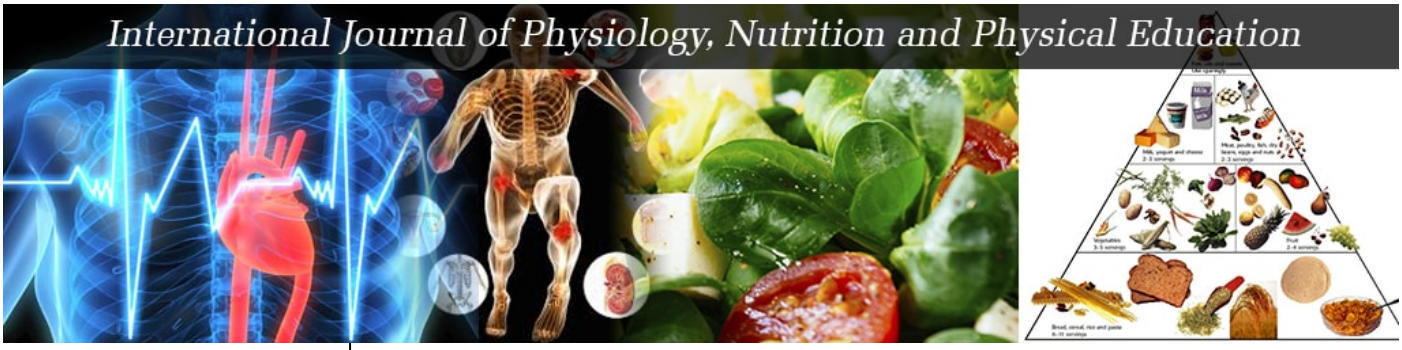

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Combined effect of aerobic dance and resistance training on weight control, body fat percentage and cardio respiratory fitness in obese male software professionals

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Abstract
Obesity has reached epidemic proportion in both developed and developing countries in the world. Physical inactivity is a contributing factor for obesity epidemic. Studies have done to investigate the independent effect of aerobic and resistance exercise training on obesity. However, there are no sufficient evidences to explain the combined effect of aerobic and resistance exercise in a workout on obesity. The aim was to assess the effect of combined aerobic and resistance exercise training (CART) on weight control and body composition, blood and metabolic variables, muscle strength and cardio respiratory fitness in obese men software professional. We examined the 12 weeks combined aerobic dance and resistance exercise training on 30 obese men (mean age 30.2±4.4). Baseline and after12 weeks training test included anthropometric, Body composition, fasting blood glucose and total cholesterol, blood pressure, VO2max and muscular strength (1RM) were done by using standard techniques. Incremental treadmill running test protocol and 1 RM were employed for VO2max and strength test. Data was analyzed by using SPSS statistical package software (version 17.0 for window). Paired sample T test was employed for pre and post-test difference assessment. After 12 weeks training significant (p<0.001) reduction was observed on body weight (6.1%), BMI (6.3%), body fat percentage (11.6%),Visceral fat(10.8%), systolic BP (1.97%), blood pressure, Fasting blood glucose (5.9%) and total cholesterol (4.3%). The intervention brought significant (p<0.001) greater change on Skeletal muscle percentage (10.4%), VO2max (71.5%) and on 1RM (26.3%,) from baseline. In conclusion, intervening CART in every training session brought significant improvement on weight loss and body fat control, Fasting Blood Glucose and Total cholesterol. Moreover, significant parallel improvement on cardio-respiratory and muscular strength fitness was resulted due to combined exercises intervention. Combining the two types of exercises in a session gives a chance the participants to enhance their aerobic and strength fitness simultaneously.

Keywords: Intervention, aerobic exercise, resistance exercise, combined exercise, obesity.

Introduction
Obesity is a serious public health problem in both developed and developing countries. According to world health organization, Overweight and obesity, had taken the fifth rank of leading risk factors cause of death in 2014. A healthy body requires a minimum amount of fat for the proper functioning of the hormonal, reproductive, and immune systems. Fat is essential for physiological homeostasis, not only as a source of energy but also to synthesize cell membranes and facilitate intracellular reactions. Fats play a vital role in maintaining healthy skin and hair, insulating body organs against shock, maintaining body temperature, promoting healthy cell function and serve as energy stores for the body. Despite the fact that fat is required for the proper functioning of our body, too much storage of fat above the required amount can cause the rise of metabolic abnormalities called metabolic syndrome.
Being obese refers to an excess accumulation of body fat, which is defined by a Body Mass Index of 30 and above. Body mass index (BMI) is the method used to assess the body fat content which is defined as a person's weight in kilograms divided by the square of height in meters. Based on fat distribution obesity classified in to general and abdominal obesity. General obesity is characterized by the distribution of fat to all parts of the body and

Abdominal (central) obesity is the excessive accumulation of fat in the abdominal region which resulting in an increase of waist size. A central distribution of body fat is associated with a higher risk of morbidity and mortality than a more peripheral distribution. Most obesity expert considered that abdominal body fat is the main predictor of obesity-related disease especially metabolic disorder and cardiovascular disorder. Persons become overweight or obese as they get older, which is associated with a decrease in physical activity and basal metabolism, and a body fat redistribution to the abdominal area.

Urbanization, industrialization and globalization are today contributes for the socioeconomic change in the society. Lifestyle change, Dietary habits change and reduction in physical activity are the associated outcomes which contribute for the increasing prevalence of obesity in Kerala especially in the urban areas. These changes associated with urbanization and industrialization has got no attention due to the fact that attention has given to infectious and communicable diseases. To date, physical activities have not received much importance in the daily life of the urban population. Awareness towards the healthy effect of regular physical activity has not created in the people so that it is considered only for sport competition, rather than an integral part of healthy living amongst the general public. To the author's knowledge no studies have conducted in Kerala to evaluate the effect of combined aerobic and resistance exercise training on obesity.

Aerobic dance training is characterized by the execution of cyclic exercises that carried out with large muscle groups contracting at mild to moderate intensities for a long period of time with the presents of oxygen. On the other hand resistance exercise training is characterized by the execution of exercises in which muscles from a specific body segment are contracted against a force that opposes the movement. Substantial documented evidences have shown that Aerobic dance and Resistance exercise trainings have independent effects on obesity. But limited studies were conducted in developed countries to examine the effect of aerobic and resistance exercise combination in a training program on obesity. The combination of exercise in the training programme was in different days. There is no study conducted on this issue in Kerala. Therefore, it needs to be tested in the Kerala context because there are differences in lifestyle, genetic variations, environment and demographic characteristics.

Objectives of the study

This study aims to determine

- To study the effect of combined aerobic dance and resistance exercise training on body weight, body fat percentage, systolic and diastolic blood pressure, fasting blood glucose and total cholesterol on inactive obesity male software professionals.

Limitation of the study

There are limitations in our study. One limitation is that there was no control group to compare the effect of the intervention with the non exerciser (control). The second limitation was only total cholesterol test value was used for analysis due to incomplete data of the other lipid components.

Methodology

This study was conducted in Trivandrum city, kerala. For the purpose of the study 30 Obese software professional (men) whose BMI > 30 and who have had no regular participation in physical exercise training for six months before the study were selected. Individuals who ever with heart disease, pulmonary disease, uncontrolled hypertension, kidney failure, musculoskeletal and/or neurological limitations to exercise and those who were participating in another research study were excluded. Prior to the start of the training programme orientation was given to the participants on the overall activities they performed. During the first two visits all subjects were familiarized with the training as well as the equipments. The subjects were given 12 week combined aerobic dance and resistance training. All the subjects were performed four exercise sessions per week; three supervised by the investigators in the research Fitness center and one performed at home or in a gym, according to instructions. In every workout both aerobic and resistances exercises were combined. Sequentially, aerobic dance exercises were given first and resistance exercises followed.

All workouts were preceded by a 10 minute warm which consisted of stretching of the major muscle groups and slow walking around the gym. There after the participants were instructed to perform aerobic-dance for 15 minutes. Aerobic dance intensity was adjusted based on maximum heart rate (220 - age = MHR). Table-1 shows the timeline of the intervention. For the first two weeks the target intensity was 50-60% of maximum heart rate (MHR). From the 3rd week onwards, the intensity progressively increased to moderate level 60-85% MHR. 15 minute was given for the first two weeks and increased to 20 minute from the third week onwards. The exercise program consisted of aerobic-dance activities and other exercises accompanied by music. Aerobic dance is based on walking and step variations, knee bends, lunges (low impact aerobics), running, skipping and hopping (high impact) and their combination (low-high impact); this exercise was accompanied by the controlled movement of the arms.

Immediately after the completion of aerobic dance exercise the participants are directed to Resistance exercise training. For the purpose of the study Circuit training was employed. Subjects were guided to perform sensible resistance exercise with major body muscles. Sensible resistance training is characterized by lifting lighter weights for a higher number of repetitions, moving continuously and breathing throughout each exercise. Seven different exercises (Upper body: biceps curl, bench press; Core body: sit-ups or curl-up; Lower body: squat, leg press, leg extension, leg curl) were conducted by using dumbbells, weight bench, and multipurpose studio-6 equipment. A one repetition of the maximum (1RM) was used to assess loading capabilities for each Subject. After two weeks of familiarization both the intensity, duration of a session and frequency per week were increased. From the third week onwards number of session was increased to four times per week which was arranged for every other day. After each session subjects were given cool down exercise followed by seated rest.

All tests and measurements described below were performed before and after the training period. The test was done in the morning in similar time of a day. Tests were made according to the standard.

Collection of data

Data was collected through Anthropometric measurements which was done by using standardized technique and calibrated equipments. Body composition (Body fat percentage, skeletal muscle percentage, subcutaneous fat percentage, and visceral fat) and resting blood pressure

(systolic and diastolic) were taken by using sensitive body composition analyzer and Mercury sphygmomanometer respectively. Fasting blood glucose and total cholesterol level were analyzed by using Life scan glucometer and AMS Vegasys Blood chemistry analyzer. The test were done in the morning after at least eight hour fasting.

Table 1: Timeline of intervention

Duration (week)	Workout time line(in minutes)					Frequency/week	Intensity
	Warm-up	Aerobic dance	Anaerobic dance	cool down	Seated resting		
1st and second week	10	10-25	25-40	40-45	45-50	3	Aerobic-50-60% mHR Anaerobic 30-50% 1RM 1-2 set 5-8 repetition. 6 exercise
3rd week and 12 week	10	10-30	30-50	50-55	55-60	4	Ae-60-85% m HR Anaerobic 50-60% 1RM 2-3 set 8-12 repetition. 7 exercise

AE-aerobic dance, RE-resistance exercise, mHR-maximum heart rate, RM-repetition Maximum

Statistical Analysis and data Interpretation

The statistical computation of the data was analyzed by using SPSS statistical package software (version 20.0). Descriptive statistics (mean and standard deviation) was used to analyze continuous variables. Paired sample T test was used to compare the difference between baseline and after 12 weeks intervention. Differences were considered statistically significant at p-values < 0.05. Pearson correlation coefficient was used to assess the relationship between body composition and metabolic parameters at baseline.

Results and Discussion

Results: A total of 30 (85.7%) adult obese subjects (age 45.2±5.4 y; weight 86.8 ± 3.0 kg; BMI 30.4 ± 0.7 kg/m2,) were completed the 12 weeks intervention study. The descriptive characteristics of the subjects at baseline and after 12 weeks are summarized in table 2. A paired sample T test between baseline and after training was done. After 12 weeks intervention statistically significant changes were observed in all variables from baseline.

Anthropometric and body compositions outcomes

At the end of the training programme, significant (p<0.001) reduction from baseline was observed on body weight (6.1%), waist circumference (3.8%) and waist-hip ratio (2.9%), body fat% (11.2%), subcutaneous fat% (8.6%), visceral fat (10.8%). Given the reductions on the above variables, an increasing of records from baseline was observed on skeletal muscle% (10.4%, p<0.001). Cardio vascular and metabolic variables change: At the end of the training statistically significant(p<0.001) reduction was observed on systolic blood pressure (1.97%) and diastolic blood pressure (1.8%), resting heart rate (2.1%), fasting blood glucose (5.9%) and total cholesterol (4.3%).

Cardio-respiratory and muscular strength outcomes

Table2 shows the means value for treadmill running time, VO2max and total one repetition maximum at baseline and after training. After the 12 weeks intervention of combined aerobic and resistance exercises training, significant (p<0.001) greater change was observed on treadmill running time (59.5%), Vo2max (71.5%) and total 1RM (26.3%).

Baseline correlations between variables

As it is depicted in table-3, Substantial positive correlations were observed between systolic BP and body mass index (r=0.507, p<0.01), between fasting blood glucose and waist circumference (r=0.552, p<0.01), between fasting blood glucose and body fat percentage (r = 0.564, p <0.01) and between total 1RM and skeletal muscle percentage (r= 0.570, p < 0.001). High negative correlation was observed between total 1Repetion maximum and subcutaneous fat (r= -0.710, p < 0.001). Substantial studies have documented that independently both aerobic exercise training and resistance exercise trainings have made significant changes on body weight and body composition variable in obese individuals. Exercises have been useful as a way of controlling body weight. In our study a 12 weeks intervention of combined aerobic dance and resistance exercise training showed significant lowering changes on body weight, body mass index, waist circumference, percent body fat, fasting blood glucose, total cholesterol, systolic and diastolic blood pressure. Baseline and after 12 weeks training test variable has shown in table-2.

Table 2: Baseline and after 12 weeks exercise training changes of all variables

Variable	Base line	After 12 weeks	Mean difference	Change (%)
Age. in year	30.2 ±4.4	nil	nil	nil
Subject, N(M)	30(27/3)	nil	nil	nil
Anthropometric and body composition				
Weight kg	68 ±3.0	81.46 ±2.96 *	5.32 ±1.2	6. 1
Waist circumference(cm)	111 ±2.7	106.7 ±2.7 *	4.2 ±1.1	3.8
Waist – hip ratio	1.05 ±0.04	1.01 ±0.04 *	0.03 ±0.01	2.9
BMI	30.4 ±0.7	28.5 ±0.7 *	1.9 ±0.5	6.3
Body fat percentage	37.2 ±3.3	32.8 ±3.2 *	4.3 ±1.1	11.6
Skeletal muscle%	27.0 ±1.9	29.8 ±2.1 *	2.8 ±0.9	10.4
Subcutaneous fat%	25.6 ±4.6	23.5 ±4.4 *	2.2 ±0.6	8.6
Visceral fat	15.7 ±1.9	14.0 ±1.7 *	1.7 ±0.6	10.8
Cardiovascular and metabolic variables				
Systolic BP(mmHg)	126.4 ±5.8	123.9 ±5.2 *	2.5 ±1.7	1.97
Diastolic BP(mmHg	81.3 ±3.8	79.8 ±3.9 *	1.5 ±0.9	1.8
Resting heart rate(bpm)	70.1 ±3.6	68.8 ±3.9 *	1.4 ±0.7	2.1

Fasting BG(mg/dl)	107.4 ±6.4	101.1 ±4.7 *	6.2 ±3.2	5.9
Total cholesterol(mg/dl)	194.9 ±16.2	186.7 ±12.8 *	8.3 ±4.8	4.3
Cardio respiratory and strength capacity				
Running time(minutes)	8.9 ±0.74	14.0 ±0.8 *	5.3 ±0.9	59.5
VO2 max(ml/min/kg)	30.5 ±2.9	51.9 ±3.5 *	21.8 ±4.4	71.5
Total 1RM(kg)	55.3 ±6.0	69.8 ±7.1 *	14.5 ±3.5	26.3

Data is presented in mean ± SD. M/F-male/female, RM-repetition maximum, BMI- body mass index, BG-blood glucose, VO2maxvolume of maximum oxygen consumption. *p<0.001 vs. baseline

Table 3: Baseline Pearson product moment correlation of body composition with cardiovascular, metabolic variable and aerobic and strength capacity

Variable	Age	weight	BMI	WC	WHR	BF	SKM	SCF	VF
Systolic BP	.414*	.304	.507**	.263	.355	.243	-.157	.091	.109
Sig. (2-tailed)	0.23	.102	.004	.160	.054	.195	.406	.633	-.566
Diastolic BP	.412*	.090	.436*	.218	.129	.395*	-.475**	.285	-.145
Sig. (2-tailed)	.024	.638	.016	.248	.498	.031	.008	.127	.445
Resting HR	-.499**	-.407*	-.385*	-.221	.014	-.209	.405	-.302	.151
Sig. (2-tailed)	.005	.026	.036	.241	.943	.267	.026	.105	.427
Fasting BG	-.059	.190	.344	.552**	.331	.546**	-.333	.256	.177
Sig. (2-tailed)	.758	.315	.063	.002	.074	.002	.072	.171	-.348
Total cholesterol	-.048	-.031	.152	.336	.140	.186	-.433*	.307	.044
Sig. (2-tailed)	.802	.871	.422	.069	.461	.326	.017	.099	.819
Vo2 max	-.334	.038	-.118	-.177	.021	-.055	.281	-.111	.226
Sig. (2-tailed)	.071	.841	.536	,349	.913	.773	.133	.561	.231
Total 1RM	-.031	.381*	-.019	.297	.086	-.103	.570**	-.710**	.082
Sig. (2-tailed)	.870	.038	.920	.111	.650	.586	.001	.000	.666

*. P< 0.05 level (2-tailed), **. P< 0.01 level (2-tailed). BMI-body mass index, WC-waist circumference, WHR-waist–hip ratio, BF-body fat, SKM-skeletal muscles, SCF-subcutaneous fat, VF- visceral fat, BP-blood pressure, HR-heart rate.

After 12 weeks intervention mean body weight of the group significantly decreased from 86.8±3.0 kg to 81.5±2.96 kg (p<0.001). A 6.1% weight reduction from baseline was observed at the end of the training. Our result supports the weight reduction role of physical activities on obese participants. On this study, the result shows significant weight reduction (7.7%, 10% and 9.7%) in resistance, aerobic and diet only groups respectively.

A paired sample T test was conducted to evaluate the effect of combined aerobic dance and resistance exercise training on waist circumference, waist-hip ratio, and BMI. The result showed significant difference on WC (111±2.7 cm to106±2.7cm, p<0.001), waist-hip ratio (1.05±0.04 to 1.01±0.04, p<0.001) and BMI (30.4±0.7 to 28.5±0.7, p<0.001). The percent reduction from baseline was 3.8%, 2.9% and 6.3% respectively for waist circumference, waist-hip ratio and BMI. Waist circumference is one of the indicators of cardiovascular disorders. In the present study after intervention significant reduction (3.8%, p<0.001) in waist circumference was resulted.

Physical activities have impacts on energy expenditure due to its effect on resting metabolic rate and muscular strength and muscle mass. In the present study after 12 weeks training significant (p<0.001) changes were observed on body composition variables: body fat percentage, subcutaneous fat and visceral fat from baseline records. Conversely, significant (p<0.001) increasing change of skeletal muscle percentage was resulted. Both body weight, waist circumference and body fat percentage showed significant reduction from baseline records. This reduction shows the presence of a positive association between these three variables.

Sedentary lifestyle is one of the risk factors for obesity epidemic. Many studies revealed that physical activities made significant improvement on aerobic performance and strength capacity. Aerobic exercise training mainly focused on aerobic dance performance. In our study, significant (p<0.001) increase in treadmill running time (8.9±0.74 to 14±0.8 minute), VO2max (30.5±2.9 to 51.9±3.5 ml/kg/min) and total 1RM (55.3±6 to 69.8 ±7.1 kg) was observed at the end of the training. Independent studies have conducted to examine the effect of aerobic dance and resistance exercise training. In these studies, aerobic dance group showed greater VO2max and less 1RM record than the resistance group. The present intervention addressed both cardio-respiratory and strength training simultaneously unlike independent aerobic dance and resistance training intervention. The combination of the two training type in a session contributed to the concurrent improvements for aerobic dance performance and Muscular strength capacity to the participants.

Conclusion

Intervening combining aerobic dance and resistance exercise training for 12 weeks resulted significant improvement on body weight, body fat percentage, systolic and diastolic blood pressure, fasting blood glucose and total cholesterol, aerobic performance and muscular strength capacity in obese individuals. Adhering only on one type training (aerobic or resistance) will not be guaranteed to address different health related fitness components concurrently. Based on our study result, it is therefore recommended that obese individuals should perform regular physical training by combining aerobic and resistance exercises so that the body improves both cardio-respiratory fitness and muscular strength capacity simultaneously. Further studies need to be done how the combination of combined exercise training and diet restriction affects body weight and body compositions on obese individuals.

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