



Research article

Land Based Exercises Versus Pool Based Exercises For Swimmer's Shoulder In Competitive Swimmers: Randomized Clinical Trial

Shruti Deshpande¹, Chaitanya A. Kulkarni¹, Om C. Wadhokar¹, Waqar M. Naqvi^{2*}, Pratik Phansopkar¹, Sakshi P. Arora¹

1. Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical sciences, Wardha, Maharashtra, India.
2. MGM School of Physiotherapy Aurangabad, a constituent unit of MGMIHS, Navi Mumbai, Maharashtra, India.

ABSTRACT

To compare the effect of Land based exercises and Pool based exercises for shoulder strength to reduce shoulder pain in competitive swimmers using Shoulder Pain Disability Index (SPADI) score, Hand-Held dynamometer (HHD), Randomized Clinical trial, 29 competitive swimmers with age group between 8 to 18 years were evaluated for shoulder pain using Shoulder Pain Disability Index Score [SPADI] and shoulder strength was evaluated using Hand Held Dynamometer [HHD] before and after the study. Then all the subjects were divided into 2 groups, for Group A Pool based exercises were given and for Group B Land based exercises were given. Statistically there is significant difference in values of outcome measures after the study in both groups but there is more significant difference in Group A than Group B. Pool based exercises showed more significant effect on shoulder pain than land based exercises in swimmer's shoulder.

Keywords: Land & pool based exercises, Shoulder Pain Disability Index Score [SPADI], Hand Held Dynamometer [HHD], Competitive swimmers.

Received - 17/06/2021, Reviewed - 29/07/2021, Revised/ Accepted- 13/08/2021

Correspondence: Waqar M. Naqvi* ✉ waqar@mgsop.edu.in

Professor and HOD, Department of Community Health Physiotherapy, MGM School of Physiotherapy Aurangabad, a constituent unit of MGMIHS, Navi Mumbai, Maharashtra, India.

INTRODUCTION

Swimming is an ideal form of sport considering not many athletic injuries are documented. Although, it seems because of frequent excessive and small wounds in swimming result in injuries such as swimmer's shoulder. Approximately 90% of swimming power for forward propulsion comes from upper extremities [1]. Shoulder pain is common orthopedic injury in swimmers [2]. A study showed that 35% of senior national Olympic swimmers experienced shoulder pain [3]. Condition of 'swimmer's shoulder' was described by Kennedy and Hawkins in 1974 as a 'common, painful syndrome' [4,5]. A study tells that a weight lifting exercise program done 3 times a week reduced the shoulder pain in swimmers [2,5]. Open chain exercise training can be performed using paddles, gloves, resistive bells to increase resistance [6,7]. In water inertia is increased and hence more energy is needed to change position from the state of rest [8]. Resistance is offered more by water than on dry land during movement [9]. It also works constantly to strengthen the muscles. The hydrostatic pressure is exerted equally on all surfaces of an immersed body at rest at a given depth. The major factors that gets affected in the performance

of swimmers are strength and speed [10]. The swimming technique that produces the greatest distance per stroke at good efficient energy use will produce the best result [11]. The high intensity, long duration and repetitive motions in elite swimmers put them at high risk for overuse trauma and shoulder muscle fatigue and decreased ability of rotator cuff to stabilize humeral head.

METHODOLOGY

A randomized control trial was carried out in K.L.E. Swimming Pool, JNMC Campus, Nehru Nagar, Belagavi. The duration of the study was 3 months on 29 swimmers. The inclusion criteria were competitive swimmers with age between 8 to 18 years, Swimmers with shoulder pain. The exclusion criteria were any recent shoulder injuries in last 12 months, subluxation and dislocation, any fractures, evidence of tendinitis, bursitis or effusion.

Sampling method

Subjects were randomly selected into 2 groups

Group A; Pool based exercises - 15 subjects

Group B; Land based exercises – 14 subjects

Procedure

All the competitive swimmers will be randomly allocated

into 2 groups using envelope method. Once group allocated, all competitive swimmers will be scored using, "Shoulder Pain Disability Index" And "Hand -Held Dynamometer" Score. Participants were given selective group of exercises for 3 alternative days per week for 4 consecutive weeks and after completion of intervention of 4 weeks all outcome measures will be recorded again. Warm up exercises are given for 10 minutes these are all open chain kinematics exercises like jumping running. Resistive exercises using dumbbells in side pool all shoulder movements like flexion, extension, abduction, adduction, internal rotation, external rotation. Followed by cool down phase.

Statistical analysis

Data is analysed using prism 4 software or SPSS version 21 for statistical measures. Microsoft word and Excel is used to generate graphs and tables. The correlation values for SPADI indicated significant association between the two groups hence the test has revealed a strong relationship having 70.1% movement in the same direction with at 5% significant level (i.e. $0.004 < 0.05$). The correlation values for HHD indicated significant association between the two groups hence the test has revealed a strong relationship having 95.2% movement in the same direction with at 5% significance level (i.e. $0.000 < 0.05$).

RESULTS

Demographic variables like age, gender distribution, weight were comparable between two groups. The recorded mean difference value for SPADI treatment is 12.964 which is positive and indicates the rise in post treatment outcome that is the desired or expected outcome for the study. The recorded mean difference value for HHD treatment is 11.285 which is positive and indicates the rise in post treatment outcome that is the desired or expected outcome for the study.

DISCUSSION

The result supports the hypothesis that there will be a difference in "Effect of land based exercises versus pool based exercises on shoulder strength to reduce shoulder pain in competitive swimmers". The effect of these exercises were reported with reduction in shoulder pain disability index (SPADI) score and increase in hand held dynamometer (HHD) score. Also there was reduction in pain by the mean value of 11.39 and improved daily living activities related to shoulder. Adding on to strength of shoulder muscles, there was a significant change in relation to p-value. To our knowledge, this is the first study which provides evidence from a clinical trial to demonstrate the effect of land based exercises versus pool based exercises on shoulder strength to reduce shoulder pain in Indian competitive swimmers.

Sakiko Oyama showed, shoulder injuries are very common in swimmers, Imbalance in shoulder muscles are because of biomechanics of the sport. The exercise was given for 3 times per week

for 6 weeks [12]. Which consists of strengthening exercises using resistance tubing and 2 stretching exercises. The study has no effect on strength and scapular kinematics [13]. Where in our study, a 4 week exercise program including only strengthening exercises for all shoulder muscles with the dumbbells on land and in water which shows a significant difference in outcome measures. Robert C. Manske and Stephanie Lavis showed, shoulder pain is common in competitive swimmers because of shoulder soreness and it indicates shoulder muscle to be strengthened. 21 competitive swimmers under the age of 18 were taken and 10 participants were allotted in control group and instructed not to do any exercises and continue with their swimming practice. 11 participants were allotted in experimental group and exercises were given 3 times per week for 12 weeks participants were tested for pain using VAS and strength using Hand Held Dynamometer pre and post study [14]. In current study 29 competitive swimmers between the age group of 8 to 18 years. Pool based exercises were given for 15 participants and land based exercises were given for 14 participants, shoulder disability index score was taken for pain and Hand Held Dynamometer score was taken for strength pre and post exercises.

Tanaka H, Costill DL, Thomas R, showed the value of Dry land resistance training on front crawl swimming performance. 2 groups of 12 participants each were taken. A combined swim and resistance training was given for one group and only swimming session for another group for 14 weeks [15]. No significant difference were found between the groups in any of the swim power and swimming. In the present study land based exercises were given for 14 participants and pool based exercises were given 15 participants for between the age group of 8 to 18 years for 3 alternate days per week for 4 weeks. There was reduction in pain and increase in shoulder muscle strength. Jerzy Sadowski, Andreja Mastalerz, Evaluated the effects of land based exercises training program in youth swimmers on swimming force 26 male who swim regularly at least for 6 times a week were taken and randomly divided in to 2 groups. For experimental group combined swimming and dry land training was given and for control group only swimming training was given. The training programs in water included aerobic training in front crawl. The study concluded with marked improvement in experimental group [10]. In our study 29 Indian competitive swimmers were taken and divided in to 2 groups. Group A was allotted for pool based exercises which included resistance training using dumbbells for all shoulder muscles inside water. Group B was allotted for land based exercises which included resistance training using dumbbells for all shoulder muscles on land. Study concluded with marked reduction in pain and increase in strength in Group A. Bulgakova et al showed a comparison between land based exercises and pool based exercises in competitive swimmers and reported that water based exercises were more effective than land based exercises

^[16] the current study is a comparison between land based exercises versus pool based exercises given to Indian Competitive swimmers to see their increase in strength and reduction in pain.

According to Kathryn E. Roach and Elly Budiman - Mak, the shoulder pain and Disability Index Score (SPADI) was developed to measure the pain and disability associated with shoulder pathology. The SPADI is self-administered index consisting of 13 items divided in to two subscales pain and disability. Same this type of study was conducted earlier on 37 male patients with shoulder pain to examine the measurement characteristics of the SPADI. Test –retest reliability of the SPADI, total and subscale scores ranged from 0.6377 to 0.6552. Hence it is proved that the SPADI is useful for both clinical and research purposes ^[17]. In the present study, shoulder pain and disability index score was taken as one of the outcome measure, the SPADI score was taken pre and post exercise study. While comparing the values within the group, a reduction in SPADI score was observed pre and post intervention. At the same time, it was noted group A (pool based exercises) was significantly better than group B (land based exercises). An HHD was used because of its versatility with testing muscles at several different angles and for its portability, and proven validity and reliability for measuring muscle strength in kilograms. Hand Held Dynamometer (HHD) was taken to check the shoulder strength pre and post study for all shoulder muscles ^[18]. There was an increase in HHD score in both the groups post intervention, but no increase was observed in HHD score comparing the values between both the groups. This can be because, when we exercise the muscles get relaxed and blood flow increases, thus it relieves the pain with improving daily living activities related to shoulder. Hence concluding the effect of land based exercises and pool based exercises relived pain and improved daily activities of living.

In the current study, the measurement of shoulder muscle strength was compared pre and post intervention in each group and both the groups showed significant increase in strength of shoulder muscles, also a comparison of both groups pre intervention and post intervention was done and the difference between pre and post intervention was formulated, the difference calculated was observed to be highly significant in both the groups. The cause for this increase in shoulder muscle strength could be due to the effect of exercises which strengthens shoulder muscles and also because of reduction in shoulder pain that might have induced the changes in shoulder strength. Till date land based exercises were given to reduce shoulder pain in swimmers which consisted of various exercise regimen like aquatic exercises, resistance exercises with therabands, etc. for variable time period. Taking this into consideration, a supervised land based exercise regimen consisting of dumbbells weighing ½, 1 and 2.5 kgs each according to Delorm's principle moderate intensity exercises were given for four weeks every alternate day of week. According to the

above stated reviews of literature no study has been conducted wherein a comparison has been made between the effects of land based exercises versus pool based exercises on shoulder strength to reduce shoulder pain in Indian competitive swimmers within the age criteria of 8 to 18. Thus taking into consideration the statistical analysis of the study can conclude that, both land based exercises and pool based exercises can increase shoulder strength and reduce shoulder pain but, pool based exercises, more significantly reduces shoulder pain in swimmers than compared to land based exercises.

CONCLUSION

Our study concludes that pool based exercises is more effective than land based exercises to reduce shoulder pain in swimmers shoulder.

Conflicts of interest

None declared.

Ethical approval

Permission to conduct this research was granted by the KLE Academy of higher education and research. Subjects gave written informed consent to participate in this study.

REFERENCES

1. Allegrucci M, Whitney SL, Irrgang JJ, 1994. "Clinical implications of secondary impingement of the shoulder in freestyle swimmers". *Journal of Orthopaedic & Sports Physical Therapy*. 20(6), 307-18.
2. Ciullo JV, Stevens GG, 1989. "The prevention and treatment of injuries to the shoulder in swimming". *Sports Medicine*. 7(3), 182-204.
3. McMaster WC, Roberts A, Stoddard T, 1998. "A correlation between shoulder laxity and interfering pain in competitive swimmers". *The American journal of sports medicine*. 26(1), 83-6.
4. Silva LE, Valim V, Pessanha AP, Oliveira LM, Myamoto S, Jones A, Natour J, 2008. "Hydrotherapy versus conventional land-based exercise for the management of patients with osteoarthritis of the knee: a randomized clinical trial. *Physical therapy*". 88(1), 12-21.
5. Sein ML, Walton J, Linklater J, Appleyard R, Kirkbride B, Kuah D, Murrell GA, 2010. "Shoulder pain in elite swimmers: primarily due to swim-volume-induced supraspinatus tendinopathy". *British journal of sports medicine*. 44(2), 105-13.
6. Thein JM, Brody LT, 2000. "Aquatic-based rehabilitation and training for the shoulder". *Journal of athletic training*. 35(3), 382.
7. Verhagen AP, De Vet HC, De Bie RA, Kessels AG, Boers M, Knipschild PG, 1997. "Taking baths: the efficacy of balneotherapy in patients with arthritis. A systematic review". *The Journal of rheumatology*. 24(10), 1964-71.
8. Torres-Ronda L, Schelling I, delAlcázar X, 2014. "The properties of water and their applications for training". *Journal of human kinetics*. 44(1), 237-48.
9. Codine P, Bernard PL, Pocholle M, Benaim C, Brun VI, 1997.

- “Influence of sports discipline on shoulder rotator cuff balance. Medicine and science in sports and exercise”. 29(11), 14005.
10. Sadowski J, Mastalerz A, Gromisz W, Niżnikowski T, 2012. “Effectiveness of the power dry-land training programmes in youth swimmers”. *Journal of human kinetics*. 32, 77-86.
 11. McMaster WC, Troup J, 1993. “A survey of interfering shoulder pain in United States competitive swimmers”. *Am J Sports Med*. 21(1), 67-70.
 12. McMaster WC, Roberts A, Stoddard T, 1998. “A correlation between shoulder laxity and interfering pain in competitive swimmers”. *Am J Sports Med*. 26, 83-86.
 13. Hibberd EE, Oyama S, Spang JT, Prentice W, Myers JB, 2012. “Effect of a 6-week strengthening program on shoulder and scapular-stabilizer strength and scapular kinematics in division I collegiate swimmers”. *Journal of sport rehabilitation*. 21(3), 253-65.
 14. Manske RC, Lewis S, Wolff S, Smith B, 2015. “Effects of a dry-land strengthening program in competitive adolescent swimmers”. *International journal of sports physical therapy*. 10(6), 858.
 15. Tanaka H., Costill DL, Thomas R., Fink WJ., Widrick, JJ, 1993. “Dry-land resistance training for competitive swimming”. *Med Sci Sports Exerc*. 25, 952-959.
 16. Bulgakova NZ, Vorontsov AR., Fomichenko TG, 1990. “Improving the technical preparedness of young swimmers by using strength training”. *Soviet Sports Rev*. 25(2), 102-104.
 17. Breckenridge JD, McAuley JH, 2011. “Shoulder pain and disability index (SPADI). *Journal of physiotherapy*”. 57(3), 197.
 18. Bohannon RW, 1986. “Test-retest reliability of hand-held dynamometry during a single session of strength assessment”. *Physical therapy*. 66 (2), 206-9.

How to cite this article

Shruti D, Chaitanya A. K, Om C. W, Waqar M. N, Pratik P, Sakshi P. A, 2021. “Land based exercises versus pool based exercises for swimmer’s shoulder in competitive swimmers: Randomized Clinical Trial”. *Jour. of Med. P’ceutical & Alli. Sci.* V 10 - I 4, 1305, P-3296-3299. doi: 10.22270/jmpas.V10I4.1305.