International Journal of Physiology, Exercise and Physical Education 2025; 7(2): 139-144

International Journal of Physiology, Exercise and Physical Education

ISSN Print: 2664-7249
ISSN Online: 2664-7257
IJPEPE 2025; 7(2): 139-144
www.physicaleducationjournals.com
Received: 04-05-2025
Accepted: 10-06-2025

Rajan Verma
Department of Physical Education and Sports Sciences, University of Delhi, Delhi, India

JP Sharma
Indira Gandhi Institute of Physical Education and Sports Sciences, University of Delhi, Delhi, India

Corresponding Author:
Rajan Verma
Department of Physical Education and Sports Sciences, University of Delhi, Delhi, India

Evaluation of key fitness variables in male and female college students using standardized tests

Rajan Verma and JP Sharma

DOI: https://doi.org/10.33545/26647249.2025.v7.i2c.206

Abstract
Background: Physical fitness is a critical indicator of health and functional capacity, influenced by various factors including gender and environment. Understanding gender-based differences in fitness components among college students can aid in developing targeted interventions for health promotion.
Purpose: This study aimed to examine and compare key physical fitness variables—flexibility, muscular arm strength, muscular leg power, agility, muscular endurance, and cardiovascular endurance—between male and female college students aged 18–28 years across different zones of Delhi, India.
Materials and Methods: A total of 200 college students (100 males and 100 females) were purposively randomized from five zones of Delhi, with equal representation from each zone. Female participants were drawn from five specific colleges, while male participants were selected from three colleges, ensuring gender representation across institutions. Standardized fitness assessments were administered, including the sit and reach test for flexibility, chin-ups/flexed arm hang for muscular arm strength, vertical jump for leg power, shuttle run for agility, sit-ups for muscular endurance, and the Harvard step test for cardiovascular endurance. Data were analyzed using descriptive statistics and independent samples t-tests, with assumptions of normality and homogeneity of variance verified.
Results: No significant gender differences were observed in flexibility (p =.909) and cardiovascular endurance (p =.190). However, males outperformed females significantly in muscular leg power, agility, and muscular endurance (p<.001). Conversely, females showed higher muscular arm strength compared to males (p<.001).
Conclusions: The findings highlight clear gender-based differences in most physical fitness components among college students, with males generally exhibiting superior performance except in muscular arm strength where females excelled. These insights can inform gender-specific fitness programs aimed at improving health and performance in young adults.

Keywords: Cardiovascular endurance, college students, gender differences, muscular strength, physical fitness

Introduction

Physical fitness enables individuals to perform everyday tasks and apply game-specific techniques and strategies that enhance performance during competition [1]. It reflects the body's ability to cope with physical demands, impacting not only overall health but also athletic performance [2]. Understanding these factors is particularly important when comparing groups, such as by gender or level of competition, especially in areas like lower-body power, flexibility, and balance. Further research is needed to explore these differences and their practical implications [3, 4]. Fitness is a cornerstone of good health, playing a key role in preventing disease and supporting mental well-being — particularly during young adulthood. This is a period when many college students face major lifestyle changes that often lead to reduced activity levels [5, 6]. This decline has raised concerns among health experts, as it is linked to higher risks of chronic illnesses and poorer mental health outcomes [7, 8].

There exists a strong body of research identifying demonstrable gender variation in principal physical fitness parameters, frequently influenced by biological, hormonal, and behavioral mechanisms [9, 10]. Males habitually exhibit superior muscular strength, leg power, and cardiovascular function, owing to superior muscle mass, testosterone, and greater hemoglobin and cardiac output [11, 12]. Current research demonstrates that, during standardized exercise, males experience greater cardiac output, whereas females recover cardiovasculary faster and have greater exercise heart rates—a difference that highlights the need for sex-specific health and fitness guidelines [13]. In girls, speed development reflects the physical growth of late childhood, characterized by improvements in motor skills, muscular strength, and coordination [14].

In spite of physiological superiority in strength and power, studies establish that females tend to be superior in flexibility and occasionally agility, potentially due to higher joint range of motion and connective tissue elasticity [15, 16]. A systematic review of physical fitness tests observes that the sit and reach test consistently records variation in flexibility, with young women tending to outperform their male peers [17]. Gender differences in flexibility are not always significant, based on the results of some descriptive studies with college student populations [18]. Muscular endurance is a more nuanced picture. While males will typically post higher scores in repeated high-intensity strength activity, there is some indication that females can sustain lower-intensity endurance activity over longer periods, possibly due to variations in metabolism and muscle fiber type [19]. This is evident in the sit-ups test and in prolonged submaximal effort, where scores are perhaps nearer between the sexes [20].

Efficient respiratory function and strong cardiovascular endurance play a vital role in promoting overall well-being and enhancing athletic performance [21]. As a reliable indicator of both morbidity and mortality risk, cardiovascular endurance is typically assessed through field-based tests such as the Harvard Step Test, the 1.5-mile run, or VO_2max estimations [22]. Physically active women demonstrate better performance across various daily activities compared to their sedentary counterparts [23]. While males often perform at higher levels in these tests, research consistently shows that structured physical activity programs benefit individuals of all genders [24]. Furthermore, designing fitness interventions tailored to gender-specific needs has been shown to significantly improve participation rates and enhance health outcomes [25]. Indian university samples replicate these global findings, describing poorer fitness performance in females in the majority of measures except flexibility and, sometimes, muscular endurance [26]. Worryingly, both sexes are below suggested activity standards, adding to the imperative for effective, gender-sensitive fitness initiatives at universities [27].

In conclusion, a growing body of research from reputable, varied studies confirms the importance of gender in determining college students' physical fitness. These findings are strengthened by the ongoing use of validated, trustworthy fitness tests from various researches, such as the sit and reach, vertical jump, shuttle run, and step test, which also informs the creation of best practices for programs. In college settings, programming that takes into account the unique physiological and motivational characteristics of each gender may promote health in a more equal and successful way.

Material and Methods

Subjects

The study included N = 200 college students (n = 100 males and n = 100 females), aged 18–28 years, drawn from five zones of Delhi, India—Central, East, West, North, and South—with 20 participants selected from each zone. Female participants were selected from Agrasen, Hansraj, RLA, SPM, and Satyawati colleges, with each college contributing 20 female students, accounting for 10% of the total sample. Notably, Agrasen and SPM colleges included only female participants, while Shivaji and Shyam Lal colleges contributed only male participants. In contrast, Hansraj, RLA, and Satyawati colleges had representation from both genders, each contributing 20 male and 20 female students. This distribution indicates that, while overall gender representation was equal in the total sample, participation from specific colleges varied by gender. A purposive randomized sampling technique was employed to ensure fair representation of participants from each zone and gender. All participants were apparently healthy and free from any physical disabilities that could affect their performance in the physical fitness assessments.

Variables and Test Protocols

The study assessed six key physical fitness variables using standardized test protocols. Flexibility was measured using the sit and reach test, which evaluates the flexibility of the lower back and hamstring muscles; participants sat with legs extended and reached forward along a measuring scale. Muscular arm strength was assessed using chin-ups for male participants and the flexed arm hang for female participants; males performed as many chin-ups as possible without time restriction, while females held their body in a flexed-arm position above the bar for as long as possible. Muscular leg power was evaluated through the vertical jump test, where participants jumped vertically from a standing position to touch the highest possible point on a marked wall or measuring device. Agility was measured using the shuttle run test, which involved sprinting back and forth between two lines placed 10 meters apart as quickly as possible. Muscular endurance was determined using the sit-ups test (1-minute protocol), where participants performed the maximum number of sit-ups within one minute. Lastly, cardiovascular endurance was assessed using the Harvard step test, in which participants stepped up and down on a bench at a fixed pace, followed by measurement of pulse rates to assess recovery.

Statistical Analysis

Data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics included the calculation of means and standard deviations. For inferential analysis, independent samples t-tests were conducted to determine statistically significant differences between groups. The Shapiro-Wilk test was applied to confirm the normality of the data, while Levene's test was used to assess the homogeneity of variances. All analyses were performed using SPSS Version 25, with the level of significance set at $p < 0.05$.

Results

Table 1: Physical characteristics of the subjects

Variables	Group	N	Mean	SD	Sig. (2-tailed)
Body Weight (kg)	F	100	53.17	7.02	<.001
	M	100	69.21	10.259	
Height (cm)	F	100	158.41	5.44	<.001
	M	100	175.46	6.817	
BMI (kg/m^2)	F	100	21.19	2.6	<.001
	M	100	22.41	2.51	

Table 1 presents the physical characteristics of the subjects. Males had significantly higher body weight (M = 69.21 kg) than females (M = 53.17 kg), *p*<.001. Similarly, males were taller (M = 175.46 cm) than females (M = 158.41 cm), *p*<.001. BMI was also significantly higher in males (M = 22.41) compared to females (M = 21.19), *p*<.001.

Table 2: Descriptive statistics of fitness variables by gender

Variables	Tests	Group	n	Mean	Median	SD	SE
Flexibility	Sit and Reach	F	100	31.43	34	11.88	1.188
		M	100	31.23	35	13.478	1.3478
Muscular Arm Strength	Chin Ups (boys) & Flexed Arm Hang (girls)	F	100	14.68	12.5	8.48	0.848
		M	100	7.34	7	2.66	0.266
Muscular Leg Power	Vertical Jump	F	100	39.11	37	10.49	1.049
		M	100	62.44	59.5	16.097	1.6097
Agility	Shuttle Run	F	100	6.59	6.79	1.06	0.106
		M	100	5.45	5.26	0.564	0.0564
Muscular Endurance	Sit-Ups	F	100	22.64	23	8.27	0.827
		M	100	33.23	33	10.149	1.0149
Cardiovascular Endurance	Harvard Step	F	100	48.12	43	22.73	2.273
		M	100	51.49	51	11.861	1.1861

Table 1 shows the descriptive statistics (n = 100 per group) showed that females had slightly higher flexibility (M = 31.43) and arm strength (M = 14.68) than males (M = 31.23 and 7.34, respectively). Males outperformed females in leg power (M = 62.44 vs. 39.11), agility (M = 5.45 vs. 6.59), muscular endurance (M = 33.23 vs. 22.64), and cardiovascular endurance (M = 51.49 vs. 48.12).

Table 3: Independent samples t-test of fitness variables by gender

Variables & Tests		Mean difference	SE difference	t	df	Sig. (2-tailed)
Flexibility	Sit and Reach	0.205	1.797	0.114	198	0.909
Muscular Arm Strength	Chin Ups (boys) & Flexed Arm Hang (girls)	7.34	0.888	8.263	198	<.001
Muscular Leg Power	Vertical Jump	-23.33	-1.922	-12.142	198	<.001
Agility	Shuttle Run	1.133	0.12	9.445	198	<.001
Muscular Endurance	Sit-Ups	-10.59	1.309	-8.088	198	<.001
Cardiovascular Endurance	Harvard Step	-3.371	2.564	-1.315	198	0.190

*. Significant at 0.05 level

Table 3 presents the results of independent samples t-tests revealed no significant difference in flexibility, t(198) = 0.11, p =.909, or cardiovascular endurance, t(198) = -1.32, p =.190. Significant gender differences were found in muscular strength, leg power, agility, and muscular endurance (*p*<.001), with males outperforming females in all except muscular arm strength.

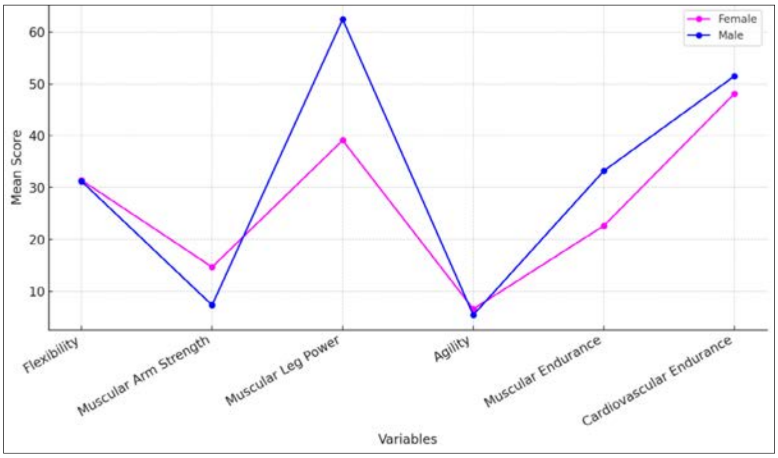

Fig 1: Comparison of physical fitness test scores by gender

Figure 1 illustrates the comparison of physical fitness test scores between males and females, highlighting gender-based differences across various fitness components.

Discussions

The current research detected sex differences in physical attributes and most aspects of physical fitness that is consistent with previous literature on physiological and performance differences between the sexes. Males had considerably greater body weight, height, and body mass index (BMI) than females ($p<.001$). Such differences are generally explained by biological mechanisms such as hormonal effects, specifically testosterone, that enhances more muscle mass and bone density in males [28]. Larger male body size may also be due to evolutionary pressures for strength and power [29].

Flexibility is defined as the range of motion around a joint. Specifically, structured stretching exercises are commonly employed to enhance flexibility [30]. Gender differences in flexibility have been widely studied, with research consistently showing that females tend to be more flexible than males. This difference is often attributed to physiological factors, such as variations in muscle fiber composition and greater joint laxity in females. Flexibility generally peaks during the early school years and gradually declines with age; however, females maintain consistently higher flexibility levels across all age groups. While these biological differences contribute to the typically greater flexibility in females, several studies have emphasized that flexibility is influenced not only by gender but also by activity levels and training practices [31, 16].

Muscular arm strength, as indicated by chin-ups for men and flexed arm hang for women, was greater in women in this sample—a result which differs from the general trend. Most research indicates that males perform better than females in absolute upper-body strength as a result of greater muscle cross-sectional area and androgen influences [32]. The difference here can partially be explained by the use of different tests between the sexes, which is indicative of strength endurance in women as opposed to maximal strength in men [33]. On the other hand, males significantly outperformed females in muscular leg power, agility, and muscular endurance. The superior vertical jump height in males is consistent with reports that men are more likely to have greater lower-body explosive power because of larger muscle fiber size and neuromuscular activation efficiency [34]. Furthermore, better agility and sit-up performance in males likely reflect their superior muscle strength and endurance capacity [35].

Surprisingly, there was no significant gender difference in cardiovascular endurance using the Harvard step test. The finding concurs with studies suggesting that when cardiovascular tests are adjusted for differences in body composition and physical activity levels, sex differences in endurance performance become smaller [36] Differences in stroke volume and efficiency of oxygen uptake might be less apparent at submaximal exercise intensities used in these types of tests [37]. These findings cumulatively support a corpus of literature highlighting biological, developmental, and environmental contributions to gender differences in physical fitness [38, 39]. Males are generally superior in variables of strength and power, whereas females may be equivalent or superior in flexibility levels. Notably, testing protocol differences and socio-cultural factors for physical activity participation need consideration in the interpretation of sex-specific fitness data [40, 41].

Conclusion

The present study revealed significant gender-based differences in various components of physical fitness among college students aged 18–28 years in Delhi. While males demonstrated superior performance in muscular leg power, agility, muscular endurance, and cardiovascular endurance, females outperformed males in muscular arm strength, and both groups showed comparable flexibility levels. These findings suggest the need for gender-specific fitness training programs that address individual strengths and weaknesses. Incorporating such targeted interventions in college wellness programs could enhance overall health, physical performance, and long-term fitness among young adults.

Acknowledgment

The authors express their gratitude to all participants who contributed to the study.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Reza MN, Rahman MH, Islam MS, Mola DW, Andrabi SMH. Assessment of motor fitness metrics among athletes in different sports: An original research. Phys Educ Theory Methodol. 2024;24(1):47–55. https://doi.org/10.17309/tmfv.2024.1.06
2. Mola DW, Rahman MH, Uvinha RR, Adane AK, Tyagi S, Adili D, *et al*. Effect of 12 week training program on the fitness and performance of long jumpers. Int J Kinesiol Sports Sci. 2025;13(1):45–53. http://dx.doi.org/10.7575/aiac.ijkss.v.13n.1p.45
3. Akter MK, Ahmed H, Khatun MM, Rumky UH, Roy S. Physical fitness differences between athletes and non-athletes at the university level: A gender-based analysis. Sports Sci Health Adv. 2025;3(1):421–427. https://doi.org/10.60081/SSHA.03.01.2025.421-427
4. Rumky UH, Khatun MM, Ahmed H, Akter MK, Roy S. Comparative analysis of sprint ability in athletes and non-athletes across 10 to 100 meters. Sports Sci Health Adv. 2025;3(1):428–434. https://doi.org/10.60081/SSHA.03.01.2025.428-434
5. Blair SN, Kampert JB, Kohl HW, Barlow CE, Macera CA, Paffenbarger RS Jr, *et al*. Influences of cardiorespiratory fitness and other precursors on cardiovascular disease and all-cause mortality in men and women. JAMA. 1996;276(3):205–210. https://doi.org/10.1001/jama.1996.03540030039029
6. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. Obesity (Silver Spring). 2008;16(10):2205–2211. https://doi.org/10.1038/oby.2008.365
7. Anderson L, Close GL, Konopinski M, Rydings D, Milsom J, Hambly C, *et al*. Case study: Muscle atrophy, hypertrophy, and energy expenditure of a Premier League soccer player during rehabilitation from anterior cruciate ligament injury. Int J Sport Nutr Exerc Metab. 2019;29(5):559–566. https://doi.org/10.1123/ijsnem.2018-0391

8. Taye AG, Mola DW, Rahman MH. Analyzing the nutritional awareness, dietary practices, attitudes, and performance of U-17 football players in Ethiopia. Phys Educ Theory Methodol. 2024;24(1):110–117. https://doi.org/10.17309/tmfv.2024.1.14
9. Maughan RJ, Watson JS, Weir J. Strength and cross-sectional area of human skeletal muscle. J Physiol. 1983;338:37–49. https://doi.org/10.1113/jphysiol.1983.sp014658
10. Janssen I, Heymsfield SB, Wang ZM, Ross R. Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr. J Appl Physiol. 2000;89(1):81–88. https://doi.org/10.1152/jappl.2000.89.1.81
11. Miller AE, MacDougall JD, Tarnopolsky MA, Sale DG. Gender differences in strength and muscle fiber characteristics. Eur J Appl Physiol Occup Physiol. 1993;66(3):254–262. https://doi.org/10.1007/BF00235103
12. Häkkinen K, Kallinen M, Linnamo V, Pastinen UM, Newton RU, Kraemer WJ. Neuromuscular adaptations during bilateral versus unilateral strength training in middle-aged and elderly men and women. Acta Physiol Scand. 1996;158(1):77–88. https://doi.org/10.1046/j.1365-201X.1996.523293000.x
13. Bassareo PP, Crisafulli A. Gender differences in hemodynamic regulation and cardiovascular adaptations to dynamic exercise. Curr Cardiol Rev. 2020;16(1):65–72. https://doi.org/10.2174/1573403X15666190321141856
14. Islam MA, Rakib MR. Comparing speed progression in pre-adolescent girls: A developmental analysis. Sports Sci Health Adv. 2024;2(2):291–298. https://doi.org/10.60081/SSHA.2.2.2024.291-298
15. Hirsch JA, Bishop B. Breathing pattern in humans: Elevated CO2 or low O2 on positive airway pressure. J Appl Physiol. 1984;56(3):777–784.
16. Zhang S, Liu J, Sang B, Zhao Y. Age and gender differences in expressive flexibility and the association with depressive symptoms in adolescents. Front Psychol. 2023;14:1185820. https://doi.org/10.3389/fpsyg.2023.1185820
17. Salse-Batán J, Sanchez-Lastra MA, Suarez-Iglesias D, Varela S, Ayán C. Effects of Nordic walking in people with Parkinson's disease: A systematic review and meta-analysis. Health Soc Care Community. 2022;30(5)\:e1505–e1520. https://doi.org/10.1111/hsc.13842
18. Yu S, Lin L, Liang H, Lin M, Deng W, Zhan X, *et al*. Gender difference in effects of proprioceptive neuromuscular facilitation stretching on flexibility and stiffness of hamstring muscle. Front Physiol. 2022;13:918176. https://doi.org/10.3389/fphys.2022.918176
19. Dalton J, Booth A, Noyes J, Sowden AJ. Potential value of systematic reviews of qualitative evidence in informing user-centered health and social care: Findings from a descriptive overview. J Clin Epidemiol. 2017;88:37–46. https://doi.org/10.1016/j.jclinepi.2017.04.020
20. Mediano MFF, Fleg JL, Wanigatunga AA, Gonçalves TR, Martinez-Amezcua P, Szklo M, *et al*. Association of physical activity with maximal and submaximal tests of exercise capacity in middle- and older-aged adults. J Aging Phys Act. 2022;30(2):271–80. https://doi.org/10.1123/japa.2020-0439
21. Pramanik TN, Rahaman A, Rahman MH, Shukla A, Pradhan P. Enhancing respiratory function and cardiovascular endurance through intensive yogic intervention: A comprehensive study. Phys Educ Theory Methodol. 2024;24(3):449–457. https://doi.org/10.17309/tmfv.2024.3.14
22. Beltz NM, Gibson AL, Janot JM, Kravitz L, Mermier CM, Dalleck LC. Graded exercise testing protocols for the determination of VO2max: Historical perspectives, progress, and future considerations. J Sports Med. 2016;2016:3968393. https://doi.org/10.1155/2016/3968393
23. Rahman MH, Chanda S, Reza MN. Comparison of simple choice visual reaction time between athlete and sedentary university women students. Eur J Phys Educ Sport Sci. 2020;6(4):1–8. http://dx.doi.org/10.46827/ejpe.v0i0.3045
24. Sheng J, Ariffin IAB, Tham J. The influence of exercise self-efficacy and gender on the relationship between exercise motivation and physical activity in college students. Sci Rep. 2025;15:11888. https://doi.org/10.1038/s41598-025-95704-5
25. Segar M, Jayaratne T, Hanlon J, Richardson CR. Fitting fitness into women's lives: Effects of a gender-tailored physical activity intervention. Womens Health Issues. 2002;12(6):338–47. https://doi.org/10.1016/s1049-3867(02)00156-1
26. Padmavathi G, Kole C, SiddI E. Detection of protein markers for identification of rice genotypes resistant to green leafhopper. Indian J Genet Plant Breed. 1999;59(4):417–421.
27. Lwamba E, Shisler S, Ridlehoover W, Kupfer M, Tshabalala N, Nduku P, *et al*. Strengthening women's empowerment and gender equality in fragile contexts towards peaceful and inclusive societies: A systematic review and meta-analysis. Campbell Syst Rev. 2022;18(1):e1214. https://doi.org/10.1002/cl2.1214
28. Janssen I, Heymsfield SB, Wang ZM, Ross R. Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr. J Appl Physiol. 2000;89(1):81–88. https://doi.org/10.1152/jappl.2000.89.1.81
29. Malina RM, Bouchard C, Bar-Or O. Growth, maturation and physical activity. 2nd ed. Champaign, IL: Human Kinetics; 2004.
30. Rahman MH, Islam MS. Stretching and flexibility: A range of motion for games and sports. Eur J Phys Educ Sport Sci. 2020;6(8):22–36. http://dx.doi.org/10.46827/ejpe.v6i8.3380
31. Tsolakis C, Bogdanis GC. Acute effects of two different warm-up protocols on flexibility and lower limb explosive performance in male and female high level athletes. J Sports Sci Med. 2012;11(4):669–675.
32. Staron RS, Hagerman FC, Hikida RS, Murray TF, Hostler DP, Crill MT, *et al*. Fiber type composition of the vastus lateralis muscle of young men and women. J Histochem Cytochem. 2000;48(5):623–629. https://doi.org/10.1177/002215540004800506
33. Fry AC, Kraemer WJ. Resistance exercise overtraining and overreaching. Neuroendocrine responses. Sports Med. 1997;23(2):106–29. https://doi.org/10.2165/00007256-199723020-00004

34. Miller R, Balshaw TG, Massey GJ, Maeo S, Lanza MB, Haug B, *et al*. Sex differences in muscle morphology between male and female sprinters. J Appl Physiol. 2024;136(6):1568–1579. https://doi.org/10.1152/japplphysiol.00009.2023
35. Miller NJ, Rice-Evans C, Davies MJ, Gopinathan V, Milner A. A novel method for measuring antioxidant capacity and its application to monitoring the antioxidant status in premature neonates. Clin Sci (Lond). 1993;84(4):407–12. https://doi.org/10.1042/cs0840407
36. Kenney W, Wilmore J, Costill D. Physiology of sport and exercise. 5th ed. Champaign, IL: Human Kinetics; 2012.
37. Sheel AW. Sex differences in the physiology of exercise: An integrative perspective. Exp Physiol. 2016;101(2):211–212. https://doi.org/10.1113/EP085371
38. Malina RM, Eisenmann JC, Cumming SP, Ribeiro B, Aroso J. Maturity-associated variation in the growth and functional capacities of youth football (soccer) players 13–15 years. Eur J Appl Physiol. 2004;91(5–6):555–62. https://doi.org/10.1007/s00421-003-0995-z
39. Moreira-Marconi E, Dionello CF, Morel DS, Sá-Caputo DC, Souza-Gonçalves CR, Paineiras-Domingos LL, *et al*. Could whole body vibration exercises influence the risk factors for fractures in women with osteoporosis? Osteoporos Sarcopenia. 2016;2(4):214–20. https://doi.org/10.1016/j.afos.2016.09.003
40. Bishop C, Turner A, Read P. Effects of inter-limb asymmetries on physical and sports performance: A systematic review. J Sports Sci. 2018;36(10):1135–1144. https://doi.org/10.1080/02640414.2017.1361894
41. Butt J, Weinberg RS, Breckon JD, Claytor RP. Adolescent physical activity participation and motivational determinants across gender, age, and race. J Phys Act Health. 2011;8(8):1074–1084. https://doi.org/10.1123/jpah.8.8.1074