Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2019;8(2):311-5

# Static and dynamic balance between older individuals with and without chronic low back pain at the University College Hospital, Ibadan

**Ayodeji Ayodele Fabunmi, Oluwafikemi Adedolapo Badmus**

*University of Ibadan, College of Medicine, Department of Physiotherapy, Oyo State, Nigeria*

Received 31 August2018; Accepted 10 November 2018
Available online 10.01.2019 with doi:10.5455/medscience.2018.07.8955



**Abstract**

Balance is an essential component of an individual's gait and it has been found to decline with age. Chronic low back pain is a common musculoskeletal disorder among aging population. This study compared dynamic and static balance performance between older individuals with and without chronic low back pain. This study was a cross sectional survey design. Willing elderly individuals with and without low back pain were recruited at three different clinics to participate in this study. Information on age, gender, occupation, marital status and duration of onset of low back pain was obtained from all participants. Sharpened Romberg test was used to measure static balance, while functional reach test and time up and go test were used to measure dynamic balance. Data were analyzed using descriptive statistics of mean, range, percentages and Inferential statistics of independent 't' test. Alpha level was set at 0.05. Ninety- two participants (46 with chronic low back pain and 46 participants without chronic low back pain) with mean age of 67.02 years participated in this study. The participants comprised of 49 females (53%) and 43 males (47%). Elderly participants with chronic low back pain had significantly lower measure of functional reach test and significantly higher measure of time up and go test. Sharpened Romberg (eyes opened and eyes closed) test measure was significantly higher in participants without chronic low back pain than participants with chronic low back pain. Balance (static and dynamic) performance among elderly with chronic low back pain was significantly affected negatively. Routine evaluation and training of balance is advocated in management of elderly patients with chronic low back pain.

**Keywords:** Static balance, dynamic balance, chronic low back pain, elderly

## Introduction

Low Back Pain (LBP) is pain appearing between 12th rib and hip with or without leg pain [1] and is one of the leading musculoskeletal disorders, with a lifetime prevalence of up to 84% [2]. The cause of LBP could be mechanical (including non-specific musculoskeletal strains, herniated discs, compressed nerve roots, degenerative discs or joints disease and broken vertebra), non-mechanical (tumors, inflammatory conditions such as infections and spondylo-arthritis), or referred from internal organs (gallbladder disease, kidney stones, kidney infections and aortic aneurysm among others) [3].

Mechanical low back pain is the general term that refers to any type of back pain caused by placing strain on the muscles of the back [4]. Typically, mechanical pain results from bad habits, such as poor posture, poorly designed sitting, and incorrect bending and lifting motions. Non mechanical low back pain refers to any low back pain that is not caused by external physical force to the spine. Low back pain maybe classified by duration as acute (pain lasting less than 6 weeks), subacute (6 to 12 weeks) or chronic (more than 12 weeks) [5]. Chronic low back pain (CLBP) is established by the persistence of pain beyond 3 months of symptoms [6] and very often, the pain is non-specific, meaning that it is related to a mechanical origin [6].

Balance is an essential element in an individual's gait and daily life activities involving sight, hearing, vestibular apparatus, proprioceptive sense, position sense, muscular force, and cognition [7]. Postural control is defined as the act of maintaining, achieving or restoring a state of balance during any posture or activity [8]. It can be described as either dynamic or static. Static postural control is attempting to maintain a base of support while minimizing movement of body segments and the center of mass, while dynamic postural control involves the completion of a functional task with

***Coresponding Author:** Ayodeji Ayodele Fabunmi, University of Ibadan, College of Medicine, Department of Physiotherapy, Oyo State. Nigeria
E-mail: aafabunmi@yahoo.com

purposeful movements without compromising an established base of support [9].

Factors that influence balance include sensory information obtained from the somatosensory system, the visual system, vestibular system and motor responses from the motor system which affects coordination, joint range of motion and muscle strength [10]. Proprioception is sensed from mechanoreceptors of muscles, ligaments, and joints and retains stability and bearings of the body during its static and dynamic movements [11,12]. Postural control is achieved by the integration of the information regarding body movement sensed through the somatosensory system in the central nervous system and the appropriate reaction of the musculoskeletal system [13]. Decrease of mobility and stability of the waist occurs in patients with chronic low back pain, and these bring about a decline of muscle strength and coordination capability and a change in proprioception [14,15].

The disabilities of the musculoskeletal system affect balance performing ability and limit use of a proper exercise strategy in perturbation [16]. In particular, patients with low back pain have a decreased balance ability compared with normal individuals [17]. When the human body is exposed to an unexpected load, muscles have to respond quickly to maintain the body's balance and posture against the load. It is said that patients with low back pain will have problems with balance and maintaining posture caused by a delayed response time [18,19]. This study therefore compared balance performance between elderly individuals with and without chronic low back pain at the University College Hospital, Ibadan. Nigeria

## Material and Methods

This study was a cross-sectional survey. Ethical approval was sought and obtained from the University of Ibadan/University College Hospital (UI/UCH) Research Ethics Committee before the commencement of the study. Verbal consent was obtained from the head of the three units in the hospital and from each participant in this study.

### Participants

All consenting elderly patients with and without chronic low back pain above the age of 60 years were allowed to participate in this study. Elderly patients with chronic low back pain were diagnosed to have low back pain of more than 12 weeks duration from time of onset. Patients were recruited from 3 clinics (Physiotherapy out-patient clinic, Chief Anthony Anenih Geriatric Clinic, General out-patient clinic) in University College Hospital (UCH), Ibadan. Measurements were taken in the respective clinics where they were recruited in a treatment room.

### Procedure of measurement:

The following instruments and forms were used for collection of data:

1. Socio-demographic and clinical data form:
This was used to obtain socio-demographic information (age, sex, occupation, marital status).

### 2. Balance tests:

Static and dynamic balance test were used to asses balance performance among the participants (elderly individuals with and without chronic low back pain)

### Static balance test

Sharpened Romberg test eyes opened and eyes closed: this test was performed as described by Briggs et al [20]. A leveled floor was used and the participant assumed a heel-to-toe standing position with the dominant leg placed at the back of the non-dominant leg. This test was done with the shoes off and with the eyes opened or closed while standing on a white plain sheet of paper. The timing started after the participants assumed the proper test position and indicated their readiness and values were recorded in seconds. The time was stopped when any of the following occurred:

(a.) when the participant moves the foot/feet from the proper starting position or swayed.

(b.) when the participant opened his or her eyes in the eyes closed trial.

(c.) when the participant reached the maximum balance time of 60 seconds.

### Dynamic balance test

a. Functional reach test (FRT): measured the distance between the length of the arm and a maximal forward reach in the standing position, while maintaining a fixed base of support. It was developed as a dynamic measure of balance with no attempt to control for the movement strategy [21]. To perform the test, the patient stood comfortably parallel to a wall, make a fist, and raise their arms to 90 degrees of flexion. A meter rule was placed parallel to the patient's raised arm. The test was stopped when touched the wall or required any assistance from the examiner while trying to reach forward. The values obtained were recorded in centimeter.

b. Time 'up and go': the participant rose from a chair, walked three meters, turned, walked back and sat down. During the test, the patients wore their routine foot wear. No form of assistive device was allowed during the test. No physical assistance was also allowed during the test. A stopwatch was used to time each test and the time was recorded in seconds. The patients received no score when they were unable to complete the test or required assistance to refrain from losing their balance or falling during the test.

### Data Analysis

Descriptive statistics of frequency, percentages, mean, range and standard deviation were used to summarise participants' age, sex, marital status, occupation, duration of onset of low back pain, static and dynamic balance performance. Inferential statistics of Independent 't' test was used to compare the mean of functional reach test, time up and go test and Sharpened Romberg test (eyes opened and eyes closed) between elderly individuals with and without chronic low back pain. Alpha level was set at 0.05.

## Results

A total number of 92 participants (46 participants with chronic low back pain and 46 participants without chronic low back pain) were involved in this study conducted at the University College Hospital, Ibadan. Nigeria. The participants comprised of 49 females (53%) and 43 males (47%) as shown in (table 1) with an overall mean age of 67.02 years. Out of the 92 participants, 69

(75.0%) were married and 49 participants (53.0%) were retired from their occupations. Out of the 46 participants with chronic low back pain, 25 participants had chronic low back pain below 5 years, 15 participants had chronic low back pain between 5-10 years and 6 participants had chronic low back pain.

**Table 1.** Socio-demographic Characteristics of participants

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Sex** | | |
| Male | 43 | 47 |
| Female | 49 | 53 |
| **Age** | | |
| 60-64 | 29 | 32 |
| 65-69 | 32 | 35 |
| 70-74 | 26 | 28 |
| 75-79 | 5 | 5 |
| **Occupation** | | |
| Retirees | 49 | 53 |
| Trader | 12 | 13 |
| Civil servants | 11 | 12 |
| Clergy | 3 | 3 |
| Teacher | 2 | 2 |
| **Marital Status** | | |
| Married | 69 | 75 |
| Widowed | 18 | 20 |
| Divorced | 3 | 3 |
| Separated | 2 | 2 |

Independent 't' test was used to compare mean balance performance between individuals with and without chronic low back pain. There was a significant difference in the balance scores obtained between the two groups. The time up and go test measure in individuals with chronic low back pain ranged 6.47-28.68sec with a mean of 16.34±3.42sec while individuals without chronic low back pain ranged 5.97-25.26sec with a mean of 12.34±4.24sec as shown in (Table 2).

**Table 2.** Comparison of the mean scores of the static and dynamic balance tests between elderly individuals with chronic low back pain and without chronic low back pain using Independent 't' test

| Variables | Chronic low back pain | | without chronic low back pain | | p |
|---|---|---|---|---|---|
| | Mean± | S.D Range | Mean±S.D | Range | |
| | n = 46 | | n = 46 | | |
| **Dynamic balance test** | | | | | |
| TUG | 16.64±3.42 | 6.47-28.68 | 12.32±4.24 | 5.97-25.26 | <0.001 |
| FRT | 16.12±6.00 | 3.15-30.00 | 32.64±10.10 | 5.51-50.00 | <0.001 |
| **Static balance test** | | | | | |
| SR (EO) | 45.91±9.22 | 25.00-58.00 | 56.88±3.97 | 43.00-60.00 | <0.001 |
| SR (EC) | 33.42±10.30 | 8.00-53.00 | 47.19±12.30 | 13.00-60.00 | <0.001 |

Key
TUG: Time up and go test (sec)
FRT: Functional reach test (centimeters)
SR (EO): Sharpened Romberg test eyes opened (sec)
SR (EC): Sharpened Romberg test eyes closed (sec)

The functional reach test measure in individuals with chronic low back pain ranged 3.15-30.00cm with a mean of 16.12±6.00cm while individuals without chronic low back pain ranged 5.51-50.00cm a mean of 32.64±10.10 cm.

The Sharpened Romberg test measure with eyes opened, individuals with chronic low back pain ranged 25-58sec with a mean of 45.91±9.22sec while for individuals without chronic low back pain ranged 43-60 secs with a mean of 56.88±3.97sec. The Sharpened Romberg test measure with eyes closed, individuals with chronic low back ranged 8-53sec with a mean of 33.42±10.30sec while individuals without chronic low back pain ranged 13-60sec with a mean of 47.19±12.30 sec.

## Discussion

A total number of 92 participants (46 participants with chronic low back pain and 46 participants without chronic low back pain) were recruited to participate in this study. The outcome of this study showed that elderly patients without low back pain performed significantly better in dynamic and static balance test compared with elderly patient with chronic low back pain. Out of all the 92 participants, 43 (47%) were males while 49 (53%) were females, this is consistent with the findings from a study by Leveille et al [22] which reported that prevalence of chronic low back pain is higher in females than males. It was observed that 49 participants (53%) were retirees and were often at home. This is consistent with findings from a study which reported that sedentary lifestyle is implicated in incidence of low back pain [23] and this may explain why retirees in this study who are living a sedentary lifestyle are more prone to having low back pain.

The mean scores for the static balance test (Sharpened Romberg Test) was significantly greater with the eyes opened than with the eyes closed for both patients with chronic low back pain and without chronic low back pain. This implies that participants had better balance with their eyes opened compared to when the eyes were closed. Emphasis has also been placed on the importance of optical input in good balance control [24]. Unfortunately as individual increase in age the visual ability tends to decline having a negative effect of balance.

Result from the sharpened Romberg test (eyes opened and eyes closed) in this study showed that the mean values obtained for participants without chronic low back pain was significantly greater than the mean values obtained for participants with chronic low back pain. This implies that participants without chronic low back had better balance than the participants with chronic low back pain. This is consistent with the findings from the study by Da Silva et al [25] which reported that people with chronic low back pain had poorer balance than people without chronic low back pain.

Results from the functional reach test showed that the mean value obtained by participants with chronic low back pain was significantly lower than the mean value obtained by participants without chronic low back pain. The reason for this is explained in that participants with chronic low back pain had poor muscle strength and hence ability of muscles to contract in functional reach to maintain body posture is limited. Limitation in functional

reach could also be attributed to the pain experienced at the low back while the participants were trying to reach forward during the test. In addition pain can impair attention and concentration in older adult with chronic low back pain while performing the test [26] and attention is a required component of sensory integration needed for postural balance in the elderly [27].

In the selection of participants for this study, participants were not marched on the basis of gender, though there were just 6 more female participants than males in this study. This gender imbalance may have some influence on the outcome of the study, but this will not be significant.

Results from the time up and go test showed that the mean value obtained by participants with chronic low back pain was significantly greater than the mean value obtained by participants without chronic low back pain. This implies that participants with chronic low back pain took a longer time to stand up from their seated position and walk. This could be due to the pain experienced by the participants while trying to stand from their seated position and walk. This is in contrast to the study conducted by Ishak et al [28] who found out that despite the presence of chronic low back pain, the participants were still walking around at the clinic. The older individuals in the study by Ishak et al [28] were still able to walk around because the pain intensity is mild and hence they can still cope, hence their ability to walk and get involved in physical activities. It is believed that chronic pain limits both strength and endurance in muscle activity which could explain why participants with chronic low back pain took longer time to perform the timed up and go test. The greater the intensity of pain the greater the reduction in muscle strength and endurance observed in the patients with chronic low back pain

## Conclusion

There is significant decline in balance (static and dynamic) among individuals with chronic low back pain compared with elderly individuals without chronic low back pain.

## Recommendations

Physiotherapists should see the need to include balance training in the treatment regime of elderly individuals with chronic low back pain. Older individuals who are retired from their occupation should be encouraged to participate in physical activities instead of having a sedentary lifestyle that could predispose them to having low back pain.

**Acknowledgements**
*The authors gratefully acknowledge all the elderly participants in this study for their cooperation and assistance in willingness to participate.*

**Competing interests**
*The authors declare that they have no competing interest*

**Financial Disclosure**
*The financial support for this study was provided by the investigators themselves.*

**Ethical approval**
*Ethical approval was sought from University of Ibadan/University College Hospital Ethics Committee.*

*Ayodeji Ayodele Fabunmi ORCID: 0000-0003-2840-7665*
*Oluwafikemi Adedolapo Badmus ORCID: 0000-0003-3439-9390*

## References

1. Krismer M, Van Tulder M. Low Back Pain Group of the Bone and Joint Health Strategies for Europe Project. Strategies for prevention and management of musculoskeletal conditions. Low back pain (non-specific). Best Pract Res Clin Rheumatol. 2007;21:77–91.
2. Airaksinen O, Brox JI, Cedraschi C, et al. Management of chronic non specific low back pain. Eur Spine J. 2006;15:192-300.
3. Manusov EG. Evaluation and diagnosis of low back pain. Primary Care. 2012;39:471-9.
4. Patrick N, Emanski E, Mark AK. Acute and chronic low back pain. Med Clin North Am. 2016;100:169-81.
5. De Vet HC, Heymans MW, Dunn KM, et al. Episodes of low back pain: a proposal for uniform definitions to be used in research. Spine J. 2002;27:2409-16.
6. Rozenberg S. Chronic low back pain- definition and treatment. Rev Prat. 2008;58:265-72.
7. Prado JM, Stoffregen TA, Duarte M. Postural sway during dual tasks in young and elderly adults. Gerontol. 2007;53:274–81.
8. Pollock AS, Durwrad BR, Rowe PJ, et al. What is balance? Clin Rehabil. 2000;14:402-6.
9. Kissner C, Kolby LA. Therapeutic Exercise: Foundations and Technique. 6th edition. F.A Davies company, Philadelphia, 2012;260-5
10. Palmieri RM, Ingersoll CD, Cordova ML, et al. The effect of a simulated knee joint effusion on postural control in healthy subjects. Arch Phys Med Rehabil. 2003;84:1076-9.
11. Newcomer KL, Laskowski ER, Yu B, et al. Differences in repositioning error among patients with low back pain compared with control subjects. Spine J. 2000;25:2488-93.
12. Laskowski ER, Newcomer-Aney K, Smith J. Proprioception. Am J Phys Med Rehabil. 2000;11:323-40.
13. Nashner LM. Sensory, neuromuscular, and biomechanical contributions to human balance in:PM Duncan (Ed.) Balance: proceedings of the American Physical Therapy Association forum. APTA, Alexandria (VA); 1990:5–12.
14. Koumantakis GA, Watson PJ, Oldham JA. Trunk muscle stabilization training plus general exercise versus general exercise only: randomized controlled trial of patients with recurrent low back pain. Phys Therapy. 2005;85:209-25.
15. Chang WD, Lin HY, Lai PT. Core strength training for patients with chronic low back pain. J Phys Ther Sci. 2015;27:619-22.
16. Walker BF. The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. J Spinal Disorder. 2003;13:205-17.
17. Alexander KM, LaPier TL. Differences in static balance and weight distribution between normal subjects and subjects with chronic unilateral low back pain. J Orthop Sports Phys Ther. 1998;28:378-83.
18. Xia T, Ankrum JA, Spratt KF, et al. Seated human response to simple and complex impacts: paraspinal muscle activity. International J. of Ergon. 2008;38:767-74.
19. Huang Q, Li D, Zhang Y, et al. The intervention effects of different treatments for chronic low back pain as assessed by the thickness of the musculus transversus abdominis. J Phys Ther Sci. 2014;26:1383-5.
20. Briggs RC, Gossman MR, Berch R, et al. Balance performance among non-institution-alized elderly women. Phys Ther. 1989;69:748-56.

21. Ducan PW, Weiner DK, Chandler J, et al. Functional reach test: a new clinical measure of balance. J Gerontol. 1990;45:M192-7.

22. Leveille SG, Bandeen-Roche KJ, Won A, et al. Wide spread musculoskeletal pain and the progression of disability in older disabled women. Ann Inter Med. 2001;135:1038-46.

23. Sanchez N. Low back pain caused by sedentary lifestyle tops disability concern Science World Report 2014 http://guardianlv.com/low-back-pain-caused-by-sedentary lifestyle-tops-disbaility-concerns access date 17.1.2018

24. Bugnariu N, Fung J. Aging and selective sensorimotor strategies in the regulation of upright balance. J Neuroeng Rehabil. 2007;4:19

25. Da Silva RA, Vieira ER, Fernandes BP, et al. People with chronic low back pain have poorer balance than controls in challenging tasks. Disabil Rehabil. 2017;40:1294-300.

26. Weiner DK, Rudy TE, Morrow L, et al. The relationship between pain, neuropschological performance, and physical function in community-dwelling older adults with chronic low back pain. Pain Med. 2006;7:60-70.

27. Redfren MS, Jennings JR, Martin C, et al. Attention influences sensory integration for postural control in older adults. Gait Posture. 2001;14:211-6.

28. Ishak NA, Zahari Z, Justine M. Muscle Function and Functional Performance among Older Persons with and without Low Back Pain. http://dx.doi.org/10.1155/8583963 access date 17.1.2018