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Effects of Yoga on Pain, Function, and Depression in Individuals with Nonspecific-Low Back Pain

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Objective: Nonspecific low back pain (NSLBP) is experienced worldwide by many age groups. Yoga is recommended as an exercise to reduce back pain and stress because it is a breathing exercise, posture, and meditation as key elements. The aim of this study is to compare the effects of yoga and stabilization exercise on pain intensity, function, and depression.

Design: An open-label, parallel arm, randomized controlled trial

Methods: Twenty-four participants were allocated to the experimental and the control group in a ratio of 1:1. Yoga (experimental group) and stabilization exercise (control group) were received twice a week for 6 weeks Participants were assessed at baseline and post-intervention for pain intensity (numeric pain rating scale), function (Aberdeen low back pain scale, flexibility,and strength), and depression (Beck depression inventory).

Results: When the experimental group (Yoga) and control group (stabilization exercise) were performed twice a week for 6 weeks, numeric pain rating scale, Aberdeen low back pain scale, and flexibility in post-intervention showed significant improvement in both groups ($P < 0.05$), However, in all variables, the experimental group showed a positive benefit compared to the control group ($P < 0.05$).

Conclusions: The results of this study show that yoga has more positive benefits compared to stabilization exercise in pain intensity, function, and depression in individuals with NSLBP.

Key Words: Low back pain, Yoga, Stabilization exercise, Physical activity, Pain

Introduction

NSLBP is a chronic symptom that occurs in many age groups worldwide [1], and the prevalence was reported to be 39% across all age groups [2]. It is considered to have various biological and behavioral etiology [3], and it is a multidimensional disease that combines psychosocial factors as well as physical problems [4].

In the treatment guidelines for NSLBP, pharmacological interventions, usual care, Tai Chi, Pilates, Yoga, psychological therapy, and complex physical and psychological programs are recommended [5, 6]. In the meta-analysis of low back pain, it was reported that stabilization exercise was more effective than general exercise for pain and disability [7]. It has also been associated with high cortisol levels in NSLBP [8], and it is used as a biochemical marker to indicate low back pain when cortisol levels are high [9, 10]. The positive effects of yoga reported by Field et al. were mediated by increased vagal activity and decreased cortisol [11].

Therefore, this study aims to compare the effects of Yoga and stabilization exercise on pain, function, and depression in NSLBP patients.

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Methods

Study design

This study is an open-label, randomized controlled trial conducted from February 17 to March 31, 2022. It was conducted twice a week for 6 weeks of intervention (Yoga and stabilization exercise) and two evaluation sessions (baselines and post-intervention). The primary outcome is pain (numeric pain rating scale [NPRS]), and the secondary outcome is function (Aberdeen low back pain scale [ABPS], flexibility, and strength) and depression (Beck depression inventory [BDI]).

Participants

Fifty-six potential participants with low back pain were recruited through a bulletin board targeting university students in their 20s attending H University, Gwangyang, Republic of Korea. The selection and exclusion criteria are as follows.

The inclusion criteria are as follows. Adult over 20 years of age; NSLBP; pain of mechanical origin; pain predominantly in the lumbar region. The exclusion criteria are as follows. Fractures; pain radiating to the lower extremities; pain elsewhere; neurological problems; history of surgery; and inability to understand study guidelines [12].

Also, participants were explained about the purpose and procedure according to the ethical standards of the Declaration of Helsinki.

Intervention

Intervention was performed for six weeks after baselines, and the control group performed 50 minutes of stabilization exercise twice per week, and the experimental group performed 60 minutes of Yoga program twice per week (Table 1).

All interventions in the experimental group and control group are divided into warm-up main program, and cool-down. The main program of the stabilization exercise of the control group consists of bridge exercise, chest lifts, bridge exercise (lift one leg), and stationary bike exercise [7, 13]. Yoga in the experimental group consisted of Vidalasana, Ardha Matsyendrasana, Bhujangasana, Pascimottanasana, Dhanurasana, Urdhva Dhanurasana, Matsyasana, and Baddha Konasana [14, 15].

Outcomes

Pain intensity

Pain intensity was assessed using numeric pain rating scale (NPRS). The NPRS is an 11-point scale, consisting of 0 (no pain) to 10 (worst pain) points [16], and the minimum clinically significant important difference (MCID) was reported as 2 points [17].

Table 1. Stabilization exercises and Yoga program

Type (time)		Exercises	
Stabilization exercise	*Warm-up (10min)*	static stetching exercise	
	Main program (30min)	bridge exercise	chest lifts
		bridge exercise (lift one leg)	stationary bike exercise
	Cool-dwon (10min)	dynamic stetching exercise	
Yoga	*Warm-up (10min)*	static stretching exercise	
	Main program (40min)	Vidalasana	Ardha Matsyendrasana
		Bhujangasana	Pascimottanasana
		Dhanurasana	Urdhva Dhanurasana
		Matsyasana	Baddha Konasana
	Cool-dwon (10min)	dynamic stetching exercise	Garbhasana
		Savasana	

Function

1) Aberdeen low back pain scale

ABPS is designed as a routinely asked questions for patients with low back pain. The questionnaires evaluate various living conditions such as pain level, pain site and duration, analgesic use, placebo, number of days in bed, sleep disturbance due to pain, daily life, work, sex, and leisure [18, 19]. The reported intraclass correlation coefficient (ICC) of ABPS is 0.88 [20].

2) Flexibility

To confirm the lumbar spine flexibility, the participant's trunk flexion test was performed. With the sole of the feet as 0, a ruler measuring 25 cm upwards and 30 cm downwards is vertically attached to the surface, and the pariticipant stands on the measuring table with both feet aligned with the heels, toes about 5 cm apart, and then bend in front of your torso, extend your fingertips over the ruler and write +(cm) below and −(cm) above. This was performed twice in total to record the maximum value [21].

3) Strength

The maximum isometric strength is measured by pulling the chain attached to the dynamometer using a Takei back and leg dynamometer (5402-C, Takei, Japin). It is a device that can be used conveniently to measure the muscle strength of the back and lower extremities, and the reported ICC is 0.97 [22].

Depression

Depression was measured using BDI. The BDI consists of 21 items. Each item is scored on a scale of 0 to 3 (total score from 0 to 63). The BDI score categories are no depression (0 to 9), mild depression (10 to 16), moderate depression (17 to 29), and severe depression (30 to 63) [12]. The reported MCID should reduce the difference from baseline by 29.64% [23].

Sample size

A sample size calculator (G-power 3.1; Heinrich-Heine-Universitä Düseldorf, Germany) was used to estimate the sample size. In the study of Gatantino, Bzdewka (24), the effect size was calculated based on the difference in back-specific disability in the Yoga group compared to the control group. The calculated effect size (Cohen's d) was 1.24, and when the two groups and the power (1-β) were set to 0.80, 18 samples were required. A total of 24 participants were enrolled in the study to account for dropouts.

Statistical analysis

This study used SPSS (SPSS 25.0, IBM, USA) for all statistical analyzes. Paired t-test was performed to determine the difference between baseline and post-intervention, and analysis of covariance (ANCOVA) was performed to compare statistical significance between groups. The significance level (α was 0.05. was set.

Results

Of the 56 potential participants, 32 were excluded and 24 participants were enrolled. All enrolled participants completed the 6-week intervention without dropouts (Figure 1). The general characteristics of the registered participants are shown in Table 2, and there was no significant difference in the homogeneity test.

Pain

Compared with the baseline, significant improvement was found in both the Yoga group and the stabilization exercise group in the post-intervention ($P < 0.05$). In comparison of the two groups, the Yoga

Table 2. General Characteristics of Participants (n=24)

Groups	N	Age (years)	Sex (male/female)	Height (cm)	Weight (kg)
Control group	12	23.67±1.56	9/3	170.34±7.98	66.00±17.99
Experimental group	12	22.17±2.17	9/3	172.58±10.78	65.58±13.56

Values are presented as mean (standard deviation)

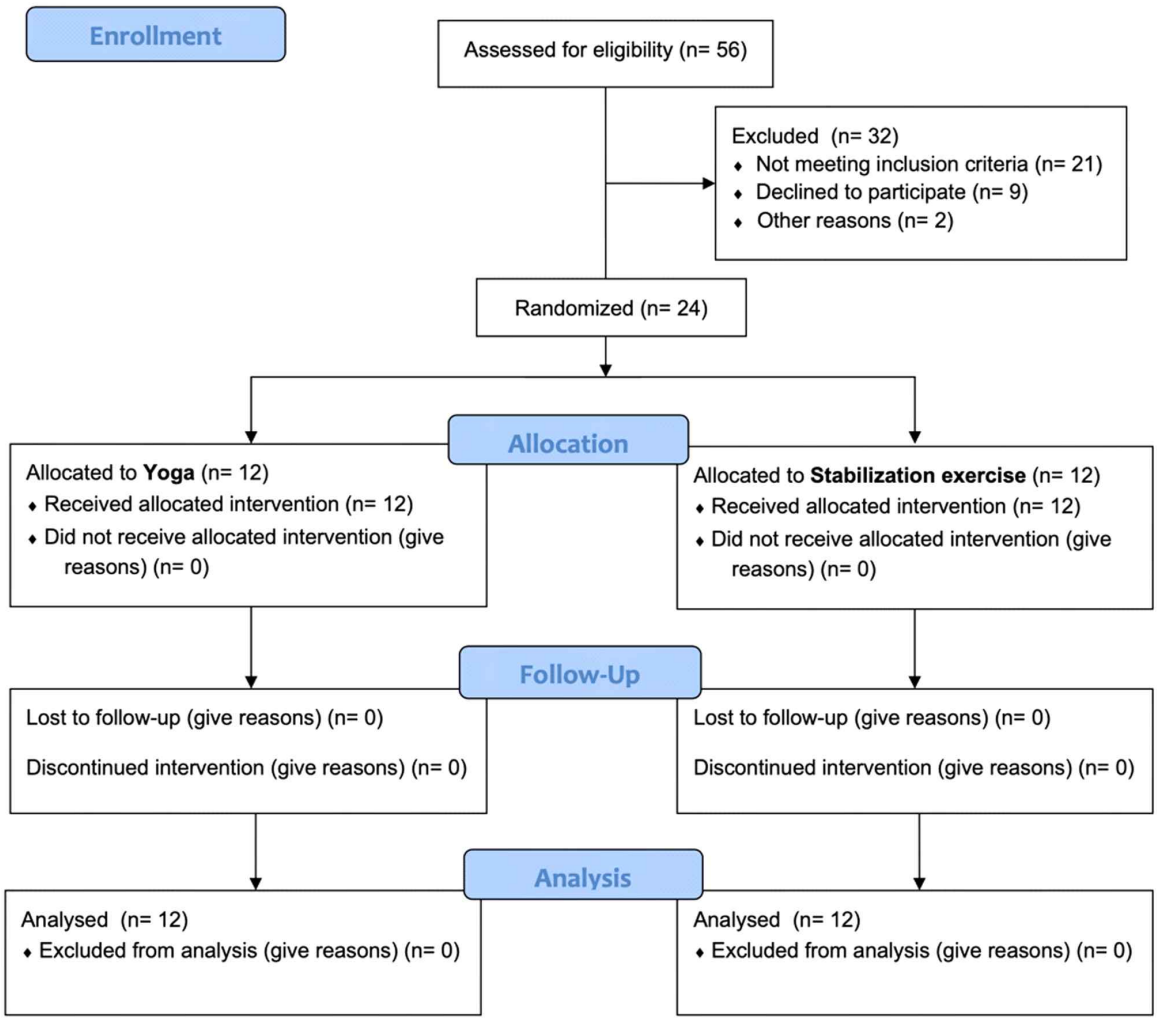

Figure 1. The consolidated standards of reporting trials flow diagram.

group showed significant improvement compared to the stabilization exercise group ($P < 0.05$)(Table 3).

Function

In ABPS, both the Yoga group and the stabilization exercise group showed significant improvement in the post-intervention compared with the baseline ($P < 0.05$). In comparison of the two groups, the Yoga group showed a significant improvement compared to the stabilization exercise group ($P < 0.05$)(Table 3).

In flexibility, both the Yoga group and the stabilization exercise group showed significant improvement in the post-intervention compared to the baseline ($P < 0.05$). In comparison of the two groups, the Yoga group showed a significant improvement compared to the stabilization exercise group ($P < 0.05$) (Table 3).

In strength, there was no significant improvement in both the Yoga group and the stabilization exercise group in the post-intervention compared to the baseline ($P > 0.05$). In comparison of the two groups, the Yoga group showed a significant improvement compared to the stabilization exercise group ($P < 0.05$)(Table 3).

Depression

In BDI, there was no significant improvement in both the Yoga group and the stabilization exercise group in the post-intervention compared to the baseline ($P > 0.05$). In comparison of the two groups, the Yoga group showed a significant improvement compared to

Table 3. Post-intervention changes in pain, function, and depression (n=24)

		Baselines	Post-intervention	t	F
NPRS	Control group	3.75±0.75	2.75±0.75	4.69*	7.48*
	Experimental group	3.50±0.67	1.17±1.40	6.57*	
ABPS	Control group	11.50±10.37	8.58±7.31	2.55*	11.78*
	Experimental group	6.83±5.70	2.33±3.11	3.39*	
Flexibility	Control group	7.46±8.85	10.72±8.88	−3.17*	35.12*
	Experimental group	7.57±6.54	14.48±5.37	−6.96*	
Strength	Control group	99.96±36.41	95.06±33.77	1.63	21.45*
	Experimental group	69.79±32.97	99.13±28.54	−4.42	
BDI	Control group	6.42±4.68	3.83±3.86	1.51	12.45*
	Experimental group	7.50±5.14	3.33±3.89	3.44	

Values are presented as mean (standard deviation).
ABPS: Aberdeen low back pain scale, BDI: beck depression inventory, NPRS: numeric pain rating scale.
*$P < 0.05$.

the stabilization exercise group ($P < 0.05$)(Table 3).

Discussion

In this study, the effect of the Yoga program on NSLBP patients compared to the stabilization exercise conventionally performed was compared. When comparing the experimental group (Yoga) and the control group (stabilization exercise) twice a week for 6 weeks in pain intensity (NPRS), function (ABPS, flexibility, and strength), and depression (BDI), compared to baseline, NPRS, ABPS, and flexibility in post-intervention showed significant improvement in both experimental group and control group ($P < 0.05$), but strength and BDI did not show significant improvement ($P > 0.05$). However, in all variables, the experimental group showed a positive improvement compared to the control group ($P < 0.05$).

Both the experimental group and the control group showed positive improvement in NPRS, the primary outcome measure, and the experimental group was more effective than the control group. Considering that the reported MCID was 2 points [17], the mean difference of the control group showed an improvement of 1.00 and the experimental group showed an improvement of 2.33 points. Therefore, the Yoga program had a clinically significant effect. According to these results, even in the meta-analysis reported by Cramer, Lauche (25), Yoga had strong evidence for short-term and long-term pain control.

In ABPS, both groups showed significant improvement, and the experimental group showed a greater improvement compared to the control group. In our results, Yoga showed significant improvement, but reported meta-analyses as low evidence for health-related quality of life and disability [25, 26]. In another meta-analysis, it is reported as strong evidence for multi-item functional outcomes [27], so more studies are needed in the future.

In the results of flexibility, both groups showed significant improvement, and the experimental group showed a greater improvement. These results are also consistent with the results of meta-analysis compared with active control [28]. However, there was no significant improvement in strength, but there was a positive improvement in the experimental group compared to the control group, which is consistent with the results of previous studies showing improvement in lower extremity muscle strength [29]. However, the fact that there was no significant improvement is that 6 weeks of training might be a relatively short intervention period for improving muscle strength due to neurological adaptation [30]. Nevertheless, it is thought that static stretching-oriented movements contributed to the more positive increase in yoga compared to stabilization exercises [31].

In the results of depression, the experimental group showed positive improvement compared to the control group, but there was no significant improvement in the post-intervention for the baseline in both groups. The baseline score was 6-7 in both groups. Since this is within the normal range [12], it is considered a ceiling effect. Also, a more significant difference was found in the experimental group, but it was not a clinically significant change when compared with the reported MCID [23].

NSLBP is a complex syndrome in which a nociceptive component and a neuropathic component coexist [32]. In addition, an increase in cortisol levels with increased stress is also associated with NSLBP [32]. In other words, in order to control this mixed pain, stress reduction, which is a characteristic of Yoga, is closely related not only to the effect of known physical activity [33]. Therefore, as in the results of this study, yoga in physical activity for NSLBP is considered to have some influence on not only pain control of mechanical origin but also other factors.

The limitations of this study are as follows. Participants were limited to adults in their twenties; It is difficult to generalize due to the small sample size; The time taken between the interventions to be compared is different; does not differentiate between acute, subacute, and chronic; Since it is an open-label trial, other bias can be considered.

Conclusion

The results of this study show that yoga has more positive benefits compared to stabilization exercise in pain intensity, function, and depression in individuals with NSLBP. In further studies, variables that evaluate physiological or psychosocial factors targeting a large sample size are needed.

Conflicts of interest

The authors declare no conflict of interest.

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