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The Effect of Peanut Butter Overfeeding in Trained Men and Women: A Pilot Trial

Research Brief

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Abstract

Introduction: It is known that consuming carbohydrate and fat calories above one's daily needs affect body composition differently in comparison to protein. Thus, the purpose of this study was to determine how peanut butter overfeeding affects body composition in exercise-trained subjects.

Methods: 17 healthy exercise-trained men and women participated in the study. Subjects initially recorded their food intake via MyFitnessPal for a period of two weeks prior to coming to the laboratory in order to establish a baseline intake of energy and macronutrients. Subsequently, they came to the exercise science laboratory for body composition assessment via the Bod Pod® (i.e., weight, lean body mass, fat mass) and Impedimed® (i.e., total body water). Subsequently, they were instructed to consume 5 jars of peanut butter (Smuckers® Natural, 16 ounce jar) over the 4-week treatment period and were then post-tested.

Results: Of the 17 subjects that participated in the study, 14 were compliant (i.e., actually consumed more total calories in comparison to baseline intake). Three subjects did not consume calories above their baseline intake. The 14 subjects that complied with the study consumed 6.4±4.6 jars (mean±SD) of peanut butter over the 4-week treatment period. Energy and fat intake increased (Kcals/day [p=0.0365]: Pre 2066±658 vs. Post 2592±1346, Fat grams/day [p=0.0361]: Pre 79±31 vs. Post 125±79). There were no significant changes in carbohydrate (grams/day: Pre 179±59 vs. Post 187±59) or protein intake (grams/day: Pre 160±110 vs. Post 179±136). The subjects' fat mass significantly increased [p=0.0311] (Pre 11.7±6.0 vs. Post 12.5±5.2 kg) whereas body fat percentage showed a trend (p=0.0610) towards an increase (Pre 15.9±7.4 vs. Post 17.2±6.0 percent). There were no significant pre to post changes in body weight, lean body mass or total body water.

Conclusions: Overfeeding on peanut butter (+500 kcal/day) results in an increase in body fat.

Key Words: body composition, overweight, fat, obese

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Introduction

It is known that overfeeding (i.e., caloric intake in excess of one's daily needs) on carbohydrate and fat differ in their effects on body composition in comparison to protein.[1] Previous work has examined the effects of protein overfeeding on body composition, and discovered that in exercise-trained subjects, consuming a very high protein diet of 4.4 g/kg/d for a period of four weeks had no effect on body composition despite an increase of ~800 kcal versus the control group.[2] A follow-up study showed that a high protein diet of 3.4 g/kg/d improved lean body mass similarly to 2.3 g/kg/d; however, there was a greater loss of fat mass in the higher protein group despite a higher energy intake.[3] The primary source of the extra protein from these investigations was whey. It is not known if overfeeding on a specific non-protein food such as peanut butter would elicit the same effect. Thus, the purpose of this investigation was to determine the effects of 4 weeks of peanut butter overfeeding on body composition in exercise-trained men and women.

Methods

Participants

17 healthy exercise-trained men and women participated in this study (mean±SD – age: 30±9 years, height: 171±10 centimeters). All subjects were regularly training for a period of at least one year. The total treatment period was 4 weeks. Subjects came to the laboratory for body composition assessment at baseline and 4-weeks post overfeeding. Nova Southeastern University's Human Subjects Institutional Review Board approved all procedures involving human subjects and written informed consent was obtained prior to participation.

Protocol

Subjects initially recorded their food intake via MyFitnessPal® for a period of 2 weeks prior to coming to the laboratory. This was done to establish their baseline food intake. Subsequently, they were instructed to consume 5 jars of peanut butter (Smuckers Natural, 16 oz jar) over the 4-week treatment period. The peanut butter accounted for the additional calories above their normal baseline intake.

Body Composition

Height was measured using standard anthropometry and total body weight was measured using a calibrated scale. Body composition was assessed by whole body densitometry using air displacement via the Bod Pod® (COSMED USA, Concord, CA). All testing was performed in accordance with the manufacturer's instructions. Subjects were instructed to fast for 3 hours prior to testing and to refrain from exercise prior. Briefly, subjects were tested while wearing only tight fitting clothing (swimsuit or undergarments) and an acrylic swim cap. The subjects wore the same clothing for all testing. Thoracic gas volume was estimated for all subjects using a predictive equation integral to the Bod Pod® software. The calculated value for body density used the Siri equation to estimate body composition. Data from the Bod Pod® included body weight, % body fat, lean body mass and fat mass. All testing were done with each subject at approximately the same time of day pre- and post-. The total time taken for Bod Pod analysis was approximately 10 minutes. Total body water was estimated via bioimpedance analysis (Impedimed, Carlsbad CA). This is a non-invasive test that involves a low level electrical current sent through the body (i.e., the subject does not feel it). Subjects were instructed to lay supine with their legs and arms extended. Disposable electrodes were placed inferior and superior to the wrist as well as ankle joints. The device determines the resistance

to flow of the current; this in turn provides estimates of total body water. The total time for using the bioimpedance device is approximately 15 seconds.

Statistical Analysis

Pre- versus post-test data was analyzed using a t-test. Data is expressed as the mean±SD. A $p \leq 0.05$ was considered statistically significant a priori.

Results

Fourteen exercise-trained subjects completed the investigation (age 30±9 years; height 171±10 centimeters) (Table 1). The four-week treatment showed that subjects consumed significantly more total calories (> 500 kcals) as well as dietary fat (Table 2). There was a trend for an increase in protein consumption. However, dietary fat represented the vast majority of extra calories consumed (79%) whereas carbohydrate (6%) and protein (15%) did not change appreciably. 4 weeks of overfeeding on peanut butter resulted in a significant (p=0.0311) 0.8 kilogram increase in fat mass with 1.3% increase (p=0.0610) in percent body fat (Table 3). However, there were no changes in body weight, lean body mass or total body water.

Table 1 – Hours of Training Per Week: Percentage of Subjects

	0 hr/week	1-3 hr/week	4-6 hr/week	>6 hr/week
Aerobic training	15%	64%	22%	0%
Resistance training	0%	36%	28%	36%

Legend: hr - hours

Table 2 – Diet

	Baseline	Post-Feeding	p value
Energy (kcal)	2066±658	2592±1346*	0.0365
Protein (grams)	160±110	179±136	0.0616
Carbohydrate (grams)	179±59	187±59	0.4443
Fat (grams)	79±31	125±79*	0.0361

Data are expressed as the mean±SD. n=14 (8 male, 6 female). *Significantly greater than baseline.

Table 3 – Body Composition

	Baseline	Post-Feeding	p value
Body Weight (kg)	72.5±18.2	72.5±17.4	0.9045
Lean Body Mass (kg)	60.8±16.1	60.1±15.4	0.3700
Fat Mass (kg)	11.7±6.0	12.5±5.2*	0.0311
Body Fat %	15.9±7.4	17.2±6.0	0.0610

Total Body Water (liters)	47.4±13.5	46.9±12.1	0.5464

Data are expressed as the mean±SD. n=14. Legend: kg – kilograms.
*Significantly greater than baseline.

Discussion

This is the first investigation on the effects of eating an energy surplus in the form of peanut butter. Subjects experienced a significant increase in fat mass (+0.8 kilograms or +1.8 pounds) after a brief 4-week treatment period. This is of course unsurprising in that there have been several carbohydrate/fat overfeeding studies. Although the majority of overfeeding studies have been done in sedentary populations, the results of the current study are similar to prior work.[1] Carbohydrate overfeeding may produce increases in carbohydrate oxidation and total energy expenditure; nevertheless, 75-85% of excess energy will be stored.[4] On the other hand, fat overfeeding ostensibly has minimal effects on fat oxidation and total energy expenditure; therefore, it may result in the storage of 90-95% of excess energy.[4]

Horton et al. [5] recruited 9 normal and 7 obese men to eat a diet providing 150% of energy requirements for 2 weeks. Fifty percent of energy surplus came entirely from carbohydrates or fats in a randomized crossover design. Fat mass represented 52% and 58% of the weight gain in the high carbohydrate and high fat groups, respectively. Lammert et al.[6] examined 20 normal-weight males and overfed them by ~1200 kcal for three weeks. The diets were either high in carbohydrates (11% protein (1.7 g/kg), 11% fat, and 78% carbohydrate) or high in fats (11% protein (1.7 g/kg), 58% fat, and 31% carbohydrate).[6] The increase in fat mass represented 57% and 69% of the total weight gain in the higher carbohydrate and higher fat groups, respectively. Similarly, the current investigation found that peanut butter overfeeding resulted exclusively in a fat mass gain. It should be noted that body weight did not change.

Media-Friendly Summary

Despite the “halo” around peanut butter as a ‘healthy’ food choice, it’s an energy-dense food comprised mainly of dietary fat. If you eat too much fat and calories above your energy needs, you’ll end up gaining fat mass. Moderation is still the key in keeping that svelte physique.

Reference

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