



Effects of twelve-week aerobic exercise on selected health-related physical fitness variables on Gonji preparatory school male students

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Body composition;
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ABSTRACT

The purpose of this study was to find out effects of 12-week aerobic exercises on health-related physical fitness variables on Gonji preparatory school grade eleven male students. 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 wellbeing of people of all, whether they participate in exercise or some type of moderate health-enhancing physical activity. 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 heart, lungs and all working groups of muscles and produces valuable changes in body and mind. Many physiological changes can be determined by daily aerobic exercises. During aerobic workouts, oxygen is flowing through the body and to the muscles which result in the production of more blood vessels to carry that oxygen to enable the physiological works for elongated time without undue fatigue. It also increases the size of blood vessels. These changes to blood vessels help more nutrients and oxygen get to the muscles and then take waste away (Shahana et al., 2010).

Schools Physical Education develops students' competence and confidence to take part in a range of physical activities that become a central part of their lives, both in and out of school. A high-quality Physical Education curriculum enables all students to enjoy and succeed in many kinds 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, Federal

Democratic Republic of Ethiopian 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 and preparatory schools have been limited compared with other country class schedules to ensure and develop student's optimal physical fitness. In California, all schools offering grades 7–12 are mandated to provide at least 400 minutes of physical education instruction every 10 days (<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 and muscular endurance. Finally, the researchers hypothesized an experimental group's of body composition and cardio-respiratory fitness would have significant differences post exercise interventions compare with control groups.

Thus, this study was conducted 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 rate of 30 steps per minute must be sustained for five minutes or until exhaustion. To ensure the right speed, a metronome is used. Exhaustion is the point at which the subject cannot maintain the stepping rate for 15 seconds. The subject immediately sits down on completion of the test, and the heartbeats are counted for 1 to 1.5, 2 to 2.5, 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: $t_c \times 100 / h_b \times 2$ (Brouha et al., 1943).

Body Mass Index

Body Mass Index (BMI) is a measure of body fat based on height and weight that applies to women and men. 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 determine BMI divided the weight by the height squared: $BMI = \text{weight} / \text{height}^2$ (Quetelet, 1835).

Data quality control

To standardize the testing procedure and ensure the validity and reliability of the tests and measurements were administered. To measure study variables accurately to assess validity data collection standard instruments were used to measure designed for data collection. The instruments used to measure dependent variables of this study were standard quality. To ensure the uniformity and reliability of the data and consistency of measurements, the measurements were taken three times from each variable of the study participants at the same time of the day and in similar environmental conditions. The measurements were arranged the same day and time throughout the testing schedule to make sure it was properly calibrated before each testing session. The test measurements were taken with the same examiner.

Ethical consecrations

The study procedures used in this study were approved by Hawassa University, College of Natural and Computational Sciences Research Ethics Review Committee (RERC/004/20) and participant's written informed consent.

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.

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 $\bar{x} \pm SD$	Post-test $\bar{x} \pm SD$	t	p
BMI (kg/m²)	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 x± SD	Post-test x± SD	t	p
BMI (kg/m²)	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) examined the effects of a 12-week exercise training program on aerobic fitness and body composition. Their study found that exercise training significantly improved body mass index of exercise group, but on the contrary, the control group body weight increased significantly at the end of the 12-week exercise intervention program period. Based on the current study findings, 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 statistically 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-minute 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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