

ACUTE EFFECTS OF INGESTING A HIGH CARBOHYDRATE AND HIGH PROTEIN HYPOCALORIC DIET ON BODY MASS, BODY COMPOSITION, AND RESTING ENERGY EXPENDITURE IN OBESE FEMALES

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Abstract

The purpose of this study was: 1.) to determine the acute changes in energy expenditure, body composition, and body water during one week of hypocaloric dieting; and, 2.) to determine whether ingesting hypocaloric diets with a higher proportion of dietary protein or carbohydrate influence acute weight loss parameters. **METHODS:** 97 sedentary, obese women (41.4±11 yrs, 164.1±7 cm, 98.2±18.4 kg, 45.2±4.6 %, 36.4±6.4 kg•m⁻²) were randomized to consume either a normal diet (control, n=14) or a higher carbohydrate (% CHO: PRO: FAT= 46: 24: 30; n=40) or higher protein (% CHO: PRO: FAT= 24: 46: 30; n=43) hypocaloric diet (1,000 kcal•d⁻¹) for a 7-day period. Subjects were given prescribed diets developed by a registered dietician in order to provide the desired macronutrient and caloric intakes. Participants reported for testing sessions in a fasted state at the same time of day on days 0, 1, 2, 3, 4 and 7 of dieting in order to determine changes in body mass, body composition using DEXA, body water using multi-frequency BIA, and REE assessed using indirect calorimetry. Data were analyzed by repeated measures ANOVA and reported as delta values (post – pre values) for the hypocaloric (HYPO) diet groups and control (CON) group, respectively. **RESULTS:** When compared to CON, subjects maintaining the hypocaloric diet experienced significant reductions (p<0.05), irrespective of dietary group, in body mass (HYPO: -2.0±1.7 kg vs. CON: -0.25±0.5 kg), fat mass (HYPO: -0.44±1.3 kg vs. CON: 0.22±0.8 kg), fat-free mass (HYPO: -1.42±1.7 kg vs. CON: -0.40±0.7 kg), total scanned mass (HYPO: -1.90±1.2 kg vs. CON: -0.2±0.5 kg), relative REE (HYPO: -0.67±1.6 kcal•kg⁻¹•d⁻¹ vs. CON: -0.04±1.4 kcal•kg⁻¹•d⁻¹), respiratory exchange ratio (HYPO: -0.06±0.07 vs. CON: 0.01±0.02), and total body water (HYPO: -1.4±2.1 L vs. CON: -0.63±1.5 L). No significant differences (p>0.05) were noted in DEXA percent body fat. Additionally, there were no significant differences observed between the high CHO and high PRO diet groups. **CONCLUSION:** One week of following a 1,000 kcal•d⁻¹ diet with either a higher proportion of dietary CHO or PRO results in significant but similar reductions in body mass, fat mass, fat-free mass, body water, and relative REE. Percent body fat did not significantly change over time and were not different among types of diet suggesting similar percent reductions of fat mass and lean mass. Respiratory exchange ratio decreased in both groups to reflect a more preferential oxidation of fat when compared to baseline data. These findings indicate that acute dieting decreases REE and promotes loss of body mass, body water, fat mass, and fat-free mass. However, the macronutrient content of the hypocaloric diet does not affect acute weight loss parameters.

Supported by Curves International, Waco, TX

Rationale

Previous research has indicated that short-term dieting reduces resting energy expenditure (REE) and promotes weight loss primarily from loss of body water. However, it is unclear whether the macronutrient profile influences acute weight loss and/or energy expenditure. Preferential changes in energy expenditure or body composition relative to different macronutrient ratios might help to stimulate weight loss and/or promote weight maintenance.

Experimental Design

Subjects

- 97 sedentary, obese women completed all testing.
- Subjects were descriptively described as 41.4±11 yrs, 164.1±7 cm, 98.2±18.4 kg, 45.2±4.6%, 36.4±6.4 kg•m⁻².
- Subjects signed informed consent statements in compliance with the Human Subjects Guidelines of Baylor University and the American College of Sports Medicine.
- All subjects were free of disease, were not currently taking any prescription medications that would interfere with their metabolism and were not currently using any contraindicative nutritional supplements.

Diet Protocol

- Subjects were randomized to consume either a normal diet (control, n=14), a higher carbohydrate (46% CHO, 24% PRO, 30% FAT: n=40) or higher protein (46% PRO, 24% CHO, 30% FAT: n=43) hypocaloric diet (1,000 kcal•d⁻¹) for a 7-day period.
- Subjects were given prescribed diets developed by a registered dietician in order to provide the desired macronutrient and caloric intakes.
- Compliance was monitored by daily interviews with all research participants and calculation of all energy and macronutrients consumed.

Baseline Testing

- Participants reported for testing sessions at the same time of day on days 0, 1, 2, 3, 4 and 7 of dieting.
- All testing sessions were completed in a fasted state at the exact time each morning of testing.

Methods & Procedures

- Body mass was determined using a self-calibrating digital scale (±0.05 kg).
- Body water was assessed using a Xitron multi-frequency bioelectrical impedance analyzer.
- Body composition was determined using DEXA (Hologic Discovery W).
- Energy expenditure and substrate oxidation was determined using indirect calorimetry.

Statistical Analysis

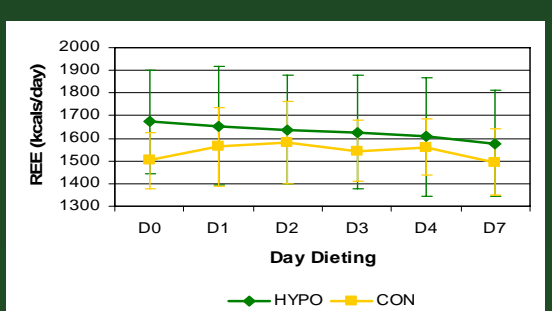
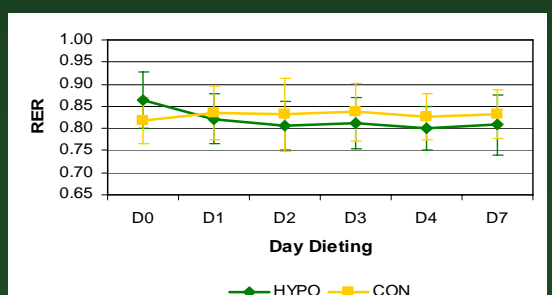
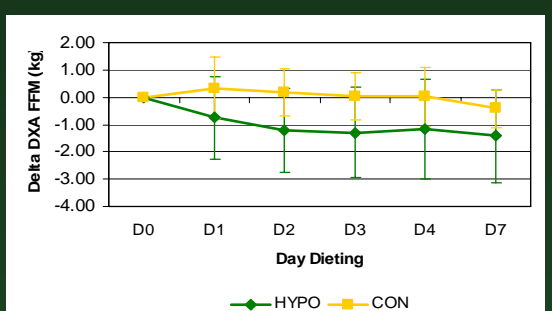
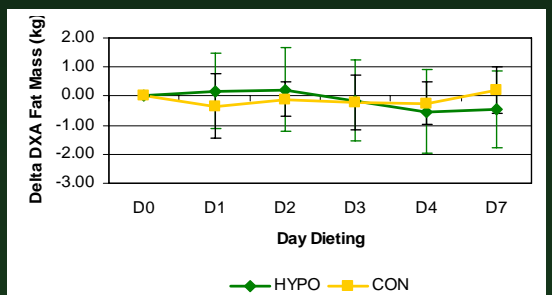
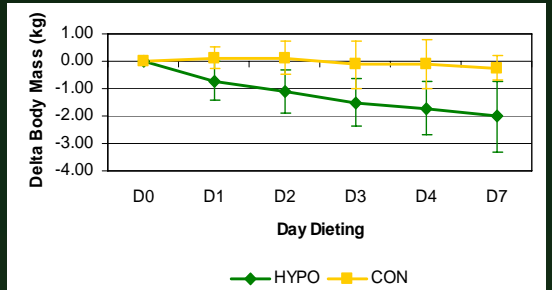
- A 3 x 6 (Group x Testing Session) repeated measures ANOVA was used to analyze all data.
- LSD post-hoc procedures were used for any significant interaction (p<0.05) to determine differences.
- SPSS for Windows version 11.5 (SPSS Inc., Chicago, IL) statistical package with an alpha-level of 0.05 was used for all statistical analysis.
- Data are presented as means ± SD and presented as delta values (post – pre values) from baseline for both hypocaloric (HYPO) diet groups and the non-dieting control group (CON).

Results

- In comparison to non-dieting controls, subjects who followed the hypocaloric diet experienced significant reductions (p<0.05), irrespective of dietary group, in the following variables:
 - Body mass (HYPO: -2.0±1.7 kg vs. CON: -0.25±0.5 kg)
 - Fat mass (HYPO: -0.44±1.3 kg vs. CON: 0.22±0.8 kg)
 - FFM (HYPO: -1.42±1.7 kg vs. CON: -0.40±0.7 kg)
 - DXA Total (HYPO: -1.90±1.2 kg vs. CON: -0.2±0.5 kg)
 - Relative REE (HYPO: -0.67±1.6 kcal•kg⁻¹•d⁻¹ vs. CON: -0.04±1.4 kcal•kg⁻¹•d⁻¹)
 - RER (HYPO: -0.06±0.07 vs. CON: 0.01±0.02)
 - Total body water (HYPO: -1.4±2.1 L vs. CON: -0.63±1.5 L).
- No significant differences (p>0.05) between any groups were noted in DXA percent body fat.

Conclusions

- One week of following a 1,000 kcal•d⁻¹ diet with either a higher proportion of dietary CHO or PRO results in significant but similar reductions in body mass, fat mass, fat-free mass, body water, and relative REE.
- Percent body fat did not significantly change over time and were not different among types of diet suggesting similar percent reductions of fat mass and lean mass.
- Respiratory exchange ratio decreased in both groups to reflect a more preferential oxidation of fat when compared to baseline data.
- These findings indicate that acute dieting decreases REE and promotes loss of body mass, body water, fat mass, and fat-free mass. However, macronutrient content of the hypocaloric diet does not influence weight loss parameters.



EFFECTS OF INCREASED LEVELS OF ENERGY INTAKE AFTER HYPOCALORIC DIETING ON BODY MASS, BODY COMPOSITION, AND RESTING ENERGY EXPENDITURE IN OBESE FEMALES

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Abstract

Research has indicated that acute dieting reduces resting energy expenditure (REE). However, it is less clear whether increasing caloric intake after dieting would increase REE in a rebound manner. **OBJECTIVE:** The purpose of this study was to examine the effects of consuming diets with different levels of caloric intake after short-term dieting on body mass, body composition, and REE. **METHODS:** 97 sedentary, obese women (41.4±11 yrs, 164.1±7 cm, 98.2±18.4 kg, 45.2±4.6 %, 36.4±6.4 kg·m⁻²) were randomized to consume either a normal diet (control, n=14) or a higher carbohydrate (%CHO: PRO: FAT= 46: 24: 30; n=40) or higher protein (%CHO: PRO: FAT= 24: 46: 30; n=43) hypocaloric (HYPO) diet (1,000 kcal·d⁻¹) for 7-day. After the diet period, subjects who followed the hypocaloric diets consumed 1,600, 2,100 or 2,600 kcal·d⁻¹ consisting of (%CHO: PRO: FAT= 55: 15: 30) while subjects in the control group (CON) maintained their normal diet. Subjects were given prescribed diets developed by a registered dietician in order to provide the desired macronutrient and caloric intakes. Participants reported for testing sessions in a fasted state at the same time of day on days 0, 3, and 7 of dieting phase as well as after 1, 2, 3, and 7 days of following the increased caloric intake diets in order to determine changes in body mass, body composition using DEXA, body water using multi-frequency BIA, and REE assessed using indirect calorimetry. Data were analyzed by repeated measures ANOVA and reported as delta values (post – pre values). **RESULTS:** As stated in the companion abstract, the 7-day hypocaloric diet intervention promoted weight loss but there were no differences between the types of diet. After 6 days of following a hypocaloric diet, subjects experienced significant reductions (p<0.05) in comparison to the CON group with no differences observed among diet groups for body mass, fat mass, fat-free mass (FFM) as well as relative REE. Increasing caloric intake for the next 7-days resulted in an overall maintenance or continuation of weight loss for body mass, fat mass and FFM. Relative REE values tended to rebound in subjects consuming the 2,600 kcal·d⁻¹ diet. Results can be found in the table below:

1 st 7 Days	1,600 kcal	2,100 kcal	2,600 kcal	CON
Body Mass (kg)	-2.0±1.4	-2.0±1.4	-2.1±1.2	-0.25±0.5
DXA Fat (kg)	-0.38±1.0	-0.45±1.0	-0.48±1.8	0.22±0.8
DXA FFM (kg)	-1.3±1.3	-1.6±1.4	-1.4±2.2	-0.40±0.7
Relative REE (kcal·kg ⁻¹ ·d ⁻¹)	-0.63±2.0	-0.45±1.5	-0.91±1.2	-0.4±1.4

2 nd 7 Days	1,600 kcal	2,100 kcal	2,600 kcal	CON
Body Mass (kg)	-2.5±1.4	-2.0±1.4	-2.2±1.6	0.0±1.1
DXA Fat (kg)	-2.5±1.4	-2.0±1.4	-2.2±1.6	0.0±1.1
DXA FFM (kg)	-1.7±1.6	-0.9±1.6	-0.5±1.8	0.5±0.8
Relative REE (kcal·kg ⁻¹ ·d ⁻¹)	-0.78±2.4	-1.0±1.6	-0.24±2.6	1.4±2.0

CONCLUSION: Hypocaloric dieting for 6-days resulted in a significant decrease in weight loss parameters when compared to a control group. Increasing caloric intake in a stepwise fashion resulted in maintenance or continuation in weight loss parameters. There was some evidence of a rebound in relative REE values when ingesting the 2,600 kcal·d⁻¹ diet while REE values remained lower than baseline in remaining diet groups. These data help to identify the acute responses of body mass, body composition and energy expenditure after brief periods of hypocaloric dieting as well as progressive increases in caloric intake.

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Rationale

Previous research has indicated that short-term dieting reduces resting energy expenditure (REE) and promotes weight loss primarily from loss of body water. However, it is unclear whether the macronutrient profile influences acute weight loss and/or energy expenditure. Preferential changes in energy expenditure or body composition relative to different macronutrient ratios might help to stimulate weight loss and/or promote weight maintenance.

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- After the 7-day diet period, subjects who followed the HYPO diets consumed 1,600, 2,100, 2,600 kcal·d⁻¹ consisting (%CHO: PRO: FAT= 55: 15: 30) while CON subjects followed their normal diet.
- Subjects were given prescribed diets developed by a registered dietician in order to provide the desired macronutrient and caloric intakes.
- Compliance was monitored by daily interviews with all research participants and calculation of all energy and macronutrients consumed.

Baseline Testing

- Participants reported for testing sessions at the same time of day on days 0, 3, 7 of the dieting phase and 1, 2, 3, 7 days after increasing their caloric intake.
- All testing sessions were completed in a fasted state at the same time each morning of testing.

Methods & Procedures

- Body mass was determined using a self-calibrating digital scale (±0.05 kg).
- Body water was assessed using a Xitron multi-frequency bioelectrical impedance analyzer.
- Body composition was determined using DEXA (Hologic Discovery W).
- Energy expenditure and substrate oxidation was determined using indirect calorimetry.

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- A 3 x 6 (Group x Testing Session) repeated measures ANOVA was used to analyze all data.
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Results

- As stated in the companion abstract, the 7-day hypocaloric diet intervention promoted weight loss but there were no differences between the types of diet.
- After 6 days of following a hypocaloric diet, subjects experienced significant reductions (p<0.05) in comparison to the CON group with no differences observed among diet groups for body mass, fat mass, fat-free mass (FFM) as well as relative REE.
- Increasing caloric intake for the next 7-days resulted in an overall maintenance or continuation of weight loss for body mass, fat mass and FFM.
- Relative REE values tended to rebound in subjects consuming the 2,600 kcal·d⁻¹ diet. Results can be found in the table below:

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DXA Fat (kg)	-0.38±1.0	-0.45±1.0	-0.48±1.8	0.22±0.8
DXA FFM (kg)	-1.3±1.3	-1.6±1.4	-1.4±2.2	-0.40±0.7
Relative REE (kcal·kg ⁻¹ ·d ⁻¹)	-0.63±2.0	-0.45±1.5	-0.91±1.2	-0.4±1.4

2 nd 7 Days	1,600 kcal	2,100 kcal	2,600 kcal	CON
Body Mass (kg)	-2.5±1.4	-2.0±1.4	-2.2±1.6	0.0±1.1
DXA Fat (kg)	-2.5±1.4	-2.0±1.4	-2.2±1.6	0.0±1.1
DXA FFM (kg)	-1.7±1.6	-0.9±1.6	-0.5±1.8	0.5±0.8
Relative REE (kcal·kg ⁻¹ ·d ⁻¹)	-0.78±2.4	-1.0±1.6	-0.24±2.6	1.4±2.0

Conclusions

- Hypocaloric dieting for 6-days resulted in a significant decrease in weight loss parameters when compared to a control group.
- Increasing caloric intake in a stepwise fashion resulted in maintenance or continuation in weight loss parameters.
- There was some evidence of a rebound in relative REE values when ingesting the 2,600 kcal·d⁻¹ diet while REE values remained lower than baseline in remaining diet groups.
- These data help to identify the acute responses of body mass, body composition and energy expenditure after brief periods of hypocaloric dieting as well as progressive increases in caloric intake.

