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Research Article

EFFECT OF 3 WEEKS OF STRUCTURED AQUATIC THERAPY EXERCISE PROTOCOL IN NON SPECIFIC ACUTE LOW BACK ACHE- A CLINICAL TRIAL

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A B S T R A C T

Introduction: 90% of all the back pain is attributable to non specific low back pain and 10% to specific low back pain which is a health problem of high economic importance. The aim of this study was to investigate the effectiveness of 3 weeks of structured aquatic therapy exercise protocol in non specific acute low back ache.

Aquatic rehabilitation has proved to be an efficient one;it helps to control the gravitational force in water with patients having low back pain. Various properties of water such as buoyancy, surface tension enhances flexibility, muscle strength.

Methods: This study was a clinical trial and subjects were aged between 18-30 years. VAS,

Pressure Biofeedback and Popliteal angle were used to measure the Pain, Strength and Hamstring flexibility. Subjects were given one week adaptation time and intervention was given three times a week for two weeks. Paired and independent t test was used to analyze the data and significance level was set at 0.05 ($P<0.05$)

Results: Paired t test showed that significant improvement was indicated ($P<0.05$) and the independent t test showed that there was a significant difference in the change of these variables. Significant changes were indicated in terms of pain reduction, strength and hamstring flexibilty.

Conclusion: The aquatic therapy program used in this study improved pain, core strength and hamstring flexibility, which is an important factor in low back ache. According to the results of this study, the structured aquatic therapy exercise protocol can probably be used in rehabilitation program in patients with low back pain.

INTRODUCTION

90% of the population have low back ache at some point.[1] Non-specific low back ache is a global economic concern which affects 20% of the population.[2-6] World Health Organization reported a life prevalence of 84%.[7]90% of all the back pain is attributable to non -specific low back pain and 10% to specific low back pain which is a health problem of high economic importance.[10] Non-specific low back pain is defined as pain experienced between 12th rib and the inferior gluteal fold with or without associated leg pain often because of core muscle weakness and paraspinal muscle tightness.[8] Based on the duration of the back pain there are three sub-divisions namely: acute: <6 weeks, sub-acute 6 weeks 3 months and chronic >3 months.[9] Symptoms which may indicate low back pain are onset of pain at any age, pain which worsens with movement and improves with rest, stiffness in the lower back, radiating to either one side or both the sides of buttocks/thighs.[11]

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Various factors which are considered as risk factors for non -specific low back pain are: Postural stress, Weak abdominal strength, Poor hamstring muscle flexibility.[12] Physical therapy is relatively a safe and an effective approach in the management of non -specific low back pain. Core muscles which include the abdominals, back muscles, hip muscles and pelvic floor muscles are responsible for trunk stability, posture and balance. Weakness of these muscles results in compensation of other muscles which is where back pain comes into picture. Training the muscles of the core helps in correcting the posture and reducing the strain on the spine.[13] The main defense against the gravity are the muscles of the spine. Elimination of back pain can be achieved by strengthening the muscles that support the spine.[14] Hamstring muscles are posterior thigh muscles. It plays a vital role in maintaining our posture, by assisting to straighten the lower curvature of the spine which curves the pelvis forward when sitting. Poor flexibility leads to compressive stress on the spine which causes low back ache.[15,16] Aquatic rehabilitation is a late twentieth century term that describes a scientific therapy and various clinical procedures using water immersion for restoring physical mobility.[17] Various properties of water such as buoyancy and surface tension may give unique advantages

in comparison with land based interventions.[20,21,22] It is also proved that treatment in water is effective than land therapy for patients having difficulty with weight-bearing.[23] Ariyoshi *et al* suggests that in low back pain patients, the ability to control gravitational force makes aquatic therapy an efficient one.[24] Toleration of weight bearing is dependent on the depth of the water in which they are immersed. Depending on the depth of the water, 50% of an individual's weight is experienced when waist deep. 25%-30% when chest deep. Only 10% when neck deep submersion.[18] Body weight in relation to water displacement is another concept. The body sinks when the weight of the body is more as compared to that of the water displaced.[25] It floats when the body weight is less than the weight of the water. Buoyancy of the water helps achieve a greater range of motion.[26] Also, working in opposition to the buoyancy enhances flexibility, muscle strength and supports weak muscles.[19]

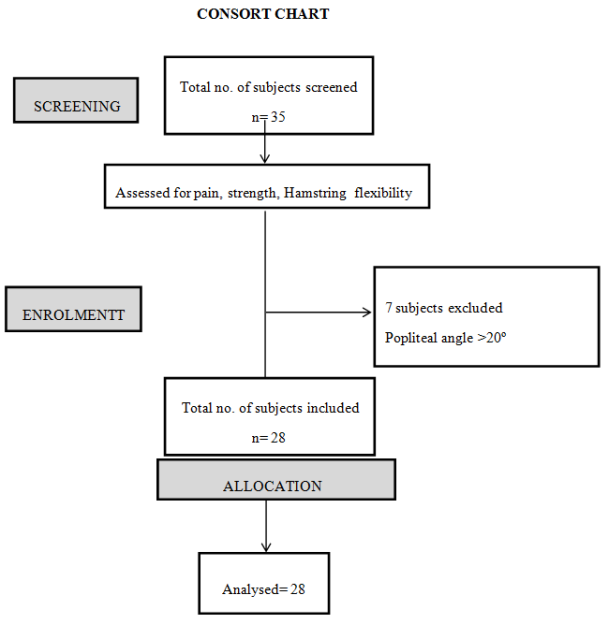
METHODOLOGY

Design and study setting

This study was a single blinded (assessor blinded) clinical trial with a sample of convenience. Ethical clearance was obtained by the Institutional Ethical Review Committee following which the study participants was screened for inclusion and exclusion criteria. All participants gave a written informed consent prior to commencement of the study, participant's rights were protected throughout the trial. This study was conducted in the swimming pool of KAHER UNIVERSITY.

Participants

Consecutive presentations of people with a referral for low back ache treatment to the swimming pool were screened. Participants were clinically diagnosed with LBA were recruited and further assessed for inclusion and exclusion criteria. The inclusion criteria were (1) Non specific low back ache (2) Less than 3 weeks (3) Low back pain not radiating to buttocks, thighs or legs (4) Age group: 18-30 years. Participants were excluded if they had (1) Altered sensations (2) Subjects receiving muscle relaxants (3) LBA with specific pathology (4) Recent abdominal or back surgery.



Intervention

The study participants were given a brief idea about the nature of study and intervention. Aquatic exercises were given for 6 sessions for 2 weeks.

Data Collection and Outcome Measure Assessment

Baseline demographic data for age, gender, BMI, popliteal angle, duration of symptoms were collected from all the participants. Evaluation of pain intensity was done using VAS (Visual Analogue Scale).

Popliteal angle was evaluated using a goniometer. The fulcrum was kept on lateral condyle of femur with hip-knee 90 degrees. The angle above 90 degree was evaluated as popliteal angle. Strength of transverse abdominis was evaluated using a pressure biofeedback unit. In supine lying, the unit was kept under the lower back. With a minimum pressure of 40 mm Hg, the unit was inflated. The subject was explained to maintain the pressure. The average of the outcome was taken.The measurement was taken on 1st day before the intervention and after the last session of intervention.

Statistical Analysis

Statistical analysis for the present study was done manually as well as using the statistics software SPSS 23 version so as to verify the results obtained. For this purpose the data was entered into the Microsoft Excel Sheet, tabulated and subjected to statistical analysis. Mean standard deviation was used for age, height, weight and BMI and test of significance such as paired 't' test was utilized for the comparison of the pre and post intervention outcome measures of Visual Analogue Scale, Pressure Biofeedback and Popliteal Angle. Probability Value less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant.

RESULT

Visual Analogue Scale

In the present study, the mean Visual Analogue Scale score at pre intervention was 5.72± 0.85. The mean Visual Analogue Scale score for post intervention was 3.43± 0.93. The results showed highly statistically significant difference with t= 9.618, p=0.000.

Pressure Biofeedback

In the present study, the mean strength at pre intervention was 36.71± 0.97. The mean strength at post intervention was 39.14± 1. The results showed highly statistically significant difference with t= -9.230, p= 0.000.

Popliteal Angle

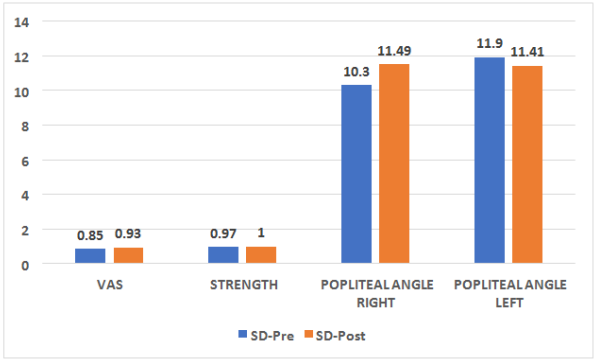
In the present study, the mean popliteal angle for right side at pre intervention was 123.03±10.30 and for left side was 125.17. The mean strength at post intervention for right side was 136.07±11.49 and for left side was 136.96±11.41. The results showed highly statistically significant difference with t= -4.472, p=0.000 for right side; t= -3.784,p=0.000 for left side.

Comparison of pre-post intervention demonstrated statistically significant results.

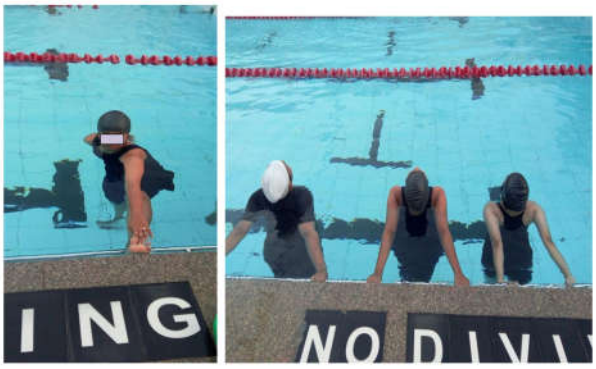
Summary independent samples t-test for comparison

Measures	PRE		POST		t-value	p-value
	Mean	SD	Mean	SD		
Vas	5.72	0.85	3.43	0.93	9.618	**0.000***
Strength	36.71	0.97	39.14	1.00	-9.230	**0.000***
Popliteal Angle right	123.03	10.30	136.07	11.49	-4.472	**0.000***
Popliteal Angle left	125.17	11.90	136.96	11.41	-3.784	**0.000***

***Significant at 5% level (p<0.05)**



PICTURES



DISCUSSION

The present study showed positive outcome in low back ache in decreasing pain, increasing strength and hamstring flexibility using structured aquatic therapy program. A systematic review of randomized controlled trial by Daniel A Olson *et al* concluded that Aquatic therapy is beneficial in treating low back ache.[27]

Similarly, the present study showed a significant decrease in pain and hamstring flexibility. The proposed effect is because spine flexion-extension exercises allowed discs to exchange fluids and thereby increasing nutrition of the discs. In addition, the fluid exchange helped in reducing swelling of the neighboring soft tissues and keeping the connective fibers of ligaments and tendons flexible. Improved mobility through back exercises helped to prevent the connective fibers from tearing under stress, which in turn prevented back pain.[28,29] Hamstring inflexibility leads to hamstrings pull on the lower back causing the hips and pelvis to rotate backwards. This leads to flattened back which in turn stresses the lower back muscles and often leads to pain. Hamstring stretches can gradually lengthen and reduce tension in the muscle, in turn reduce stress in lower back.[30-33] Hence, the present study witnessed a high level improvement in hamstring flexibility with the hamstring stretching using therapeutic aquatic exercise regimen. A systematic review by Benjamin Waller *et al* concluded that therapeutic aquatic exercises were beneficial in treatment of chronic low back ache. The current study also has shown similar effects with decrease in pain.[34]

Physical properties of water like buoyancy makes the execution of movements easier by reducing the weight on joints, bones and muscles which in turn decrease the pain sensation. The pressure of water in aquatic therapy blocks nociceptors by acting on thermal receptors and mechanoreceptors around the muscles and joints and exert positive effect on spinal segmental mechanisms, which is useful for painful condition.[35]

Study by Ariyoshi *et al* on 25 Females and 10 Males patients showed a more significant improvement in ones who had performed exercises twice or more in a week than those who performed exercises only once a week. The proposed effect is because the resistance of water using overload principle improved muscle strength by increasing the number of repetitions, progressing the volume of exercises which was in consensus with the present study where the intervention was done for 3 sessions for 2 weeks, where the number of repetitions and volume of exercise was increased in the 2nd week.[36]

A study by Dundar *et al* compared the effectiveness of aquatic exercise interventions with land based exercises in the treatment of chronic low back pain. The study concluded that water based exercises produced better improvement in disability and quality of life of patients with chronic low back pain than land based exercises. The current study has also shown effective results with structured aquatic exercise protocol for low back pain.[37] A study by Russell T. Nelson and William D Bandy concluded that stretching the hamstring muscle and training them eccentrically were equal to those made stretching the hamstring muscles statically. [38]

Similarly, the prevailing study observed increase in hamstring flexibility by stretching the hamstring muscles and lumbar spine which reduced the compression on disc resulting in a change in pelvic tilt suggestive of improved hamstring flexibility. A study by Aashima Datta *et al* deduced significant improvement in muscle imbalances, posture and cardiovascular fitness flexibility and strength in patients with low back ache.

The current study showed significant improvement in strength of core muscles. The intended effect is because core exercise increases the muscle mass, strength of tendons, ligaments and bone. It increases utilization of motor units during muscle contractions, thus increases the size and strength of fast-twitch muscle fibers from a high-resistance program and size of slow-twitch muscle fibers from a high repetition program. According to Janet Hopson *et al*. the strength of a muscle contraction depends upon the intensity of the nervous system stimulus, the number and size of motor units activated, and the types of muscle fibers that are stimulated. Initiating a resistance-training program increases muscular strength because of internal physiological adaptations. In response to resistance training the neural activation improves and as a result to this the amount of actin and myosin filaments within the muscle fibers increases. This leads to an increase in the size of cross-sectional area of protein filaments and the size of slow-twitch muscles, thus greater increase in strength.[39]

CONCLUSION

Structured aquatic exercise protocol is effective in treating Acute Low Back pain by decreasing pain, improving strength of the core muscle and increasing flexibility of the hamstring muscles.

Acknowledgement

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