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Isolated Effects Of Aquatic Exercises On Explosive Power And Flexibility Among Women Volleyball Players

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ABSTRACT

The purpose of this study was to analyze the isolated effects of aquatic exercises on explosive power and flexibility among women volleyball players. To execute the investigation, thirty (n=30) college women studying undergraduate engineering volleyball players from Vellor Institute of Technology, Chennai, Tamilnadu, India were randomly selected as subjects. They were divided randomly into two groups of fifteen each i.e., (n=15). Experimental group-I had undergone aquatic exercises and group-II was act as control group. The control group would not take part any physical activity or aquatic exercises other than regular routine work and their age ranged from 18-23 years. The experimental group had undergone respective training period for six days per week for twelve weeks for aquatic exercises and the number of sessions per week was also confined to six in the morning session. The dependent variables selected for this study were explosive power and flexibility. The explosive power was measured by standard vertical jump in centimeters and flexibility was tested by sit & reach test in centimeters. Aquatic exercises trained in a swimming pool while approximately 70 % of their body was floating down the water. The temperature of the swimming pool was kept consistent at 27˚c or 28˚c. Each exercise session lasted 45 minutes and every session started with a 5-min jogging, a 5-minutes stretching and ballistic movements to warm-up and 5-minutes of stretch movements to cool-down. The sufficient recovery was 30 to 60 seconds rest between the sets and 2 to 3 minutes between each jump on per session. The subjects performed the aquatic exercises with a maximum ability and capacity for each session. All the subjects were tested prior to and immediately after the experimental period on the selected dependent variables. The data obtained from the experimental group before and after the experimental period were statistically analyzed with analysis of covariance (ANCOVA). Whenever the “F” ratio for adjusted post-test mean was found to be significant, the Scheffe‟s post hoc test was applied to determine the paired mean differences. The level of confidence was fixed at 0.05 levels for all the cases. The result of the study revealed that there was significant improvement on selected explosive power and flexibility among

women volleyball players after the isolated effects of aquatic exercises however the control group had not shown any significant improvement on any of the selected variables such as explosive power and flexibility.

Keys: Aquatic exercises, Explosive Power, Flexibility and Volleyball.

INTRODUCTION

The popularity of aquatic therapy and exercise has becoming more prevalent, given the therapeutic properties of water and increased accessibility of pool facilities. Many clinicians now use aquatic therapy for rehabilitation purposes which include strength gains and functional activities in a low weighted environment. Individuals suffering from rheumatism, pain, orthopedic dysfunctions or who have any difficulty performing an exercise on land, might benefit from this form of therapy (Cassady & Nielsen, 1992). An aquatic exercise has been beneficial in several musculoskeletal conditions and has become more popular in the recent decades. It could be applied to children to improve fitness and function, as the properties of water reduce excessive joint loading and enhance strengthening, providing assistance to children with decreasing postural control and muscle weakness. (Faigenbaum, A.D, 2000).

Water proposes a unique exercise medium in which reduced gravity conditions decrease the impact forces on joints while the water itself creates resistance to movement. Aqua aerobics was the performance of aerobic exercises in water. It has also known as aqua fit or water aerobics. Aqua aerobic exercise could be performed as a special segment of workout or as a warm-up to the rest of the water activities. The body will be warm up quickly as it vigorously burns calories and increases the cardio-respiratory strength and endurance (Kelly M, Darrah J, 2005). Aquatic environments recommend an effective means for many aspects of a participant's exercise and conditioning programme. Aerobic water workouts incorporate a variety of rhythmic body movements and dance step performed in the water. Programs differ from basic to advance. In beginning programs the participant learns to combine arms and legs movements in varying combinations. As water aerobics programs become more advanced and they incorporate more intricate dance and calisthenics movements (Poyhonen, T. 2002).

Water has an equalizing medium; its gravity minimizing nature reduces compressive joint forces, providing a better exercise environment for patients with back pain, arthritis, osteoporosis or other medical conditions that might restrict physical training on land. Due to the added benefits of water many forms of aquatic therapy now existed. Each mode of aquatic therapy and exercise introduces for variety of treatment and rehabilitative exercise programs (Takeshima N, 2002). The investigator had chosen for his study as dependent variables such as explosive power and flexibility in those both variables will be opted for volleyball players. The term explosive power defines that capacity of the individual to bring

into plays maximum muscle contraction at the fastest rate of speed (Barrow and McGee, 1979). It is defined as the range of possible movement about a joint or sequence of joints (Clarke, 1972).

METHOD AND MATERIALS

The purpose of this study was to analyze the isolated effects of aquatic exercises on explosive power and flexibility among women volleyball players. To execute the investigation, thirty (n=30) college women studying undergraduate engineering volleyball players from Vellor Institute of Technology, Chennai, Tamilnadu, India were randomly selected as subjects. They were divided randomly into two groups of fifteen each i.e., (n=15). Experimental group-I had undergone aquatic exercises and group-II was act as control group. The control group would not take part any physical activity or aquatic exercises other than regular routine work and their age ranged from 18-23 years. The experimental group had undergone respective training period for six days per week for twelve weeks for aquatic exercises and the number of sessions per week was also confined to six in the morning session. The dependent variables selected for this study were explosive power and flexibility. The explosive power was measured by standard vertical jump in centimeters and flexibility was tested by sit & reach test in centimeters. Aquatic exercises trained in a swimming pool while approximately 70 % of their body was floating down the water. The temperature of the swimming pool was kept consistent at 27˚c or 28˚c. Each exercise session lasted 45 minutes and every session started with a 5-min jogging, a 5-minutes stretching and ballistic movements to warm-up and 5-minutes of stretch movements to cool-down. The sufficient recovery was 30 to 60 seconds rest between the sets and 2 to 3 minutes between each jump on per session. The subjects performed the aquatic exercises with a maximum ability and capacity for each session. All the subjects were tested prior to and immediately after the experimental period on the selected dependent variables. The data obtained from the experimental group before and after the experimental period were statistically analyzed with analysis of covariance (ANCOVA). Whenever the “F” ratio for adjusted post-test mean was found to be significant, the Scheffe‟s post hoc test was applied to determine the paired mean differences. The level of confidence was fixed at 0.05 levels for all the cases.

TRAINING PROGRAMME

The training period was twelve weeks of six days in every week. Data were collected from each subject before and after the twelve weeks of aquatic exercises group. The swimming pool of Vellore Institute of Technology, Chennai, Tamil Nadu, India was used to conduct the aquatic exercises programme for this study. The subjects have undergone their respective aquatic training programmes as per the schedule under the supervision of the investigator and swimming coach. Each training session was conducted only in the morning. Prior to every training session of the group had a fifteen minute warm-up exercise involving jogging

followed by stretching exercises and aquatic exercises workout schedule presented in table -I

TABLE –I TRAINING SCHEDULE FOR AQUATIC EXERCISES GROUP

S.No	Aquatic Exercises	Rep. x Sets 1-3 Weeks	Rep. x Sets 4-6 Weeks	Rep. x Sets 7-9 Weeks	Rep. x Sets 10-12 Weeks	Intensity	Recovery
1	Warm-up (Land)	5 Min.	5 Min.	5 Min.	5 Min.	60%	1 Min
2	Warm-up (Aquatic)	5 Min.	5 Min.	5 Min.	5 Min.	60%	1 Min
3	Aquatic Walking	3 Min.	3 Min.	3 Min.	3 Min.	60%	1 Min
4	Single Leg Jump (Alternative leg)	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min
5	Double Leg Jump	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min
6	High Knee Action	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min
7	Split Leg Jump	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min
8	Kicking Forward (Alternative leg)	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min
9	Jump lunges	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min
10	Knee Duck Jump	10x2 Sets	10x3 Sets	10x4 Sets	10x5 Sets	60%	1 Min

The training period lasted for the twelve weeks from 01.09.2019 to 30.11.2019.

Pre -tests were conducted on 30.08.2019 at 4 pm.

Post-tests were conducted on 02.12.2019 at 4.00 pm.

STATISTICAL TECHNIQUE

The following statistical techniques were employed to find out the effects of aquatic exercises on explosive power and flexibility among women volleyball players. Analysis of covariance (ANCOVA) was employed to find out the significant differences if any, among the groups for each variable separately. The Scheffe's test was applied as post-hoc test whenever the 'F' ratio of the adjusted post-test means was found to be significant at 0.05 level of confidence.

RESULTS AND ANALYSIS

EXPLOSIVE POWER

The data collected prior to and immediately after the experimental period on explosive power of aquatic exercises group and control group were analyzed and presented in Table – II.

TABLE – II ANALYSIS OF COVARIANCE ON EXPLOSIVE POWER OF AQUATIC EXERCISES GROUP AND CONTROL GROUP

Test	Aquatic Exercises Group	Control Group	SOV	Sum of Squares	Df	Mean Square	F Ratio
Pre - Test Mean	56.70	51.30	Between Within	16.70 455.60	2 28	8.35 16.27	0.51
Post -Test Mean	64.10	51.20	Between Within	342.20 380.46	2 28	171.10 13.59	12.59*
Adjusted Post-Test Mean	55.90	49.80	Between Within	340.30 180.60	2 27	170.15 6.69	25.43*

(The table value required for significance at 0.05 level of confidence with df 2 and 28 and 2 and 27 were 3.34 respectively).

The above table-II stated that the pre-test mean on explosive power of aquatic exercises group and control group numerical values were 56.70 and 51.30 respectively. The obtained 'f' ratio value of 0.51 for pre-test scores on explosive power of aquatic exercises

group and control group, here explosive power was less than the required table value of 3.34 for significance with df 2 and 28 at 0.05 level of confidence.

The post-test mean values on explosive power of aquatic exercises group and control group were 64.10 and 51.20 respectively. The obtained 'f' ratio value of 12.59 for post-test scores on explosive power of aquatic exercises group and control group, here explosive power was greater than the required table value of 3.34 for significance with df 2 and 28 at 0.05 level of confidence.

The adjusted post-test mean values on explosive power of aquatic exercises group and control group were 55.90 and 49.80 respectively. The obtained 'f' ratio value of 25.43 for adjusted post-test scores on explosive power of aquatic exercises group and control group, here explosive power was higher than the required table value of 3.34 for significance with df 2 and 27 at 0.05 level of confidence.

The above statistical analysis indicates that there was a significant improvement on explosive power after the training. Further, to determine which of the paired mean had a significant difference, the scheffe's test was applied. The result of the test is presented in table – II (A).

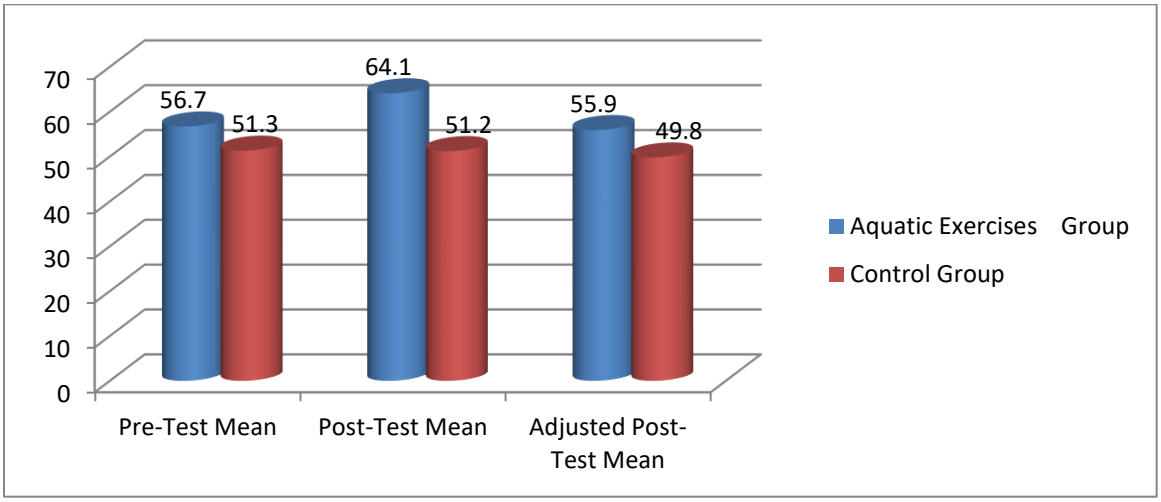
TABLE – II (A) SCHEFFE'S TEST FOR THE DIFFERENCE BETWEEN THE ADJUSTED POST-TEST MEANS ON EXPLOSIVE POWER

Variables	Aquatic Exercises Group	Control Group	Mean Difference	CI
Explosive Power	55.90	49.80	6.10*	2.98

Table – II (A) indicates that the adjusted post-test mean difference on explosive power between aquatic exercises group and control group were 6.10 which was significant at 0.05 level of confidence. It was concluded from the results of the study that of aquatic exercises group have improved on explosive power which was significant.

The mean values on explosive power of aquatic exercises group and control group were graphically represented in figure - 1.

FIGURE – 1 PRE-TEST, POST-TEST AND ADJUSTED POST-TEST MEANS DIFFERENCES OF EXPLOSIVE POWER (IN CENTIMETER)



Explosive Power (In Centimeter)

FLEXIBILITY

The data collected prior to and immediately after the experimental period on flexibility of aquatic exercises group and control group were analyzed and presented in Table – III.

TABLE -III ANALYSIS OF COVARIANCE ON FLEXIBILITY OF AQUATIC EXERCISE GROUP AND CONTROL GROUP

Test	Aquatic Exercises Group	Control Group	SOV	Sum of Squares	Df	Mean Square	F- ratio
Pre - Test Mean	16.30	15.20	Between Within	9.10 154.38	2 28	4.55 5.51	0.82
Post -Test Mean	20.10	15.10	Between Within	130.60 163.40	2 28	65.30 5.84	11.20*
Adjusted Post-Test Mean	19.90	14.80	Between Within	83.60 38.30	2 27	41.80 1.42	29.44*

(The table value required for significance at 0.05 level of confidence with df 2 and 28 and 2 and 27 were 3.34 respectively).

Table-III clearly indicates that the pre-test mean on flexibility of aquatic exercises group and control group were 16.30 and 15.20 respectively. The obtained 'f' ratio value of 0.82 for pre-test scores on flexibility of aquatic exercise group and control group, here flexibility was less than the required table value of 3.34 for significance with df 2 and 28 at 0.05 level of confidence.

The post-test mean values on flexibility of aquatic exercises group and control group were 20.10 and 15.10 respectively. The obtained 'f' ratio value of 11.20 for post-test scores on flexibility of aquatic exercise group and control group, here flexibility was greater than the required table value of 3.34 for significance with df 2 and 28 at 0.05 level of confidence.

The adjusted post-test mean values on flexibility of aquatic exercise group and control group were 19.90 and 14.80 respectively. The obtained 'f' ratio value of 29.44 for adjusted post-test scores on flexibility of aquatic exercise group and control group, here flexibility was higher than the required table value of 3.23 for significance with df 2 and 26 at 0.05 level of confidence.

The above statistical analysis indicates that there was a significant improvement on flexibility after the training. Further, to determine which of the paired mean had a significant difference, the scheffe's test was applied. The result of the test is presented in Table – III (A).

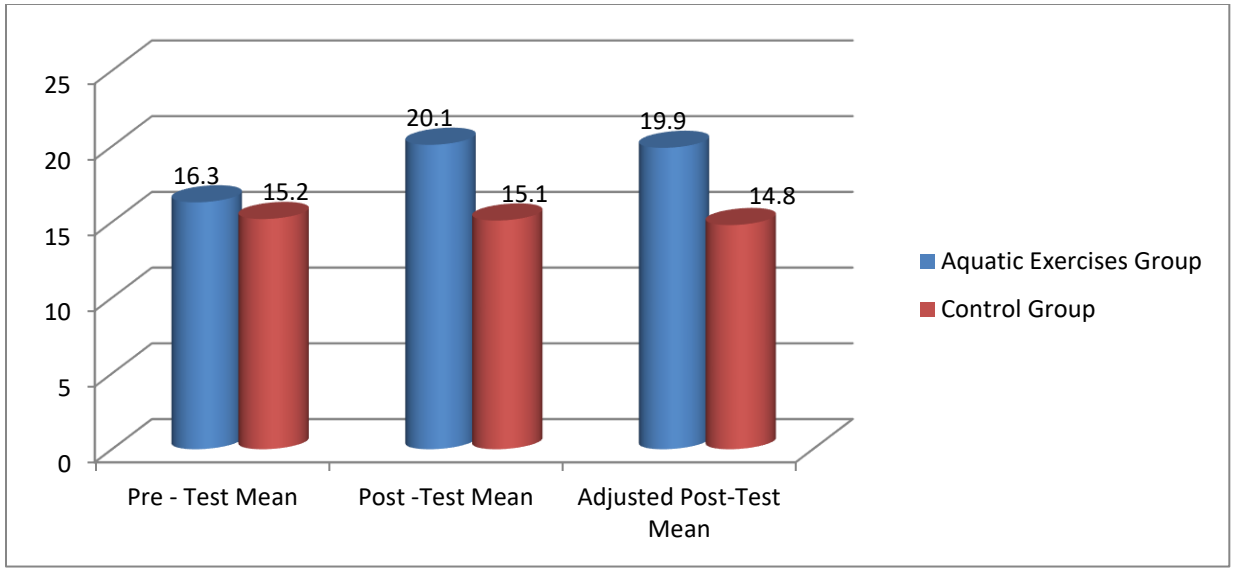
TABLE-III (A) SCHEFFE'S TEST FOR THE DIFFERENCE BETWEEN THE ADJUSTED POST-TEST MEAN OF FLEXIBILITY

Variables	Aquatic Exercises Group	Control Group	Mean Difference	CI
Flexibility	19.90	14.80	5.10*	2.90

Table – III (A) shows that the adjusted post-test mean difference on flexibility between aquatic exercises group and control group were 5.10 which were significant at 0.05 level of confidence. It was concluded from the results of the study that of aquatic exercises group have increased on flexibility which was significant.

The mean values on flexibility of aquatic training group and control group were graphically represented in figure - 2.

FIGURE – 2 PRE-TEST, POST-TEST AND ADJUSTED POST-TEST MEANS DIFFERENCES OF FLEXIBILITY (IN CENTIMETER)



Flexibility (In Centimeter)

DISCUSSION ON FINDINGS

The outcomes of the study show that there is a significant improvement on explosive power and flexibility due to aquatic exercises. Further the results of the study indicated that there is an improvement aquatic exercises group on explosive power and flexibility.

The result of the study also revealed that there was improvement on explosive power and flexibility due to the aquatic exercises and significant improvement was found between the training group and control group on explosive power and flexibility in favour of aquatic exercises group. The results of this study coincide with these made by K. Jayachandran (2015) and Martel (2005) demonstrated the ability to increase vertical jump in female volleyball players using specific aquatic plyometric training and these improvements could be accomplished with less muscle pain as well. Tsourlou (2006) aquatic training (AT) program supported that muscle strength, flexibility was improved due to influence of aquatic training.

CONCLUSION

The result of the study revealed that there was significant improvement on selected explosive power and flexibility among women volleyball players after the isolated effects of aquatic exercises however the control group had not shown any significant improvement on any of the selected variables such as explosive power and flexibility.

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