

Baseline Body Fat Percentage Is Associated to Weight and Fat Mass Gain From High-Fat Overfeeding Over 8 Weeks

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Abstract

Context: Epidemiological data suggest that participants with lower vs higher body mass index (BMI) resist exposure to the obesogenic environment.

Objective: To test this, we analyzed the relationship between overfeeding-induced weight and fat mass gains with baseline BMI and body fat percentage.

Methods: In this controlled intervention study, 34 men (age 26 ± 5 years; BMI 25.5 ± 2.4 kg/m²; body fat [by dual-energy x-ray absorptiometry] 19.3 ± 5.1 %) consumed for 8 weeks 40% more energy than needed at weight maintenance. The energy costs of weight and fat mass gain were calculated as the 8-week excess energy consumed divided by weight or fat mass gain. Energy expenditure (baseline and after overfeeding) was determined using a metabolic chamber and doubly labeled water. Transcriptomic analysis was conducted from abdominal subcutaneous adipose tissue samples.

Results: Body weight increased 7.2 ± 2.1 kg and fat mass 4.0 ± 1.4 kg. There was no statistical association between baseline BMI and weight and fat mass gains. However, baseline body fat percentage was significantly associated with weight ($r = 0.57$) and fat mass ($r = 0.59$) gains. Body fat percentage was also statistically associated with energy cost of weight ($r = -0.38$) and fat mass ($r = -0.40$) gains. Metabolic adaptation in energy expenditure (adaptive thermogenesis) was unrelated to the energy cost of weight and fat mass gains. Transcriptomics analysis showed that high energy cost of weight gain was associated with upregulation of inflammation-related pathways.

Conclusion: Body fat percentage at baseline was inversely associated with overfeeding-induced weight and fat gain resistance. The underlying compensatory response appears unrelated to changes in energy expenditure.

Key Words: obesity, adipose tissue function, adaptive thermogenesis, fitness, weight gain

Abbreviations: BMI, body mass index; DEG, differentially expressed gene; DLW, doubly labeled water; DXA, dual-energy x-ray absorptiometry; EEC, excess energy consumed; FDR, false discovery rate; PBRC, Pennington Biomedical Research Center.