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Effects of Combined Strength Training and Stretching on Lumbar Disc Herniation in Older Adults

Sonay Serpil DAŞKESEN [1], Alperen, ŞANAL [2], Melissa ÜNSALAN [3] Ahmet KURTOĞLU [4]

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[1]Atatürk University, Faculty of Sports Sciences, Erzurum, Türkiye

[2]Independent Researcher, Çanakkale, Türkiye

[3]Girne American University, Faculty of Health Sciences, Girne, TRNC.

[4]Bandırma Onyedi Eylül University, Faculty of Sports Sciences, Balıkesir, Türkiye

Corresponding Author:
Sonay Serpil DAŞKESEN

sonayserpilalpdogan@gmail.com

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Abstract

This study aimed to investigate the effects of strength and stretching exercises on lumbar disc herniation (LDH) in older adults, focusing on pain reduction, increased mobility, and functional outcomes. Sixteen participants aged 65–75, with LDH diagnoses confirmed via MRI, were assigned to two groups using a non-random method; those unwilling to participate in the exercise program were included in the control group. Group 1 (Combined Strength and Stretching Group – SSG) performed a standard exercise program seven times a week for six weeks, while Group 2 served as the control group receiving no intervention. Baseline demographic and physical characteristics (age, height, weight, BMI) were similar between the groups. Pain intensity (Visual Analog Scale), mobility (straight leg raise test), and functional disability (Oswestry Disability Index) were assessed at baseline and after the intervention. Statistical analysis was conducted using a two-way repeated-measures ANOVA, focusing primarily on the group × time interaction; results were reported using F-values, p-values, 95% confidence intervals, and partial eta-squared effect sizes. The two-way repeated-measures ANOVA revealed a significant group × time interaction regarding pain intensity (VAS: $F(1,14)=81.918$, $p<0.001$, $\eta^2p=0.854$, 95% CI [4.6–6.1]), indicating a markedly greater reduction in pain in the SSG compared to the control group. Similar significant interactions were also observed for mobility (right leg: $F(1,14)=197.397$, $p<0.001$, $\eta^2p=0.934$; left leg: $F(1,14)=137.089$, $p<0.001$, $\eta^2p=0.907$) and functional disability (Oswestry: $F(1,14)=120.169$, $p<0.001$, $\eta^2p=0.896$). These findings indicate that a structured strength and stretching exercise protocol can effectively reduce pain, increase mobility, and improve functional outcomes in elderly individuals with LDH.

Keywords: Lumbar Disc Herniation, Older Adults, Exercise, Sport.

Yaşlılarda Kombine Kuvvet Antrenmanı ve Esneme Hareketlerinin Bel Fıtığı Üzerindeki Etkileri

Öz

Bu çalışma, ağrının azaltılması, hareketliliğin artırılması ve fonksiyonel sonuçlara odaklanarak, yaşlı bireylerde lomber disk hernisi (LDH) üzerine kuvvet ve esneme egzersizlerinin etkilerini araştırmayı amaçlamıştır. MRI ile LDH tanısı doğrulanmış 65–75 yaş arası on altı katılımcı, rastgele olmayan bir yöntemle iki gruba ayrılmış; egzersiz programına katılmak istemeyenler kontrol grubuna dahil edilmiştir. Grup 1 (Kombine Kuvvet ve Esneme Grubu - SSG), altı hafta boyunca haftada yedi kez standart bir egzersiz programı uygularken, Grup 2 herhangi bir müdahale yapılmayan kontrol grubu olarak yer almıştır. Gruplar arasında başlangıçtaki demografik ve fiziksel özellikler (yaş, boy, kilo, VKI) benzerlik göstermiştir. Ağrı şiddeti (Görsel Analog Skalası), hareketlilik (düz bacak kaldırma testi) ve fonksiyonel yetersizlik (Oswestry Yetersizlik İndeksi), başlangıçta ve müdahale sonrasında değerlendirilmiştir. İstatistiksel analizler, öncelikle grup × zaman etkileşimi etkisine odaklanılarak iki yönlü tekrarlanan ölçümlü ANOVA kullanılmış; sonuçlar F değerleri, p değerleri, %95 güven aralıkları ve kısmi eta kare etki büyüklükleri ile raporlanmıştır. İki yönlü tekrarlanan ölçümlü ANOVA, ağrı şiddeti açısından anlamlı bir grup × zaman etkileşimi ortaya koymuş (VAS: $F(1,14)=81,918$, $p<0,001$, $\eta^2p=0,854$, %95 GA [4,6–6,1]) ve bu durum, SSG'de kontrol grubuna kıyasla ağrıda belirgin şekilde daha fazla azalma olduğunu göstermiştir. Benzer anlamlı etkileşimler hareketlilik (sağ bacak: $F(1,14)=197,397$, $p<0,001$, $\eta^2p=0,934$; sol bacak: $F(1,14)=137,089$, $p<0,001$, $\eta^2p=0,907$) ve fonksiyonel yetersizlik (Oswestry: $F(1,14)=120,169$, $p<0,001$, $\eta^2p=0,896$) için de gözlemlenmiştir. Bu bulgular, yapılandırılmış bir kuvvet ve esneme egzersiz protokolünün, LDH'li yaşlı bireylerde ağrıyı etkili bir şekilde azaltabileceğini, hareketliliği artırabileceğini ve fonksiyonel sonuçları iyileştirebileceğini göstermektedir.

Anahtar kelimeler: Lumber Disk Hernisi, Yaşlı Yetişkin, Egzersiz, Spor.

Introduction

Lumbar disc herniation (LDH) is a pathological condition where the nucleus pulposus displaces from the intervertebral space, causing severe and progressively increasing pain in the back, hip, and leg. The herniated disc can compress the nerve and/or spinal cord, leading to back and leg pain (Zheng et al, 2021; Wang et al. 2024). This condition adversely affects many countries and is more prevalent in middle and low-income countries (Sany et al, 2021; Hartvigsen et al., 2018; Hossain et al., 2018). Although LDH can occur in all age groups (Frino et al., 2006), it is more common in the elderly population (Jung et al, 2020). The reasons for this include the physiological changes brought about by aging and a decrease in physical activity.

LDH causes back pain and lower extremity pain. In lumbar disc herniation, pain can arise from the mechanical compression of the nerve root and chemical irritation. Surgical treatment of this problem is performed to reduce the pressure on the nerve root. However, the recovery process in surgical intervention is long and painful. Previous studies indicate that 22-45% of patients experience sciatica pain and 30-70% experience back pain after LDH surgery (Arja et al., 2003; Balague et al., 1999; Dyorak et al., 1988; Weber, 1983). Additionally, approximately 60% of patients experience a decrease in mobility and a loss of strength after surgery (Häkkinen et al., 2005; Cassisi et al., 1993; Roy et al., 1989; Mayer et al., 1989). These circumstances have led patients with LDH to seek alternative treatments. A study states that 85% of patients prefer non-surgical treatment (Kreiner et al., 2014). One of these alternative methods is rehabilitation. The numerous benefits of exercise are well-documented in many studies (Lopez-Ortiz et al., 2023). In existing studies, rehabilitation programs vary greatly in terms of duration, intensity and timing (Hayden et al., 2005; Wang et al. 2024). Short-term intensive rehabilitation programs have been effective in improving functionality and reducing the time to return to work. However, in the long term, these interventions do not appear to make a significant difference in pain, disability, or return to work (Häkkinen et al., 2005). Various exercise programs have been suggested for the symptomatic treatment of LDH, including routine activities, McKenzie exercises, flexibility exercises, and core stabilization exercises (Pourahmadi et al., 2016). The type of exercise to be performed in elderly individuals must be carefully determined due to factors such as decreased protein synthesis, autophagy, motor unit loss, sarcopenia, and dynapenia in the elderly (Westcott & Baechle, 2010). Previous studies indicate that high-intensity strength training (1RM $\geq$ 70%) and aerobic training (maximum heart rate or maximum oxygen consumption $\geq$ 70%) in elderly LDH patients have led to symptoms such as joint damage in some elderly LDH patients (Wang et al. 2024; Saal, 1996). Therefore, strength exercises using free weights and stretching/flexibility movements are considered more appropriate exercises for the rehabilitation of LDH, especially in individuals over the age of 65. Additionally, strength training is safe for the

elderly and helps them regain muscle strength (Sany et al, 2021). Another study has shown that strengthening exercises are effective in alleviating chronic back pain and preventing disability in the elderly (Ishak et al., 2016; Hyoung, 2008).

Considering all these situations, there are two different gaps in the literature. The first of these is the age group to which exercise is applied, and the second is the type of exercise (Yıldırım & Gültekin, 2022). When non-invasive approaches are examined, stretching exercises and strength training stand out (Arslan & Ülger, 2025). Stretching exercises help increase flexibility and reduce pain (Gou et al., 2024), while strength training supports the spine by strengthening the muscles (Chang et al., 2024). However, studies investigating the effects of such approaches on elderly individuals are limited in the literature. The majority of existing studies focus on individuals aged 20–55 (Morkoç et al., 2025; Linhares et al., 2026). This study aims to investigate the effects of stretching and strengthening exercises on the treatment of lumbar disc herniation in elderly individuals.

H1: The combined strengthening and stretching exercise program will lead to a greater increase in straight leg raise (SLR) mobility compared to the control group.

H2: The combined strengthening and stretching exercise program will result in a greater reduction in Visual Analogue Scale (VAS) pain scores compared to the control group.

H3: The combined strengthening and stretching exercise program will produce a greater reduction in Oswestry Disability Index (ODI) scores compared to the control group.

Materials and methods

Model of the Research

This study involved a 6-week controlled experimental design with activities performed every day of the week (Büyüköztürk et al., 2024). The 6-week strength and stretching exercises were conducted according to a protocol based on established guidelines (Cameron & Monroe, 2007; Durstine et al., 2016). Participants were equally assigned to groups (Combined Strength and Stretching Group - SSG: 4 Men, 4 Women; Control Group: 4 Men, 4 Women). Those unwilling to participate in the exercise program were allocated to the control group. Individuals diagnosed with LDH who did not wish to undergo any treatment were assigned as the control group, while those willing to attend intensively 7 days a week were assigned as the experimental group. Initially, 24 individuals participated in the study. The participants' physical characteristics and medical histories were inquired about and recorded. Subsequently, the participants were informed about the research.

The intervention was designed as a combined program in which strength and stretching exercises were performed in the same session.

Study Group

Sample Size

Calculated using the G*Power 3.1 software (Kiel University, Germany). The study was designed based on previous research (Hayden et al., 2005; Wang et al., 2024). According to the G*Power 3.1.9.7 analysis results based on a 95% confidence interval and 80% power the calculations indicated that a minimum of 8 individuals per group was required (accounting for potential dropouts). The parameters set include $\alpha = 0.05$, power (1-β err prob) = 0.95, and effect size = 0.27, indicating a minimum of 10 participants for an actual power of 85%.

Inclusion and Exclusion Criteria

Participants received information about the research. Those interested in joining the program joined the study. The study excludes participants who smoke or consume alcohol. At this stage, 2 individuals decided not to proceed with the tests and left the study. Individuals aged 65-75 participate. During this phase, 2 participants leave the study. The research includes only individuals with Lumbar Disc Herniation. Four individuals with additional issues such as meniscus tears, retrolisthesis, or anterolisthesis do not participate. After these stages, 16 participants remain in the study (Figure 1).

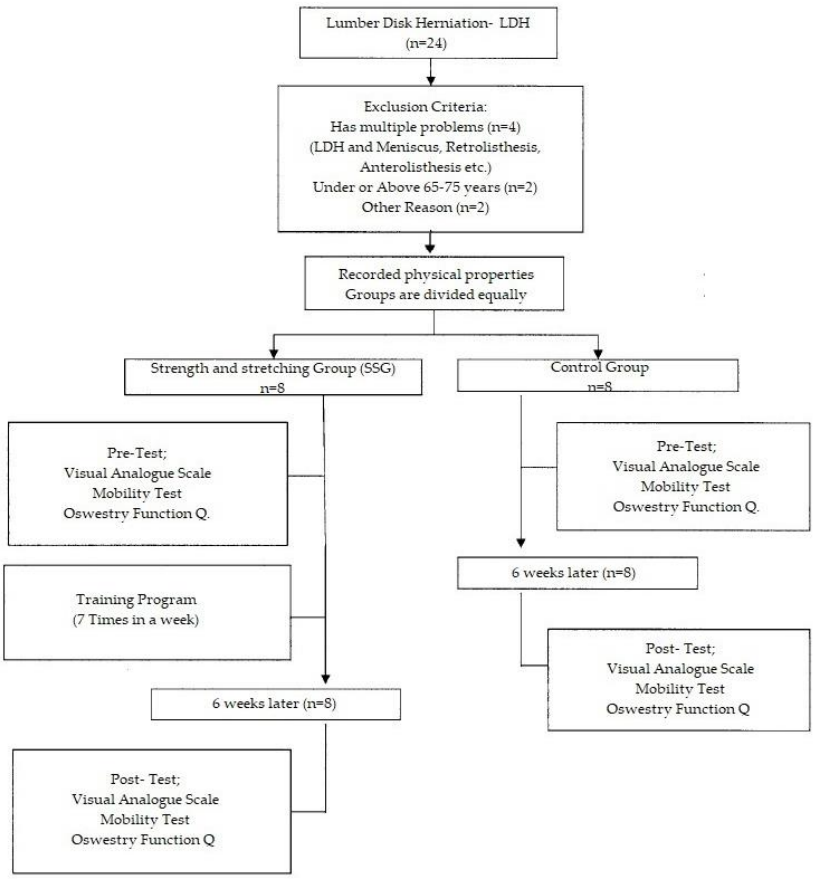


Figure 1. Experimental Design of Study.

Sixteen individuals (8 women and 8 men) aged 65–75 years, diagnosed with lumbar disc herniation, participated in the study. The physical characteristics of the individuals participating in the study are given in Table 2. Diagnosis was confirmed by MRI (predominantly at L4–L5 and L5–S1 levels) and clinical evaluation by a physiotherapist. Participants with previous lumbar surgery, chronic medication use, or concurrent treatments were excluded. Individuals with major comorbidities (e.g., cardiovascular or metabolic diseases) or additional musculoskeletal disorders (e.g., meniscus tears, retrolisthesis, anterolisthesis) were not included. All participants were sedentary, performing only light daily routines, and were instructed to maintain these routines until the final data collection session. Written informed consent was obtained from all participants.

Exercise Protocol

The SSG participants underwent a strength and stretching exercise program. Exercise customization is generally recommended for the group aged 60 and above. However, this could introduce confounding factors in the research. Therefore, exercises were selected from those feasible for all SSG participants. Exercises that posed challenges for SSG participants were excluded from the program. The scope and duration of the exercise program were structured in accordance with the American College of Sports Medicine (ACSM) guidelines titled "Exercise Management for Individuals with Chronic Diseases and Disabilities" (Durstine et al., 2016). Although intensive 7-day-a-week protocols are less frequently reported for older adults (Garber et al., 2011), the exercise frequency (seven sessions per week) was planned to be appropriate for older adults with chronic diseases, aligning with ACSM recommendations; however, future studies should examine the feasibility of this frequency in greater detail. Table 1 presents the final exercise protocol. The exercise program was designed to utilize low-resistance elastic bands and body weight. Exercise intensity, set at a moderate level, was monitored using the Borg scale. Each session consisted of three sets of 15 repetitions. Stretching exercises were performed at a controlled pace; each stretch was held for 20–30 seconds, with 2–3 repetitions performed for the target muscle group. A rest period of 1–1.5 minutes was allowed between sets. The exercise program was progressively intensified every two weeks. The program was designed and administered by a physiotherapist holding a master's degree in a physiotherapy laboratory.

Table 1

Excercise Protocol for the SSG.

Weeks	Time	Strengthening Exercises (3×15)	Stretching Exercises (20–30 sec, 2–3 reps)
1	45 min	Prone Bridge, Glute Bridge	Hamstring Stretching, Lumbar Rotation Stretching
2	45 min	Straight Leg Raise, Prone Straight Leg Raise, Superman Exercise, Flutter Kicks	–

3	45 min	–	Lumbar Extensor Stretching (One leg and Double leg), Piriformis Stretching, Gastrocnemius Stretching
4	45 min	Straight Leg Raise, Prone Straight Leg Raise, Superman Exercise, Flutter Kicks	–
5	45 min	Prone Bridge, Glute Bridge, Straight Leg Raise, Prone Straight Leg Raise, Superman Exercise, Flutter Kicks	Hamstring Stretching, Lumbar Rotation Stretching, Lumbar Extensor Stretching, Piriformis Stretching, Gastrocnemius Stretching
6	45 min	Prone Bridge, Glute Bridge, Straight Leg Raise, Prone Straight Leg Raise, Superman Exercise, Flutter Kicks	Hamstring Stretching, Lumbar Rotation Stretching, Lumbar Extensor Stretching, Piriformis Stretching, Gastrocnemius Stretching

Data Collection

Prior to the start of the exercise program, assessments of physical characteristics, the Visual Analog Scale (VAS), mobility, and the Oswestry functional test were conducted for all participants. No intervention was applied to the control group. The experimental group, however, underwent an exercise program seven days a week for six weeks. Meanwhile, the control group was instructed not to exercise and to maintain their normal routines. At the end of the six-week period, all measurements were repeated for both the experimental and control groups. To minimize the impact of mental fatigue, assessments were carried out between 09:00 and 11:00. Participants were instructed to sleep for at least seven hours the night before the test and to avoid alcohol consumption and strenuous physical activity on the preceding day.

Visual Analog Scale (VAS) Test

On this scale, 0 indicates the absence of pain, while 10 indicates unbearable pain. Participants were asked to mark the intensity of the pain they felt on the line during the assessment. The distance measured in millimeters from the zero point was recorded as the pain score. The VAS assessment was administered before and after each intervention session. This method is considered reliable and valid for pain assessment (Wewers & Lowe, 1990).

Mobility Assessment Test

In this test, the hip flexion angle on both sides was evaluated. To this end, the Straight Leg Raise (SLR) test was administered to the participants. Hip flexion angles were recorded in degrees using a goniometer. The goniometer was positioned with its stationary arm parallel to the edge of the table, its movable arm aligned with the lateral midline of the thigh, and its axis centered over the upper half of the greater trochanter (Hsieh et al., 1983).

Oswestry Functional Questionnaire

This assessment is used to determine the extent to which patients' general functioning is affected by low back pain (Fairbank et al., 1980; Hudson-Cook, 1989). Previous studies indicate that

the Oswestry Functional Questionnaire is more reliable than other tests for measuring physical function in cases of low back pain (Chiarotto et al., 2016). The Turkish validity and reliability of the questionnaire have been established (Yakut et al., 2004). The Oswestry Functional Questionnaire consists of 10 questions, each with 6 response options ranging from 0 to 5 points. Patients selected the statement that best described their condition. The maximum score reaches 50. The patient's score converts to a percentage based on the answered questions. The evaluation criteria are as follows: 0–20%: minimal disability, 20–40%: moderate disability, 40–60%: severe disability, 60–80%: crippled, 80–100%: bed-bound or symptom exaggeration.

Physical Measurements

Participants' height was measured using a stadiometer, and body weight was measured using a Tanita MC-780 bioelectrical impedance analysis (BIA) device. Body Mass Index (BMI) was calculated using the kg/m^2 formula (Pelc et al., 2024).

Analysis of Data

Statistical analysis was performed IBM SPSS Statistics software for Windows, vn. 25.0 (IBM Corpn., Armonk, NY, USA). Conformity of the data to normal distribution was assessed using the Shapiro-Wilk test. Descriptive statistics for measured variables were given as mean ± SD values. To evaluate the effects of group (SSG vs. control), time (pre vs. post), and their interaction, a two-way repeated measures ANOVA was conducted. The primary focus was on the group × time interaction effect, reported with F values, p values, 95% confidence intervals, and partial eta squared effect sizes (ηp^2). The level of statistical significance was accepted as $p < 0.05$ for all tests.

Ethics of Research

The study was approved by the Graduate Ethics Committee of Çanakkale Onsekiz Mart University (approval date and number: 2024-10/11; 2024-YÖNP-0551) and conducted in accordance with the principles of the Declaration of Helsinki. Throughout the conduct of the present study, the principles set forth in the 'Directive on Scientific Research and Publication Ethics of Higher Education Institutions' were strictly adhered to.

Results

In Table 2, it was determined that there was no significant difference between the SSG and control groups participating in the study ($p>0.05$). This indicates that the experimental and control groups possess similar physical characteristics.

Table 2

Distribution of Physical Characteristics of SSG and Control Groups.

Variable	SSG (n=8) x̄±Sd	Control Group (n=8) x̄±Sd	t	p
Age (year)	67.50±2.82	67.12±4.64	0.195	0.848
Height (cm)	164.87±10.81	167.37±4.92	-0.595	0.561
Weight (kg)	80.62±11.95	77.00±7.91	0.715	0.486
Body Mass İndex (kg/m²)	29.73±4.13	28.19±3.46	0.805	0.434

SSG: Combined Strenght and Stretching Group

When the SSG and Control groups were examined using Two-Way Mixed ANOVA, a significant interaction effect was found between time and group for the Visual Analog Scale ($p<0.001$; $F=81.918$; $\eta^2p=0.854$). Additionally, significant main effects were identified for time ($p<0.001$; $F=81.918$; $\eta^2p=0.854$) and group ($p=0.002$; $F=14.039$; $\eta^2p=0.501$). According to the simple effects analysis, a significant difference was found between the pre-test and post-test values of the SSG ($p<0.001$; $F=275.383$; $\eta^2p=0.975$), whereas no significant difference was observed in the Control Group ($p=1.000$; $F=0.000$). Furthermore, a significant difference was identified between the post-test values of the SSG and the Control Group ($p<0.001$; $F=58.767$; $\eta^2p=0.808$). This indicates that the SSG had lower pain scores (Table 3).

Table 3

Comparison of the Pre-Test and Post-Test Values of the SSG and Control Group with Two-Way ANOVA Results

Variable	Group	Pre-Test (M±SD)	Post-Test (M±SD)	95% CI (Difference)	Group Effect F(df), p, ηp²	Time Effect F(df), p, ηp²	Group × Time Interaction F(df), p, ηp²
VAS	SSG	7.38±1.30	2.00±1.41	4.6–6.1	F(1,14)=14.039, p=0.002, ηp²=0.501	F(1,14)=81.918, p<0.001, ηp²=0.854	F(1,14)=81.918, p<0.001, ηp²=0.854
VAS	CG	6.75±0.89	6.75±1.04	-0.39–1.1			
SLR Right Leg	SSG	55.75±12.42	110.25±10.63	-60.6–-48.3	F(1,14)=18.092, p<0.001, ηp²=0.564	F(1,14)=212.431, p<0.001, ηp²=0.938	F(1,14)=197.397, p<0.001, ηp²=0.934
SLR Right Leg	CG	61.50±8.26	62.50±9.13	-2.48–-0.4			
SLR Left Leg	SSG	56.25±13.50	111.25±10.61	-62.5–-47.4	F(1,14)=24.914, p<0.001, ηp²=0.640	F(1,14)=154.292, p<0.001, ηp²=0.917	F(1,14)=137.089, p<0.001, ηp²=0.907
SLR Left Leg	CG	59.25±6.69	60.88±7.90	-5.4–-0.2			
ODI	SSG	58.75±10.28	9.88±4.36	42.1–55.6	F(1,14)=51.437, p<0.001, ηp²=0.786	F(1,14)=121.405, p<0.001, ηp²=0.897	F(1,14)=120.169, p<0.001, ηp²=0.896
ODI	CG	59.00±5.37	58.88±8.64	-2.3–3.3			

$p<0.05$, ηp^2: Partial Eta Squared, CG: Control Group, SSG: Combined Strenght and Stretching Group

When the SSG and Control groups were examined using Two-Way Mixed ANOVA, a significant interaction effect was found between time and group for the Mobility Assessment of the Right Leg ($p<0.001$; $F=197.397$; $\eta^2p=0.934$). Additionally, significant main effects were identified

for time ($p<0.001$; $F=212.431$; $\eta^2p=0.938$) and group ($p<0.001$; $F=18.092$; $\eta^2p=0.564$). According to the simple effects analysis, a significant difference was found between the pre-test and post-test values of the SSG ($p<0.001$; $F=433.161$; $\eta^2p=0.984$), whereas no significant difference was observed in the Control Group ($p=0.155$; $F=2.545$). Furthermore, a significant difference was identified between the post-test values of the SSG and the Control Group ($p<0.001$; $F=92.827$; $\eta^2p=0.869$). This indicates that the SSG had greater mobility in the right leg (Table 3).

When the SSG and Control groups were examined using Two-Way Mixed ANOVA, a significant interaction effect was found between time and group for the Mobility Assessment of the Left Leg ($p<0.001$; $F=137.089$; $\eta^2p=0.907$). Additionally, significant main effects were identified for time ($p<0.001$; $F=154.292$; $\eta^2p=0.917$) and group ($p<0.001$; $F=24.914$; $\eta^2p=0.640$). According to the simple effects analysis, significant differences were found between the pre-test and post-test values of both the SSG ($p<0.001$; $F=298.239$; $\eta^2p=0.977$) and the Control Group ($p=0.014$; $F=10.658$; $\eta^2p=0.604$). However, the effect size was substantially larger in the SSG. Furthermore, a significant difference was identified between the post-test values of the SSG and the Control Group ($p<0.001$; $F=116.066$; $\eta^2p=0.892$). This indicates that the SSG had greater mobility improvement in the left leg compared to the Control Group (Table 3).

When the SSG and Control groups were examined using Two-Way Mixed ANOVA, a significant interaction effect was found between time and group for the Oswestry Function Questionnaire ($p<0.001$; $F=120.169$; $\eta^2p=0.896$). Additionally, significant main effects were identified for time ($p<0.001$; $F=121.405$; $\eta^2p=0.897$) and group ($p<0.001$; $F=51.437$; $\eta^2p=0.786$). According to the simple effects analysis, a significant difference was found between the pre-test and post-test values of the SSG ($p<0.001$; $F=294.083$; $\eta^2p=0.977$), whereas no significant difference was observed in the Control Group ($p=0.928$; $F=0.009$). Furthermore, a significant difference was identified between the post-test values of the SSG and the Control Group ($p<0.001$; $F=205.042$; $\eta^2p=0.936$). This indicates that the SSG had less functional disability (Table 3).

Discussion and Conclusion, Suggestions

The aim of this study was to investigate the effects of strength training and stretching on older adults with LDH. The research results showed that strength and stretching exercises have positive effects on older adults with LDH. These positive effects were observed in increased mobility and decreased pain. The primary finding is the significant group × time interaction, indicating that changes over time differed between the exercise and control groups. While the control group showed a significant improvement in left leg mobility ($p=0.014$), no significant changes were observed in pain, right leg mobility, or functional disability.

LDH is a significant condition affecting many age groups within the population. The general consequences of lumbar disc herniation typically result in back and leg pain for the individual. Clinical research indicates that exercise has multifaceted positive effects on LDH. These effects include reductions in back pain associated with LDH and increases in mobility (Gülsen et al., 2019; Khanzadeh et al., 2020; Xu et al., 2020; Selim et al., 2022; Taşpınar et al., 2023). Additionally, improvements in flexibility, balance, and coordination have been reported (França et al., 2013; Lu et al., 2014; Gülsen et al., 2019). There are various exercise methods to mitigate the adverse effects of LDH (Zhou et al., 2022; Iosub et al., 2023; Shen et al., 2009; Yıldırım & Gültekin, 2022). Studies in the literature have shown that strengthening the back and core muscles can alleviate back pain associated with lumbar disc herniation. However, these studies primarily focus on middle-aged individuals (20-55 years old) (Hayden et al., 2005; Wang et al., 2024). In our study, we targeted an older age group because physical aging becomes more pronounced as people age (Amarya et al., 2018). Aging brings many physical challenges for older adults. Research shows that aging is associated with conditions such as sarcopenia, osteoporosis, decreased mitochondrial numbers, cellular senescence, and weakened nerve conduction (Farley et al., 2011). The adverse effects of LDH are more pronounced in the elderly compared to younger adults and middle-aged individuals; the reduced impact observed in the latter groups is attributed to their superior physical capacity. However, exercise can have a positive effect on pain reduction, particularly in older adults, though it must be implemented with caution. Research indicates that exercises involving loads ≥70% of the one-repetition maximum (1RM), or intensities ≥70% of maximum heart rate or maximum oxygen consumption, may lead to adverse effects in older adults with LDH (Wang et al., 2024; Saal, 1996). Consequently, it is suggested that bodyweight exercises are more suitable than high-intensity workouts or weight training for this demographic (Durstine et al., 2016).

Our study determined that combined stretching and strengthening exercises have positive effects on lumbar disc herniation (LDH). These findings align with prior research in the literature. In this context, studies have shown that hamstring stretching exercise programs used in the rehabilitation of LDH and low back pain yield positive results (Paul, 2001). Similarly, another study applied two different stretching exercises to individuals with low back pain and observed positive effects on the participants (Rezk-Allah et al., 2011). Additionally, the intervention in this study was administered three days a week. Another study examining the effect of core stretching exercises on lower back pain revealed that such exercises can have a positive effect on lower back pain (Houglum, 2001; Prentice, 2006). In another study, a stretching exercise program was added to the lumbar traction rehabilitation program. This resulted in positive improvements in VAS scores (Yang & Yoo, 2014).

Our findings regarding strengthening exercises align with the literature. Studies report that strengthening exercises targeting specific anatomical regions particularly the back and surrounding

muscle groups—are effective in reducing lumbar disc herniation (LDH) and associated low back pain (Kim et al., 2013; Lee et al., 2013; Sipaviciene & Kliziene, 2020; Li, 2021). Another study concluded that exercise is more important than surgical or pharmacological treatments in the management of LDH-related low back pain (Bernstein et al., 2017). This finding supports our study, given the positive improvements observed in Oswestry Disability Index and VAS pain scores. In the present study, a combined exercise program spanning seven days a week was implemented. In contrast, studies indicate that short-term exercise programs are insufficient for providing long-term benefits to participants (Kim et al., 2010). Viewed in this light, the findings suggest that long-term exercise regimens may yield more favorable outcomes.

In the literature, studies employing combined exercise programs are preferred over those using isolated exercise programs. A study conducted by Stankovic et al. (2012) found that a combined exercise program was more effective than a single-exercise program. Furthermore, studies indicate that combined exercises are effective in reducing lumbar disc herniation (LDH) and low back pain (Hayden et al., 2005a; Hayden et al., 2005b; Richardson et al., 1999; McGill et al., 2003; Claims et al., 2006; Koumantakis et al., 2005; Rohini et al., 2007).

The present study found that the combined use of stretching and strengthening exercises yielded significant improvements for elderly individuals with LDH. However, this does not constitute a definitive treatment method for individuals with LDH.

The limitations of this study can be listed as follows:

- A small sample size that limits the generalizability of the findings,
- The fact that participants were not randomly assigned to groups,
- The use of a combined exercise program for the experimental group, which makes it difficult to isolate the effects of a single type of exercise,
- The inclusion of functional assessments, which may reduce the objectivity of the results,
- A high-intensity exercise program with the potential to lead to adverse outcomes, such as joint damage, in different contexts.

Author's Notes: This research was presented as a poster at the Congress on Innovative Approaches in Physiotherapy, held on March 26–27, 2026.

Abbreviations

LDH: Lumbar Disc Herniation

SSG: Strength and Stretching Group

BIA: Bioelectrical impedance analysis

VAS: Visual Analouge test

SLR: Straight Leg Raising

Q: Questionnaire

Ethics Committee Permission Information

Ethics review board: Graduate Ethics Committee of Çanakkale Onsekiz Mart University

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Authors' Contributions

The idea development and conceptualization processes of the study were carried out by the first and second authors. The study design and methodological processes were conducted by the first and second authors. The data collection process was carried out by the third author. The data processing, statistical analyses, interpretation of the findings, and the Method and Results sections were prepared by the fourth author with contributions from the second author. The Introduction section was prepared by the first, second, and third authors. The Discussion and Conclusion sections, as well as the critical revision of the manuscript, were carried out by the second and fourth authors. All authors contributed to the supervision of the study and approved the final version of the manuscript.

Conflicts of Interest

The author(s) declare that there is no conflict of interest related to this study.

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