



Effectiveness of dry land strength training in competitive swimmers

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Abstract

Background: The main focus of swimming researchers is to enhance performance. Swimming performance is a multifactorial phenomenon involving energetics, biomechanics, hydrodynamics, anthropometrics and strength parameters. Strength training has the potential to develop muscle strength under dynamic conditions. Strength represents the ability to perform movements at high speed or the possibility of exerting high strength in a short period of time. Strength and speed are major factors determining performance of swimmers.

Aim: This study is about checking the competitive swimmers' performance pre and post dry land strength training in a 25m pool.

Material and Methodology: Study Design: experimental based study, Sample Population: competitive swimmers, Sample Size- 50, Inclusion Criteria:- both male and female competitive swimmers of age group 14-19 years, Exclusion Criteria: any previous injury or surgery in the past 12 months. Material Required: stopwatch.

Results: After Dry land strength training, there was significant increase in the performance of competitive swimmers with a mean of 20.96.

Conclusion: The Dry land strength training significantly increases the performance by reducing the time taken to cover 25m lap after a 4 weeks protocol.

Keywords: dry land, strength training, performance, swimmers

Introduction

Competitive swimming is one of the most challenging sports to perform scientific research. Not only the research of human movement is quite complex, because human beings are not so, determinists as other (bio) mechanical systems; but also, assessing human beings in aquatic environment becomes even more as this is not their natural environment and other physical principles have to be considered. The main focus of swimming researchers is to enhance performance. From a historic perspective, a large part of the research dedicated to competitive swimming aims to identify variables that determine the performance. This can be considered as an exploratory research trend. Very recently, confirmatory data analysis became another topic of interest. In such research designs, researchers try to understand the relationships between the variables identified in previous researches and model the links among them and performance^[1].

Swimming performance is a multifactorial phenomenon involving energetics, biomechanics, hydrodynamics, anthropometrics and strength parameters. Strength training has the potential to develop muscle strength under dynamic conditions. Strength represents the ability to perform movements at high speed or the possibility of exerting high strength in a short period of time. Strength and speed are major factors determining performance of swimmers.

Several studies support the view that strength dry-land training in swimming improves swimming performance^[2, 3]

and performance-related parameters such as increased stroke length reduced stroke rate^[2, 3] and increased tethered swimming force^[2, 3, 4].

Dry-land training includes specially structured strength training program performed usually with the resistance of the swimmer body.

Importance of dry land strength training in swimmers

Coaches should incorporate swimming dryland training to maximize swimmer performance. The type of swimming dryland training may change over time, perhaps incorporating more weights once the athlete reaches the collegiate level, but all programs should incorporate dryland workouts. The purpose of dryland training for swimming is to improve the swimmer's power, athleticism, and overall speed in the pool. Here are five major reasons to incorporate dryland training into a swimmer's program:

Building muscle and bone density

It is very difficult to build muscle through swimming alone. Despite the repetitive movements and whole body integration while swimming, muscle groups are not triggered to develop significantly. When a stress is placed on a muscle, such as bodyweight or a dumbbell, the muscle is signalled to resist the downward force of gravity by contracting. Strength exercises on land create a number of these stressors. When muscles respond, as in the lifting of a dumbbell, micro-tears in the

tissue occur and cause soreness. As the body repairs these micro-tears, muscle builds up. Pulling one's body through water cannot create this stimulation for tissue growth as much as strength exercises on land because the perceived force of gravity is reduced.

Another benefit of weight-bearing strength training for swimmers is that it increases bone density. Swimmers have a tendency to have low bone density because they spend the majority of their training in the pool. Dryland training and loading weight on bones stimulates bone tissue to develop.

Core Strength

The core is critical to swimming. It maintains the correct "downhill" body position of the swimmer when horizontal to minimize drag. It enables the swimmer to accelerate faster in a turn, and carry more speed off a dive with a clean entry. Swimming dryland training often requires the integration of various muscles in complex movements, with the core at the centre of the action. In order to transfer force efficiently from one part of the body to another, an athlete needs a strong core that engages quickly. This applies to every part of a swimmer's race, from the hip rotation in freestyle to the underwater dolphin kick off the wall.

Injury Prevention

The repetitive motions in swimming can lead to chronic injuries. Dryland training varies an athlete's patterns of movement and challenges their muscles to learn new exercises. It can target areas left underdeveloped by swimming and relieve some of the demand placed on more stressed muscle groups. Stronger muscles also help distribute force correctly, putting less strain on joints, tendons and ligaments.

Learn correct biomechanics

Especially for swimming dryland training, athletes must learn correct body position for a variety of exercises. This requires focus, muscle recruitment, and coordination. Swimmers develop better posture through core engagement and upper body strength, which helps improve breathing in the water. Balance and stability improve with single-legged exercises and strengthening of large muscle groups.

Generate More Power

Dryland training develops power unmatched by any training a swimmer can do in the pool. Once the athlete develops a baseline level of strength, there are countless exercises that can be done in quick bursts of energy. Explosiveness develops well on land, where the athlete has a harder surface to push off of. Squat jumps, lateral pull-downs, and push ups are just a few of the exercises that develop power for the pool.

Materials and Methods

- Study design: experimental study
- Study setting: swimming pools 25m in length or more in and around Pune
- Sample size: 50
- Target population: competitive swimmers
- Outcome measure: stopwatch, length measurement of the

pool.

- Inclusion criteria:
- male and female competitive swimmers
- Age group 14 - 19yrs
- Exclusion criteria:
- Any previous injury or surgery in the past 12 months

Procedure

- Initially, the synopsis was submitted to the institute and was approved by the ethical committee.
- It was an experimental study in which 50 sample size constituted of competitive swimmers between the ages of 14-19 yrs.
- The participants were selected according to the inclusion and exclusion criteria.
- All the components of the outcome measures were explained and performed under supervision.
- The experimental group underwent dry land strength training programme.
- Dry-land strength training programme is as follows:

Warm up about 5-10 minutes

1. 20 squat jumps
2. 10 lunge jumps



Fig 1

3. 10 dive bomber push ups



Fig 2

4. 20 regular squats

5. 10 lunges with twists per side



Fig 3

- 6. 20 front plank taps
- 7. 20 side plank rotations
- 8. 20 supermans
- 9. 20 flutterkicks per side



Fig 4

This programme was held 3 times per week for approximately 90 minutes each day for 4 weeks.

At the end of 4 weeks, the performance of individual subject was noted down (i.e., 25m lap covered in seconds)

Results

50 competitive swimmers were taken according to the inclusion and exclusion criteria to participate in this study. The number of male competitive swimmers were 52% and that of females were 48%.

1. Gender distribution:

Table 1

Gender	Group 1
Males	26
Females	24

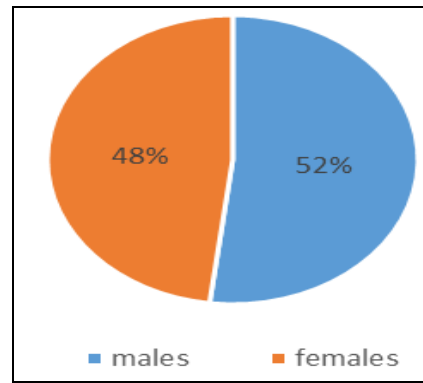


Fig 5

Both the pre and post dry land strength training measurements were obtained and compared with paired t-test and the results were significant of pre dry land strength training with a mean of 31.76 and post dry land strength training with a mean of 20.96.

2. Comparison of performance Pre and Post Dry land strength training:

Table 2

	Mean	Standard deviation	P value
Pre	31.76	2.143	<0.0001
Post	20.96	1.498	

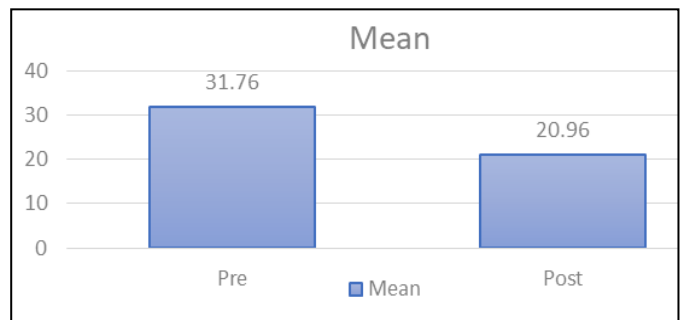


Fig 6

Discussion

The need of this study was to evaluate the effects of dry land strength training on swimming performance in competitive swimmers. This study showed the effectiveness of dry land training to increase the participant's performance and lower the duration required to cover 25meters.

Total of 50 participants were included with an age group between 14-19 years. The study included both males and females out of which 26 participants were female and 24 were males. Dry land strength training was carried out for 4 weeks. The dry land strength training is a clinical exercise protocol to improve the performance of the swimmers by improving their core strength, build muscle group strength, improve biomechanics. The dry land strength training was carried out to check the performance of the swimmers and its effectiveness of the performance of the swimmers. The participants were asked to perform a 25-meter lap and the performance was calculated in seconds pre and post dry land

strength training.

In the present study the mean pre experimental time recorded was 31.76 seconds and after intervention the post experimental time recorded was 20.96 seconds. The mean difference was 10.800 seconds and the p value was <0.0001 which was extremely significant. This study shows that there is a reduction in the time after performing the dry land strength training. This indicates that the strength training exercises on land improves the strength and build the muscle groups which improves their performance in swimming and reduces the time required to complete a 25 meter lap.

It is believed that a strong core allows an athlete the full transfer of forces generated with the lower extremities, through the torso, and to the upper extremities. A weak core is believed to interrupt the transfer of energy, resulting in reduced sport performance and efficiency and risk of injury to distal limbs or to a weak or underdeveloped muscle group^[1].

As defined by Kibler *et al.*, “core stability” is “the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated kinetic chain activities”^[6].

Core stability is a vital aspect of the human body as it not only provides strength and balance but also aids in creating anticipatory postural adjustments, or pre programmed activation of core muscles, that allow the body to handle perturbations during activities such as kicking, throwing, and running. This demonstrates the importance of the core in decreasing incidences of injury. The purposes of anticipatory postural adjustments within the body are to allow proximal stability with distal movement. Injuries can occur when core stability does not keep the proximal body stable while an individual carries out distal movements or perturbations^[5].

Borghuis *et al.* suggest that only minimal voluntary isometric contractions of trunk musculature are necessary to stabilize the spine, implying that muscular endurance along with sensory- motor control is of greater importance than strength when considering core stability. Similarly, key states that coactivation and coordination of the core, rather than strength, create an ideal core. A core lacking muscular endurance consequently possesses poor motor control and therefore has decreased the function of its stabilizing structures. This can lead to slow kinematic response to sudden trunk loading and can result in injury^[7].

A well- developed core is vital when the goal is high- level athletic performance as all movements either originate or are coupled through the trunk. A well- developed core allows for improved force output, increased neuromuscular efficiency, and decreased incidence of overuse injuries. It also enhances an athlete’s ability to utilize the musculature of the upper and lower body, which allows for more efficient, accurate, and powerful movements. This is because force is transferred most efficiently through the body in a straight line. A position of balance is a position of power. An athlete with a poorly developed core as well as poor posture will not be able to fully utilize their body’s potential power, often wasting energy through jerky, uncoordinated, and extraneous movements. If the lumbar muscular component has not been trained to function optimally, this can lead to weakness and reduced movement capabilities. Over time, this can lead to impaired

athletic performance, injury, and pain. Motion is not an isolated event that occurs in one direction. Body movement is a complex event involving agonist and antagonist structures that work together to create motion and to stabilize the body in all three directional planes. Hence, an athlete’s core must be strong, flexible, and unimpeded in its movement to achieve maximum performance^[8]. Therefore, core training should be the centrepiece of any rehabilitation program but should not be the only focus of training.

Dry-land strength training aims to increase maximal power outputs through an overload of the muscles used in swimming^[9] and it may enhance swimming technique. If these two points of view are correct, then the increase of muscular strength would improve swimming performance. However, results from the available experiments remain inconclusive^[2, 4, 9, 10]. In this article it is presented a critical review of the swimming literature concerning the effects of dry-land strength training on the swimming performance, not taking into account the effects for starts and turns. It is aimed to summarize existent knowledge, in order to stimulate further researches.

In conclusion, strength training using dry-land regimens may enhance the ability to produce propulsive forces in-water, especially in short distance events. More studies are essential to identify appropriate volume and intensities of training programs, according to gender and level. Additionally, movement velocity should be taken in consideration as it may improve the specificity of the exercises performed^[11].

Conclusion

- There is a significant effect of dry land strength training programme on the performance of the swimmers.
- The Dry land strength training significantly increases the performance by reducing the time taken to cover 25m lap after a 4 weeks protocol.

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