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Original Article

Effects of Additional Walking Aerobic Exercise on Pain Intensity and Disability Status in Office Workers with Mechanical Chronic Low Back Pain at Dr. Soetomo Surabaya Hospital

I Nengah Bagus Surianta[1,*], Damayanti Tinduh[1], Nur Sulastri[1], Soenarnatalina Melaniani[2]

[1]*Department of Physical Medicine and Rehabilitation, Dr. Soetomo General Hospital, Faculty of Medicine, Airlangga University, Indonesia*
[2]*Department of Community Medicine, Faculty of Medicine, Airlangga University, Indonesia*

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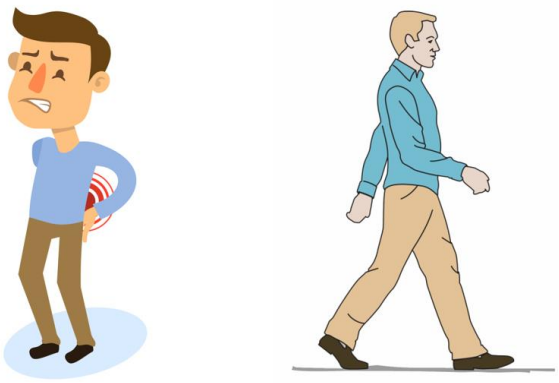
ABSTRACT

Background: Aerobic exercise is recommended starting from the subacute phase of low back pain, which can increase daily activities. This study aims to analyse the effect of adding walking aerobic exercise on pain intensity and disability status of mechanical chronic low back pain in office workers at Dr. Soetomo Hospital.
Methods: True experimental with pre-test and post-test randomized control group design. Each group consisted of 16 respondents. The treatment group received walking aerobic exercise therapy three times a week for 30 minutes with gradually increasing intensity and conventional low back pain exercises for eight weeks. The control group only received conventional exercise therapy 3x/week for eight weeks. The parameters evaluated in this study were pain intensity values using NPRS and disability status using ODI. Measurements were made twice, namely before and after eight weeks of intervention.
Results: There was a significant improvement in the NPRS score in the treatment group and the control group ($p<0.000$ and $p<0.001$), but there was no difference between the two groups after the intervention ($p=1.000$), and there was no difference (delta) in the NPRS score between groups ($p=0.714$). Improvements in ODI scores were found in the treatment and control groups ($p<0.000$ and $p<0.001$), and there were differences between the groups after the intervention ($p<0.001$), and there were significant differences (delta) in ODI between the two groups after the intervention ($p<0.001$).
Conclusion: Addition of walking aerobic exercise to conventional mechanical chronic low back pain exercises can synergistically benefit in decreasing pain intensity and disability status after eight weeks.

* Corresponding author: I Nengah Bagus Surianta
✉ E-mail: bagussurianta.ikfr@gmail.com

GRAPHICAL ABSTRACT



Introduction

The most frequent causes of chronic low back pain are paralumbar spasms, strains, and sprains. Chronic low back pain is a prevalent issue that results in impairment and lowers a person's quality of life [1]. A risk factor for mechanical chronic low back pain is sedentary behavior, which is linked to poor posture at work, workplace ergonomics, and psychology, which is related to job satisfaction [2]. The COVID-19 pandemic policy's effects have also increased the severity of low back pain in office workers [3].

A measurement scale, such as the visual analog scale (VAS), Numerical Pain Rating Scale (NPRS), or Wong's Backer Face Scale, can be used to evaluate the intensity of pain [4]. The Oswestry Disability Index (ODI), the Roland Morris Disability Questionnaire (RMDQ), the Functional Rating Index, and the Quebec Back Pain Disability Scale (QDS) can all be used to measure disability evaluation. However, the ODI is more sensitive than other tools. In addition, it is capable of identifying clinical changes following conservative care in subacute and chronic low back pain conditions [5]. Both pharmaceutical and non-pharmacological techniques can be used to manage chronic low back pain. Starting in the subacute phase, aerobic activity is advised in addition to the exercises for improving flexibility and learning about appropriate ergonomics. Exercise that involves walking is easy and has a low risk of injury. When it comes to relieving chronic low back pain, walking exercise has a higher level of compliance than other exercises [6-8]. This study looked at how office workers with mechanical chronic low back pain responded to adding walking aerobic exercise in terms of pain severity and disability level.

Materials and Methods

A randomized control group design for the pre-test and post-test, this study is an actual experiment. The Dr. Soetomo Surabaya Hospital's Health Research Ethics Committee has approved this study under ethical feasibility no. 0994/LOE/301.4.2/VIII/2022. The Outpatient Polyclinic of the Medical Rehabilitation Installation of Dr. Soetomo Surabaya Hospital is where the first and final data gathering took place. Thirty-two persistent LBP patients who were separated into a treatment group and a control group (each with 16 participants) made up the study's participants. Three times a week, the treatment group underwent walking aerobic exercise therapy. Exercises for low back pain were done for eight weeks with a 30 minute daily commitment, an intensity that was gradually raised. For eight weeks, the control group received only three sessions per week of low back pain exercise therapy. The Oswestry Disability Index was used to determine disability status, and pain intensity values were determined using a numerical pain rating scale.

Measurements were taken twice, once before and once after the intervention lasted for eight weeks. Inclusion criteria are as follow: (1) Men and women in the age range of 18 and 55, (2) age, (3) full-time employment as an office worker at Dr. Soetomo Hospital, (4) IPAQ-SF daily physical activity classification of light, (5) non-organic mechanical chronic low back pain diagnosis, and (6) willingness to participate in the study by signing an informed consent. Exclusion criteria are as follow: (1) Patients who actively engage in physical activity other than walking, (2) Patients with low back pain and red flag symptoms, (3) Patients with chronic illnesses like hypertension, ischemic heart disease, kidney disease, diabetes mellitus, and restrictive and obstructive pulmonary disease, (4) Patients with neuromusculoskeletal and vascular disorders in the lower limbs contraindicated for walking training, and (5) Patients with fractures.

Using SPSS statistic 26 (IBM, USA), the data were examined: (i) Shapiro-Wilk test is used to determine the normality of the data; if the data are normally distributed, a parametric analysis test is run. Otherwise, a nonparametric statistical analysis test is used, (ii) paired t-test or Wilcoxon Signed Rank test was used to compare the NPRS and Oswestry Disability Index values before and after treatment in each group (control and treatment), (iii) to compare the difference between pre and post NPRS and Oswestry Disability Index between treatment and control groups, the unpaired t-test is used if the data is normally distributed or the Mann-Whitney test if the data are not normally distributed.

Results and Discussion

The total 32 participants in the study who met both the inclusion and exclusion criteria were divided into treatment and control groups, with 16 participants in each group. According to the Therapeutic Exercise Foundation's guidelines, conventional exercises can be administered in the acute phase of low back pain, beginning with kinesthetic training exercises (pelvic tilt, posture correction to achieve a neutral spine position, abdominal draw in, breath, and relaxation exercises with the goal of reducing pain). In the subacute to chronic period, strengthening, cardio, and stretching exercises are provided [9].

The homogeneity test results, which show that there were no significant differences between the treatment group and the control group on all variables, including age, weight (BB), height (TB), body mass index (BMI), pain intensity (NPRS Pre), and disability status (ODI Pre), are provided in Table 1 along with the characteristics of the research data.

This study's homogeneity is comparable to a study by *Cho et al.* (2015) that looked at the benefits of combining treadmill walking training with patients who had persistent low back pain. The provision of treadmill exercise and traditional therapy programs for chronic low back pain was found to improve pain intensity and disability scores [10]. The comparison of homogeneity of age, gender, and BMI in both groups in this study is crucial because it can influence how low back pain is perceived. Research on the relationship between age, gender, BMI, and psychiatric disorders and pain perception was done by Ozlece *et al.* [11]. Men are considered to be more resistant to tenderness because they have less pressure-sensitive nociceptors as they age. Women are less tolerant of temperature-related pain than males are, including ischemia disorders, musculoskeletal pain, and visceral discomfort. Some research claims that age has no bearing on pain threshold. Different study methodologies are the cause of this variation. The experience of pain is also influenced by psychological issues. Comorbidities with pain can worsen under depressive situations. Increased BMI has been linked to an increase in pain perception. As a result, because it may have an impact on the two groups' inconsistent measurement results, the homogeneity of the research subjects' basic data is crucial.

The Oswestri Disability Index Questionnaire was used to assess disability status while a numerical pain rating scale was used to assess pain intensity. Google forms were used to distribute this evaluation both before and after the intervention. Table 2 lists NPRS and ODI values for each group.

Table 1: The results of a test for normalcy and homogeneity of the study subjects' characteristics in the two groups

Variables	Treatment (n = 16) Means ± SD	p-value* (Normality)	Control (n=16) Means ± SD	P-value (Normality)	P-value** (Homogeneity)
Age (Years)	38.50 ± 11.35	0.195	37.09 ± 12.06	0.093	0.566
Gender	L = 8 (50 %) P = 8 (50 %)		L = 8 (50 %) P = 8 (50 %		
Height (cm)	158.50 ± 8.12	0.129	162.13 ± 9.35	0.208	0.112
Body Weight (kg)	62.69 ± 10.86	0.443	64.38 ± 14.99	0.535	0.273
BMI (kg/m2)	24.90 ± 3.56	0.194	24.25 ± 3.88	0.107	0.544
NPRS pre	3.56 ± 0.96	0.061	3.5 ±1.03	0.060	0.719
ODI pre	17,63± 3,67	0.055	18,25 ± 2,52	0.122	0,088

**Independent Sample t-Test; **Saphiro Wilk test; significant if p>0.05. ODI: Oswestry Disability Index, NPRS: Numerical Pain Rating Scale, SD: Standard Deviation, and BMI: Body Mass Index.*

Table 2: The NPRS and ODI scores for both groups (pre- and post-treatment)

Variable	Treatment (n=16)			Control (n=16)		
	Before	After	p-value*	Before	After	P-value*
NPRS	3,56± 0,96	1,63± 0,96	<0,001	3,50 ± 1,03	1,63 ± 1,15	<0,001
ODI	17,63 ± 3,67	4,25 ± 3,42	<0,001	18,25± 2,52	8,75±3,72	<0,001

**Pair sample t test; significant if p<0.05. ODI: Oswestry Disability Index and NPRS: Numerical Pain Rating Scale.*

Both the treatment group (p-value 0.001) and the control group (p-value 0.001) experienced statistically significant reductions in pain intensity values measured with NPRS before and after exercise. Both the treatment group and the control group experienced a statistically significant decline in the value of disability status as determined by the ODI questionnaire (p-value 0.001).

The findings of this study are consistent with those of Cho *et al.*'s (2015) study, which looked at 20 people with chronic low back pain [10]. The control group only received conventional low back pain exercises, while the experimental group received breathing exercises, stretching exercises, posture correction exercises, and strengthening exercises. This study found that after 6 weeks of training, pain severity, and impairment status decreased in both groups.

In their study, Shnayderman and Katz-Leurer (2012) found that a combination of aerobic exercise on a treadmill for 40 minutes three times per week, togok muscle flexibility exercises, and lower extremity strengthening exercises given to the treatment group for six weeks led to significant improvements in pain intensity, ODI scores, and six-minute walk times [11, 12].

Both studies found that six weeks of exercise reduced pain in both the treatment group and the control group. After 8 weeks of exercise, both the treatment group and the control group in this study noticed a reduction in pain intensity and an improvement in ODI ratings. Exercise has an analgesic impact to lessen pain intensity in people with persistent low back pain, according to Duvillard's research [13]. A biomechanical approach to pain management includes stretching, strengthening exercises, and posture adjustment. Exercises that involve stretching will activate free nerve endings that are responsive to mechanical stimulation. Through gate control mechanisms, these stimuli, which are sent through afferent pathways of higher caliber and conduction velocity than nociceptive afferent pathways, further modify pain.

The study by Tagliaferri *et al.* on 125 individuals with persistent low back pain discovered changes in pain complaints that dropped by 50% (p=0.0001) after 12 weeks of management with strengthening and stretching exercises [14]. Improvements in pain intensity and quality of life are related to the minimum duration of intervention carried out, according to Hayden *et al.* on 412 patients with chronic low back pain.

They found that after 8 weeks of intervention with strengthening exercises, endurance training, and stretching, pain complaints decreased by 50% as measured by the SF-36 (p 0.0001) [15]. According to the previous studies, the minimal time frame for measuring pain is two weeks, while the minimum time frame for measuring impairment using the ODI is six weeks.

The value of pain intensity and disability status in the treatment group and control group is presented in Table 3.

Although there was no statistically significant difference between the treatment group and the control group in the NPRS value following the inclusion of walking aerobic exercise (p = 1.000), both groups demonstrated a synergistic favorable effect in reducing pain intensity and low back pain disability status. While there was found to be a significant difference between the treatment group and the control group in the ODI score value following the inclusion of walking aerobic activity (p-value = 0.001).

The NPRS scores of treatment group in this study showed no interaction impact of adding walking aerobic exercise when compared to the control group.

Table 3: NPRS and ODI values between groups after training

	Treatment n=16	Control n=16	P-value
NPRS	1,63 ± 0,96	1,63 ± 1,15	1.000[b]
ODI	4,25 ± 3,42	8,75±3,72	0,001[b]

[b]*Independent sample t-test; significant if p<0.05.*

However, the impaired status was improved with the addition of aerobic walking exercise. According to research by Hayden, chronic low back pain patients who engaged in high-intensity aerobic exercise for 12 weeks showed a significantly lower level of pain, disability status, and psychological burden compared to those who only received conservative physical treatment [15]. Chronic low back pain patients who just received conservative physical treatment showed a significantly lower level of pain, disability status, and psychological burden. The control group engaged in walking activities that were challenging for the researcher to manage during the exercise pause, which affected the results of the NPRS measurement.

The ODI score showed a significant difference between the two groups, demonstrating that the treatment group that engaged in more aerobic exercise had fewer complaints of disability in the daily activity area. According to Citko *et al.*'s study, increasing physical activity with walking aerobic exercise can reduce the recurrence of low back pain complaints by 3.5 times, so that subjects in the treatment group benefit from additional exercise during daily activities [16]. Disability conditions improve, particularly in standing, walking, and traveling, as well as in social activities. Since the subjects recruited for this study had an average degree of mild-moderate pain intensity and a relatively narrow range of the minimum and the maximum values, the improvement between the treatment group and the control group was comparable. This selection of subjects also had an impact on the improvement in pain intensity. To corroborate the results of this investigation, additional systematic long-term studies involving a large number of people are required because other studies have noted additional benefits of aerobic exercise. Both the treatment group and the control group experienced similar levels of discomfort on average. This is because the pathophysiology of chronic pain can adapt because neuroplasticity is present.

In this study, the treatment group's impact size was -2.01 on the NPRS and -3.77 on the ODI, while the control group's effect size was -1.71 on the NPRS and -2.99 on the ODI. The addition of walking aerobic exercise to regular exercise has a significant impact on lowering pain intensity and disability status, as shown by the effect size value of greater than one. It can be mentioned that, in patients with mechanical chronic low back pain for 8 weeks, both the addition of walking aerobic exercise to the conventional exercise and delivery of conventional exercise alone had a synergistic

effect on reducing pain intensity and disability status.

This study is in line with research done by Chan (2011) that found that giving abdominal muscle strengthening exercises and spinal flexibility alone had a smaller effect size on pain reduction than giving the combination of aerobic exercise walking with a frequency of two times a week 50 minutes a day for 12 weeks [17]. Walking aerobic exercise can increase the release of endorphin which will reduce pain. In this study, walking aerobic exercise was performed flexibly for at least 10 minutes each time, adding up to 30 minutes every day.

Table 4 indicates the difference (delta) between the treatment and control groups' NPRS and ODI scores after eight weeks of training.

Prior to and following training, there was no discernible variation in the NPRS scores (Delta) between the treatment group and the control group (p-value Delta NPRS 0.714). It was determined that there was a significant (p-value Delta ODI 0.001) difference in the ODI values between treatment group and control group (Delta). Regarding the differences between the NPRS values obtained in the treatment group and the control group, this study is consistent with research carried out by Chan *et al.* [17].

Table 4: Comparison of Difference (Delta) of NPRS and ODI values between groups after training

	Treatment (n=16)	Control (n=16)	P-value
NPRS	-1,94 (0-4)	-1,87(1-3)	0,714[a]
ODI	-13,37 ± 2,90	-9,5 ± 2,58	<0,001[b]

[a]Mann-Whitney U test;[b] Independent sample t test; significant if p<0.05.

Both groups experience less pain over the 8-week exercise regimen. This demonstrates that adding aerobic walking exercise to regular exercise reduces pain in both groups in a synergistic manner. Although pain measures of both groups were thought to have improved, the comparison of pain reduction was thought to be equivalent. However, because the improvement in the ODI score was better than the control group in the sub categories of standing, walking, engaging in social activities, and traveling, the improvement in the treatment group's disability status had a more favorable influence on the treatment group.

In this study, aerobic walking exercise had no negative consequences. In both groups, there was a decline in fitness levels, which is consistent with other research findings and the condition of chronic low back pain. The treatment group was encouraged to enhance their physical activity during the exercise period by engaging in pedometer-assisted walking aerobic exercise.

Exercises like walking encourage isometric contractions by raising lumbar muscular activation, which is crucial for avoiding low back pain. The more quickly you walk while maintaining good posture, the less low back pain complaints you will hear. According to the previous research, quick walking causes more multifidus muscle activity than slow walking. In contrast to the lumbar muscles, leisurely walking might stimulate the mid lumbar muscles [12]. This condition can result in a significant decrease in ODI scores in the group that received walking aerobic exercise because there were significant improvements in the statements regarding walking, standing, traveling, and engaging in social activities obtained in the walking exercise group. Longer activation of the lumbar muscles can have a strengthening effect on these muscles.

It is possible to treat low back pain with both pharmaceutical and non-pharmacological methods. activities, modalities, lumbar traction, and the use of orthoses are all examples of non-pharmacological therapy [18]. The activities given include strengthening exercises, cardio exercises, and stretching exercises. Nobody claims that any workout is more dominant than another. Exercises that promote aerobic fitness are administered to avoid low back pain-related deconditioning. Giving walking exercises is one of the aerobic workouts that can be done. The exercise regimen is also modified based on the clinical situation.

Walking is a low-cost, safe exercise that can be performed independently at home because it carries a low risk of injury [18]. In this study,

adding walking to conventional exercise was used as a treatment; the treatment group experienced no negative side effects as a result, indicating that the treatment was safe. Exercise safety and security should be a top priority, particularly in light of the ongoing COVID-19 pandemic. Exercise should be performed outside, or if inside a closed space, with the windows open and the air conditioner off. Do it in a location with sufficient illumination, a flat, non-slip floor surface, and enough water to prevent dehydration from sweating during exercise. Adjust the space between subjects if the activity is done in a group. This study adds to earlier research on the advantages of walking aerobic exercise for people with chronic low back pain. In this trial, there was an 8-week reduction in both pain severity and disability level.

The duration of previous studies on walking aerobic exercise in people with chronic low back pain ranges from 6 to 12 weeks. Although some findings result in a drop in pain intensity that is not substantial but has a synergistic effect on pain intensity, the outcomes of research on pain intensity and disability status have a favorable impact.

This study has a number of limitations, including the following: 1) The research subjects' physical activity outside of the exercise program cannot be controlled, potentially confounding the study's findings and 2) both the researchers and the research participants were not protected from exercise intervention. The benefits of walking aerobic exercise cannot be assessed when it is given alone without being combined with conventional exercise and the condition of workplace ergonomic factors was not addressed so that it would not have an impact on the findings of the study, particularly with regard to pain intensity and disability status.

Conclusion

In the group that underwent additional aerobic activity, which included walking for 30 minutes, three times per week for eight weeks, there was a reduction in pain intensity and disability status.

In the control group, which just received standard low back pain exercises, there was a reduction in pain severity and disability status.

While the group that received additional walking exercise did not experience a greater reduction in pain than the group that only received conventional exercise, the group that received aerobic walking exercise did experience a greater reduction in disability status.

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Authors' Contributions

All authors agreed to be accountable for every part of this work and contributed to data analysis, writing, and revision of the article.

ORCID

I Nengah Bagus Surianta
https://orcid.org/0000-0003-3363-7828
Damayanti Tinduh
https://orcid.org/0000-0001-6604-8152
Nur Sulastri
https://orcid.org/0000-0002-4005-0016
Soenarnatalina Melaniani
https://orcid.org/0000-0002-4449-153X

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