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Effect of aerobic and Swiss ball exercise on muscular flexibility and muscular strength of untrained collegiate men

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Abstract
The purpose of the study was to find out the effect of aerobic and swiss ball exercise on muscular flexibility and muscular strength of untrained collegiate men. In this study fourty five (45) untrained college men were randomly selected from Pt. Kundan Lal Shukla Mahavidyalaya, Kanpur Dehat, Uttar Pradesh, India. The subject's age ranged between 18 to 25 years. The subjects were divided into three equal groups of fifteen subjects each and name of the groups as aerobic exercise group, swiss ball exercise group and control group. The training period was 12 weeks and training 5 days in a week. Muscular flexibility and muscular strength were measured by sit and reach test and push-ups respectively. The pre-test and post-test data were collected before and after 12 weeks aerobic and swiss ball exercise training program. In statistical method ANCOVA was used to find out the significant difference between groups and level of significance was set at 0.05 levels. The study confirmed that muscular flexibility and muscular strength has significant improved in experimental groups when compared with control group.

Keywords: Aerobic exercise, Swiss ball exercise, muscular strength, muscular flexibility, college men

Introduction
Aerobic fitness is defined as the ability of the lungs, heart, and blood vessels to pass needed amount of oxygen and other things as nutrients to the cells to meet the demands of sustained activity. Aerobic capacity is usually assessed by measuring maximal oxygen consumption. The oxygen required for the breakdown of carbohydrate and fat comes from air we breathe. (www.medicinenet.com). Aerobics refers to a variety of activities like walking, jogging and running for a measured time. This is sufficient for a short distance runner and yet in short time helps to produce beneficial changes in the body, especially in the action of the lungs, heart and blood circulation. (Mitchell and Daka, 1980**)** [21]. Training to improve aerobic endurance capacity involves four basic elements. Mode, intensity, duration, and frequency of exercise, a training program which does not contain all four to an adequate degree is not likely to be effective.

This exercise is designed to produce a sustained increase in heart rate and whose energy cost can be met by the body from aerobic sources i.e. from increased oxygen consumption (Yadav and Rachna, 1998) [22]. A Swiss ball is strengthening programs for injury rehabilitation and performance conditioning. It is often assumed that the use of a Swiss ball increases muscular strength, abdominal strength and trunk muscle activity. Strength is the single dominant factor in predicting and also improving speed. Strength is required before power training and it helps to lay the foundation for overall body conditioning. Swiss ball exercises are that they are very effective at targeting core muscles. Swiss balls are one of today's top fitness tools - and for good reason. Using a Swiss ball will improve the muscular strength, muscular flexibility, abdominal strength, balance and also strength of the abs and the lower back.

In recent years, fitness practitioners have increasingly recommended core stability in sports conditioning programs. Greater core stability may benefit sports performance by providing a foundation for greater force production in the upper and lower extremities. Swiss ball exercise also involving isometric muscle actions, small loads, and long tension times are recommended for increase in strength and endurance.

Core muscles must produce sufficient and well-coordinated muscle contraction to both support and stabilize the lumbar spine during a variety human movement tasks

The physical object known as a "Swiss Ball" was developed in 1963 by Aquilino Cosani an Italian plastics manufacturer. He perfected a process for molding large puncture-resistant plastic balls. Swiss balls are large, heavy-duty inflatable balls offer you a fun, safe and highly effective way to exercise. Swissball is a ball constructed of soft elastic with a diameter of approximately 35 to 85 centimeters (14 to 34 inches) and filled with air. The air pressure is changed by removing a valve stem and either filling with air or letting the ball deflate. It is most often used in rehabilitation, physical therapy, athletic training, joints movements and core exercise. It can also be used for weight training. Most exercises in both healthcare and fitness modalities use the ball as nothing more than an unstable base for traditional linear movements to increase core strength and balance. The real benefit of these balls is that they allow for complete multidimensional movement which allows the body to be stretched and worked in ways not possible without the ball.

A primary benefit of exercising with an exercise ball as opposed to exercising directly on a hard flat surface is that the body responds to the instability of the ball to remain balanced, engaging many more muscles those muscles become stronger over time to keep balance. Most frequently, the core body muscles as the abdominal muscles and back muscles are the focus of exercise ball fitness programs. (http://en.wikipedia.org/wiki/Exercise_ball)

The use of physioballs/Swiss balls in strength and conditioning programs has become ubiquitous. Swiss balls have been incorporated into strength training regimes and touted as a means to more effectively train the musculoskeletal system. Performing strength exercises on Swiss balls has been advocated on the belief that a labile surface will provide a greater challenge to the trunk musculature, increase the dynamic balance of the user and possibly train users to stabilize their spines to prevent and treat injury**.** (http://www.sportsinjuryclinic.net)

Methodology

Subjects

The main purpose of the study was to determine the effect of aerobic and Swiss ball exercise on muscular strength and muscular flexibility of untrained college male students. There are 45 college male students randomly selected from Pt. Kundanlal Shukla Mahavidyalya, Kanpur-Dehat (U.P), who were volunteered participated to conduct the study and the purpose of the study was explained. The study was formulated as a random group design consisting of a pre-test and post-test. The randomly selected subjects were divided in three groups. In each groups 15 subjects are and groups were named Group A, Group B and Group C. In which Group A was aerobic exercise group, Group B was swiss ball group and Group C was control group. The control group was not allowed to participate in any of the training programmes, except their daily work. The training period was 12 weeks and training 5 days a week Monday to Friday (except Saturday and Sunday) for the duration of forty five minutes daily. The method of performing the test on muscular strength and muscular flexibility was explained to the subjects before the test. The age ranged of the subjects between 18 to 25 years as per their admission record.

Tools and Instruments

The test of muscular strength measured with the help of push-ups and for muscular flexibility, it measured by the sit and reach test. The score of the push-ups and sit and reach was noted as many times as possible.

Procedure

Aerobic and Swiss ball exercise training given as per scheduled. The duration of the training program was 45 minute per day and frequency of the training was five days in a week.

Statistical Technique

The treatment difference between the pre and post-test scored in selected variables were to statistical work by using Analysis of Covariance (ANCOVA) to find out whether the mean difference were significant or not. The obtained 'F' ratio was tested for significance at 0.05 and 0.01 level of confidence. Scheffe's post-hoc test of significance was employed in order to test the significant difference between paired adjusted means.

Analysis of Covariance for Pre Test and Post Test (Table-1)

Data on Muscular Flexibility of Experimental Groups and Control Group

Table 1: Analysis of Covariance for Pre Test and Post Test

	Aerobic exercise	Swiss ball exercise	Control Group	Source of Variance	Sum of Squares	Df.	Mean square	'F' ratio
Pre-test Mean S.D.	19.933 1.907	19.000 1.812	19.666 1.397	B W	6.933 124.267	2 42	3.467 2.959	1.172
Post-test Mean S.D.	24.866 1.355	25.266 1.486	20.866 1.457	B W	177.600 86.400	2 42	88.800 2.057	43.167*
Adjusted Post-test Mean	24.596	25.628	20.776	B W	194.034 29.348	2 41	97.017 0.716	135.535*

* Significant at 0.05 level.

Required table value at 0.05 level of significance for 2 & 42, 41 degrees of freedom = 3.22 & 3.23

From the table - 1 it shows that the pre-test mean scores on muscular flexibility of the experimental groups and control group are 19.933, 19.000 and 19.666 respectively. The calculated 'F' ratio value 1.172 and it is lesser than the required table value 3.22 for 2 & 42 Df. at 0.05 level of significance. It meant no statistically significant difference between the experimental and control groups on muscular flexibility.

From the table of post-test means scores on muscular flexibility of the experimental groups and control group are

24.866, 25.266 and 20.866 respectively. The calculated 'F' ratio value 43.167 and it is higher than the table value 3.22 for 2 & 42 Df. at 0.05 levels of significance. It meant statistically significant difference between the experimental and control group on muscular flexibility. After

From the table of the adjusted post-test means scores on muscular flexibility of the experimental groups and control group are 24.596, 25.628 and 20.776 respectively. The obtained 'F' ratio value of 135.535 and it is higher than the table value 3.22 for 2 & 41 Df. at 0.05 level of significance. It meant significant change on muscular flexibility as a result of the experimental training. Since the result has revealed that there is a significance difference, the hypothesis is accepted.

Ordered adjusted muscular flexibility means and difference between means for experimental groups and control group in analysis of covariance problem (Table-2)

Table 2: Ordered adjusted muscular flexibility means and difference between means for experimental groups and control group in analysis of covariance problem

Aerobic group	Swiss ball group	Control group	Mean Differences	C.I
24.596	25.628	-	1.032*	0.785
24.596	-	20.776	3.820*	
-	25.628	20.776	4.852*	

*Significant at 0.05 level. Scheffe's confidence interval at 0.05 level is 0.785

From the table - 2 it shows that the Scheffe's post-hoc method of testing the significance for the differences between the paired means. The adjusted muscular flexibility efficiency means in order of magnitude and the difference between this means for the experimental groups and control is given in the table. The mean differences between the aerobic group and Swiss ball group are 1.032, aerobic exercise group and control group the difference is 3.820, and Swiss ball group and control group is 4.852, which is significant at 0.05 level of confidence interval. Results indicates that the aerobic exercise group and Swiss ball group had a better improvement when compared to the with control group.

The means differences of aerobic exercise group, Swiss ball group and control group are presented in bar diagram for better understanding of the results in figure- 1.

Graphical Representation on Pre-Test, Post-Test and Adjusted

Post-Test Means on Muscular Flexibility of Experimental Groups and Control Group

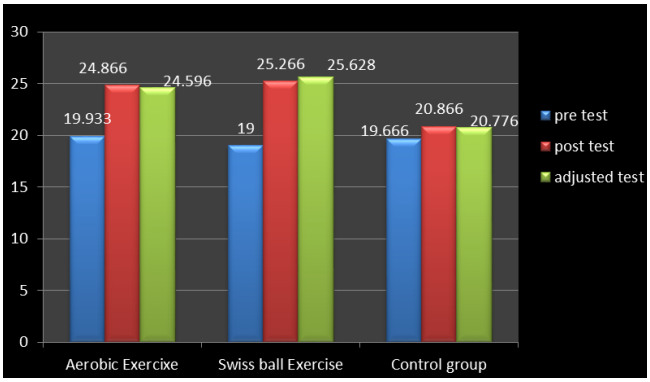

Fig 1: Analysis of Covariance for Pre Test and Post Test Data on Muscular

Table 3: Strength of Experimental Groups and Control Group

	Aerobic exercise	Swiss ball exercise	Control Group	Source of Variance	Sum of Squares	Df.	Mean Square	'F' Ratio
Pre-test Mean S.D.	23.733 1.387	23.466 1.959	23.333 1.543	B W	1.244 114.000	2 42	0.622 2.714	0.229
Post-test Mean S.D.	28.933 1.751	29.533 1.884	24.200 1.473	B W	256.044 123.067	2 42	128.022 2.930	43.691*
Adjusted Post-test Mean	28.766	29.567	24.334	B W	237.207 58.189	2 41	118.604 1.419	83.568*

* Significant at 0.05 level.

Required table value at 0.05 level of significance for 2 & 42, 41 degrees of freedom = 3.22 & 3.23

From the table - 3 it shows that the pre-test means scores on muscular strength of the experimental and control group are 23.733, 23.466 and 23.333 respectively. The calculated 'F' ratio value 0.229 and it is lesser than the table value 3.22 for 2 & 42 Df. at 0.05 level of significance. It meant no statistically significant difference between the control and the experimental groups on muscular strength.

From the table of post-test means scores on muscular strength of the experimental and control group are 28.933, 29.533 and 24.200 respectively. The calculated 'F' ratio value 43.691 and it is higher than the table value 3.22 for 2 & 42 Df. at 0.05 levels of significance. It meant statistically significant difference between the control and the experimental groups on muscular strength.

From the table of adjusted post-test means scores on muscular strength of the experimental and control group are 28.766, 29.567 and 24.334 respectively. The calculated 'F' ratio value of 83.568and it is higher than the table value 3.22 for 2 & 41 Df. at 0.05 level of significance. It reveals that there is significant change on muscular strength as a result of the experimental training. Since the result has revealed that there is a significance difference, the hypothesis is accepted.

Table 4: Ordered adjusted muscular strength means and difference between means for experimental groups and control Group in analysis of covariance problem

Aerobic group	Swiss ball group	Control Group	Mean Differences	C.I
28.766	29.567	-	0.801	1.104
28.766	-	24.334	4.432*	
-	29.567	24.334	5.233*	

* Significant at 0.05 level. Scheffe's confidence interval at 0.05 level is 1.104

From the table – 4 it shows that the Scheffe's post-hoc method of testing the significance for the differences between the paired means. The adjusted muscular strength efficiency means in order of magnitude and the difference between this means for the control and experimental groups is given in the table. The mean differences between the aerobic exercise group and Swiss ball group are 0.801, aerobic exercise group and the control group the difference is 4.432, and Swiss ball group and control group is 5.233, which is significant at 0.05 level of confidence interval. The results indicate that the aerobic exercise group had a better improvement when compared with control group.

The means differences of aerobic exercise group, Swiss ball group and control group are presented in bar diagram for better understanding of the results in figure-2.

Graphical Representation on Pre-Test, Post-Test and Adjusted

Post-Test Means on Muscular Strength of Experimental Groups and Control Group

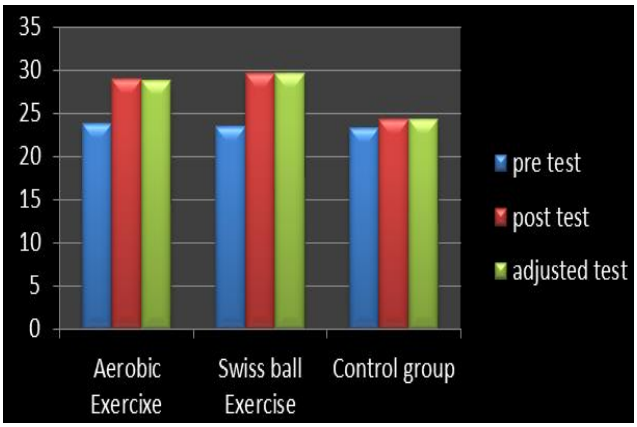

Fig 2: Post-Test Means on Muscular Strength of Experimental Groups and Control Group

Discussion

The results support the theory and effectiveness of that aerobic and swiss ball exercise has play role of significant effects on muscular flexibility and muscular strength of untrained college male students. It was found that the experimental groups gained significantly which is finding between pre-test to post-test in comparison to control group and Finally, the results indicates that the which participants followed the aerobic exercise and swiss ball exercise for 12 weeks have significant impact on muscular flexibility and muscular strength.

The result shows, it observed that there was significant difference between pre and post-test mean score of muscular strength and muscular flexibility. The Swiss ball exercise on muscular strength and muscular flexibility were improved, its means it significantly increased.

The findings of this study are in agreement with the findings of Sathish Kumar, A. & Vasanthi,G. (2012) [14] who proved that effect of 12 weeks Swiss-ball and crunches exercises on muscular and abdominal strength can be improvement in sedentary men and Raj Aruna (2012) [23] she also showed that effect of 12 weeks Swiss-ball and yogic exercises on physical and physiological variables of Pondicherry university girls. In conclusion, this study provides practical implications for sedentary individuals, physiotherapists, strength and conditioning specialists who can benefit from strength training with Swiss balls.

Conclusion

The researcher felt that the significant impact on muscular flexibility, muscular strength, In case of experimental groups may be due to the aerobic exercise and swiss ball exercise of 12 weeks programme apart from the regular work.

On the basis of findings it was evident that the aerobic and Swiss ball exercise given to experimental groups and it was found significant impact on muscular flexibility, muscular strength. It was observed that effect of aerobic and Swiss ball training program increased the muscular strength and muscular flexibility of untrained college male students. Swiss ball exercises play a significant role in muscular strength and muscular flexibility.

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