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Effect of aerobic and anaerobic exercise programme on selected physical fitness components among college women

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Abstract
The study was designed to investigate the effect of aerobic and anaerobic exercise programme on selected physical fitness components of college women. In order to achieve the purpose of the study, forty five (N = 45) women from Bharathiar University affiliated college, Coimbatore were selected as subjects. The subject age ranged from 18 to 25 years. The subjects were divided into three equal groups consists of 15 each. The group – I (n = 15) was underwent to aerobic exercise group (AEG), group – II (n = 15) was underwent to anaerobic exercise group (ANAEG) for the period of 12 weeks and group III (n = 15) acted as control Group (CG), they did not participate any specific training programme. Each group consists of 15 subjects. Physical fitness components speed was assessed by 50 yards test and unit of measurement was in seconds, agility was assessed by 4*10mts shuttle run test and unit of measurement was in seconds, Cardio-vascular endurance was assessed by 12 minute cooper run/walk test and unit of measurement was in meters. The result of the present study explored that aerobic and anaerobic exercise program produced significant improvement over speed, agility and cardio vascular endurance among college women. Further it was concluded that aerobic exercise produced significant improvement over cardio vascular endurance when compared with anaerobic exercises training and anaerobic exercise produces significant improvement over speed and agility when compared with aerobic exercise.

Keywords: Aerobic and anaerobic exercise, speed, agility, cardio vascular endurance and college women

Introduction
The terms aerobic and anaerobic are essentially used to describe two different energy systems in the body aerobic operating in the presence of oxygen while the anaerobic operates without the presence of oxygen.
The word aerobic is made up of two Greek words: Aeros meaning air and Bios meaning life. Aerobic exercise is vigorous enough to increase the body's need for oxygen and hence air intake and breathing rate increase. Aerobic exercise is done at a pace that allows an adequate supply of oxygen to reach your muscles as you work out. If you can hum to yourself or carry on a conversation as you work out then you are probably exercising aerobically. This type of exercise can be continued for 20 - 45 minutes without being exhausting.
Doing aerobics regularly can decisively improve your heart rate, your body condition, and your state of mind. Over 20 years of research has shown that aerobic exercise is one of the best exercises you can do since it is a safe and complete work out, as well as a fun sport to do. Aerobics conditions your heart and lungs, help you use oxygen more efficiently and help control weight and reduce stress. A regular aerobics program gives you a sense of responsibility and the assurance of being in control of your body, which are two positive mental attitudes that are necessary to help reduce stress. Aerobics helps relax tense muscles, and a regular aerobics activity increases the body's production of endorphins (a natural sedative) and catecholamines (chemical substances that help stabilize moods). So, aerobics can makes you feel happy.
"Aerobic" means literally "with oxygen" in opposition to "anaerobic," which means without or with little oxygen. In order to understand what aerobic and anaerobic systems do in the human body, we must explain first what role they play during exercising. There are three energy systems in the body that provide the muscles with enough energy to do any physical activity.

There are two anaerobic systems and one aerobic system. The anaerobic systems are used for high intensity exercise. One is used by the body for fast and quick physical bursts sustained no more than 15 to 20 seconds: sprinting, jumping, throwing, kicking & lifting heavy weights. It has the capacity to deliver energy immediately since it relies entirely on chemical sources of fuel. The second anaerobic system relies on glucose, the usable form of carbohydrates in the body. It provides energy for types of exercise that result in tiredness after 45 to 90 seconds of activity. Shorter, more intense exercises would rely on the first anaerobic system.

Aerobic exercise strengthens your heart and lungs (which make up the cardiovascular system). During exercise, your muscles demand more oxygen-rich blood and give off more carbon dioxide and other waste products. As a result, your heart has to beat faster to keep up. When you follow a consistent aerobic exercise plan, your heart grows stronger so it can meet the muscles' demands without as much effort. Everyone, regardless of their weight, age. Regular aerobic exercise, performed most days of the week, also helps reduce the risk of illness and premature death. Regular aerobic exercise improves health in the following ways: Reduces body fat and improves weight control, Reduces resting blood pressure (systolic and diastolic). Increases HDL (good) cholesterol. Decreases total cholesterol. Improves glucose tolerance and reduces insulin resistance. Decreases clinical symptoms of anxiety, tension and depression. Increases maximal oxygen consumption (VO2 max). Improves heart and lung function. Increases blood supply to the muscles and enhances your muscles' ability to use oxygen. Lowers resting heart rate. Increased threshold for muscle fatigue (lactic acid accumulation). Anaerobic exercise is a form of exercise in which energy for the activities performed comes from the sugars present in the muscle cells and not from oxygen in the blood. In fact, anaerobic means "in the absence of oxygen". Such exercises are basically of short duration and intense.

Anaerobic exercise is a form of exercise in which energy for the activities performed comes from the sugars present in the muscle cells and not from oxygen in the blood. In fact, anaerobic means "in the absence of oxygen". Such exercises are basically of short duration and intense. Examples of anaerobic exercise include sprinting and weight training. Because the effort required for such exercise is intense, it cannot be sustained for long. There are many factors that contribute to muscle fatigue during anaerobic exercise, chief amongst them is the production of lactic acid when sugars are broken down. The accumulation of lactic acid in the blood is a limiting factor to the extent we can carry out high-intensity activity without oxygen.

If you wish to incorporate anaerobic exercise into your training regimen, it is advisable to go slow and first develop a certain level of aerobic fitness. Warming up and cooling down are very important aspects of aerobic training. It is important to have the muscles supple and loose before loading them with weights in any kind of aerobic regimen. You can come up with an exercise routine that will help you target the muscles you wish to develop. If you are averse to weights, you can train with bodyweight exercises such as pull-ups, push-ups, and dips on parallel bars.

Anaerobic exercise builds muscle mass and muscle endurance. The objective of these exercises can be described as getting bigger, faster, and stronger. The exercise exerts fast-twitch skeletal muscles that naturally display anaerobic metabolic characteristics.

Developing muscle, which means more strength and also higher amounts of calories burnt as muscle burns more calories than fat. Muscle building increases Basal Metabolic Rate (BMR), metabolism when the body is at rest. Increase in muscle mass and bone density are two big advantages, particularly for elderly people that are susceptible to osteoporosis. Developing muscle around joints helps maintain joint health. Lowers blood sugar. Sugar is the primary source of energy in anaerobic exercise. Regular exercise regulates blood sugar levels which otherwise would be converted into fat, as it indeed happens with people that lead a sedentary life style. For people above forty, this exercise form helps in retaining muscle mass which otherwise may start slowly wasting away due to the inevitable process of aging.

Avoid overtraining. Train under the supervision of a qualified instructor. Stay away from things that can nullify the hard-earned benefits of anaerobic exercise. These include hard drinking, smoking, drugs, and lack of sleep. A balanced diet that includes all essential nutrients and is low-fat should serve you well. Breakfast cereal, fruit, nuts, lean meat, sprouts, etc. should all be a part of your diet. Avoid high-carb and high-sugar foods after an anaerobic workout so that the body replenishes the sugar stores by breaking down fat.

For optimum health benefits, one should look to combine aerobic and anaerobic exercise. This way you build muscle, lose fat, and improve cardiovascular performance. Because anaerobic exercise increases muscle mass and muscles burn more calories per unit time as compared to fat, this type of exercise helps in controlling weight as your metabolism rate increases. One pound of muscle can burn 30 to 50 Calories a day whereas a pound of fat burns around 3 Calories a day. Therefore, if weight loss is your aim you should include an anaerobic workout to your jogging, cycling routine so that the body continues to burn fat in a sustained manner.

Methods

To achieve the purpose of the study, forty five (N = 45) college women were selected. The subject age ranged from 18 to 28 years. The selected subjects were divided into three equal groups consists of 15 each. The group – I (n = 15) was underwent to aerobic exercise group (AEG), group – II (n = 15) was underwent to anaerobic exercise group (ANAEG) and acted as control Group (CG) (n = 15), they did not participate any specific training programme.

Experimental design

Physical fitness components speed was assessed by 50 yards test and unit of measurement was in seconds, agility was assessed by 4*10mts shuttle run test and unit of measurement was in seconds, Cardio-vascular endurance was assessed by 12 minute cooper run/walk test and unit of measurement was in meters.

Training programme

Training programme is lasted for 60 minutes a day for a session, 3 days in week for a period of 12 weeks. Those 60 min consists of 10 minutes warm-up, 40 min respective training and 10 minutes for warm-down. Each two week's 5% of load was increased from 50% to 80% of load.

Statistical techniques

The collected data were statistically analyzed with Analysis of co-variance (ANACOVA) was applied to determine whether the two programmes of training produced significant improvements in selected variables after twelve weeks of training. Since the initial means were not matched,

comparisons between actual could not be made, all means were adjusted by regression to a common mean. The significance difference of pairs of adjusted final group means was tested for significance by applying Scheffe's post hoc test.

Table 1: Analysis of covariance on speed of aerobic exercise, anaerobic exercise and control group

Variables	AEG	ANAEG	CG	Source of variance	Sum of square	df	Mean square	F
Pre-test	9.65	9.91	9.88	Between	0.64	2	0.32	1.23
				Within	10.87	42	0.26	
Post-test	9.16	9.45	9.87	Between	3.83	2	1.91	18.64*
				Within	4.31	42	0.1	
Adjusted	9.14	9.46	9.89	Between	4.11	2	2.05	21.09*
				Within	3.99	41	0.1	

*Significant at 0.05 level

Table 1 shows that the pretest mean values on speed for aerobic exercise group, anaerobic exercise group and control group were 9.65, 9.91 and 9.88. The obtained F ratio 1.23 was lesser than the table value of 3.21. Which indicates the pre-test mean difference among three groups was statistically insignificant at 0.05 level of confidence for the degree of freedom 2 and 42.

The post-test mean values on speed for aerobic exercise group, anaerobic exercise group and control group were 9.16, 9.45 and 9.87. The obtained F ratio 18.64 was higher than the table value of 3.21. Which indicates the post-test mean difference among three groups was statistically significant at 0.05 level of confidence for the degree of freedom 2 and 42.

The adjusted post-test mean values on speed for aerobic exercise group, anaerobic exercise group and control group were 9.14, 9.46 and 9.89. The obtained F ratio 21.09 was higher than the table value of 3.21. Which indicates the adjusted post-test mean difference among three groups was statistically significant at 0.05 level of confidence for the degree of freedom 2 and 41. The result of the study indicates that there was statistically significant difference in aerobic exercise group, anaerobic exercise group and control group on speed.

Therefore, it may be conclude that there is significant difference among the adjusted mean of aerobic exercise group, anaerobic exercise group and control group on speed.

To determine which of the adjusted mean had significant difference, the Scheffe's post-hoc test was used and the results are presented in Table-2.

Table 2: Scheffe's post hoc test for the difference between the adjusted post-test means on speed

AEG	ANAEG	CG	MD	CI
9.14	9.46	----	0.32*	0.27
9.14	----	9.89	0.75*	
----	9.46	9.89	0.43*	

Table 2 shows that adjusted post-test mean difference between aerobic exercise group and anaerobic exercise group, aerobic exercise group and control group and anaerobic exercise group and control group are 0.32, 0.75 and 0.43 respectively, which is higher than the confidence interval value of 0.27 for significant at 0.05 level of confidence.

It may be concluded from the result of the study that there was a significant difference between the adjusted post-test means of aerobic exercise group and anaerobic exercise group, aerobic exercise group and control group and anaerobic exercise group and control group on speed.

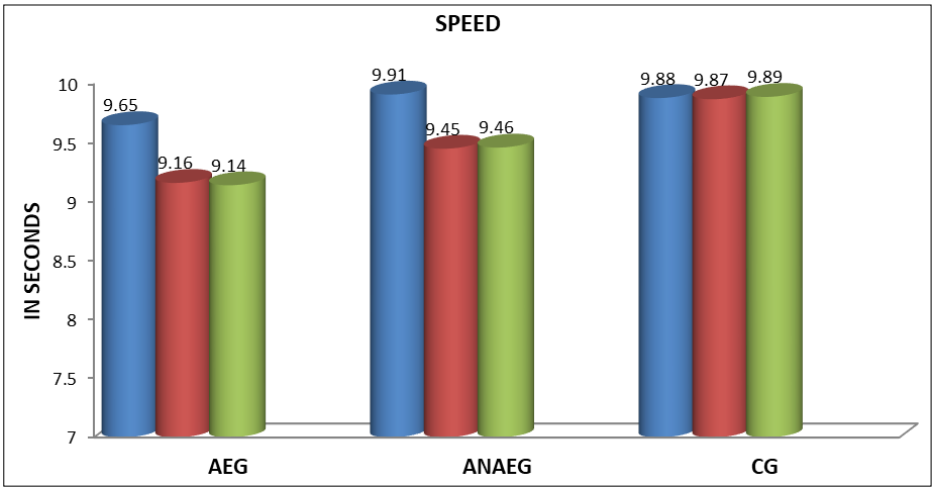

Fig 1: Bar diagram showing the values of aerobic exercise group, anaerobic exercise group and control group on speed

Table 3: Analysis of covariance on agility of aerobic exercise, anaerobic exercise and control group

Variables	AEG	ANAEG	CG	Source of variance	Sum of square	df	Mean square	F
Pre-test	14.12	13.25	14.04	Between	6.9	2	3.45	2.57
				Within	56.33	42	1.34	
Post-test	12.66	11.27	13.92	Between	52.52	2	26.26	25.30*
				Within	43.59	42	1.04	
Adjusted	12.53	11.5	13.82	Between	37.73	2	18.87	22.95*
				Within	33.70	41	0.82	

*Significant at 0.05 level

Table 3 shows that the pre-test mean values on agility for aerobic exercise group, anaerobic exercise group and control group were 14.12, 13.25 and 14.04. The obtained F ratio 2.57 was lesser than the table value of 3.21. Which indicates the pre-test mean difference among three groups was statistically insignificant at 0.05 level of confidence for the degree of freedom 2 and 42.

The post-test mean values on agility for aerobic exercise group, anaerobic exercise group and control group were 12.66, 11.27 and 13.92. The obtained F ratio 25.30 was higher than the table value of 3.21. Which indicates the post-test mean difference among three groups was statistically significant at 0.05 level of confidence for the degree of freedom 2 and 42.

The adjusted post-test mean values on agility for aerobic exercise group, anaerobic exercise group and control group were 12.53, 11.50 and 13.82. The obtained F ratio 22.95 was higher than the table value of 3.21. Which indicates the adjusted post-test mean difference among three groups was statistically significant at 0.05 level of confidence for the degree of freedom 2 and 41. The result of the study indicates that there was statistically significant difference in aerobic exercise group, anaerobic exercise group and control group on agility.

Therefore, it may be conclude that there is significant difference among the adjusted mean of aerobic exercise group, anaerobic exercise group and control group on agility.

To determine which of the adjusted mean had significant difference, the Scheffe's post-hoc test was used and the results are presented in Table-4.

Table 4: Scheffe's post hoc test for the difference between the adjusted post-test means on agility

AEG	ANAEG	CG	Mean difference	CI
12.53	11.50	----	1.03*	0.8
12.53	----	13.82	1.29*	
----	11.50	13.82	2.32*	

Table 4 shows that adjusted post-test mean difference on agility between aerobic exercise group and anaerobic exercise group, aerobic exercise group and control group and anaerobic exercise group and control group are 1.03, 1.29 and 2.32 respectively, which is higher than the confidence interval value of 0.8 for significant at 0.05 level of confidence.

It may be concluded from the result of the study that there was a significant difference between the adjusted post-test means of aerobic exercise group and anaerobic exercise group, aerobic exercise group and control group and anaerobic exercise group and control group on agility.

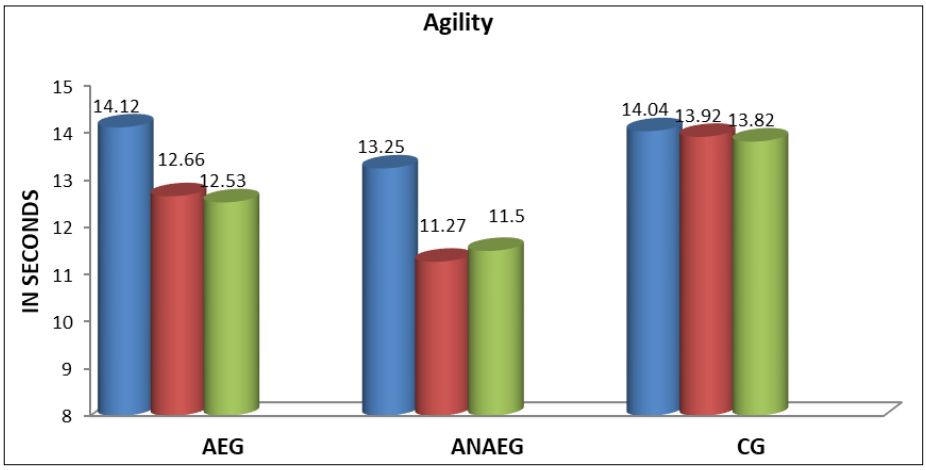

Fig 2: Bar diagram showing the values of aerobic exercise group, anaerobic exercise group and control group on agility

Table 5: Analysis of covariance on cardiovascular endurance of aerobic exercise, anaerobic exercise and control group

Variables	AEG	ANAEG	CG	Source of variance	Sum of square	df	Mean square	F
Pre-test	2274.67	2256.67	2174.67	Between	85240.00	2	42620.00	1.44
				Within	1241880.00	42	29568.57	
Post-test	2410.00	2506.67	2162.67	Between	944271.11	2	472135.56	17.08*
				Within	1161226.67	42	27648.25	
Adjusted	2382.00	2491.48	2205.85	Between	594264.41	2	297132.21	22.90*
				Within	532050.17	41	12976.83	

*Significant at 0.05 level

Table 5 shows that the pre-test mean values on cardiovascular endurance for aerobic exercise group, anaerobic exercise group and control group were 2274.67, 2256.67 and 2174.67. The obtained F ratio 1.44 was lesser than the table value of 3.21. Which indicates the pre-test mean difference among three groups was statistically insignificant at 0.05 level of confidence for the degree of freedom 2 and 42.

The post-test mean values on cardiovascular endurance for aerobic exercise group, anaerobic exercise group and control group were 2410.00, 2506.67 and 2162.67. The obtained F ratio 17.08 was higher than the table value of 3.21. Which indicates the post-test mean difference among three groups was statistically significant at 0.05 level of confidence for the degree of freedom 2 and 42.

The adjusted post-test mean values on cardiovascular endurance for aerobic exercise group, anaerobic exercise group and control group were 2382.00, 2491.48 and 2205.85. The obtained F ratio 22.90 was higher than the table value of 3.21. Which indicates the adjusted post-test mean difference among three groups was statistically significant at 0.05 level of confidence for the degree of freedom 2 and 41. The result of the study indicates that there was statistically significant difference in aerobic exercise group, anaerobic exercise group and control group on cardiovascular endurance.

Therefore, it may be conclude that there is significant difference among the adjusted mean of aerobic exercise group, anaerobic exercise group and control group on cardiovascular endurance.

To determine which of the adjusted mean had significant difference, the Scheffe's post-hoc test was used and the results are presented in Table-6.

Table 6: Scheffe's post hoc test for the difference between the adjusted post-test means on cardiovascular endurance

AEG	ANAEG	CG	MD	CI
2382.00	2491.48	----	109.48*	102.67
2382.00	----	2205.85	176.15*	
----	2491.48	2205.85	285.63*	

Table 6 shows that adjusted post-test mean difference on cardiovascular endurance between aerobic exercise group and anaerobic exercise group, aerobic exercise group and control group and anaerobic exercise group and control group are 109.48, 176.15 and 285.63 respectively, which is higher than the confidence interval value of 0.8 for significant at 0.05 level of confidence.

It may be concluded from the result of the study that there was a significant difference between the adjusted post-test means of aerobic exercise group and anaerobic exercise group, aerobic exercise group and control group and anaerobic exercise group and control group on cardiovascular endurance.

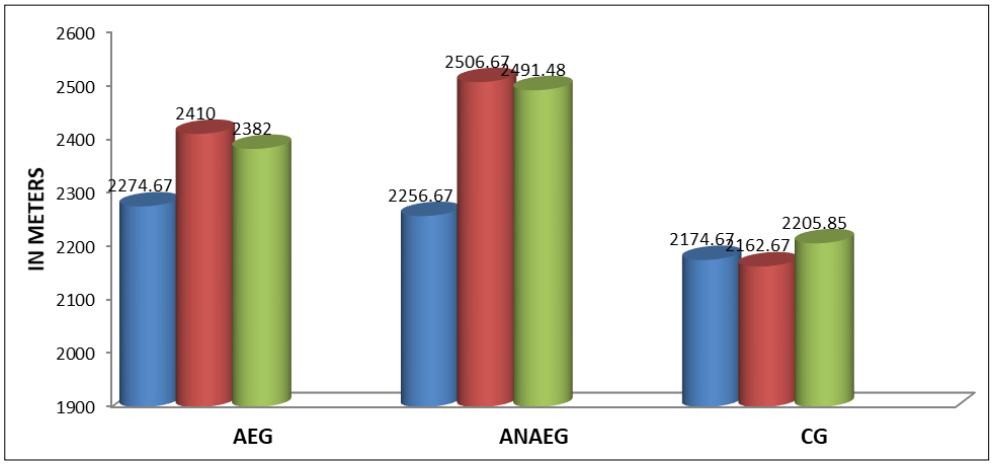

Fig 3: Bar diagram showing the values of aerobic exercise group, anaerobic exercise group and control group on cardiovascular endurance

Discussion on findings

The results of the study indicate that the experimental group namely aerobic exercise group and anaerobic exercise group had significantly improved the selected variables namely speed, agility and cardiovascular endurance.

The Aerobic exercise group had significantly improved cardiovascular endurance. Panton LB *et al*., 1990 [23]. The subjects in the Aerobic exercise group improve cardiovascular endurance respectively by finding significant improvements were noted from the cardiovascular endurance between the pre and post-test scores. Therefore, Aerobic exercise group is indeed effective in enhancing cardiovascular endurance. The Anaerobic exercise group had significantly improved speed and agility (Sanjeevkumar S *et al.*, 2010) [26]. The subjects in the Anaerobic exercise group improves speed and agility respectively by finding significant improvements were noted from the speed and agility between the pre and post-test scores. Therefore, anaerobic exercise group is indeed effective in enhancing speed and agility. Smith DJ *et al*., (1992) [27] Volleyball has been described as an 'interval' sport with both anaerobic and aerobic components. The results suggest that either years of specific physical conditioning and playing or the selection of individuals for the national team who possess more desirable characteristics as a consequence of genetic endowment, plays a significant role in the preparation of international caliber volleyball players. Panton LB *et al*., (1990) [23] to evaluate the effect of aerobic and variable resistance exercise training on fractionated reaction time (RT) and speed of movement (SM) in elderly individuals, premotor time (PMT), motor time (MT), total RT, and SM were measured in 49 healthy, untrained men and women, 70 to 79 years of age, before and after 6 months of training. Martins R *et al*. (2011) [16] Seventy eight participants (age 65 to 95 year old) were randomly assigned to a control group, aerobic training (AT), or strength training group (ST). Kin-Isler *et al*. (2006) has conducted study was to investigate the effects of 10 weeks of aerobics training on anaerobic performance of men and women. Rankovic G, *et al.*, (2010) [25] Aerobic capacity as an indicator in different kinds of sports. Physical capacity of athletes is an important element of success in sports achievements.

Conclusions

Based on the results of the study the following conclusions were drawn.

1. It was concluded that the aerobic exercise and anaerobic exercise programme enhanced the performance of physical fitness components namely of (speed, agility and cardiovascular endurance) among college women.
2. The aerobic exercise programme was more effective than the anaerobic exercises in improving physical fitness components (cardiovascular endurance) among college women.
3. It was concluded that the anaerobic exercise programme was more effective than the anaerobic exercises in improving physical fitness components (speed and agility) among college women.

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