

Modest Caloric Surplus Combined with Resistance Training Leads to Healthy Weight Gain in Athletic Individuals



A. Sanchez¹, J. Reynolds¹, E. Marinik¹, B. Davy¹, G. Hunter², D.E. Larson-Meyer¹

¹Department of Human Nutrition, Foods, and Exercise, Virginia Tech, Blacksburg, VA, USA

²Department of Nutrition Sciences, University of Alabama at Birmingham, USA

Abstract

Many athletes and military personnel desire weight gain ideally as lean mass to improve performance and effectiveness in sport and military endeavors. These athletes are commonly encouraged to increase energy intake by ~500 kcal/day with an emphasis on adequate protein (PRO) and carbohydrate (CHO), and judicious inclusion of healthy fat-containing calorically dense foods, including peanuts/peanut butter, along with rigorous resistance training (RT). These guidelines target gains of ~0.23 kg/wk. However, little is known about the efficacy of such regimens, particularly in female athletes. **PURPOSE:** To evaluate the outcomes of a 10-week (wk) diet and exercise regimen designed to promote healthy weight gain. **METHODS:** 32 male (N=19) and female (N=13) athletes (U.S. military, collegiate, club, firefighter, and recreational; previous RT experience) were randomly assigned to receive 500 additional kcal/day above weight maintenance diet through provision of either peanut-based whole foods/snacks (PRO group) or a similar, high-CHO, peanut-free snack (CHO group) along with a supervised RT regimen (3 days/wk for 60-120 minutes targeting major muscle groups). Body composition was assessed by dual-energy x-ray absorptiometry (DXA) at baseline, 3-wk, 7-wk, and post intervention. **RESULTS:** Total body mass (TBM) increased 2.1±1.2 kg (range of -0.9 to 4.4 kg) with 1.5±1.1 kg (range of -0.5 to 3.5 kg) as lean body mass (LBM) after 10-wk. The PRO group (N=16; 27±7 y; 10 men, 6 women) gained less TBM than the CHO group (N=16; 23±3 y; 9 men, 7 women) (1.6±1.1 kg vs 2.7±1.2 kg, respectively, p=0.008) and tended to gain less LBM (1.2±1.1 kg vs 1.9±1.0 kg, p=0.09). The age difference between the groups was significant (p=0.047). Men and women had a TBM gain of 2.0±1.3 kg and 2.4±1.1 kg (p=0.307) with a LBM gain of 1.3±1.1 kg and 1.9±1.0 kg (p=0.178), respectively. **CONCLUSION:** These results suggest that the addition of 500 kcal/day from whole foods/snacks in combination with a rigorous RT program promotes a similar weight gain of ~0.21 kg/wk, primarily as LBM, over 10-wk in both male and female athletes. However, age and/or snack macronutrient content may impact the effectiveness of this regimen.

Introduction

To improve strength and power for athletic performance, athletes, such as military personnel and sports players, opt for intentional weight gain strategies. The overall aim of the study was to determine the efficacy of the standard hypercaloric sports performance diet (500 kcal daily surplus; adequate PRO and CHO, judicious fat) and RT regimen with excess calories from peanut (PRO) or high-CHO (CHO) snack foods on total and lean mass gains over 10-wk in athletic men and women desiring weight gain. We hypothesized that the aforementioned diet and RT regimen with excess calories from whole snack foods would result in an average weight gain of 0.23 kg/wk in both men and women, with the majority of that gain as LBM.

Methodology

Randomized Intervention Trial

- 32 athletes: 19 men & 13 women (**Table 1**)
- 10-wk diet and exercise intervention**
Diet: 500 kcal daily surplus from whole foods from either peanut/peanut butter based (PRO) or similar high-carbohydrate (CHO) snacks (i.e. dried fruit and crackers)
Exercise: Supervised RT regimen (3 days/wk for 60-120 minutes targeting major muscle groups)
- RT experience determined by training history questions and best 1-repetition maximum barbell back squat and bench press.

- Body composition assessed by DXA (Lunar iDXA (GE Healthcare, Madison, WI, USA) at baseline and post intervention. (**Table 1**)
- 3-day food records assessed by the Food Processor Nutrition Analysis Software (2021, Version 11.9.14, ESHA Research, Salem, OR) at baseline and during the final wk. (**Table 2**)
- Linear mixed effects modeling used to examine changes in outcomes of interest (body weight, body composition, and anthropometric variables) over time by snack group (PRO vs. CHO) using R statistical computing language.

Results

Table 1. Baseline Characteristics.

	Overall (N= 32)	PRO (N= 16)	CHO (N= 16)
Demographics			
M/W, N	19/13	10/6	9/7
Low RT Experience, N (%)	17 (53.1)	11 (68.8)	6 (37.5)
Age (y)	24.69 (5.54)	26.62 (6.80)	22.75 (3.04)*
Body Weight and Composition			
Total Body Mass (kg)	69.04 (11.36)	67.73 (12.72)	70.35 (10.06)
Body Fat (%)	22.47 (6.68)	23.51 (6.24)	21.42 (7.14)
Lean Body Mass (kg)	51.59 (10.57)	49.94 (11.0)	53.23 (10.21)

Data are presented as mean ± standard deviation (SD) unless stated otherwise. PRO=protein, CHO=carbohydrate, M=Men, W=Women, RT=resistance training. *Significant difference (p<0.05) between PRO vs CHO.

Table 2. Reported Food Intake.

	Overall (N= 32)	PRO (N= 16)	CHO (N= 16)
Food Intake**			
	BSL/End	BSL/End	BSL/End
Kcal/day	2,745 (760)/ 3,043 (809)	2,525 (547)/ 2,826 (707)	2,966 (890)/ 3,274 (870)
PRO (g/kg)	1.62 (0.50)/ 1.72 (0.40)	1.53 (0.46)/ 1.77 (0.48)	1.71 (0.54)/ 1.66 (0.31)
CHO (g/kg)	4.64 (1.25)/ 5.04 (1.33)	4.58 (1.34)/ 4.64 (1.25)	4.70 (1.20)/ 5.46 (1.31)

Data are presented as mean ± SD. PRO=protein, CHO=carbohydrate, BSL=baseline. **One participant was dropped from the CHO group due to missing data.

Figure 1

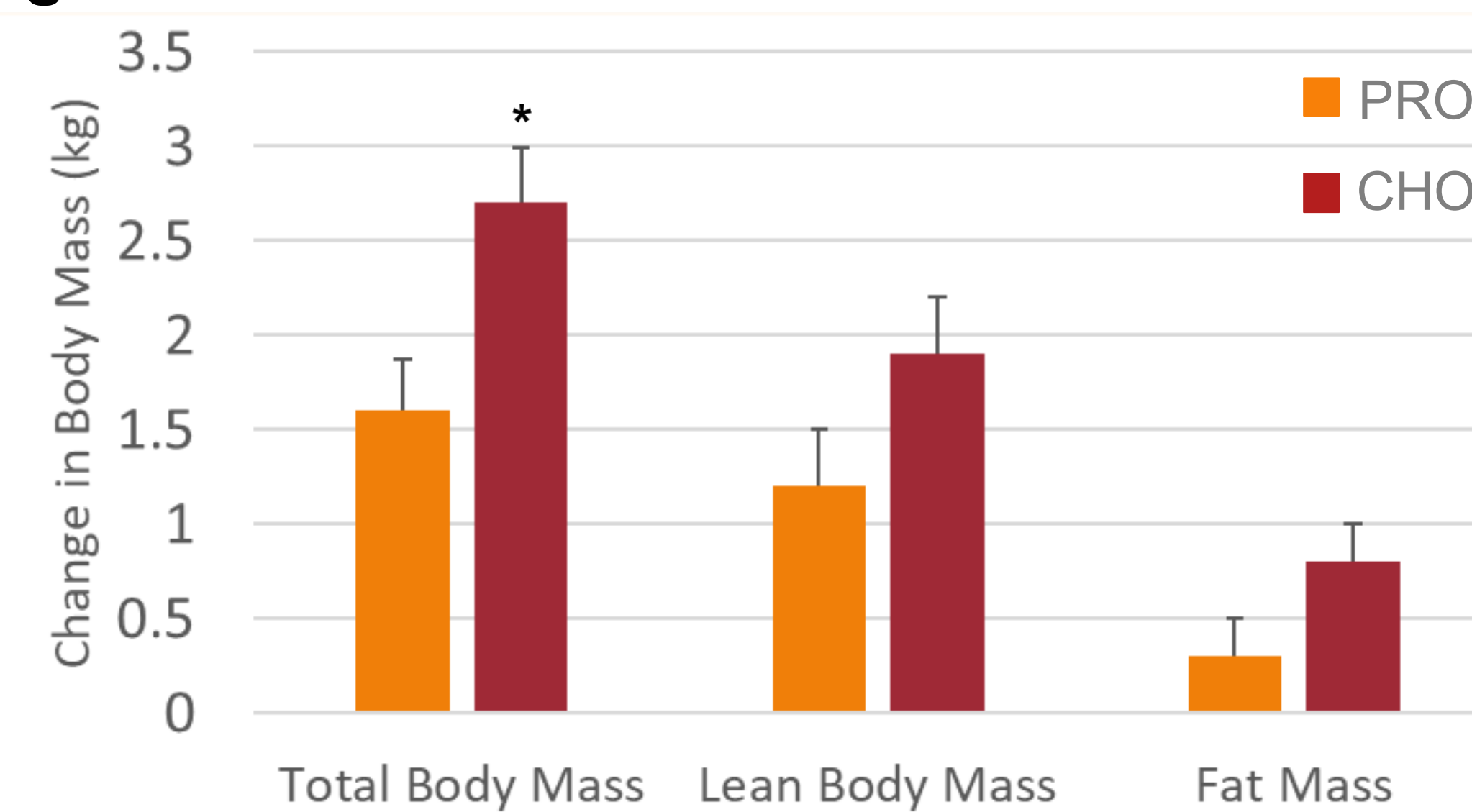


Figure 1. Change in body mass (kg) by snack group. *Significant difference (p=0.008). Data are presented as mean ± standard error of the mean (s.e.m).

Figure 2

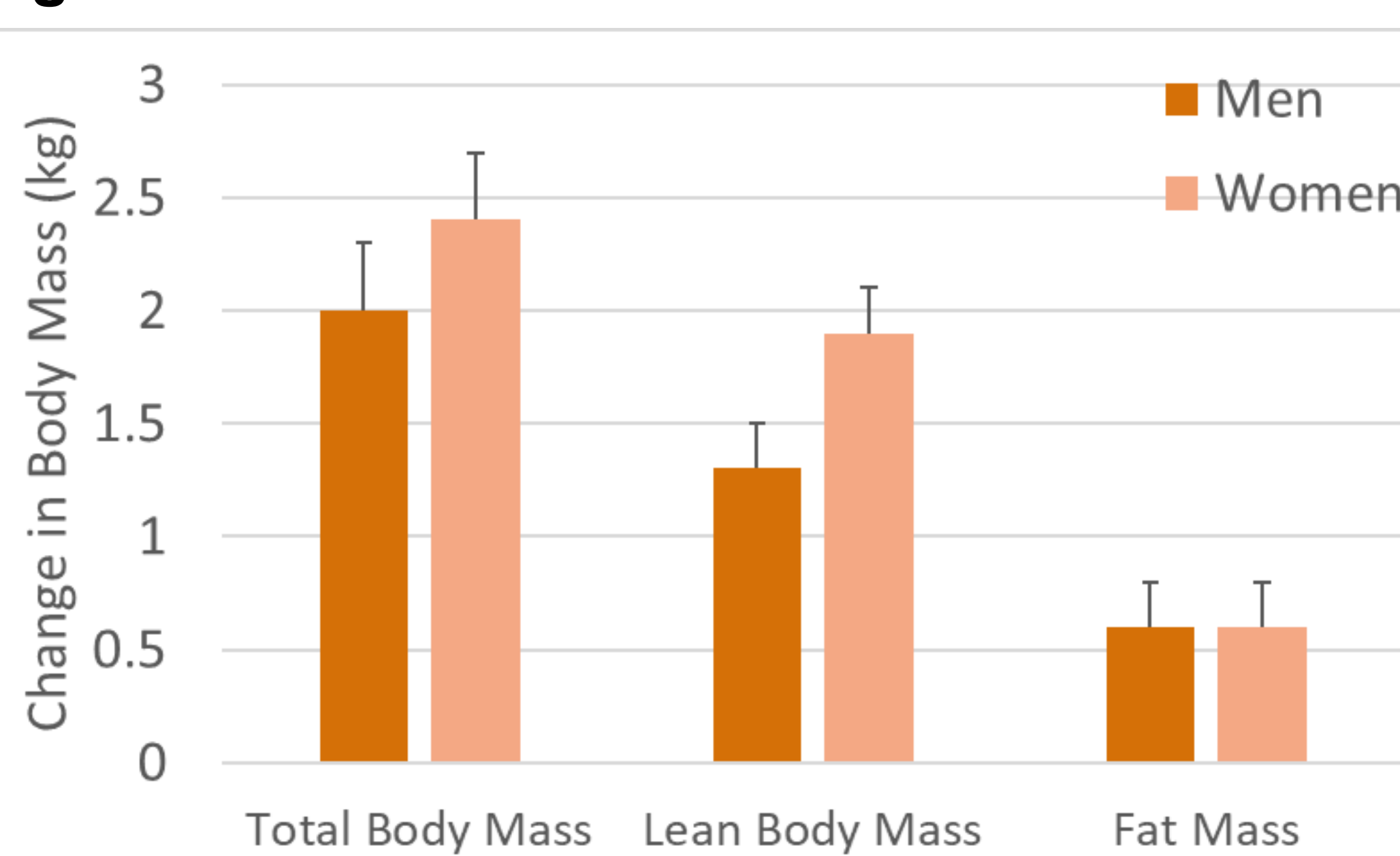


Figure 2. Change in body mass (kg) by sex. Data are presented as mean ± s.e.m.

Summary & Conclusions

These results suggest that the addition of 500 kcal/day from whole foods/snacks in combination with a rigorous RT program promotes a similar weight gain of ~0.21 kg/wk, primarily as LBM, over 10-wk in both male and female athletes. (**Figures 1 & 2**)

However, age and/or snack macronutrient content may impact the effectiveness of this regimen.

Reference

Larson-Meyer DE, Krason RK, Meyer LM. Weight Gain Recommendations for Athletes and Military Personnel: a Critical Review of the Evidence. *Curr Nutr Rep.* 2022 Jun;11(2):225-239.

Acknowledgements/Funding

- We thank Ryann Kolb for her assistance with the statistical analyses.
- Supported by a grant from the Peanut Institute.

The views and information presented are those of the authors and do not represent the official position of the U.S. Army Medical Center of Excellence, the U.S. Army Training and Doctrine Command, or the Department of Army, Department of Defense, or U.S. Government.