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THE IMPACT OF NON-SPECIFIC LOW BACK PAIN ON POSTURAL CONTROL, BALANCE, FALL, MOBILITY AND PHYSICAL ACTIVITY IN ELDERLY INDIVIDUALS: A COMPARATIVE STUDY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Studies investigating the effects of non-specific low back pain (NSLBP) on elderly individuals are limited in the literature. The study aimed to compare postural control, balance, physical activity and related factors in elderly individuals with and without the NSLBP.

Methods: The study was designed as a cross-sectional. A total of 67 elderly individuals (NSLBP group n=33 and control group n=34) were included in the study. Patients' pain intensity and disability levels were evaluated using Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI), respectively. Postural control and fall risk were measured using the Biodex Balance System. Participants' balance performance, mobility, fear of falling and physical activity levels were evaluated using functional reach test (FRT), timed up and go test (TUG), Falls Efficacy Scale International (FES-I) and International Physical Activity Questionnaire (IPAQ)-Short Form, respectively.

Results: While there was a significant difference between the two groups in all parameters of static postural stability test ($p<0.05$), no difference was found in dynamic postural stability, modified clinical sensory integration test, and fall risk index ($p>0.05$). The FES-I score ($p=0.003$) and the TUG time ($p=0.001$) were significantly higher in the NSLBP group than in the control group. The FRT distance ($p=0.001$) and the IPAQ score ($p=0.029$) were significantly lower in the NSLBP group than in the control group.

Conclusion: This study suggests that static postural control, balance, mobility, and physical activity are impaired in elderly individuals with NSLBP. Clinicians should take into account these disadvantages in planning rehabilitation programs in elderly individuals with the NSLBP.

Key Words: Elderly; Low Back Pain; Postural Control.

YAŞLI BİREYLERDE NON-SPESİFİK BEL AĞRISININ POSTÜRAL KONTROL, DENGE, DÜŞME, MOBİLİTE VE FİZİKSEL AKTİVİTE ÜZERİNE ETKİSİ: KARŞILAŞTIRMALI BİR ÇALIŞMA

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Non-spesifik bel ağrısının (NSBA) yaşlı bireyler üzerindeki etkilerini araştıran çalışmalar literatürde sınırlıdır. Çalışmamızın amacı NSBA olan ve olmayan yaşlı bireylerde postural kontrol, denge, fiziksel aktivite ve ilgili faktörleri karşılaştırmaktı.

Yöntem: Bu çalışma kesitsel bir çalışma olarak tasarlandı. Çalışmaya toplam 67 yaşlı birey (NSBA Grubu n=33 ve Kontrol Grubu n=34) dahil edildi. Hastaların ağrı şiddeti ve özürlülük düzeyleri Görsel Analog Skalası (GAS) ve Oswestry Özürlülük İndeksi (OÖİ) ile değerlendirildi. Postural kontrol ve düşme riski Biodex Denge Sistemi ile ölçüldü. Katılımcıların denge performansı, mobilite, düşme korkusu ve fiziksel aktivite düzeyleri sırasıyla fonksiyonel uzanma testi (FUT), zamanlı kalk yürü testi (ZKYT), Uluslararası Düşme Etkinlik Skalası (UDES) ve Uluslararası Fiziksel Aktivite Anketi (UFAA) -kısa form ile değerlendirildi.

Sonuçlar: Statik postural stabilite testinin tüm parametrelerinde iki grup arasında anlamlı fark bulunurken ($p<0,05$), dinamik postural stabilite, modifiye klinik duyu entegrasyon testinde ve düşme risk indeksinde fark yoktu ($p>0,05$). UDES skoru ($p=0,003$) ve ZKYT süresi ($p=0,001$) NSBA grubunda kontrol grubuna göre anlamlı olarak daha yüksekti. Ek olarak, FUT mesafesi ($p=0,001$) ve UFAA skoru ($p=0,029$), NSBA grubunda kontrol grubuna göre anlamlı olarak daha düşüktü.

Tartışma: Bu çalışma, NSBA olan yaşlı bireylerde statik postural kontrol, denge, mobilite ve fiziksel aktivitenin bozulduğunu göstermektedir. Klinisyenler, NSBA olan yaşlı bireylerde rehabilitasyon programlarının planlanmasında bu dezavantajları dikkate almalıdır.

Anahtar Kelimeler: Yaşlı; Bel Ağrısı; Postüral Kontrol.

INTRODUCTION

The average lifetime has substantially increased due to the advance in technology and medicine. However, diseases and physical disabilities (e.g., musculoskeletal complaints) increase in the ageing population (1). The prevalence of musculoskeletal pain in the elderly is over 50%, and low back pain is the most common (2). Non-specific low back pain (NSLBP) is defined as low back pain without recognizable specific underlying pathology (3). The NSLBP is an essential indicator of disease burden all over the world (4). The NSLBP affects people of any age, but it gets more frequent and complex with age (5).

Age-related changes (structural and physiological changes) also low back pain cause high disability rates in elderly individuals with the NSLBP (5). There are abnormalities in the motor control of deep trunk muscles, characterized by delayed neuromuscular recruitment in individuals with low back pain (6). Additionally, patients with low back pain have impaired lumbar proprioception compared with controls (7). These abnormalities that lead to postural control, balance and mobility problems increase disability in patients with the NSLBP (8,9).

Although it is well known that there are problems in balance and postural control in individuals with low back pain, the effects of this issue on the elderly are limited in the literature. However, the mechanism and prognosis of pain in the elderly are quite common and complex compared to the young. Knowing these problems' effects can improve low back pain management in older people (1). Therefore, our study aimed to compare balance, postural control and related factors in elderly individuals with and without the NSLBP.

METHODS

Study Design and Participants

Individuals aged 65 years or older with and without the NSLBP were included in this cross-sectional study. Patients who had low back pain for at least 12 weeks, no low back originating from various pathologies, such as the presence of cord compression, radiculopathy and history of spine surgery were included in the NSLBP group. People with neurological, orthopaedic or cognitive problems that could negatively affect the measurements were excluded from the study in both groups (10). Patients with the NSLBP, who admitted to İzmir Bozyaka Training and Research Hospital, the department of physical therapy between November 2014 and May 2015, were included in the study. The study was announced to control group advertising via social media and brochure. All participants provided written consent to participate in the study according to the Helsinki Declaration. Dokuz Eylül University ethics committee approved the study (Approval Date: 06.11.2014 and Approval Number: 2014/34-06).

Outcome Measures

The participants' demographic and descriptive data including age, gender, height, weight, body mass index (BMI), and the number of falls in the past year, the number of medications used, and comorbidities were recorded.

The low back pain intensity was evaluated using the Visual Analogue Scale (VAS). "0" expressed the absence of pain on the 10 cm straight horizontal line, and "10" expressed unbearable pain. Participants were asked to mark the severity regarding their pain on the scale (11).

The disability level associated with low back pain was evaluated using the Turkish version of the Oswestry Disability Index (ODI). Patients answered 10 questions in total, and each question was scored between 0-5. The patient's score was calculated as follows: (Received score/Maximum score) x 100. The total score ranges from 0 to 100, where a higher score indicates a higher level of disability. The Turkish version of the ODI was used (12).

In order to evaluate static and dynamic balance, the Biodex Balance System (BBS, Biodex Medical Systems, Shirley, New York, USA) was used. This system is used to measure the stability limits of individuals. Furthermore, the system examines the control of gravity centre on the support surface and balance abilities while struggling to make it move (13). A force platform capable of tilting the surface up to 20° in the 360° range of motion of this system is available. In this movable platform, "1" represents the most significant unstable level, "12" represents the lowest unstable level. This platform

is connected to its computer software, providing an objective assessment of balance. The Postural Stability Test and the Modified Clinical Test of Sensory Integration of Balance (mCTSIB) were applied to this system. The postural stabilities of the individuals were evaluated in two different ways, as static and dynamic. While the platform was set at a static level for the Static Postural Stability Test; the platform mobility was set at level 12 for the Dynamic Postural Stability Test. Measurements consisted of three tests, each of which lasts for 20 s, and rest periods of 10 s between each test. In the results of the tests anteroposterior (AP), mediolateral (ML) and overall (OV) stability index was obtained. The mCTSIB was used to assess participants' ability to use sensory inputs for balance. The test included four conditions: standing with eyes open and closed on a firm surface, standing with eyes open and closed on a foam surface. The sway index obtained in the result of the test was recorded. A higher score indicates a lower level of postural control (14).

Fall risks of individuals were evaluated using the Biodex Balance System (BBS, Biodex Medical Systems, Shirley, New York, USA). Pre-test platform level was set at "12" as the starting position and "8" as the ending position. A test protocol was created with three tests, each lasting 20 s, and rest periods of 10 s between each test. Results were recorded as the fall risk index score obtained with the average of these three tests. A higher score indicates a higher fall risk (15).

Fear of falling was assessed with the Turkish version of the Falls Efficacy Scale International (FES-I). This scale gives information about the risk of falling in the daily life of the individual. The scale consists of a total of 16 questions with each question scored 1 to 4. The cut-off score of the scale is 24. Higher values indicate a higher fear of falling (16).

The balance performance was determined using the functional reach test (FRT). The participants were asked to raise their dominant arm 90˚ and reach out forward as far as possible. The third metacarpal head position was recorded for a start. The distance in cm between the start and the end positions was recorded. During the test, the attention was paid not to take heels off the ground while reaching out forward and not to step. The test was repeated three times, and the average score was recorded. Higher values indicate higher balance performance (17). It showed that FRT distance of less than 25 cm indicated the risk of multiple falls in the elderly (18).

The mobility level was evaluated by using the timed up and go (TUG) test. During the test, the participant was seated in the chair. An object that can easily be detected by the participant was placed at a distance of 3 m. The participant stands up from the chair with the command "go," walk towards the object at a distance of 3 m, and turn around the object, walk back, and sit in the chair. The time to complete the TUG test was recorded. Higher time indicates lower mobility level (19). A score of 13.5 s indicates that the person may be prone to fall (20).

The Turkish version of the International Physical Activity Questionnaire (IPAQ) -Short Form was used to evaluate the level of physical activity. Severe and moderate physical activities of the participants in the last seven days and walking distances were asked. MET value was taken inside each section, and the total score was obtained with the sum of these scores. Higher scores indicate a higher physical activity level. The Turkish version of the IPAQ was used (21). The permissions for all the questionnaires were taken via e-mail.

Sample Size

The G*Power Software (ver. 3.1.9.2 Universität Düsseldorf, Düsseldorf, Germany) was used to determine the minimum number of participant required for each of two independent groups. A previous study has demonstrated that the NSLBP patients presented significantly sway (22). Based on the results of the reference study (22), the minimum required sample size for each group for a comparison analysis was calculated as 32 participants for each group for the probability level as 0.05, the anticipated effect size as 0.71, and the statistical power level as 80%. The 71 subjects were recruited into the study, allowing for a 10% dropout rate.

Statistical Analyses

The IBM® SPSS® Statistics for Windows software (Version 20.0., IBM Corp., Armonk, New York, USA) was used to analyze the data. Kolmogorov–Smirn-

ov test and histograms checked normality. Values were expressed as mean±standard deviation and median (25-75 quartiles) for continuous variables, and frequencies were reported for categorical variables. Chi-Square test was used to compare the categorical variables between the two groups. Student t test (when samples met parametric conditions) and Mann–Whitney U Test (when samples did not meet parametric conditions) were used to comparing the continuous variables between the two groups. Statistical significance was set at $p<0.05$.

RESULTS

A total of 71 geriatric individuals (the NSLBP group n=36 and control group, n=35) were included in the study. Three participants in the NSLBP group and one participant in the control group were excluded because they did not complete the tests. Finally, the study was completed with 33 participants in the NSLBP group, and 34 participants in the control group.

Demographics and clinical characteristics (age, gender, height, weight, BMI, number of medications, comorbidities), except the number of falls in the past year (p=0.042), of the groups were similar (p>0.05) (Table 1). The median value of pain duration and the VAS rest were 16.00 months and 2.00 cm; the mean value of the VAS activity and the ODI score was 6.55 cm and 51.87, respectively, in the NSLBP group.

While there was a significant difference between the two groups in all parameters of static postural stability test (p<0.05, Table 2), there was no difference in dynamic postural stability and modified clinical sensory integration test (p>0.05, Table 2). Additionally, both groups were similar in terms of fall risk index (p>0.05, Table 2).

The FES-I score (p=0.003) and the TUG time (p=0.001) were significantly higher in the NSLBP group than in the control group (Table 2). Additionally, the FRT distance (p=0.001), the IPAQ total score (p=0.029), and the IPAQ walking score (p=0.009) were significantly lower in the NSLBP group than in control group (Table 2). The IPAQ sitting time was significantly higher in the NSLBP group than in the control group (p=0.005, Table 2).

DISCUSSION

The main findings of our study revealed that static postural stability, balance performance and functional mobility decreased in older adults with the NSLBP. Additionally, in individuals with the NSLBP, increased fear of falling and decreased physical activity level was found.

While there are many studies in the literature evaluating postural control and low back pain, the number of studies conducted regarding older adults is limited (23). Karimi et al. showed that the ML and the OV stability index are different (AP stability in-

Table 1: Participants' Characteristics.

Variables	NSLBP Group (n=33)	Control Group (n=34)	p
Age (years)	71.60±4.32	71.58±5.06	0.980[a]
Females, n (%)	25 (76)	22 (65)	0.323[c]
Height (cm)	158.18±8.89	160.38±8.69	0.310[a]
Weight (kg)	75.00±9.61	75.17±11.69	0.947[a]
Body Mass Index (kg/m²)	30.11±4.23	29.28±4.47	0.443[a]
Number of Medications	4 (3-5)	4 (2-4)	0.564[b]
Falls (in the past year) (n)	1 (0-3)	0.50 (0-1)	0.042*[b]
Comorbidities	**n (%)**	**n (%)**	**p**
Hypertension	19 (57.57)	18 (52.94)	0.807[c]
Diabetes Mellitus	8 (24.24)	11 (32.35)	0.590[c]
Heart Failure	9 (27.27)	6 (17.64)	0.392[c]
Asthma	5 (15.15)	7 (20.58)	0.752[c]
COPD	2 (6.06)	4 (11.76)	0.673[c]

*p<0.05. [a]Student t test; [b]Mann-Whitney U Test; [c]Chi-square Test. Values are expressed as mean±standard deviation or median (25-75 quartiles) for continuous variables, and frequencies were reported for categorical variables. NSLBP: Non-specific Low Back Pain, COPD: Chronic Obstructive Pulmonary Disease.

Table 2: Comparison of Outcome Measures.

Variables	NSLBP Group (n=33)	Control Group (n=34)	p
	Mean±SD	Mean±SD	
Static Postural Stability			
Overall Stability Index	1.11±0.60	0.64±0.36	0.001*[a]
AP Stability Index	0.91±0.52	0.50±0.32	0.001*[a]
ML Stability Index	0.48±0.39	0.27±0.24	0.011*[a]
Dynamic Postural Stability			
Overall Stability Index	1.62±0.40	1.54±0.58	0.505[a]
AP Stability Index	1.13±0.47	1.17±0.59	0.761[a]
ML Stability Index	0.90±0.39	0.80±0.40	0.292[a]
Modified Clinical Test of Sensory Integration on Balance			
Eyes Opened Firm Surface Sway Index	0.61±0.20	0.55±0.17	0.230[a]
Eyes Closed Firm Surface Sway Index	0.92±0.30	0.98±0.25	0.383[a]
Eyes Opened Foam Surface Sway Index	1.36±0.43	1.37±0.33	0.894[a]
Eyes Closed Foam Surface Sway Index	3.07±0.65	3.19±0.85	0.501[a]
Fall Risk Assessment			
Fall Risk Index	1.83±0.79	1.79±0.70	0.813[a]
Fear of Falling			
FES-I (16-64)	34.54±12.30	26.00±10.05	0.003*[a]
Balance			
Functional Reach Test (cm)	26.15±5.47	30.87±5.11	0.001*[a]
Mobility			
Timed Up and Go test (s)	13.74±3.01	10.70±2.79	0.001*[a]
Physical Activity			
IPAQ Total (MET-min/week)	330 (176-782)	693.00 (439-1314)	0.029*[b]
IPAQ Vigorous (MET-min/week)	0(0-0)	0(0-0)	0.328[b]
IPAQ Moderate (MET-min/week)	0 (0-180)	12.00 (0-375)	0.610[b]
IPAQ Walking (MET-min/week)	297 (165-438)	495 (325-726)	0.009*[b]
IPAQ Sitting (min)	660 (450-750)	480 (300-600)	0.005*[b]

*p<0.05. [a]Student t test; [b]Mann-Whitney U Test. Values are expressed as mean±standard deviation or median (25-75 quartiles). NSLBP: Non-specific Low Back Pain, AP: Antero-posterior, ML: Medio-lateral, FES-I: Falls Efficacy Scale International, IPAQ: International Physical Activity Questionnaire.

dex similar) in young individuals with and without chronic low back pain (24). In a systematic review in which studies conducted in young and adult people, it was reported that people with low back pain had increased postural sway, especially in AP direction compared to healthy individuals, apart from two studies (23). It was demonstrated that while there was found significantly higher AP sway in the group with pain than without pain group, ML sway was similar between the groups in community-dwelling people aged 75 years and older (25). In another study in which older women with and without chronic low back pain were compared, it was stated that a significant difference between groups in terms of postural sway was not found (26). It has been seen that most of the studies on low back pain and postural control were conducted in middle-aged and young population in the literature. Furthermore, there is heterogeneity in the results and evaluation methods of the studies. In this study, it was concluded that the static postural stability in elderly people with NSLBP decreased compared to elderly people without low back pain. While in the studies conducted on the cases with

low back pain in the younger age groups in the literature, the increase in AP postural sway was emphasized, the increase both in AP and ML postural sway was observed in elderly people with the NSLBP in our study. This result shows that negative changes observed with age together with low back pain may also affect postural stability.

In addition, dynamic postural stability was similar between the groups. This similarity may have occurred due to trunk muscles affected in low back pain. While trunk muscles are related to static balance, lower extremity muscles are related to dynamic balance (27). A previous study showed that low back pain affects trunk muscles and leads to proprioceptive losses (28).

The FRT is useful for detecting balance impairment and change in balance performance over time (19). Rudy et al. showed that the FRT distance is significantly lower in the elderly with low back pain (29). In our study, balance performance was significantly lower in the NSLBP group than in the control group. Moreover, the mean FRT distance was approximately 25 cm in the NSLBP group. It indicates that the risk of multiple falls can be higher in the elderly with the NSLBP (18). These results show that it is essential to question chronic musculoskeletal pain in the evaluation of balance in the elderly.

In the study conducted by Querioz et al., TUG durations in elderly women with low back pain were significantly higher compared to healthy elderly people (30). In the current study, following the literature, the levels of mobility in the group with NSLBP were lower than the group without low back pain. It is considered that non-specific low back pain reduces the level of mobility in elderly people and, accordingly, leads to the limitation of activity together with the loss of balance. Moreover, the mean TUG time was higher than 13.5 s in the NSLBP group. It indicates that elderly individuals with NSLBP may be prone to fall (20).

Marshall et al. showed that back pain is associated with increased fall risk among older men (31). Additionally, low back pain increases fear of falling and disability, and fear of falling are correlated with each other in low back patients (32). Following the literature, falls and fear of falling was higher in patients with the NSLBP in our study. In addition, the mean FES-I score of both groups was higher than the cut-off value (FES-I score >24). It has demonstrated that fear of falling is high in both groups. Surprisingly, the fall risk index was similar in both groups. To the best of our knowledge, this study is the first to evaluate fall risk with the Biodex Balance System in elderly with the NSLBP. This finding may be due to the difference in the evaluation methods in the literature. There is a need for studies on this subject.

It was reported in the literature that the level of physical activity decreased with low back pain (29,33). In this study, it was concluded that the level of physical activity was significantly lower in patients with the NSLBP. The fact that low back pain leads to the avoidance of activity by causing losses in the balance and mobility level may cause physical inactivity.

The study had some limitations. First, muscle strength, which may affect physical performance, was not assessed. Second, the cross-sectional design of the study precludes inferences about the direction of causality among the variables.

This study is critical due to its being a comprehensive study which investigates the effects of NSLBP in the geriatric population. Our findings suggest that static postural control; balance, mobility, and physical activity are impaired in elderly individuals with the NSLBP. Additionally, increased fear of falling is seen in elderly individuals with the NSLBP as another trouble. Evaluation and rehabilitation program should be planned considering all these problems.

Sources of Support: None.

Conflict of Interest: The authors report no conflict of interest.

Ethical Approval: This study protocol was approved by Dokuz Eylul University Ethics Committee (Approval Date: 06.11.2014 and Approval Number: 2014/34-06)

Informed Consent: A written informed consent was obtained from each subject.

Peer-Review: Externally peer-reviewed.

Author Contributions: Concept – GÖ, Nİ; Design – GÖ, Nİ; Supervision – GÖ, Nİ; Resources and Financial Support – GÖ, Nİ; Materials – GÖ, Nİ; Data Collection and/or Processing – GÖ; Analysis and/or Interpretation – GÖ, Nİ; Literature Research – GÖ, Nİ; Writing Manuscript – GÖ, Nİ; Critical Review- GÖ, Nİ.

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