Original Article

Physical Fitness Differences between Athletes and Non-Athletes at the University Level: A Gender-Based Analysis

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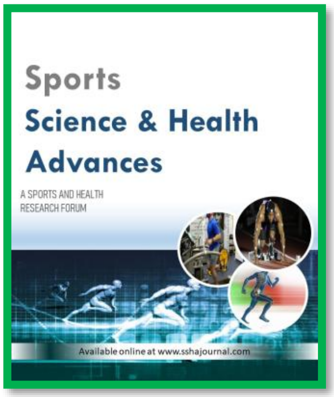

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Abstract

Background: Physical fitness is a critical determinant of athletic performance and general health. However, differences in flexibility, balance, and lower-body power between athletes and non-athletes, especially by gender and competitive level, require further investigation. **Objective**: This study aimed to compare key fitness components flexibility, balance, and lower-body strength between university-level athletes and non-athletes, with a focus on sex-based differences. **Methods**: Eighty students from Jashore University of Science and Technology, Bangladesh (N = 80), participated in the study. They were evenly divided into four groups: male athletes, male non-athletes, female athletes, and female non-athletes (n = 20 per group). Anthropometric data were recorded, and fitness tests included the Sit-and-Reach test (flexibility), One-Leg Stork Stand Test (balance), and Standing Broad Jump (leg power). Independent t-tests were used to compare athletes and non-athletes within each sex. Statistical significance was set at $p < 0.05$. **Results**: Male athletes had significantly greater flexibility $t(38) = 5.55$, $p < .001$, balance $t(38) = 8.24$, $p < .001$, and leg power $t(38) = 8.07$, $p < .001$ compared to male non-athletes. Female athletes also outperformed non-athletes in flexibility $t(38) = 4.26$, $p < .001$, balance $t(38) = 10.26$, $p < .001$, and leg power $t(38) = 13.13$, $p < .001$. **Conclusion**: University athletes, regardless of gender, demonstrated significantly better flexibility, balance, and lower-body power than their non-athlete peers. These findings emphasize the physical benefits of athletic training and support incorporating structured fitness programs into university wellness initiatives.

Keywords: Physical Fitness, Flexibility, Balance, Lower-Body Strength, University Athletes

Introduction

Physical activity is one of the most essential human needs and functions, offering benefits across all age groups. It has been widely recognized for its role in preventing behavioral and psychological issues, as well as chronic conditions such as diabetes, hypertension, cardiovascular disease, and cancer (Curran et al., 2020). Among university students, sufficient evidence supports that regular physical activity improves sleep patterns, boosts energy levels, and enhances both mental and physical well-being (Rajappan et al., 2015). In the context of sports, fitness plays a vital role in an athlete's success, serving as the foundational element that, combined with sport-specific skills and strategies, significantly influences overall performance (Reza et al., 2024).

Physical fitness encompasses both health and performance aspects that are vital for overall well-being and athletic success (Singh et al., 2024). According to Caspersen et al. (1985), fitness is defined as the ability to perform daily tasks energetically and efficiently, without excessive fatigue, and with sufficient energy for recreational activities. It includes two main components: health-related and skill-related fitness. Health-related components such as body composition, cardiovascular endurance, muscular endurance, strength, and flexibility play a preventive role against numerous health issues. Meanwhile, skill-related components, including agility, balance, coordination, power, speed, and reaction time, are directly linked to athletic performance (Corbin et al., 2008). A crucial element underpinning these abilities is biomotor ability, which significantly enhances an individual's efficiency, responsiveness, and overall performance. In exploring gender differences in performance, Rahman et al. (2020) found that female athletes exhibit a slight edge in quickness over their sedentary peers, highlighting the influence of training on specific skill-based fitness traits.

Physical fitness and anthropometric characteristics offer important insights into an individual's average body size, health status, and body composition (Muñoz-Catalán et al., 2007; Kurt, Catokkas, & Atalog, 2011). Accurate assessment of body composition is essential in both sports and health sciences, and various methods have been evaluated for their precision and practicality (Ackland et al., 2012). Among these, anthropometric measurements are commonly used in both research and applied settings due to their simplicity and accessibility (Buchheit & Mendez-Villanueva, 2013). In addition to body composition, proper nutrition also plays a vital role in athletic development. Adequate nutrition knowledge helps athletes adopt healthy eating habits, which in turn significantly influence their sports performance (Taye et al., 2024).

Physical fitness is shaped by both skill-related and health-related components, each of which can be accessed through specific tests. These fitness indicators are directly linked to health promotion and the prevention of disease. Key elements such as flexibility, strength, balance, and endurance are particularly associated with positive health outcomes (Likithaa et al., 2023). Among them, balance training has gained recognition as an effective strategy for improving coordination and stability, especially during dynamic movements (Yaggie & Campbell, 2006; Islam et al., 2024). To optimize these physical attributes, consistent and well-structured training programs are essential for enhancing overall fitness and athletic performance (Mola et al., 2025).

Balance training (BT) consists of exercises that aim to improve an individual's ability to maintain body stability and control. These exercises enhance proprioception and strengthen stabilizing muscles, especially in the lower limbs and core (Neptune & Vistamehr, 2019). Flexibility, another fundamental aspect of physical fitness, is also crucial for improving athletic performance (Blake, 2023). Regular, structured physical activity significantly contributes to better flexibility (Alonso-Fernández et al., 2022). Athletes with greater flexibility exhibit more efficient movement patterns, reduced injury risk, and better technical performance (Diffendaffer et al., 2023). Optimal flexibility allows muscles to move safely through their full range of motion (ROM) without compromising strength, enabling them to adapt effectively to physical stress (Shariat et al., 2017).

Muscular strength, the ability to exert force quickly or to complete tasks efficiently has traditionally been categorized as a skill- or performance-related fitness component, although some consider it to be a combination of both skill- and health-related attributes (Corbin et al., 2000). One commonly used field test for assessing horizontal power and lower-body strength is the standing broad jump (SBJ), also known as the standing long jump (SLJ). The SBJ is recognized as a valid and reliable field test for muscular fitness and lower-body power. Due to its simplicity, cost-effectiveness, and minimal equipment requirements, it is widely used among coaches and athletes of all levels (The Sports Edu, 2024).

The rationale behind this study is to explore how physical fitness is interconnected with anthropometric variables, flexibility, balance, and power. These components collectively influence athletic performance, movement efficiency, and injury prevention. Understanding these relationships is essential for evaluating and improving overall physical health and functional capabilities, particularly in active populations such as student-athletes.

Materials and Methods

Subjects

A total of 80 university-level students (N = 80) from Jashore University of Science and Technology, Jashore, Bangladesh, participated in the study. They were evenly divided into four groups: male athletes, male non-athletes, female athletes, and female non-athletes (n = 20 each). All participants provided informed consent in accordance with institutional ethical standards. The following Table 1 presents the general characteristics of the subjects, including variables such as age, height, weight, and body mass index (BMI), categorized by group: male athletes, male non-athletes, female athletes, and female non-athletes.

Table 1 General characteristic of the subjects (mean±SD)

Groups	Groups	n	Age (yr)	Height (cm)	Weight (kg)	BMI (kg/m^2)
Male	Athletes	20	23.10±2.15	167.50±6.48	63.80±7.04	22.81±2.78
	No-athletes	20	24.20±1.01	168.90±5.39	71.55±13.23	25.08±4.34
Female	Athletes	20	22.00±2.38	161.95±6.27	52.65±6.95	20.08±2.42
	No-athletes	20	22.35±1.27	156.75±6.70	54.40±11.83	22.14±4.69

Procedures

Data were collected at the central gymnasium and sports field of Jashore University of Science and Technology. The measurements included anthropometric and lower-extremity assessments, as well as evaluations of flexibility, balance, and lower-body strength. Height and weight were measured using a stadiometer and a calibrated digital scale and recorded in centimeters (cm) and kilograms (kg), respectively. Flexibility was assessed using the Sit-and-Reach test, in which participants reached forward from a seated position with legs extended; the distance reached beyond the toes was measured in centimeters. Balance was evaluated using the One-Leg Stork Stand Test, where participants stood barefoot on one foot with their hands on their hips. Time was recorded until the raised foot touched the floor, with the best of three trials (in seconds) used for analysis. Lower-body power was measured using the Standing Broad Jump. Participants completed three standing jumps, and the longest distance (in cm) was recorded.

Statistical Analysis

All data were analyzed using IBM SPSS Statistics (version 25; IBM). Descriptive statistics, including means and standard deviations, were calculated for all variables. Independent t-tests were performed to assess differences between groups based on sex and athletic status (athletes vs. non-athletes). Statistical significance was set at $p < 0.05$.

Results

Table 2 shows that athletes had higher mean scores than non-athletes in all fitness components flexibility, balance, and leg power—for both males and females. Females generally exhibited greater flexibility, while males demonstrated higher leg power and balance.

Table 2. Descriptive statistics of fitness component

Variables	Groups	Groups	N	Mean	Std. Deviation	Std. Error Mean
Flexibility	Male	Athletes	20	10.35	4.61	1.03
		No-Athletes	20	4.00	2.20	0.49
	Female	Athletes	20	14.50	3.76	0.84
		No-Athletes	20	9.00	4.38	0.98
Balance	Male	Athletes	20	24.12	10.79	2.41
		No-Athletes	20	3.88	2.05	0.46
	Female	Athletes	20	17.73	4.35	0.97
		No-Athletes	20	5.18	3.32	0.74
Leg Power	Male	Athletes	20	2.58	0.16	0.04
		No-Athletes	20	1.76	0.42	0.09
	Female	Athletes	20	2.41	0.22	0.05
		No-Athletes	20	1.39	0.27	0.06

Table 3 Independent Sample t-test of Fitness Variables

Variables	Groups	Groups	Mean difference	Std. error difference	t	df	Sig. (2-tailed)
Flexibility (cm)	Male	Athletes	6.35	1.14	5.55	38.00	0.00
		No-athletes	6.35	1.14	5.55	27.22	0.00
	Female	Athletes	5.50	1.29	4.26	38.00	0.00
		No-athletes	5.50	1.29	4.26	37.16	0.00
Balance (sec.)	Male	Athletes	20.24	2.46	8.24	38.00	0.00
		No-athletes	20.24	2.46	8.24	20.37	0.00
	Female	Athletes	12.55	1.22	10.26	38.00	0.00
		No-athletes	12.55	1.22	10.26	35.51	0.00
Standing Broad Jump (m)	Male	Athletes	0.82	0.10	8.07	38.00	0.00
		No-athletes	0.82	0.10	8.07	24.34	0.00
	Female	Athletes	1.02	0.08	13.13	38.00	0.00
		No-athletes	1.02	0.08	13.13	36.68	0.00

*. Significant at 0.05 level

Table 3 presents the results of independent samples t-tests, which show significant differences in fitness variables between athletes and non-athletes for both males and females. Male athletes had significantly higher scores in flexibility ($t(38) = 5.55$, $p < .001$), balance ($t(38) = 8.24$, $p < .001$), and standing broad jump ($t(38) = 8.07$, $p < .001$) compared to non-athletes. Similarly, female athletes outperformed non-athletes in flexibility ($t(38) = 4.26$, $p < .001$), balance ($t(38) = 10.26$, $p < .001$), and standing broad jump ($t(38) = 13.13$, $p < .001$). All differences were statistically significant at the $p < .05$ level.

Discussion

Based on the results, significant differences were observed in flexibility, balance, and lower-body power between athletes and non-athletes for both males and females. Athletes consistently outperformed non-athletes across all fitness components, with all differences being statistically significant ($p < .001$). Male and female athletes demonstrated greater flexibility, longer balance duration, and superior leg power, as reflected by higher mean values in each test. These findings suggest that regular athletic training plays a vital role in enhancing physical fitness, likely due to improved muscular strength, coordination, and neuromuscular efficiency.

This study's findings confirm that athletes significantly outperform non-athletes in flexibility, balance, and lower-body power. This aligns with Behm and Chaouachi (2011), who explained that regular dynamic and static stretching embedded in athletes' routines leads to improved muscle elasticity and joint range of motion. These adaptations enhance movement efficiency and reduce injury risk. Moreover, the gender differences observed in flexibility correspond with Moraes et al. (2013), who found that females typically have greater hamstring flexibility than males due to physiological and hormonal variations influencing connective tissue properties and muscle compliance.

Balance abilities were also considerably better among athletes, confirming results reported by Gribble et al. (2012) and Bressel et al. (2007). Their studies showed that sport-specific training improves neuromuscular coordination, proprioceptive accuracy, and postural control, all essential for maintaining stability during dynamic activities. Paillard (2017) further emphasized that neuromuscular improvements gained through training not only enhance balance performance but also contribute to injury prevention by enabling athletes to better manage sudden shifts in body position. Despite mixed evidence on gender differences in balance, the consistent superiority of athletes over non-athletes is well supported.

Regarding lower-body power, the superior standing broad jump performance in athletes echoes findings from Chelly et al. (2010) and Markovic et al. (2007). These researchers documented that plyometric and resistance training significantly increase explosive leg strength, crucial for jumping and sprinting performance. Comfort et al. (2012) added that males generally exhibit higher power output than females, a difference attributed to muscle mass and hormonal factors. This study's data reflect similar patterns: male athletes showed slightly higher leg power compared to females, although both groups significantly outperformed their non-athlete peers, reinforcing the critical role of training in power development.

The observed superiority of athletes in flexibility, balance, and lower-body power aligns with previous research highlighting the multifaceted benefits of regular sports training. Arazi and Asadi (2011) found that trained individuals exhibit significantly higher neuromuscular coordination and muscular strength, contributing to improved balance and explosive power. Enhanced flexibility among athletes may also result from dynamic warm-ups and sport-specific movements that increase joint range of motion. These findings reinforce that consistent athletic training fosters comprehensive physical fitness adaptations.

Finally, the influence of competitive level on physical fitness is supported by Nikolaidis et al. (2015), who reported that elite athletes outperform non-elite athletes and non-athletes in flexibility, balance, and power tests. This emphasizes the combined effects of consistent, specialized training and individual anthropometric and physiological characteristics such as gender, body composition, and muscularity. These factors work synergistically to enhance performance outcomes in athletes. Together, these findings suggest that training programs should be customized to consider both gender differences and athlete level to maximize improvements in these fitness components.

Conclusion

Both male and female university athletes exhibited markedly enhanced flexibility, balance, and lower-body strength compared to their non-athlete counterparts. This underscores the substantial benefits of consistent athletic training and supports the inclusion of organized fitness programs within university wellness efforts to promote overall physical health.

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Conflicts of interest

The authors declare no conflicts of interest.

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