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EFFICACY OF DRYLAND SHOULDER STRENTHENING VERSUS CONVENTIONAL SHOULDER STRENTHENING ON SWIM SPEED IN FREE STYLE SWIMMERS

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ABSTRACT

INTRODUCTION: Implementation of Dryland shoulder strengthening exercises into a welldesigned, sport-specific physical conditioning programme in competitive swimmingenhances performance and prevents injuries. This Dryland shoulderstrengthening exercise has been advocated for athletes participating in swimming thatrequire explosiveness, high power outputs and increased swimming speed ability.
AIM OF THE STUDY: To determine the efficacy of Dryland shoulder strengthening exercises versus Conventional shoulder strengthening exercises on swim speed and shoulder strengthin free style swimmers.
OBJECTIVE OF THE STUDY: To know the efficacy of Dryland shoulder strengthening exercises on swim speed and shoulder strength in free style swimmers. To know the efficacy ofConventional shoulder strengthening exercises on swim speed and shoulder strengthin free style swimmers.
METHODOLOGY: The samples meeting inclusive criteria are taken for study. A 1-RM benchpress screening test has been done to take up the samples for study. 30 samples weredivided into 2 groups. The subjects of study group underwent 6 week Drylandshoulder strengthening exercise program and the subjects of control group underwent conventional shoulder strengthening exercises to the swimming for a period of 6weeks, 4 days per week and with a duration of 45 minutes per session. A warm upperiod of 15 min for both the groups was given prior to the specified protocol. Pre andpost training swim speed test and 1 RM bench press test done to find out influene of training program on specific groups.
STATISTICAL ANALYSIS AND RESULTS: The results were found to be highly significant (p<0.05) in both the parameters
of two groups when compared, significant improvement was seen in both parametersof experimental group.
CONCLUSION: This study proves that Dryland shoulder strengthening exercises are effectivein improving shoulder strength and swim speed.

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INTRODUCTION

Swimming is a globally cherished activity, valued for its fitness and therapeutic benefits. Historical evidence of water therapy dates to 2400 B.C., with early civilizations like the Egyptians and Assyrians recognizing its healing potential. Despite its low injury rates (2.2 injuries per 1000 swimming sessions), competitive swimmers face significant challenges, particularly shoulder injuries, with over 25% reporting training disruptions due to shoulder pain.

Freestyle swimming, the fastest competitive stroke, involves extensive shoulder movements for propulsion, with swimmers completing millions of rotations weekly. This repetitive motion often leads to overuse injuries, especially "swimmer's shoulder," caused by impingement and rotator cuff tendinopathy. Factors like scapular muscle weakness, muscle imbalances, and biomechanical faults exacerbate these issues. Swimmers aiming for efficiency with prolonged strokes may inadvertently increase injury risks due to hypovascularity in muscles like the supraspinatus.

Preventive measures focus on strengthening scapular stabilizers, normalizing internal-to-external rotator strength ratios, and ensuring flexibility in scapulohumeral muscles. Incorporating dynamic exercises like TheraBand resistance training can improve strength, mobility, and function. These exercises are low-cost, portable, and effective for injury rehabilitation and prevention.

Pre-competition warm-ups are crucial, increasing muscle temperature, blood flow, and joint flexibility while reducing injury risks. Dynamic movements specific to swimming, rather than static stretching, enhance neuromuscular performance and mimic stroke mechanics. Activities such as medicine ball throws can replicate the freestyle pull-through phase, further preparing athletes for competition.

Understanding biomechanics and adopting proper training techniques are vital for competitive swimmers to optimize performance and minimize injuries. Effective strength training, flexibility programs, and tailored warm-ups can significantly reduce shoulder-related issues, enabling swimmers to train and compete with longevity and success.

The study aims to evaluate the efficacy of Dryland shoulder strengthening exercises compared to conventional shoulder strengthening exercises in improving swim speed and shoulder strength in freestyle swimmers. It seeks to determine the effectiveness of conventional methods on swim speed and one-repetition maximum (1RM) bench press performance, as well as assess the impact of Dryland exercises on these parameters. Furthermore, the study compares the outcomes of both approaches to identify which method offers superior benefits for enhancing swim performance and shoulder strength.

The literature review highlights various studies and findings related to shoulder injuries and strength in freestyle swimmers. Richardson et al. reported a significant incidence of shoulder injuries in competitive freestyle swimmers, with repetitive overhead strokes increasing the risk of injury. Scovozzo et al. found that shoulder pain in swimmers led to altered muscle activation patterns, suggesting that pain affects the motor program and muscle recruitment during swimming. Bak et al. categorized shoulder pain in swimmers into four phases, emphasizing that many swimmers experience pain that affects performance. Beach et al. described the muscular components involved in different phases of the freestyle stroke, highlighting the complex interplay of muscles required for efficient swimming.

Other studies, such as Wadsworth and Bullock-Saxton's work, investigated muscle latency in swimmers with shoulder impingement, finding delayed muscle activation in those with shoulder pain. In 2001, Riewald's biomechanical analysis supported the idea of a "straight-through" pull in freestyle swimming, reconsidering the role of body rotation in propulsion. Further studies by Pelayo and Siders showed that while muscle strength did not significantly influence swimming performance in younger swimmers, it became an important factor in older swimmers. Additionally, research by Cronin et al. suggested that dryland resistance training can enhance swimming strength and power when properly designed, although some studies, like Tanaka et al., found limited benefits for dryland training on sprint performance.

Swanik et al. investigated the effects of exercise training on shoulder strength and pain incidence, showing that targeted shoulder exercises, including resistance training, helped reduce the incidence of shoulder pain. Overall, the literature emphasizes the importance of shoulder strength and conditioning, both for injury prevention and improving performance in freestyle swimmers. The efficacy of different training methods, including dryland and in-water resistance exercises, remains a key area of study.

MATERIALS AND METHODOLOGY

The study was conducted with 30 volunteer subjects who were divided into two groups: the Control Group and the Experimental Group. The source of data was the SRI SRINIVASA SPORTS COMPLEX, under the Sports Authority of Andhra Pradesh (SAAP), located in Tirupati. The study followed an informal experimental design and lasted for a period of 6 weeks, from January 19th to March 2nd, 2011. The sample size was equally split, with 15 subjects in each group. The Control Group performed dryland shoulder strengthening exercises, while the Experimental Group engaged in conventional shoulder strengthening exercises. Various materials were used throughout the study, including a weighing machine, inch tape, stopwatch, Theraband, dumbbells, and a bench press to assess strength and performance. The structured intervention was designed to measure the impact of the exercises on shoulder strength and swim speed.

The study included male professional freestyle swimmers aged between 18 and 24 years, with a normal body mass index (BMI) ranging from 18 to 25. These subjects were selected to ensure they had the appropriate physical profile for the intervention and could provide reliable data on the effects of shoulder strengthening exercises. The exclusion criteria were set to ensure that only suitable candidates participated in the study. Females, individuals younger than 18 or older than 24 years, and recreational swimmers were excluded. Additionally, participants with a BMI outside the normal range (below 18 or above 25) were not considered. Swimmers with severe muscular pain, or those with pathological conditions such as skin diseases, tumors, or systemic, cardio-thoracic, orthopedic, or neurological impairments, were also excluded. Finally, subjects who had undergone any previous surgeries were not included in the study to avoid any confounding factors that could affect the results.

This study aimed to compare the efficacy of Dryland shoulder strengthening exercises and Conventional shoulder strengthening exercises on freestyle swimmers. A total of 37 male swimmers aged 18-24 years were initially screened, and 30 subjects met the inclusion criteria. These 30 swimmers were divided into two groups: the Experimental group (15 subjects) performing Dryland shoulder strengthening exercises, and the Control group (15 subjects) performing Conventional shoulder strengthening exercises. Both groups participated in a 6-week program, with 4 sessions per week, each lasting 45 minutes. Pre- and post-tests were conducted to measure swim speed and 1RM bench press. A 15-minute general warm-up and cool-down were included in each session.

e general warm-up consists of non-specific, sub-maximal exercises designed to increase body temperature and joint range of motion for swimming. It typically lasts 5-10 minutes and may include activities like leg and arm swings, skipping, and stretch cord exercises. Proper timing is crucial—too long may cause fatigue, while too short may not provide adequate physiological benefits.

Stage 1 (Aerobic Activity): 5 minutes of aerobic activities such as jogging, jumping jacks, skipping, or cycling.

Stage 2 (Dynamic Flexibility): 10 minutes of dynamic stretches to increase joint and muscle range of motion, including lunges, arm swings, and leg swings, with each stretch held for 1-2 seconds.

Specific Warm-Up: Shoulder-specific exercises performed in a series of repetitions (30 seconds each), including:

- **Double Arm Rotation**: Slow, controlled arm rotations in both directions.
- **Double Arm Swing**: Forward and backward arm swings while maintaining trunk flexion.
- **S-Shaped Double Arm Swing**: Alternating arms in an 'S' shape while flexing and extending shoulders.
- **Opposite Arm Swings**: Swinging opposite arms forward and backward through a full range of motion.

- **Arm Swings with Trunk Rotation**: Rotating the arms and torso left and right.
- **Push-Ups**: Traditional push-ups performed with the body in a straight line.

These exercises are designed to activate the muscles and joints used during swimming and prepare the body for the training session.

Conventional Shoulder Strengthening Exercises are performed slowly and with control, ensuring no pain during the exercises. If any discomfort arises, the exercise should be stopped immediately. The protocol involves 2-3 sets of 15 repetitions, with a 2 kg dumbbell used for resistance.

Exercises:

1. **Shoulder Abduction**: Standing position, arm with thumb up, lift arm to shoulder level, then gradually toward the ear, completing the full range of motion.
2. **Shoulder Flexion**: Standing position, arm with thumb up, lift arm forward to shoulder level, then gradually toward the ear, completing the full range of motion.
3. **Military Press**: Sitting position, press dumbbells overhead, ensuring arms are straight but not locked. Keep the abdominal muscles tight and back straight.
4. **Bench Press**: Sit on a bench, dumbbells overhead, lower them slowly to shoulder level, then press them back up when arms are at 90 degrees.
5. **Internal Rotation**: Supine position, elbow at 90°, lower hand outward, then bring it back across the stomach.
6. **External Rotation**: Side-lying position, small towel roll under the upper arm, elbow flexed at 90°, lift hand away from the floor.

Dryland Shoulder Exercises are designed to improve strength, flexibility, muscular coordination, and injury prevention for swimmers. The exercises use light weights or resistance bands to target shoulder muscles.

1. **Rotator Cuff Backhand Exercise**: Start standing, holding a small weight. Move the hand away from the body and return it slowly. Perform 10–30 reps, stopping if pain occurs.
2. **Rotator Cuff Forehand Exercise**: From the resting position, move the hand toward the chest, then return slowly. Repeat 10–30 reps, stopping if pain occurs.
3. **Rotator Cuff 45° Lifts**: With light weights, lift arms at a 45° angle. Perform 10–30 reps on each arm, stopping if pain occurs.
4. **Shoulder Flexion**: Using a theraband, raise the arm in front of the body to overhead and return. Repeat 10–30 reps.
5. **Shoulder Extension**: Pull the arm backward with the theraband, keeping the elbow straight. Repeat 10–30 reps.
6. **Shoulder Abduction**: Raise the arm to the side and overhead, using the theraband. Repeat 10–30 reps.
7. **Shoulder Adduction**: With theraband tension, pull the arm medially across the body. Repeat 10–30 reps.
8. **Shoulder Internal Rotation**: Pull the arm inward with the theraband while the elbow is flexed at 90°. Repeat 10–30 reps.
9. **Shoulder External Rotation**: Rotate the arm outward with theraband tension. Repeat 10–30 reps.

Outcome Measures:

1. **Swim Speed Test**: The 50m swim test with a dive start measures maximal swimming speed. Times are recorded to the tenth of a second using electronic timing.
2. **1-RM Bench Press Test**: Measures upper body strength, essential for shoulder power. The subject performs progressively heavier lifts to find the maximum weight they can lift once with correct technique.

STATISTICAL ANALYSIS

DATA ANALYSIS

Student t – test is used for data analysis using software package for the social science

(SPSS) version 16.0, excel programmer and level of significance is set at <0.05.
Of the 30 subjects, 15 were divided into control group and 15 were experimental group.

TABLE – I: ANALYSIS OF EXPERIMENTAL GROUP WITH PRE AND POST EXERCISES

EXPERIMENTAL GROUP

To compare the pre and post exercises of the parameters speed test and bench press test, the t-test for paired sample observations has been utilized.

PARAMETERS		MEAN	SD	t- value	p- value
SPEED TEST	PRE	56.106	5.817	- 5.36	0.001*
	POST	48.779	5.294		
BENCH PRESS	PRE	0.893	0.072	13. 55	0.001*
	POST	1.88	0.0845		

*Indicates significant at 5% level.

Interpretation: In experimental group the speed test shows that the pre-values of mean is 56.106 and the post value is 48.77 then the pre value of standard deviation is 5.81 and the post value is 5.29 then the t-value is – 5.36 and p-value is 0.001. In the 1 RM bench press test shows that the pre-values of mean is 0.89 and the post value is 1.88 then the pre value of standard deviation is 0.07 and the post value is 0.08.

It is observed that the post exercises have shown some significant impact on the subjects.

TABLE – II: ANALYSIS OF CONTROL GROUP WITH PRE AND POST EXERCISES:

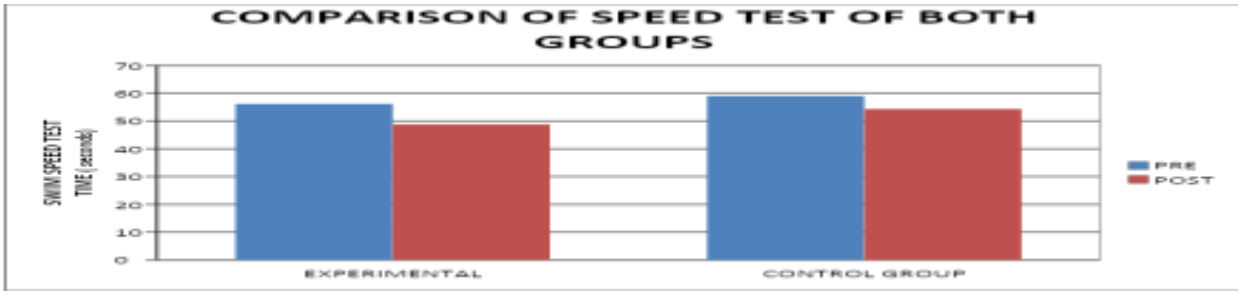
CONTROL GROUP:

PARAMETERS		MEAN	SD	t- value	p- value
SPEED TEST	PRE	58.983	5.696	- 3.02	0.01*
	POST	54.282	6.034		
BENCH PRESS	PRE	0.884	0.049	8.11	0.001*
	POST	1	0.055		

* indicates significant at 5% level.

Interpretation: In the Control group the speed test shows that the pre-value of mean is 58.98 and the post value is 54.28, then the pre value of standard deviation is 5.69 and the post value is 6.03, then the t-value is - 3.02 and p-value is 0.01. In 1 RM bench press test shows that the pre-value of mean is 0.88 and the post value is 1, then the pre value of standard deviation is 0.04 and the post value is 0.05, then the t-value is 8.11 and the p-value is 0.001.

To test the significance of the pre and post exercises of the parameters speed test and bench press test, t test for paired sample observations is used. Since all the p values, are less than 0.05, there is a significant improvement of the parameters.



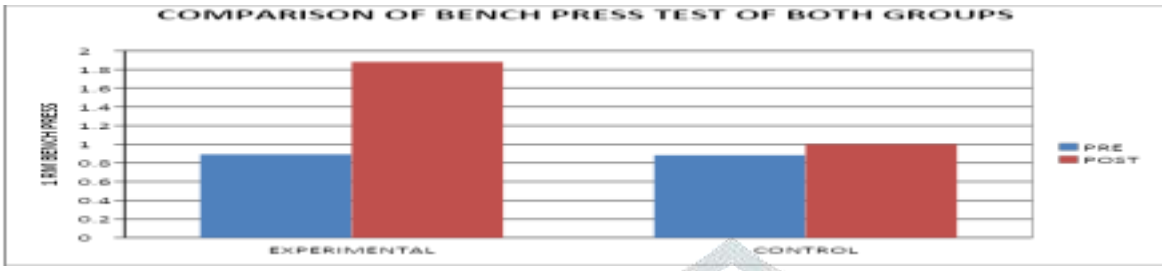


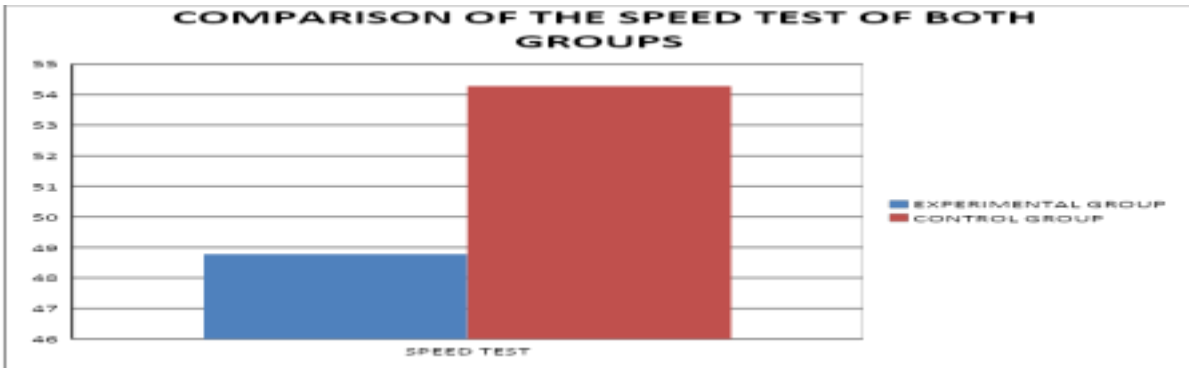
TABLE – III: ANALYSIS OF EFFECTIVENESS OF THE TREATMENT AMONG TWO GROUPS OF THE PARAMETERS

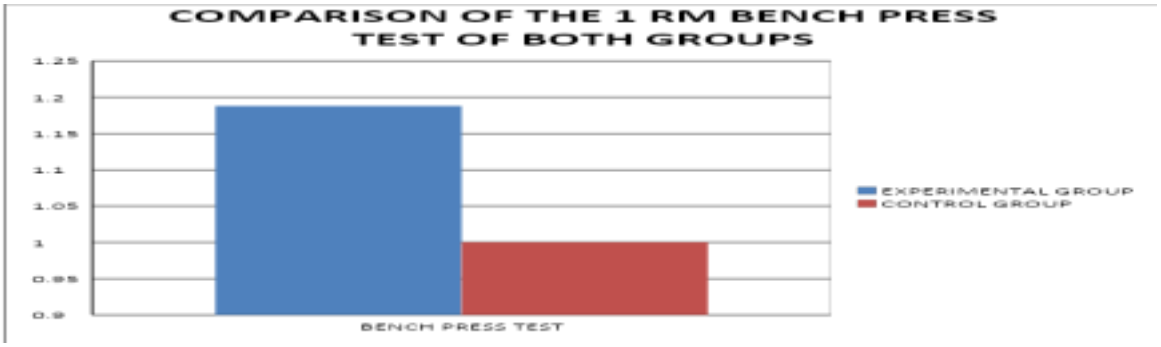
PARAMETERS	GROUP	MEAN	SD	t- value	p- value
SPEED TEST	EXPERIMENTAL	48.779	5.294	2.65	0.01*
	CONTROL	54.282	6.034		
BENCH PRESS	EXPERIMENTAL	1.188	0.084	-7.23	0.001*
	CONTROL	1	0.055		

* indicates significant at 5% level.

Interpretation: In speed test shows that the mean of experimental group is 48.77 and the control group is 54.28, then the standard deviation for experimental group is 5.29 and the control group is 6.03 then the t-value for both the groups is 2.65 and p-value is 0.01. In 1 RM bench press shows that the mean of experimental group is 1.18 and the control group is 1, then the standard deviation for experimental group is 0.08 and the control group is 0.05, then the t-value is – 7.23 and the p-value is 0.001.

On observing the means of post test parameters, of experimental group and control group, independent t-test was done and the p values is less than 0.05 it shows a significant difference between the 2 groups.





RESULTS:

The results were found to be highly significant ($p<0.05$) in both the parameters of two groups when compared to the control group, significant improvement were seen in both parameters of experimental group.

DISCUSSION

The purpose of this study was to examine the impact of a six-week dryland shoulder strengthening program on swim speed and 1 RM bench press performance in freestyle swimmers. A proper warm-up, which improves blood flow, muscle flexibility, and reduces injury risk, is crucial for enhancing athletic performance. After six weeks of dryland shoulder exercises, swimmers showed improvements in muscle strength and swim speed.

The physiological changes from the dryland program likely involved muscle hypertrophy and improved neural adaptations, leading to increased muscle force and power. Resistance training enhances muscle strength, mainly through hypertrophy and neural adaptations, which can improve strength without significantly increasing muscle size. This process also increases anaerobic energy stores, which are crucial for sprint performance.

The results of the study align with previous findings, such as improvements in swim speed after similar dryland shoulder exercises. Additionally, combining dryland exercises with swim-specific training has been shown to be more effective than swim training alone in improving performance. However, sport-specific training may still be important for maximizing performance gains. The improvements in swim speed and 1 RM bench press in the experimental group suggest that dryland strengthening exercises are beneficial for enhancing swimming performance, particularly in sprints.

LIMITATIONS

- The small sample size in the study limits the generalization of the results to the broader sports population.
- Shorter duration of the study.
- Confined to only one type of specific sport.
- Gender selection limited to only males.

RECOMMENDATIONS

- The long-term effects of the Dryland shoulder training programme need to be further studied.
- It is suggested that more studies need to be done in various techniques to improve shoulder strength and swim speed endurance.

CONCLUSION

This study proves that Dryland shoulder strengthening exercises are more effective than conventional shoulder strengthening exercises in improving shoulder strength and swim speed.

SUMMARY

The present study was done to find out the efficacy of Dryland shoulder strengthening versus Conventional shoulder strengthening on swim speed in free style swimmers. For this the swimmers selected on basis of elite freestyle swimmers, normal BMI level and age group between 18 to 24 yrs and they were grouped into experimental and control groups. Prior to training, the swim speed test and 1 RM bench press test values were taken. The Dryland shoulder exercises four times in a week for 6 weeks were incorporated in experimental group subjects and the control group had conventional shoulder strengthening exercises four times in a week for 6 weeks. After 6 weeks the swimmers re-assessed for Swim speed test (50 mts) and 1 RM bench press test. The comparison of the two groups has shown that distinct difference among control and experimental group with significantly improved values in the experimental group. The present study has shown that the Dryland shoulder strengthening exercises improve the performance of swim speed and 1 RM bench press. Incorporating these along with the sport specific training would bring beneficial effects in freestyle swimmers.

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