

## Effect of Aerobics and Zumba on Selected Body Composition Variables on Young Working Women

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### Abstract

The purpose of the present study was to find out the effect of Aerobics and Zumba on selected Body Composition variables of 20 to 25 years working women. Total 90 working women participated in this study, out of which 30 subjects were selected at random for the Aerobics group another 30 subjects were selected at random for the Zumba group and other 30 subjects were considered as the member of the control group. The subjects were selected from various non govt. and corporate sectors office of Salt Lake and Newtown area of Kolkata. Body Fat Percentage, Muscle mass percentage and Bone Mineral Density were measured Pre and Post of the treatment. Analysis of Covariance (ANCOVA) was conducted to identify the effect of Aerobics and Zumba on Body composition variables. Results indicates that There was significant difference between both Aerobics and Zumba group with control group ( $p=.000$ ), in both case  $p$ - value is less than 0.05 level of significance.

**Key Words:** Aerobics, Zumba, Body Fat Percentage, Muscle Mass Percentage, Bone Density.

### **1. Introduction:**

Population is on continuous rise on this planet. Natural environment is on the verge of being extinct. Complexity of civilization has made man too much dependant on machine and technology. And our physique, thus affected, is a paving the way for all kinds of hypo kinetic diseases. Today the younger generation is robbed off the provision for games and physical exercise. Aerobics or Zumba can be breath in some respite in such a situation promoting sports and physical activities even indoor.

People who are engaged in some professions that are quite time consuming, cannot afford to devote time for games and sports. The maximum effort they can come up with is to join a Gym. But soon they develop boredom. Aerobics or Zumba can be an interesting workout in such situation. Commonly, people in general prefer to dance along with music. Aerobics and Zumba provides them with the scope. The strict grammars of dance lessons are not followed here. Just people are required to catch up the rhythm of the music that is played. Aerobics and Zumba is thus a fun-packed physical fitness regime. Once can dance along with some music for fun and can retain his or her physical fitness.

Nowadays, many corporate officials, both in the private sector and the govt. sector, have to sit for a long hours at their desks. This certainly aggravates their situation of being unfit. They even remain absent from gymnasium either for the reason of being lazy or simply for lack of time. If they are made to understand the importance of Aerobics and Zumba, they will be benefited. Recently, it has already been observed that they are showing interest in such fitness programs. As such fitness programs can be organized within a very small space; they are growing popular in the coming days. The fitness components of aerobics or Zumba are of immense benefit and people from different walks of the society can reap them quite easily.

Aerobics is a type of exercise which is performs in the presence of oxygen. The term AEROBIC was first introduce by Dr. Kenneth H. Copper, an Exercise Physiologist. Aerobics and Zumba both are under aerobic exercise. Aerobics is a form of physical exercise that combines all rhythmic exercise, stretching, dancing etc. it is usually performed to music. The main objectives of this rhythmic exercise is to improve cardio-vascular endurance, flexibility, muscular strength and over all physical fitness.

Aerobics exercise shortly may be describe, the amount of oxygen get into the body is slightly more than or equal amount of oxygen utilize by the body. It is that type of activity in which body produce least lactic acid, sustained activity for extended period of time without building an oxygen debt. Aerobics increase oxygen utilization during vigorous exercise and lower heart rate during rest. (Bucher-1983)

Inactive life may leads to type 2 diabetes, obesity, coronary heart diseases as well as mental diseases like depression, insomnia, and many more. It is necessary for a child, an adult or old people to exercise daily at least half an hour for maintain their body to work daily life activity. (1995 CDC/ ACSM consensus statement and surgeon General's 1996 report.)

The responsibility of a physical educationist is not only educated the student who are engage in Physical education Classes or courses but also responsible for the people, for the nation. The researcher tried a bit whether three months Aerobic program can be helpful or not for those people who are very much busy with their daily work scheduled.

Zumba is also a rhythmic Aerobic fitness program. Zumba involves dance and all components of Aerobics. In the mid of 1990<sup>th</sup> Beto Perez, once he forgot to bring his traditional Aerobics music for the particular class he was teaching. Then he started the Aerobics class without the specific Aerobics music. He played some Colombian music and introduced some local dance form. As he previously announced that class would be a special class. Basically he used some local traditional dance form and music like, Cumbia, Salsa, Reggaeton, meringue etc. Very rapidly this form of exercise spread not only in Latin America but also all over the world. The dance form basically use in Zumba are Cumbia, Salsa, Reggaeton, Samba, Hip Hop, Mambo, Merangue etc. (www.zumba.com)

Basically Aerobics and Zumba program involves beats music and organized pre-planned movement or dance steps. Thus the pupil hardly loses their interest and attention from the activity.

**Aerobics History**-Before 1968 we did not know that why some people who has greater muscular body and strength, still they are poor in cardiovascular type of exercise, like long distance running, swimming, bicycling etc. Dr. Kenneth H. Cooper worked on that topic. He was puzzled when he faced the problem. He started investigation systematically, to measure human performance; he measured human ability to use oxygen. He used bicycle ergo meter test. In 1968 Dr. Kenneth H. Cooper published AEROBICS, a book that helps to understand the fitness form weakness or inactive life. Aerobics became worldwide famous again when Jane Fonda an Aerobics trainer released her Aerobics videos in 1982. (Wikipedia.org/wiki/Aerobics)

**Types of Aerobics**- After that different sports physiologist and aerobics trainer divided the aerobics into different types. Such as Steps Aerobics, Water Aerobics, Dance Aerobics, Sports Aerobics, Free style Aerobics etc.

**Step Aerobics**- Step aerobics first introduce Gin miller in 1986. He had knee injury, after consulting with an orthopedic doctor he was started to strengthen the knee muscle using a milk crate by stepping up and down. Nowadays, lots of well known companies are developing such stepper. The height can be adjusted to individual needs. Step aerobics is very good for develop leg muscle strength as well as cardio vascular efficiency. These classes are offered at many Gym and Fitness Center.

**Water Aerobics**- A swimming pool is needed, typically in waist deep water. Water aerobics differ from the land aerobics. Heart Rate does not increase as much as land aerobics. It develop strength endurance, it's a registrant training activity.

**Free Style Aerobics** – It involves Steps, Dance, Calisthenics movements. Some apparatus such as barbell, stepper, gym ball, dumbbell etc uses. A choreographer choreographs a routine for the need of his / her trainee in Class. The aim is to improve total fitness.

**Aerobics Gymnastics**- It is basically sports Aerobics and Competitive Aerobics. It involves complicated choreography, Rhythm and acrobatic movements. This aerobics is not recommended for general population. Highly trained athletes show their Excellency in the field of sports.

**Dance Aerobics**- Basically involves dance steps. Now a day's some people calling dance aerobics and Zumba synonymously. But there is some difference in legal point of view. Obviously Dance Aerobics and zumba are on same category. Zumba is a

private fitness company. Those who are not trained or taken membership from the fitness ZUMBA registered company, he or she will be treated as illegal trainer if he or she continues any Zumba Class.

Zumba class is typically about an hour's fitness program. The main objectives of the fitness is as the same as Aerobics. Zumba improves endurance, strength, flexibility, agility and over all fitness component more or less. All the classes are divided according to the age or need of the people.

***There are nine types of classes in Zumba.***

1. **Zumba Gold**- This program is for beginners and older people.
2. **Zumba Steps**- This program is for lower body workout and steps aerobics, in which Latin dance rhythms are used.
3. **Aqua Zumba**- organized in a swimming pool in shallow water.
4. **Zumba Toning** – This fitness program involves cardio workout and strength training. Some time use toning stick. This program is basically for abs, thighs, arms and other muscles.
5. **Zumba Circuit training**- some exercise has to be done with music and zumba steps and movements completing one by one station, following the rules of circuit training.
6. **Zumba Gold toning**-This is for older people. Objectives of this fitness program are to improve muscles strength, posture, mobility and coordination.
7. **Zumba Kid**- This fitness program is for children age between 7 to 11 years.
8. **Zumba Sentao**- Uses chair and body weight is utilized.
9. **Strong by Zumba**- this fitness program launched in 2016. It involves special combined synced music motivation with high intensity interval training. ([www.zumba.com](http://www.zumba.com))

A licensed Zumba trainer can teach one year after the date of zumba training from Zumba registered company network. After one year his/ her license will be invalid until he/she joins Zumba Instructor network (ZIN) membership.

Exercises are categorized into two categories i.e. aerobic exercise and anaerobic exercise. Aerobic exercise includes jogging, cycling, running, swimming, skiing etc. All the exercise which is performed in presence of oxygen is called aerobic exercise. Aerobics and Zumba are aerobic exercise in nature. The other part is anaerobic; the exercise which is performed without presence of sufficient oxygen is anaerobic exercise. Short distance run, Throwing, Jumping, Power lifting all are anaerobic in nature.

The term AEROBIC is referred to all the activity which is performed in presence of oxygen. And the term AEROBICS represent a particular type of aerobic exercise which is performed with music and choreographed movements and obviously in presence of sufficient oxygen.

In metropolitan area everybody is so much busy with their work schedule. They don't have enough time to do exercise, basically the female of any metropolitan city. Status of women in modern society is high. Women are highly educated and work parallel to men in different walks in life. They are given due importance and share in decision making and resource sharing.

The researcher met several times with many women to identify their problem that why they don't join a gym or any fitness center. And the problem was that, they have either day shift or night shift. If they work at night shift they feel sleepy in the next morning, so joining a fitness centre is not possible for those who do night shift duty. On the other hand they are unable to join in the evening class for that they have to get prepared for their next night shift duty. The researcher also came to know that they have some facility that their job is target job; they have to finish a task within a given period of time. So they can manage few times in between their work. The type of work they do basically involve only brain, no physical movement that leads to anxiety, eye problem, and headache etc. After a few months of the job they start acquiring fat in their body that also leads to other health related problems.

Any natural activity is better than organized activity for general people. Jogging, running, walking, cycling, swimming is very good for health. But they don't have enough time or may be lack of interest. Walking, running or cycling alone on the road may not be satisfactory at all for them. For that, gym is best option for them. Researcher asked about joining a gym. Many of them show interest and answered positively. But many of them thought "if any female do exercise in gym they

might gain bigger shoulder, bigger biceps and other muscle will appear masculine in nature, and that will not look good for a female.”

The researcher felt the need for providing the fitness program through Aerobics and Zumba for the working women as per their working schedule.

### **WHY AEROBICS AND ZUMBA ?**

As we know any exercise improves heart function, lung function, and other organs to function well. Aerobics and Zumba have some benefits that are; it improves cardiac function, increase stroke volume that causes down the resting heart rate. That is good for one health. During Aerobics and Zumba exercise body burn fat, resultant body fat decreases. University of Harvard, published in New England Journal of medicine in 1986, revealed that for the first time there was scientific link between exercise and longevity. So the working woman who does regular exercise may lead a quality life and a long life. During the class in Aerobics and zumba or immediate after class we may feel tired, but in long term it increases the strength and sense of well being. It increase the glucose metabolism reduce insulin resistance and therefore reduces the risk of diabetes. Reduce anxiety, psychological stress, improves mood with more vitality and help us to sleep well.

Aerobics and Zumba may organize at indoors or outdoors both in special cases. But basically these two programs generally organize in a hall room. The hall may be big or small. The beauty of the exercise that is, if special facility is available it can be use, otherwise a small room and a music player is enough to conduct Aerobics or Zumba classes.

However a well equipped Aerobics and Zumba program involves a sufficient hall room with or without air-condition. If such activity conduct without air-condition the trainer has to make sure before starting the class that, all the windows remain open for better ventilation. A wooden floor, mirror, good quality of music system, proper light, changing room, fresh drinking water are required for a better quality Aerobics and Zumba classes.

Dumbbells, skipping rope, stepper, gymnastics ball, cattle bell etc. are used in an aerobics and Zumba centre.

The researcher has finding out some research work on Aerobics and Zumba. Such as Sandhya Menon(2011), studied on Aerobics where she found twelve weeks Aerobic exercise can improved cardiovascular endurance, flexibility, lean body mass, airflow rate, vital capacity, cholesterol and hemoglobin content. Resting heart rate, body weight, fat percentage decreases after the training.

Barene,S. Krustrup, P. Jackman,SR. Brekke,O.L. Holtermann,A (2013) investigated on Do Soccer and Zumba exercise improve fitness and indicators of health among female hospital employees? A 12 week RCT. The study conclude that workplace initiated short-term soccer training as well as Zumba outside working hours may result in fitness and modest health benefits among female hospital employees.

Krishnan,sridevi; Tokar, Theresa N; Boylan, Mallory, M; Griffin, Kent; Feng,DU; Mcmurry, Linda; Esperal, Chrishtina; Cooper, Jamie A.(2015) studied on Zumba Dance Improves Health in Over weight / obese or Type 2 Diabetic Women. In this study Aerobic fitness improved significantly, body weight and body fat percentage decreased significantly. They concluded, Zumba intervention improved health and physical fitness in women.

Roth L Donath, Y. Hohn, L. Zahner, O. Faude(2014) studied on Zumba fitness, where they conclude the zumba training may be applied to improve well being; aerobics fitness and neuromuscular function for the female college students. Another study on Zumba, Crossfit and Pilates were studied by G.Basting, R.Ozcan, D.Gultekin and O.Guney(2016). They found that Body weight and BMI decreased after twelve weeks training, Body area satisfaction values increased after training.

However the reality is that the Aerobics and Zumba in India are not so much popular as other physical activity does. Now a day's people from urban and metropolitan cities are showing interest on such type of activities.

Basically no hard and fast rules are there in Aerobics and Zumba. No need to be a well dancer. Anybody wants to dance with good rhythm music. Zumba music involves basically Latin American song. The songs attract the person to dance. It is says that the 'movement is basis of life'. 'Move' 'move' and 'move' is the main mantra in Aerobics and Zumba.

The researcher felt the need for fitness especially for working women residing in metropolitan cities in Kolkata, considering the benefits of Aerobics and Zumba on body composition aspect variables the researcher took the present investigation.

## 2. Materials & Methods:

### 2.1. Criterion Measure:

- I. Body Fat Percentage
- II. Muscle Mass Percentage
- III. Bone Density.

### 2.2. Collection of Data:

The data of all the subjects were collected by testing Body composition variables. Two sets of data were collected for the study. The first set of data was collected successively for three days and second set of data was recorded as a same order which was recorded in first set.

### 2.3. Design of the Study:

In the present study Ninety (N=90) subjects were selected at random from 20 years to 25 years age group female. Total Number of selected subjects divided into three equal groups. i) Aerobics group. ii) Zumba group and iii) Control group. Pre test were conducted on the Criterion Measures. Twelve weeks training was employed among Aerobics and Zumba Group. No treatment was employed on Treatment group. Post test were conducted on Aerobics, Zumba and Control group after completion of Twelve weeks. Therefore, Pre test - post test randomized group design was followed in this experiment.

### 2.4. Administration of Treatment:

All the subjects were strictly had to follow the described scheduled. Their attendance was recorded. It was found that more than 95% class they attended. For both Aerobics and Zumba, basic music was played. For Aerobics, Jane Fonda's (who was the founder of AEROBICS) music CD and for Zumba, Beto perez's (who was the founder of ZUMBA) music DVD was played.

## 3. Results and Discussion:

**TABLE 1**  
**DESCRIPTIVE STATISTICS OF POST-TEST OF AEROBICS, ZUMBA AND CONTROL GROUP IN BODY FAT PERCENTAGE**

Groups	Mean	Std. Deviation	N
Aerobics	33.44	6.26	30
Zumba	34.00	8.28	30
Control	34.61	8.11	30
<b>Total</b>	<b>34.02</b>	<b>7.53</b>	<b>90</b>

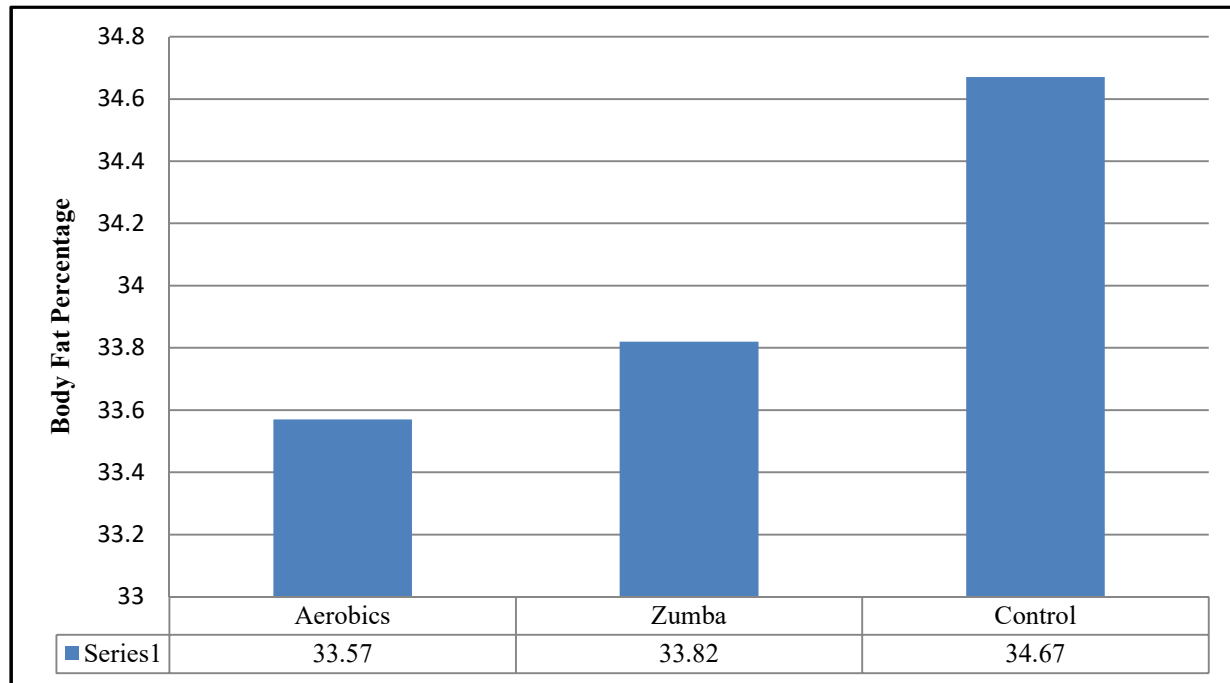
The value of the mean (unadjusted) and standard deviation for the data on Body Fat Percentage in Aerobics, Zumba and Control Groups during post test are shown in table 29. The mean value of Body Fat Percentage for Aerobics, Zumba and Control groups are 33.44%±2.88, 34%±8.28, and 34.61%±8.11 respectively.

Adjusted means for data on Body fat Percentage of different groups during post test shows in table 2.

**TABLE 2**  
**ADJUSTED POST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN BODY FAT PERCENTAGE**

Groups	95% Confidence Interval			
	Mean	Std. Error	Lower Bound	Upper Bound
Aerobics	33.571 <sup>a</sup>	0.13	33.31	33.84
Zumba	33.818 <sup>a</sup>	0.13	33.55	34.08
Control	34.668 <sup>a</sup>	0.13	34.40	34.93

a. Covariates appearing in the model are evaluated at the following values: Body Fat % pretest = 34.5911.



**Figure 1: Graphical representation of the Adjusted mean on Body Fat percentage.**

In table 3 (test between subject) shows that the F- value for the groups during post test. Since p- value of groups is less than 0.05 level of significance, which indicate that there is significant difference in adjusted means of Body Fat Percentage between 3 groups.

**TABLE 3**  
**ANALYSIS OF CO-VARIANCE OF COMPARISON OF ADJUSTED POST TEST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN BODY FAT PERCENTAGE**

Source	Type I Sum of Squares	df	Mean Square	F	p value
Corrected Model	5004.532 <sup>a</sup>	3	1668.18	3112.92	0
Intercept	104155.63	1	104155.63	194360.82	0
Pre_Fat_Perc	4984.66	1	4984.66	9301.68	0
Groups	19.87	2	9.94	18.54	0
Error	46.09	86	0.54		
Total	109206.25	90			
Corrected Total	5050.62	89			

a. R Squared = .991 (Adjusted R Squared = .991)

Since, the analysis of covariance for Body Fat Percentage score was found significant difference among the groups. Therefore post hoc comparison LSD test was applied and is presented in table number 4.

**TABLE 4**  
**POST HOC COMPARISON (LSD) OF ADJUSTED POST TEST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN BODY FAT PERCENTAGE**

(I) Groups	(J) Groups	a				
		Mean Difference (I-J)	Std. Error	p value. <sup>a</sup>	95% Confidence Interval for Difference <sup>a</sup>	
					Lower Bound	Upper Bound
<b>Aerobics</b>	Zumba	-.247	0.19	0.20	-0.62	0.13
	Control	-1.097*	0.19	0.00	-1.47	-0.72
<b>Zumba</b>	Aerobics	.247	0.19	0.20	-0.13	0.62
	Control	-.850*	0.19	0.00	-1.23	-0.47
<b>Control</b>	Aerobics	1.097*	0.19	0.00	0.72	1.47
	Zumba	.850*	0.19	0.00	0.47	1.23

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

\*. The mean difference is significant at the .05 level.

Table 4 indicates that there is no significant difference between Aerobics and Zumba, because the p- value is .195 which is more than 0.05 level of significance. There is significant difference between both Aerobics and Zumba group with control group (p=.000), in both case p- value is less than 0.05 level of significance.

Considering the adjusted mean values of Aerobics and Zumba group it shows that Aerobics groups (33.82%) was a little better to zumba group (33.82%) following after twelve week treatment.

Aerobics and Zumba groups improve significantly in Body fat Percentage following twelve weeks treatment. The adjusted pre training Body Fat percentage was 34.5911%. After twelve weeks Aerobics and Zumba training, the adjusted post mean of Body Fat Percentage were 33.571%+-0.13 and 33.818%+-0.13 for Aerobics and Zumba group respectively. This shows an average decrease of 2.949% and 2.234% for Aerobics and Zumba group respectively.

**TABLE 5**  
**DESCRIPTIVE STATISTICS OF POST-TEST OF AEROBICS, ZUMBA AND CONTROL GROUP IN MUSCLE MASS PERCENTAGE**

Groups	Mean	Std. Deviation	N
Aerobics	32.98	3.17	30
Zumba	32.62	4.10	30
Control	31.82	4.12	30
<b>Total</b>	<b>32.47</b>	<b>3.81</b>	<b>90</b>

The value of the mean (unadjusted) and standard deviation for the data on Muscle Mass Percentage in Aerobics, Zumba and Control Groups during post test are shown in table 5. The mean value of Muscle Mass Percentage for Aerobics, Zumba and Control groups are 32.98%+-3.17 and 32.62%+- 4.10 respectively.

Adjusted means for data on Muscle Mass Percentage of different groups during post test shows in table 6.

**TABLE 6**  
**ADJUSTED POST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN MUSCLE MASS PERCENTAGE**

Groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Aerobics	32.715 <sup>a</sup>	.124	32.47	32.96
Zumba	32.644 <sup>a</sup>	.124	32.40	32.89
Control	32.056 <sup>a</sup>	.124	31.81	32.30

a. Covariates appearing in the model are evaluated at the following values: Muscle Mass % Pretest = 32.0544.

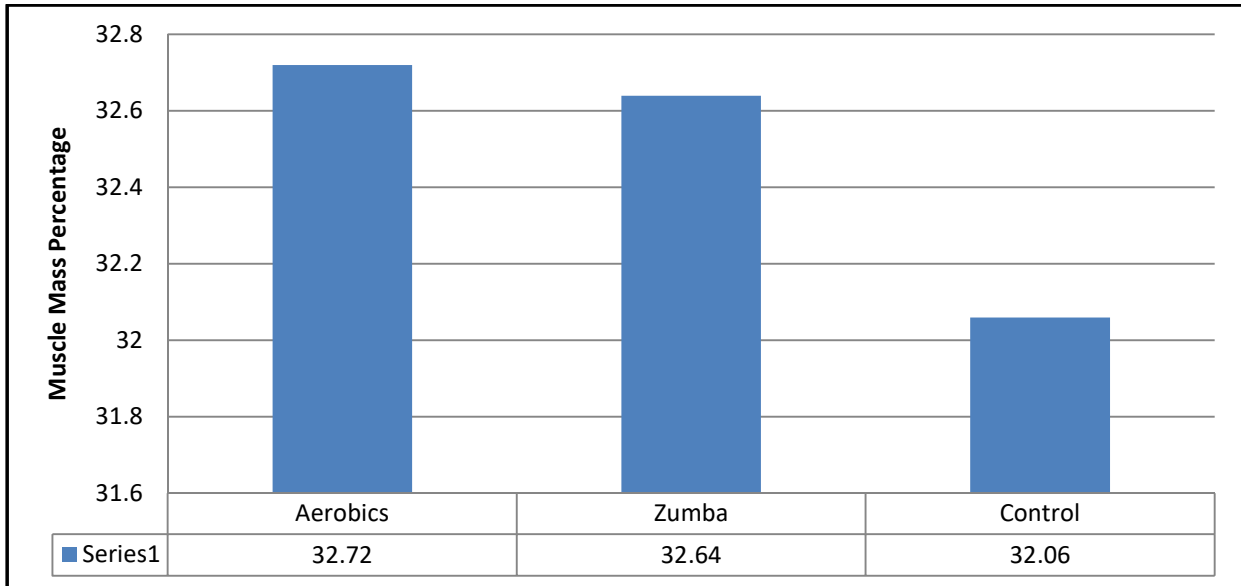


Fig. 2: Graphical representation of the adjusted mean on Muscle mass Percentage.

In table 7 (test between subjects) shows that the F-value for the groups during post tests. Since p- value of groups is less than 0.05 level of significance, which indicate that there is significant difference in adjusted means of Muscle Mass Percentage between 3 groups.

**TABLE 7**  
**ANALYSIS OF CO-VARIANCE OF COMPARISON OF ADJUSTED POST TEST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN MUSCLE MASS PERCENTAGE**

Source	Type I Sum of Squares	df	Mean Square	F	p value
Corrected Model	1253.547 <sup>a</sup>	3	417.85	909.40	.000
Intercept	94898.12	1	94898.12	206535.74	.000
Muscle_Perc_Pre	1245.72	1	1245.72	2711.19	.000
Groups	7.82	2	3.91	8.51	.000
Error	39.52	86	.459		
Total	96191.18	90			
Corrected Total	1293.06	89			

a. R Squared = .969 (Adjusted R Squared = .968)

Since, the analysis of covariance for Muscle Mass Percentage score was found significant difference among the groups. Therefore post hoc comparison LSD test was applied and is presented in table number 8.



**TABLE 8**  
**POST HOC COMPARISON (LSD) OF ADJUSTED POST TEST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN MUSCLE MASS PERCENTAGE**

(I) Groups	(J) Groups	a				
		Mean Difference (I-J)	Std. Error	p value <sup>a</sup>	95% Confidence Interval for Difference <sup>a</sup>	
					Lower Bound	Upper Bound
<b>Aerobics</b>	Zumba	0.07	0.18	0.69	-0.28	0.42
	Control	.659*	0.18	0.00	0.31	1.01
<b>Zumba</b>	Aerobics	-0.07	0.18	0.69	-0.42	0.28
	Control	.588*	0.18	0.00	0.24	0.94
<b>Control</b>	Aerobics	-.659*	0.18	0.00	-1.01	-0.31
	Zumba	-.588*	0.18	0.00	-0.94	-0.24

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

\*. The mean difference is significant at the .05 level.

Table 8 indicates that there is no significant difference between Aerobics and Zumba, because the p- value is .686 which is more than 0.05 level of significance. There is significant difference between both Aerobics and Zumba with control group (p=.000), in both case p- value is less than 0.05 level of significance.

In the present study Aerobics and Zumba group improved significantly in Muscle Mass Percentage following after twelve weeks treatment. Statistically it may not be mentioned that which group is better than that of other, but considering the adjusted mean vale of Aerobics (32.715%) was a little better to Zumba (32.644%) group for improving Muscle Mass Percentage following twelve weeks treatment. The adjusted pre training Muscle Mass Percentage was 32.05%. After twelve weeks Aerobics and Zumba Treatment the post mean of Muscle Mass Percentage were 32.715%+-0.124 and 32.644%+-0.124 for aerobics and zumba group

respectively. This shows an average improvement of 2.06% and 1.84% for Aerobics and Zumba group respectively.

**TABLE 9**  
**DESCRIPTIVE STATISTICS OF POST-TEST OF AEROBICS, ZUMBA AND CONTROL GROUP IN BONE DENSITY**

Groups	Mean	Std. Deviation	N
<b>Aerobics</b>	10.92	0.44	30
<b>Zumba</b>	10.95	0.44	30
<b>Control</b>	10.69	0.25	30
<b>Total</b>	10.85	0.40	90

The value of the mean (unadjusted) and standard deviation for the data on Bone Density in Aerobics, Zumba and Control Groups during post test are shown in table 9. The mean values of Bone Density for Aerobics, Zumba and Control groups are 10.92 gm/cm<sup>2</sup>+-0.44 and 10.95 gm/cm<sup>2</sup>+-0.44 respectively.

Adjusted means for data on Bone Density of different groups during post test shows in table 10.

**TABLE 10**  
**ADJUSTED POST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN BONE DENSITY**

Groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Aerobics	10.886 <sup>a</sup>	.015	10.86	10.92
Zumba	10.919 <sup>a</sup>	.015	10.89	10.95
Control	10.752 <sup>a</sup>	.015	10.72	10.78

a. Covariates appearing in the model are evaluated at the following values: Bone Density Pretest = 10.7844.

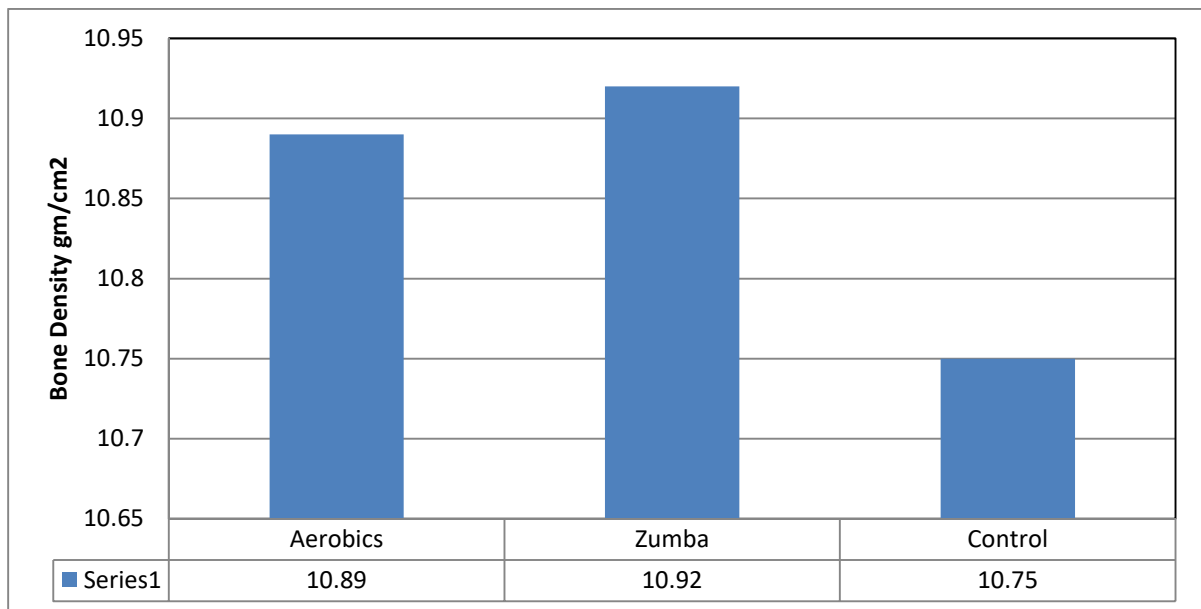


Fig. 3: Graphical representation of the adjusted mean on Bone Density.

In table 11 (test between subjects) shows that the f-value for the groups during post tests. Since p- value of groups is less than 0.05 level of significance, which indicate that there is significant difference in adjusted means of Bone Density between 3 groups.

**TABLE 11**  
**ANALYSIS OF CO-VARIANCE OF COMPARISON OF ADJUSTED POST TEST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP IN BONE DENSITY**

Source	Type I Sum of Squares	df	Mean Square	F	p value
Corrected Model	13.712 <sup>a</sup>	3	4.57	663.80	.000
Intercept	10599.37	1	10599.37	1539302.99	.000
Pre_BMD	13.25	1	13.25	1924.40	.000
Groups	0.46	2	0.23	33.50	.000
Error	0.59	86	0.01		
Total	10613.67	90			
Corrected Total	14.31	89			

a. R Squared = .959 (Adjusted R Squared = .957)

Since, the analysis of covariance for Bone Density score was found significant difference among the groups. Therefore post hoc comparison LSD test was applied and is presented in table number 12.

**TABLE 12**  
**POST HOC COMPARISON (LSD) OF ADJUSTED POST TEST MEANS OF AEROBICS, ZUMBA AND CONTROL GROUP**  
**IN BONE DENSITY**

(I) Groups	(J) Groups	a				
		Mean Difference (I-J)	Std. Error	p value <sup>a</sup>	95% Confidence Interval for Difference <sup>a</sup>	
					Lower Bound	Upper Bound
<b>Aerobics</b>	Zumba	-.033	0.02	0.13	-0.08	0.01
	Control	.134*	0.02	0.00	0.09	0.18
<b>Zumba</b>	Aerobics	.033	0.02	0.13	-0.01	0.08
	Control	.167*	0.02	0.00	0.12	0.21
<b>Control</b>	Aerobics	-.134*	0.02	0.00	-0.18	-0.09
	Zumba	-.167*	0.02	0.00	-0.21	-0.12

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

\*. The mean difference is significant at the .05 level.

Table 12 indicates that there is no significant difference between Aerobics and Zumba, because the p- value is .126 which is more than 0.05 level of significance. There is significant difference between both Aerobics and Zumba with control group (p=.000), in both case p- value is less than 0.05 level of significance.

In this study Aerobics and zumba group improved significantly in Bone Density following twelve weeks treatment. After considering the adjusted mean value of Aerobics (10.866) is less good to Zumba (10.919) group.

The adjusted pre training Bone Density mean was 10.78 gm/cm<sup>2</sup>. After twelve weeks Aerobics and Zumba training the post mean of bone density were 10.866 gm/cm<sup>2</sup>+0.015 and 10.919 gm/cm<sup>2</sup>+0.015 for Aerobics and Zumba group respectively. This shows an average improvement of 0.756% and 1.248% for Aerobics and Zumba group.

#### 4. Discussion of Findings:

##### Body Fat Percentage

Body Fat Percentage can be calculated, Total mass of Fat / Total body mass multiples by 100. Fat includes storage Fat and Essential Fat. In average women essential body fat (10-13%) is higher than that of men (2-5%). It is important to maintain for physiological needs and organs to functions. Body fat is important for an individual's health, but too much and too less body fat can be unhealthy.

Body Fat percentage gives an accurate measure of fitness than weight alone. Loosening storage fat is good for health but not muscle mass. Sometimes it is found a high percentage of fat even when a scale indicates at a normal weight.

**Table 13**  
**Body Fat Percentage (women)**

Rating	20-29	30-39	40-49	50-59	60 plus
<b>Low</b>	Less than 19	Less than 20	Less than 21	Less than 22	Less than 23
<b>Normal</b>	20-28	21-29	22-30	23-31	24-31
<b>Mod. High</b>	26-31	30-32	31-33	32-33	33-35
<b>High</b>	31 plus	32 plus	33 plus	34 plus	35 plus

(University of Illinois department of food science and nutrition. Body fat percentage calculator.)

Angappan, Ranjan (2000) conducted a study on Body Fat Percentage .Total 105 (N=105) female students were randomly selected for this study. 10 weeks treatment was given to the experimental group. Study concluded that 10 weeks treatment can significantly decreases the Body Fat Percentage of college women students.

In this study, Aerobics and Zumba groups improved significantly in Body fat Percentage following twelve weeks treatment. So the hypothesis stated earlier is rejected.

The adjusted pre training Body Fat percentage was 34.5911%. After twelve weeks Aerobics and Zumba training, the adjusted post mean of Body Fat Percentage were 33.571%±0.13 and 33.818%±0.13 for Aerobics and Zumba group respectively. This shows an average decrease of 2.949% and 2.234% for Aerobics and Zumba group respectively.

**Muscle Mass Percentage:**

Muscle is a soft tissue. The Mesoderm layer of embryo is produce muscle. There are three types of muscles; Skeleton muscles, Cardiac muscle and Smooth muscle. Skeletal muscles can moves voluntarily, where Cardiac muscle and Smooth muscle does not move voluntarily. Cardiac muscle found only in heart. Smooth muscles found only in visceral organs like kidney, pancreas etc. Skeletal muscle is responsible for locomotion and movements. Skeletal muscle can be further divided into two types; slow twitch or red muscle- carry more oxygen and sustain aerobic activity for a long period of time. Second type is fast twitch or white muscle, can contract very rapidly. For an example, the individuals who carry more white fibers they can run very fast. But a drawback is there, lactic acid accumulation is also faster, result, it becomes fatigue very rapidly.

A muscle can move only when an electrical impulse comes from brain across the nerves. Finally the nerves join a group of muscles. The join is called neuromuscular junction. The nerve and the group of muscle make a unit called motor unit. The impulse from brain arrives at the junction and start some biochemical process only after then a muscle can move. Muscle is important in a healthy body as it store ATP, the fuel for movements. Many researches show that due to lack of physical activity one could be losing muscle mass. According to American College of Sports Medicine muscle mass may decrease nearly 50 percentages between the ages of 20 to 90 years.

Muscle is one of the parts of lean body mass. Lean body mass includes muscles, bone, tissues and water in body. Shortly it is the sum total of all except the body fat. Calculating muscle mass percentage allow to determine how much total body weight is lean body mass versus how much is body fat. The percentage equation also helps to determine actual lean body weight.

**Table 14**  
**Women Muscle Maas Percentage**

Age (year)	Low	Normal	High	Very high
18- 39	Less than 24.3	24.3 - 30.3	30.4 - 35.3	More than 35.4
40-59	Less than 24.1	24.1 - 30.1	30.2 - 35.1	More than 35.2
60-80	Less than 23.9	23.9 - 39.3	39.4 - 44	More than 44.1

Omron Healthcare reported.

In the present study Aerobics and Zumba group improved significantly in Muscle Mass Percentage following after twelve weeks treatment. So the hypothesis stated earlier is rejected.

Statistically it may not conclude that which group is better than that of other, but considering the adjusted mean vale of Aerobics (32.715%) was a little better to Zumba (32.644%) group for improving Muscle Mass Percentage following twelve weeks treatment.

The adjusted pre training Muscle Mass Percentage was 32.05%. After twelve weeks Aerobics and Zumba Treatment the post mean of Muscle Mass Percentage were 32.715%±0.124 and 32.644%±0.124 for aerobics and zumba group respectively. This shows an average improvement of 2.06% and 1.84% for Aerobics and Zumba group respectively.

**Bone Density:**

Bones appear to be the most lifeless of body organs, and may even summon images of a graveyard. But as you have just learned, bone is a dynamic and active tissue, and small-scale changes in bone architecture occur continually. Every week we recycle 5-7% of our bone mass, and as much as half a gram of calcium may enter or leave the adult skeleton each day! Spongy bone is replaced every three to four years; Compact bone, every ten years or so. This is fortunate because

when bone remain in place for long periods more of the calcium salts crystallize and the bone becomes more brittle-ripe conditions for fracture.

When we break bones- the most common disorder of bone homeostasis- they undergo a remarkable process of self repairs. (pp-187)

Weight bearing exercise (walking, jogging, tennis, etc) throughout life this will increase bone mass above normal values and provide a greater buffer against age related bone loss. (pp193)

(Elaine N. Marieb, Katja Hoehn. Human Anatomy and Physiology, ninth edition, )

Marzieh Shafiei Zargar(2014) studied "Effect of Pilates Exercise on Bone mineral density and Balance among sedentary girls where the researcher found 24 weeks Pilates exercise can improve bone mineral density significantly.

In this study Aerobics and Zumba group improved significantly in Bone Density following twelve weeks treatment. So the hypothesis stated earlier is rejected.

After considering the adjusted mean value of Aerobics (10.866) is less good to Zumba (10.919) group for improving bone mineral density.

The adjusted pre training Bone Density mean was 10.78 gm/cm<sup>2</sup>. After twelve weeks Aerobics and Zumba training the post mean of bone density were 10.866 gm/cm<sup>2</sup>+0.015 and 10.919 gm/cm<sup>2</sup>+0.015 for Aerobics and Zumba group respectively. This shows an average improvement of 0.756% and 1.248% for Aerobics and Zumba group respectively.

## 5. Conclusion:

Body Fat Percentage was decrease significantly after twelve weeks Aerobics and Zumba training for working women. No superiority was observed in decreasing Body Fat Percentage due to Aerobics and Zumba treatment.

Significant improvement was observed in Muscle Mass Percentage among women following twelve weeks Aerobics and Zumba training. No superiority was observed in improving in Muscle Mass Percentage due to Aerobics and Zumba treatment.

Bone density improved significantly after twelve weeks Aerobics and Zumba treatment among women. Neither treatment was superior for improving bone density following twelve weeks Aerobics and Zumba treatment.

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