

Effects of a Eucaloric High Fat Diet on Anterior Pituitary Trophic Hormones, their Targets and Adipocytokines in Normal Weight Women

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Introduction:

Obesity in women is associated with decreased fertility, adverse pregnancy outcomes and relative hypogonadotropic hypogonadism, which we termed reprometabolic syndrome. We previously demonstrated that acute hyperlipidemia and hyperinsulinemia recapitulates this phenotype in normal weight women and exerts differential effects on the hypothalamic-pituitary-gonadal, adrenal and thyroid axes. We hypothesized that a eucaloric high-fat diet (HFD) designed to elevate insulin and circulating free fatty acids would also impact anterior pituitary trophic hormones and adipocytokines.

Methods:

17 normal weight (BMI 18-24.9) healthy, cycling women (mean age 29 ± 8) underwent frequent blood sampling (q10 min) in the early follicular phase (days 2-5) for 4 hours starting at 7 am, during a pre-diet cycle. They were subsequently provided a prescribed, eucaloric HFD (48% calories from fat) for the duration of their next menstrual cycle and the frequent blood sampling was repeated in their post-HFD cycle. Serum TSH, free T4 (fT4), total T3 (tT3), cortisol, GH, prolactin (PRL), IGF-1, HMW adiponectin, and leptin were measured by immunoassay. Wilcoxon signed-rank tests were used to compare hormone levels before and after the HFD intervention.

Results:

There was a small but significant decrease in tT3 ($p=0.01$) and cortisol ($p=0.02$) after the HFD. No changes in TSH, fT4, PRL, GH or IGF-1 were observed in response to the HFD. Similarly, leptin and adiponectin levels were not significantly different (Table).

Table: Hormone and Adipocytokine Levels Pre- and Post-HFD

	Pre-Diet		Post-HFD		
Characteristic	N	Median (IQR)	N	Median (IQR)	P value
Adiponectin (ng/mL)	17	0.44 (0.34, 0.61)	17	0.41 (0.34, 0.51)	0.33
Cortisol (µg/dL)	17	9.92 (6.96, 10.80)	17	7.36 (6.29, 8.50)	0.02
fT4 (ng/dL)	17	1.34 (1.14, 1.40)	17	1.34 (1.24, 1.43)	0.55
GH (ng/mL)	17	0.72 (0.38, 1.14)	17	1.37 (0.83, 1.69)	0.22
IGF-1 (ng/mL)	16	2078.31 (1654.85, 3559.21)	17	2221.83 (1864.64, 2693.08)	0.86
Leptin (ng/mL)	17	7.73 (5.32, 14.27)	17	6.33 (4.88, 13.80)	0.13
Prolactin (ng/mL)	17	8.13 (6.06, 9.34)	17	7.25 (6.50, 9.00)	0.71
TSH (µIU/mL)	17	1.17 (0.87, 1.40)	17	1.08 (0.91, 1.43)	0.85
tT3 (ng/mL)	17	1.09 (1.03, 1.17)	17	1.04 (0.97, 1.11)	0.01

IQR: interquartile range (25th, 75th percentiles)

Conclusion:

A one-month HFD, designed to induce the reproductively obese syndrome of obesity, resulted in differential effects on the hypothalamic-pituitary-gonadal, adrenal, and thyroid axes, implicated in reproductive function. The observed decrease in morning cortisol after the HFD is novel. Studies have not addressed the impact of eucaloric HFD on thyroid hormones and the clinical significance of the small reduction in tT3 is unclear.