Received: 18 August. 2023 Accepted: 12 October, 2023 Published: 31 Dec, 2023

Era of Physiotherapy and Rehabilitation Journal (EPRJ)
Volume 4, Issue 1 (2023) | Page No. 16-20

ORIGINAL ARTICLE

LEVEL OF LOCOMOTIVE RISK SYNDROME AND RISK OF FALL IN PATIENTS WITH KNEE OSTEOARTHRITIS AND ITS COMPARISON WITH HEALTHY ELDERLY POPULATION

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ABSTRACT:

Knee osteoarthritis (OA) is a common condition that greatly affects mobility, but mobility is also reduced with aging due to multiple factors including muscular weakness, joint stiffness, balance issues, and inactivity. **Methods:** In a comparative cross-sectional study conducted at the Railway General Hospital Rawalpindi spanning from July to December 2018 a total of two hundred patients aged between 65 and 75 years were recruited using a non-probability convenience sampling technique. Patients clinically diagnosed with knee osteoarthritis with grades II or III according to the Kallgren and Lawrence classification were included while those with other forms of arthritis a history of knee surgery, lower limb arthroplasty, or any musculoskeletal or neurological impairments affecting balance were excluded. The healthy elderly group had inclusion criteria of the absence of arthritis and exclusion criteria for lower limb deformities or other musculoskeletal and neurological impairments. Locomotive syndrome assessment involved The Stand-Up Test, Two-Step Test, and Geriatric Locomotive Function Scale-25 Questionnaire. Fall risk was evaluated through the Time Up and Go Test, Five Times Sit to Stand Test, and investigation about walking difficulty, road crossing, standing on a single leg, and fall history. Data was analysed using SPSS version 21 employing the Mann-Whitney U-test due to deviation of data from normal distribution. **Results:** The study population had a mean age of 68.05±5.44 years. The locomotive syndrome Risk Level test, TUG, FTSST, difficulty in stair climbing, difficulty in continuous walking, and difficulty in road crossing all showed statistical significance with $p < 0.05$. However, the p-value for fall on the floor was greater than 0.24. **Conclusion:** Patients with knee osteoarthritis exhibit a higher locomotive syndrome risk level, increased fall risk, and greater difficulty in stair climbing, continuous walking, and road crossing when compared to the healthy elderly population. **Key Words: Elderly, Healthy, Locomotive syndrome, Mobility, Osteoarthritis**

INTRODUCTION:

Locomotive dysfunction represents a decline in fundamental motor functions, including sit-to-stand transitions, gait, and stair climbing, or individuals may be susceptible to its symptoms, which, if left unaddressed, could lead to immobility and dependence in the future (1). Knee osteoarthritis is particularly linked to locomotive syndrome, significantly contributing to physical impairment and pain among elderly individuals worldwide (2, 3) The National Livelihood Survey in Japan underscores the impact of locomotive dysfunction on disability levels, ranking osteoporotic fractures fourth and osteoarthritis fifth, resulting in lifelong dependency on others (4). According to a recent World Health Organization report, knee osteoarthritis has the potential to become the fourth major cause of disability (3, 5). Locomotive syndrome limits walking capacity, posing obstacles to normal daily activities. Within the locomotor system, bones, muscles, joints, ligaments, tendons, and cartilage form the main components necessary for movement and structural support (3, 6). Current literature has revealed that 25% of elderly individuals urgently require intervention to address these locomotive disorders (6). The elderly population faces significant challenges, including a reduced ability to move forward due to pain and discomfort, particularly in the lower limbs. This difficulty is frequently exaggerated by the onset of the locomotive syndrome (L.S). L.S can also lead to secondary conditions in older individuals, such as osteoporosis, which can negatively affect joint stability. In cases where surgery is required, preoperative mobility is crucial for achieving optimal functional outcomes, especially in the context of L.S. an increase in individuals experiencing the delayed restoration of normal function post-orthopaedic procedures is observed (3). Another critical factor contributing to the locomotive syndrome is the natural process of aging (7, 8). Even though L.S manifests with acute symptoms, its initial onset is predominantly asymptomatic, as the pathology of the disease progresses, the signs of degeneration become evident to a level where further interventions become priority (3, 5). In Pakistan, the total population includes 7.64 million older adults, there is a scarcity of information concerning health-related issues in the geriatric population (9). This limited information highlights the urgent need of addressing the concerns associated with locomotive syndrome (L.S), as the mobility and level of independence in the elderly are intricately linked to this (10). A study examining the correlation between Osteoarthritis and Locomotive Syndrome investigates the prevalence and co-occurrence of locomotive organ syndrome alongside other conditions such as OA of knee and hip, lumbar spondylosis, and osteoporosis. The results indicate a prevalence of

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around 69.8 percent in stage 1 and 25.1 percent in stage 2 knee osteoarthritis, respectively (4). Astha et al. (2017) directed a concentrate on the evaluation of train disorder, which uncovered a huge absence of mindfulness and suitable instruments for assessing L.S. (8). In 2013, the Japanese Muscular Affiliation carried out the main arrangement of instruments to distinguish L.S, which incorporated a scale with 25 inquiries, a stand-up test, and a two-step test. A decrease in independence in regular errands is a sign of the decay of the condition. This study looks to offer huge experiences into the gamble levels and predominance of Train Condition (LS) in various gatherings, helping clinical professionals in the proactive avoidance and proficient administration of this normal medical problem Patients with knee osteoarthritis often suffer from low levels of mobility due to increased joint wear and tear and pain. The aging is directly related to decreased mobility, resulting from a gradual decline in muscle strength and increased balance problems. This research aims to address the differences in mobility between elderly people of the same age with and without KOA. By finding out these differences, this research would help to provide valuable insight into the nature of mobility challenges associated with L.S. and KOA, and would also help to provide targeted interventions and improved healthcare strategies for both affected populations.

METHODS:

This comparative cross-sectional study was conducted at the Railway General Hospital Rawalpindi spanning from July to December 2018, after ethical approval from the Review Committee of Riphah College of Rehabilitation Sciences. By utilizing the epi tool software, a sample size of 200 participants was calculated (15). Out of 200 participants, 100 were healthy elderly and 100 were with KOA. The participants were selected through a non-probability convenience sampling technique. The participants from the age range 65 to 75 years, clinically diagnosed knee osteoarthritis with grades II or III OA on Kellgren and Lawrence classification were included in the KOA group of the study, the elderly participants with the absence of any type of arthritis were included in the healthy group, while the participants with other types of arthritis, positive knee surgical history and lower limb arthroplasty, any other musculoskeletal or neurological impairment, and structural foot deformity which may affect the balance were excluded from participation. Assessment of L.S. was conducted using the Stand-Up Test, Two-Step Test, and GLFS-25 Questionnaire. The Stand-Up Test evaluates leg strength by incorporating four seats positioned at varying heights: 40 cm, 30 cm, 20 cm, and 10 cm. Participants initiate the test at 40 cm, sequentially rising from different seated positions, with bilateral rises initially and progressing to unilateral leg rises. The two-Step Test was used to assess stride length measurement and additionally, offers insights into the overall evaluation of mobility, muscle strength, balance ability, and flexibility of the lower extremity Initially, the participants positioned themselves with their toes placed behind this designated line. Subsequently, participants were instructed to take two substantial steps, followed by standing with both feet closely aligned. The measurement of the length of these two steps was done by a measuring tape, and the resultant value was determined by two-step length÷ participant's height. 25-question Risk Assessment was used to assess body pain and the performance of basic ADL during the last month (11, 12). The patients were categorized into Level I or Level II on locomotive risk test based on the criteria given by JOA. Participants categorized as risk level 1 exhibited specific characteristics, including difficulty rising from a 40 cm height with either leg, a Two-Step Test score below 1.3, and a verbal questionnaire score of 7 points or higher. Conversely, those classified as risk level 2 displayed an inability to rise from a 20 cm height using both legs, a Two-Step Test score lower than 1.1, and a score of 16 points or more on a 25-question assessment tool (1, 11). Time up and go is a highly reliable test used to assess the risk of falls (13), the participants covered a 3-meter path, got up from the chair returned, and took their seat (14), time taken for a person to complete this task was calculated. The cut-off value for the time up and go test was 12 seconds for the risk of fall (13). Five Times STS Test was employed to assess the fall risk (15). The participants sat on a firm chair, with arms folded over their shoulders, and were subsequently asked to stand up and sit down 5 times as fast as possible. The total time taken during the process was measured by stopwatch. Cut-off values for FTSST for risk of fall was 14 sec (13). The assessment also encompassed inquiries into mobility-related aspects such as stair climbing ability, history of falls, walking difficulties, challenges in road crossing, and the single leg standing. Prior to the commencement of data collection, all participants gave informed consent. The same battery of tests was administered to both populations to determine their respective risk levels for locomotive syndrome.

DATA ANALYSIS:

Data analysis was carried out through SPSS version 21. Normality was assessed through the Kolmogorv-Smirnov test, with $p < .05$, which demonstrated that data was non-normally distributed. Frequencies and mean SD of demographics and all tests were demonstrated. Furthermore, the Mann-Whitney U test was used to compare locomotive syndrome test level, TUG, FTSST, and risk factors for mobility with knee osteoarthritis.

RESULTS:

The study included 200 participants, with half of them being healthy individuals (n=100) and the other half being knee osteoarthritic (KOA) patients (n=100). The mean age of the KOA group was 68.05±5.44 years, while the average age of the healthy elderly group was 67.85±4.83 years. The Body Mass Index for the two groups was 30.2±6.08 and 29.3±5.23, respectively. Among the KOA group, 25% had osteoarthritis in one knee, and 25% had it in both knees. In the KOA group, 29% were classified as stage II, and 21% were at stage III of knee osteoarthritis. The statistical analysis of the assessments employed to evaluate the risk of locomotor disorders demonstrated notable differences between individuals with osteoarthritis and healthy counterparts. Specifically, the mean score accompanied by the standard deviation for the 25-question Risk Questionnaire among osteoarthritis subjects was 20.6±11.9, contrasting with a mean of 6.4±4.12 observed in the healthy cohort. Similarly, the mean value with standard deviation for the Two-Step Test in the osteoarthritis group was 0.92±0.19, whereas in the healthy population, it was 1.22±0.17. For osteoarthritis patients, the mean values with standard deviations for the TUG test and the Five Times STS Test were 14.9±4.07 and 24.8±7.8, respectively, and 9.4±2.14 and 13.9±4.19 for healthy people. Levels of L.S according to locomotive risk tests are given in Figures 1 and 2. Frequencies of risk factors of mobility are mentioned in (Table:1). Lastly, the Mann-Whitney U test, highlighted that a statistically significant difference was found in terms of mobility in the Knee OA population and normal population of the same age group ($p<0.05$) except for fall history ($p>0.05$), (Table:3).

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Figure 1: Levels of L.S of GLF-25, Two-Step Test& Stand-Up Test

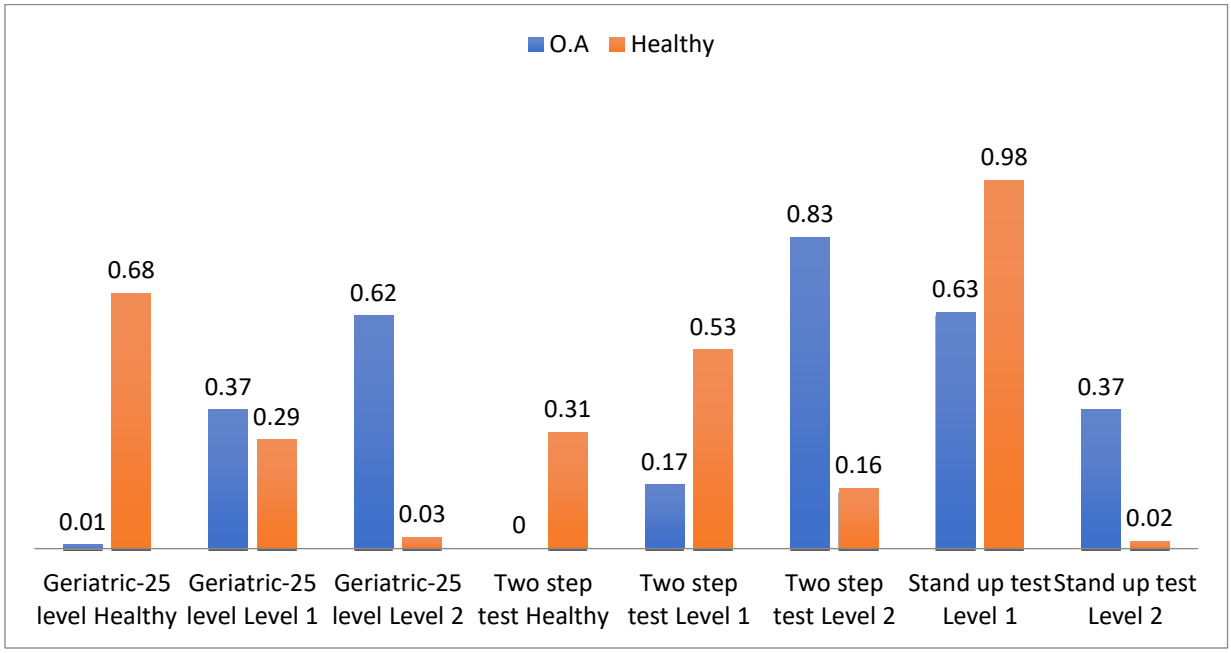

Figure 2: Frequency of Locomotive Risk Test

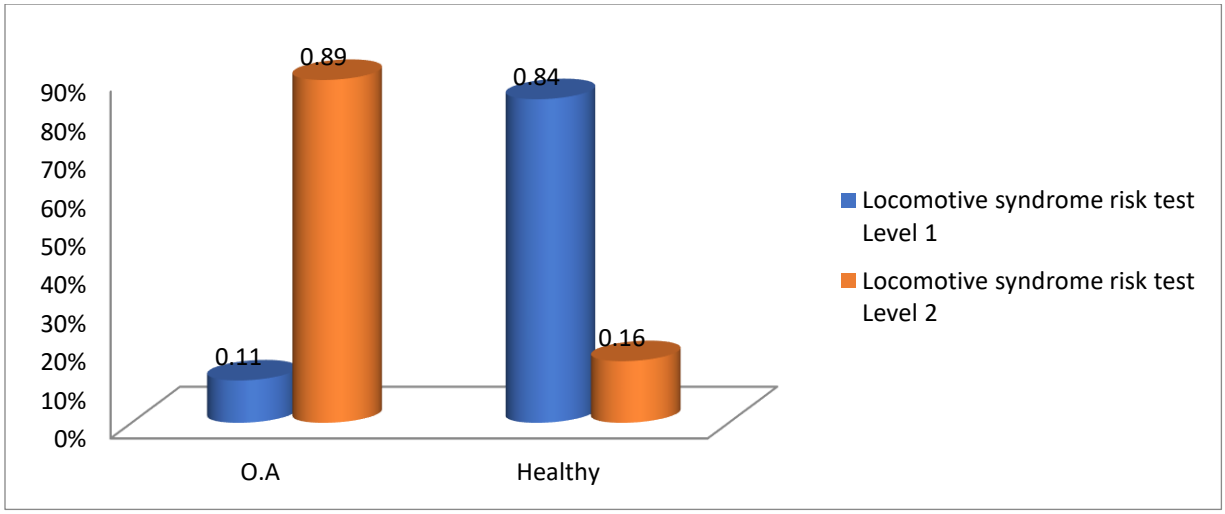

Table 1: Frequencies of factors affecting mobility

VARIABLES	Categories	KOA	HEALTHY
Difficulty In Stair Climbing	Yes	98%	53%
	No	2%	47%
Fall On Floor	Yes	22%	15%
	No	78%	85%
Difficulty In Cont. Walk	Yes	94%	36%

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	No	6%	64%
Difficulty In Road Crossing	Yes	85%	23%
	No	15%	77%
Difficulty In Single Leg Standing	Yes	94%	36%
	No	6%	64%

Table 2: (Mann-Whitney U test) Comparison between KOA and Healthy Groups.

VARIABLES	MEDIAN(IQR)		P-VALUE
	KO. A	HEALTHY	
L.S Risk Level	2 (0)	1 (0)	<0.001*
Time Up and Go Test	14.4 (5.26)	9.37 (2.65)	<0.001*
Five Times Sit to Stand Test	24.4 (11.15)	13.5 (5.76)	<0.001*
Difficulty In Stair Climbing	1 (0)	1 (1)	<0.001*
Fall On Floor	2 (0)	2 (0)	0.204*
Difficulty In Continuous Walk	1 (0)	2 (1)	<0.001*
Difficulty In Road Crossing	1 (0)	2 (0)	<0.001*
Unable To Stand on Single Leg	1 (0)	2 (1)	<0.001

*p<0.001

DISCUSSION:

This study was conducted to determine the difference in locomotive syndrome risk and fall risk in knee osteoarthritic and healthy elderly population. With increased age mobility is generally reduced due to balance issues, muscular weakness, and sensory impairment. In Knee OA the mobility is also reduced due to pain, structural changes within the joint, and impaired proprioception. A statistically significant difference was depicted in healthy elderly and patients with knee OA of the same age group. The study revealed that 11% of the knee osteoarthritis (KOA) population was categorized at level I of locomotive syndrome, whereas 84% of the healthy population fell into this category. Sixteen percent of healthy females and eighty-nine percent of knee OA patients were categorized at level two. These results indicate a heightened risk of Locomotive Syndrome among knee osteoarthritic patients compared to the general population. In a study by Takashi Oshawa et al. in 2015, it was found that 35% of the knee OA population was suffering at level I of locomotive syndrome, and forty percent at level II ($p<0.001$). Current investigation focused on the association between KOA and locomotive syndrome risk, aligning with the findings of the current study and providing further support for the observed relationship (16). The statistical analysis of the study indicates that among healthy elderly individuals, 29%, 37%, and 53% are classified at level 1 concerning GLFS, SU, and TST, respectively. For those at level II, these values decreased to 3%, 2%, and 16% in the healthy elderly population. These findings reflect the probability that a larger proportion of healthy elderly individuals fall into level I of locomotive syndrome, as indicated by the lower prevalence at level II across the assessed outcome measures (GLFS, SU, TST). As mentioned earlier, the Timed Up and Go (17) test exhibited a notable change in frequency within the study groups in the Mann-Whitney U test. Another research investigation focusing on the assessment of STS ability in individuals who had balance dysfunction concluded similar findings. These investigations and concluded results further support the findings of the current study. Noriko et al. (2015) concluded from their investigation that a higher percentage of females were at Level I of L.s., in consent with the current study (4). In the research, both the Five Times STS Test and the TUG test were administered to observe their effects on both study populations. The knee osteoarthritic group displayed a mean FTSST value of 24.8 seconds, while the healthy group had a significantly lower mean of 13.9 seconds. Allan Goldberg et al. conducted a study on the validity of FTSST in older adults, revealing that elderly individuals with balance impairments exhibited prolonged completion times in the FTSST compared to their normal female counterparts (18). A recent study indicated the TUG test was effective in predicting disability in activities of daily living (ADLs), with knee osteoarthritis (KOA) patients taking longer to complete the test compared to the control group (14). Questions regarding mobility difficulties, such as walking, climbing stairs, crossing the road, and SLS, were posed to participants from both groups. The evaluation discoveries demonstrated that women with knee osteoarthritis experienced more huge difficulties while taking part in these exercises contrasted with their sound partners. These discoveries line up with past investigations, for example, the review done by Florien et al. (2016). Their investigation discovered that patients with knee osteoarthritis (KOA) had more regrettable adherence to work-out schedules and are less genuinely dynamic contrasted with solid people ($p <0.001$) (19). A new report shows that 98% and 94% of people with knee osteoarthritis (KOA) experienced troubles when it came to rising steps and taking part in delayed times of strolling. The discoveries of this study demonstrate that patients experiencing knee osteoarthritis (KOA) have more difficulties while participating in exercises, for example, strolling and other

actual activities, in contrast with people who don't have KOA. The factual examination offered help for this determination, as demonstrated by a critical p-worth of 0.001, which recommends an outstanding contrast in apparent trouble levels between the two gatherings (19). A different examination evaluated the utilitarian capacity of people experiencing knee osteoarthritis (KOA). Investigated were the movement levels of people with knee osteoarthritis (OA) through exercises, for example, step climbing and brief times of strolling. The discoveries of this examination offer extra help to the ends attracted the ongoing review (20). The current examination contains a few requirements that might confine the degree to which the discoveries might be applied to a more extensive populace. These limits comprise of the incorporation of only one area or setting and the consideration of just specific levels of knee osteoarthritis. Extra examination is important to handle these limitations. In light of the current examination, the continuous investigation has verified that knee osteoarthritis considerably affects patients' versatility.

CONCLUSION:

The discoveries of this study show that people with knee osteoarthritis have a raised weakness to train condition, falls, and experience more prominent difficulties in performing regular undertakings when contrasted with senior people without knee osteoarthritis.

Author Contributions:

Conception and design: *Zahra Ghazanfar*
Collection and assembly of data: *Aruba Saeed*
Analysis and interpretation of the data: *Tayyeba Tahir*
Drafting of the article: *Fizah Mahnoor Khan*
Critical revision of article for intellectual content: *Hifsa Waheed*
Statistical expertise: *Aruba Saeed*
Final approval and guarantor of the article: *Hifsa Waheed*
Conflict of Interest: *None declared*

REFERENCES:

1. Kim Y, Suehara Y, Ishii M, Kawasaki T, Matsuoka K, Okubo T, et al. A comparative study of 2 screening tools for locomotive syndrome (The “Loco-check” and the “GLFS-25”): An orthopedic outpatient-based survey. British Journal of Medicine and Medical Research. 2016;17(5):1-13.
2. Kusumaningtyas M, Tamtomo D, Murti B. Factors associated with the occurrence of osteoarthritis: a path analysis evidence from Surakarta, Central Java. Journal of Epidemiology and Public Health. 2019;4(1):9-19.
3. Ivanenko YP, Cappellini G, Dominici N, Poppele RE, Lacquaniti F. Coordination of locomotion with voluntary movements in humans. Journal of Neuroscience. 2005;25(31):7238-53.
4. Yoshimura N, Muraki S, Oka H, Tanaka S, Ogata T, Kawaguchi H, et al. Association between new indices in the locomotive syndrome risk test and decline in mobility: third survey of the ROAD study. Journal of orthopaedic science. 2015;20(5):896-905.
5. Silverwood V, Blagojevic-Bucknall M, Jinks C, Jordan J, Protheroe J, Jordan K. Current evidence on risk factors for knee osteoarthritis in older adults: a systematic review and meta-analysis. Osteoarthritis and cartilage. 2015;23(4):507-15.
6. Ishijima M, Kaneko H, Hada S, Kinoshita M, Sadatsuki R, Liu L, et al. Osteoarthritis as a cause of locomotive syndrome: its influence on functional mobility and activities of daily living. Clinical Reviews in Bone and Mineral Metabolism. 2016;14(2):77-104.
7. Stergiou N. Nonlinear analysis for human movement variability: CRC press; 2018.
8. Patel AH, Arora AM, Patel NJ, Patel HG, Mansuri MM. ASSESSMENT OF LOCOMOTIVE SYNDROME: A PROSPECTIVE, OBSERVATIONAL STUDY IN COMMUNITIES OF GANDHINAGAR AND AHMEDABAD. 2017.
9. Misbah S, Kadir E, Roshan R, Khan IA, ur Rahman M. GERIATRIC PROBLEMS AWARENESS AMONG ADULTS IN RAWALPINDI. Pakistan Armed Forces Medical Journal. 2015(6):743.
10. Iwaya T, Doi T, Seichi A, Hoshino Y, Ogata T, Akai M. Characteristics of disability in activity of daily living in elderly people associated with locomotive disorders. BMC geriatrics. 2017;17(1):165.
11. Seichi A, Hoshino Y, Doi T, Akai M, Tobimatsu Y, Iwaya T. Development of a screening tool for risk of locomotive syndrome in the elderly: the 25-question Geriatric Locomotive Function Scale. Journal of Orthopaedic Science. 2012;17(2):163-72.
12. Matsumoto H, Hagino H, Wada T, Kobayashi E. Locomotive syndrome presents a risk for falls and fractures in the elderly Japanese population. Osteoporosis and sarcopenia. 2016;2(3):156-63.
13. Makizako H, Shimada H, Doi T, Tsutsumimoto K, Nakakubo S, Hotta R, et al. Predictive cutoff values of the five-times sit-to-stand test and the timed “up & go” test for disability incidence in older people dwelling in the community. Physical therapy. 2017;97(4):417-24.
14. Muramoto A, Imagama S, Ito Z, Hirano K, Ishiguro N, Hasegawa Y. Physical performance tests are useful for evaluating and monitoring the severity of locomotive syndrome. Journal of Orthopaedic Science. 2012;17(6):782-8.
15. Whitney SL, Wrisley DM, Marchetti GF, Gee MA, Redfern MS, Furman JM. Clinical measurement of sit-to-stand performance in people with balance disorders: validity of data for the Five-Times-Sit-to-Stand Test. Physical therapy. 2005;85(10):1034-45.
16. Ohsawa T, Yanagisawa S, Shiozawa H, Omodaka T, Saito K, Kitagawa T, et al. Relationship between knee osteoarthritis and the locomotive syndrome risk tests: a cross-sectional study. Journal of Orthopaedic Science. 2016;21(4):512-6.
17. Safaz I, Turk H, Yasar E, Alaca R, Tok F, Tugcu I. Gulhane Medical Journal. 2015;57(null):142.
18. Goldberg A, Chavis M, Watkins J, Wilson T. The five-times-sit-to-stand test: validity, reliability and detectable change in older females. Aging clinical and experimental research. 2012;24(4):339-44.