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PHYSIOLOGICAL AND ENDURANCE PERFORMANCE OF SOCCER PLAYERS IN RELATION WITH DIFFERENT EXERCISE INTENSITIES

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ABSTRACT

This study was aimed to investigate the effects of exercise intensities on physiological and endurance performance efficiency male soccer players. The subjects of this study were twenty male soccer players (ten players in each group) and they were purposively selected and randomly assigned in each group. The analysis were carried out by the descriptive statistical analysis coded and analysed using SPSS version 20 software. Anthropometric (height, weight and body mass index), physiological (resting heart rate and blood pressure), and endurance performance (12 min run and Bruce incremental test) variables were tested by digital scale in meter, digital balanced beam scale in kilogram, and body mass index was calculated, Sphygmomanometer and stop watch before, during and after intervention of exercise intensities within 12 weeks of the study period. Therefore, both in high and moderate intensity training statistically significant mean difference were observed in RHR, SBP, DBP, and Cooper test at ($p<0.05$).This study showed that exercise intensities increased physiological and endurance performance efficiency of the soccer players in high and moderate intensity endurance training, but a better mean difference were observed in moderate intensity training group.

Keywords: *Endurance, exercise, intensity, soccer player.*

1. INTRODUCTION

Soccer requires a number of physiological qualities to perform at the highest intensity and skill execution with an exceptionally high standard of technical ability, as well as a tactical understanding of the game. Physical qualities include aerobic, anaerobic endurance, agility, and sprinting ability, jumping and kicking

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power. Like elite sprinters or distance runners, soccer players generally have extraordinary capacities in one single physical quality (Hoff & Helgerud, 2004).

Good performance in soccer consists of many factors, including excellence in games skills, cognitive abilities to make correct decisions within the game, moderate to high aerobic and anaerobic power (Reilly, Bangsbo, Franks, 2000). Aerobic exercise (also known as cardiovascular exercise) is physical exercise of relatively low intensity that depends primarily on the aerobic energy-generating process (Sharon & Denise, 2007). Aerobic literally means "living in air" (Kenneth, 1997), and refers to the use of oxygen to adequately meet energy demands during exercise via aerobic metabolism (William, Frank, & Victor, 2006).

Generally, light to moderate intensity activities that are sufficiently supported by aerobic metabolism can be performed for extended periods of time (Sharon & Denise, 2007). High-intensity interval training has also been shown to improve athletic performance. For already well-trained athletes, improvements in performance become difficult to attain; increases in training volume may yield no improvements. Previous research would suggest that, for athletes who are already well-trained, improvements in endurance performance can be achieved through high-intensity interval training. A 2009 study by Driller, James, John, Cecilia, and Andrew showed an 8.2 second improvement in 2000m rowing time following 4 weeks of HIIT in well-trained rowers.

The accumulated oxygen deficit is an accurate measure of the anaerobic energy release during treadmill running (Medbø, Mohn, Tabata, Bahr, Vaage, & Sejersted, 1988) and bicycling (Medbø & Tabata, 1989). This principle may allow examination of the anaerobic capacity (Hermansen, Medbo, Mohn, Tabata, & Bahr, 1984), taken as the maximal accumulated oxygendeficit during 2-3 min of exhaustive exercise (Medbø, *et al.,* 1988; Medbø & Tabata, 1989).

During high-intensity exercise lasting more than a few seconds, adenosine triphosphate (ATP) is resynthesized by both aerobic and anaerobic processes (Medbø & Tabata, 1989). The ability to resynthesize ATP may limit performance in many sports. Thus, the training of athletes for sports involving high-intensity exercise should improve the athletes' ability to release energy both aerobically and anaerobically. The success of different training regimens can and should be evaluated by the athletes' performance. Therefore, the effect of specific training on the anaerobic capacity may be evaluated by measuring the athletes' performance before and after training.

Thus, the researcher hypothesized that; high intensity exercise could have a positive effects on physiological and performance efficiency on soccer players and moderate intensity exercise could have less positive effects on physiological and performance efficiency on soccer players. Therefore, based on aforementioned problems and methods for quantifying performance this study

was focused to see the physiological and endurance performance of soccer players; in relation with different exercise intensities.

2. METHODS AND MATERIALS

2.1 Subjects

The subjects of the study were healthy male varsity soccer players of Jimma University, Ethiopia, who took part in national higher governmental institutions sport festival. 20 purposively selected subjects were randomly and equally categorized in to high and moderate intensity exercise groups. Participants were free of risk factors associated with cardiovascular, pulmonary or metabolic disease, deemed safe to begin physical activity, and were not engaged in other regular training program.

2.2 Exercise and Warming-Up Protocol

The high intensity training group was performed high intensity (70% - 85% HR max) endurance training and the moderate intensity training group was also performed moderate intensity (50%-70% HR max) endurance training. The endurance training programs were long aerobic run, speed vo2 intervals, tempo run and strength efforts.

All participants performed a standardized warm up, followed by the exercise and testing protocol for Bruce Incremental Treadmill and Cooper 12 minute tests. The standardized warm up were include: dynamic movements in order to properly warm up the body before testing. Sub-maximal jumps, active and dynamic stretching, and dynamic motions emphasizing quadriceps and hamstrings as agonistic muscle groups are included in the sport specific warm up. All players experienced an identical warm-up protocol prior to testing procedures to limit the potentially confounding effect of using different warm-up procedures. All participants were asked to not participate in any physical activity 24 hours prior to testing.

2.3 Identification of Variables

The tested variables were illustrated in the below mentioned table.

No	Types of variables	Units	Instruments
1	Body Height	*M*	Digital scale
2	Body Weight	*Kg*	Digital balanced beam scale

3	BMI	Kg/m^2	Calculated
4	Resting Heart Rate	*b/min*	stop watch
5	Systolic blood pressure	*mmHg*	Sphygmomanometer
6	Diastolic blood pressure	*mmHg*	Sphygmomanometer
7	Bruce Inc. Treadmill	*Min*	Treadmill
8	Cooper 12 minute Run	*m in 12min*	stop watch

2.4 Data Quality Control

To ensure the data quality, only standardized tests were used. And also to ensure general safety, calibrated materials and to minimize the mistake replication measurements were used by the researcher.

2.5 Ethical Issues

The study was designed in such way that ethical issues were properly addressed. Privacy of the participants and confidentiality were strictly observed and maintained throughout the study.

2.6 Methods of Data Analysis

Descriptive statistics in mean ± SD were computed for body height, body weight, BMI, Resting Heart Rate, Blood Pressure, Bruce Incremental Treadmill and Cooper 12 minute. Multiple Variants tests were performed for Resting Heart Rate, Blood Pressure, Bruce Incremental Treadmill and Cooper 12 minute, to find out the significant difference of pre-test with post-tests. The percentile (%) was calculated to evaluate the changes of variables (% = mean difference multiplied by 100 and divided by pre-test (mean diff X 100 / pre-test)). The significance level was set at $P< 0.05$ for each statistical tests performed. The SPSS 20 software was used for the statistical analysis.

3. RESULTS

Table 1: Characteristics of the study subjects

Variables	HIG (mean ± SD)	MIG (mean ± SD)
Age (years)	22.1 ± 0.73	23 ±1.24
Height (m)	1.78 ±0.04	1.74 ± 0.06
Weight (Kg)	60.4 ± 6.39	62.9 ± 7.78
BMI (Kg/m^2)	18.71 ± 1.33	20.45 ± 1.32

The characteristics of the subjects are shown in Table 1. The mean age and height of participants was 22.1 and 1.78m in high intensity group (HIG) and 23 and 1.74m in moderate intensity group (MIG) respectively. The mean value of the participants weight in HIG was 60.40 kg and in MIG was 62.90 kg. Table 1 also showed that the mean BMI value in HIG was 18.7 kg/m2 and in MIG were 20.4 kg/m2 at the end of the study period.

Table 2: Mean effects of physiological and performance efficiency test of high intensity group of soccer players

Treatments	RHRb /min	Sbp mmHg	Dbp mmHg	Cooper M/12min	Bruce min
Pre-Test	60.90 ± 3.54	112.50 ±5.401	75.00 ± 5.27	2740 ±134.99	7.20 ±0.63
Post-Test	57.20 ± 3.29	105.00 ±4.08	66.00 ± 3.94	3320 ±257.33	9.40 ±0.84
Mean diff.	3.70*	7.50*	9.00*	580.00*	2.20*
Sig.	0.021	0.000	0.000	0.000	0.000

*Mean ± SD in the same columns in each parameter with different * superscripts are significantly different (p<0.05), RHR (beat/min) = resting heart rate in beat per minute, Sbp (mmHg) = systolic blood pressure in millimeter mercury, Dbp (mmHg) = diastolic blood pressure in millimeter mercury, Cooper test in distance within 12 minute and Bruce incremental treadmill test in stage.*

Table 3: Mean effects of physiological and performance efficiency test of moderate intensity group of soccer players

Treatments	RHR b/min	Sbp mmHg	Dbp mmHg	Cooper M/12min	Bruce min
Pre-Test	62.00 ±2.82	113.00 ±4.83	77.00 ±4.83	2620 ±187.38	6.80 ±1.39
Post-Test	59.20 ±3.15	109.50 ±1.58	71.50 ±3.37	2860 ±250.33	8.00 ±1.33
Mean diff.	2.80*	3.50*	5.50*	240.00*	1.20
Sig.	0.050	0.032	0.012	0.025	0.058

Effects of high and moderate intensity exercise on physiological variables

Table 2 & 3 shows that the mean value of physiological and performance efficiency in high and moderate intensity group before and after intervention. The mean value of RHR in HIG was 60.90 b/min and 57.20b/min before and after intervention respectively and also in MIG were62.00 b/min and 59.20 b/min before and after intervention respectively. The mean value of Blood Pressure in HIG was 112.50/75.00 mmHg and 105.00/66.00 mmHg before and after intervention respectively and also in MIG were 113.00/77.00 mmHg and 109.20/71.50 mmHg before and after intervention respectively.

Effects of high and moderate intensity exercise on performance variables

The mean values of performance efficiency in high and moderate intensity group before and after intervention also present in table 2, the mean value of cooper 12 minute run in HIG was 2740m and 3320m with in 12 minute before and after intervention respectively and also in MIG were 2620m and 2860m with in 12 minute before and after intervention respectively. The mean values of Bruce incremental treadmill test in HIG was 7.20 min and 9.40 min before and after intervention respectively and also in MIG were6.80 min and 8.00 min before and after intervention respectively.

4. DISCUSSION

The more demanding the training, the greater the fitness benefits. Therefore, the researcher was interested in learning whether the effects of training on physiological and endurance capacity are dependent on the magnitude of energy release developed by different exercise intensities. To this study, the researcher compared two different training protocols: a moderate-intensity endurance training that is not supposed to depend on anaerobic metabolism and a high-intensity intermittent training that is supposed to recruit the anaerobic energy releasing system almost maximally.

Effects of high and moderate intensity exercise on physiological variables

In both groups the resting heart rate was reduced significantly after completing the intervention period, this is because of through him proved efficiency of peripheral muscles and higher stroke volume. The mean difference of RHR in high intensity group was decreased by 3.70 b/min (6.07%). However, the mean difference of RHR in moderate intensity group was decreased by 2.80 b/min (4.51%).This showed that, high intensity group was revealed better decrement in RHR. Recent studies (Wisløff, et al., 2009; Cornelissen, et al., 2010) showed that high-intensity aerobic exercise is associated with greater cardiac benefits than

exercise at low to moderate intensity. Whereas a journal (Hafstad, et al., 2011) showed that the effect of training especially on resting heart rate is greater at higher intensity the results of the present study confirmed a similar reduction of the resting heart rate in both high and moderate intensity training. Similarly, in a recent study found that exercise training of high intensity would be superior to moderate intensity (Eunhee, et al., 2012; Chase, et al., 2009) because it promotes beneficial cardiovascular adaptation (Chase, et al., 2009).

Blood pressure (Sbp (systolic blood pressure) and Dbp (diastolic blood pressure)) mean difference was decreased by 7.5 mmHg (6.66%) Sbp and 9 mmHg (12%) Dbp in high intensity group and also at moderate intensity group mean difference was decreased by 3.5 mmHg (3.09%) Sbp and 5.5 mmHg (7.14%) Dbp. This showed that, high intensity group was revealed better decrement in blood pressure. Up to date research output demonstrated that the superiority of high-intensity interval training for improving cardio respiratory fitness has important clinical implications because there is a strong association between low cardio respiratory fitness and in cadence of hypertension (Myers, et al., 2002). Of all established risk factors, low cardio respiratory fitness seems to be the strongest predictor of mortality (Wisloff, et al., 2007). Increases in central O2 delivery (cardiac output) and peripheral O2 uptake (arterial and venous oxygen difference) contribute to training induced improvements in cardio respiratory fitness (Swain & Franklin, 2002).

Effects of high and moderate intensity exercise on performance variables

The mean difference value of Cooper test in high intensity and moderate intensity group was increased to 580m (21.16%) and 240m (9.16%) respectively. This result indicates that effective performance have been observed in high intensity group than moderate intensity group. Inconformity with this, Recent review of training studies have found that the higher the exercise intensity, the greater the increase in aerobic fitness (Wenger, 1986). If exercise of a more vigorous intensity elicits a greater increase in aerobic fitness than does moderate intensity exercise, perhaps more vigorous exercise has greater cardio protective benefits. Exercise of a vigorous intensity incurs greater energy expenditure (EE) than does exercise of a moderate intensity performed for the same duration. However, in Bruce incremental treadmill test no improvements have been observed.

5. CONCLUSIONS

Based on the results of 12 weeks intervention of different exercise intensities and the main findings in physiological and endurance performance; resting heart rate,

blood pressure (Systolic and Diastolic), and Cooper 12 minute run show a significant changes in both high intensity and moderate intensity exercise groups. Bruce incremental treadmill test has shown significant changes in high intensity group, but no improvement have been observed in moderate intensity exercise group. High intensity training has a great role for physiological (RHR, Sbp and Dbp) and endurance performance efficiencies of soccer players.

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