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Wondifraw Mergiyaw

Haramaya University, Ethiopia

Sangeeta Rani

PhD, Maa Omwati College of

Education, Palwal, Haryana,

India

Molla Deyou

Haramaya University, Ethiopia

## Effect of moderate intensity aerobic exercises combined with yoga on cardiorespiratory capacity and self-concepts of Haramaya University sedentary female undergraduate students

Wondifraw Mergiyaw, Sangeeta Rani and Molla Deyou

### Abstract

Regular physical exercise is an important factor to improve health and well-being. The practice of combined physical exercise has little evidenced as the best intervention of modulating physiological and psychological variables. The main interest of the present study was to evaluate the effect of moderate intensity aerobic exercises combined with yoga on cardiorespiratory capacity and self-concept. The study design was experimental and simple survey without control group or placebo. For this study 35 young (age: 19-22 years) healthy sedentary female undergraduate subjects were selected using purposive sampling method. Out of the 35 subjects, only twenty eight subjects were able to complete the study. The training program was given to the Subjects with specified level of intensity for 8 weeks. The training exercises were such as walking, swimming, bhastrika, kapalbhati and bhamari. The cardiorespiratory capacity and self-concept assessment tests were taken before and after the training.  $VO_2\max$  was assessed by Rockport fitness walking test at Haramaya University 400meter stadium track. The Body Mass Index (BMI) was calculated using the weight and height of the subjects ( $BMI = W/H^2$ , where W is weight in kilograms and  $H^2$  is height in meters squared). Heart rate was taken using 15 second count at the Carotid artery. The Self-concept was assessed by Revised Janis-Field self-concept inventory scale. The data was analyzed by SPSS- version 20 software package. The comparison of means was carried out by paired T-test. The level of significance was 0.05%.

The result of the present study showed significant ( $P \leq 0.05$ ) improvement in  $VO_2\max$  (MD -3.64), BMI (MD 1.22), RHR (MD 4.86), social-confidence (MD -16.72), physical ability (MD -4.18) and global self-esteem (MD -2.97). The academic ability (MD -0.25) and physical appearance (MD -0.65) were not shown significant change. The present study concluded that the combined practice of moderate aerobic exercise with yoga provide the beneficial effect on improvement of cardiorespiratory capacity and general self-concept.

**Keywords:** aerobic exercise, cardiorespiratory capacity, self-concepts, yoga

### Introduction

On the 4<sup>th</sup> century BC Plato suggests that in order for man to succeed in life, God provided him with two means, education and physical activity. Not separately, one for the soul and the other for the body but for healthy life these two together. With these two means, men can attain perfection (Strohle, 2009). Physical activity is among the basic human needs and is the key precondition for the maintenance and enhancement of health throughout all periods of life (Wojtyla *et al.*, 2011) [6].

Now a day's evidences believed that the prevalence of obesity in developing country is on the rise (Dhudmal, 2005) [2]. The importance of physical activity as a means of NCD prevention and control is recognized in developing countries. However, the evidence base on implementing physical activity interventions in the developing country context is sparse (WHO, 2005) [5].

The effect of aerobic exercises and yoga has been studied independently regarding their effects on physiological and psychological health and fitness perspectives. However, the combination effects have not been well researched. In addition to that, there are no considerable evidences supporting the role of self-concept (self-perception or self-identity) and exercise dependence in

Correspondence

Wondifraw Mergiyaw

Haramaya University, Ethiopia

a multidimensional perspective (Patrizia *et al.*, 2013) [4].

The present study concerned on examination of the combined physical and breathing exercises and its potential effect on the cardio-respiratory fitness and psychological aspects of multidimensional self-concepts among Haramaya University sedentary female undergraduate students. The exercise training that involves yoga and moderate intensity aerobic exercises were maintained over 8 weeks.

The study was focused on the following questions:

- Is there any effect of combined use of moderate aerobic exercises and yoga trainings on cardio-respiratory capacity?
- What is effect of moderate aerobic exercises combined with yoga on self-concept of sedentary female participants?
- What is the effect of aerobic and yoga trainings on heart rate and BMI of sedentary female students?

### Objectives of the study

General objective: The general objective of this study was to examine the effects of moderate intensity aerobic exercise combined with yoga on cardio-respiratory capacity and self-concept of female students after eight weeks of training program.

Specific objective

- To examine the effect of moderate intensity aerobic exercises combined with yoga on cardiovascular capacity of sedentary female students
- To investigate the effect of moderate intensity aerobic exercises combined with yoga on self-concept and  $VO_2$  max of female students

### Materials and Methods

#### Description of the Study Area

The study took place in Haramaya University Ethiopia

#### Sources of Data

The primary data was obtained from the subjects using questionnaires, fitness tests, field works and experimental variables according to the designed procedures. The secondary data was collected from journals, books and different updated reports.

#### Research Design

The study was an experimental and simple survey without control group. One group pre-test/ post-test design was used. The combined moderate aerobic intensity exercise and yoga was experimented for two months (8 weeks) to examine the cardio-respiratory fitness and self-concept of the subjects. The selection of the subjects was carried out after they filled the PARQ form (CSEP, 2012) and given pre-test to check the initial level of fitness. Then the participants were allowed to practice different types of aerobic exercises combined with yoga from low to moderate intensity mode for eight weeks. After eight weeks the post test was taken to observe the changes. The training was done 4 days per week for 40 – 60 minutes duration.

#### Sampling and Sampling Technique

The purposive sampling techniques was used to select the subjects from Haramaya University female undergraduate students. Thirty five sedentary female undergraduate students with age range 19 – 22 years old were selected for the study purpose.

### Inclusive and Exclusive Criteria

The health status of the subjects were assessed by physical activity readiness questionnaire. The subjects who were free from any impairment or disability and chronic disease were included for the study. Subjects who could not fulfill these criteria were excluded from the study.

### Instrumentation

The following materials were used through the process of the study. These instruments were such as Weight machine, Haramaya University fitness centers (Gymnasium and Swimming pool), and mattresses for yoga and 400m stadium track for the assessment of  $VO_2$ max.

### Methods and Procedures of Data Collection

**Body weight measurement:** This measurement was taken by calibrated digital balanced beam scale in kilogram to measure the total body mass of the individuals. Body Height Measurement was taken by calibrated height-weight measurement digital balanced beam scale in meter to measure the total body height of the individuals and Body mass index (BMI) was taken purposely to calculate the percentage of total body height and weight ratio. Body mass index (BMI) is an estimate of fatness calculated as body weight (kg) divided by the square of body height ( $m^2$ ).  $BMI = \text{Weight (kg)} \div \text{Height (m)}^2$  (Yar, 2010).

### Assessment of Cardiorespiratory Capacity

#### Rockport fitness walking test

The objective of this test was to monitor the status of students  $VO_2$ max (Mackenzie, 2005; Moradi and Jafari, 2012). The required equipment to undertake the Rockport fitness walking test were Haramaya University old Stadium 400m Track and Stop watch. The subjects were allowed to walk one mile (1609 meters) as fast as possible. Each lap around the track measure 400 meters in length. The analysis of  $VO_2$ max result was done by comparing it with the results of previous tests. It is expected that, with appropriate training between each test before and after the training, the analysis was indicated an improvement. The formula used to calculate  $VO_2$ max was:  $132.853 - (0.0769 \times \text{Weight}) - (0.3877 \times \text{Age}) + (6.315 \times \text{Gender}) - (3.2649 \times \text{Time}) - (0.1565 \times \text{Heart rate})$ . Where: Weight in pounds (lbs), Gender Male = 1 and Female = 0. Time was expressed in minutes and  $100^{\text{th}}$  of minutes, Heart rate was considered in beats per minute and age in years (Mackenzie, 2005).

### Assessment of Self-concept

#### Self-concept inventory Scale

The level of Multidimensional Self Concept was assessed by Revised Janis-Field Scale. The scale consists of 36 items with rating scale ranges from 1–7 for all items. The scale covers various dimensions of self-concept such as self-regard (global self-esteem), social confidence, school abilities, physical appearance and physical ability aspects of the subjects (Janis, 1984).

**Exercise Training Protocol: The training program was carried out for 8 weeks.**

#### Aerobic exercises training

The walking exercise was started with the Beginner program.

#### Swimming

The swimming activity involved all types of free style with

moderate intensity level. Other recreational activities such as water gymnastics, water polo and dancing, walking and running in the pool have been executed by the subjects at moderate level of intensity. The intensity level of swimming activities was monitored by determining training heart rate (THR).

$$\text{THR (bpm)} = (\text{HRmax (bpm)} - \text{RHR (bpm)}) \times \text{TI\%} + \text{RHR (bpm)}$$

The pulse was located just by simply sliding fingers (index and middle figure) downward at the angle of the jaw below the earlobe to the side of the neck. Participants were allowed to apply only enough pressure up on the neck to feel the pulse, particularly at the carotid artery. After the participants located the specified place of the artery, they were informed to count the pulse rate immediately after exercise. The beats were counted for 15 seconds and multiplied by 4. The actual result was changed into beats per minute (bpm). The duration of swimming exercise was ranged from 40 – 60 minutes with the frequency of 2 days per week.

### Yoga - Pranayama trainings

Bhastrika pranayama was practiced according to the procedure used in Grady for (Grady, 1994). Kapalbhata pranayama and Bhramari pranayam also have done according to the procedure given by (Kekan *et al.*, 2013) [3].

Method of Data Analysis After the collection of data on VO<sub>2</sub> max and self-concept parameters the data was analyzed by SPSS-20 software package. The mean value between pre- and post-exercise fitness and inventory scale tests were compared by using paired T- test. The level of significant was set at 0.05%.

## Results and Discussion

### Cardio respiratory Variable Test Results and Discussion

The present study have been assessed the main determinants of cardiorespiratory variables before and after the exercise training intervention. Resting heart rate, body mass index and maximum oxygen of the subjects were measured by using appropriate tools. The study discussed according to the factual data obtained.

**Table 1:** The Mean values of Resting Heart rate (RHR), Body mass index (BMI) and Maximum oxygen consumption (VO<sub>2</sub>max).

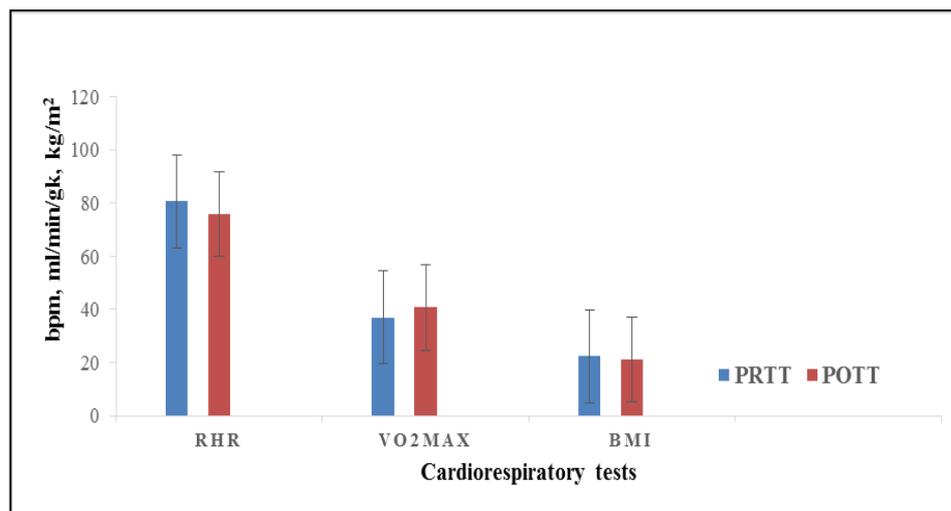
Variables	PRTT	POTT
RHR (bpm)	80.71 ± 3.13	75.85 ± 2.59
BMI (kg m <sup>2</sup> - <sup>1</sup> )	22.40 ± 1.65	21.18 ± 1.54
VO <sub>2</sub> max (mL kg <sup>-1</sup> min <sup>-1</sup> )	37.08 ± 3.02	40.72 ± 2.52

Values (Mean ± SD), PRTT: Pre training Test, POTT: Post Training Test, RHR: resting heart rate, BMI: body mass index, VO<sub>2</sub>max: maximum oxygen consumption, bpm: beats per minute, kg m<sup>2</sup> -<sup>1</sup>: kilogram per meter square, mLkg<sup>-1</sup>min<sup>-1</sup>: milliliter per kilogram per minute.

As indicated in table 1, the mean value of RHR of the subjects before training was 80.71 bpm and after they engaged in moderate aerobic exercise combined with pranayama, the mean value of RHR of the subjects was decreased to 75.85bpm. At the end of the study period, totally the mean value of RHR of the subjects was improved by mean difference of 4.86.

Alike RHR Initially the mean value of BMI was 22.40. After the training exercise the mean value of BMI was changed into 21.18. The mean difference (1.22) between pre and post-exercise result showed significant improvement of BMI. On the other hand, the VO<sub>2</sub>max was increased from 37.08 to 40.72. In VO<sub>2</sub>max Statistically significant change ( $P < 0.05$ ) was observed with the mean values difference of 3.64. This was due to the training program yoga in which the participants were engaged in.

The percent body fat and BMI are significant predictors of VO<sub>2</sub>max (Culbertson *et al.*, 2008; Setty *et al.*, 2013). Regarding environmental conditions such as relative humidity, air temperature and atmospheric pressure, correlation exist in between BMI and VO<sub>2</sub>max using the regression equations:  $Y_b = -0.4858a + 51.689$  ( $R^2 = 0.039$ ). Where,  $Y_b$  = body mass index (kg/m<sup>2</sup>), and  $a$  = aerobic power (ml/min/kg) (Afolabi and Akanbi, 2013) [1]. The finding of this study indicate the close relationship between body mass index and VO<sub>2</sub>max. When BMI increases, VO<sub>2</sub>max decreases that shows the lower level of aerobic capacity and predisposition to CVDs pandemic.



PRTT: pre training test, POTT: post training test, RHR: resting heart rate, VO<sub>2</sub> MAX: maximum oxygen consumption, BMI: body mass index.

**Fig 1:** Graphical representation of mean value difference of cardiorespiratory variables, BMI and RHR.

## Self-concept Variable Test Results and Discussion

**Table 2:** Mean value of academic self, global esteem, physical self and social self in pre-training test and post training tests.

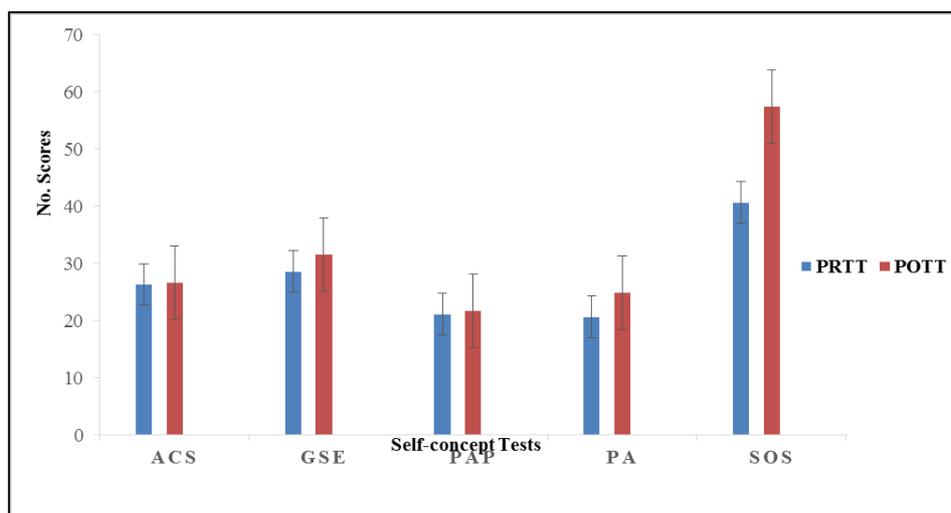
Variables	PRTT	POTT
Academic Self	26.32 ± 4.16	26.57 ± 4.20
Global Self-esteem	28.60 ± 4.29	31.57 ± 3.79
Physical Appearance	21.10 ± 3.58	21.75 ± 3.41
Physical Ability	20.64 ± 3.49	24.82 ± 2.69
Social Self	40.67 ± 6.09	57.39 ± 6.51

Values: Mean ± SD, PRTT: Pre training Test, POTT: Post Training Test

As shown in table 2, the self-regard (global self-esteem) of the subjects at the beginning was 28.60 (58%). At the end of the training the result was increased in to 31.57 (64%). The mean value difference of 2.97 (6%) showed the existence of significant improvement in global self-esteem. Simultaneously the highest significant difference 16.72 (20%)

between pre- and post-exercise inventory results were observed in social-confidence of the subjects. The mean value of pre-exercise social confidence was 40.67 (48%). However, after the exercise training the mean value of inventory test was increased in to 57.39 (68%). This highest significant difference was assumed that the participation of combined aerobic training with yoga had a remarkable effect on social-confidence of the subjects.

Similarly the improvement was shown in physical ability. The pre-test of physical ability self-concept was 20.64 (60%). At the end of the training the result was changed in to 24.82(71%). The mean difference between pre-exercise and post-exercise inventory test was 4.18 (11%). However, the slight that would said to be statistically insignificant change was observed in between pre and post-inventory tests of academic ability and physical appearance. The mean value differences of these two variables were 0.25 (0.5%) and 0.65 (1.8%) respectively.



Where, PRTT: pre training test, POTT: post training test, ACS: Academic self, GSE: Global self-esteem, PAP: Physical Appearance, PA: Physical ability and SOS: Social-self.

**Fig 2:** Graphical representation of the mean value difference in academic-self, global esteem, physical self and social self in pre-training test and post training tests

## Summary, Conclusions and Recommendation Summary

Indeed, the benefit of physical exercise gained central attention in either improving health or enhancement of performance efficiency among human beings. Particularly, research evidences have provide many opinions on remarkable result of women in physiological and psychological perspectives towards physical exercises. Though evidences in the combined usage of different exercises together are short in the area of sport science research.

The purpose of this study was to find out the effects of moderate intensity aerobic exercises combined with yoga on cardio-respiratory capacity and self-concepts of Haramaya University sedentary female undergraduate students with the age range 19-22 years. The design used for this study was experimental and simple survey without taking control group. Twenty eight subjects were accomplished the study. The combined program of moderate aerobic exercise with yoga was carried out by the subjects. Tests were taken from the subjects by using field and survey approach at pre and post exercise programs. After collecting data from the given tests, the paired sample T-test was used to find out the probable change. The level of significant was set at  $P \leq 0.05$ .

After the data was analyzed the result showed significant

improvement in cardiorespiratory capacity, social-confidence, global self-esteem and physical ability. While the academic ability and physical appearances were brought slight improvement as a result of exercise trainings.

## Conclusions

Based on the major findings of the study, the following points are stated as conclusions.

- The 8 week practice of aerobic exercise with yoga was found to be effective tool of improving physiological and psychological variables of Haramaya University sedentary female undergraduate students.
- The cardio-respiratory capacity and certain portion of self-concept of subjects were significantly changed after the practice of moderate aerobic exercises combined with yoga.
- The  $VO_2$ max, RHR and BMI of the subjects were shown positive correlation to combined practice of moderate aerobic exercise with yoga.
- The self-concept variables such as social confidence, physical ability and global self-esteem shown significant improvement. While the academic ability and physical appearance changed in small value.

### Recommendations

The finding of this research proved that combined aerobic and yoga training program has significant effect on improving physiological and psychological health variables. Based on the results and findings as well as discussions of the research, the following recommendations are made.

- In Ethiopia the idea of physical activity and health as well as improvement of physiological and psychological capacity is not well recognized. The public educational institutes are expected to announce the benefit of physical activity for improvement of health status, better academic achievements and performance enhancement.
- The sport professionals working in the higher educational institutes should make recreational programs, sport competitions and designed experiments able to participate massive students in physical activity. These programs are evidenced tool in order to keep students from negative behavioral patterns. The professionals are supposed to conduct community based researches related to physical activity, health and pandemic.
- The sport professionals need to conduct further investigations to include the Yoga education as a subject in Sport Science curriculum.

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