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Effects of Twelve-Week Aerobic Exercise on Selected Health-Related Physical Fitness Variables on Gonji Preparatory School Male Students

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ABSTRACT

This study aimed to examine the impact of a 12-week aerobic exercise program on health-related physical fitness variables among grade eleven male students at Gonji Preparatory School. The study design was experimental method. Initially, 242 students aged from 18 to 22 years were purposively selected, but only 108 students fulfilled inclusion criteria of the study. From these, 51 students declined to participate and 57 were willing to participate. For ease of management, only 30 students were selected from these willing groups based on simple random sampling technique,which were then grouped equally into control and experimental groups. Experimental group was exposed to aerobic exercises for 40 - 60 minute a day for 3 days a week during 12-week. Both study groups were exposed to 40 minute per week in school regular physical education class during 12-week. Study groups had taken pre-test and post-test measurements. Paired t-test and independent t-test were used for data analysis. The level of significant was set at $p<0.05$. Statistically significant difference have been detected between the pre-test and post-test values on experimental group in body composition ($t=-3.571$, $p<0.05$ and cardio-respiratory fitness ($t=-4.258$, $p<0.05$), but control group in body composition ($t=-1.786$, $p>0.05$ and cardio-respiratory fitness ($t=-0.091$, $p>0.05$) registered no statistically significant difference. The result obtained from experimental group indicated that there were significant differences observed in body composition and cardio-respiratory fitness, but not on control group. Based on the current finding, a 12-week moderate aerobic exercise program for 40 - 60 minute a day for 3 days a week has positive effect on the improvement of physical fitness, but not improvement 40 minute school regular physical education class, so that it needs additional time for physical education class for grade 11 male students in preparatory schools.

INTRODUCTION

Physical fitness is the biggest potentiality of the human beings. It cannot be bought; it can only be achieved through day to day physical activity (Bharath and Mukesh, 2011). Regular physical exercise and fitness are critically important for the health and welfare of people of all categories, whether they regularly participate in exercise (usually referred as sport) or some type of moderate health-enhancing physical activities. Even among frail adults and very old adults, mobility and functioning can be

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improved through physical activity (Butler *et al.*, 1998). Correctly performed progressive exercise increases the level of fitness and improves health. It also creates a sense of wellbeing, produce greater energy and reduce the risk of developing many diseases. Exercise makes improvements on the body systems over and above normal day to day activities and as a result, the systems adapt anatomically and physiologically (Rosser, 2001).

Aerobic exercise stimulates the cardiovascular and respiratory systems, as well as major muscle groups, resulting in improved physical and mental well-being. Consistent engagement in aerobic activities promotes notable physiological changes. Specifically, aerobic workouts increase blood flow to various tissues, encourage blood vessel angiogenesis (sprouting of new vessels), and optimize oxygen transport, leading to more efficient nutrient delivery to muscles and waste removal, allowing for sustained activity with less fatigue (Shahana *et al*., 2010).

Physical education in schools builds students' competence and confidence, enabling them to participate in a variety of physical activities that play a central role in their lives, both within and beyond the school environment. A well-designed physical education curriculum allows all students to enjoy and excel in diverse forms of physical activity. The time allocated to physical education in the majority of schools has declined with a consequent increase in time allocation for other academic subjects (Hillman *et al*., 2008). Unfortunately, many schools have reduced physical education opportunities in order to dedicate more class time to meet these academic standards (Lavall, 1984).

Similarly, the Federal Democratic Republic of Ethiopian, the Ministry of Education has been developed a physical education curriculum in secondary and preparatory schools with a one-day class schedule per week for 40 minutes long for both theoretical and practical sessions. The allocation of periods for secondary, junior and preparatory schools have been limited compared with other country class schedules to ensure and develop student's optimal physical fitness. In California,schools serving grades 7–12 are required to provide a minimum of 400 minutes of health physical education (i.e sport) instruction over every 10 day period (source:(http://www.cde.ca.gov/ci/cr/cf/documents/, Accessed on June 12, 2019)

The objective of teaching physical education curriculum designed by Federal Democratic Republic of Ethiopian Ministry of Education was intended to develop and maintain all aspects of personality such as physical, mental and social wellbeing of students. But, the question is it possible within 40 minutes per week class schedule? According to American College of Sports Medicine, (2009) participation in at least 30 minutes of moderate physical activity per day carried out 3 days a week will yield significant health benefits. On the other hand, Thomas *et al*. (2004) stated that an appropriate frequency for aerobic exercise is 3-5 time per week and total workout time should be able 20-60 minute depending on the intensity of the activity. World health organization (2006)suggests that one should take at least 10,000 walking step counts per day for health promotion. In Gonji preparatory school, male students particularly show high motivation to participate in physical education class, the time allocated for physical education period allocated is one period per week for 40 minute it might be limit them further progression and intensity of

exercise. This trend might be made students developing poor fitness levels against expected norms in each grade level. Based on the period allocated for grade eleven students physical education class and its effectiveness on physical fitness variables of students the researcher conducted this research to fulfilled gap investigate the effect of twelve-week aerobic exercise training on selected health-related physical fitness variables of body composition, cardio-respiratory fitness, skeletal strength, and muscular endurance. Finally, the researchers hypothesized an experimental group's of body composition and cardio-respiratory fitness would have significant differences following exercise interventions compare with control groups.

Thus, this study was undertaken with the objective of investigating the effects of aerobic exercise training on selected health-related physical fitness parameters in Gonji preparatory school grade eleven male students.

MATERIALS AND METHODS

Description of the study area

The study was conducted at Gonji preparatory school by involving grade eleven male students. Gonji Kolela Woreda is located in West Gojjam Zone, Amhara National Regional State. The administrative center of West Gojjam is Finoteselam; it is also the administrative center of Gonji kolela Woreda, which lies 72 km South-east of Baihr Dar the Amhara regional state capital.

Sampling method and Strategy

For this study, 242 grade eleven male students were selected purposively from the target population. Based on inclusion criteria only 108 students fulfilled the criteria, of which 51 students declined to participate and 57 were volunteer to participate in the study. However, to manage the study properly, only 30 students were selected by simple random sampling technique from 57 volunteers. Then the study subjects (n=30) were randomly assigned into equal experimental and control groups (n = 15) respectively. The age of these students assigned in the two groups (n = 30) ranges from 18 to 22 years. All students selected to participate in the study were with good health condition.

Study design and methodology

Exercise training protocol

The necessary data were collected pre-test and post-test interventions from experimental and control groups. The training period lasted for 12-week.Study participants were exercised for three nonconsecutive days per week i.e. Monday, Wednesday and Friday morning for 40 - 60 minute, at 50-74% Hr max moderate intensity. During each training session, six different exercises were performed in aerobic training; aerobic dance, walking, jogging, running, rope jumping and minor game of football. To control the intensity of the exercise, first the researcher calculated training heart rate of each student by using Karvonen's formula for aerobic using the maximum heart rate to calculate a training threshold and listed down on paper then counted their heart rate for 15 seconds between the training (Costill *et al.*, 2008).

Harvard Step Test

Step test was designed to measure cardiovascular fitness or endurance by using a 51 cm high bench or box watch for timing minute. The step test works on the rationale that individuals with a high level of cardio-respiratory fitness will have a lower heart rate during recovery from three minutes of standardized exercise than less conditioned individuals. The lower heart rate after the test will be an indicator of being fitter (Brouha *et al*., 1943).

Procedure:-The test subject repeatedly steps onto and off of a platform in a cycle of two seconds. The height of the platform is 51 centimeters for men. The participant must maintain a stepping rate of 30 steps per minute for five minutes or until reaching exhaustion. A metronome is used to ensure the correct pace. Exhaustion is defined as the inability to sustain the stepping rate for 15 seconds. Upon completing the test, the participant immediately sits down, and heartbeats are recorded at intervals of 1 to 1.5 minutes, 2 to 2.5 minutes, and 3 to 3.5 minutes.

Scoring:- the results were recorded as time until exhaustion in seconds (t_c) and total heartbeats counted (h_b). It is plotted into a simple fitness index equation: $t_c x 100/h_b$ x 2 (Brouha *et al*., 1943).

Body Mass Index

Body Mass Index (BMI) is a calculation used to estimate body fat based on a person's height and weight, applicable to both men and women. The purpose of BMI is to determine the ideal body weight in relation to body fat and lean tissue.

Procedure:-Measured the student's height in meters and weight in kilograms.

Scoring:-To determined BMI divided the weight by the height squared: BMI = weight / height^2 (Quetelet, 1835).

Data quality control

To ensure the validity and reliability of the study, standardized testing procedures and measurement instruments were employed. Standardized instruments designed for data collection were used to accurately measure study variables and to assess data collection validity. To ensure the uniformity, reliability, and consistency of measurements, each variable was measured three times on each participant, at the same time of day, and under similar environmental conditions. Measurements were consistently scheduled at the same time throughout the testing period and were taken by the same examiner, following instrument calibration before each session.

Ethical consecrations

The study procedures were approved by the Research Ethics Review Committee of Hawassa University, College of Natural and Computational Sciences (RERC/004/20), and written informed consent was obtained from the participants.

The benefits of this research were highlighted to participants. They were assured that their participation in this study is voluntary, and that it is greatly appreciated. Clear awareness was also given to all grade eleven male students that the choice not to be involved in this study was not affect their future career in any way.

Each participant was allocated a number and alphabetical code to ensure that confidentiality and anonymity is maintained. Information sheets, agreement and consent forms have been translated into the national language of Ethiopian in Amharic.

All data will be kept in the possession of the principal research team, and will be destroyed five years after the completion of this study.

Data analysis

The collected data were analyzed using statistical package software for social science (SPSS) version 20. Paired t-test and independent t-test were used for data analysis. The level of significant was set at $p<0.05$.

The characteristics of study participants mean and standard deviation (SD) of age (yr.), height (m), weight (Kg) and maximum heart rate were 19.13±0.74, 1.69± 0.06, 54.39 ± 4.82 and 200.86±0.74, and 19.07±0.88, 1.68± 0.04, and 55.78±3.65 and 200.93±0.88 for the experimental group (EG) and Control group (CG), respectively. These showed that the study participants' characteristics were homogeneous groups.

Experimental and control groups data analyzed within-groups by paired t-test and between-group effects analyzed by independent t-test design were applied during pretest and post-test of exercise interventions'. Experimental and control groups were participated in regular physical education programs aligned with the Ministry of Education school curriculum one period of 40-minute per week. In addition the experimental group engaged 12-week aerobic exercise training for 3 days per week for 40 up to 60 minutes per session.

RESULTS

The results of the study purpose at the effects of aerobic exercise on selected health-related physical fitness parameters in Gonji preparatory school male students are summarized in table 1.

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Table- 1: Paired t-test analysis result of the pre-test and post-test data of the experimental group and control group

Variables (n=30)	Group	Pre-test $\bar{x}$± SD	Post-test $\bar{x}$± SD	t	p
BMI (kg/m^2)	Experimental group	18.97±1.33	18.35±1.10	9.64	0.000*
	Control group	19.77±1.12	19.81±1.14	1.72	0.107
Harvard step test (30 steps/ minute)	Experimental group	104.53±12.55	118.27±12.55	-12.06	0.000*
	Control group	104.13±11.45	103.67±12.41	-0.344	0.736

BMI: Body mass Index, *Significant at $p<0.05$ level

Body mass index (BMI) and Harvard step test pre-test and post-test data of control group revealed that ($t=-1.72$, $p>0.05$) and ($t=-0.344$, $p>0.05$) no statistical significant. On the other hand, experimental group in body mass index pre-test and post-test data ($t = 9.64, p <0.05$) and Harvard step test ($t =-12.06, p < 0.05$) have been found statistical significant.

Table -2: Independent t-test analysis result of the pre-test and post-test data of the experimental group and control group

Variables (n=30)	Group	Pre-test $\bar{x}$± SD	Post-test $\bar{x}$± SD	t	p
BMI (kg/m^2)	Experimental group	18.97±1.33	18.35±1.10	-3.57	0.001
	Control group	18.78±1.12	19.81±1.14	-1.79	0.085
Harvard step test (30 steps/ minute)	Experimental group	104.53±12.55	118.27±12.55	-4.26	0.000
	Control group	104.13±11.45	103.67±12.41	0.091	0.928

*Significant at p<0.05 level

As summarized in table 2, body mass index pre-test and post-test data of the control group (t =-1.79, p > 0.05) and Harvard step test (t =0.091,p > 0.05) have been found no statistical significant. Whereas, in the experimental group the pre-test and post-test body mass index data (t = -3.57, p<0.05) and Harvard step test (t = -4.26, p < 0.05) have been found statistical significant.

DISCUSSION

In this study, a statistical significance reduction in BMI and Harvard step test values has been determined for male students participated in 12 weeks aerobic workout.

When pre-test and post-test values with-in groups experimental group were examined, the difference in the body mass index average before exercise (18.97±1.33) and after exercise (18.35±1.10) was statistically significant (p < 0.05). On the other hand, pre-test and post-test values with-in control group were examined, body mass index average before exercise (19.77±1.12) and after exercise (19.81±1.14) was not statistically significance (p > 0.05). These findings are comparable with the findings of Arslan (2011) who investigated the effect of two exercise protocols (step-up and aerobic dance exercise) on body composition parameters after eight-week exercise. The study participants took part in a step-up and aerobic dance exercise programs for one hour per day, 3 days a week for 8 weeks. After the eight weeks of the step-up and aerobic dance exercise program, it was found that the decrease in the waist body mass index in exercise groups was significant. Similarly, Patricia (2008) tried to examine the effects of a 12-week exercise based training program on aerobic fitness and body composition. Their study found that exercise training significantly improved body mass index of the exercise group, but on the contrary, the body weight of the control group increased significantly at the end of the 12-week exercise intervention program period. Based on the findings of the current study, in parallel with the literature, aerobic exercises program can result a positive effect in body fat percentage.

Following 12-week aerobic exercise training the difference in the Harvard step test average before exercise (104.53 ± 12.55) and after exercise (118.27±12.55) in experimental group was statistically significant(p < 0.05). On the contrary, the difference in the Harvard step test average before exercise (104.13±11.45) and after exercise (103.67±12.41) in the control group was not statistically significant (p > 0.05). In lie with this, Williams and Morton

(1986)also conducted a 12-week aerobic dance exercise protocol. Accordingly, significant improvements were observed in VO_2 max, increased lean body mass and decreased body fat percentage following the 12 weeks exercise intervention. However, the difference of these parameters in the control group were not statistical significant. Mahendran (2009) also conducted similar study on the effects of 12-week aerobic exercises on selected health-related variables of body composition, cardiovascular endurance and muscular endurance. The exercise program protocols were walking, jogging, running and rope skipping at the end of exercise interventions a 12-minutes run test was given for the study participants**.** Mahendran I his finding showed that statistical significant in body composition, cardiovascular endurance and muscular on the study participants of experimental group $p < 0.05$. were observed, but not on control group. It can be can conclude that walking, jogging, running and aerobic dance increase the performance of step test exercise according to the study findings which is parallel to the literature.

CONCLUSION

Based on the major finding of this study, it was conclude that 12-week aerobic exercise training program has significantly improved on student's cardio-respiratory fitness and body composition on the study participants of experimental group. On the contrary, Student's participated in regular physical education class for 40-minute per week assigned as control group has no significant improvement on selected health related physical fitness components of cardio-respiratory fitness and body composition. So that, based on the findings indicated 40-minute physical education period may be limiting the students' performance to improve health-related physical fitness components. Therefore, it is better to revisit the period allocation of regular physical education practical class, i.e. the allocated, 40 minute per week for grade eleven curriculum needs modification to protect the student's health through movement and enhance physically fit, mentally alert, emotional stable and socially interactive citizens.

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