

**ISOLATED AND COMBINED EFFECT OF AQUA AND RESISTANCE TRAINING ON
SELECTED PHYSIOLOGICAL VARIABLES AMONG
MEN BASKETBALL PLAYERS**

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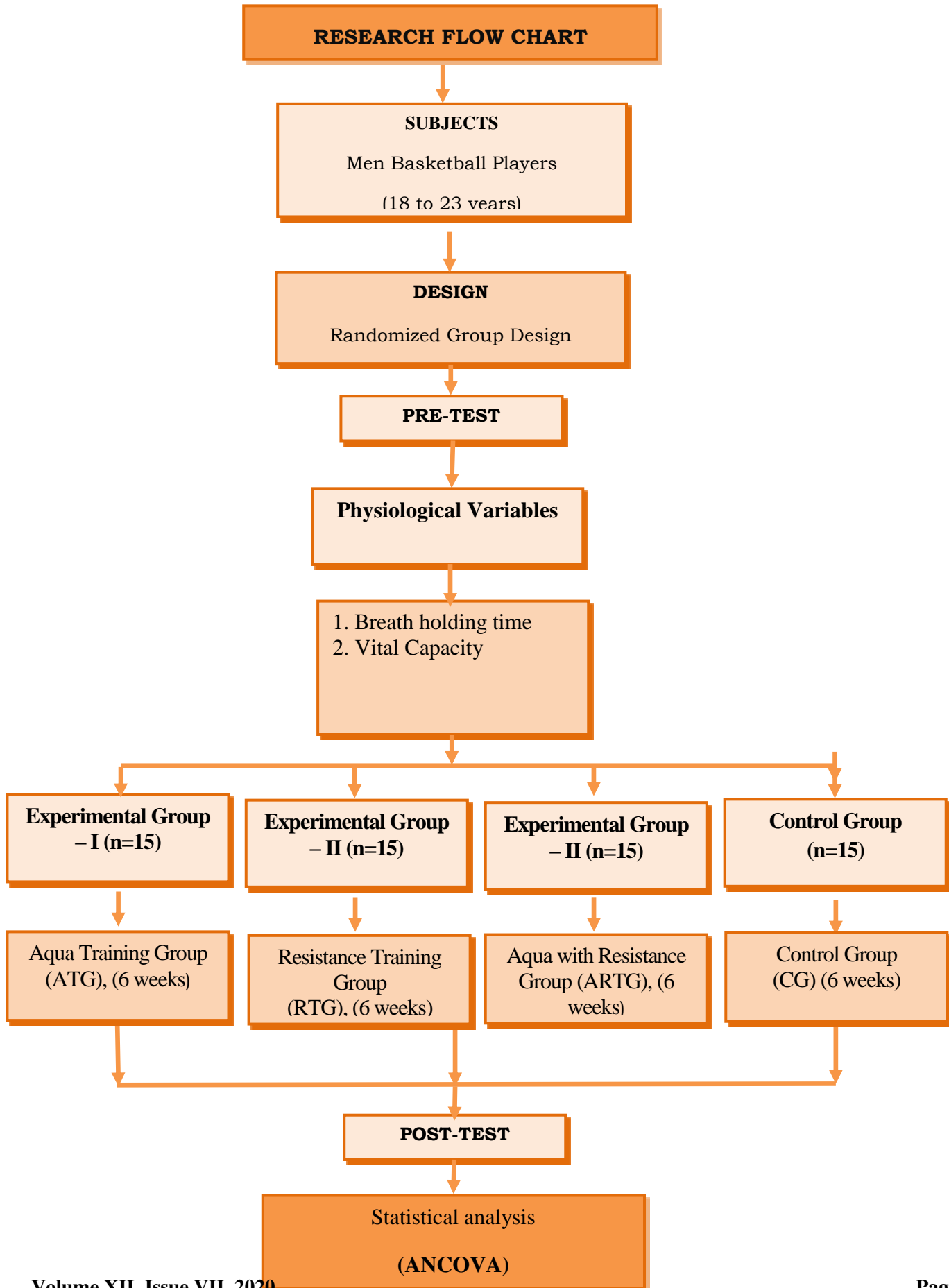
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Abstract:

Background: the main aim of this research was to evaluate the effectiveness of isolated aqua resistance and combined training on selected physiological variables among men basketball players. **Method:** Therefore the purpose of the study was to investigate the isolated and combined effect of aqua and resistance training on vital capacity and breath holding time among men basketball players. The selected subjects (N=60) would be classified into four equal groups of fifteen each (n=15) at random. Group-I undergo Aqua training, Group-II Resistance training, and Group III Aqua with Resistance training group and group-IV act as control group. **Timeline:** The aqua training and in low altitude training consisted of 45 min/day, 3 days in a week till six weeks from the Alagappa University college of physical education, Karaikudi, Tamilnadu. Physiological variables completed of the both groups at zero time and after six weeks of isolated and combined aqua and resistance training intervention group. **Results:** The results on physiological variables of breath holding time and vital capacity of men basketball players produced significant changes. **Conclusion:** The advantage of combined aqua resistance training group had shown significant improvement compared in all the other groups the selected physiological variables. Therefore isolated and combined effect of aqua training and resistance training covered in this study are beneficial for the men basketball players.

Keywords: Aqua Training, Resistance Training, ANCOVA, Physiological Variables, Men Basketball Players.



Introduction:

Basketball may be considered a predominantly anaerobic exercise which exhibits several high intensity activities actions such as jumping (for rebounds, blocks and shots), running sprint, accelerations/decelerations, and changes of direction. These anaerobic movements of basketball players are related to the development of strength, sprint and agility. Specially, explosive strength levels, mainly in the improvement of vertical jump, are essential for basketball performance (Santos & Janeira,2011).Two training methods, resistance and plyometric training (PT),are usually employed for improving the explosive strength in basketball players (Santos & Janeira,2008). Plyometric exercises(jumping, bounding and hopping) have been a more usual strength training employed by coaches of National Basketball Association Strength and Conditioning Coaches (Simenz,Dugan, & Ebben,2005). In particular, human movement such as jumping, hopping, leaping and other bounding movements are improved by making a counter-movement, these activities are often described as stretch shortening cycle (SSC) movements (Harrison & Gaffney,2001), which means a combination of eccentric and concentric contractions forms a muscle function (Komi,2000). Therefore, PT have consistently been proven to improve the production of muscle force and power (Wagner&Kocak,1997). Moreover, a regular PT can lead to significant improvements in postural control, jumping, sprint, change-of-direction speed and agility performance in young basketball players (Asadi,2013;Asadi,Villarreal,&Arazi,2015; McCormicket al.,2016; Zribi et al.,2014). Aquatic exercise training interventions. While most community swimming pools are heated between 26° to 28° Celsius (80° to 84° Fahrenheit), which is comfortably cool and ideal for movement, pools for therapeutic purposes are usually heated to between 30° and 32° Celsius (86° to 90° Fahrenheit). Some another studies meta-analysis demonstrates that resistance training throughout the year, using bodyweight or external weight, significantly improves vertical jump performance in healthy basketball players. Since vertical jump improvements were independent of intervention period but dependent on the duration of each individual training session the total training amount should be based on longer training sessions.

Methodology:

The purpose of the study was to investigate the isolated and combined effect of aqua and resistance training on vital capacity and breath holding time among men basketball players. The

selected subjects (N=60) would be classified into four equal groups of fifteen each (n=15) at random. Group-I undergo Aqua training, Group-II Resistance training, and Group III Aqua with Resistance training group and group-IV act as control group. The aqua training and in low altitude training consisted of 45 min/day, 3 days in a week till six weeks from the Alagappa University college of physical education, Karaikudi, Tamilnadu. Physiological variables completed of the both groups at zero time and after six weeks of isolated and combined aqua and resistance training intervention group. Breath holding time measured by nose clip test unit of measurement in seconds. Vital capacity measured by spirometer unit of measurement in liters. Analysis of Co-variance was applied to determine whether the training programmes produced significantly different improvements in selected variables after six weeks of training. Since, the initial means were not matched, comparisons between actual could not be made, all means were adjusted by regression to a common mean. The significance on difference of pairs of adjusted final group means was tested for significance by applying Scheffe's post hoc test.

Table I

**COMPUTATION ANALYSIS OF COVARIANCE OF MEANS OF AQUA,
RESISTANCE TRAINING, AQUA WITH RESISTANCE AND CONTROL GROUPS ON
BREATH HOLDING TIME (in seconds)**

Test	Aqua Training Group (AG)	Resistance Training Group (RTC)	Aqua With Resistance (AWRTG)	Control Group(C G)	Source of Variance	Sum of Squares	Df	Means Squares	F-ratio
Means of the Pre-Test	0.39	0.40	0.39	0.39	BG	0.001	3	0.001	0.02
					WG	0.408	56	0.007	
Means of the Post-Test	0.50	0.52	0.59	0.41	BG	0.268	3	0.089	5.51*
					WG	0.908	56	0.016	
Means of the Adjusted Post-Test	0.50	0.53	0.59	0.41	BG	0.268	3	0.089	5.50*
					WG	0.896	55	0.016	

B.G. –Between Groups W.G. – Within Groups *Significant at 0.05 level of confidence.

(The table values required for significance at 0.05 level of confidence for 3 & 56 and 3 & 55 are 2.76 and 2.77 respectively).

Table I indicates that the pre-test means of the pretest of aqua training group (ATG), resistance training group (RTG), aqua with resistance training group (AWRTG) and Control Groups (CG) are 0.39, 0.40, 0.39 and 0.39 respectively. The obtained F-ratio for the pre-test is 0.02 and the table F-ratio is 2.76. Hence the pre-test means breath holding time of F-ratio is insignificant at 0.05 level of confidence for the degrees of freedom 3 and 56.

The means of the post-test of aqua training group (ATG), resistance training group (RTG), aqua with resistance training group (AWRTG) and Control Groups (CG) were 0.50, 0.52, 0.59 and 0.41 respectively. The obtained F-ratio for the post-test was 5.51 and the table F-ratio was 2.76. Hence, the means of the post-test on breath holding time of F-ratio was significant at 0.05 level of confidence for the degrees of freedom 3 and 56.

The means of the adjusted post-test of aqua training group (ATG), resistance training group (RTG), aqua with resistance training group (AWRTG) and Control Groups (CG) were 0.50, 0.53, 0.59 and 0.41 respectively. The obtained F-ratio for the adjusted post-test was 5.50, and the table F-ratio is 2.77. Hence the means of the adjusted post-test on breath holding time of F-ratio is significant at 0.05 level of confidence for the degrees of freedom 3 and 55.

Table II

**THE SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN
PAIRED MEANS OF THE ADJUSTED POST-TEST ON
BREATH HOLDING TIME**

The Means of the Adjusted Post-test				Mean Difference	Confidence Interval
Aqua Training Group (AG)	Resistance Training Group (RTC)	Aqua With Resistance (AWRTG)	Control Group(C G)		
0.50	0.53	---	---	0.03*	0.03
0.50	---	0.59	----	0.09*	
0.50	---	---	0.41	0.09*	
-----	0.53	0.59	----	0.06*	
-----	0.53	-	0.41	0.12*	
---	---	0.59	0.41	0.18*	

** Significant at 0.05 level of confidence*

Table II shows that the mean difference between aqua group and resistance Group; aqua Group and Combined Group; aqua Group and Control Group; resistance group and Combined Training Group; resistance group and Control Group; and between Combined Group and Control Group are 0.03, 0.09, 0.09, 0.06, 0.12 and 0.18 respectively.

When the control group and experimental groups were compared with each others, the mean differences are 0.03, 0.09, 0.09, 0.06, 0.12 and 0.18 which are significant at 0.05 level of confidence. Hence, there is significant difference between control and experimental groups on breath holding time of men basketball players.

Moreover the mean difference between combined group and control group shows better improvement on breath holding time compared to other groups. It may be concluded from the

results that there is a significant difference between means of the adjusted post-test among the experimental groups and control group. The results of the study show that there is a significant difference between aqua Group and resistance group; aqua group and Combined Group; aqua group and Control Group; resistance Group and Combined Group; Combined Training Group and Control Groups on breath holding time.

Table III

**COMPUTATION ANALYSIS OF COVARIANCE OF MEANS OF AQUA,
RESISTANCE TRAINING, AQUA WITH RESISTANCE AND CONTROL GROUPS ON
VITAL CAPACITY (in liters)**

Test	Aqua Training Group (AG)	Resistance Training Group (RTC)	Aqua With Resistance (AWRTG)	Control Group(CG)	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Means of the Pre-Test	3.08	3.09	3.09	3.09	BG	0.001	3	0.001	0.01
					WG	19.116	56	0.341	
Means of the Post-Test	3.54	3.62	3.74	3.12	BG	3.283	3	1.094	4.09*
					WG	14.98	56	0.268	
Means of the Adjusted Post-Test	3.54	3.62	3.74	3.12	BG	3.288	3	1.096	10.79*
					WG	5.585	55	0.102	

B.G. –Between Groups W.G. – Within Groups *Significant at 0.05 level of confidence.

(The table values required for significance at 0.05 level of confidence for 3 & 56 and 3 & 55 are 2.76 and 2.77 respectively).

Table III indicates that the pre-test means of the pretest of aqua training group (ATG), resistance training group (RTG), aqua with resistance training group (AWRTG) and Control Groups (CG) are 3.8, 3.09, 3.09 and 3.09 respectively. The obtained F-ratio for the pre-test is 0.01 and the table F-ratio is 2.76. Hence the pre-test means resting heart rate of F-ratio is insignificant at 0.05 level of confidence for the degrees of freedom 3 and 56.

The means of the post-test of aqua training group (ATG), resistance training group (RTG), aqua with resistance training group (AWRTG) and Control Groups (CG) were 3.54, 3.62, 3.74 and 3.12 respectively. The obtained F-ratio for the post-test was 4.09 and the table F-ratio was 2.76. Hence, the means of the post-test on resting heart rate of F-ratio was significant at 0.05 level of confidence for the degrees of freedom 3 and 56.

The means of the adjusted post-test of aqua training group (ATG), resistance training group (RTG), aqua with resistance training group (AWRTG) and Control Groups (CG) were 3.54, 3.62, 3.74 and 3.12 respectively. The obtained F-ratio for the adjusted post-test was 10.79, and the table F-ratio is 2.77. Hence the means of the adjusted post-test on resting heart rate of F-ratio is significant at 0.05 level of confidence for the degrees of freedom 3 and 55.

Table IV

**THE SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN
PAIRED MEANS OF THE ADJUSTED POST-TEST ON
VITAL CAPACITY**

The means of the Adjusted Post-test				Mean Difference	Confidence Interval
Aqua Training Group (AG)	Resistance Training Group (RTC)	Aqua With Resistance (AWRTG)	Control Group(CG)		
3.54	3.62	---	---	0.08	0.34
3.54	---	3.74	----	0.20	
3.54	---	---	3.12	0.42*	
-----	3.62	3.74	-----	0.12	

-----	3.62	-	3.12	0.50*	
---	---	3.74	3.12	0.62*	

Table – IV shows that the mean difference between aqua Group and Control Group; resistance group and Control Group; and between Combined Group and Control Group are 0.42, 0.50 and 0.62 respectively.

When the control group and experimental groups were compared with each others, the mean differences are 0.42, 0.50 and 0.62 which are significant at 0.05 level of confidence. Hence, there is significant difference between control and experimental groups on vital capacity of men basketball players.

The mean difference between aqua group and resistance Group; aqua Group and Combined Group; and between resistance group and Combined Training Group are 0.08, 0.20 and 0.12 respectively.

When the experimental groups were compared with each other's, the mean differences are 0.42, 0.50 and 0.62 which are significant at 0.05 level of confidence. Hence, there is insignificant difference between experimental groups on vital capacity of men basketball players.

Moreover the mean difference between combined group and control group shows better improvement on vital capacity compared to other groups. It may be concluded from the results that there is a significant difference between means of the adjusted post-test among the experimental groups and control group. The results of the study show that there is a significant difference between aqua group and Control Group; resistance group and control group; Combined Training Group and Control Groups on vital capacity.

Discussion on findings

Moreover the mean difference of combined group shows better improvement on breath holding time and vital capacity compare to other groups, because of specific aqua with resistance training on breath holding timer of men basketball players.

The results conformity with other studies research conducted the effect of land based and water based aerobic exercises significantly changed breath holding time among school students (Kalaiselvi 2018). The results showed that the effect of aqua aerobics and floor aerobics in breath holding time among school girls was a significant difference among the experimental and control group on breath holding time (Shelvam et al, 2013) and effect of varied impacts and frequencies of aerobics dance training significantly improvement on breath holding time male subjects (Murugavel 2014). The experimental groups showed significant difference than the control group after aerobic training in all the selected physiological variables (Senthilkumar et al, 2019). The results showed that the combined aerobics and resistance training improves respiratory and exercise out comes more than aerobic training in adolescent changed significantly on vital capacity (Xavier et al, 2020). The experimental group positive effects showed six weeks inspiratory resistance training ameliorates endurance performance in obese (cheng et al, 2020)

Conclusion

1. The experimental group 'I' had shown significant improvement in all the selected physiological variables after undergoing the aqua for a period of six weeks.
2. The experimental group 'II' had shown significant improvement in all the selected physiological variables after undergoing the resistance training for a period of six weeks.

3. The experimental group 'III' had shown significant improvement in all the selected physiological variables after undergoing the combined aqua with resistance for a period of six weeks.

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