

EFFECT OF AEROBIC TRAINING ON VO₂ MAX AND OTHER PHYSIOLOGICAL PARAMETERS IN WORKING WOMEN

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ABSTRACT:

Background: Low level of aerobic fitness is an inevitable consequence of physical inactivity and sedentary lifestyle that some experts state to be the most important public health problem of the 21st century. Working women have more stress than nonworking women. Increasing amount of work stress at home and also at work place. The concept of aerobic exercise for reducing anxiety & improving cardio respiratory parameters has created a great interest in medical research field. The present study was conducted to assess the effect of 16 weeks of aerobic exercise on different physiological parameters like pulse rate, respiratory rate, systolic blood pressure, diastolic blood pressure, breath holding time and VO₂ max (Maximal Oxygen Consumption).

Methods: Thrity healthy young adult female subjects between age 30 to 45 years were selected for study. Subjects practiced aerobic exercise at least 5 days a week. VO₂ max was calculated by Queens college step test, pulse rate by palpatory method, respiratory rate and breath holding time visually, systolic and diastolic blood pressure by mercury sphygmomanometer. All parameters were calculated before and after 16 weeks of aerobic training program.

Results: Study demonstrated that 16 weeks of aerobic training produced favorable changes in all cardiovascular parameters.

Keywords: Working women, Aerobic exercise, VO₂ max, Queens College step test

INTRODUCTION

Physical training has become increasingly popular as a method of health enhancement. Epidemiological and laboratory studies have shown that increased levels of physical activity are associated with longevity and reduced risk for cardiovascular risk [1,2]. Physical inactivity and poor physical fitness are associated with several health problems, such as cardiovascular diseases, metabolic disorders (e.g. overweight, obesity, diabetes), musculoskeletal disorders, pulmonary diseases, cancer, psychological problems etc. and so on.[3]

We live today in a world that functions in extreme stress conditions. Stress is considered to be a crucial trigger for physical and mental illness. Since 1968 women lifestyle has changed in many ways. Many more women now work outside the homes. A female has to go through different psycho-physiological changes resulting in hormonal issues. In addition to this she is also expected to give birth to children, nurture them, educate them and make them good citizens while doing her office work and taking care of in laws especially in India.[4]

All this type of stress causes an imbalance of parasympathetic and sympathetic nervous system due to disturbances of homeostatic mechanisms in the body.[2]

Here comes the role of aerobic dance training which not only improves the physical but mental stress as well as establishing equilibrium between sympathetic and parasympathetic components.

Most of the previous research on exercise was carried out on young middle aged male subjects. Hence the present study is attempted to see the effect

of aerobic exercise training on some physiological parameters in working women.

MATERIAL AND METHODS

Study was carried out in an Aerobic dance class in Nanded city of Maharashtra. Ethical committee of the institution was informed about the nature of the study. The approval of the study protocol was obtained from the committee.

Selection of the subjects: Thirty women between the age group of 30 to 45 years working in different offices in city were recruited as subjects for the study. We selected the volunteers by taking detailed history regarding any present complaint, past medical history etc.

Volunteers with history of any major illness like diabetics, hypertension, thyroid disorders, addictions or any medication for long duration in present and past were excluded. Only healthy female volunteers were selected for the study. Subjects practiced aerobics daily from 7 a.m. to 8.15 a.m. under supervision of aerobics instructor. Aerobic exercise included exercises done by subjects involving 5 to 10 minutes of warm up followed by 30 minutes of rhythmical fast aerobic steps and ending with 5 to 10 minutes of cooling down slow aerobic steps.

Subjects were called to Physiology department in morning between 9 to 10 a.m. Parameters namely Pulse rate (PR), respiratory rate (RR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Breath holding time (BHT) , VO₂ max were recorded before and after 16 weeks of aerobic training. Pulse rate was examined by palpatory method and respiratory rate was recorded

per minute visually. Blood pressure was recorded by routine mercury sphygmomanometer from right hand in sitting position. BHT was measured by taking deep breath and holding it as long as possible. (5)

VO2 max was calculated by using Queens’s college step test. Queens College step test was used to predict maximal oxygen capacity. It is a standard method to measure ones maximal oxygen uptake using sub maximal exercise in the form of bench stepping. A wooden stepping bench of 16 ¼ inch was used along with metronome and stop watch. Metronome was set at 24 complete steps per minute. Prior to test subjects were trained by giving demonstration. Subjects were asked to perform up-up down-down continuously for 3 minutes. After completion of the test subjects remain standing while pulse rate (radial) was measured for 15 seconds from 5th to 20th of the recovery period.

Following equation was used:

$$VO2 \text{ max (ml/kg/min)} = 111.33 - (0.42 \times \text{step pulse rate in beats /min}) \text{ (6)}$$

STATISTICAL ANALYSIS

Statistical analysis was done by using SPSS version 10 software. Mean and standard deviations were tested statistically by paired t-test. Statistical significance was taken at p<0.05 level and highly significant at p<0.001.

RESULTS

The results are summarized in table 1, 2 and 3.. The mean age of the subjects was 39.60 ± 5.34 Table also depicts mean and standard deviation values of different parameters i.e. Pulse rate (PR), Respiratory rate (RR), Systolic Blood Pressure(SBP), Diastolic Blood Pressure (DBP) before and after 16 weeks of aerobic training .

Table 1: showing baseline characteristics of study group.

Parameter	Before aerobics	After aerobics
Age (years)	39.60 ±5.34	39.60 ± 5.34
Weight (kg)	67.34 ± 4.23	64.30 ± 2.33
Height (cm)	168.7 ± 3.4	168.7 ± 3.4

(n=30)

Table 2: Showing physiological parameters in pre- and post-aerobic session.

Parameters	Before aerobic	After 16 wks aerobics	p-value
PR /min	78.12 ± 7.346	71.28 ± 6.942	<0.001**
SBP (mmHg)	126.46 ± 6.298	124.39 ± 5.612	0.0073*
DBP(mmHg)	86.03 ± 7.123	83.60 ± 7.571	0.0315*
RR /min	17.09 ± 2.242	12.77 ± 2.774	<0.001**
BHT (min)	42.35 ± 9.121	52.18 ± 9.324	<0.001**

(n=30) *Depicts Significant ** Highly Significant

Mean Pulse rate before aerobic training was 78.12 /min and mean pulse rate after training was 71.28 /min. Thus significant decrease in PR was found. Mean systolic blood pressure before aerobic training was 126.46 mm Hg and mean systolic blood pressure after training was 124.39mm Hg. Thus significant decrease in SBP was found. Mean diastolic blood pressure before aerobic training was 86.03 mm Hg and mean diastolic blood pressure after training was 83.60 mm Hg. Thus significant decrease in SBP was found. Mean respiratory rate before aerobic training was 17.09/min and mean respiratory rate after training was 12.77/min. Thus significant decrease in RR was found. Mean increase breath holding time before aerobic training was 42.35 min and mean BHT after training was 52.18 min. Thus significant increase in BHT was found.

Table 3: Showing comparison of VO2 max

Parameter (mean ± SD)	Before	After 16 wks aerobics	p-value
Recovery heart rate (per minute)	108 ± 6.05	92 ± 5.07	<0.001**
VO2 max ml/kg/min	42.62 ± 3.05	59.53 ± 5.05	<0.001**

(n=30) *Depicts Significant ** Highly Significant

Mean recovery heart rate and VO2 max before aerobic training was 108 /min and 42.62 ml/kg/min respectively. Mean recovery heart rate and VO2 max after training was 92 /min and 59 .53 ml/kg /min. Thus significant change was found.

DISCUSSION

Exercise training most of the time is used to find out the physical capabilities and physiological responses of an individual. It is already known that participating in regular exercise can prevent coronary heart disease, hypertension, obesity, mental stress etc. Aerobic fitness is related to a person’s ability to perform dynamic, moderate-to-high intensity physical activity with large muscle groups for prolonged periods. Thus, it expresses the abilities of both cardio-respiratory and muscular systems to transport and utilize oxygen for energy [7].

The present study was designed to explore the relationship of physical fitness and cardiovascular performance. In our study resting heart rate and respiratory rate were decreased in subjects after 16 weeks of aerobic training. Autonomic nervous system which controls all major functions of the body also helps in co-ordinating the functions. Sympathetic arousal resulting in increased catecholamine and cortisol levels mediated through the hypothalamo-hypophysial axis is the effect of sensation of

relaxation and reduction in heart rate and respiratory rate. The resting Heart Rate is modulated by a balance between sympathetic and parasympathetic tone [8,9]. It was previously reported that the bradycardia exhibited by endurance-trained individuals is attributed, at least in part, to greater parasympathetic activity [8]. On this basis, some findings state that an increased vagal tone is the main mechanism for the bradycardia induced by aerobic physical training.

On the other hand, studies on animals and on humans have suggested that this bradycardia is mainly due to a reduction in intrinsic Heart Rate [10].

Both systolic and diastolic blood pressure were found to be decreased in the present study after aerobic training. Our findings are consistent with results of Inber et al. who showed significant reduction in systolic and diastolic blood pressure in two types of exercises. These changes may be due to a decrease in sympathetic activity in the S.A.Node. or both an increase in vagal activity and a decrease in sympathetic activity [11].

Our subjects also showed increased aerobic capacity after 16 weeks of aerobic dance (exercise) training. A person's maximal oxygen uptake (VO2 max) refers to the maximal amount of oxygen the individual can consume typically over one minute during an intense physical effort.

VO2 max is the golden standard measure for the person's aerobic fitness level. Increased aerobic capacity may be due to increased vagal tone which slows down heart allowing more time for ventricular filling. Thus because of enlarged ventricular volume according to Frank sterling law of heart, myocardium will eject a larger volume of blood with each systole. [12,13]

Beneficial effects of exercise are well documented with regard to changes in endothelial function, increase in mitochondrial content, carotid artery intima, media thickness, left ventricular ejection fractions and left ventricular stroke volume [4].

CONCLUSION

A aerobic exercise session of even 16 weeks showed positive impact on physical and psychological functioning of working women. It is expected that consistent and more prolonged similar sessions will lead to more significant changes.

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