



EFFECT OF 24 WEEKS OF RESISTANCE TRAINING ON BODY COMPOSITION IN HEALTHY INDIVIDUALS

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ABSTRACT

Resistance training is gaining importance in weight loss programmes. The objective was to assess the effect of 12-24 weeks of resistance training on the body composition in both males and females. The cross sectional analytical study was performed on 286 participants including 244 males and 42 females in the age range of 18-49 years. All participants took part in a supervised resistance training program (4 - 6 d/week) for the duration of up to 6 months. The anthropometric and body composition parameters (height, weight, fat% & BMI) were measured at base line and periodically. The body composition parameters were measured by bioelectric impedance method. The mean values for each parameter were compared at 0 weeks, 12 week & 24 weeks using one way annova & post hoc test. There was significant decrease in weight, fat% and BMI (p values 0.004, 0.000, 0.001 respectively) in males after 12 weeks of resistance training and the change was more significant after 24 weeks of training (p values 0.001, 0.000, 0.000 respectively for weight, fat % and BMI). In females the change in body weight was not significant after 12 weeks but was significant after 24 weeks of training (p0.048). In case of fat % significant change seen after 12 as well as 24 weeks of training (p0.000, 0.000). With respect to BMI significant change was observed after 24 weeks of training (p0.022). From our study it is evident that 24 weeks of resistance training significantly alter body composition in males as well as female participants.

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INTRODUCTION

The term physical fitness encompasses several individual yet integrated components, including cardiovascular-respiratory fitness, muscular strength and endurance, flexibility, and body composition.(1) The addition of resistance training as a component of fitness and part of a comprehensive fitness program was an important inclusion by American college of sports medicine(ACSM). (2) American heart association (AHA)(3,4) & American association of cardiovascular and pulmonary rehabilitation(AAPCR).(5,6) All recommends strength/resistance training as part of a well-rounded fitness program for both healthy and diseased populations. In addition to resistance training, flexibility exercise has been considered essential for developing and maintaining joint range of motion and functional capacity (7) The ACSM acknowledges the importance of flexibility exercise as an integral component in the comprehensive fitness program (2) The current trend of the comprehensive fitness program including muscular strength and endurance, and flexibility exercises has been shown to be important for developing both fitness and health.(1)

Previous studies found significant reduction in fat % after 8 weeks (8) and 24 weeks of resistance training(9) In a study conducted by K umamaheshwari significant change in weight and fat % was found in high and moderate intensity exercise

groups after 15 weeks of training(10) Some observed increase in body weight(11) & Some showed insignificant change in BMI after resistance training programme (12)

Resistance exercise might be an attractive alternative to aerobic training for obese individuals because of its lower aerobic intensity and the positive feedback from the visible strength gain. Studies investigating the effects of resistance exercise programs on body composition parameters are crucial in designing strategies that provide various intervention options to prevent obesity related disease. Recognizing exercise protocols that are effective in reducing body fat and feasible to be followed by overweight, sedentary and healthy individuals are important.

Moreover very few data is available on the effect of resistance training on body composition in females. Also in case of males we found limited data showing the effect of resistance training on body composition for the period of 24 weeks. Therefore the present study was undertaken to assess the effect of a controlled resistance exercise program alone, without additional dietary intervention or weight loss, on body composition.

MATERIAL & METHODS

In this cross sectional analytical study sample size was calculated considering confidence limit of 5%, confidence

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interval of 95% and mean change in BMI. Participants were selected randomly from the gymnasium who were normal, overweight and obese. Total 356 participants attending the gymnasium in the age group of 18-49 yrs including both males and females volunteered for the study, of which 286 participants completed the study and 70 were dropouts. Exclusion criteria comprised individuals with history of previous surgery, diabetes, hypertension, asthma, cardiopulmonary and musculoskeletal disorders. The written informed consent was obtained from the participants. The study was approved by the institutional ethics committee. For measurement of body composition parameters the participants were called after the fast of 4 hours. The height (cm) was measured with a standing stadiometer and recorded with a precision of 0.1 cm. Weight, Body fat percentage and body mass index was measured by bioelectric impedance method with the help of OMRON HBF 510 Full Body Sensor Body Composition Monitor and scale. All the recordings were taken by the same person in the same experimental set up. All participants took part in a supervised resistance training program (4 - 6 d/week) for

The duration of up to 6 months. The participants were measured at baseline and periodically during the training program for anthropometric and body composition parameters. For all performance tests and training, the participants were familiarized with the technique in a separate session. Their fitness was estimated at starting of the exercise and then periodically at every 1st week of each month thereafter. In the fitness test, for the Muscular endurance, "Push up and "Curl Up" is used. For the Flexibility "Sit and Reach test" is used and for cardiovascular endurance Heart rate is used at resting and after treadmill. (13)

Following grades of exercise were considered as per K11 academy of fitness sciences standardized protocol (14)

Level 1 Novice

Day	Workout	exercises 1: 2-3 sets x 12-15 repeats
1	Strength	quadriiceps : squats l static lunges / leg press calves : standing calf raise hamstrings: hamstrings curls alternate standing leg curls back : lateral pull down l low cable rows chest : bench press l 15 incline db press shoulder : overhead press shoulder internal rotation abdominals: partial crunches upper man / reverse back extension stretches : alternate hand / leg raises full body stretches

Table 2 Level: Beginner

Day	Workout	Exercises 1: 1-2 sets x 12-15 repeats
1	Strength	quadriiceps : squats l leg press calves : standing calf raise hamstrings : hamstring curls alternate standing leg curls back : lateral pull down l seated rows chest : 15 incline db press shoulder : overhead press shoulder external rotation stretches : alternate hand / leg raises 30 leg raise full body stretches

Table 3 level: Intermediate

Day	Workout	Exercises 1: 2-3 sets x 10-12 repeats
1	Lower Body	Quadriiceps : squats l front squats static lunges / leg press Calves : seated calf raise, standing calf raise Hamstrings : hamstrings curls ,full body stretches
2	Upper Body	back : low cable rows lateral pull down l shrugs chest: bench press decline bp shoulder: overhead press, lateral raises external rotation, back extension l full body stretches

Table 4 level: Expert

Day	Workout	Exercises 1: 2-3 sets x 4-6 repeats
1	quadriiceps	quadriiceps : back squats l overhead / front squats l lunges l step ups
2	calves, hamstrings & abdominals	calves : seated calf raise, standing calf raise, tibia raises hamstrings : hamstring curls abdominals : crunches l twisting crunches
3	Pull	back : dead lifts / bentover db rows shrugs l seated rows, prone pull up / prone lateral pull, down supine pull up / supine lateral pull down rear deltoid : prone high rows biceps : bicep curl l hammer curl
4	Push	chest : bench press l decline bp, incline bp shoulder : overhead db / military press lateral raises, l external rotation triceps : parallel bar dips l close grip bp

Table 5 level: Advanced

Day	Workout	Exercises 1 2-3 sets x 8-10 repeats
1	Legs	Quadriiceps : squats l lunges l step ups Calves : seated calf raise Standing calf raise l tibia raises Hamstrings : hamstrings curls
3	Pull	back : deadlifts / bentover db rows shrugs l seated rows prone pull ups / prone lateral pull down supine pull ups / supine lateral pull down rear deltoid : prone high rows biceps : bicep curl l hammer curl
5	Push	chest : bench press l decline bp, incline bp shoulder : overhead press l lateral raises external rotation triceps : parallel bar dips close grip bp

Activity Records: Participants were required to do physical activity as prescribed by trained professional gym trainers. As the physical exercises were arranged as novice, beginner, and intermediate, expert & advanced. Exercise was allotted to the participants as per their status and ability of the physical fitness. For all the groups the instruction was to "Repeat day 1 & 2. Cardio every alternate day and remaining once a week". This regimen is a training guideline designed to maximize performance by minimizing reciprocal inhibition.

As over the time as the participants fitness improved due to the strict continuous exercise module application and they were allotted to next higher level of exercise module. Participants were asked to include specific information regarding the type

of exercise, duration, and intensity in their record. Activity records were checked for any significant changes in activity levels at weeks 0 and on each month (1st week of month).

Training Procedure: The resistance training sessions consisted of total body workouts using a combination of different body weight and power exercises, as well as a variety of exercise equipment (Table 1 to 5). The primary aim was to incorporate exercises at the Novice level (table 1) and once the subject has well acquainted with Novice level then the transition is made to next Beginner level (Table 2), usually this transition requires 4 to 6 weeks, and there after transition is made to Intermediate level and so on.

Statistical analysis

Data analysis was performed using SPSS software. Baseline measures were presented as means and standard deviations. Comparison of means among the population was done by one way analysis of variance (ANOVA) and post hoc test. The significance level was set at (p<0.05)

RESULTS

The baseline measures expressed as mean± sd in case of males were age (28.66±7.28), height (170.7±6.6), weight(71.6±11.5), fat%(22.23±5.68) & BMI(24.55±3.52). Baseline parameters in females were age (29.2±7.48), height (160.8±7.8), weight (66.2±10.7), fat% (27.38±6.08), BMI (25.57±3.81).

There was significant decrease in weight, fat% and BMI (p values 0.004, 0.000, 0.001 respectively) in males after 12 weeks of resistance training and the change was more significant after 24 weeks of training (p values 0.001, 0.000, 0.000 respectively for weight, fat % and BMI).The level of significance for fat% was same at 12(p0.000) as well as 24 (p0.000) weeks as shown in table 1.

In case of female participants the change in body weight was not significant after 12 weeks of training but it was significant after 24 weeks of training (p0.048).In case of fat % significant change seen after 12 as well as 24 weeks of training (p0.000, 0.000).With respect to BMI significant change was seen after 24 weeks of training (p0.022) as shown in table 2.

Table 1 Changes in body composition of male participants at 0, 12 and 24 weeks

Parameter	0 weeks mean±SD	12weeks mean±SD	24weeks mean±SD	P value (0-12 wks)	P value (0-24wks)
Height(cm)	170.7±6.6	170.7±6.6	170.7±6.6	0.993	0.993
Weight(kg)	71.6±11.5	69.1±9.0	68.8±7.8	0.004*	0.001*
Fat%	22.23±5.68	19.64±3.46	18.37±2.43	0.000*	0.000*
BMI	24.55±3.52	23.70±2.58	23.58±2.03	0.001*	0.000*

*P<0.05 significant, BMI:body mass index

Table 2 Changes in body composition of female participants at 0,12 and 24 weeks

Parameters	0 weeks mean±SD	6weeks mean±SD	12weeks mean±SD	P value (0-12 wks)	P value (0-24wks)
Height(cm)	160.8±7.8	160.8±7.8	160.8±7.8	1.000	1.000
Weight(kg)	66.2±10.7	63.3±8.5	62.3±7.8	0.136	0.048*
Fat%	27.38±6.08	22.68±3.84	20.86±3	0.000*	0.000*
BMI	25.57±3.81	24.43±2.74	24.07±2.40	0.083	0.022*

*P<0.05 significant, BMI:body mass index

DISCUSSION

Body composition is not only important for athletes but also for individuals of all ages, gender and ethnic groups.(15) The present study has examined the effect of 12 to 24 weeks of

resistance training on body composition in both male and female participants in the age range of 18-49 years.

High impact activities & aerobic dance cause significantly higher rates of injuries than low impact activities (16) Training with frequency of 3days/week does not produce any significant change in body composition but if performed for 3-5days/week produces changes in body composition(17) It has been shown that the adaptations to resistance training may be retained for several months when training is maintained at reduced level (18)

Michael R Macgugan studied the effect of 8 weeks of resistance training performed for three days per week on 48 overweight and obese children in the age group of 7-12 yrs and found significant decrease in fat %.The change in weight and body mass index was insignificant. (8) Michael S lo conducted the study on 30 healthy male students with mean age of 20.4±1.36. Participants were divided into resistance training group, endurance training group and control group. After a 24 weeks resistance training programme which was performed for three days per week there was a decrease in fat % but the difference was not statistically significant.(9) Fleck *et al* 2006 and Beni2012 respectively also found reduction in fat content after 14 and 8 weeks of resistance training programme.(19,20) Our exercise protocol was very much similar to above mentioned studies. K umamaheshwari studied the effect of moderate and high intensity exercise on obese and overweight volunteers in the age range of 19-35 yrs for 15 weeks. There was significant decrease in weight and fat percentage in both the groups, but was more in high intensity group. (10). Our results are consistent with the above mentioned studies.

Kaukab azeem did not found any significant difference in the BMI of participants after 5 weeks weight training program. The age group was 18-22 years and the training sessions were 5 days per week (12) There was significant increase in body weight of participants after 12 weeks of resistance training in another study. The increase in weight was attributed to increase in lean body mass. (11) Our results are contradictory to them.

Mezghani *et al* and Alberto carvalho found significant decrease in BMI and body fat % after 12 weeks of training. The exercise protocol used was aerobic training by Mezghani (21) and strength training with specific plyometric exercises five days per week session by Alberto carvalho. (22)

In our study weight, fat % as well as BMI all decreased after 12 and 24 weeks of exercise. But the decrease in fat % was same at 12 and 24 weeks in males. In females weight and BMI did not decreased after 12 weeks of training but decreased after 24 weeks of resistance training. Fat% showed significant change at 12 as well as 24 weeks. The decrease in weight of the participants may be because of decrease in fat % and decreased weight had decreased the BMI. The development of muscle tissue after a strength programme seems to increase energy consumption (20) which supports decrease in fat content.

CONCLUSION

From our study it is evident that even 12 weeks of resistance training is sufficient to decrease the fat% in both males and females. But in case of females 24 weeks training is required to decrease weight and on the contrary BMI. We believe our results will have strong implications and contribute to weight

reduction programmes. From the results of this study it is clearly demonstrated that the resistance training programme was able to produce significant changes in body composition as well as being well tolerated by the participants. Less female participation may be the cause we did not get reduction in fat% in them after 12 weeks of training.

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Conflict of Interest: All authors confirm that there is no conflict of interest with this study or authors.

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