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Impact of Structured Aquatic Training on Lower Limb Muscular Power in Competitive Water Polo Athletes

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Abstract

This research evaluates the critical role of integrating strength training into competitive swimming to enhance key performance metrics, including explosive starts, efficient turns, and overall stroke speed. By moving beyond traditional yardage, the study explores how structured resistance protocols trigger the physiological adaptations necessary for long-term athletic development. A primary focus of the paper is the architectural design of a specialized leg strength programme. It investigates variables such as optimal training intensity and the strategic selection of exercises to ensure gym-based gains translate directly to aquatic power. Crucially, the research identifies common training pitfalls elements that may feel productive but fail to improve clean swimming speed or mechanical force during transitions. This distinction helps coaches and athletes avoid "junk miles" in the weight room that do not contribute to faster race times. The empirical heart of the study involved a comparative analysis between a control group and an experimental group. Following the intervention, post-test data revealed a statistically significant disparity in performance scores between the two cohorts. Specifically, the experimental group—which underwent the targeted swimming and strength training programme demonstrated a marked improvement in muscular leg strength.

These findings suggest that leg power is a foundational driver for propulsion and technical execution in the water. By quantifying these gains, the study concludes that a comprehensive strength regimen is not merely a supplement but a vital component for middle-aged swimmers looking to overcome age-related plateaus and improve their functional capacity across all phases of a swim.

Keywords: Swimming, Strength, Program, Design, Muscular leg strength.

Introduction

The debate over the role of resistance training in swimming dates back to the 1920s with pioneers like Robert Kiphuth. Despite this long history, modern consensus remains divided on the most effective methodologies, with some researchers still underestimating its impact. This study addresses these gaps by prioritizing injury prevention and athlete well-being as the foundation for any performance-enhancing protocol. Swimming, a near-universal skill used for recreation and competition, relies heavily on the coordinated development of the limbs for propulsion. To test the efficacy of structured intervention, this research utilized a randomized pre-test/post-test design**.** The experimental group followed a 90-day progressive regimen, training for 60 minutes daily, six days a week, while the control group maintained standard activities.

The results demonstrated a statistically significant disparity between the groups during the post-test evaluation. The data confirmed that the structured swimming training program effectively enhanced the muscular leg strength of the participants compared to the control group. Ultimately, the findings suggest that while empirical evidence has historically been mixed, a graduated, safety-first approach to leg strength training is a vital driver for improving physiological adaptations and athletic output in the water. Research by Hough indicates that even a brief 15-day preparation period improves swimming performance, supported by the physiological benefits of chest-deep water immersion, which includes increased venous pressure and improved oxygen transport. Furthermore, swimming offers long-term therapeutic, social, and psychological benefits, making it an effective, accessible activity for individuals with disabilities, as noted by studies from Latto (1981) and Jansma (1988).

Methodology

Because every investigation requires a systematic technique and procedure, this follows the following procedure, which includes information about Sources of Data in the present research study, 16 to 18 years Water polo players from Shree Hanuman Vyayam Prasarak Mandal's Aquatic Center, Amravati were the source of data.

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Selection of Subjects

In the present research study, 16 to 18 years Water polo players who did the daily practice in Shri. H.V.P. Mandal's Swimming Pool, Amravati was chosen as one of the subjects. The participants selected for the study were between the ages of 16 to 18 years old.

Sampling Procedure

The study utilized the purposive sampling method to select its participants.

Experimental Design

This study utilized a randomized pre-test/post-test control group design to examine the impact of a structured training intervention. Participants were divided into four groups; the control group continued their standard daily routines, while the experimental group participated in a specialized 90-day training program. The training regimen consisted of 60-minute sessions held six times per week. Exercises were introduced using a progressive, simple-to-complex framework to ensure gradual adaptation. All relevant variables were measured at the beginning of the study (pre-test) and again upon the completion of the 90-day period (post-test). To determine the effectiveness of the intervention, an Analysis of Covariance (ANCOVA) was performed on the push-up performance data. This analysis specifically targeted swimmers in the 16 to 18 age bracket, comparing the experimental and control groups while adjusting for baseline variations to ensure statistical accuracy.

Table 1: ANOVA table for Pre-Test (x) and Post-Test (y) scores

Source of Variance	d.f	SSx	SSy	MSSx	MSSy	Fx	Fy
Treatment group means	1	410.82	2318.82	410.82	2318.82	2.489@	14.541*
Error	58	9571.37	9248.83	165.02	159.46		

**Significant and @Not Significant at 0.05*
Tabulated F0.05(1,58)= 4.00

The table presented demonstrates that there is no significant distinction between the pre-test means of both groups in terms of leg lift performance, as the calculated Fx value of 2.489 is less than the tabulated F-value of 4.00 at a 0.05 level of significance for 1/58 degrees of freedom. However, the Fy value of 14.541 is significant, indicating that there was a substantial distinction between the experimental and control groups' leg lift performance in the post-test.

Table 2:

Source of Variance	d.f	SSx	SSy	Ssxy	Ssyx	MSSyx	Fyx
Treatment-group means	1	410.82	2318.82	976.02	783.07	783.07	139.496*
Error	57	9571.37	9248.83	9244.53	319.97	5.61	

**Significant and @Not Significant at 0.05*
Tabulated F0.05(1,57)= 4.00

Since the calculated Fyx = 139.496 is greater than Tabulated $F_{0.05\ (1,\ 57)}$ = 4.00, It is clear that the swimming teaching programme does not improve the leg lift performance of both groups equally. Pairwise comparison examination on the adjusted means of the post test data will be used to determine whether group is more productive.

Table 3: Group Means and Adjusted Final Means

Groups	Sample size	Mx	My	Mean adjusted Myx
Experimental	30	99.73	109.57	107.04
Control	30	94.50	97.13	99.66

The research employed the LSD (Least Significant Difference) Test to determine the significance of the contrast or difference noted between the adjusted means of the experimental and control groups.

Table 4:

Experimental Group	Control Group	Mean Difference	Critical Difference
107.04	99.66	7.38*	1.22

Above findings reveals that MD=7.38 > CD=1.22, and as a result, the post-test averages of the control, as well as experiment groups, differ significantly. It follows naturally that the swimming training schedule given to the experimental group was successful in enhancing the swimmers' muscular leg endurance.

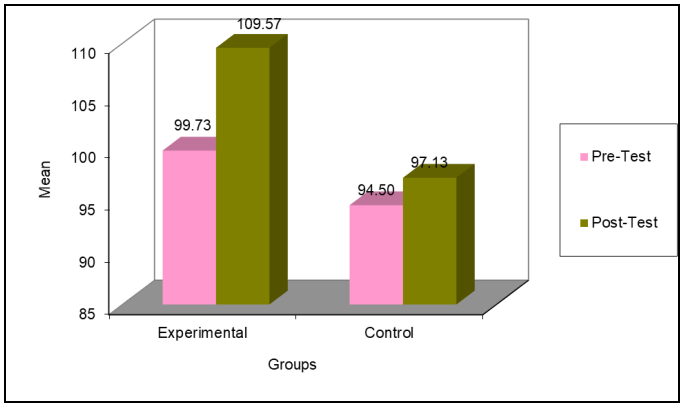

Chart 1: Comparing experimental as well as control groups, there was a mean variance in leg lift (16-18 years old) between the pre- and post-test.

The study is examining the Mean Difference in Leg lift performance between the Pre and Post Tests of both the Experimental and Control Groups within the age range of 16-18 years.

Results

Based on the results presented in Table, the value of Fx is 2.489, which is not significant. This indicates that the control and experimental groups had similar push-up performance in the pre-test. However, Fy is significant at 14.541, indicating a substantial difference in push-up performance between control and experimental groups in the post-test. The value of Fyx is 139.496, which exceeds the tabulated F-value of 4.00 at the 0.05 level for 1/57 degrees of freedom. The study findings suggest that the impact of the swimming training program on the push-up performance was not evenly distributed between the two groups. In order to determine which group was more effective, a recommended approach would be to carry out a pairwise comparison analysis on the adjusted means derived from the post-test data.

Conclusion

As per the paper, a significant variation was observed in the post-test means between the control and experimental groups.

This suggests that the swimming training program administered to the experimental group had a positive effect on their muscular leg strength.

References

1. Hines E. *Fitness Swimming*. Translation. American University: Human Kinetics; 2008. p. 5-7.
2. Kamalesh ML. *Psychology of Sportsmanship and Sports*. Delhi: Metropolitan Book Company Private Ltd.; 1993. p. 12.
3. Katz J, Browning NP. *Swimming for Total Fitness*. New York: Broadway; 1993. p. 17-19.
4. Livingstone C. *Dictionary of Sport and Exercise Science and Medicine*. Elsevier Limited; 2008.
5. Mathews DK, Fox EL. *The Physiological Basis of Physical Education and Athletics*. 3rd ed. Philadelphia: Mosby College Publishing; 1981.
6. May. *Depression*. My Foundation for Medical Education and Research; 2012. p. 26.
7. Morris E. *An Introduction to Swimming*. Available from: http://ezinerarticles.com/?AnIntroduction-ToSwimmingddid=2
8. *Mosby's Medical Dictionary*. 9th ed. Elsevier Publications; 2009.
9. Paige. *Definition of flexableco*. 2007. Available from: http://sportsmedicine.about.com/glossary/Flexibility.def.