

The Effect of Hydrotherapy in Low Back Pain Patients

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Abstract

Background: Low back pain (NPB) is the first disease that causes disabilities at all ages, and its incidence increases with age. A number of previous studies have reported that hydrotherapy has an effect on improving low back pain and increasing flexibility. Therefore, this study aims to determine the effect of hydrotherapy on pain intensity and lumbosacral flexibility in low back pain patients at dr. Mohammad Hoesin Palembang. **Methods:** This study is a pre-experimental study with a one group pretest-posttest design with a sample size of 35 NPB patients. Inclusion criteria were NPB patients who did not undergo operative action, had no contraindications to undergo hydrotherapy, and were > 29 years old. The exclusion criteria were patients with communication disabilities and a history of low back pain due to infection, tumor and metastases. Subjects dropped out of the study if they underwent hydrotherapy less than three times or withdrew. Pain intensity and lumbosacral flexibility data were obtained before and after the subject underwent hydrotherapy once a week for one month. **Results:** There was a decrease in pain intensity from 5.57 to 4.00 ($p < 0.001$) and an increase in lumbosacral flexibility from 48.10 to 48.73 ($p = 0.014$) in low back pain patients undergoing hydrotherapy. **Conclusion:** There is an effect of hydrotherapy on reducing pain intensity and increasing lumbosacral flexibility in low back pain patients undergoing hydrotherapy at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang

Keywords: Low back pain (NPB), hydrotherapy, pain, flexibility

1. Introduction

Lower back pain (NPB) is pain that is felt between the angle of the lower ribs and the fold of the lower buttocks, namely in the lumbar or lumbosacral region¹. NPB can be both local pain and pain that radiates to the legs. Based on the Global Burden of Disease Study, NPB ranks first as the main cause of disability from 1990 to 2017 for all ages globally. The prevalence of NPB in Indonesia is 18% and increases with age².

Age, body mass index, pregnancy, trauma, posture errors, excessive activity, degeneration processes, and psychological factors are risk factors for the occurrence of NPB. These can lead to damage or lesions to the intervertebral disc, fascia articular, muscles, tendons, and ligaments of the lower back. A protective mechanism to prevent further damage is muscle spasm³. Muscle spasm can result in tissue ischemia, causing pain in the lower back. Muscle spasm can also limit lumbar movement, resulting in atrophy and decreased muscle strength. The decrease in muscle strength will decrease the stability in the lumbar area which will increase the workload of the muscles, causing pain. Immobilization can decrease muscle strength, reduce elasticity, and result in the formation of tissue adhesions resulting in decreased flexibility⁴. Decreased flexibility will limit movement activities, making it more difficult for patients to carry out daily activities. Therefore, the role of physiotherapy is needed to increase flexibility and functional ability, and prevent further complications in people with NPB⁵.

Hydrotherapy (Aquatic Exercise) is an option used as therapy for patients with NPB. Hydrotherapy is the use of water externally to treat physical disorders or for healing⁶. The biological and physiological effects of exercise in water result from the properties of water: density and gravity, hydrostatic pressure, buoyancy, viscosity, and thermodynamics⁷. The properties of water can reduce muscle spasm, block nociceptors, reduce the load on the sore joints, make it easier for patients to exercise in water, and increase muscle strength, resulting in decreased pain, and increased lumbar flexibility and stability in NPB patients⁸.

The results of previous research by Susanto et al. demonstrated that hydrotherapy is significantly better than McKenzie Exercise in reducing disability in patients with discogenic NPB (clinical symptoms due to degeneration of the intervertebral disc) significantly, reported hydrotherapy is faster in reducing pain and functional disability in chronic nonspecific NPB patients compared to other conventional physiotherapy. In contrast to research^{9,10}. showed that there was no difference in the effect of hydrotherapy and other conventional physiotherapy, namely William's Flexion Exercise (WFE), in reducing NPB. One of the studies on the effect of hydrotherapy on the flexibility of NPB patients was conducted by Baena-beato et al. demonstrated that the hydrotherapy program resulted in improvements in pain reduction, decreased disability, improved quality of life, and increased flexibility in chronic NPB patients^{11,12}.

Hydrotherapy services at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang have been available since 2015. Research on hydrotherapy at Dr. Mohammad Hoesin Palembang has just been performed on lumbar nucleus pulposus (HNP) hernia patients. Research on the effect of hydrotherapy on NPB patients in general has never been done. This study was intended to examine the effect of hydrotherapy on pain intensity and lumbosacral flexibility in low back pain (NPB) patients at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang.

2. Research methods

This type of research is pre-experimental research with a one group pretest-posttest design or numerical comparative analytic pairs with repeated measurements of two times (without a control group) (Dahlan, 2016; Dahlan, 2018).

The research was conducted at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang in December 2019.

The population of this study were all low back pain patients in the Medical Rehabilitation Installation Dr. Mohammad

Hoesin Palembang in December 2019. Based on a preliminary survey, the average number of patients undergoing hydrotherapy per month at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang is ± 30 people.

The samples in the study were all low back pain patients who met the inclusion criteria in the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang in December 2019.

Sampling was carried out sequentially (consecutive sampling), namely making patients who met the inclusion criteria as the study sample until the minimum required sample size was achieved.

Inclusion criteria were low back pain patients who did not undergo operative action at Dr. Mohammad Hoesin Palembang. Low back pain patients who have no contraindications to undergo hydrotherapy (hydrophobia, uncontrolled hypertension, heart defects, open skin infections, infectious infections, pulmonary function disorders, impaired consciousness, epilepsy, inability to control bowel and urination, and deep menstrual period). Lower back pain patient > 29 years old.

Exclusion criteria were patients who were unwilling to participate in the study. Patients with verbal and nonverbal communication disorders. Patients with diseases that can cause decreased flexibility in addition to lower back pain (stroke, lower limb fracture, and contracture of the lower limb). Patients with a history of low back pain due to infection, tumors, and metastases.

Drop Out criteria are patients who undergo hydrotherapy less than three times the number of hydrotherapy that has been determined. The patient resigns for some reason.

The independent variable is hydrotherapy, which is done once a week for a month.

The dependent variables are pain intensity and lumbosacral flexibility.

The data that has been obtained will be presented in tabular and narrative form and will be processed using the Statistical Package for Social Science (SPSS) program. Data were processed, compiled, and analyzed using

univariate and bivariate methods.

Univariate analysis aims to analyze each variable from the research results. Univariate analysis serves to summarize the distribution and percentage of each variable (Notoadmodjo, 2010). The summary will be presented in tabular form.

Bivariate analysis aims to determine the effect of the independent variable and the dependent variable by looking at the mean difference between one group of paired data, before and after the intervention. The normality test is carried out first with the analytical method to determine the distribution of data. The Shapiro-Wilk parameter was used because the number of subjects was ≤ 50 . Analysis for comparative numerical pairwise 2 groups was paired t-test when the data distribution was normal ($p > 0.05$). If the data distribution is not normal, the test used is the Wilcoxon test ($p < 0.05$) (Dahlan 2015; Dahlan, 2018).

In numerical comparative analytic research, the expected results are the mean in each group, the mean difference between groups, the confidence interval (IK) and the p value of the mean difference (Dahlan, 2018).

3. Result

This research was a pre-experimental study on low back pain (NPB) patients undergoing hydrotherapy at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang. The research was conducted on Monday-Friday at 08.30-14.30 WIB during December 2019. Sampling was carried out sequentially (consecutive sampling) followed by informed consent, so that the total number of subjects was 35 NPB patients. In this study, none of the patients dropped out. Pain intensity data were obtained through interviews and filling out the Numerical Pain Rating Scale (NPRS) questionnaire¹³. Lumbosacral flexibility data were obtained by measuring the Modified Back Saver Sit and Reach (MBSR) Test method. The data was collected by measuring two times, namely before (pretest) and after (posttest) the subject underwent hydrotherapy once a week for a month¹⁴.

Sociodemographic Characteristics of the subjects of the 35 research subjects, the age range was 40-83 years. **Table 1** states that the age group > 65 years is the largest, namely 18 people (51.4%). Subjects with female gender, amounting to 24 people (68.6%) more than men, amounting to 11 people (31.4%).

The results of the NPRS and MBSR Test **Table 2** show that of the 35 research subjects, the mean NPRS and standard deviation (SD) before hydrotherapy (pretest) were 5.57 ± 1.614 accompanied by a standard error (SE) of 0.272; median 5; mode 5; and ranges from 3-9. There was a decrease in the mean value of the NPRS after the subject underwent hydrotherapy for 4 weeks (posttest), namely 4.00 ± 1.328 accompanied by SE 0.224; median 4; range 2-6; and multimodus, namely 3 and 5. In table 2, only the mode with the smallest value is shown. In the MBSR Test, the mean value before hydrotherapy (pretest) was 48.10 ± 12.101 with SE 2.045; median 51.5; mode 56; and ranges from 26.5 to 69. The mean MBSR test after the subject underwent hydrotherapy for 4 weeks (posttest) was 48.73 ± 12.395 with a SE 2.095; median 52.5; range 24-70; and multimodus, namely 39; 52.5; 53.5; 57; 57.5; and 58.5. In table 7, only the mode with the smallest value is shown.

The Effect of Hydrotherapy on Pain Intensity in NPB Patients The Shapiro-Wilk parameter was used for the normality test because the number of subjects was ≤ 50 . In **Table 3**, the value of $p = 0.041$ (pretest) and $p = 0.03$ (posttest) is obtained. Because both p values < 0.05 (α), the NPRS data distribution is not normal

Because the NPRS data is not normally distributed in the normality test, the test used on the results of the subject's NPRS before

(pretest) and after (posttest) hydrotherapy for 4 weeks is the Wilcoxon test. In the Wilcoxon test on the subject's NPRS (**Table 4**), the p value is obtained = $0.000 < 0.05$ (α) so that H_0 is rejected. Statistically, the effect of hydrotherapy on the pain intensity of NPB patients was considered significant and there were differences in the mean NPRS values before and after undergoing hydrotherapy. This suggests that there is an effect of hydrotherapy on the pain intensity of NPB patients undergoing hydrotherapy at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang within 4 weeks

The Effect of Hydrotherapy on Lumbo-sacral Flexibility in NPB Patients The Shapiro-Wilk parameter was used for the normality test because the number of subjects was ≤ 50 . In **Table 5**, the value of $p = 0.044$ (pretest) and $p = 0.037$ (posttest) is obtained. Because both p values < 0.05 (α), the MBSR Test data distribution is not normal.

The normality test of the MBSR Test results was not normally distributed, so the test used was the Wilcoxon test on the MBSR Test results before (pretest) and after (posttest) hydrotherapy for 4 weeks. In the Wilcoxon test on the MBSR Test results (**Table 6**), the p value was obtained = $0.014 < 0.05$ (α) so that H_0 was rejected. Thus, the effect of hydrotherapy on the lumbo-sacral flexibility of NPB patients is considered statistically significant and there is a difference in the mean value of the MBSR Test before and after undergoing hydrotherapy. This suggests that there is an effect of hydrotherapy on the lumbo-sacral flexibility of NPB patients undergoing hydrotherapy at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang within 4 weeks.

Table 1. Distribution of Subjects by Age and Gender (N = 35)

Variable	Group	N	%
Age	36 - 45	3	8.6
	46 - 55	7	20.0
	56 - 65	7	20.0
	> 65	18	51.4
Gender	Male	11	31.4
	Female	24	68.6

Table 2. The Results of NPRS and MBSR Test (N = 35)

Variable	Category	Means (SD)	SE	Median	Mode	Min	max
NPRS	Pre-test	5.57 (1.614)	0.272	5	5	3	9
	Post-test	4.00 (1.328)	0.224	4	3 ^a	2	6
MBSR Test	Pre-test	48.10 (12.101)	2.045	51.5	56	26.5	69
	Post-test	48.73 (12.395)	2.095	52.5	39 ^a	24	70

a. There is a multimodus of data. The modus with the smallest value is displayed.

Table 3. NPRS Normality Test before and after Hydrotherapy (N = 35)

Numerical Pain Rating Scale	N	Shapiro-Walk	p value
Pretest	35	0.935	0.041
Protest	35	0.894	0.003

Table 4. Wilcoxon Test Results on NPRS in NPB Patients (N = 35)

Numerical Pain Rating Scale	N	Average ± SD	p value
Pre-test	35	5.57 ± 1.614	< 0.001
Post-test	35	4.00 ± 1.328	

Table 5 MBSR Normality Test Before and after Hydrotherapy (N = 35)

Modified Back Saver Sit and Reach Test	N	Shapiro-Wilk	P value
Pre-test	35	0.937	0.044
Post-test	35	0.934	0.037

Table 6. Wilcoxon Test Results on the MBSR Test for NPB Patients (N = 35)

Numerical Pain Rating Scale	N	Average ± SD	P value
Pre-test	35	48.10 ± 12.101	0.014
Post-test	35	48.72 ± 12.395	

4. Discussion

In the results of this study, from the age range of 40-83 years, the incidence of low back pain was more prevalent in the age group > 65 years (51.4%). This is the same as the research of Quintino et al. That is, patients with low back pain are most often at the age of 60-65 and above. The incidence of low back pain also increases with age¹⁵. Studies have also suggested that increasing age is associated with intervertebral disc disorders and increased pain in the fascia articular and pain in the sacroiliac joints leading to lower back pain until around age 70 years¹⁶.

Subjects with female gender, amounting to 24 people (68.6%) more than men, amounting to 11 people (31.4%). This is in accordance with the research of Wáng et al. that the incidence of lower back pain is greater in female than male, the prevalence of NPB is higher in school-age girls than school-age boys, which is probably due to psychological factors, female hormonal fluctuations, and

menstruation^{17,18}. Compared with young and middle-aged subjects, the prevalence of NPB in the elderly was higher in women than men, which was recorded after the age of menopause.

After hydrotherapy intervention once a week for 4 weeks, there was a decrease in the mean pain intensity of NPB patients, namely from the average NPRS value of 5.57 to 4. In the results of the Wilcoxon test on NPRS NPB patients before and after hydrotherapy for 4 weeks in this study, the value was obtained. $p = 0.000 < 0.05$ (α) so that H_0 is rejected. Thus, it can be said that there is an effect of hydrotherapy on the pain intensity of NPB patients undergoing hydrotherapy at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang within 4 weeks. This is consistent with research by Susanto et al., Sawant et al., And Baena-beato et al. which also had the same result, namely the effect of hydrotherapy on reducing pain in patients with NPB, although the intensity and duration of hydrotherapy were different from this study¹⁹.

Previous studies have shown that the intensity and duration of hydrotherapy interventions also have an influence on changes in the pain intensity of NPB patients. In that study, there was better improvement in NPB patients who underwent hydrotherapy 3 times a week for 8 weeks compared to NPB patients who underwent hydrotherapy 2 times a week for 8 weeks. Due to the limited research time in this study, hydrotherapy interventions were carried out less than in previous studies, namely once a week for 4 weeks, but the results can be seen with the effect of hydrotherapy on reducing the pain intensity of NPB patients²⁰.

Hydrotherapy is often used as a rehabilitation for patients with musculoskeletal disorders, including patients with low back pain. In hydrotherapy, there is a decrease in muscle spasm due to the warmth of the water temperature, thus increasing blood flow into the tissues which reduces pain²¹. In a previous study by Gabrielsen et al. it was found that the hydrostatic effect can inhibit sympathetic nerve activity. The thermodynamic effect and buoyancy (buoyancy) of water block nociceptors by acting on thermal and mechanical receptors. These sensory stimuli influence the pain stimulus by activating large diameter myelinated fibers, which can clear the pathway to small nociceptive impulses, thereby reducing pain²². The upward force of the water reduces gravity, thereby reducing stress on the joints and reducing pain. Buoyancy causes the body that is in water to experience an equilibrium state which reduces the workload of the muscles, resulting in decreased pain²³.

In the research of Olson et al. found previous studies which reported the effect of hydrotherapy which is effective in treating low back pain. However, the long-term effectiveness of hydrotherapy is unclear. collect data on subjects after one year (posttreatment) undergoing hydrotherapy. As a result, it was concluded that hydrotherapy still does not have long-term effects after stopping hydrotherapy²⁴. Therefore, hydrotherapy programs should always be carried out routinely by low back pain patients, to maintain and maintain pain reduction and

maintain body function. This is also carried out by patients with low back pain in the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang, who routinely undergoes a hydrotherapy schedule once a week.

After NPB patients underwent hydrotherapy once a week for 4 weeks, there was a slight increase in the mean lumbosacral flexibility of NPB patients, from the mean value of MBSR Test 48.10 to 48.734. In the results of the Wilcoxon test on the MBSR Test of NPB patients before and after hydrotherapy for 4 weeks in this study, the value of $p = 0.014 < 0.05$ (α) was obtained so that H_0 was rejected. This suggests that there is an effect of hydrotherapy on the lumbosacral flexibility of NPB patients undergoing hydrotherapy at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang within 4 weeks. This is consistent with research by Baena-beato et al²⁵. which also had the same result, namely the effect of hydrotherapy on the increase in lumbosacral flexibility in NPB patients. Research by Baena-beato et al. (2013) showed a better improvement in the flexibility of NPB patients because the intensity and duration of hydrotherapy given in that study were more, namely 3 times a week for 8 weeks²⁶.

Hydrotherapy can influence social aspects which are very significant. Alikhajeh et al. The hydrotherapy program involves several patients in one group in one therapy that makes patients interact with each other, thus motivating patients to be active in exercise movements^{27,28}. This was also experienced by subjects in this study who participated in the hydrotherapy program at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang. Hale et al. also reported in his research, that patients undergoing hydrotherapy can create a motivating environment, and there is an increase in psychosocial aspects and positive attitudes. When the patient's body moves in the water, which results in resistance between the bodies, plus the ease with which the patient performs exercise movements in the water, this can strengthen muscle tissue resulting in increased flexibility and lumbar stability^{29,30}.

Ease of exercising or stretching motion

(stretching) which can stimulate the production of lubricants (lubricants) between tissue fibers thereby reducing adhesion to the tissue. During stretching and contraction of muscles during exercise, the helical structure releases and stores elastin when the actomyosin bridge formation is active. The thermodynamics of hydrotherapy can affect substantial changes in tissue resulting in collagen relaxation and increased tissue elasticity in ligaments, tendons, and muscles which help improve flexibility^{31,32}.

There are research limitations that affect the results of this study, namely the changes that occur between pretest and posttest in NPB patients can be caused by other factors such as age, body weight and height (BMI), and subcutaneous fat under the abdomen.

5. Conclusion

Based on the results of research on the effect of hydrotherapy on pain intensity and lumbosacral flexibility in low back pain patients (NPB) at the Medical Rehabilitation Installation Dr. Mohammad Hoesin Palembang, concluded:

The mean pain intensity value before hydrotherapy was 5.57 ± 1.614 with a range of 3-9, while the mean pain intensity value after the subject underwent hydrotherapy was 4.00 ± 1.328 with a range of 2-6.

The mean value of lumbosacral flexibility before hydrotherapy was 48.10 ± 12.101 with a range of 26.5-69, while the mean value of lumbosacral flexibility after the subject underwent hydrotherapy was 48.73 ± 12.395 with a range of 24-70.

There was a difference in the mean value of pain intensity in low back pain patients before and after hydrotherapy, from 5.57 to 4.00. There is a difference in the mean value of lumbosacral flexibility in patients with low back pain before and after hydrotherapy, from 48.10 to 48.73.

There is an effect of hydrotherapy on reducing pain intensity ($p < 0.001$) and increasing lumbosacral flexibility ($p = 0.014$) in low back pain patients undergoing hydrotherapy at the Medical Rehabilitation Installation of Dr. Mohammad Hoesin Palembang.

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