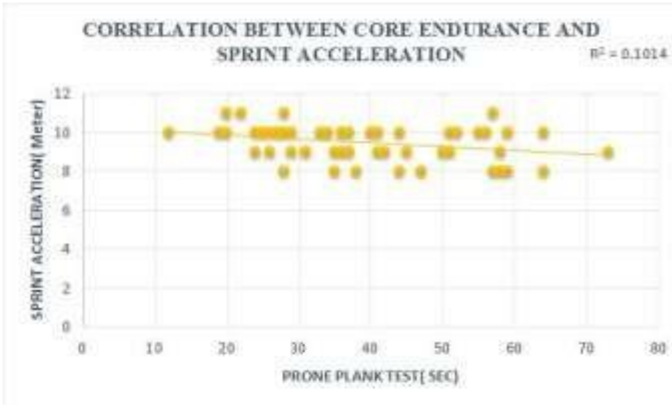

Figure 1: Scatter Plot Showing Relationship Between Core Endurance and Sprint Acceleration

DISCUSSION

This study aimed to determine the relationship between core endurance and sprint acceleration in recreational college athletes. The findings revealed a weak but statistically significant negative correlation ($r = -0.339$, $p = 0.01$) between prone plank duration and 35-meter sprint time. This suggests that higher core endurance is modestly associated with faster sprint acceleration performance, although the relationship is not strong.

These results align partially with previous studies that have highlighted the core's critical role in athletic performance. The core musculature is responsible for maintaining postural control, trunk stiffness, and energy transfer between the lower and upper extremities[5].. A stable and enduring core can minimize unwanted trunk motion and facilitate effective force transmission during high-velocity movements like sprinting [4,7].There are various mechanisms Underlying the Core Sprint Relationship. The first one being Force Transmission Efficiency. During sprinting, the arms and legs generate large amounts of force. A stable core ensures these forces are efficiently transmitted across the body, minimizing energy dissipation and maximizing propulsion[5]. An enduring core helps maintain optimal trunk position, reducing compensatory movements that could disrupt sprint mechanics [6].The second possible mechanism could be Postural and Neuromuscular Control. The ability to stabilize the spine dynamically enables athletes to maintain a streamlined sprint posture. Improved posture and reduced trunk sway reduce drag and improve stride efficiency [11]. Studies have also shown that core endurance is associated with enhanced neuromuscular control and balance during high-intensity movements [10]. The third mechanism is Injury Risk Reduction and Training Consistency. Athletes with poor core endurance are more likely to experience lumbar fatigue or postural collapse under load, increasing the risk of injury [12]. Better endurance may protect the musculoskeletal system during repeated sprint training, facilitating consistent performance improvements [13]. The Mechansim behind weak correlation could be despite the biomechanical importance of core stability, the weakness of the observed correlation suggests that core endurance alone is not a dominant predictor of sprint acceleration. Sprinting is a complex skill influenced by various neuromuscular, mechanical, and technical factors, such as Lower-limb power and reactive strength , Stride frequency and length [2],Starting technique and ground contact time, Muscle fiber composition and anaerobic capacity [14]. Moreover, Saeterbakken et al. [10] emphasized that core strength, core endurance, and core stability are independent physiological capacities, meaning that improvements in one domain may not directly translate to improvements in another. For instance, the prone plank test evaluates isometric anterior core endurance, which may not reflect dynamic trunk demands during sprinting. Another possible explanation is related to training specificity. The principle of training specificity suggests that adaptations are specific to the type of training performed [15]. While isometric core endurance exercises may build muscular endurance, they may not effectively enhance the explosive demands of sprint acceleration. Plyometric and sprint-specific drills may have a more direct impact on sprint performance.

CONCLUSION

The finding suggests that individuals with greater core endurance tend to exhibit slightly faster sprint acceleration performance. While core endurance contributes to trunk stability, postural control, and injury prevention, it should not be considered an exclusive determinant of sprint performance.

Limitation

First, the relatively small and gender-imbalanced sample size may limit the generalizability of the findings. Second, only one test (prone plank) was used to assess core endurance, which may not capture the multidimensional nature of core function. Third, sprint performance was evaluated using a field-based stopwatch method, which may be less accurate than electronic timing systems. Lastly, the cross-sectional design prevents establishing a causal relationship between core endurance and sprint acceleration

Clinical Implication

Although the correlation is weak, this study suggests that core training should not be neglected in the overall training regimen. Integrating core endurance with explosive lower-limb strength training, plyometrics, and sprint mechanics drills is likely to yield better performance outcomes.

Future Recommendations

To build upon the findings of this study and enhance the validity and applicability of future research, the following recommendations are proposed with Larger Sample Size: across different age groups, genders, and athletic populations to enhance generalizability. Inclusion of Additional Core Tests: Utilizing multiple tests (e.g., side plank, Sorensen test) can offer a more comprehensive evaluation of core endurance across all planes of motion, Biomechanical Analysis by incorporating motion analysis or electromyography (EMG) could provide deeper insight into muscle activation patterns during sprinting and core engagement.

REFERENCE

1. Brechue, W. F., Mayhew, J. L., & Piper, F. C. (2010). Characteristics of sprint performance in college football players. *Journal of Strength and Conditioning Research, 24*(5), 1169–1178. https://doi.org/10.1519/JSC.0b013e3181d6736f
2. Washif, J. A., & Kok, L. Y. (2022). Relationships between vertical jump metrics and sprint performance, and qualities that distinguish between faster and slower sprinters. *Journal of Science in Sport and Exercise, 4*(2), 135–144. https://doi.org/10.1007/s42978-021-00117-w
3. Martuscello, J. M., Nuzzo, J. L., Ashley, C. D., Campbell, B. I., Orriola, J. J., & Mayer, J. M. (2013). Systematic review of core muscle activity during physical fitness exercises. *Journal of Strength and Conditioning Research, 27*(6), 1684–1698. https://doi.org/10.1519/JSC.0b013e3182877a5e
4. Willson, J. D., Dougherty, C. P., Ireland, M. L., & Davis, I. M. (2005). Core stability and its relationship to lower extremity function and injury. *Journal of the American Academy of Orthopaedic Surgeons, 13*(5), 316–325. https://doi.org/10.5435/00124635-200509000-00005
5. Hibbs, A. E., Thompson, K. G., French, D., Wrigley, A., & Spears, I. R. (2008). Optimizing performance by improving core stability and core strength. *Sports Medicine, 38*(12), 995–1008. https://doi.org/10.2165/00007256-200838120-00004
6. Behm, D. G., Wahl, M. J., Button, D. C., Power, K. E., & Anderson, K. G. (2005). Relationship between hockey skating speed and selected performance measures. *Journal of Strength and Conditioning Research, 19*(2), 326–331. https://doi.org/10.1519/00124278-200505000-00015
7. Raabe, M. E., & Chaudhari, A. M. W. (2018). Biomechanical consequences of running with deep core muscle weakness. *Journal of Biomechanics, 67*, 98–105. https://doi.org/10.1016/j.jbiomech.2017.11.039

8. Mossa, M. E. (2022). The effect of core strength training on 14-year-old soccer players' agility, anaerobic power, and speed. *American Journal of Sports Science, 10*(1), 24–28. https://doi.org/10.11648/j.ajss.20221001.14

9. Afandi, M. A., Mohamad, N. I., Fazila, N., Malek, A., Chinnasee, C., & Nadzalan, A. M. (2021). The relationship between core strength performance with sprint acceleration. *Journal of Physics: Conference Series, 1793*(1), 012056. https://doi.org/10.1088/1742-6596/1793/1/012056

10. Saeterbakken, A. H., Fimland, M. S., Navarsete, J., Kroken, T., & van den Tillaar, R. (2015). Muscle activity and the association between core strength, core endurance, and core stability. *Journal of Novel Physiotherapy and Physical Rehabilitation, 1*(1), 028–034.

11. Brady, C. J., Harrison, A. J., Flanagan, E. P., Haff, G. G., & Comyns, T. M. (2014). The relationship between isometric strength and sprint acceleration in athletes. *International Journal of Sports Physiology and Performance, 9*(5), 760–765. https://doi.org/10.1123/ijspp.2013-0376

12. Rackwitz, B., De Bie, R., Limm, H., Von Garnier, K., Ewert, T., & Stucki, G. (2006). Segmental stabilizing exercises and low back pain: What is the evidence? A systematic review of randomized controlled trials. *Clinical Rehabilitation, 20*(7), 553–567. https://doi.org/10.1191/0269215506cre1266oa

13. Raabe, M. E., & Chaudhari, A. M. W. (2018). Biomechanical consequences of running with deep core muscle weakness. *Journal of Biomechanics, 67*, 98–105. https://doi.org/10.1016/j.jbiomech.2017.11.039

14. Keiner, M., Brauner, T., Kadlubowski, B., Sander, A., & Wirth, K. (2022). The influence of maximum squatting strength on jump and sprint performance: A cross-sectional analysis of 492 youth soccer players. *International Journal of Environmental Research and Public Health, 19*(10), 5835. https://doi.org/10.3390/ijerph19105835

15. Marques, M. C., Gil, H., Ramos, R., Costa, A. M., & Marinho, D. A. (2011) Relationships between vertical jump strength metrics and 5 meters sprint time. *Journal of Human Kinetics, 29*, 115–122. https://doi.org/10.2478/v10078-011-0045-6

16. Dinç, N., & Ergin, E. (2019). The effect of 8-week core training on balance, agility and explosive force performance. *Universal Journal of Educational Research, 7*(2), 550–555. https://doi.org/10.13189/ujer.2019.070226

17. Struzik, A., Konieczny, G., Stawarz, M., Grzesik, K., Winiarski, S., & Rokita, A. (2016). Relationship between lower limb angular kinematic variables and the effectiveness of sprinting during the acceleration phase. *Applied Bionics and Biomechanics, 2016*, 7480709. https://doi.org/10.1155/2016/7480709

18. Borysiuk, Z., Waśkiewicz, Z., Piechota, K., Pakosz, P., Konieczny, M., Błaszczyszyn, M., Nikolaidis, P. T., Rosemann, T., & Knechtle, B. (2018). Coordination Aspects of an Effective Sprint Start. Frontiers in Physiology, 9. https://doi.org/10.3389/fphys.2018.01138

19. Emanuelsson, E. B. (2015). The relationship between power output in different squats and sprint performance in young male soccer players. http://www.diva-portal.org/smash/get/diva2:817223/FULLTEXT01

20. Keiner, M., Brauner, T., Kadlubowski, B., Sander, A., & Wirth, K. (2022). The Influence of Maximum Squatting Strength on Jump and Sprint Performance: A Cross-Sectional Analysis of 492 Youth Soccer Players. International Journal of Environmental Research and Public Health, 19(10), 5835. https://doi.org/10.3390/ijerph19105835

21. Marques, M. C., Gil, H., Ramos, R., Costa, A. M., & Marinho, D. A. (2011). Relationships Between Vertical Jump Strength Metrics and 5 Meters Sprint Time. Journal of Human Kinetics, 29(2011), 115. https://doi.org/10.2478/v10078-011-0045-6

22. McCormick, A., Meijen, C., Anstiss, P. A., & Jones, H. S. (2018). Self-regulation in endurance sports: theory, research, and practice. International Review of Sport and Exercise Psychology, 12(1), 235. https://doi.org/10.1080/1750984x.2018.1469161

23. Merlau, S. (2005). Recovery Time Optimization to Facilitate Motor Learning During Sprint Intervals. Strength and Conditioning Journal, 27(2), 68. https://doi.org/10.1519/1533-4295(2005)027<0068:rtotfm>2.0.co;2