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Full Paper

Effects of different exercise approaches on pain, disability, sleep and quality of life in older adults with chronic non-specific low-back pain: Comparative randomised study

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Abstract: Chronic non-specific low-back pain (CNSLBP) is a common issue among older adults, negatively affecting their physical health, daily activities, sleep quality and overall quality of life. This comparative randomised study aims to compare the effects of various interventions including standard therapy (ST), transcutaneous electrical nerve stimulation (TENS), yoga, kinesiology taping (KT), awareness training and home exercises on pain, disability, sleep quality and quality of life in older adults with CNSLBP. Sixty-three participants were included in the analysis and were randomised into 4 groups: G1, G2, G3 and G4, which received the following treatments: ST + TENS, yoga, awareness training + home exercises, and KT + home exercises respectively. Pain, disability, sleep quality and quality of life were assessed using Visual Analog Scale (VAS), Oswestry Disability Index (ODI), Pittsburgh Sleep Quality Index (PSQI) and Short Form-36 health survey (SF-36) respectively, before and after the intervention. The data were analysed using ANOVA, paired-sample t-tests and Pearson's chi-square test. Significant improvements were found in VAS, ODI, PSQI and SF-36 scores for G2 ($p<0.05$) while G1, G3 and G4 showed improvements in ODI, PSQI and SF-36 respectively ($p<0.05$). The results suggest that yoga may be an effective treatment for CNSLBP in older adults, and combining yoga or KT with standard therapy may further enhance outcomes.

Keywords: chronic non-specific low back pain, elderly patient, yoga, electrotherapy, kinesiology taping

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INTRODUCTION

Low-back pain (LBP), one of the musculoskeletal disorders, is the main factor leading to disability worldwide and is shown as the main cause of disability in 160 countries [1].

Approximately 90% of LBP cases occur without any specific pathology [2]. If this non-specific pain lasts for at least three months or more, it is defined as chronic non-specific low-back pain (CNSLBP) [3].

In its statement published in 2023, WHO emphasised that LBP affects 619 million people in the world and the number of cases will increase to 843 million by 2050 due to the effect of aging [2]. The increasing number of such high cases in the older adults over the years causes increases of functional losses, participation restrictions and disability and decrease of the quality of life of the elderly. In addition, the decrease in sleep quality with chronic pain further exacerbates sleep problems seen with aging [4]. In order to prevent the mentioned negative health conditions, it is necessary to determine the treatment methods for CNSLBP specifically for the elderly.

There are many different pharmacological and non-pharmacological intervention approaches in the treatment of LBP [5-8]. However, the treatments applied for LBP are scattered and contradictory. While moderate evidence was reported for yoga, one of these treatments, it was suggested that there were no sufficient or consistent data on the effectiveness of transcutaneous electrical nerve stimulation (TENS) and awareness training [6-8]. The insufficient/unclear evidence of the treatment methods mentioned for LBP and the limited number of studies of non-pharmacological treatment methods specifically adapted for the elderly constitute the starting point of this study. There were studies on approaches such as yoga, kinesiology taping (KT), home exercises and awareness training [3, 9-15]. However, most of these studies were conducted on young or middle-aged adults (18-64 years old). Many physiological factors such as age-related muscle strength losses, proprioceptive/vestibular system deteriorations, neuroplastic and degenerative changes in the movement system in older adults may differentiate the response of CNSLBP to treatment from that for young/middle-aged individuals. The exercise for chronic back pain in older people focusing on a single group-based intervention demonstrated that group-based exercise could reduce pain and disability in older adults with CNSLBP [16]. The present study compares four different individualised treatment modalities. Furthermore, psychosocial outcomes such as sleep quality and health-related quality of life are also assessed in conjunction with physiological measures.

MATERIALS AND METHODS

Design

The study was planned in parallel, single-blind, randomised controlled experimental trial. It is reported in accordance with the Consolidated Standards of Reporting Trials 2025 guideline [17]. The independent variables of the study are standard therapy (ST), TENS, yoga, awareness training, KT and home exercises. The dependent variables are pain, disability, sleep and quality of life.

Participants

The sample size of the study consisted of 63 older adults with CNSLBP who met the inclusion criteria of the study. Individuals who voluntarily agreed to participate in the study, understood verbal, visual and written information, were 65 years of age or older and had CNSLBP were included. Exclusion criteria constituted those who had spinal infection, radiculopathy, myelopathy, autoimmune disease, spondylolysis, spondylolisthesis, cancer, spinal fracture and serious systemic diseases that could constitute a contraindication, those with uncontrolled cardiovascular or pulmonary diseases, older adults who were continuously using opioid analgesics, sleep and psychiatric medications, and those who desire to withdraw from the study. The power of the study was calculated using the G. Power-3.1.9.2 program for the dependent sample t test. Accordingly, a two-way hypothesis was established at 95% confidence level for the difference between the Visual Analog Scale (VAS) scores of the yoga group before and after treatment, and the power of the study was found to be 82% by taking the effect size as 0.77.

Data Collection Forms

Data were collected using questionnaire for sociodemographic and clinical characteristics, VAS, Oswestry Disability Index (ODI), Pittsburgh Sleep Quality Index (PSQI) and Short Form-36 Health Survey (SF-36). The sociodemographic form was developed based on relevant literature [3, 11, 18, 19] and included potential confounders related to pain, disability, and sleep. VAS, originally developed by Hayes and Patterson [20], assesses pain on a 10-cm line from 'no pain' to 'unbearable pain.' The ODI, developed by Fairbank et al. and validated by Yakut et al. [21, 22] measures disability across ten domains. Higher scores indicate greater disability (Cronbach's α=0.91). The PSQI, created by Buysse et al. and validated by Agargün et al. evaluates sleep quality over the past month, with scores ≥5 indicating poor sleep [23, 24]. The SF-36, developed by Ware et al. and validated by Koçyiğit et al. covers eight health domains. Sub-scale scores range from 0 to 100, with higher scores reflecting better health status. In the Turkish validity and reliability studies Cronbach's α values were reported to range from 0.73 to 0.76 depending on the sub-scale. [25, 26]. In this study the total score obtained by averaging all SF-36 items was used to represent health-related quality of life. No sub-scale analysis was performed.

Data Collection Process

The study was conducted in a physical therapy and rehabilitation centre in the Aegean region in Turkey between July-November 2024. While collecting data from the participants, both pre-intervention and post-intervention evaluations were made. The evaluations were made by another expert physiotherapist other than the researcher physiotherapist; 70 patients who met the study criteria were evaluated before the application; 2 patients wanted to leave the study at the beginning of the study. The application started with 68 patients. The study was randomly divided into 4 intervention groups, i.e. G1, G2, G3 and G4 (17 participants in each group), which respectively received the following treatments: ST + TENS, yoga, awareness training + home exercises, and KT + home exercises. A total of 5 participants, 2 from G1, 2 from G2 and 1 from G3, wanted to leave during the application. Accordingly, the study was completed with a total of 63 participants. The participant flow chart arranged according to the Consolidated Standards of Reporting Trials guide is shown in Figure 1.

Randomisation

Randomisation was performed using a stratified block randomisation method with a block size of four determined by an independent biostatistician. Stratification was based on baseline pain intensity (VAS <5 or ⩾5) to ensure balance between groups.The randomisation sequence was computer-generated (https://www.randomizer.org/), and allocation confidentiality was maintained using sequentially numbered, opaque and sealed envelopes prepared by an independent researcher not involved in participant recruitment or assessment.

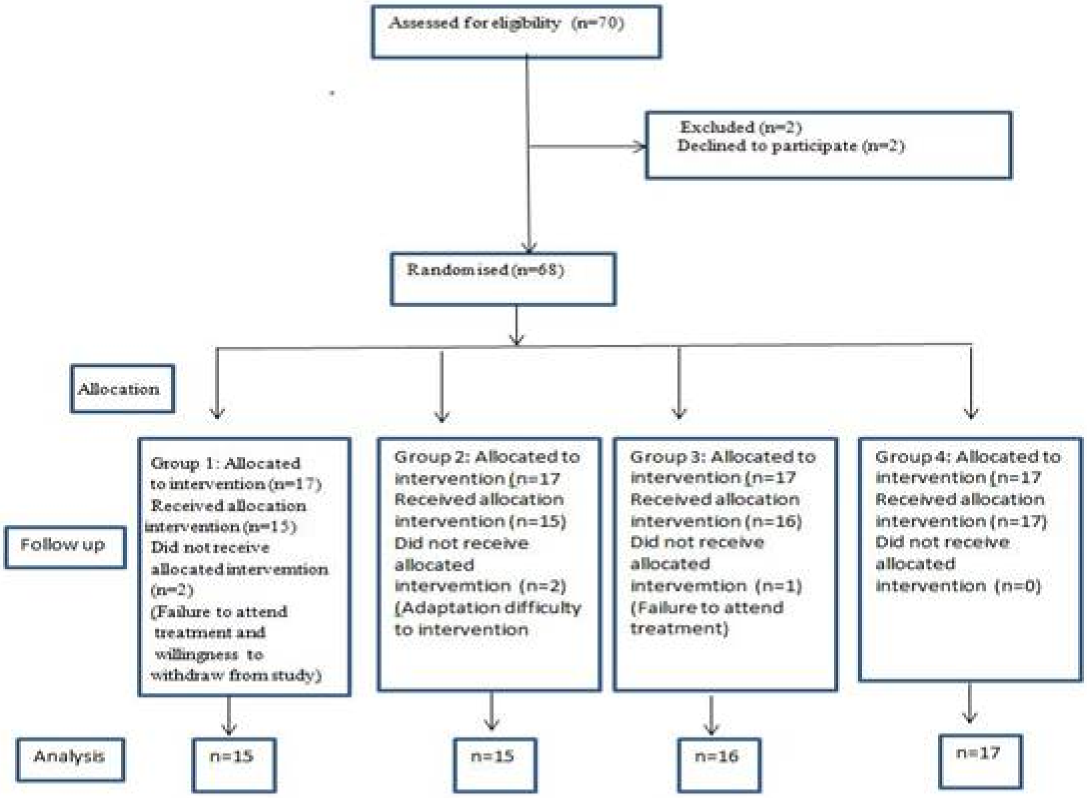

Figure 1. Patient flow diagram

Bias

Preventing bias in the study process in the planning of each stage of the study before, during and after data collection is scientifically necessary for the generalisability and acceptance of the results [27]. For this purpose, before the data of the study were collected, the literature was scanned from up-to-date, sufficient and reliable references on the subject. In order to ensure the blindness of the evaluator in the study, the participants were evaluated by another expert physiotherapist other than the researcher. The evaluations were made twice, before and after the intervention. The participants knew which intervention group they were in due to the nature of the study. Assessments were conducted in a separate assessment room independent of the intervention area, and the blind assessor was kept unaware of the participants' group assignments. After data collection, the researcher checked the data to prevent any errors. The data were also checked by the statistician during the statistical analysis process. Thus, an accurate and reliable objective statistical analysis was performed.

Intervention

Participants were divided into four different groups. In the first group (G1), ST (therapeutic ultrasound, hot pack) and TENS (2-channel, four 5×5 cm electrodes placed paraspinally at the T12 and S1 regions and applied for 20 min. with a pulse width of 50-100 μs and a frequency of 60-120 Hz.) were applied. In the second group (G2) Iyengar yoga asanas were performed as group exercises for 35-45 min. Asana varieties called Supta Padangusthasana, Setu Bandha Sarvangasana, Adho Mukha Svanasana, Viparita Karani, Marjaryasana/Bitilasana, Tadasana, Uttanasana and Parsva Balasana were performed. During the yoga exercises, warnings were given to ensure mental focus, adjust breath control and not to perform valsalva maneuver. In addition, asanas were performed with wall or chair support under the supervision of the researcher for participants who were at risk of falling and injury. Participants continued their yoga exercises on the days they did not attend the sessions. Participants were encouraged to continue the sequence at home on non-session days. The third group (G3) was given awareness training and home exercises for the waist. Awareness training was based on the WHO guideline for LBP [28]. The fourth group (G4) was given KT and home exercises. In the KT technique a tape was applied to the m.quadratus lumborum muscle in an I-shaped parallel manner. The applications were made three times a week for four weeks, for a total of 12 sessions.

Ethical Statement

Approval for this study was procured from Republic of Turkey Yozgat Bozok University Social and Human Sciences Ethics Committee (decision no. 15/18, dated 28.06.2024). In addition, this study was registered with the ClinicalTrials.gov database under the number NCT06835270.

Statistical Analysis

The data obtained in the study were analysed using the Statistical Package for Social Sciences for Windows 25.0 program. Descriptive statistical methods were used to evaluate the data. The kurtosis and skewness values were examined for the normality of the measurement tools. Accordingly, in normally distributed groups, the dependent sample t test was used for the difference in dependent groups, and in more than two independent groups the ANOVA (F) and Pearson chi-square test were used. Significance level was accepted as $p<0.05$.

RESULTS

Analysis of Sociodemographic and Clinical Characteristics of Participants in Groups

Descriptive statistical values regarding the sociodemographic and clinical characteristics of participants in G1, G2, G3 and G4 groups are given in Table 1. The groups show similar characteristics in terms of gender, education level, marital status, presence of chronic disease and regular medication use ($p>0.05$). In addition, no significant difference is found between the groups in terms of continuous variables such as age, height, weight and body mass index ($p>0.05$). These findings show that randomisation is successful and that the sociodemographic and clinical characteristics are distributed homogeneously between the groups.

Comparison of VAS Scores of Participants in Groups

VAS scores were examined in four different groups (G1, G2, G3 and G4). Pre-treatment and post-treatment scores of each group were compared (Table 2). While the mean VAS score is 4.73±1.49 in G1 before treatment, it is calculated as 4.33±1.18 after treatment; however, this change is not statistically significant ($p=0.253$). While the mean score is calculated as 5.07±1.22 in G2 before treatment, it is calculated as 4.07±1.39 after treatment. The difference is considered statistically significant ($p=0.016$). In G3 the mean score is calculated as 4.81±1.68 before treatment. It decreases to 4.56±1.67 after treatment but this change is statistically insignificant ($p=0.362$). In G4 the mean pre-treatment score is 4.65±1.41 and shows a slight decrease to 4.47±1.74 after treatment; however, this change does not constitute a significant difference ($p=0.382$). When the change between the groups is examined, no significant difference is found between the groups in terms of pre-treatment VAS scores (p=0.869). This shows that the groups are at similar levels at the beginning. The difference between the groups is not significant after treatment (p=0.977).

Table 1. Distribution of patients' sociodemographic characteristics by group

		Group								Chi-square value	p value
		G1		G2		G3		G4			
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage		
Gender	Female	8	53.3	9	60.0	10	62.5	9	52.9	0.449^{P}	0.930
	Male	7	46.7	6	40.0	6	37.5	8	47.1		
Education Level	Literate	2	13.3	2	13.3	1	6.3	2	11.8	3.014^{FE}	1.000
	Primary School	4	26.7	3	20.0	4	25.0	3	17.6		
	Middle School	4	26.7	5	33.3	5	31.3	4	23.5		
	High School	3	20.0	4	26.7	4	25.0	5	29.4		
	University	2	13.3	1	6.7	2	12.5	3	17.6		
Marital Status	Married	10	66.7	12	80.0	10	62.5	11	64.7	1.398^{FE}	0.746
	Single	5	33.3	3	20.0	6	37.5	6	35.3		
Chronic Illness	Present	12	80.0	11	73.3	10	62.5	10	58.8	2.071^{FE}	0.582
	Absent	3	20.0	4	26.7	6	37.5	7	41.2		
Regular Medication Use	Present	11	73.3	11	73.3	12	75.0	10	58.8	1.345^{FE}	0.750
	Absent	4	26.7	4	26.7	4	25.0	7	41.2		
		X	**SD**	**X**	**SD**	**X**	**SD**	**X**	**SD**	**F test**	**p**
Age (years)		71.40	5.96	71.67	5.72	73.19	6.02	73.00	5.66	0.381	0.767
Height (m)		1.68	0.08	1.68	0.09	1.69	0.06	1.70	0.07	0.493	0.688
Weight (kg)		76.27	9.39	78.27	9.07	78.69	9.46	79.00	7.85	0.292	0.831
Body mass index (kg/m^2)		27.16	2.97	27.68	1.71	27.14	2.73	27.36	2.36	0.154	0.927

Note: F test: One-Way ANOVA; FE = Fisher's Exact Chi-square value; P = Pearson Chi-square value. G1: standard treatment approach+electrotherapy, G2: yoga, G3: awareness training+home exercises, G4: kinesiology taping+home exercises, X=Mean, SD=Standard deviation

Table 2. Comparison of VAS scores by group

	Group	Pre intervention		Post intervention		t test	p value
		X	SD	X	SD		
VAS	G1	4.73	1.49	4.33	1.18	1.193	0.253
	G2	5.07	1.22	4.07	1.39	2.74	**0.016***
	G3	4.81	1.68	4.56	1.67	0.939	0.362
	G4	4.65	1.41	4.47	1.74	0.899	0.382
	F test	0.238		0.068			
	p value	0.869		0.977			

Note: t: paired samples t-test; F = One-Way Analysis of Variance (ANOVA); *p<0.05. G1: standard treatment approach+electrotherapy, G2: yoga, G3: awareness training + home exercises, G4: kinesiology taping + home exercises

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Comparison of ODI Scores of Participants in Groups

Four groups were examined in terms of ODI scores. Pre- and post-treatment values for each group were compared (Table 3). In G1 the mean ODI score decreases from 48.87±15.29 before treatment to 44.67±14.97 after treatment and this change is statistically significant (p<0.001). In G2 the mean ODI score decreases from 49.53±19.12 to 45.47±16.57 and this change is significant (p=0.008). In G3 the mean score decreases slightly from 44.31±17.04 to 43.38±16.37 but this difference is not significant (p=0.348). In G4 no significant difference is found between pre- and post-treatment values (p=0.940). In comparison between groups, no significant difference is found in initial ODI scores (p=0.717). This result shows that the groups are similar at the baseline. No significant difference is found between the groups after treatment (p=0.985).

Table 3. Comparison of total ODI scores across groups

	Group	Pre intervention		Post intervention		t test	p value
		X	SD	X	SD		
ODI	G1	48.87	15.29	44.67	14.97	4.370	**<0.001***
	G2	49.53	19.12	45.47	16.57	3.119	**0.008***
	G3	44.31	17.04	43.38	16.37	0.968	0.348
	G4	43.82	18.59	43.88	16.76	-0.076	0.940
	F test	0.452		0.050			
	p value	0.717		0.985			

Note: t: paired samples t-test; F = One-Way Analysis of Variance (ANOVA); *p<0.05. G1: standard treatment approach+electrotherapy, G2: yoga, G3: awareness training +home exercises, G4: kinesiology taping+home exercises

Comparison of PSQI Scores of Participants in Groups

Four different groups were examined in terms of PSQI. Pre-treatment and post-treatment scores of each group were compared (Table 4). In G1 the mean PSQI score before treatment is 6.33±2.97 while it is calculated as 6.07±2.60 after treatment but this change is statistically insignificant (p=0.217). In G2 the mean score before treatment is 7.07±2.71 while it decreases to 5.93±2.15 after treatment and the difference is statistically significant (p=0.008). In G3 the mean score before treatment is 7.31±2.68 and after treatment is 6.25±2.32 and the difference is statistically significant (p=0.019). In G4 the mean score before treatment is 6.18±2.51 and it increases to 6.53±2.50 after treatment; however, this change does not constitute a significant difference (p=0.083). When the change between the groups is examined, no significant difference is found between the groups in terms of pre-treatment PSQI scores (p=0.577). This shows that the groups are at similar levels at the beginning. The difference between the groups is significant after the treatment (p=0.906). This shows that the final scores of the groups are close to each other despite the different interventions.

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Table 4. Comparison of PSQI scores across groups

	Group	Pre intervention		Post intervention		t test	p value
		X	SD	X	SD		
PSQI	G1	6.33	2.97	6.07	2.60	1.293	0.217
	G2	7.07	2.71	5.93	2.15	**3.119**	**0.008***
	G3	7.31	2.68	6.25	2.32	**2.638**	**0.019***
	G4	6.18	2.51	6.53	2.50	-1.852	0.083
	F test	0.665		0.185			
	p value	0.577		0.906			

Note: t: paired samples t-test; F = One-Way Analysis of Variance (ANOVA); *p<0.05. G1: standard treatment approach+electrotherapy, G2: yoga, G3: awareness training+home exercises, G4: kinesiology taping+home exercises

Comparison of SF-36 Scores of Participants in Groups

Four different groups were examined in terms of SF-36. Pre-treatment and post-treatment scores of each group were compared (Table 5). In G1 the mean SF-36 score before treatment is 79.60±5.60 while it is calculated as 80.20±4.62 after treatment but this change is not statistically significant (p=0.246). In G2 the mean score before treatment is calculated as 77.67±6.78 while it increases to 79.67±6.42 after treatment and the difference is statistically significant (p=0.049). In G3 the mean score before treatment is calculated as 77.31±6.96 while it is calculated as 77.81±6.56 after treatment but the difference is not statistically significant (p=0.369). In G4 the mean pre-treatment score is 76.35±6.30 and after treatment it slightly increases to 77.29±6.26 and this change constitutes a significant difference (p=0.034). When the change between the groups is examined, no significant difference is found between the groups in terms of pre-treatment SF-36 scores (p=0.554). This shows that the groups are at similar levels at the beginning. The difference between the groups is also insignificant after treatment (p=0.537). Despite the fact that different interventions are applied, the final scores of the groups are still close to each other.

Table 5. Comparison of total SF-36 scores across intervention groups

	Group	Pre intervention		Post intervention		t test	p value
		X	SD	X	SD		
SF-36	G1	79.60	5.60	80.20	4.62	-1.210	0.246
	G2	77.67	6.78	79.67	6.42	-2.16	**0.049***
	G3	77.31	6.96	77.81	6.56	-0.926	0.369
	G4	76.35	6.30	77.29	6.26	**-2.315**	**0.034***
	F test	0.703		0.733			
	p value	0.554		0.537			

Note: t: paired samples t-test; F = One-Way Analysis of Variance (ANOVA); *p<0.05. G1: standard treatment approach+electrotherapy, G2: yoga, G3: awareness training+home exercises, G4: kinesiology taping+home exercises

DISCUSSION

This randomised controlled trial aims to comparatively examine the effects of four different non-pharmacological approaches to pain, disability, sleep quality and quality of life in older adults. While previous studies mostly included younger adults and focused on a single intervention, this study directly compares multiple methods in the ≥65 age group and assesses both physiological and psychosocial outcomes.

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Pain

Pain levels were similar in all groups before the applications. After the applications, decreases in pain levels were observed in the group where yoga was applied. Yoga was shown to be more effective in reducing pain compared to KT, electrotherapy and awareness training applied in other groups. The reason for this is that yoga is not just a physical exercise. This may be due to the fact that yoga exercises include both psychosocial and mental therapeutic components. The basis of pain is a complex process caused by physiological mechanisms as well as stress and anxiety. In addition, the parasympathetic systems of the elderly may have been activated by the yoga practice, making it more effective in pain treatment.

In a review study conducted for individuals with CNSLBP, it was emphasised that yoga would be better than no exercise to reduce pain and improve functions in the lumbar region, but the effects would be small [29]. In a different meta-analysis study conducted on individuals with CNSLBP, it was found that a 12-week yoga programme significantly reduced LBP levels [30]. In another systematic review study conducted on the adult and elderly population, the effectiveness and safety of yoga in the treatment of acute or chronic pain was stated to be better than normal standard treatments [31]. In a randomised study conducted on 176 older adults, it was found that participation in a 3-month yoga programme did not improve chronic low-back pain (CLBP) in a period of 3 or 6 months [32]. In the studies conducted in the literature it can be said that yoga reduces the pain level of the elderly in CNSLBP, although the application of yoga to different groups and the duration and type of yoga are different from this study.

Disability Level

It has been established that the intensity of pain in CNSLBP is directly related to the level of disability [33]. In the present study, the disability levels of older adults with CNSLBP were high before the application. After the application, the disability levels of decreased in the yoga group and in the group in which the ST and TENS were applied.

In a review study analysing 18 randomised controlled trials to investigate the effectiveness of exercise therapy in elderly people with CLBP, it was stated that there were significant improvements in the disability levels of the elderly attributable to exercise therapy [34]. In a meta-analysis study in which different types of exercises such as aerobic training, water exercises, motor control exercises, resistance training, Pilates, suspension exercises, traditional Chinese exercises, walking and yoga were performed in CLBP, it was emphasised that the disability levels significantly decreased across these interventions [9]. In patients with neuropathic pain due to lumbar disc herniation, a stretching and strength-based yoga exercise programme was applied to the patients for 12 weeks and it was observed that there were improvements in the disability levels [35]. Although different sample groups and different exercise types were used in the present study, the results seem to support one another.

Sleep

Patients with CLBP may experience decreased total sleep time, poor sleep quality, difficulty in falling asleep, more awakening after falling asleep, drowsiness while awake and decreased sleep satisfaction [36]. The effects of yoga and physical therapy applied to individuals with CLBP on sleep quality have not been much investigated. Based on this, the present study has evaluated the sleep quality of older adults with CLBP in addition to increasing sleep problems with aging and found that there were improvements in sleep quality in the group that did yoga and awareness training and home exercises. In a randomised controlled trial [11] conducted on 320 adults with CLBP (average age 46), one group received yoga for 12 weeks while the other group received physical therapy and training. Almost all had poor sleep quality before the interventions while slight improvement in sleep quality was observed in both the yoga and physical therapy groups.

Quality of Life

The quality of life of individuals with CNSLBP usually decreases significantly, even more so with aging. In this study conducted on elderly patients with CNSLBP the quality of life was similarly low initially. An increase in the quality of life was found in the groups that received yoga and KT with home exercises. There are no studies in the literature examining the effect of KT applied to patients with CNSLBP on the quality of life of the patients. In CNSLBP, individuals experience postural instability, muscle tension, hypertonus and pain-related restrictions. KT provides common beneficial effects such as providing motor control which gives correct proprioceptive input and adjust posture.

However, although SF-36 is statistically significant, this finding does not necessarily reflect a clinically meaningful change. In the study conducted by Zardoust et al. [19], the increase in the quality of life of the patients was due to the decrease in pain levels. In the present study, it was found that the quality of life of the KT group increased even though the pain levels did not decrease. This result may be due to the fact that the SF-36 questionnaire for older adults depends on their current perception. This result shows that a subjective experience such as pain can be evaluated differently from the general quality of life of the elderly individual. In addition, the physical contact provided by KT to the body and the increased stimulation of receptors on the skin during movement may have increased the body awareness of the elderly and created confidence in movement. The placebo effect of KT may also be an important reason. The visual appeal of the tapes may create a strong expectation that the elderly individual is receiving effective treatment. In this context, a similar study has shown that patients' expectations may be effective in perceiving their general health status [37]. It is thought that psychological, neurophysiological and behavioural interactions should be evaluated together to explain the effects of KT on the quality of life of the elderly.

Limitations of Study

Some limitations of the study are noted. Using self-report measurement tools in the evaluation of variables such as pain, quality of life and sleep may increase the possibility of bias originating from personal perceptions of older adults. This may limit the precision of the measurements. Another limitation is that home exercises given to elderly patients are performed under the control of the patient and the follow-up period of the exercise application is short. In addition, the differences in perception in evaluating the treatment compliance levels, pain tolerance, psychosocial status and effectiveness of the interventions in patients with CNSLBP are also limitations of the study.

CONCLUSIONS

In this study conducted on elderly patients with CNSLBP, the findings demonstrate that ST+TENS reduces disability; awareness training+home exercises improves sleep quality; KT+home exercises improves quality of life; and yoga provides significant improvement in all domains including pain. ST+TENS demonstrates significant improvements in disability levels while the other interventions yield comparatively limited benefits. Clinicians can integrate yoga into treatment plans due to its features such as low cost, safety and easy application. The role of KT in improving quality of life may be due to the awareness and psychosomatic support provided by taping. This result can be used in the clinic as an alternative intervention approach, especially for older adults who have limited exercise capacity or who have lost their motivation for exercise. Home exercises+awareness training intervention provides significant improvements on sleep quality. These results draw attention to the role of a multidisciplinary rehabilitation approach that increases cognitive and behavioural awareness when treating older adults with CNSLBP.

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