THE EFFECT OF HYDROTHERAPY EXERCISE PROGRAM TO REHABILITATE THE MILD-MODERATE LUMBAR DISC HERNIATION ON FEMALES

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Abstract:

Several lines of evidence indicate that the hydrotherapy could rehabilitate the disc herniation. Relatively limited number of studies describe the effects of hydrotherapy exercises on rehabilitate the lumbar disc herniation in females. The purpose of these studies was to determine the interrelation between the hydrotherapy exercise programs and rehabilitate the mild-moderate lumbar disc herniation on female patients. We examined the hydrotherapy exercise program and crawl style swimming training on some study variables of the volunteers, they were divided equally into two groups: experimental group (n=7 females; aged 54.857 ± 3.848) control group (n=7 females; aged 54.143 ± 3.848). To evaluate the effect of both programs on our subjects we measured each of Abdominal Fat by fat caliper, Forward Range of Motion and Backward Range of Motion by the protractor, the Back Muscles Strength by the Dynamometer, Pain Intensity with visual analogue scale (VAS) and Daily Activity by SF-12. The results were by comparing the pre and posttests of each group, and comparing differences between the posttests for the control and experimental groups. Participants of this study were a mild-moderate lumbar disc herniation female patients. The results of the Crawl Style Swimming Training was there is a statistically significant differences at the level of ($p<0.05$) between the pre and posttests of the control group in favor of posttests. And results the Hydrotherapy Exercise Program was there is a statistically significant differences at the level of ($p<0.05$) between the pre and posttests of the experimental group in favor of posttests. And there is a differences between the posttests averages for the control and experimental groups in favor of the experimental group. We demonstrated that the hydrotherapy exercise program rehabilitate the mild-moderate lumbar disc herniation in female patients.

Keywords: Lumbar Disc Herniation, Rehabilitation, Hydrotherapy

1. Introduction

The Lumbar Disc Herniation (LDH) is a fragment of the disc nucleus that pushed out the annulus into the spinal canal through a tear or rupture in the annulus (Herniated Disc – Symptoms, Causes, Prevention and Treatments, n.d.), Can occur anywhere along the spinal column (Manchikanti et al., 2012), And it's a condition where there is a protrusion of part or all parts of nucleus pulpous through the annulus fibers of intervertebral disc, which can be directed to spinal canal and pressing the spinal root (Dezawa et al., 2012) Not only cause local and radicular pain, but also limit the back muscles movements, this limitation caused a muscle spasm, which is caused decrease the spinal flexibility and range of motion (ROM) (Rahmadhani et al., 2020) and a functional disability that interferes with daily activities (III et al., 2021) Thus, any malfunction effecting the axis of the body (functional or anatomically) will adversely affect the functional level of the spine (Monitoring of Pain Management Practices; a Patient Satisfaction Approach, 2003) and body movement in general (Shaltout et al., 2006).

The most common Disc Herniation happen in Lumbar Region, that consist of five vertebrae (L1-L5) due to the great pressure and the huge loads, and incorrect motor skills and bad posture. Mostly effects people aged (30-60) years. with a male to female ratio of 2:1 (Jordan et al., 2011) In Women 80% of the global percentage, is due to weak muscles and ligaments as a result of exposure to hormonal fluctuations in the menstrual cycle and pregnancy pressures (Wang et al., 2016) .

Several studies by (The Unguarded Moment Book by Vert Mooney, M.D. | Spine and Sport, n.d.) (Choi et al., 2005) , (Bakhtiary et al., 2005) have proven that more than 90% of people with a herniated disc can recover without resorting to surgeries, but by resorting to various physical therapy methods. According to (Rahmadhani et al., 2019) hydrotherapy has an effects on reducing pain intensity and improving functional ability in lumbar disc herniation patients that undergo the non-operative procedure, and for athletes who need to relax their muscles to prepare for exercise. And for (Erickson, 2015) the hydrotherapy can be a relative protective from complex surgeries and it's inexpensive therapy. (Becker, 2009) shows that the physical properties of water explains why water is a unique therapeutic medium as safe for adults to exercise. Where surface tension, viscosity, and hydrostatic pressure helps strengthening the muscles, re-education, and increase endurance, coordination, balance, speed, and sense of movement in therapy. In addition, the buoyancy helps to increase the flexibility and joints range of motion (Rahmadhani et al., 2020) . In addition, therapist is able to provide an entirely different aspect of therapy that cannot be achieved on land, like, control the water temperature, which has been found that the warm water relaxes muscles and reduces spasm muscle (Morris, n.d.). Therefore, the results of this study are appropriate with the results of a study conducted by (Oleh et al., n.d.)(Susanto et al., 2015) but the duration of hydrotherapy given was different. The purpose of these studies was to determine the effect of a hydrotherapy exercise program to rehabilitate the mild-moderate lumbar disc herniation on female patients aged between (40-60) years.

1.1 Problem Statement

Despite the development of medical sciences, lumbar disc herniation continues to spread globally, and although the protocols of the ministries of world health in treating and rehabilitating patients with lumbar disc herniation are clear procedures, there are some therapeutic procedures that are conservative, such as surgeries or dispensing pain-relieving medications and muscle relaxants. Some of them are rehabilitative measures such as hydrotherapy exercises. Also, most of the research in this field has applied several rehabilitation methods to the

same experimental groups. Therefore, the researcher decided to design a hydrotherapy exercise program to find out the extent of its effect in rehabilitating mild-moderate lumbar disc herniation in female patients aged 40-60.

2. Material and Methods

Participants. 20 patients participated in the study, but only 14 patients of them adhered the sessions without being absent. Were divided equally into two groups: control and experimental group. The control group consists of (7 female; aged 54.143 ± 3.848). The experimental group consists of (7 female; aged 54.857 ± 3.848). All volunteers were female patients of mild-moderate LDH, based on a specialist physician (orthopedic) diagnosis. All cases were re-classified according to the modified World Health Organization (WHO). The study protocol was approved by a local Ethics Committee Procedure. The exercise program that used in this study was presented to a specialist physician (orthopedic), and evaluated by Sport Medicine and Swimming lecturers.

Data was collected by direct interview with patients, fill out a questionnaire includes: Name, Age, Bodyweight, Hight, Underwent LDH surgery? Undergoing any other physiotherapy? Suffering from any other influencing diseases? To make sure they qualified to join the study. Then the measurement phase taken pre and post the hydrotherapy exercise program, by measure the abdominal fat by Caliper, forward and backward range of motion by the protractor, the pain intensity by Visual Analog Scale (VAS), daily activity by SF-12, and back muscle strength by the Dynamometer. Before and after six weeks of the hydrotherapy exercise program.

This study used an exercise program, The control group applied moderate intensity of crawl style swimming training: 5 minutes warm up: 1 minute breathing, 1 minute light jumping, 1 minute leaning the body left & right, 2 minutes of walking side-side. 30 minutes intermittent of crawl style swimming. 5 minutes of cool down: breathing and stretching exercises 5 seconds each part. And the experimental group applied a moderate intensity of hydrotherapy exercises: 5 minutes warm up: 1 minute breathing, 1 minute light jumping, 1 minute leaning the body left & right, 2 minutes of walking forward & backward. 30 minutes of aqua exercises: full body stretches 5 seconds each part, knee to chest, twisting side-side, pull up & down, Toe taps, with 20 repetition for 3 sets for the first & second weeks. Full body stretches 5 seconds each part, knee to elbow, leg raise & flutter leg, push up & down, butt kick, with 30X2 for the third & forth weeks. And the same program for the fifth & sixth weeks but with adding some water weights. Lastly, 5 minutes of cool down: breathing and stretching exercises 5 seconds each part.

Each session 40 minutes/ 2 times per week, for 6 weeks in a row, totaling 12 sessions.

Statistical analysis. The data then analyzed using the Statistical Package for Social Science (SPSS) for Windows. The data normality test was carried out by the Shapiro-Wilk method, Independent T test to measure the differences among the data points, Mann Whitney test used to measure the differences between the data, Wilcoxon test were used to compare the pre- and post-test of the experimental group and the control group.

3 Results

From the normality test with Shapiro-Wilk on Abdominal Fat, Forward Range of Motion, the Backward Range of Motion, Pain intensity, Daily Activity, Back Muscle Strength, which can be seen in tables 1, p=0,000<0,05 (α). This means that the study variables is not normally distributed.

Table 1. Results of the normal distribution test done on the pre-data for the study variables

Variable	Test	Statistic	Sig.
Abdominal Fat	Shapiro-Wilk	0.893	0.040
F.R.O.M		0.895	0.010
B.R.O.M		0.887	0.007
Pain Intensity		0.900	0.011
Daily Activity		0.646	0.000
Back Muscle		0.892	0.009

Table 2 demonstrate the arithmetic averages, standard deviations of the study variables in the pre and posttests for both the control and the experimental groups. And table 4 shows the results of Wilcoxon test to compare the pre and posttests of the control group observations.

Wilcoxon test found that the significance level values of the Abdominal Fat variable reached 0.034, the Forward Range Of Motion variable reached 0.017, the Backward Range Of Motion variable reached 0.039, the Pain Intensity variable reached (0.016), the Daily Activity variable reached 0.317, and the Back Muscle Strength variable reached 0.017. All of the values are statistically significant because they are less than 0.05, except for the Daily activity variable whose significance level was 0.317. This was higher than 0.05. This significance was in favor of the posttests. It was noted from the results in Table 3 that post-swimming training indicates that there was a decrease in the year average of the Abdominal Fat and Pain Intensity of the study sample. There was an increase in the overall average of the Forward Range of Motion, the Backward Range of Motion and Back Muscle Strength. It was noted that there was a slight decrease in the Daily Activity variable that was not statistically significant.

Table 2. The arithmetic averages and standard deviations of the study variables in the pre- and post-measurement stages for both the control (swimming training) and the experimental (hydrotherapy program) sample groups

Variable	Swimming training				Hydrotherapy Program			
	Pre		Post		Pre		Post	
	Mean	SD.	Mean	SD.	Mean	SD.	Mean	SD.
Abdominal Fat	2.96	0.63	2.83	0.55	2.46	0.76	2.06	0.54
FROM	83.43	7.61	88.00	6.58	88.86	11.94	101.00	10.42
BROM	15.29	4.23	17.43	4.16	19.14	7.13	25.71	8.16
Pain Intensity	5.71	1.80	3.43	2.07	4.29	2.14	0.57	1.13
Daily Activity	2.00	0.00	1.86	0.38	2.00	0.00	1.14	0.38

Back Muscle	24.00	3.37	26.93	3.94	25.79	4.81	33.29	2.93

Table 3. The results of the Wilcoxon test between the pre- and post-measurements for the control sample observations (swimming training)

Variable	Measurement	Sum of ranks	N	Mean rank	Z	Significance
Abdominal Fat	Negative Ranks	15.00	5	3.00	2.121-	0.034
	Positive Ranks	0.00	0	0.00		
	Ties	--	2	--		
F.R.O.M	Negative Ranks	0.00	0	0.00	2.384-	0.017
	Positive Ranks	28.00	7	4.00		
	Ties	--	0	--		
B.R.O.M	Negative Ranks	0.00	0	0.00	2.06-	0.039
	Positive Ranks	15.00	5	3.00		
	Ties	--	2	--		
Pain Intensity	Negative Ranks	28.00	7	4.00	2.41-	0.016
	Positive Ranks	0.00	0	0.00		
	Ties	--	0	--		
Daily Activity	Negative Ranks	1.00	1	1.00	0.994-	0.317
	Positive Ranks	0.00	0	0.00		
	Ties	--	6	--		
Back Muscle	Negative Ranks	0.00	0	0.00	2.388-	0.017
	Positive Ranks	28.00	7	4.00		
	Ties	--	0	--		

Table 4 shows the results of the Wilcoxon test between the pre and posttests of the experimental group. It was found that the significance level values for the Abdominal Fat variable reached 0.026, the Forward Range of Motion variable reached 0.018, the Backward Range of Motion variable reached 0.018, the Pain Intensity variable reached 0.017, the Daily Activity variable reached 0.014, and the Back Muscle Strength variable reached 0.018. All of the values were statistically significant because they were less than 0.05, indicating that there are differences between the pre and posttests for these variables. The significance was in favor of the posttests.

Table 4. The results of the Wilcoxon test for the pre- and post-measurements of the experimental sample (hydrotherapy program)

Variable	Measurement	Sum of ranks	N	Mean rank	Z	Sig.
Abdominal Fat	Negative Ranks	21	6	3.50	-2.226	0.026
	Positive Ranks	0.0	0	0.00		

Variable	Measurement	Sum of ranks	N	Mean rank	Z	Sig.
	Ties	--	1	--		
FROM	Negative Ranks	0.0	7	0.00	-2.375	0.018
	Positive Ranks	28	0	4.00		
	Ties	--	7	--		
BROM	Negative Ranks	0.00	0	0.00	-2.375	0.018
	Positive Ranks	28	7	4.00		
	Ties	--	0	--		
Pain Intensity	Negative Ranks	28	7	4.00	-2.388	0.017
	Positive Ranks	00	0	0.00		
	Ties	--	7	--		
Daily Activity	Negative Ranks	21-	7	3.50	-2.449	0.014
	Positive Ranks	0.00	0	0.00		
	Ties	--	0	--		
Back Muscle Strength	Negative Ranks	0.00	7	0.00	-2.371	0.018
	Positive Ranks	28.00	6	4.00		

Variable	Measurement	Sum of ranks	N	Mean rank	Z	Sig.
	Ties	--	0	--		

Based on table 5 results, it is clear that they don't follow the normal distribution. This makes it necessary to rely on non-parametric tests to measure the differences between the post-measurements averages for the control and experimental samples using Mann Whitney test.

Table 5. Results of the normal distribution test for the post data of the study variables

Variable	Test	Statistic	.Sig
Abdominal Fat	Shapiro-Wilk	9390.	0400.
F.R.O.M		9190.	0210.
B.R.O.M		8780.	0050.
Pain Intensity		8350.	0140.
Daily activity		5160.	0000.
Back Muscle		9710.	0090.

Table 6 shows Mann Whitney test for the study variables in the post measurement stage. By reviewing the Z calculated values and their level of significance, It was found that the significance level values for the Abdominal Fat variable reached 0.012 the Forward Range of Motion variable reached 0.008, and the Backward Range of Motion variable reached 0.032 the Pain Intensity variable reached 0.016 the Daily Activity variable reached 0.010 and the Back Muscle Strength variable reached 0.015 All of these values are statistically significant because they are less than 0.05 this indicates that there are differences between the two samples in the posttests, and this significance is in favor of the experimental sample.

Table 6. Results of the Mann Whitney test on the two samples for the study variables in the post-measurement stage

Variable	Group	Sum of ranks	N	Mean rank	Z	Sig.
Abdominal Fat	Swimming Training	72.00	7	10.29	-2.505	0.012

	Hydrotherapy Program	33.00	7	4.71		
FROM	Swimming Training	32.00	7	4.57	-2.643	0.008
	Hydrotherapy Program	73.00	7	10.43		
BROM	Swimming Training	36.00	7	5.14	-2.144	0.032
	Hydrotherapy Program	69.00	7	9.86		
Pain Intensity	Swimming Training	70.50	7	10.07	-2.408	0.016
	Hydrotherapy Program	34.50	7	4.93		
Daily Activity	Swimming Training	70.00	7	10.00	-2.575	0.010
	Hydrotherapy Program	35.00	7	5.00		
Back Muscle Strength	Swimming Training	33.50	7	4.79	-2.438	0.015
	Hydrotherapy Program	71.50	7	10.21		

4 Discussion

Based on Wilcoxon test result on the study variables before and after the crawl style swimming training, there was a decrease in overall average of the Abdominal Fat on the study samples, that was confirmed by (Commission, n.d.) About the effectiveness of swimming by reducing body fat levels (12%) in males and (20%) in females. And there was a decrease in Pain Scale, similar research has been carried out by (Irandoust & Taheri, n.d.) , (Backhausen et al., 2017) showed significant results in decreasing the pain intensity. And as (PENGARUH HYDROTHERAPY *EXERCISE DAN WILLIAM'S Pengaruh Hydrotherapy Exercise Dan William's Flexion* Exercise Terhadap Nyeri Punggung Bawah., n.d.) The mechanism of decreasing pain intensity by hydrotherapy is caused by warmth which results in vasodilation of blood vessels, so that it can reduce muscle spasticity and pain. As for the increase in overall average of the Forward and Backward Range of motion, the effect of body buoyancy during swimming reducing the body weight in water so the pressure on the intervertebral disc decrease.

Regarding the increasing in Back muscle strength agreed with (Shaltout et al., 2006) study, that the water environment is a comfortable medium for the human body, which helped to relax and loosen the adhesions, which led to an increase in blood flow to the cells, thus increasing and activating metabolic processes and raising the temperature and relaxation of the muscles. And about the slight decrease that was observed in the variable of daily activities, which was not statistically significant, it was found that the general stress and fatigue from swimming was the reason, since swimming make the body feel sleepy after training. And before and after the Hydrotherapy Exercise Program for six weeks in a row, there was a decrease in overall average of the Abdominal Fat on the study samples(Academia Arabia, n.d.) Confirmed the importance of water exercise on pelvic circumference and fat percentage on the study sample. In terms of relieving pain, applying and practicing number of the suggested hydrotherapy exercises, contributed reducing pain, due to the reduction of muscle tension in the lumbar region (low back). And the current study is in agreement with (Irandoust & Taheri, n.d.) (Cuesta-Vargas et al., 2011),(Angel Baena-Beato et al., n.d.), and (Cuesta-Vargas et al., 2011) study, where they found the water exercise effectively contributed to relieving the pain. And some of the suggested stretching and breathing exercises that applied, contribute to relieve muscle tension, thus relieve pain and improve Forward and Backward spinal Range of Motion. In addition, Water stimulate blood circulation, which explains the improvement daily activity in a statistically significant way as a natural outcome. The individual's ability to carry out the requirements of his daily life is strongly correlated with the degree of flexibility, muscle strength, and the degree of pain, and this is consistent with the study (Angel Baena-Beato et al., n.d.)(Cuesta-Vargas et al., 2011) Other characteristics of water such as, viscosity and hydrostatic pressure, can effect on back muscle strength, so that suppression of the intervertebral disc is reduce.

Based on the posttests of Mann Whiteny test, the experimental group sample were better than the posttests of the study variables for the control group sample. Which the overall average of Forward and Backward Range of motion, and Back Muscle Strength in the experimental group sample was higher than the overall averages in the control group sample. These reasons might be due to uses the music during apply the hydrotherapy exercise program, since using music helps to relax and overcome tension and fear during therapy, this in agreement with (Rabadi, 2009) study, that the aqua yoga accompanied by music has an improving breathing and relaxation. In addition, it consistent with study (Tomas-Carus et al., 2007) that running in deep water had a positive effect on the physiological variables of the study. Where the study applied walking and cycling exercises on the experimental group and practiced a crawl style swimming it's like running in water. So, the researcher explained that the result was in favor of the hydrotherapy exercise program, because it contains a wide and varied assortment of stretching, breathing exercises, and yoga, which in turn help to relax and thus relieve muscle tension, thus relieving pain and improving daily activity. It is very difficult to stop the researches about hydrotherapy and it's effective on the lumbar disc herniation patients. Hydrotherapy is a therapy discipline which requires a lot of studies and researches. Therapist must be up to date, and give more attention to hydrotherapy exercises program. Participants of this study were female patients of mild-moderate lumbar disc herniation, therefore, we cannot exclude that the factors not controlled for in this study effected to the final results, for example: exercise techniques, diet, mood, and different lifestyle etc. These factors are also known to influence the study .results

5 Conclusion

The data demonstrate that the both hydrotherapy exercise program and the crawl style swimming training could rehabilitate the mild-moderate LDH in female patients aged between 40-60 years, but the hydrotherapy exercise program is more effective than the crawl style swimming training as the results. However, more research is needed to confirm our observations and elucidate the underlying mechanism of the hydrotherapy exercise program to rehabilitate the mild-moderate LDH. In order to confirm the negative influence of LDH disease on lifestyle of human. The limitation of this study was that some patients did not attend the sessions regularly in this study, which led to an impact on the size of the study sample.

6 Recommendations

The study recommends using the hydrotherapy exercise program to rehabilitate females of mild-moderate lumbar disc herniation aged 40-60 years, where the results of this study has proven its effectiveness, Using the crawl style swimming training to rehabilitate females of mild-moderate lumbar disc herniation aged 40-60 years, where the results of this study has proven its effectiveness, Conducting another study, a hydrotherapy exercise program with diet program, Conducting another study, on another age patients of mild-moderate lumbar disc herniation.

7 Conflicts of interest

- No Conflicts of interest.

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