DOI: 10.21088/potj.0974.5777.18425.6

Physiotherapy and Occupational Therapy Journal
Volume 18 Number 4, October - December 2025

ORIGINAL ARTICLE

Normative Values of One Leg Stance in Urban Adults of 20-40 Years

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HOW TO CITE THIS ARTICLE:

Vidhi Kalantri, Madhavi Santosh Doke, Medha Deo. Normative Values of One Leg Stance in Urban Adults of 20-40 Years. Therapy Jr. 2025; 18(4): 329-337.

ABSTRACT

Background: The One-Leg Stance (OLS) test is a simple, cost-effective, and reliable tool used in clinical settings to assess static balance, particularly in those with musculoskeletal problems such as ACL or ankle injuries. It also holds prognostic value in sports.

Aim: This study aimed to establish normative values for One-Leg Stance (OLS) in urban adults aged 20–40 years.

Objectives: To assess balance with both eyes open and eyes closed in males and females.

Material: A total of 284 healthy participants were recruited from community settings. Balance was evaluated by measuring the duration each participant could maintain a stance on their dominant leg.

Result: Statistical analysis was done using an Unpaired t-test, and the findings revealed that males aged 20–40 years achieved a mean OLS time of 111.81 ± 6.76 seconds with eyes open and 35.65 ± 2.89 seconds with eyes closed. In comparison, females recorded a mean OLS time of 92.32 ± 5.84 seconds with eyes open and 22.06 ± 1.72 seconds with eyes closed. A statistically significant difference was observed between genders in the eyes-closed condition, with males demonstrating superior balance performance.

Conclusion: This study provides normative data for OLS in urban adults aged 20–40 years and highlights a gender-based difference in balance ability, particularly under eyes-closed conditions.

KEYWORDS

• Normative Values • One Leg Stance • Balance • Eyes open • Eyes closed

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➤ **Received:** 13-06-2025 ➤ **Accepted:** 01-08-2025

Key Message: Urban adults aged 20–40 years show distinct gender-based differences in one-leg stance (OLS) performance, particularly with eyes closed, with males demonstrating significantly better balance. This study provides valuable normative data for OLS that can aid in clinical assessment and balance training strategies.

INTRODUCTION

Background: The One-Leg Stance (OLS) test is a simple, cost-effective, and reliable tool used in clinical settings to assess static balance, especially in individuals with musculoskeletal conditions like ACL or ankle sprains, etc. It also holds prognostic value in sports.[1-3] Despite its utility, limited normative data particularly for Indian adults, restricts its use in detecting subtle balance impairments. This study aims to establish normative OLS values in urban Indian adults aged 20–40 years, assessing balance duration with eyes open and closed, and comparing performance between males and females under both conditions to enhance clinical interpretation and monitoring in clinical practice.

Aim: To establish the normative values of one leg stance with eyes open and closed.

Primary Objective

1. To establish the duration of one leg stance with eyes open and closed.

Secondary Objectives

1. To compare the difference between one leg stance time in males and females with eyes open.
2. To compare the difference between one leg stance time in males and females with eyes closed.

Null Hypothesis:

- There is no difference in one leg stance time between males and females with eyes open.
- There is no difference in one leg stance time between males and females with eyes closed.

Alternate Hypothesis 1:

- Males have better one leg stance time than females with eyes open.
- Males have better one leg stance time than females with eyes closed.

Alternate Hypothesis 2:

- Females have better one leg stance time than males with eyes open.
- Females have better one leg stance time than males with eyes closed.

MATERIAL AND METHODOLOGY

284 healthy urban adults, both males and females, between 20 and 40 years of age, were enrolled in the study. Subjects were divided according to Body Mass Index (BMI) within the normal range (18.5-22.9 kg/m^2), Overweight (23-24.9 kg/m^2), Obese I (25-29.9 kg/m^2), as per the recent classification of BMI for the Asian Population updated in 2023.[4] Subjects with a history of balance impairment due to recent trauma or neurological ailments were excluded from the study.

1. Materials used:

- Stopwatch
- Football

Figure 1: Materials used in the study

DATA COLLECTION AND PROCEDURE

Approval from the ethics committee was obtained before commencing the study. Subjects were selected based on the inclusion and exclusion criteria. All participants were explained the study in a language they could understand, and a written consent form was obtained from each of them. Demographic data, including age, gender, dominant limb, height, and weight, were recorded.

Before starting the One leg stance test, the subject was asked to kick a ball placed on the floor in front of him, and the kicking limb was recorded as the dominant limb.[5] Subjects were asked to stand barefoot and 2 feet away from the wall. They were asked to fixate their gaze on a given point at eye level on the wall.[2,3] They were made to stand on the dominant lower limb. For the other lower limb, the hip and ankle are in neutral with the knee flexed at 90°, hands on hips.[2]

The time was noted using a stopwatch from the moment of lifting the leg and stopped when

- Stance limb moved on the floor.
- Raised foot moved towards or away from the standing limb or touched the floor.
- Participant's gaze moved away from target.
- Used his arms.
- Opened eyes on eyes closed trials.[3,5]

The procedure was repeated 3 times each for eyes open and eyes closed. 15 seconds of rest was given between each trial to avoid fatigue. Mean of 3 readings was taken as final reading for eyes open and eyes closed respectively. Subjects performed 3 trials with eyes open, and 3 trials with eyes closed alternating between eyes open and eyes closed.[3,5,6] The data collected was used for statistical analysis.

Figure 2: Dominant limb

Figure 3: One Leg Stance (Anterior View)

Figure 4: One Leg Stance (Lateral View)

RESULTS

Data obtained was compiled on MS Office Excel sheet and analysis was done using SPSS Version 26.0, IBM software. The Shapiro Wilk test of normality was applied. The data was normally distributed. For inter group comparison as the data was normally distributed, Unpaired t - test was used for comparison. For all the statistical tests, $p<0.05$ was considered to be statistically significant (the alpha value was considered to be 0.05)

Descriptive statistics:

Table 1: The demographic data:

Total no of participants		284
Gender	Male	142 (50%)
	Female	142 (50%)
Age (years)	Mean	30.13
	SD	6.18
Weight (kg)	Mean	67.76
	SD	11.177
Height (m)	Mean	168.01
	SD	10.03
BMI (kg/m^2)	Mean	23.91
	SD	2.72

Table 2: Group-wise gender distribution:

Variables	Male	Female
Age (years)		
Mean	30.05	30.19
SD	6.01	6.33
Weight (kg)		
Mean	73.93	61.58
SD	9.56	9.01
Height (m)		
Mean	174.64	161.37
SD	8.07	6.87
BMI (kg/m^2)		
Mean	24.22	23.59
SD	2.52	2.86

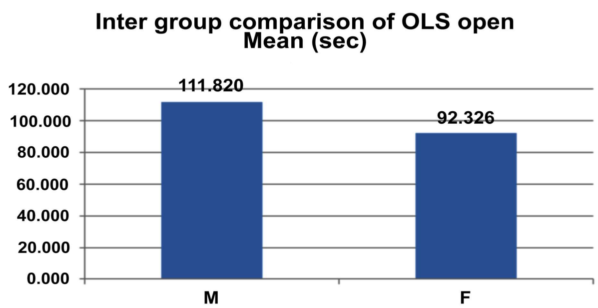
Table 3: The normative data of males and females of 20-40 years with eyes open and eyes closed

	Eyes open (seconds)	Eyes closed (seconds)
	Mean±SD	Mean±SD
Males	111.81±80.55	35.65±34.50
Females	92.32±69.60	22.06±20.61

Inference: The mean One Leg Stance time for males with eyes open was 111.81 seconds, and for females with eyes open was 92.32 seconds. The mean One Leg Stance time for males with eyes closed was 35.65 seconds, and for females it was 22.06 seconds.

Table 4: Inter-group comparison of males and females with eyes open:

Outcome measures	Eyes open			p-value
	Males	Females	T value	
Seconds	111.81±80.55	92.32±69.60	2.182	0.059

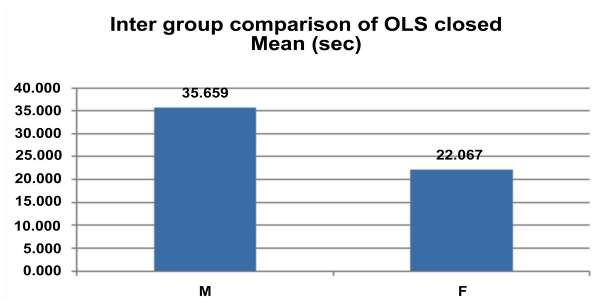


Graph 1: Inter-group comparison of One Leg Stance between males and females with eyes open

Inference: The intergroup comparison of one leg stance between males and females with eyes open showed statistically non-significant differences ($p>0.05$).

Table 5: Inter-group comparison of males and females with eyes closed:

Outcome measures	Eyes closed			p-value
	Males	Females	T value	
Seconds	35.65±34.50	22.06±20.61	4.030	0.000



Graph 2: Inter-group comparison of the One Leg Stance between males and females with eyes closed

Inference: The intergroup comparison between males and females with eyes closed showed statistically highly significant differences ($p<0.01$) with males having a better one leg stance time than females.

DISCUSSION

OLS is one of the tests used to assess static balance. It has several advantages over the others, which make it a useful tool to use in clinical setups. Limited normative data for the Indian population of the age group 20-40 years makes it difficult for clinicians to assess and monitor subtle balance impairments. Thus, this study was undertaken to estimate the normative data for males and females with eyes open and eyes closed. Also, to compare the OLS time between the two genders with eyes open and closed.

The results of the current study report that OLS of males of 20-40 years with eyes open was 111.81±6.76 seconds and with eyes closed was 35.65±2.89 seconds. OLS of females of 20-40 years with eyes open was 92.32±5.84 seconds and with eyes closed was 22.06±1.72 seconds. Also, males had a statistically highly significant OLS time than females with eyes closed.

Barbara A. Springer *et al* conducted a study to establish the normative values for repeated trials of Unipedal Stance Test (UPST) with eyes open and eyes closed across age groups 18 to 99 years for each decade and gender wise. They found that for the age group 18 to 39 years, UPST of males with eyes open was 43.2±6.0 seconds and with eyes closed was 10.2±9.6 seconds. UPST of females with eyes open was 43.5±3.8 seconds and with eyes closed was 8.5±9.1 seconds.[5]

In a study evaluating the relationship between UPST and aging, Bohannon *et al* obtained normative values for each decade from 20 to 79 years for both eyes open and closed. In the 2nd and 3rd decades, subjects were able to maintain OLS for 30 seconds with both eyes open and closed.[7] Amin Ansari *et al* conducted a study to determine normative values of OLS with eyes open across 6 age groups 18–29, 30–39, 40–49, 50–59, 60–69, ≥70 years, and gender in healthy Iranian adults.

They found OLS for age group 18-29 years for the Right lower limb was 56.4±8.8 seconds and for the Left lower limb was 56.7±8.69 seconds. OLS for age group 30-39 years for the Right lower limb was 47.0±16.5 seconds and for the Left lower limb was 46.5±15.4 seconds. OLS of males for the Right lower limb was 56.9±7.8 seconds and for the Left lower limb was 58.0±7.1 seconds. OLS of females for the Right lower limb was 55.9±9.8 seconds and for the Left lower limb was 55.4±10 seconds.[8]

McKay *et al* through their study found age and sex stratified reference values for OLS with eyes closed for the age group 3-60 years and above. For the age group 20-59 years, OLS for males was 12.6±7.0 seconds and for females was 12.7±6.6 seconds.[9]

The findings of this study align with the conclusions drawn in previous studies that OLS time decreases with eyes closed.

Key sources of sensory information used to control balance and prevent body sway during OLS are somatosensory signals from legs and vision.[10] Stones and Kozma reported that important sources of feedback for the maintenance of balance are visual cues and visual information from the environment.[11] The visual system is the predominant sensory system used by young adults as reported by Liaw, Chen, Pei, Leong, and Lau.[12] As visual inputs provide exteroceptive information about the environment, they are the most reliable source of perceptual information for balance control.[13]

The current study's results follow Fitzpatrick *et al*, Lord *et al*, and Paulus *et al* who reported that removing visual cues by closing eyes increases body sway by about 1/3rd. Closing the eyes affects the reliance on proprioceptive sensory input from the legs.[14-16] Patricia A Hageman, Michael L, and Daniel B conducted a study, on age and gender effects on postural control measures, where they found out values of body sway were smaller during eyes open with visual feedback than when eyes were closed.[17] A similar result was found in a study by Seong-Gil Kim, and Wan-Soo Kim where sway length and velocity were larger in the absence of visual information.[18] Sway measurements were greater with eyes closed than with eyes open.[17,19,20]

Gatev *et al* reported that postural control while standing still is performed through feedforward in the presence of visual information and through feedback in the absence of visual information.[21]

Feedforward is more commonly used than feedback in controlling balance. The number of times action is needed to control posture in feedforward is higher than feedback. Thus, the load on structures stabilizing the ankle increases, and there is the use of more muscles around the ankle.[21] As there is a loss of balance, feedback modifies posture, hence the number of muscles used for postural control will be relatively less and the role of non-contractile structures will also be relatively less.[18]

Integration of visual, vestibular, and somatosensory input is needed for the maintenance of balance while performing OLS. Also, it requires both biomechanical properties and neuromuscular control.[13] Changes of integrity in physiological systems, mainly sensory, has an effect on stability during an upright stance.[22] Thus, when vision is suppressed greater role of the sensory-motor, vestibular system occurs to maintain balance.[20,23]

Butler Annie *et al* reported that people with lower limb weakness and without visual acuity or proprioceptive loss rely more on vision to detect and stabilize their body sway than people with strong lower limb muscles.[10]

Considering OLS as an inverted pendulum, it is a strategy used to reduce the number of biomechanical variables that could affect COM and COP sways. The body stiffness and inertia of the ankle are the two parameters of the inverted pendulum model. With closed eyes, the difference between the position of COM and COP increases. Also, the muscle activation around the ankle increases leading to stiffness at the ankle and other joints in an attempt to decrease fall.[20]

The findings of the current study are in agreement with earlier studies conducted by different authors, Balogun J.A., and Salwa B. El-Sobkey, which concluded that OLS is related to gender and that men had a better OLS time than females.[3,24] However, Springer A. Barbara *et al* reported that OLS is age-specific and not gender specific.[5] Gender-related differences could be due to factors such as anthropometric factors, muscle fibre activation pattern, muscle fibre morphology, muscle strength, adipose tissue distribution, ligament laxity, proprioception, menstruation, lean body mass, anatomical variations in the pelvis.

Balance ability is affected by body characteristics, muscle weakness, and flexibility.[25] Differences in muscle strength and anthropometric factors have been reported between males and females.[25-27] According to the inverted pendulum model, increased height would cause a greater amplitude of movement than shorter height. This affects the selection of motor strategies between males and females to maintain balance.[27]

Pincivero *et al* reported that males show higher strength values than females in normalized muscle force or torque production which may be due to gender differences in muscle activation pattern and muscle fibre morphology.[28] According to previous studies, men had significantly higher skeletal muscle mass and stronger knee extension strength than women.[25] There is a high correlation between muscle strength and muscle cross-sectional area. Men have greater absolute muscle strength due to their larger muscles relatively.[29] Prince *et al*, and Sale *et al* reported larger amounts of intramuscular fat or connective tissue in females which do not contribute to force production.[30,31] As per previous studies, in the vastus lateralis muscle, males have larger type II fibres than type I, whereas, women have larger type I fibres than type II. The increased cross-sectional area of male muscle is mainly the result of larger fibres rather than increased fibre number.[29]

Concentric strength tends to peak in the 20's and 30's, and plateaus until 50 years of age. Women's concentric strength was more affected by age than eccentric strength. Changes in neural, muscular and mechanical, and/or elastic properties of muscle may contribute to the maintenance of eccentric strength with age.[32] Males exhibit greater peak isometric and isokinetic strength measures for the hip and knee compared to females.[33,34] Strength differences may cause differences in perceived exertion in males and females. Pincivero *et al* found that males rated their perceived exertion response during isometric and isokinetic knee extension contraction lower than females.[35,36]

P.X. Ku *et al* reported that there is a trend in female young adults to generate greater postural sway in AP and ML directions when compared to male young adults. There was an increase in COP displacement towards the limit of BOS. A plausible explanation for gender difference could be related to adipose tissue distribution as the android type exists in males, whereas, the gynoid type exists in females. In the android type, adipose tissue distribution occurs in thorax abdominal region while in the gynoid type, adipose tissue distribution occurs around the thigh and hip area. Females have an arch angle in the foot causing greater ligament laxity.[37] Aurichio *et al* reported higher body weight and flexible longitudinal arch in females would lead to a greater postural sway.[38] Increased joint laxity in females can be a contributing factor to their lower proprioceptive acuity.[39] Rozzi, Lephart, Gear, and Fu (1999) concluded that at the end range of knee extension, females showed lower proprioceptive acuity than males as proprioception may be less stimulated in females than males.[40]

Hewett reported that males tend to be more muscle dominant while females tend to be more ligament dominant in their joint control strategy.[41] Hu, Li, and Wang conducted a study that reported that males had a significantly higher ankle and knee joint kinesthetic sense than females, particularly females in the ovulatory and luteal phases. For ankle and knee joint kinesthetic sense, significant differences were found for ankle DF/PF/knee extension at different phases of the menstrual cycle i.e., follicular, ovulatory, and luteal phases.[34]

OLS was more in the ovulation phase compared to the early follicular phase. During the respective phases, hormonal levels are controlled through the hypothalamic–hypophyseal–ovarian system.[42] Studies have shown that neurological function may be influenced by estradiol and progesterone during menstrual cycle.[55] During ovulation, a peak of estrogen was detected, whereas, during the early follicular phase, a low level of estrogen and almost no progesterone was detected.[42] These fluctuations of estradiol and progesterone can influence the sensitivity of the central nervous system via binding to related neurotransmitters and altering their interactions.[34,42] Female sex hormonal changes might compromise the homeostasis of labyrinthine fluids which might influence balance.

Estrogen has positive effects on preserving muscle strength and connective tissue elements. Fluctuation of hormones affects tissue elasticity. Also, it has strengthening effects on skeletal muscle, and contractile proteins and reduces joint laxity.[42]

A study conducted by Alonson AC *et al* reported that lean mass and fat mass only correlated among males, which indicates that greater body mass in men interfered more with balance than it did in females. The greater lean mass in men and smaller BOS during OLS cause greater displacement and sway area. This doesn't increase their risk of falls; however, it is one of the strategies to maintain COP within an area of stability to maintain balance. Also, balance in men is more dependent on the action of joint and muscle effectors.[23]

There are anatomical differences between male and female pelvis anatomy. The male pelvis has a conical cavity with a sacral concavity shallower. The female pelvis has a cylindrical cavity with a sacral concavity deeper. The male sacrum is longer and narrower, whereas, the female sacrum is shorter and wider. Males have a narrower anterolateral wall of the pelvis and greater sciatic notch, whereas, females have a wider anterolateral wall of the pelvis and greater sciatic notch. In males, the ischium is relatively and absolutely longer than the pubis. In females, the pubis is relatively and absolutely longer than the ischium.[43]

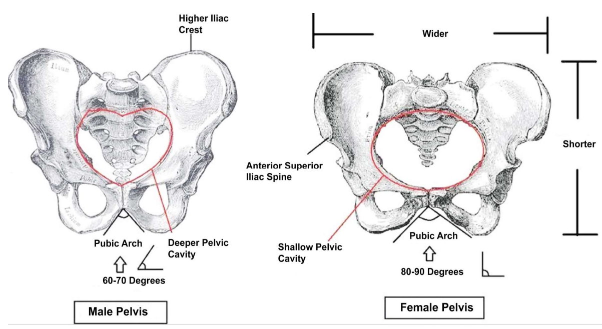


Figure 5: Anatomical differences between male and female pelvis[43]

The above anatomical variations affect OLS. Women have wider hips and BOS, which may contribute to increased stability during OLS. Men have narrower hips and narrower BOS which may require more effort to maintain balance.[43]

Conclusion: This study provides normative data for OLS in urban adults aged 20–40 years and highlights a gender-based difference in balance ability, particularly under eyes-closed conditions.

Conflict of Interest: The author declares no conflict of interest related to this study.

Funding: This study did not receive any specific grant from funding agencies.

Ethics Declaration: Ethical approval was obtained from the institutional review board (TMCHRC/Surg/2022/IEC Protocol-11/59), and informed consent was obtained from all participants before enrolment.

REFERENCES

1. Schorderet C., Hilfiker R., Allet L. The role of the dominant leg while assessing balance performance. A systematic review and meta-analysis. Gait and Posture. 2021; 84(1): 66–78.
2. Shaikh A.A., Chavan U. Influence of leg dominance on single leg stance test in healthy children between 12-14 years. International Journal of Basic and Applied Medical Sciences. 2015; 5(3): 62-5.
3. Salwa B. El-Sobkey. Normative Values for One-Leg Stance Balance Test in Population-Based Sample of Community Dwelling Older People. Middle-East Journal of Scientific Research. 2011; 7(4): 497-503.
4. Weir C.B., Jan A,. BMI classification percentile and cut off points. StatPearls: Treasure Island, FL, USA. 2023.
5. Springer B.A., Marin R., Cyhan T., Roberts H., Gill N.W. Normative values for the unipedal stance test with eyes open and closed. Journal of Geriatric Physical Therapy. 2007; 30(1): 8–15.
6. Dhanani S.D., Parmar L.D. Normative values of tandem and unipedal stance in school children. Int J Cur Res Rev. 2014 December;6(24).
7. Bohannon R.W., Larkin P.A., Cook A.C., Gear J., Singer J. Decrease in timed balance test scores with aging. Physical Therapy.1984; 64(7): 1067–70.
8. Nakhostin-Ansari A., Naghshtabrizi N., Naghdi S., Ghafouri M., Khalifeloo M., Mohammadzadeh M., *et al.* Normative values of functional reach test, single-leg stance test, and timed "UP and GO" with and without dual-task in healthy Iranian adults: A cross-sectional study. Annals of Medicine and Surgery. 2022; 80: 104053.
9. McKay M.J., Baldwin J.N., Ferreira P., Simic M., Vanicek N., Burns J., *et al*. Reference values for developing responsive functional outcome measures across the lifespan. American Academy of Neurology. 2017; 88(16): 1512–9.
10. Butler A.A., Lord S.R., Rogers M.W., Fitzpatrick R.C. Muscle weakness impairs the proprioceptive control of human standing. Brain Research. 2008; 1242(1): 244–51.
11. Stones M.J., Kozma A. Balance and age in the sighted and blind. Arch Phys Med Rehabil. 1987; 68(2): 85–9.
12. Liaw M.Y., Chen C.L., Pei Y.C., Leong C.P., Lau Y.C. Comparison of the static and dynamic balance performance in young, middle-aged, and elderly healthy people. Chang Gung Med J. 2009; 32(3): 297–304.
13. Lee AJY, Lin W.H. The influence of gender and somatotype on single-leg upright standing postural stability in children. Journal of Applied Biomechanics. 2007; 23(3): 173–9.
14. Fitzpatrick R., Rogers D.K., McCloskey D.I. Stable human standing with lower-limb muscle afferents providing the only sensory input. J Physiol. 1994; 480 (2): 395–403.
15. Lord S.R., Clark R.D., Webster I.W. Postural stability and associated physiological factors in a population of aged persons. J Gerontol. 1991; 46(3): 69-76.
16. Paulus W., Straube A., Krafczyk S., Brandt T. Differential effects of retinal target displacement, changing size and changing disparity in the control of anterior/posterior and lateral body sway. Exp Brain Res. 1989; 78(2): 243–52.
17. Hageman P.A., Leibowitz J.M., Blanke D. Age and gender effects on postural control measures. Arch Phys Med Rehabil. 1995; 76(10): 961–5.
18. Kim S.G., Kim W.S. Effect of ankle range of motion (ROM) and lower-extremity muscle strength on static balance control ability in young adults: A regression analysis. Med Sci Monit. 2018; 24(1): 3168–75.
19. Giagazoglou P., Amiridis I.G., Zafeiridis A., Thimara M., Kouvelioti V., Kellis E. Static balance control and lower limb strength in blind and sighted women. Eur J Appl Physiol. 2009; 107(5): 571–9.
20. Alonso A.C., Mochizuki L., Silva Luna N.M., Ayama S., Canonica A.C., Greve JMDA. Relation between the sensory and anthropometric variables in the quiet standing postural control: Is the inverted pendulum important for the static balance control? Biomed Research International. 2015: 985312.
21. Gatev P., Thomas S., Kepple T., Hallett M. Feedforward ankle strategy of balance during quiet stance in adults. J Physiol. 1999; 514(3): 915–28.
22. Wiesław Błaszczyk J., Fredyk A., Mikołaj Błaszczyk P. Transition from double-leg to

single-leg stance in the assessment of postural stability. J Biomech. 2020 Sep 18; 110.

23. Alonso A.C., Mochizuki L., Silva Luna NM, Ayama S., Canonica A.C., Greve JMDA. Relation between the sensory and anthropometric variables in the quiet standing postural control: Is the inverted pendulum important for the static balance control? Biomed Research International. 2015: 985312.

24. Balogun A.J., Ajayi O.L., Alawale F. Determinants of single limb stance balance performance. Afr J Med Med Sci. 1997; 26(3–4): 153–7.

25. Okabe T., Suzuki M., Goto H., Iso N., Cho K., Hirata K., *et al.* Sex differences in age- related physical changes among community-dwelling adults. J Clin Med. 2021; 10(20): 4800.

26. Vereeck L., Wuyts F., Truijen S., Van de Heyning P. Clinical assessment of balance: normative data, and gender and age effects. International Journal of Audiology. 2008; 47(2): 67–75.

27. Melam R.G., Buragadda S., Alhusaini A. Gender Differences in Static and Dynamic Postural Stability Parameters in Community Dwelling Healthy Older Adults. Middle-East Journal of Scientific Research. 2014; 22(9): 1259-1264.

28. Pincivero D.M., Coelho A.J., Campy R.M. Perceived exertion and maximal quadriceps femoris muscle strength during dynamic knee extension exercise in young adult males and Femalees. Eur J Appl Physiol. 2003; 89(2): 150–6.

29. Miller A.E., MacDougall J.D., Tarnopolsky M.A., Sale D.G. Gender differences in strength and muscle fiber characteristics. Eur J Appl Physiol. 1993; 66(3): 254–62.

30. Prince F.P., Hikida R.S., Hagerman F.C. Muscle fiber types in women athletes and non-athletes. Pflugers Arch. 1977; 371(1–2): 161–5. Lindle R.S., Metter E.J., Lynch N.A., Fleg J.L., Fozard J.L, Tobin J, *et al.* Age and gender comparisons of muscle strength in 654 women and men aged 20-93 yr. J Appl Physiol. 1997; 83(5): 1581–7.

31. Sale D.G., MacDougall J.D., Alway S.E., Sutton JR. Voluntary strength and muscle

32. characteristics in untrained men and women and male bodybuilders. J Appl Physiol. 1987; 62(5): 1786–93.

33. Dwyer M.K., Boudreau S.N., Mattacola C.G., Uhl T.L., Lattermann C. Comparison of lower extremity kinematics and hip muscle activation during rehabilitation tasks between sexes. Journal of Athletic Training. 2010; 45(2): 181–90.

34. Hu X., Li J., Wang L. Sex differences in lower limb proprioception and mechanical function among healthy adults. Motor Control. 2020; 24(4): 571–87.

35. Pincivero D.M., Coelho A.J., Erikson W.H. Perceived exertion during isometric quadriceps contraction. A comparison between men and women. J Sports Med Phys Fitness. 2000; 40(4): 319–26.

36. Pincivero D.M., Coelho A.J., Campy R.M., Salfetnikov Y., Bright A. The effects of voluntary contraction intensity and gender on perceived exertion during isokinetic quadriceps exercise. Eur J Appl Physiol. 2001; 84(3): 221–6.

37. Ku P.X., Abu Osman N.A., Yusof A., Wan Abas WAB. Biomechanical evaluation of the relationship between postural control and body mass index. Journal of Biomechanics. 2012; 45(9): 1638–42.

38. Aurichio T.R., Rebelatto J.R., de Castro AP. The relationship between the body mass index (BMI) and foot posture in elderly people. Arch Gerontol Geriatr. 2011; 52(2): e89-92.

39. Muaidi Q.I. Does gender make a difference in knee rotation proprioception and range of motion in healthy subjects? Journal of Back and Musculoskeletal Rehabilitation. 2017; 30(6): 1237–43.

40. Rozzi S.L., Lephart S.M., Gear W.S., Fu F.H. Knee joint laxity and neuromuscular characteristics of male and female soccer and basketball players. The American Journal of Sports Medicine.1999; 27(3): 312–9.

41. Hewett T.E. Neuromuscular and hormonal factors associated with knee injuries in female athletes: Strategies for intervention. Sports Med. 2000; 29(5): 313–27.

42. Emami F., Kordi Yoosefinejad A., Motealleh A. Comparison of static and dynamic balance during early follicular and ovulation phases in healthy women, using simple, clinical tests: a cross sectional study. Gynecological Endocrinology. 2019; 3 5(3): 257–60.

43. Carol A. Oatis. Kinesiology The Mechanics and Pathomechanics of Human Movement. Second. 2009.