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Research Article

The effect of aquatic and land exercises on pain, health related quality of life, kinesiophobia and disability in chronic low back pain: A randomized clinical trial

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Abstract

Background: This study aims to compare the effectiveness between aquatic exercise interventions and land-based exercises in the treatment of Chronic Low Back Pain.

Methods: Thirty patients were randomly allocated to land exercise (n=15) and aquatherapy group (n=15). Both groups underwent Hot pack, conventional TENS, and continuous ultrasound. A water-based exercise program was conducted in the aquatherapy group for 15 patients in an indoor swimming pool. The land-based exercise program included abdominal and back strengthening exercises. All assessments were done before and after the treatments (4th week). The pain and functional status of patients were evaluated.

Results: There were no statistically significant differences in the demographic features between groups. The pre and post-therapy differences between groups showed no significant results between groups in VAS, MODI, TAMPA, and the standardized SF-36 ($p>0.05$). There was a significant improvement in SF-36 role-emotional score in the land exercises group compared to aquatic exercises ($p \le 0.05$). The pre and post-therapy differences within groups showed a significant decrease in VAS score in aquatic exercises group ($p<0.05$), a similar observation was noted in the land exercises group too ($p<0.05$). There was also a significant decrease in ODI, TAMPA, and the physical functioning component of SF-36 in land exercises group.

Conclusions: The findings from this study show similar benefit of aquatic exercises and land exercises on pain, disability, health related quality of life and kinesiophobia in chronic low back pain, even land exercises has significant effect in emotional role domain of health-related quality of life.

Introduction

Low Back Pain (LBP) is a common musculoskeletal occupational health problem and the leading specific cause of years lived with disability [1]. Between 75% and 85% of the population will experience some form of low back pain during their lifetime [2]. LBP can be classified into three categories: acute, subacute, and chronic. In most cases (90%) pain is resolved within 12 weeks without long-term impairment. Chronic Low Back Pain (CLBP) accounts for the remaining 10% of the cases and is responsible for the majority of the associated economical burden [3,4]. It is also one of the leading causes of morbidity and works absenteeism and therefore, cost-effective strategies used to treat this condition are important [5].

Numerous studies have demonstrated the favorable effects of rehabilitative exercise on reducing chronic (longer than three months) LBP [6,7]. Exercise helps to develop core stability and increases range of motion. A combination of aerobic, strength, and stretching exercises have been reported to be more effective in treating LBP than leaving it untreated [8]. Evidence has shown that exercise can decrease pain, disability, time off work, and the increase quality of life in patients with chronic low back pain [9,10].

Many types of physical treatment are recommended for the management of pain and disability in patients with chronic low back pain [11]. Aquatic therapy has been used for many years in the management of musculoskeletal problems including low back pain. Water immersion decreases axial loading of the spine and, through the effects of buoyancy, allows the performance of movements that are normally difficult or impossible on land [12]. Aquatic therapy is also used to manage additional benefits in the treatment of pain, disability, and quality of life in chronic low back pain[13].

The recent guidelines for the management of patients with CLBP recommend supervised exercise therapy as a first-line treatment for the reduction of pain and disability [14]. The aim of this study is to compare the effectiveness of aquatic exercise interventions with land-based exercises in the treatment of CLBP.

Materials and methods

Research design

This study was conducted at a University Hospital Physical Medicine and Rehabilitation Outpatient clinic. All patients provided written informed consent before the study began. This study was approved with the permission of the university social and humanities and arts research board (Project no:62310886-600).

The inclusion criteria for the patients were to be age ranging between 20 and 65, and each patient had to be diagnosed with clinical examination and radiological findings of low back pain from at least 6 months.

All patients who had spinal stenosis and mechanical lumbar pain for 3 months, had lumbar spine surgery before the intervention, had a progressive neurological loss, was pregnant, had umbilical, hiatal, inguinal hernia and active hemorrhoids, primary or metastatic spinal malignancy, infectious spondylodiscitis such as tuberculosis, brucella, inflammatory spondylitis, advanced osteoporosis, severe pulmonary and cardiovascular disease and patients who had previously undergone traction therapy were all excluded from the study.

The randomization procedure was performed using an online random-allocation software program. 30 patients were randomly divided into 2 groups: The first group (n=15) underwent a land exercise; The second group (n=15) undertook aquatherapy.

Procedures

Both groups underwent Hot pack (HP) for 20 minutes conventional TENS (Enraf NoniusBDelftechpark 39, 2600 AV, Delft, The Netherlands), for 20 minutes at 60-100 Hz and a 60 pulse duration with the intensity of patients' comfort feeling, continuous ultrasound (Enraf-Nonius-B Delftechpark 39; 1-MHz; 1.5 watt/cm^2).

A water-based exercise program was conducted in the second group of 15 patients in an indoor swimming pool. The temperature of mineral water was 36°C. The program included warming up by walking forwards, sideways, and backward through the water in the pool; active range of motion of the joints of the lower extremities; stretching lower extremities; strengthening exercises for hips, knees, arms, elbows, and wrists; and cooling down (slow walking, squatting and standing).

The land-based exercise program included abdominal and back strengthening exercises.

Sociodemographic and clinical characteristics of patients were recorded. All assessments were done before and after the treatments (4th week). The pain and functional status of patients were evaluated.

The pain was assessed at rest and at movement by using a 10-cm-long visual analog scale (0 means no pain while 10 means worst pain [14]. For disability assessment, the Modified Oswestry Disability İndex was used [15]. Quality of life was assessed by the Short-Form 36 Health Survey (SF-36) [16]. The assessment of kinesiophobia was made with the Tampa Scale [17].

Statistical analysis

The power of analysis was conducted by G*Power 3.0.10, which indicated a sample size of 30 gives 81.41% power for each variable.

Data are presented as number of observations (n, %), mean ± standard deviation, median. The results of homogeneity (Levene's test) and normality (Shapiro-Wilk test) were used to decide the statistical methods for comparing the

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study groups. Among normally distributed groups with homogeneous variances, independent groups were compared using the Student's t-test. According to the test results, parametric test assumptions were not available for some variables; therefore, the independent groups were compared using the Mann Whitney-U test. Among normally distributed groups with homogeneous variances, dependent groups were compared using the Pariad t-test. According to the test results, parametric test assumptions were not available for some variables; therefore, the independent groups were compared using the Wilcoxon test. Categorical data were analyzed using Fischer's exact test and the chi-square test. In cases in which the expected counts for inclusion were not met in less than 20% of the cells, the "Monte Carlo Simulation Method" was used and the values were determined. Statistical analyses were performed using the IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. p-value <0.05 was considered statistically significant.

Results

There were no statistically significant differences in the demographic features between the groups (Table 1).

Back pain (VAS during rest and physical activity), disability (MODI), kinesiophobia (TAMPA), and quality of life (SF-36) results are shown in Table 2. The pre and post-therapy differences between groups showed no significant results between groups in VAS, MODI, TAMPA, and the standardized SF-36 ($p>0.05$). There was a significant improvement in SF-36 role-emotional score in the land exercises group compared to aquatic exercises ($p \leq 0.05$) (Table 2).

The pre and post-therapy differences within groups, Wilcoxon test showed a significant decrease in VAS score in aquatic exercises group ($p<0.05$), a similar observation was noted in land exercises group too ($p<0.05$). There was also a significant decrease in ODI, TAMPA, and the physical functioning component of SF 36 in land exercises group. Evaluation of the d-value between pre and after-therapy of the two groups is given in Table 3.

Table 1: Sociodemographic characteristics of participants by group (n=15 in each group).

	Aquatic Exercises Group X±SD Median (min-max)	Land Exercises Group X±SD Range (min-max)	p
Age (years)	51,06±9,57 48 (40-74)	54,93±13,49 57 (21-72)	0,161 ²
Height(cm)	161,27±2,35 160 (151-180)	160,60±2,79 160 (140-188)	0,901 ²
Weight(kg)	77,93±3,66 74 (63-104)	72,07±,92 70 (54-89)	0,361 ²
Body/mass index (kg\cm2)	29,91±0,95 29,60 (24,21-37,70)	28,19±1,16 28,20 (21,60-37,04)	0,351 ²
	n (%)	n (%)	P
Gender Men Women	3 (20) 12(80)	3 (20) 12 (80)	1,000 ³

**p<0,01 *p<0,05, ¹ Student t Testi; ² Man Whitney U Testi; ³ Pearson Chi-Square

Table 2: Means and comparing results of outcome measures before and after treatment by groups. Pre and post-therapy results within groups.

		Aquatic Exercises Group X±SD Range (min-max)	Land Exercise Group X±SD Range (min-max)	p
VAS During resting	BT	4,10±0,31 4 (2-6,5)	4,20±0,74 4 (0-10)	0,900 ²
	AT	2,70±0,30 3 (0-5)	2,03±0,49 2 (0-6)	0,257 ¹
p		0,007** ⁴	0,003** ⁴	
During physical activity	BT	5,87±0,49 6 (3-9)	6,47±0,80 7 (1-10)	0,527 ¹
	AT	4,40±0,47 4 (1-6,5)	5,20±0,68 5 (1-9)	0,326 ²
p		0,006** ⁴	0,079 ⁴	
MODI	BT	44,53±4,28 44 (14-70)	48,93±4,96 48 (12-88)	0,507 ¹
	AT	37,73±3,02 36 (18-62)	35,33±4,96 32 (4-74)	0,493 ²
p		0,088 ⁴	0,018* ⁴	
TAMPA	BT	42,93±1,06 44 (34-48)	41,40±1,43 43 (32-49)	0,429 ²
	AT	43,47±0,74 43 (40-48)	43,47±1,60 45 (29-54)	0,707 ²
p		0,726 ⁴	0,033* ⁴	
SF 36-PF (Physical functioning)	BT	50,67±6,23 50 (15-90)	50,00±4,76 45 (25-90)	0,884 ²
	AT	54,33±5,79 50 (15-100)	60,67±4,80 60 (30-85)	0,317 ²
p		0,687 ⁴	0,044 * ⁴	
SF 36-RP (Role-physical)	BT	28,33±8,40 25 (0-100)	45,00±10,12 50 (0-100)	0,216 ¹
	AT	31,67±9,59 25 (0-100)	48,33±9,28 50 (0-100)	0,222 ¹
p		0,430 ³	0,762 ⁴	
SF 36-BP (Bodily-pain)	BT	40,53±4,87 45 (10-68)	34,93±5,19 33 (0-70)	0,415 ²
	AT	45,73±5,05 50 (10-70)	41,20±5,80 45 (0-80)	0,391 ²
p		0,206 ⁴	0,331 ⁴	
SF 36-GH (General health)	BT	54,00±2,45 55 (30-65)	53,67±4,94 55 (25-85)	0,738 ²
	AT	51,00±3,13 50 (25-70)	55,00±4,88 55 (25-85)	0,545 ²
p		0,168 ⁴	0,570 ⁴	
SF 36-VT (Vitality)	BT	39,00±3,97 40 (15-70)	43,33±7,39 45 (0-90)	0,676 ²
	AT	39,33±3,08 40 (20-70)	49,00±6,29 40 (10-90)	0,222 ¹
p		0,864 ⁴	0,112 ⁴	
SF 36-SF (Social functioning)	BT	36,13±5,80 38 (13-75)	57,67±8,08 50 (0-100)	0,061 ²
	AT	39,53±6,18 50 (13-75)	54,47±7,49 50 (0-100)	0,147 ²
p		0,288 ³	0,865 ³	
SF 36-RE (Role-emotional)	BT	33,36±9,27 33 (0-100)	28,93±9,15 0 (0-100)	0,732 ¹
	AT	17,80±8,54 0 (0-100)	48,87±11,22 33 (0-100)	0,037*¹
p		0,113 ³	0,058 ³	
SF 36-MH (Mental health)	BT	56,53±4,71 56 (24-92)	60,00±6,21 60 (12-96)	0,662 ²
	AT	55,47±4,57 48 (24-88)	60,27±6,76 60 (16-96)	0,616 ²
p		0,833 ⁴	0,905 ⁴	

**p<0,01 *p<0,05 ¹ Student t Testi; ² Man Whitney U Testi; ³ Paired t Test; ⁴ Wilcoxon Testi

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Table 3: Evaluation of the d-value between pre and after-therapy of the two groups.

	Aquatic Exercises Group X±SD Range (min-max)	Land Exercise Group X±SD Range (min-max)	p
VAS During resting	-0,53±0,00 4,24 (-11-7)	-2,07±-1,00 3,33 (-9-3)	0,293 [1]
During physical activity	-3,67±0,00 23,18 (-60-40)	-10,67±-10,00 17,41 (-50-15,00)	0,933 [2]
MODI	-3,33±0,00 29,68 (-50-50)	-3,33±0,00 39,94 (-75-75)	0,493 [2]
TAMPA	14,29±0,00 31,45 (-34-67)	-19,93±0,00 37,43 (-100-34)	0,280 [1]
SF 36-PF (P hysical functioning)	-0,33±0,00 8,76 (-20-20)	-5,67±0,00 13,48 (-40-20)	0,193 [2]
SF 36-RP (Role-physical)	1,07±0,00 11,26 (-16-28)	-0,27±0,00 12,33 (-32-20)	0,913 [2]
SF 36-BP (Bodily-pain)	-3,40±0,00 11,92 (-25-12)	3,20±0,00 27,43 (-25-84)	0,607 [2]
SF 36-GH (General health)	-5,20±0,00 18,33 (-37-33)	-6,27±-10,00 18,88 (-32-32)	0,430 [2]
SF 36-VT (Vitality)	3,00±0,00 7,97 (-5-25)	-1,33±0,00 11,25 (-25-20)	0,269 [2]
SF 36-SF (Social functioning)	6,80±6,00 15,32 (-18-38)	13,60±12,00 19,93 (-26-52)	0,400 [1]
SF 36-RE (Role-emotional)	1,40±1,00 1,72 (-1-5)	2,17±2,00 2,17 (0-8)	0,028* [2]
SF 36-MH (Mental health)	1,47±1,00 1,78 (-1-6)	1,27±1,00 2,60 (-4-7)	0,897 [2]

**p<0,01 *p<0,05 [1] Student t Testi; [2] Man Whitney U Testi

Discussion

The present study shows no significant differences between aquatic and land exercises on back pain, disability, kinesiophobia, and health-related quality of life after a 4 weeks program in sedentary adults with chronic low back pain, except a significant improvement in emotional role domains of health-related quality of life in land exercises group compared aquatic exercises. We observed significant improvements in back pain levels from baseline at rest in both groups, decreased levels of pain during physical activity in the aquatic exercises group when compared before treatment scores. We also observed significant improvements in disability, kinesiophobia, and physical functioning domain in land exercises when compared to pre treatment.

Previous studies recommended land-based exercises in managing chronic low back pain [18-21]. These trials showed that exercise therapy is as effective as other conservative interventions for chronic low back pain. Previous researches have demonstrated that the hydrostatic effect of aquatic exercise can facilitate the relief of pain via reducing peripheral edema and inhibition of sympathetic nervous system activity [22]. Baena-Benato, et al, Dundar, et al, and Yozbatiran, et al. revealed that therapeutic aquatic exercise produced a statistically significant benefit for pain and disability in patients suffering from chronic low back pain [13,23,24]. In our study, we also found a significant decrease in pain in both aquatic and land exercise groups but we found no difference between aquatic and land exercises. This may be due to the fact that the other studies had a control group while we had two different exercise groups besides conventional physical therapy including thermotherapy and electrotherapy in both of our groups. Also, there is heterogeneity about no standard guidelines exist for aquatic exercises in chronic low back pain, particularly regarding the number of sessions and duration and frequency. In our study, patients received a program with a three-days per week frequency as like on land exercises. Similar to our study Sjogren, et al. studied subjects with chronic low back pain. Patients were allocated to either hydrotherapy treatment or land treatment groups. They attended their respective group sessions twice weekly for 6 weeks. At the end of the study, results indicated that both groups improved significantly in functional ability and in decreasing pain levels [25]. But, overall there was no significant difference found between the 2 types of treatment. Recently, Carayannopoulos, et al. suggested combining both water and land modalities, which enhance the benefits of exercise synergistically [26].

We observed a significant improvement in the emotional parameters of the SF-36 in land exercises but no improvement in the aquatic exercise group. Our improvements in emotional parameters of quality of life could possibly be explained by the improvements in pain, disability, kinesiophobia, and the improvement in the physical domain of health-related quality of life in land exercise. Differently, Dundar, et al. Baena-Benato, et al. Foley, et al. and Gunsoo, et al. found significant improvements in health-related quality of life in the aquatherapy group [13,23,27,28].

The other difference in our study was the decrease in pain during an activity in the aquatherapy group after treatment. This may be due to the type of exercises and environmental factors in water that made a difference in aquatic exercises. In aquatic exercise group the whole body enrolled in the therapy sessions and maybe mobility and strength of the whole body has improved which concluded as a decrease in pain during activity.

It is theorized that for some individuals with chronic low back pain, negative beliefs about pain and/or negative illness information lead to a catastrophizing response in which the worst possible outcome of the activity is imagined. This leads to fear of activity and avoidance that in turn causes disuse and resultant distress, reinforcing the original negative appraisal in a deleterious cycle [29]. Ishak, et al. concluded that kinesiophobia predicted mobility and balance in older persons with low back pain. Kinesiophobia should be continuously assessed in clinical settings to recognize the obstacles that may affect patient's compliance towards a rehabilitation program in low back pain [30]. Osumi, et al. also found evidence of a particular lumbar movement pattern associated with kinesiophobia. Thus, psychological factors impact lumbar movement patterns in individuals with chronic low back pain [31]. There are several studies for the management of kinesiophobia in chronic low back pain [32-35]. To our knowledge, this is the first study that evaluated the effect of aquatic exercises on kinesiophobia in low back pain. In our study, we observed no difference between aquatic exercises and land exercises in terms of kinesiophobia. In land exercises, significant improvements were found in kinesiophobia in the evaluation between before and after treatment.

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Conclusion

The findings from this study show similar benefit of aquatic exercises and land exercises on pain, disability, health-related quality of life and kinesiophobia in chronic low back pain, even land exercises has a significant effect in emotional role domain of health related quality of life. Further studies with a larger sample size with long-term outcomes are needed to confirm these findings.

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