

# REGIONAL BODY COMPOSITION CHANGES IN WOMEN DUE TO RESISTANCE TRAINING

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## INTRODUCTION

Regional body composition changes may be an important consideration for women performing resistance training. Little data concerning this topic is presently available and results are inconsistent with studies showing greater hypertrophy in upper body musculature compared to lower body musculature (Kraemer et al. 2004) and greater hypertrophy in the lower body compared to the upper body musculature (Nindl et al. 2000). The purpose of the present study is to examine changes in regional body composition due to 14 weeks of resistance training and aerobic training in women aged 40-44 years.

## METHODS

Twelve women (mean  $\pm$  SD, age  $41.9 \pm 1.6$  yr, height  $165.4 \pm 7.3$  cm, body mass  $68.1 \pm 12.3$  kg) with at least 6 months of recreational weight training experience performed resistance and aerobic training 3 days per week for 14 weeks. A total body resistance training program (11 exercises) was performed using adjustable cam equipment (Strive Fitness Inc, Canonsburg, Pennsylvania, U.S.A.) for 1 set at each of the settings 1, 2 and 3 for a total of 3 sets of each exercise. The different cam settings of 1, 2 and 3 result in a bell, ascending and descending shaped resistance curve. All resistance exercises were performed using the 10-repetition maximum at cam settings 1 with 1-minute rest periods between sets and exercises. Aerobic training consisted of 20 minutes of either running or cycling at a minimum of 60% of age predicted maximum heart rate. One repetition maximum resistances using cam setting 1 for the bench press, leg press, lat pull-down and overhead press were determined after two weeks of introduction to the prescribed training program, after 7 weeks of training and upon completion of the 14 weeks of training. Total and regional body composition changes were determined after two weeks of introduction to the prescribed training program and upon completion of the training program using dual-energy x-ray absorptiometry (DEXA). The body composition variables analyzed were total body, arm (left + right arm), leg (left + right leg) and trunk % fat, lean tissue (g) and fat (g). Repeated measures ANOVAs were used in the analysis of one repetition maximum strength gains with the Tukey HSD test used as a post hoc test where indicated. Dependent t tests were used in the analysis of total and regional body composition changes. The level of significant for all statistical analyses was  $p \leq 0.05$ .

## RESULTS

One repetition maximum strength significantly increased in all 4 exercises tested from pre-training to the 7-week value and from the 7-week value to the 14 value (Table 1).

Table 1. One Repetition Maximum Changes (kg)

Exercise	Pre-Training Value	7 Week Value	14 Week Value
Bench Press	$40.9 \pm 8.0$	$46.9 \pm 8.2^a$	$51.9 \pm 7.4^{a,b}$
Leg Press	$124.0 \pm 25.8$	$141.7 \pm 27.0^a$	$160.2 \pm 25.2^{a,b}$
Lat Pull-Down	$43.5 \pm 6.8$	$51.1 \pm 8.4^a$	$56.6 \pm 9.4^{a,b}$
Overhead Press	$25.6 \pm 5.0$	$29.0 \pm 6.4^a$	$32.0 \pm 6.2^{a,b}$
Composite	$233.9 \pm 41.6$	$268.5 \pm 43.0^a$	$300.8 \pm 37.0^{a,b}$

a = significantly greater than pre-training value, b = significant greater than 7 week value

Total body mass did not change significantly during the 14 weeks of training. Total % fat was the only % fat variable that significantly changed ( $34.5 \pm 5.6\%$  vs  $32.1 \pm 5.0\%$ ). Total lean ( $40,116.0 \pm 5086.7$  g vs  $42,468.2 \pm 5080.6$  g), arm lean ( $4235.4 \pm 598.1$  g vs  $4429.8 \pm 647.1$  g) and trunk lean ( $20,447.1 \pm 2786.7$  g vs  $20,992.6 \pm 2846.8$  g) tissue all significantly changed pre-to post-training. However, leg lean tissue was not significantly changed due to the training. Neither total fat (g) nor any of the regional fat (g) variables were significantly changed pre-to post-training.

## **DISCUSSION**

The major findings of the present study were the training program employed produced significant and consistent strength gains during the 14 weeks of training and that in this group of women muscle hypertrophy was more apparent in the upper body than the lower body musculature. Significant strength gains (1 repetition maximum) in all exercises tested and composite strength (sum of all 4 exercises tested) significantly increased from pre-training to week 7 and week 7 to week 14 of training. However, slightly greater strength gains were shown during the first 7 weeks of training compared to the last 7 weeks training. For example, during the first 7 weeks of training the composite strength value increased 15 % while during the last 7 weeks of training the composite strength value increased 12 %. The slowing of strength gains as training progresses is in agreement with previous studies.

Total body composition changed positively due to the training. Total % fat decreased significantly and total lean tissue increased significantly from pre- to post-training. The total % fat decrease was due to a significant increase in total lean tissue and a nonsignificant decrease in fat mass. These changes in body composition were also shown in the regional (arms, legs and trunk) body compositions except the regional % fat changes were not significant.

The significant increases in lean arm and trunk tissue and the nonsignificant change in lean leg tissue indicates in this group of women with a mean age 41.9 years muscle hypertrophy was greater in the upper compared to the lower body. This result of smaller changes in muscle hypertrophy in the lower body is in agreement with a previous study 24 weeks in length during which women aged 22-23 years performed both aerobic and resistance training 3 days per week. The women in this previous study demonstrated significant upper-arm muscle cross-sectional area increases ranging from 15% to 19% with thigh muscle cross-sectional area increases, although also significant, ranging from approximately 5% to 9% (Kraemer et al. 2004). The present study's results concerning regional body compositional changes are contradictory to a previous study 24 weeks in length where women with a mean age of 28 years performed resistance and aerobic training 5 days per week. The women in this previous study demonstrated a 31% loss in fat mass but no change in lean tissue of the arms, a 5.5% gain in lean tissue but no change in fat mass in the legs and a 12% fat lose with no change in lean mass in the trunk. The women in the present study were asked not to alter their dietary habits during the 14 weeks of physical training. This may in part account for the nonsignificant changes in fat mass and regional % fat.

## **CONCLUSIONS**

The results indicate the weight training program utilized in the present study results in greater increases in lean tissue of the upper compared to the lower body musculature.

## **REFERENCES**

- (1) Kraemer et al. *Med. Sci. Sports Exerc.* 36:697-708, 2004.
- (2) Nindl et al. *J. Appl. Physiol.* 88:2251-2259, 2000.