Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 3s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Influence of Shallow and Deep-Aqua Aerobic Exercises on Maximal Oxygen Consumption Parameter Tested to College Men Students

Dr. R. Mohana Krishnan [1]

[1] Director Sports, SRM Institute of Science and Technology, Chennai.

Email ID: mohanakr@srmist.edu.in

Cite this paper as: Dr. R. Mohana Krishnan, (2025) Influence of Shallow and Deep-Aqua Aerobic Exercises on Maximal Oxygen Consumption Parameter Tested to College Men Students. *Journal of Neonatal Surgery*, 14 (3s), 23-28

ABSTRACT

The current study set out to investigate the effects of aerobic exercises in shallow and deep water on the maximal oxygen consumption metric given to male college students. The objective of this research was accomplished in 2023–2024 when 45 college male students were chosen from North Chennai Swimming Academy in Chennai, Tamil Nadu. The age range of the subject is 17–23. Three equal groups of 15 subjects each were formed from the chosen subjects: the two experimental groups and a control group of undergraduates. For six weeks, the testing groups I and II engaged in deep aqua aerobic exercise (DAAG) and shallow aqua aerobic activity (SAAG), correspondingly. Throughout the trial, there was no exercise performed by the control group. The study's primary outcome was the maximal oxygen consumption measured using Cooper's formulas and, in turn, the Cooper 12-Minute Run/Walk Assessment. Before the six-week exercise session, a pre-test was administered, and right after, a post-test was measured. The analysis of covariance (ANCOVA) was utilized to determine the F ratio after the data gathered from the three groups was statistically examined for significance. The matched mean differences are ascertained by applying the Scheffe's test as a post-hoc test. The significance level will be set at the 0.05 level of confidence for every instance.

Keywords: *High and shallow water swimming, physical activity, and oxygen consumption maximization.*

1. INTRODUCTION

Aqua cardiovascular exercise, aquatic fitness, aqua health, or aquatic fit are terms used to describe the practice of aerobic exercise in relatively shallow water, as a swimming pool. This type of resistance training is typically done in waist-deep or deeper water, vertically, and without swimming. One kind of cardiovascular activity that calls for participants to be submerged in water is called aqua gymnastics. For around an hour, a qualified expert teaches aqua aerobics in a group training class. The lessons emphasize weight training, cardio endurance, and using music to create a fun environment [1, 2, 3]. There are various types of aqua aerobics, such as aquatic jog, aquatic yoga, aquatic aerobics, and aqua Zumba. Most land-based cardiovascular exercisers can greatly improve their health by adding water physical activity, which they usually do not include weightlifting in their routines. Aqua aerobics can eventually lower cholesterol levels and heart rate at rest, which will benefit general health.

Aqua aerobics varies from land aerobics in that it incorporates buoyancy and aqua opposition, although both emphasize cardiac exercise. The heart functions just as hard during underwater exercise, and the heart is actually pumping more blood to it, even though the heart's rate does not increase substantially as it would during aerobic exercises performed on land [4, 5]. Because of the aqua rebellion, swimming in the water is not just aerobic but also focused on strength training. Muscle groups will be activated by the resistance created by moving yourself through the aqua.

The stimulation of opposing muscles for an even workout is one of the advantages of aqua resistance training, according to Moreno (1996) and her quotations from Olympic athlete trainer Huey. Both enhanced muscle training and an inherent joint safety barrier are made possible by the aqua's push and pull. Actually, the advantages of aqua were utilized in damage therapy prior to water aerobics. Additionally, the aqua lessens the accumulation of lactic acid. The cooling effect of aqua on the body is another clear advantage of aqua workout. A group exercise pool's average temperature is about 78 degrees, which will encourage the body to burn energy in order to maintain homeostasis while simultaneously keeping the space cool and comfortable and reducing the amount of perspiration that participants perceive.

2. LITERATURE REVIEW

The amount of anthropogenic garbage produced and the degree of environmental harm it causes both rises in tandem with the growing human population. Additionally, as population densities rise, so do the amounts of extremely concentrated liquid and solid waste that can pollute and degrade the environment. A push to regulate and lessen waste production and related pollution has arisen as a result of growing concern about the capacity of Earth's natural systems to absorb these pollutants [6]. The variety, quantity, volume, and concentration of pollutants produced by resource consumption and emitted through residential and industrial wastes pose a hazard to human health and environment. Water conservation is one of the primary issues resources, particularly ground and surface waters that are frequently used for human use. Water has become a scarcer resource globally as demand rises and quality declines.

VO2max is a globally recognized measure of an individual's cardiorespiratory fitness and is the highest rate of metabolic activity that may be achieved during intense labor that wears a person out in five to ten minutes. In addition to physical characteristics, environmental influences [7], job habits, and medical problems are important VO2max drivers. Only a well-equipped laboratory can use the direct evaluation of lung capacity in respect to maximum oxygen uptake (VO2max) due to its time-consuming, complex, and difficult experimental methods. It might be better to use another indirect test that requires fewer equipment to anticipate VO2max in nature.

The prevalence of obesity more than doubled globally between 1980 and 2014. With growing levels of obesity, Cardiovascular disease, hypertension, type II diabetes, osteoarthritis, gallbladder disease, and various malignancies are all more likely to occur. A low VÇO2max level has been shown to be a risk factor for cardiovascular death on its own. Additionally, it is regarded as a non-essential risk factor for predicting future hypertension. BMI [8, 9], which is determined by the subject's height and weight, is a proxy for body fat. However, a significant drawback is that it fails to differentiate between FFM and body fat. A proven indirect technique for determining the proportion of fatty tissue and FFM is BIA. In light of this, the purpose of this study was to ascertain how young people' BMI, fat percentage, and FFM correlated with their V̇O2max.

The aorta cross-sectional surface, which was calculated using the resting aortic diameter, was multiplied by the VTI to get SV. The subject was placed on the cycle ergometer, and the biggest size of the descending aorta (estimated at the sinotubular confluence from inner edge to inner corner) was estimated using two-dimensional videography (parasternal long-axis aspect) [10]. Assuming the aorta to be circular, the aortic cross-sectional area was computed by averaging five to ten diameter measurements. The cardiac output was calculated by multiplying the beat rate by SV, and the mean arterial venous oxygen differential was calculated by dividing relative V˙ o2 by cardiac output. The zenith of the velocity-time curves was used to determine the peak aortic velocity values.

Step tests frequently use a fixed step height, but since leg length varies greatly among individuals, so does the energy needed to complete each step. If a step is too high for a given person, it may indicate a mechanical disadvantage and be more reliant on muscle strength than cardiorespiratory fitness [11]. On the other hand, an effort that is too small might not offer enough resistance to elicit the necessary cardiorespiratory response. Individuals with smaller body heights, greater body mass indexes and less capacity for activity have also shown increased exercise intensity during step tests with a set cadence. In certain situations, fixed-rate step assessments may produce intense exercise intensities, negating its usefulness as a submaximal fitness test since they may necessitate medical monitoring and may affect its reliability and precision.

3. METHODS AND MATERIALS

Forty-five male college students from North Chennai Swim Academy in Chennai, ages 17 to 23, were chosen at random to participate in the program. Three groups of fifteen subjects each were created: the control group (group III), the deep aqua cardiovascular exercise group (group II), and the shallow water aerobics group (group I) of the experiment.

Group III served as the control [12, 13, 14], while groups I and II underwent six weeks of aerobic exercise instruction in shallow and deep water, separately. For a period of six weeks, the difficulty level of water cardiovascular drills was gradually increased from 50%, 60%, and 70%. The actions included were journey, up, down, downwards, vine (feet simultaneously cross in front and hinter), in revolves (in location but change orientation faced), whirlpool, ladder, downward (alternate two exercises, do 8, 6, 4, 2 reps each), toward (as higher, but start with less extensive number of representatives), and the load. Before and after the training period [15, 16, 17], the individuals in each of the three groups had their maximal oxygen consumption measured.

Cooper's formulas were utilized to determine the individuals' maximum oxygen intake, and the mean value counted by mille/liter was then used to the Cooper's 12-minute run/walk test.

3.1 Analyzing gas

The open-circuit calorimetric system of an MGC Cardio2 pulmonary, which uses a combination of chemicals with consistent amounts of oxygen (O2) and carbon dioxide (CO2)—was used to do gas analysis during exercise.

VO2 and VCO2 levels were calculated using Breeze Suite software by monitoring the variation in gas pressure in infused and expelled air, measured in VE (minutely volumes or expelled volumes per minute), breathe by breath. The level of CO2 was determined by an electrode using non-dispersive infrared analysis (NDIR), and a zirconium cell was employed in a different transducer to measure the percentage of O2 [18, 19]. For every respiratory invasion, respiratory exchange ratios (RER = VCO2/VO2) were computed using the VCO2/VO2 ratio. To calibrate the spirometers apparatus, the circuits were first warmed up by leaving the apparatus on for half an hour. After that, the airflow was altered using a test infusion with a 3 L volume power consumption. By manually controlling the syringe to generate a flow of 0.4 to 12 L/s, the unit's accuracy for both low and high flow levels was confirmed. Two reference gases were used to calibrate the O2 and CO2 detectors: one with 22% O2 and 0% CO2, and another with 12% O2 and 5% CO2.

3.2 Minimal oxygen Intake

To determine the workloads required to create a maximal oxygen intake, the volunteers were instructed to stay in the laboratory for at least three days, and often ups to five days. A modest breakfast was provided to the subjects. However, the subjects did not eat breakfast when they arrived at the laboratory for supplementary measurements. The subject's participation in the study determined the subsequent visits [20]. During the first visit, the subject completed the treadmill version of the Harvard Fitness Test and became acquainted with the respiratory apparatus (12). A realistic estimate of the appropriate grade that would result in the maximum oxygen intake may be made based on the test score.

The participant completed the treadmill variant of the Harvard Fitness Test and became acquainted with the respiratory equipment during the initial appointment (12). A realistic estimate of the appropriate grade that would result in the maximum oxygen intake may be made based on the test score.

4. RESULTS AND DISCUSSION

Table 1: The covariance coefficient for the Means of the Pre, Post, and Adjusted Post Tests for the Control group on Maximum Oxygen Consumption, the Groups for Shallow Underwater Aerobic Training and Deep Aqua Aerobic Activity (Maximal oxygen consumption means value measure by Cooper's 12 Minutes run / Walk Test in mille/liter)

Variable name	Test	Shallow aqua aerobic exercise group	Deep aqua aerobic exercise group	Control group	Source of Variance	Sum of Square	df	Mean square	'F' ratio
Vo2 Max	Pretest	134.66	134.61	134.71	Between	0.07	2	0.035	0.01
					Within	10796.1	42	257.05	
	Post test	122.31	117.49	136.01	Between	2770.88	2	1385.44	9.28*
					Within	6269.37	42	149.27	
	Adjusted post test	122.31	117.52	135.98	Between Set	2754.14	2	1377.07	29.16*
					Within Set	1936.46	41	47.23	

With df 2 and 42, the table value needed to be noteworthy at the 0.05 level is 3.22 and 3.23, respectively.

The statistical analysis from Table 1 shows that the pre-test means for the deep aqua cardiovascular exercise group, shallow aqua cardiovascular fitness group, while regulating group are 134.66, 134.61, and 134.71, respectively. For df 2 and 42, the pre-test F ratio of 0.01 is less than the table number 3.22 [21], which are necessary for significance at the 0.05 level. The post-test means for the control group, the deep aqua cardiovascular workout group, and the shallow aqua cardiovascular exercise group are 136.01, 117.49, and 122.31, respectively. At the 0.05 level of significance, the post-test's calculated F ratio of 9.28* is more than the reported figure of 3.22 for df 2 and 42. The control group, deep aqua cardiovascular workout group, and shallow aqua aerobic training group all had adjusted post-test averages of 135.98, 117.52, and 122.31, respectfully. At the 0.05 level of significance, Additionally, the reported result of 3.23 for df 2 and 41 is lower than the F ratio for the corrected post-test, which is 29.16.

Table.2: Scheffe's Test to Compare College Male Students' Adjusted Post-Test Paired Average on Vo2 Max

Variables	Control group	Shallow aqua aerobic group	Deep aqua aerobic group	Mean Difference	C.I value
Arm strength	135.98	122.31	-	13.67*	6.25
	135.98	-	117.52	18.47*	
	-	122.31	117.52	4.80	

In the table 2, the mean variances among the superficial water aerobics education group and the control group were 13.67* P>0.05, while the mean variations between the deeper aquatic aerobic exercise group and the control group were 18.47* (P<0.05). The calculated C.I. value was 6.25 (P<0.05). Both the shallow and deep aqua cardiovascular exercise groups had mean differences of 4.80 (P>0.05) and 6.25 (P>0.05), respectively, as well as a computed C.I. value in Table 2. It was clear that the deep aqua aerobic exercise group responded to the training with greater positive effects on Vo2 Max when compared to the shallower aqua aerobic activity group and control group (see Figure 1). The shallow aqua cardiovascular exercise group outperformed the control group.

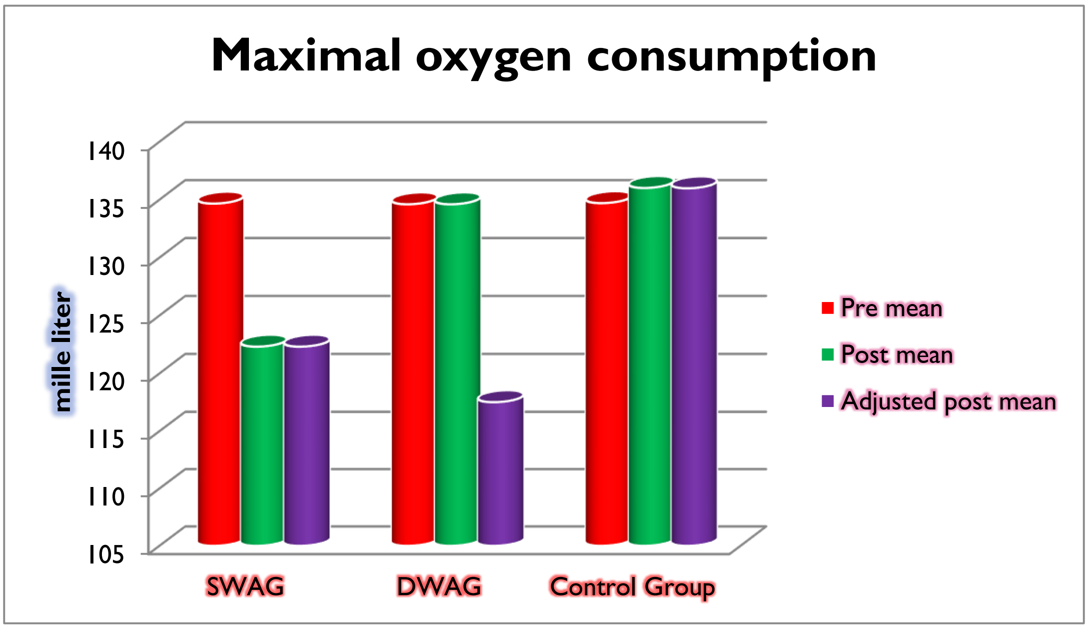

Figure 1: The cylinder diagrams ordered mean oxygen consumption values

4.1 DISCUSSION OF FINDINGS

According to the research's final findings, college male students' maximal oxygen consumption reactions to a six-week training intervention varied significantly between the training groups and the control group. Furthermore, when comparing the experimental groups to the control group, a notable improvement in the maximal oxygen consumption response has been observed. The researcher discovered that the chosen training groups had considerably raised their maximum oxygen intake after assessing the statistical summary, comparing the start point to the post-interventions amount. The differences between initial and subsequent to receiving treatment are as follows:

From pre (36.02) to post (39.54), the high-water aerobic training group drastically changed the pre and post results, as did the shallow acrobatics group from pre (36) to post (38.95). The current study shows that the groups who engaged in deep aerobic workouts and shallow aqua exercise had respective increases in maximum oxygen consumption of 1.06 and 1.27 percent. According to the study's findings, the maximal oxygen consumption increased as a result of the six-week workout impact of the deep cardiovascular activity and shallow aqua aerobic exercise groups. When compared to the training group that engaged in shallow aerobic workouts, the deep water aerobic exercises group exhibits the highest amount of enhanced maximum oxygen consumption. When compared to the control group of male learners, the exercising group that engaged in additional shallow aerobic workouts also significantly raised their maximum oxygen consumption level.

5. CONCLUSION

Following the completion of all work, the researcher came to the following conclusions:

- The deep aqua aerobic exercise group consumed more oxygen at its maximum than both the shallow and the control group;
- The shallow group consumed more oxygen at its maximum than the control group.

REFERENCES

[1] Aellen, R., W. Hollmann and U. Boutellier, " Effects of Aerobic and Anaerobic Training on Plasma Lipoproteins", *International Journal of Sports Medcine.*14:7,1993.

[2] Bowman A.J.and Clayton, R.H., et.al., "Effects of Aerobic Exercise Training and Yoga on the Baroreflex in healthy elderly persons". *European Journal and Clinical Invest,* 27:5, May 1997, p.443-449

[3] Colcombe, S.J, and K.I. Ericken " Aerobic Exercise Training increases Brain Volume in Aging Humans" – *Biological Sciences and Medical Sciences Journal*,1,Nov.2006,61:11,p1166-1170.

[4] Moreno, b. (1996). "Making a splash". *Ebscohost.com.* Retrieved 2013-11-07.

[5] SINGH, B. (2013). IMPACT OF SHALLOW AND DEEP WATER AEROBIC EXERCISES ON VO2 MAX PARAMETER AMONG COLLEGE MEN STUDENTS. International Journal of Behavioral Social and Movement Sciences, 2(4), 121-126.

[6] *Rica, R. (2013).* "Effects of aqua-based exercise in obese older women: impact of short-term follow-up study on anthropometric, functional fitness and quality of life parameters". *Geriatrics & gerontology international, 13(1)*. Retrieved 2013-11-21.

[7] Town, G.P., and S.S. Bradley. "Maximal metabolic responses of deep and shallow aqua running in trained runners". *Med.Sci. Sport Exerc.* 23:238–241. 1991.

[8] *Bocalini, D. S., Serra, A. J., Rica, R. L., & Santos, L. D. (2010). Repercussions of training and detraining by water-based exercise on functional fitness and quality of life: a short-term follow-up in healthy older women. Clinics, 65, 1305-1309.*

[9] M. Kumar Madhan. (2018) "Effect of aqua aerobic exercises and aerobic exercises with sun salutation on flexibility parameter among college men students". *Asian Journal of Multidimensional Research (AJMR)*, ISBN: 2278-4853, Volume-7 Issue-2, Pg. No:845-849

[10] Sekhon, B. S., & Shelvam, P. V. (2017). Effect of aerobic training resistance training and concurrent training on vo2 max among college boys. Int. J. Phy. Edu. Spo, 2(3), 11-14.

[11] Ramírez-Vélez, R., Correa-Bautista, J. E., Sanders-Tordecilla, A., Ojeda-Pardo, M. L., Cobo-Mejía, E. A., Castellanos-Vega, R. D. P., ... & González-Ruíz, K. (2017). Percentage of body fat and fat mass index as a screening tool for metabolic syndrome prediction in Colombian university students. Nutrients, 9(9), 1009.

[12] Zafar, S., Haque, I. U., Butt, A. R., Mirza, H. G., Shafiq, F., Rehman, A. U., & Ch, N. U. (2007). Relationship of body mass index and waist to hip ratio measurement with hypertension in young adult medical students. Pakistan Journal of Medical Sciences, 23(4), 574.

[13] Ranjith, R. M., & Prasanna, D. T. A. Effect Of Varied Intensities And Frequency Of Aerobic Exercises On Selected Motor Ability And Physiological Variables Amonginter School Handball Students. *Journal Aegaeeum Journal*, *8*, 1071-1076.

[14] R., Mohanakrishnan, R., & Arun Prasanna, T. (2019). Effect of Core Training with and without Yogic Practices on Selected Psychological Variables among College Women Athletes. *Indian Journal of Public Health Research & Development*, *10*(4).

[15] Chin, E. C. Y., Lai, S. C. N., Tsang, S. F., Chung, S. H. N., Wong, Y. L., Sran, N., ... & Sun, F. (2024). Comparing the Effects of Aqua-and Land-Based Active Cooldown Exercises on Muscle Soreness and Sport Performance: A Randomized Crossover Study. International Journal of Sports Physiology and Performance, 1(aop), 1-10.

[16] Bandyopadhyay, A. (2015). Validity of Cooper's 12-minute run test for estimation of maximum oxygen uptake in male university students. Biology of sport, 32(1), 59-63.

[17] Bose, S., Hor, S., Firdaus, S. B., Mandal, S., Singha, P. S., Ghosh, S., ... & Ghosh, D. (2023). A cross-sectional study of the association of Body Mass Index and Physical Fitness Index of college students of Madpur region of West Midnapore district of West Bengal, India. Indian Journal of Clinical Anatomy and Physiology, 10(1),

41-45.

[18] Mondal, H., & Mishra, S. P. (2017). Effect of BMI, body fat percentage and fat free mass on maximal oxygen consumption in healthy young adults. Journal of clinical and diagnostic research: JCDR, 11(6), CC17.

[19] Rowland, T., Goff, D., Martel, L., & Ferrone, L. (2000). Influence of cardiac functional capacity on gender differences in maximal oxygen uptake in children. Chest, 117(3), 629-635.

[20] Taylor, H. L., Buskirk, E., & Henschel, A. (1955). Maximal oxygen intake as an objective measure of cardio-respiratory performance. Journal of applied physiology, 8(1), 73-80.

[21] Bennett, H., Parfitt, G., Davison, K., & Eston, R. (2016). Validity of submaximal step tests to estimate maximal oxygen uptake in healthy adults. Sports Medicine, 46, 737-750.