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Which Comes First, Overeating or Obesity?

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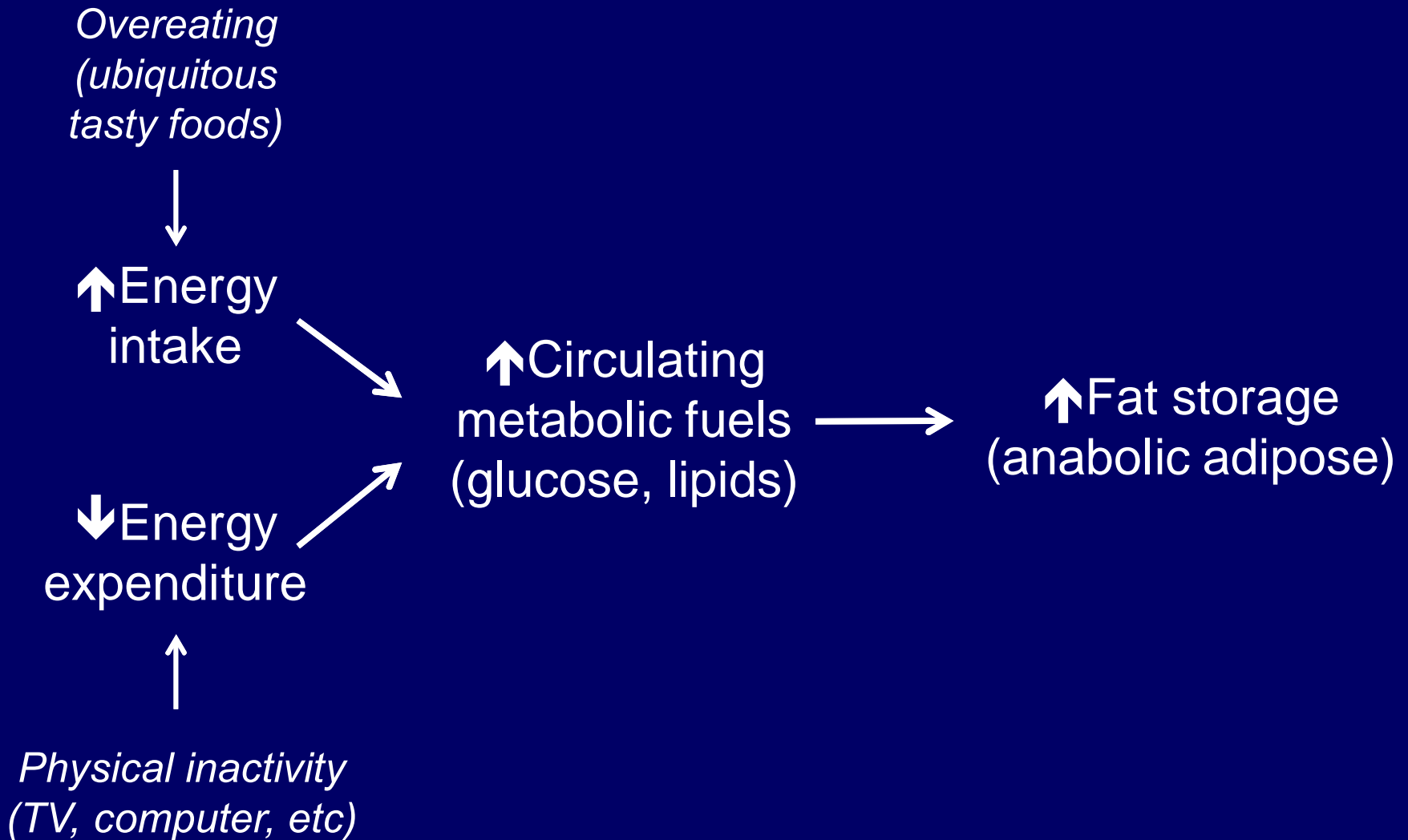
Law of Thermodynamics

Energy can neither be created or destroyed

$$\text{Calorie intake} - \text{Calorie expenditure} = \text{Calories stored (change in body fat)}$$

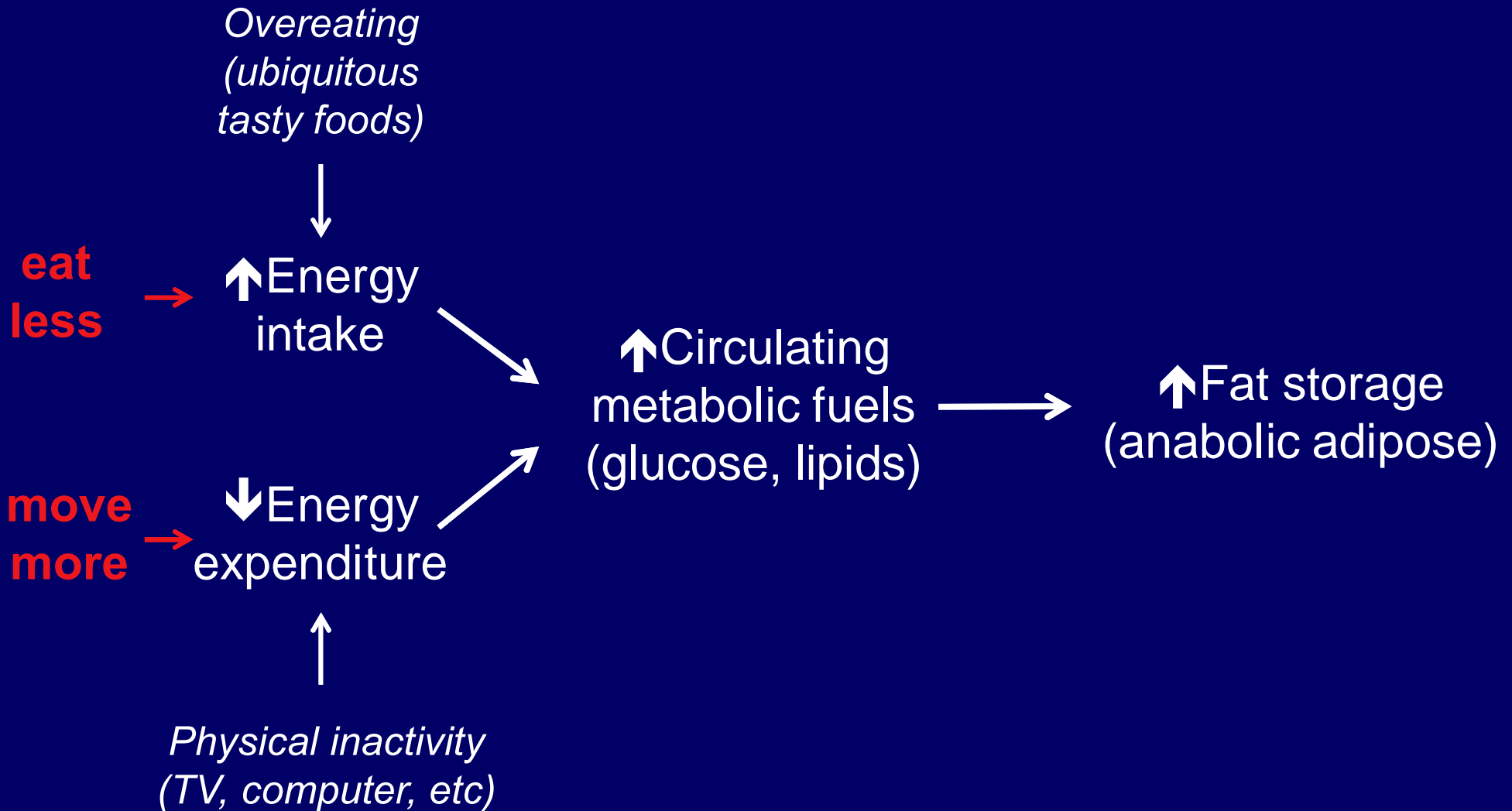
Interpretation of the First Law

Obesity, a failure of voluntary control over energy balance



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Conventional Obesity Treatment in Adults *National Health & Nutrition Examination Survey 1999-2006*

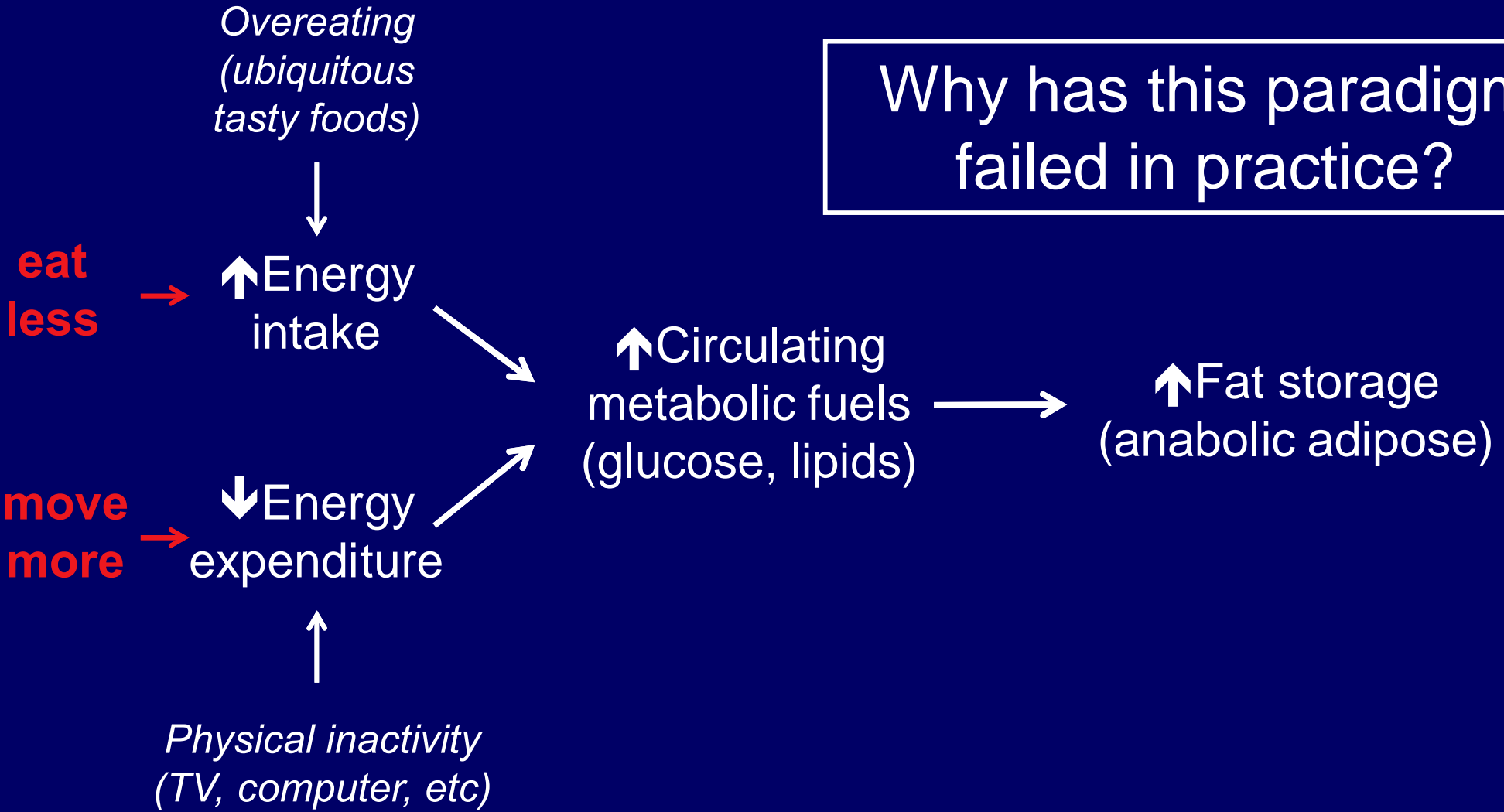
Only 1 in 6 overweight and obese adults in the US report ever
having maintained weight loss of at least 10% for 1 year

Kraschnewski et al. *Int J Obes.* 2010, 34:1644-54

Conventional View of Obesity

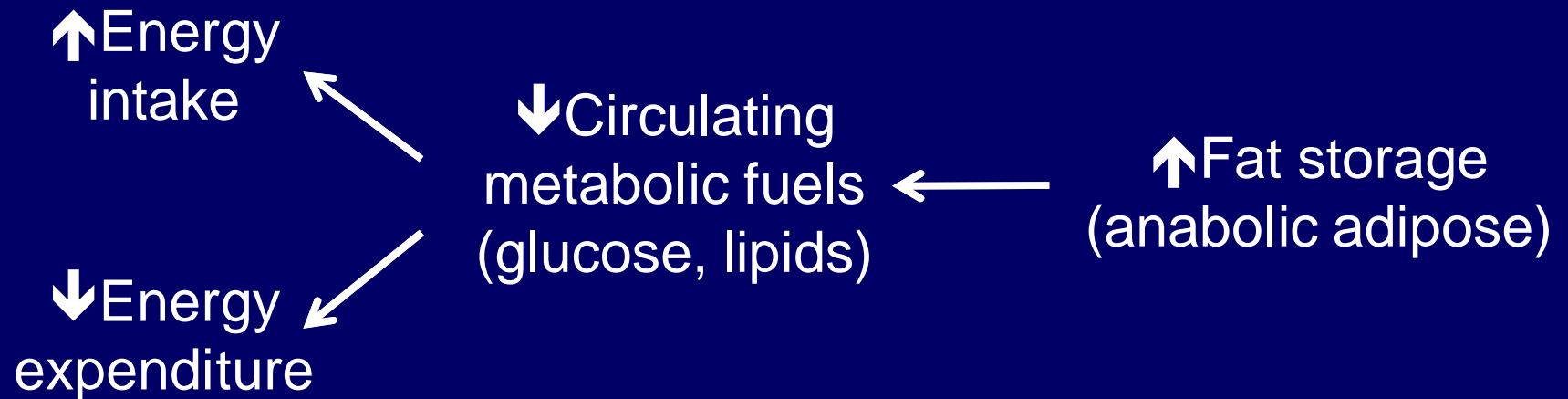
Failure of voluntary control over energy balance

Why has this paradigm failed in practice?



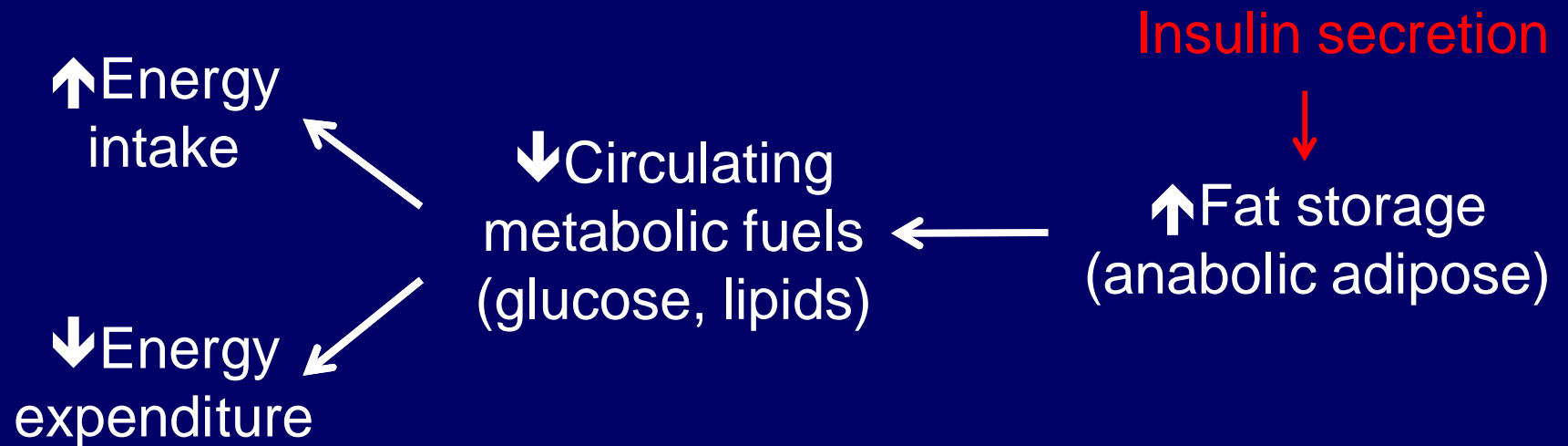
Alternative View of Obesity

Excessive anabolic drive in adipose tissue



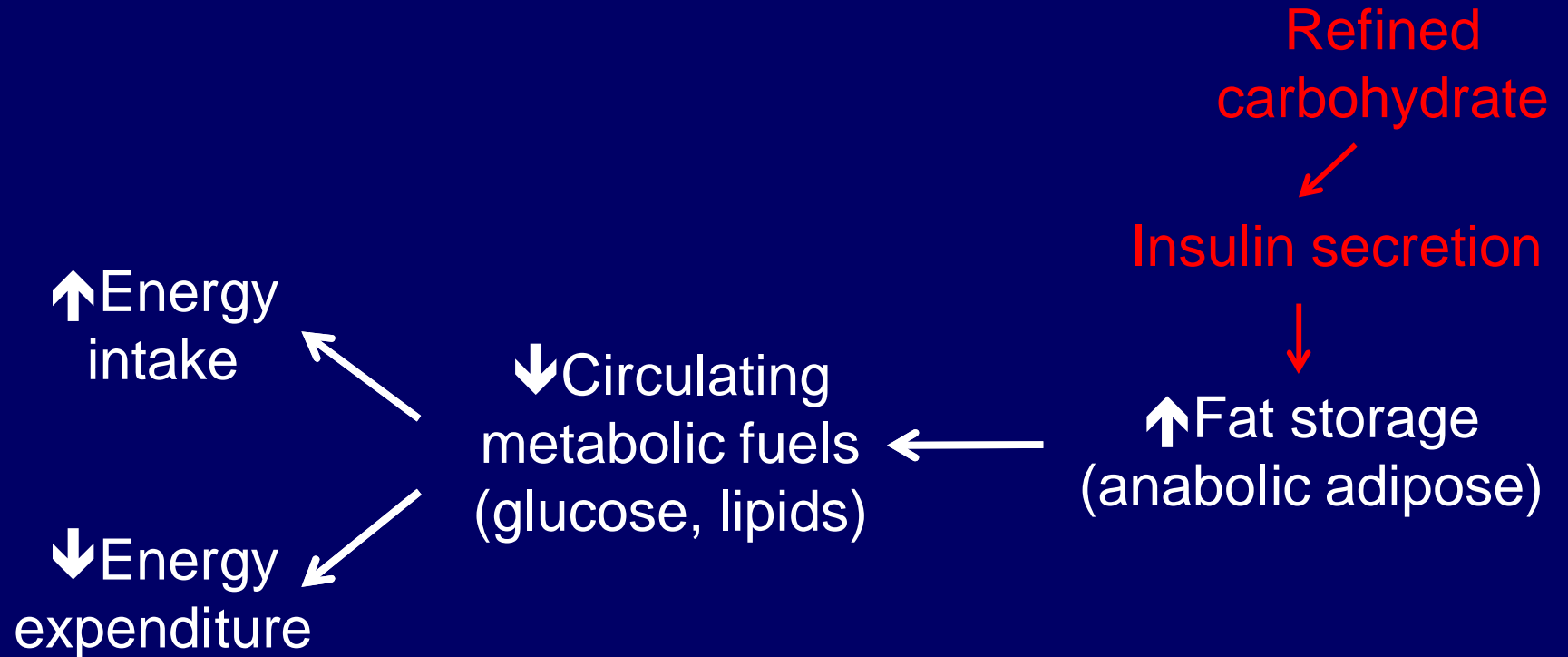
Alternative View of Obesity

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Alternative View of Obesity

Excessive anabolic drive in adipose tissue



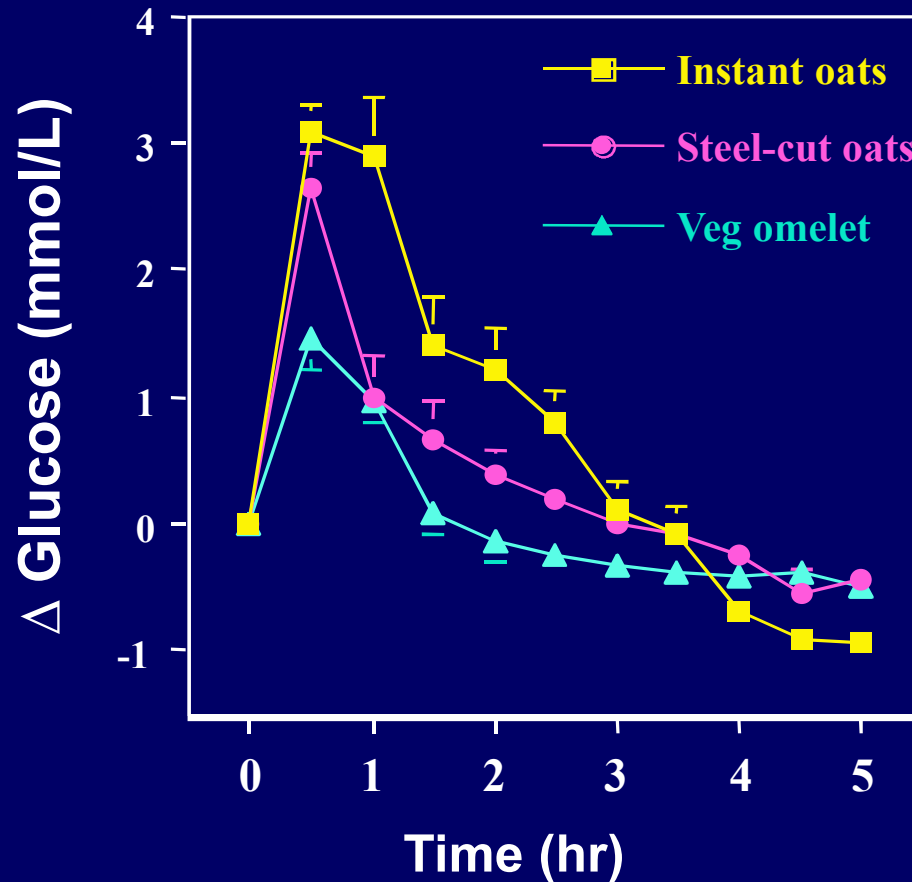
Effects of Refined Carbohydrate

Methods

- “ Subjects: 12 obese adolescents
- “ Design: cross-over feeding study on 3 separate days
- “ Intervention: breakfasts with identical calories:
 - Instant oatmeal (highly processed carbohydrate)
 - Steel-cut oatmeal (minimally processed carbohydrate)
 - Vegetable omelet with fruit (no processed carbohydrate)
- “ Blood tests and hunger followed through the day

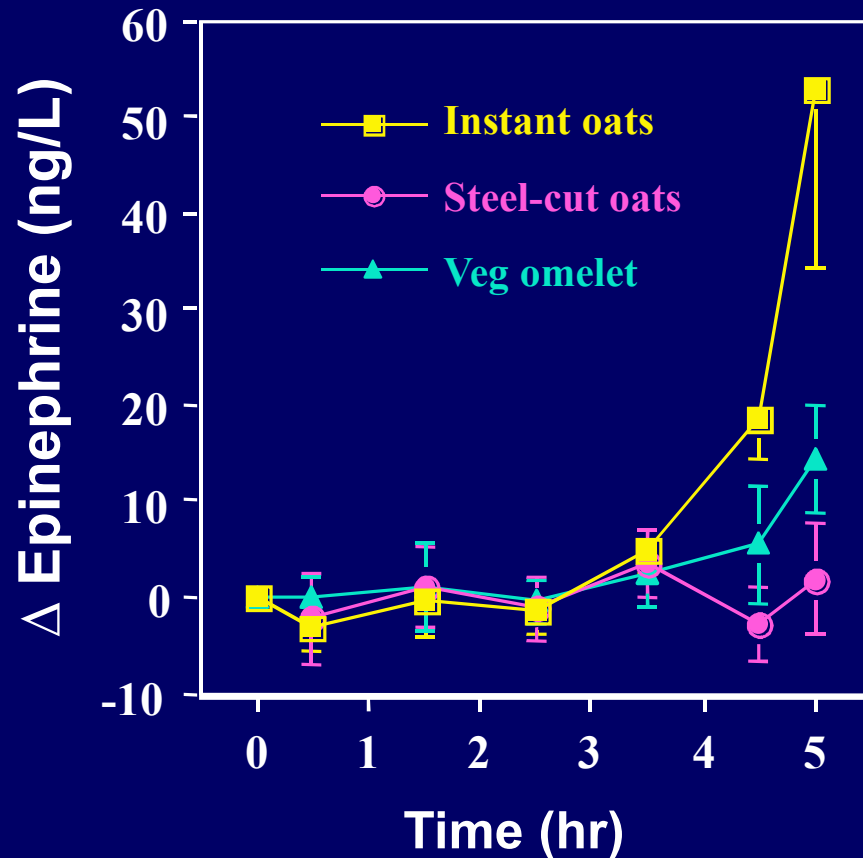
Processed Carbohydrate

Effects on blood glucose



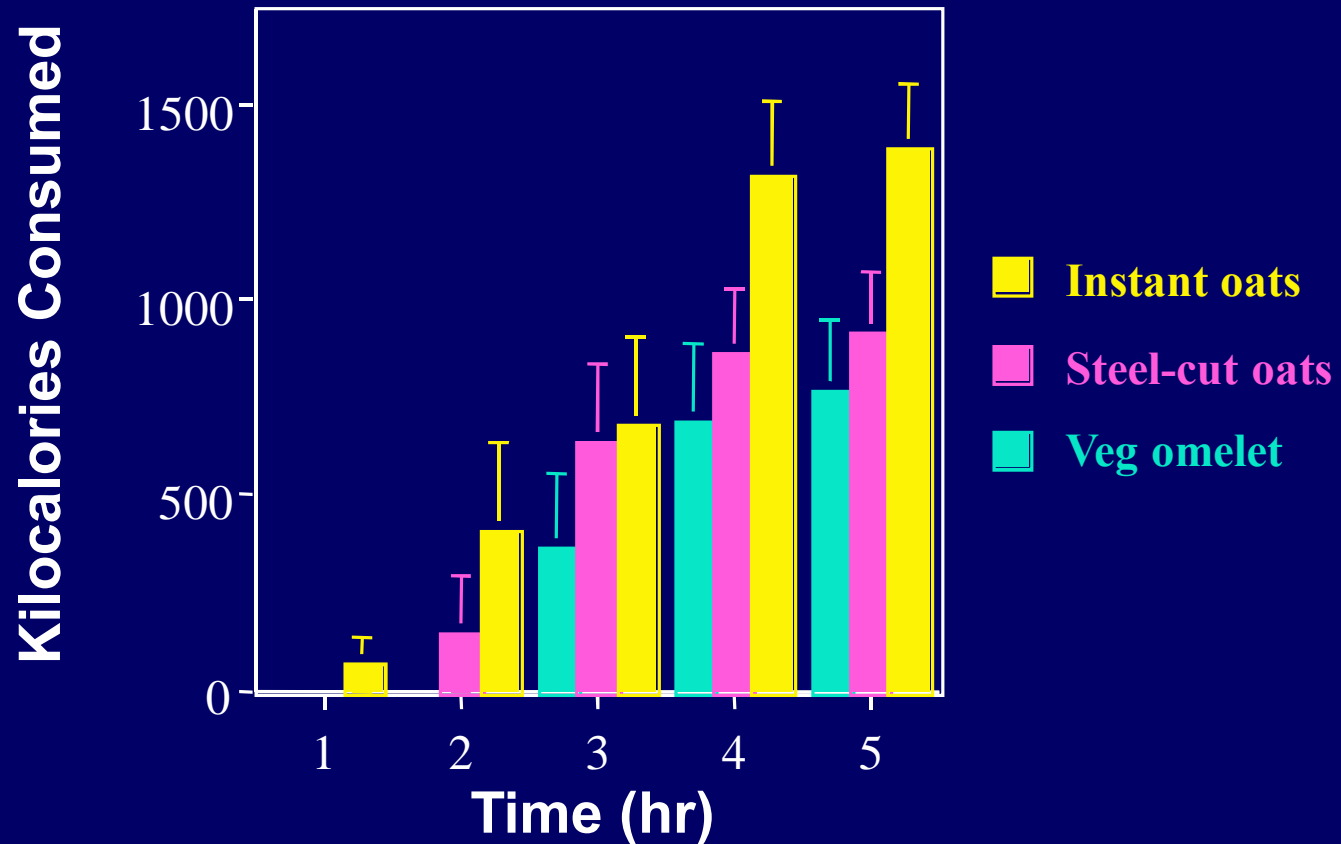
Processed Carbohydrate

Effects on stress hormones



Processed Carbohydrate

Effects on hunger



g Index & Brain Function

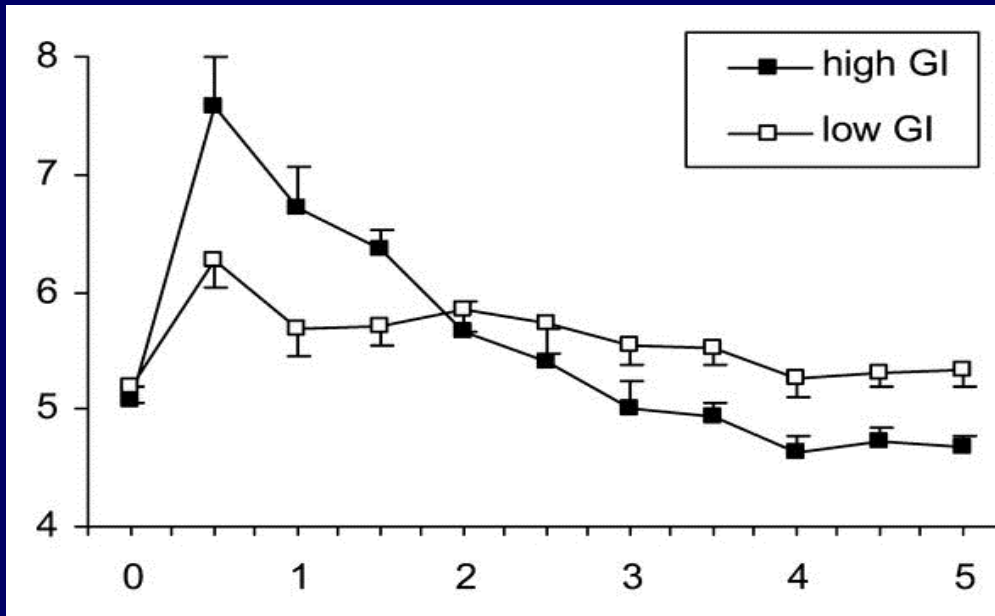
Methods

- “ Subjects: 12 overweight/obese young men
- “ Design: Double-blind, cross-over feeding study
- “ Intervention: high vs. low GI liquid meals, controlled for:
 - macronutrients
 - calorie content
 - sweetness
- “ Neuroimaging: Arterial spin labeling 4 hr after the meal

GI Index & Brain Function

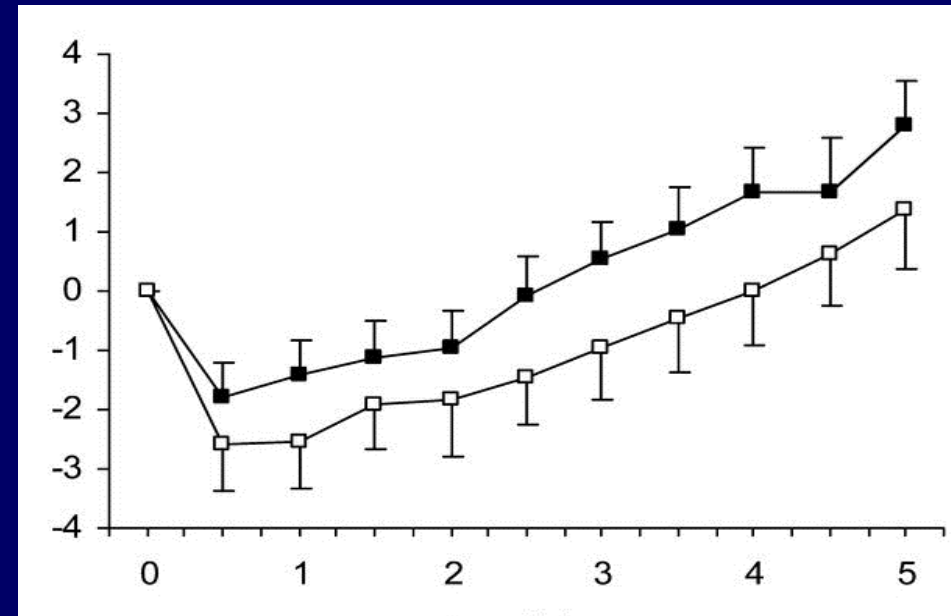
Effects of test meals on plasma glucose and hunger

Plasma Glucose (mmol/L)



Time (hr)

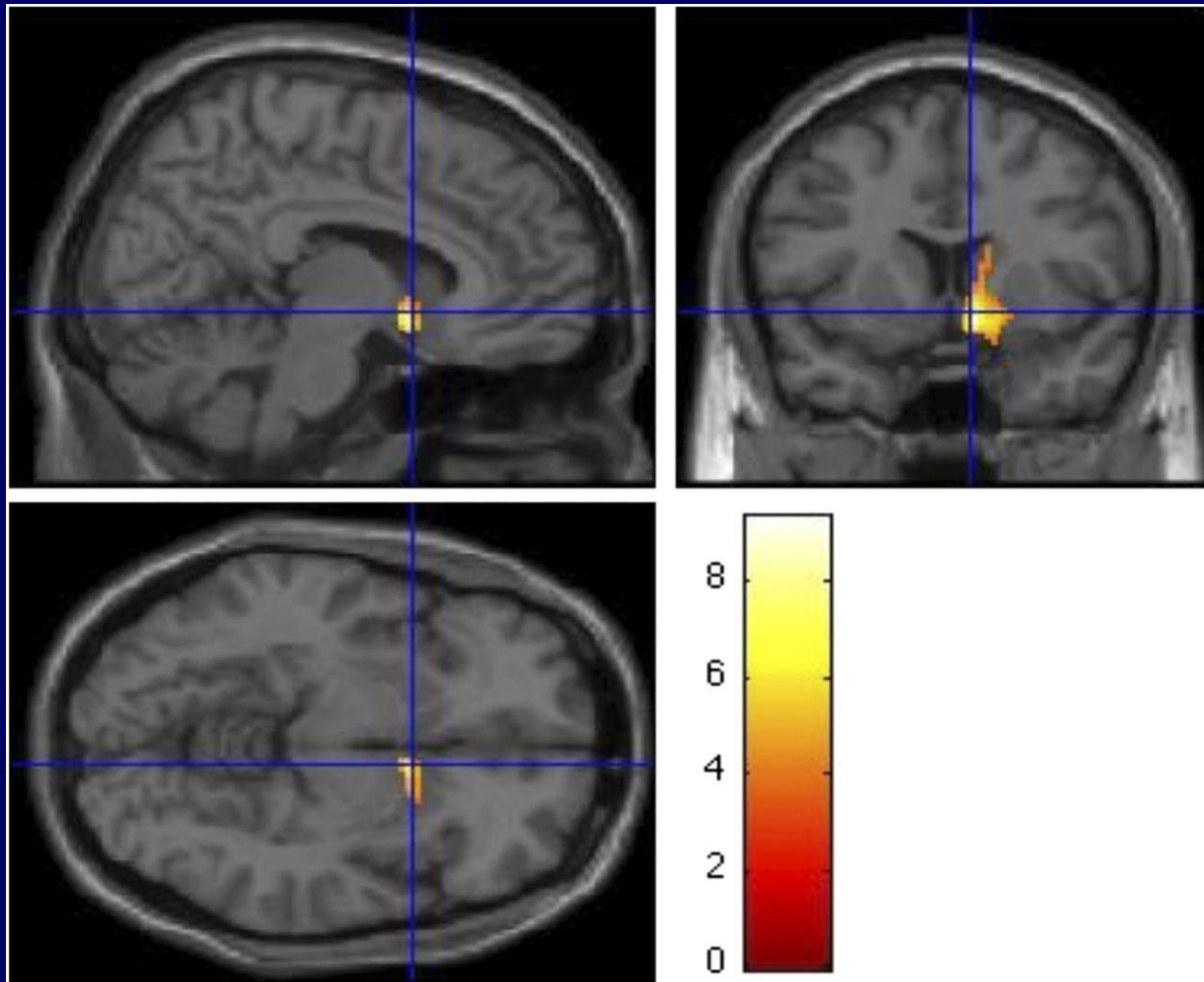
Hunger rating (10-pt scale)



Time (hr)

Brain Index & Brain Function

Activation of nucleus accumbens after high GI meal



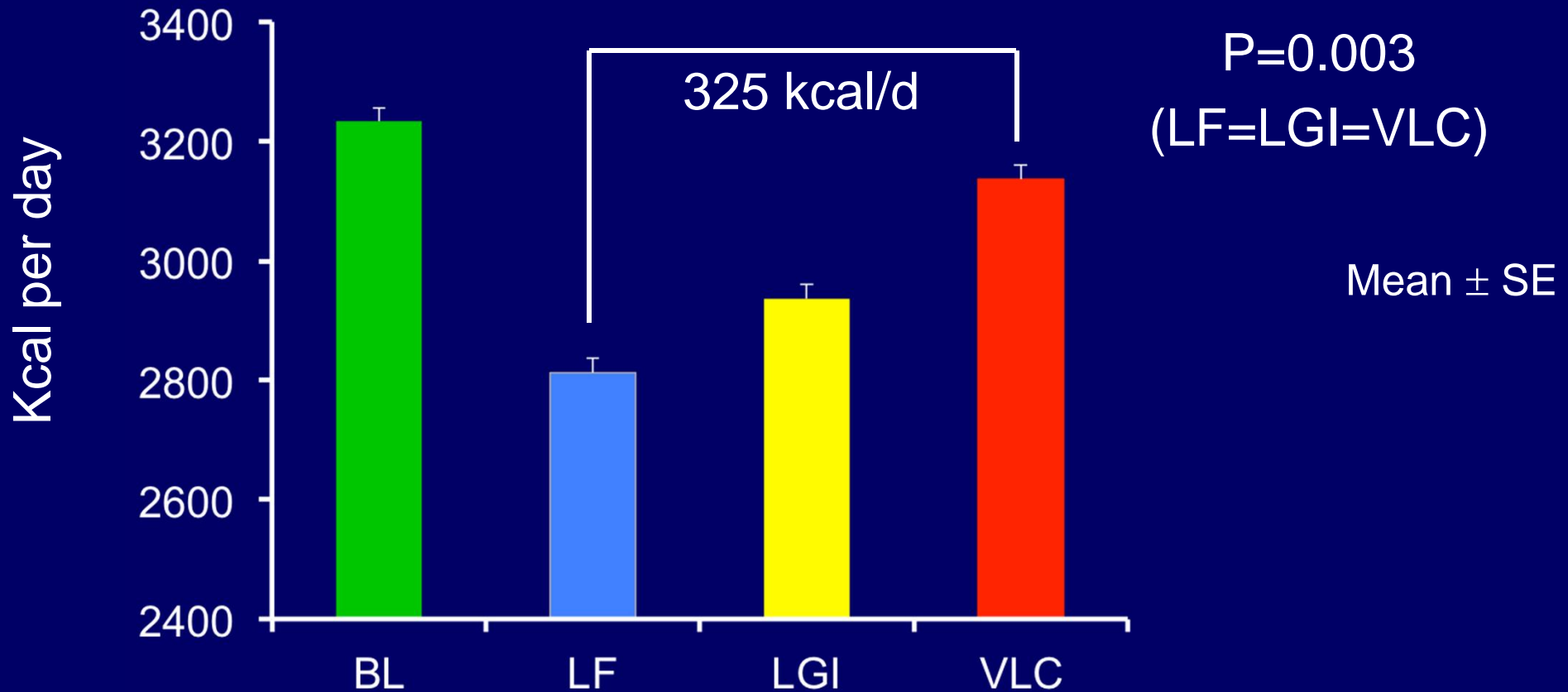
$p < 0.001$, adjusted for multiple comparisons

Intake & Weight Loss Maintenance *Methods*

- “ 21 obese young adults, studied for 7 months
- “ 10 to 15% weight loss on a standard low calorie diet
- “ Then studied during weight maintenance on each of three test diets with the same calories:
 - Low fat (60% carbohydrate, 20% fat, 20% protein)
 - Low glycemic index (40% carbohydrate, 40% fat, 20% protein)
 - Atkins very low carb (10% carbohydrate, 60% fat, 30% protein)

Intake & Weight Loss Maintenance

Effects on total energy expenditure (doubly labeled water)



Summary & Conclusions

1. The conventional approach to weight loss, the calorie-restricted diet, has poor efficacy in an environment with unlimited calorie availability
2. An alternative approach aims to reduce anabolic drive, leading to reduced adiposity with *ad libitum conditions*
3. Reduced anabolic drive may be achieved by lowering carbohydrate amount and/or carbohydrate processing, and other qualitative changes in diet
4. Future research is needed to compare strategies to improve dietary composition vs. reduce calorie intake in the treatment of obesity