Relationship of Land and Water Based Exercises in Improving Cardiovascular Fitness, Muscular Strength and Speed among Male Soccer Players

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Abstract: The primary purpose of this study was to evaluate the relationship of land and water based exercise in improving cardiovascular fitness, muscular strength and speed among Soccer Players. Twenty-four young male beginner soccer players from ‘C’ level soccer team were selected as subjects. Their ages were 15-18 years. The subjects were randomly assigned to land based performing exercise group, twelve in number (LEG no 12 male) and water based performing exercise group, twelve in number (WEG no 12 male). They participated in land based and water based exercises (both deep and shallow water) training for three month, three days per week for 50 minutes. The fitness variables selected for the study were cardiovascular fitness, muscular strength, and speed. After 12 weeks of training, the WEG improved better in soccer types of physical fitness qualities. In cardiovascular fitness the WEG increase by 21% (SHYR 22% and TMR 20%) and the LEG increased by 13% (SHYR 18% and TMR 8%). Speed increased more by WEG as compare to LEG group. In 40-yard performance WEG showed 12% change, while the LEG improved by 11%. In addition, 9% increment was observed in WEG and 7% improvement by the LEG was recorded in 60-meter speed performance. Muscle strength was highly enhanced in the WEG. In a barbell squat test, the WEG and LEG have shown 46% and 29% changes, respectively. Standing long jump performance of the WEG and LEG were improved by 29% and 16%, respectively. These results indicated that long-term water based performing exercises were better than the land based performing exercises in improving cardiovascular fitness, muscular strength and speed of beginner soccer players.

INTRODUCTION

Water fitness activities are an exercise that is performed in the water, which promotes and enhances physical and mental fitness. Water fitness is among the most popular and widely prescribed fitness activities because it appears to be suitable for different groups: older, injured, and even healthy people (Benelli et al., 2004). Water exercise has significant implications, in improving some health-related components of fitness (Carrasco and Vaquero, 2012). Water exercise programs had an enormous benefit in the improvement of physical fitness and are attributes for each physical fitness components (Barbosa et al., 2009). The density of water is approximately 800 times that of air, this has an important contribution to the energy cost of water exercise (Prampero, 1986). Land-based fitness programs are those exercises which are performed as indoor and outdoor (on the ground) physical activities. They can refer to physical activities that carried various aerobic and anaerobic exercises. Both aerobic and anaerobic exercises are the most important to any workout and are the basis for a healthy lifestyle and aerobic fitness, strength and other fitness components (http://www.fitness).

PROCEDURE AND METHODS

Study Design
Complete randomize design was used for this study. The research was conducted with 24 young male soccer players with the age of 15-18 years old. Beside this, the research focused on field study of twelve-week fitness program including land and water based performing exercise. The selected subject took part in to two groups; LEG and WEG. These groups were matched in terms of their age level. The average age of LEG was 16.08 ±0.9 years whereas for WEG was 16.58 ±0.7 years. Both groups were involved in training program for 12 weeks, 3 days/ week for 50 minutes. In addition to this, tests were administered for the selected subject on a selected physical fitness (cardiovascular fitness, muscular strength and speed) at pre, during, and post training.

Sample and Sampling Techniques
The purposive sampling technique was used to select twenty-eight (28) beginners’ soccer players from ‘C’ level Soccer Team. Their age was 15 to 18 years with the normal range of body mass index. twenty-eight volunteer player filled the medical history questionnaire, which was prepared with the aim of identifying whether they are free from cancer, heart disease, stroke and kidney problems. Additionally, body mass indexes and injury status
was used as one of the selection criteria for the study. Since four of the twenty-eight players were rejected due to the factors mentioned above, the study was conducted with the remaining twenty-four male subjects.

**Variables**
Components of physical fitness are the major dependent variables of soccer game. Physical fitness is divided into four health and six skill related components. From those two of health related components; cardiovascular fitness and muscular strength and one of skill related fitness component speed was selected as dependent variables for this study. The land and water based performing fitness programs were the independent variables of the study.

**Method and Procedures of Data Collection**
Double experimental measurement was used to measure each dependent variable of this study (cardiovascular fitness, muscular strength and speed). Primary data was gathered from the subjects by three phases with six weeks gap as PT, DT and PoT. This data was collected from the subjects through structured programs. Data was collected at the same time of the day to control biological factors and between subject’s variations (Reily and brooks, 1982) with the following physical fitness tests and procedure.

**600 yard run /walks Test**
In this test, subjects from both groups were ordered to run for 600 yard three times at BT, DT and PoT. Depending on the interest of the subject, the running activity could be interspersed with walking. However, the subjects strived to cover the distance with the shortest possible time. Then Seconds spent by the subject to cover the distance was calculated as their final score (Nathaniel, 2012).

**12 Minutes run/walk**
The participants of both groups were subjected to start running on athletics track to measure their cardiovascular fitness. They did their best to run as many laps as they could for 12 minutes. After 12 minutes of running, they stood on their place. Then the amount of distance covered by subjects in meter within twelve minutes was recorded as their final score (Li et al., 2005).

**40 Yard Dash**
This test was used to measure the speed of the participants. In this regard the participant from both groups was subjected to run a single maximum sprint over 40 yards, with the time recorded. Warm up was given including some practice starts and accelerations. The starting position was held for 3 seconds prior to starting, using a standing start, subjects may lean across the starting line, and no rocking movements were allowed. The tester had given hints to maximizing their speed and encouragement to continue running hard pass the finish line. The test was taken as before training (BT), in the middle of training (DT) and after training (AT). Two trials with 10 min rest between sprints was given, and the best time was recorded and calculated as his final score (Erbaugh, 1990).

**60-Meter Speed**
In this test, subjects from both groups (LEG and WEG) were involved in running a single maximum sprint over 60 meters; with the time used to cover the given distance was recorded. They started from a stationary position with one foot in front of the other. The front foot was kept nearest to behind starting line. This starting position was held for about 2 seconds prior to starting, and no rocking movement was allowed. Three trials were allowed and the best time was recorded to the nearest two decimal places. The best time was recorded and calculated as his final score and for false start chance was given again to start. (Davies, 2002).

**Barbell Squat**
The subjects were asked to hold a barbell on their shoulder with the support of their hand. After that, the participants slightly bent their knees until they reached to semi squat position. They stayed for 2 to 3 seconds in that position. Finally, returned to their standing position and dropped the barbell. This test was used to check the strength of gastronomies, Quadriceps, hamstring and Gluteal muscles of the subjects. The unit was kilogram (http://www.mensfitness.com, 2013).

**Standing Long Jump**
Standing Long Jump was conducted to measure subject’s strength. For this test, the subject took crouch position by swing his arm back ward with static position and jump horizontally as far as possible with two feet. Three trials were given and the longest distance result was recorded as a score in meter (Manuel, 2009).

**Exercise Training Protocol**
The selected subject was randomly divided in two groups. Both groups were engage in conditional exercises for two weeks. In the third week, WEG began water-based fitness training program and the LEG continued in land based fitness training program. Both kinds of training programs consist; cardiovascular fitness, speed, and muscular strength exercises.
The land based performing cardiovascular fitness class included: jogging, running and mini football game or training. The water based aerobic activities comprised with the following exercises; shallow water jogging, running and deepwater swimming. In both cases work out was done at 55%- 65% of maximal heart rate according to ACSM guideline (William et al., 1998) On the other hand the speed variable of land based performing exercise included 50 meters sprint, 15 meter sprint with step up on spot, quick running on spot + short sprint with different football drills. As well as the water based speed activities comprised the following exercises; 20 and 10 meters sprinting in shallow water, and shallow water quick running on spot.

The water based fitness program of strength variable included hip extension- flexion, abdominal crunches and dips. As well as the land-based strength activity included Push up, sit up and squat up. The exercise was performed at10-15 repetition with 3 set according to ACSM Strength training guide line (Wetcote, 2009). The duration of exercise was 50 minutes with the frequency of three days per week. This includes 10 minute of warm up and stretching, 35 minute of main activity, 5 minute of cool down and stretching. All exercises were conducted on swimming pool, which has 13 x 25m shallow water (0.5 to 1 meter depth) and 27 x 25m deep water (2-3m depth) and in stadium.

**Data Quality Control**
The researcher collected the data with the help of one assistant (diploma holder). To avoid errors, training has been given for the assistance data collector on how to use data collecting instruments and measurements during data collection. Only standardized materials were used to keep the quality of the data. Additionally, all the aforementioned tests were recorded with video and photograph. Finally, the data had been coded and feed to software twice, with different persons to avoid error in data feeding.

**Method of Data Analysis**
The data analysis was done by SPSS statistical software package Version 16. After collecting the data on speed, muscular strength and cardiovascular fitness from both groups it was analyzed with Paired sample T-test. Moreover, the level of significance was set at 0.05%.

**SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

**Summary**
The purpose of this study was to evaluate the of relationship of land and water based fitness program in improving cardiovascular fitness, muscular strength and speed among young male ‘C’ level soccer team beginner players. To achieve the purpose of the study, 24 male beginner soccer players were selected as subject from ‘C’ level soccer team. Beside this, all the subjects in this study lived in a similar life style and their age ranges between 15-18 years. The subjects were randomly divided in to two groups. Both groups consisted of twelve subjects. While group one acted as land based performing exercise group, the second group act as water based performing exercise group. The experimental period was 12 weeks during preparatory training phase of ‘C’ level soccer team. The variables selected for the study were cardiovascular fitness, speed and muscular strength. The experimental measurements used for this study were 600 yard running/walking, 12 minutes running/walking, 40-yard dash,60-meter speed, standing long jump and barbell squat. Before training program, pre physical fitness test for each variable was given to them. Then after six weeks of training program during physical fitness test and at the end of training program post test was given to both groups. Finally, the data were analyzed with Paired sample T-test. The analysis was used to figure out the effect of both trainings and to find out significant difference. In all cases, the 0.05% level of confidence was fixed to the test’s significance, which was considered as an appropriate. Generally, this study proved that water based performing exercise was significantly better than land based performing exercise in improving cardiovascular fitness, speed and muscular strength. Especially, water based performing exercise was recorded 15% improvement in muscular strength, 9% in aerobic fitness and 1.5% in speed which was better than land based performing exercise group.

**Conclusions**
Based on the major findings of the study, the following points are stated as a conclusion

- As proved from this study the land based performing and water based performing exercise programs significantly improve cardiovascular fitness, speed and muscular strength of soccer players.
- Water based performing exercise is much better to improve cardiovascular fitness than land based performing exercise program.
- Due to the dual effect of buoyancy and water resistance, water-base exercises improve muscular strength of soccer players over land-based performing exercise.
- Land based and water based performing exercise program improve the speed of participants. However, water based exercise is more effective
than land based exercise program in doing so.

**Recommendations**

The findings of this research provide that a twelve weeks’ land and water based fitness programs significantly altered a selected physical fitness variable of the participants. Based on these results, discussions and findings of the research, the following recommendations are made.

- Considering the benefits of water-based exercise, coaches of soccer players should include such kind of exercise in their training programs.
- Efforts should be taken to popularize the benefits of water based fitness program for soccer kind of fitness quality, which in turn make the nation to produce fit soccer players.
- Ethiopian sport science professionals should play a great role in changing the attitude of the young soccer players toward improvement of fitness. In addition, they should do further investigation on water based fitness program in relation to incidence of injury and therapeutic benefits of the program.
- Related to water-based fitness program the future research shall focus on match related soccer performance, training phase, and the possible benefits of water based fitness programs in any other sports like athletics, volleyball, basketball, etc and their possible side effects.

**REFERENCES**


