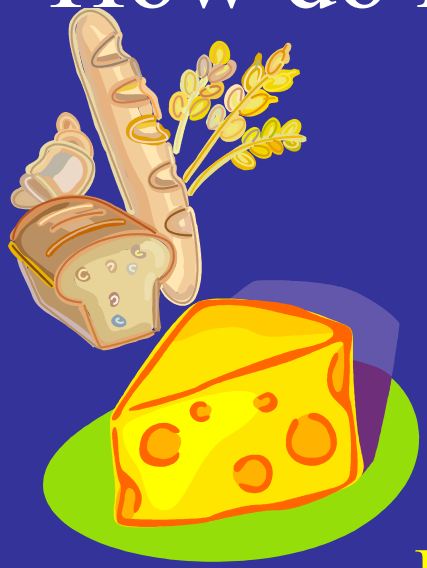
Health disparities in obesity: How do race and diet impact weight loss?



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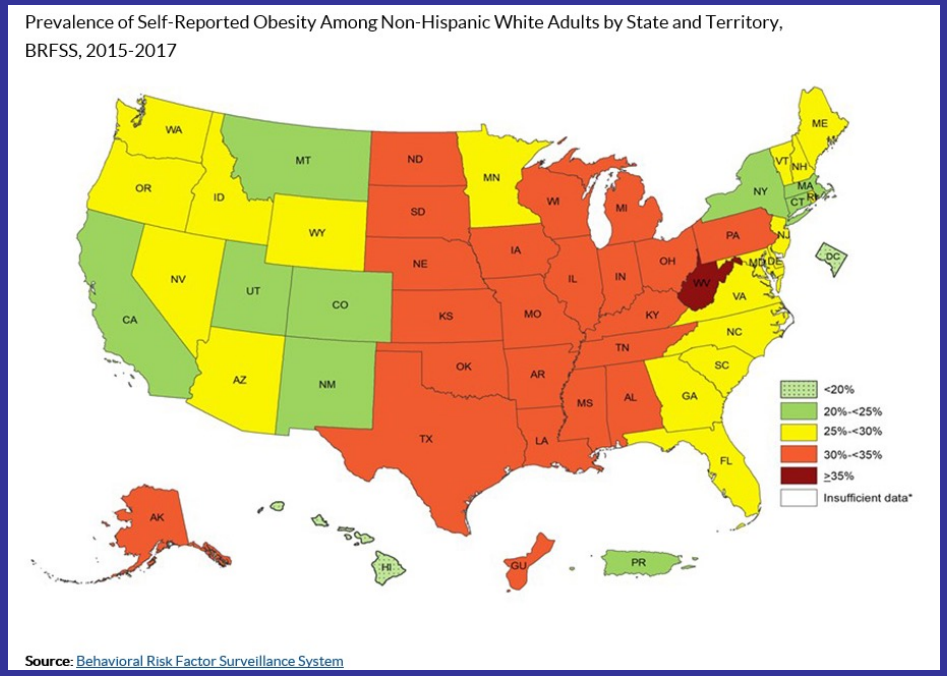
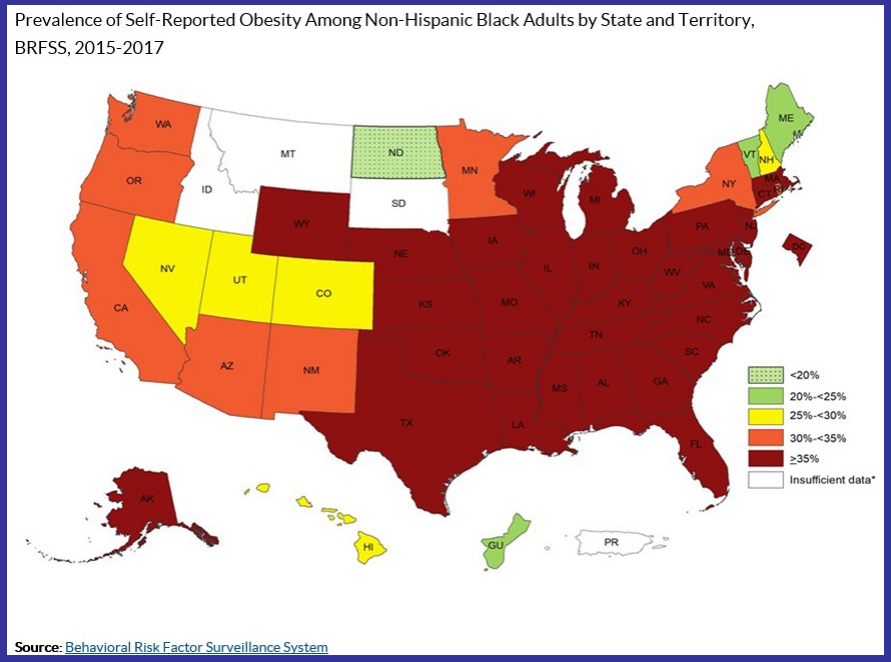
Learning Objectives

1. Understand why some individuals may be "wired for obesity" due to their physiology
2. Understand how diet can interact with physiology to promote obesity or help with weight loss
3. Understand that food triggers the endocrine system in ways that affect storage of energy as fat



Greater obesity in African-Americans

https://www.cdc.gov/obesity/data/prevalence-maps.html



Greater obesity in African-American…

women

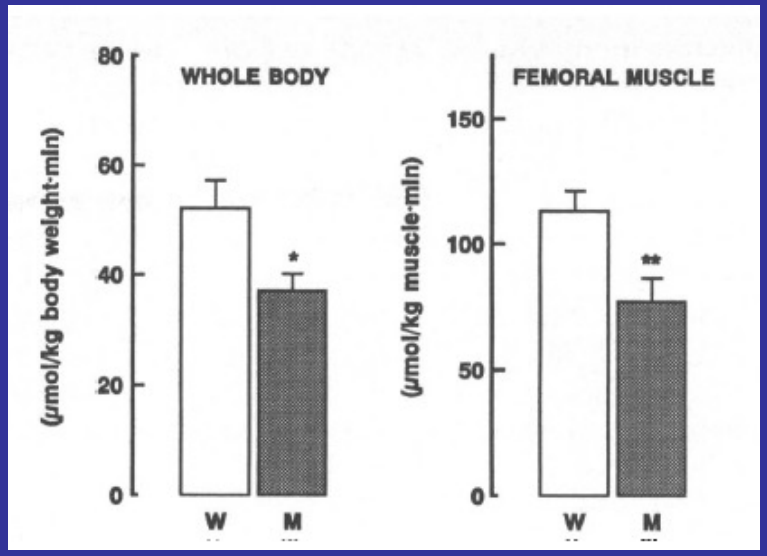
	NH Black	NH White
Men	37	38
Women	**55**	38
Overall	**47**	**38**

https://www.cdc.gov/nchs/data/databriefs/db288.pdf

Based on 2015-16 NHANES data

Why African-American women?

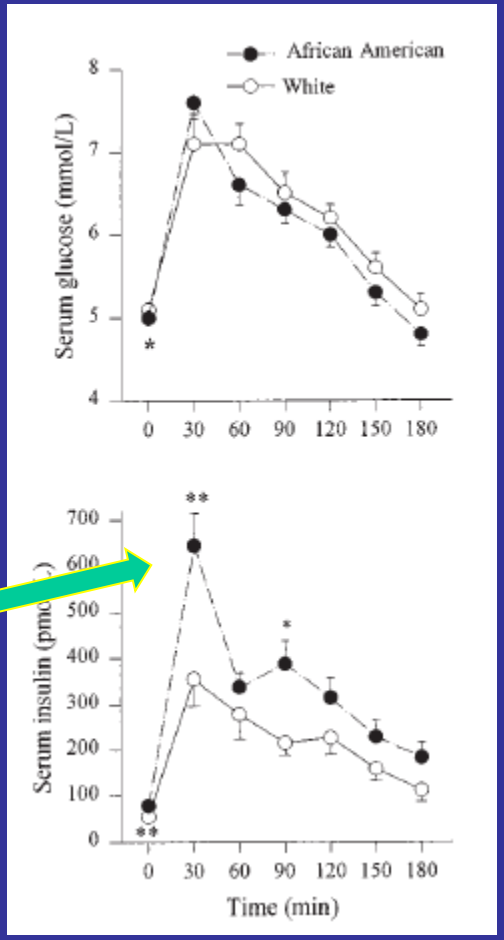
- Unique effects of race and sex
  - Women are more insulin sensitive than men
- Potentially additive or synergistic



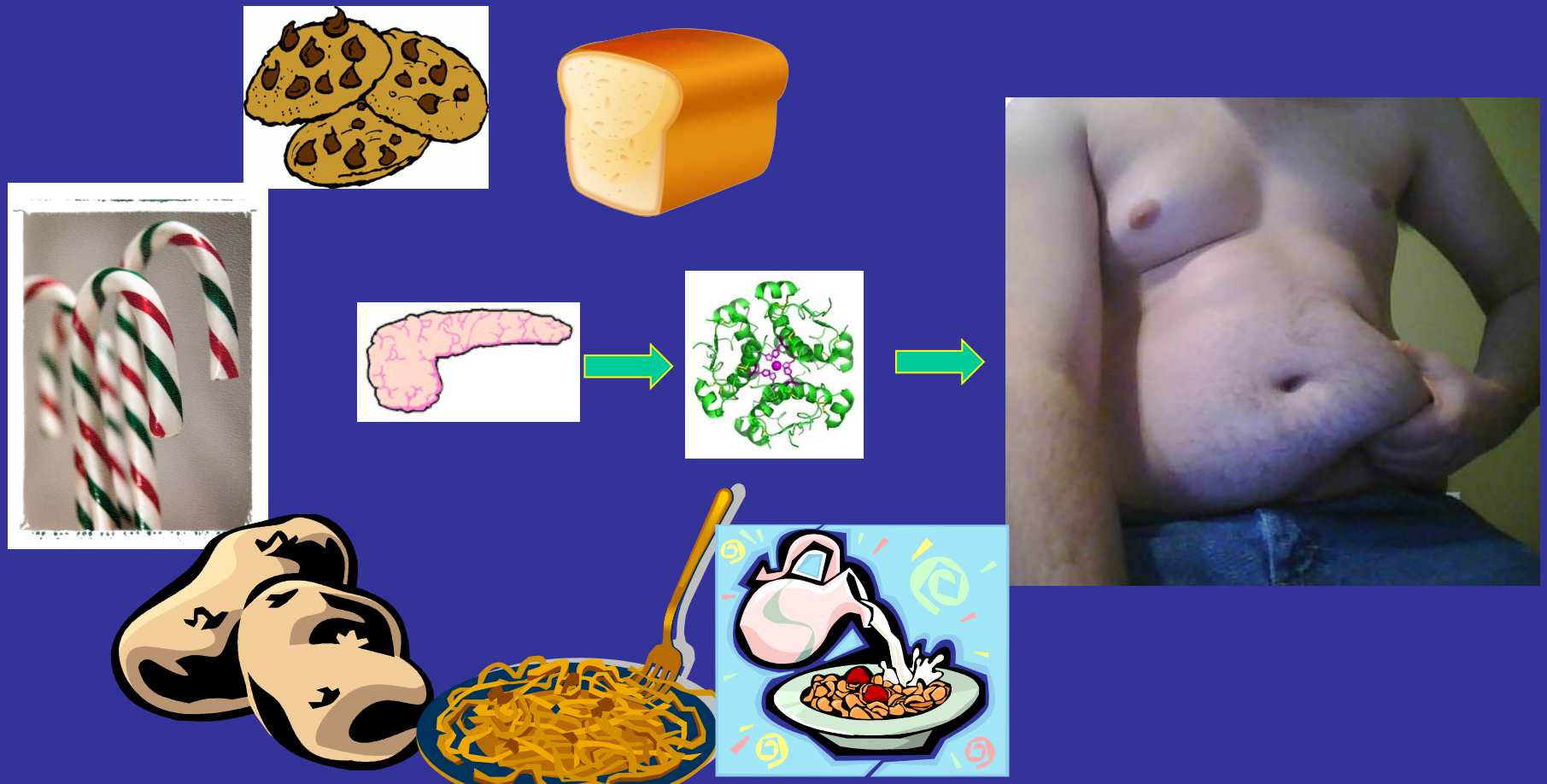
Nuutila et al. 1995, *Diabetes* 44:31-36

Unique effect of race

- Prepubertal children (5-10 y); n=73
- Oral glucose tolerance test
- Acute insulin response to glucose (AIR)
- Gower et al., 1998, *AJCN* 67:821

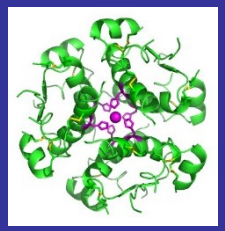


Insulin promotes fat deposition

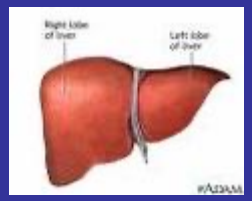


How insulin causes fat storage

Insulin



Impair fat oxidation



↑De novo lipogenesis

↑lipid uptake: LPL

↓lipid mobilization: HSL

Predisposition to obesity

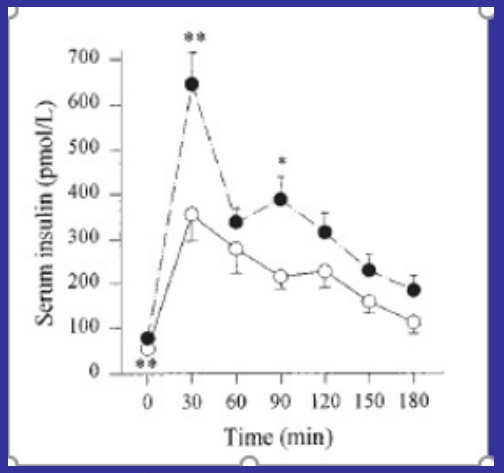
- If you secrete a lot of insulin
  - High AIR

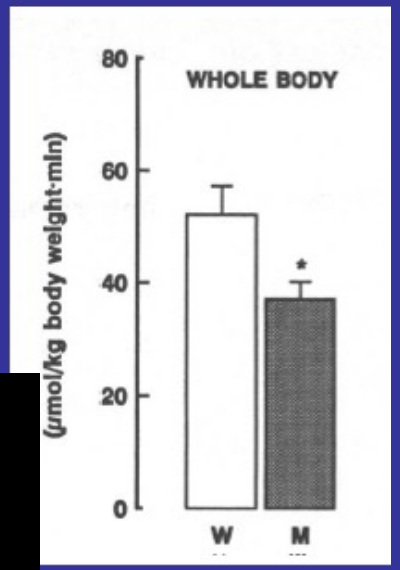
AND

- If you respond to it really well
  - High insulin sensitivity (SI)

AND

- If you eat a sugar/starches





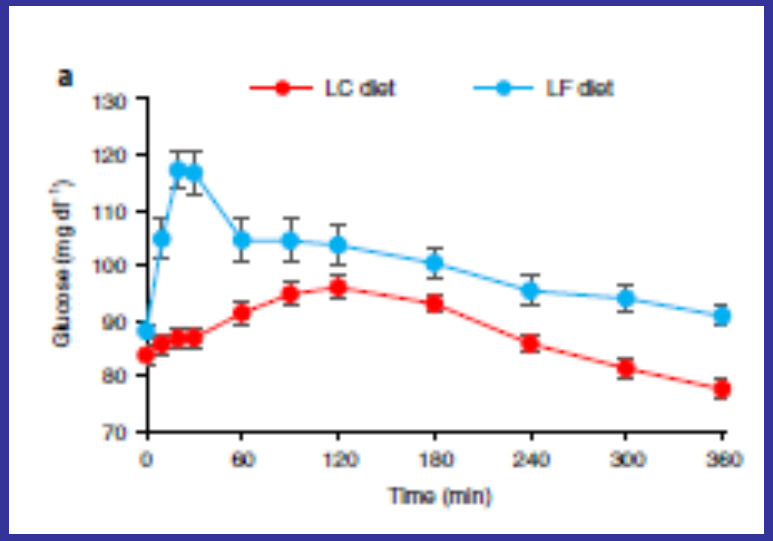
Does higher insulin in AA promote obesity?

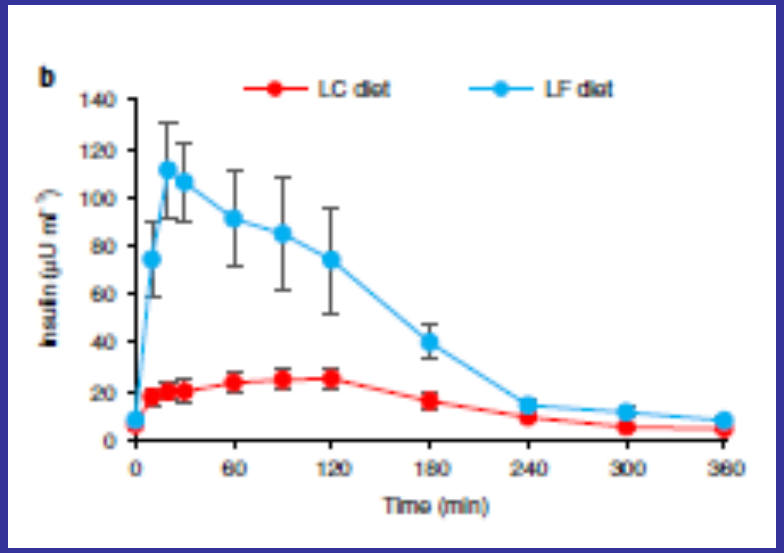
- White and Black women, BMI ~28 kg/m^2
- ~16 week weight loss
- 1-year follow-up
- Outcome: change in %body fat
- Differences based on insulin sensitivity and diet glycemic load (ability to raise insulin)

Glycemic index and load

- Glycemic index (GI) ranks a food according to how high it causes blood glucose to rise
  - Low: ≤55
  - Medium: 56-69
  - High: ≥70 (refined grains, starchy vegetables, fruit juice, sweets)
- Glycemic load (GL) is the total amount of that food consumed x the GI
  - High GL diets increase insulin

Higher glucose and insulin on a high carb, low fat diet





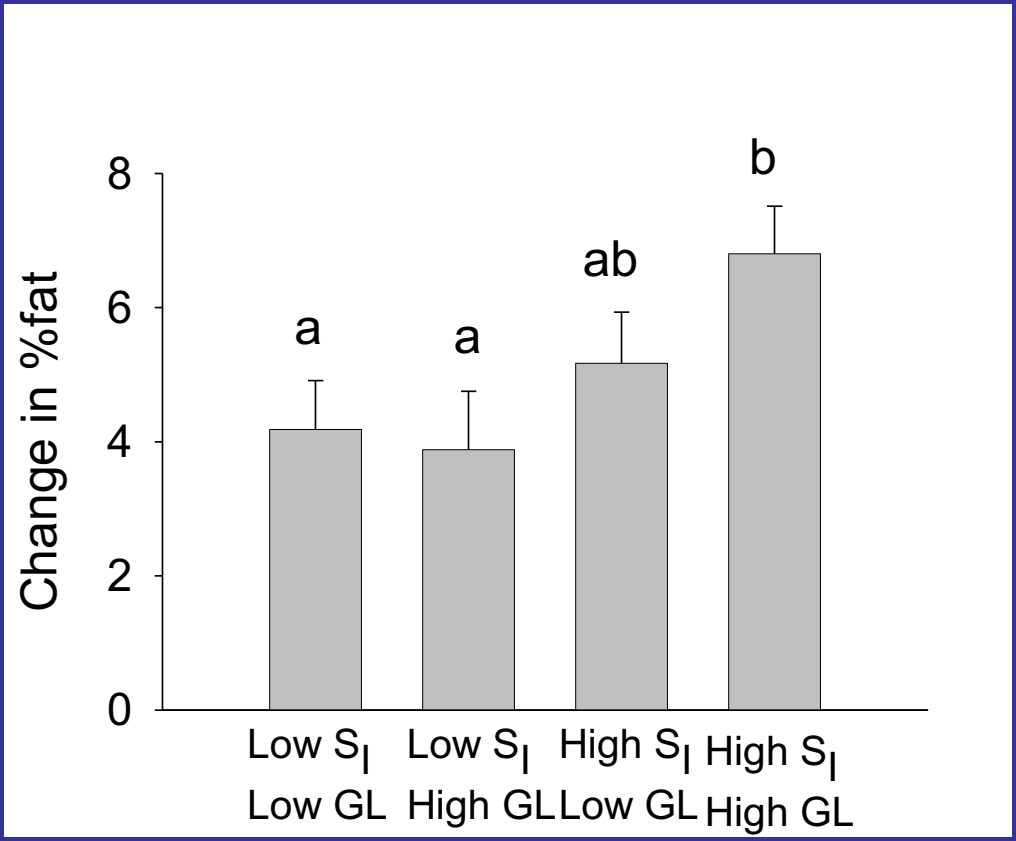
"Veggie scramble"
Eggs, cheese, onion, broccoli, spinach

Bagel, hummus, spinach, raisins, soy milk

Plant/animal-based 75% fat diet vs plant-based 75% CHO
Hall et al. 2021 *Nature Med* 27:344-353

Interactive effect of diet and insulin sensitivity on fat deposition

**S_I

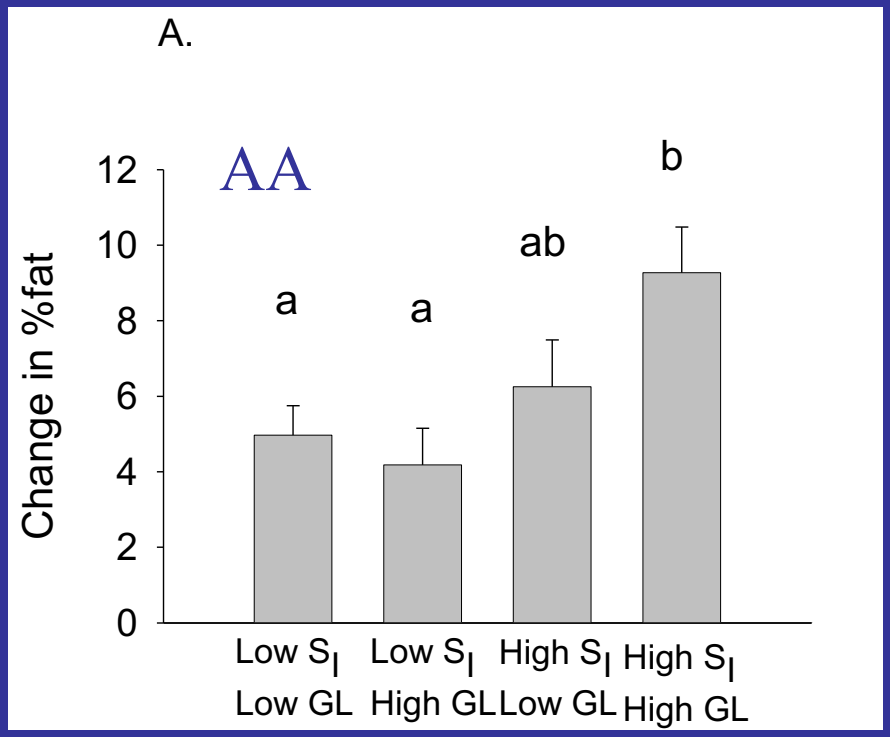


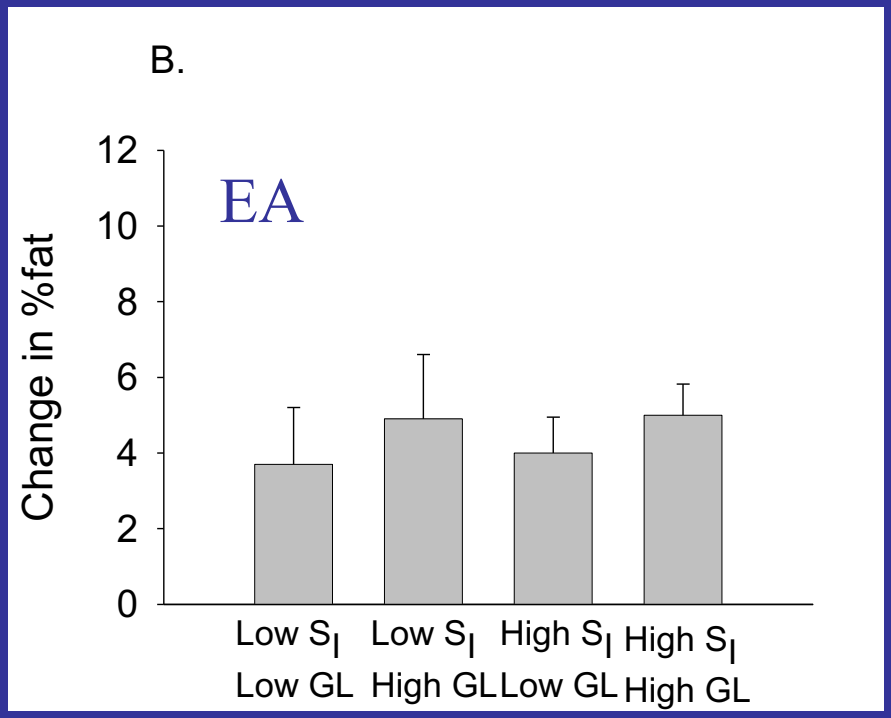
*Race
P<0.05
50% greater weight gain in AA

Adjusted for race; Gower et al. 2010 *Obesity* 18:1532

Race specificity of diet x S_I interaction

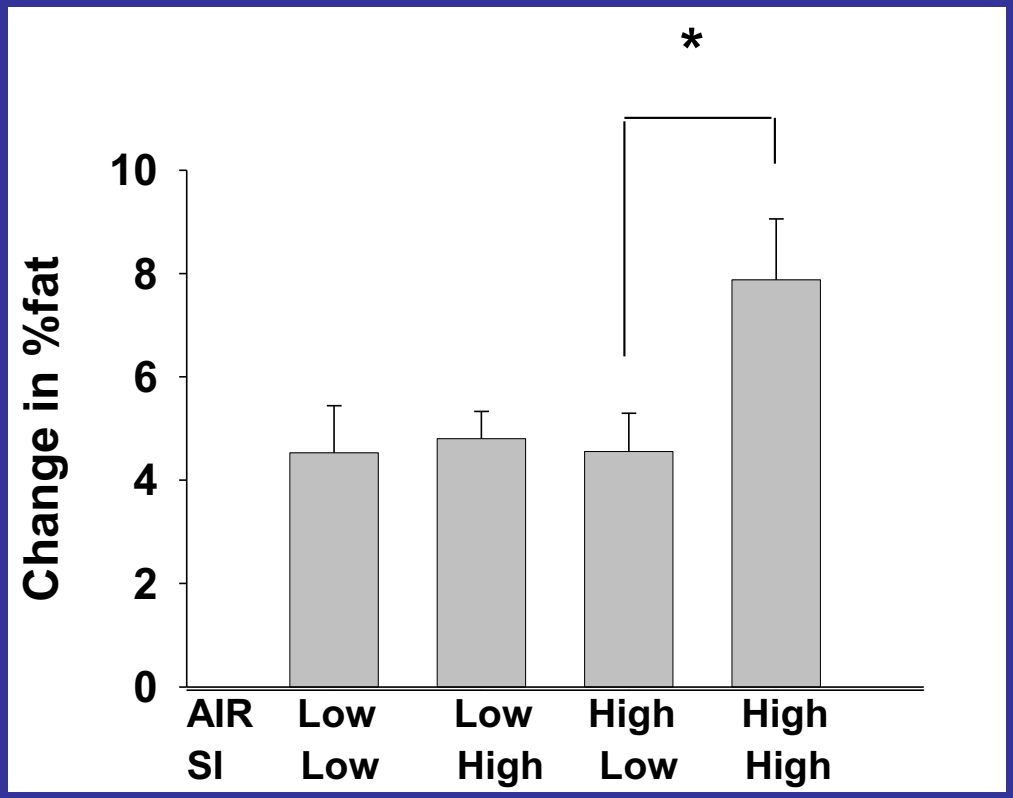
*Insulin sensitivity
*Diet x insulin sensitivity





Gower et al. 2010. *Obesity* 18:1532

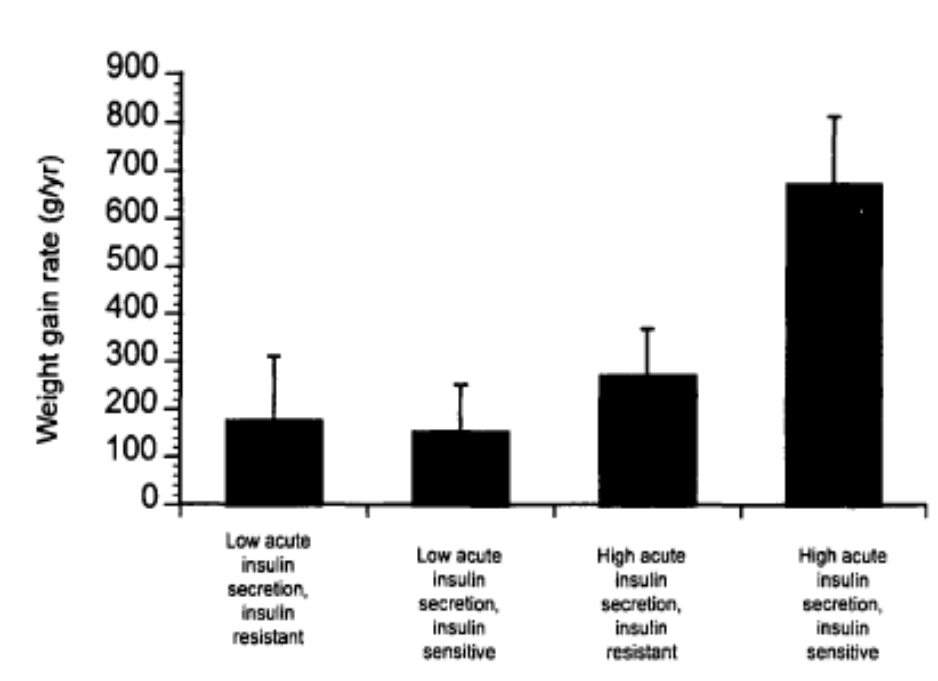
S_I only predicts fat gain if insulin is high (race deconstructed)



Data adjusted for GL (**race NS**)

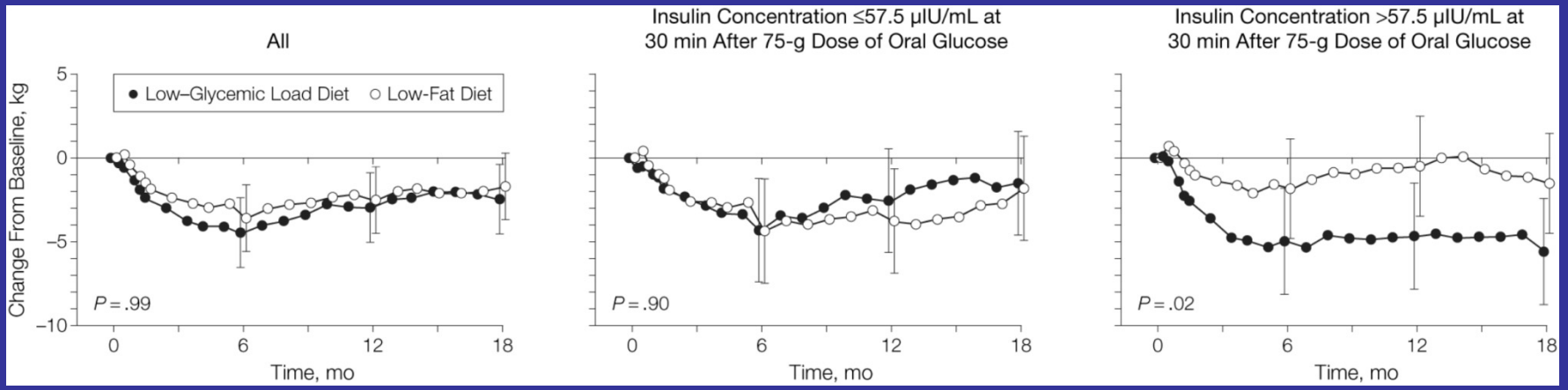
Gower et al. 2013 *Nutr. Metab.* 10:3

Offspring of parents with T2D



Synergistic effect of S_I and AIRg on free-living weight gain over a mean follow-up period of 17 years (Sigal et al., 1997).

Diet x AIR interaction on weight loss



Ebbeling et al *JAMA*. 2007;297:2092-2102

Factors that affect weight gain/loss in susceptible individuals

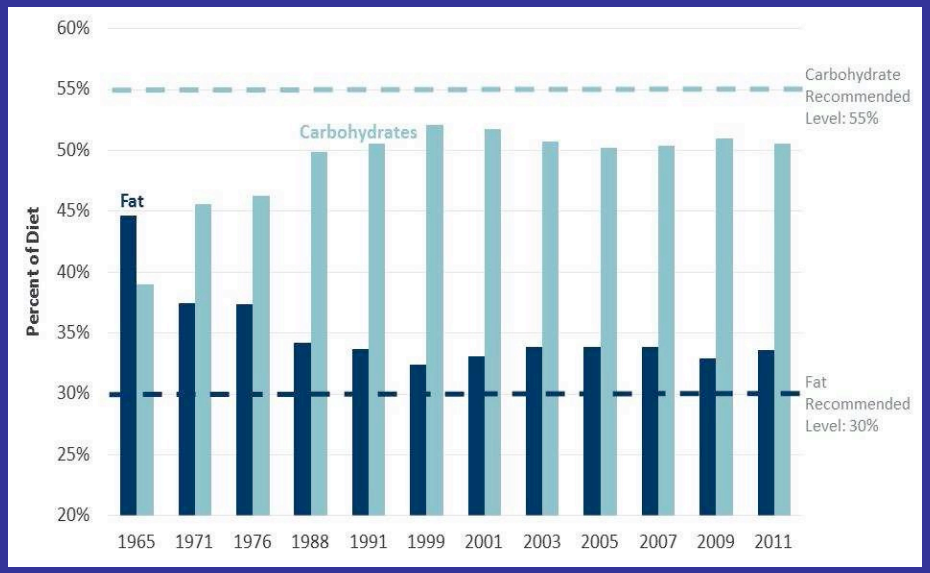
- Insulin response
- Insulin sensitivity
- Diet

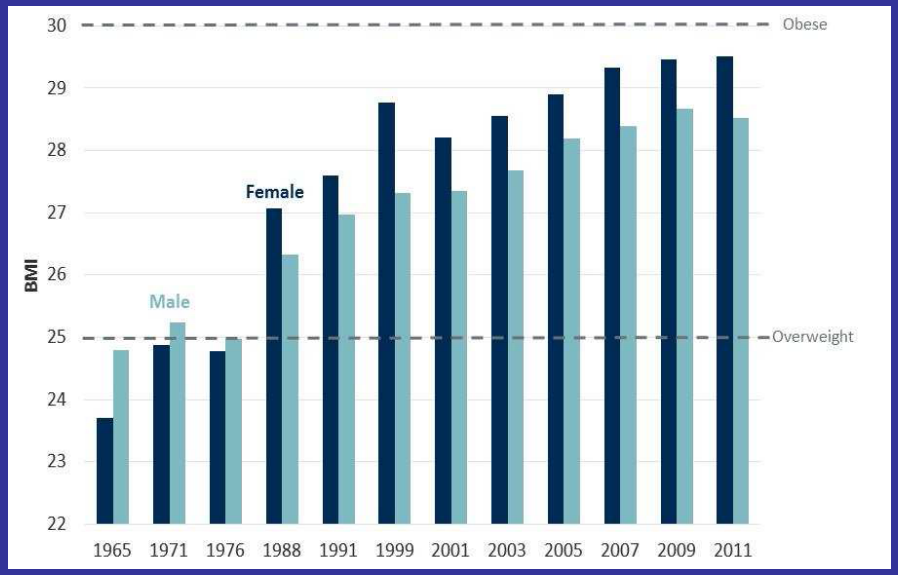
Modifiable

$$AIRg \times S_I \times Diet$$

Does an insulin-lowering (low glycemic) diet promote weight loss in overweight AA?

In the ‘60s, the American diet was <40% carbohydrate





Cohen E, Cragg M, deFonseka J *et al.* Nutrition 2015; 31:727-732.

- All food provided for 16 weeks
- 8 weeks eucaloric, 8 weeks hypocaloric (-1000 kcal/day)
- Individualized energy prescription
- Food packaged for off-site consumption
- 43C:18P:39F “low GL”
- 55C:18P:27F “Standard”

What does a low glycemic diet look like?

Table 1 – Example day of meals for the reduced CHO diet and the standard (STD) diet.

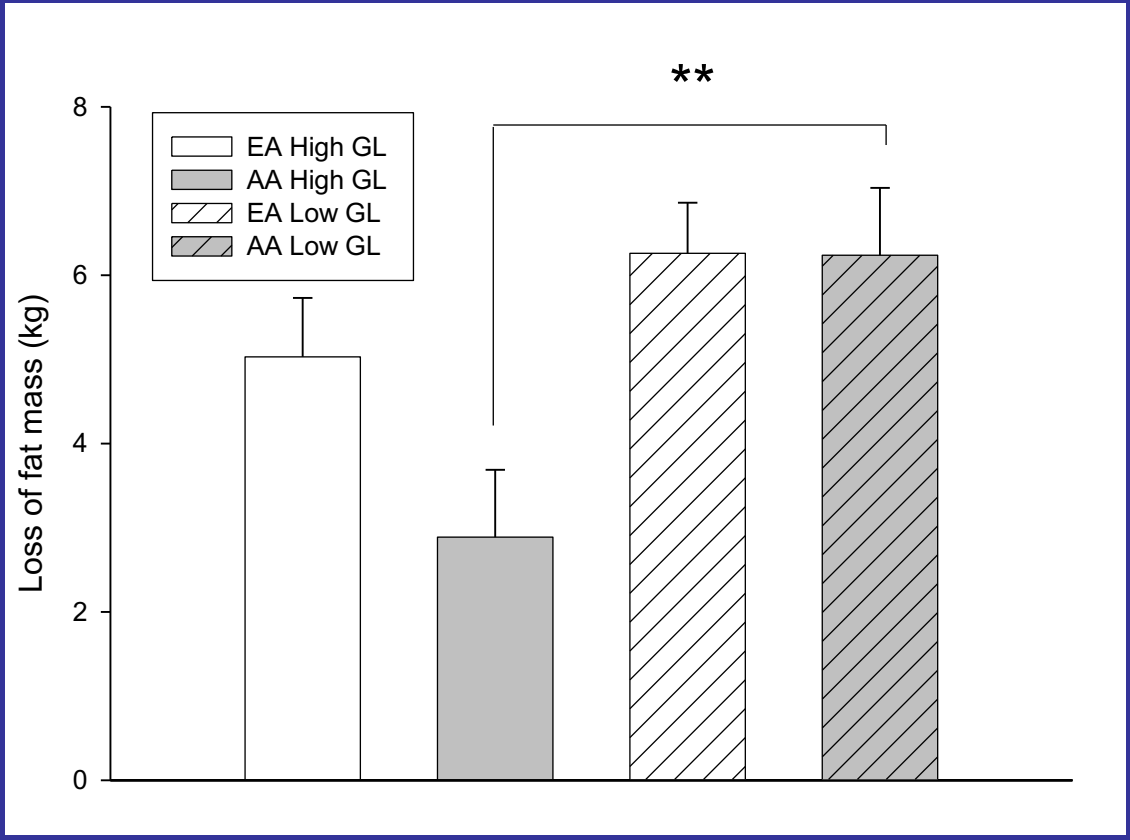
Reduced-CHO diet (1800 cal)		STD diet (1800 cal)	
Breakfast			
Pear, fresh	1 medium	White bagel	1 medium
Oatmeal, instant	1 packet (28 g)	Cream cheese, regular	28.4 g
Butter, regular	10 g	Boiled egg	2 large
Sugar	1 packet (4 g)	Orange juice	118.3 mL
Egg, boiled	1 large		
2% Milk	236.6 mL		
Bacon, regular	2 slices (28.4 g)		
Lunch			
Chicken Vegetable Soup	396.9 g	White bread	2 slices
Black bean vegetarian burger	1 each (67 g)	Peanut butter, regular	21.3 g
Hamburger bun	1 medium	Jelly, regular	2 packets (28 g)
American cheese	1 slice (42 g)	Light canned peaches	227.2 g
Mustard	1 packet (6 g)	Baby carrots, fresh	10 medium
Mayonnaise, regular	1 packet (12 g)	Ranch dressing, fat free	12.4 g
Ketchup	1 packet (10 g)		
Bugles, original[1]	15 g		
Orange, fresh	1 small		
Dinner			
Chicken breast	1 breast (85 g)	Breaded chicken patty, pre-cooked	1 each (129 g)
Green beans, frozen	1 cup	Hamburger bun, white	1 medium
Lima beans, frozen	1 cup	Ketchup	1 packet (10 g)
Butter, regular	10 g	Mustard	1 packet (6 g)
Graham crackers, plain	2 squares	Broccoli, frozen	1 cup
Peanut butter, regular	21.3 g	Hard candy	3 each (18 g)
		Pretzels	28.4 g
		Orange juice	118.3 mL

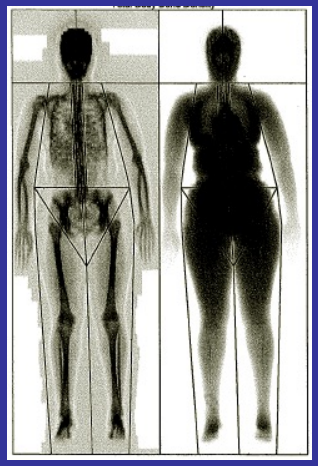
Participants

Baseline characteristics by ethnicity

	EA *n*=36	AA *n*=33
Sex (M/F)	18/18	13/20
BMI (kg/m^2)	31.8 ±3.7	33.2 ±4.7
Age (yr)	36.1 ±8.0	34.1 ±8.6
Weight (kg)	97.2 ±18.5	102.0 ±19.0
Fat mass (kg)	38.9 ±9.2	40.6 ±8.8
AIRg (uIU/ml x 10 min)	824 ±628	1415 ±917**

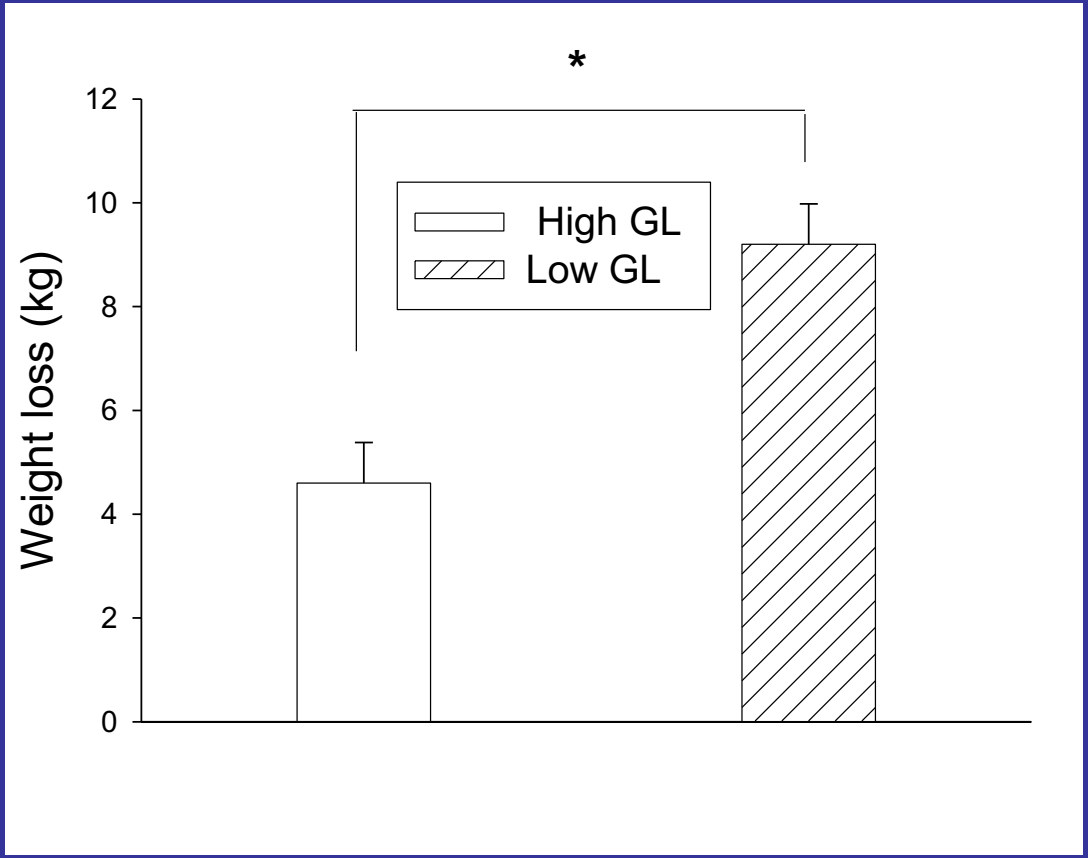
AA but not EA show diet difference in fat loss over 16 wk





Gower and Goss; *J Nutr* 2015, 145(1):177S-83S; Adjusted for S_I, baseline fat

Premenopausal AA women: Greater weight loss with low glycemic diet than calorie matched high glycemic (low fat) diet



10 lbs vs 20 lbs over 10 weeks; all women normal glucose tolerant

Etiology of obesity in susceptible individuals

High sugar diet

↑ Insulin

↑ Energy storage

↑ hunger, energy intake

↑ fatigue, ↓ energy expenditure

Obesity

Summary

- Healthy AA have high insulin secretion response (high AIR)
- Among AA, weight gain/loss predicted by:
  - AIR x SI x diet
- A low glycemic diet promotes greater weight loss in AA

Acknowledgements

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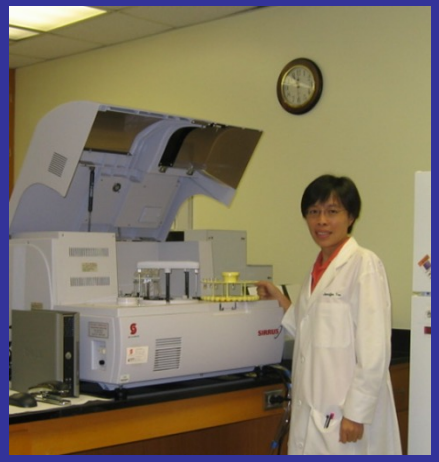

Staff

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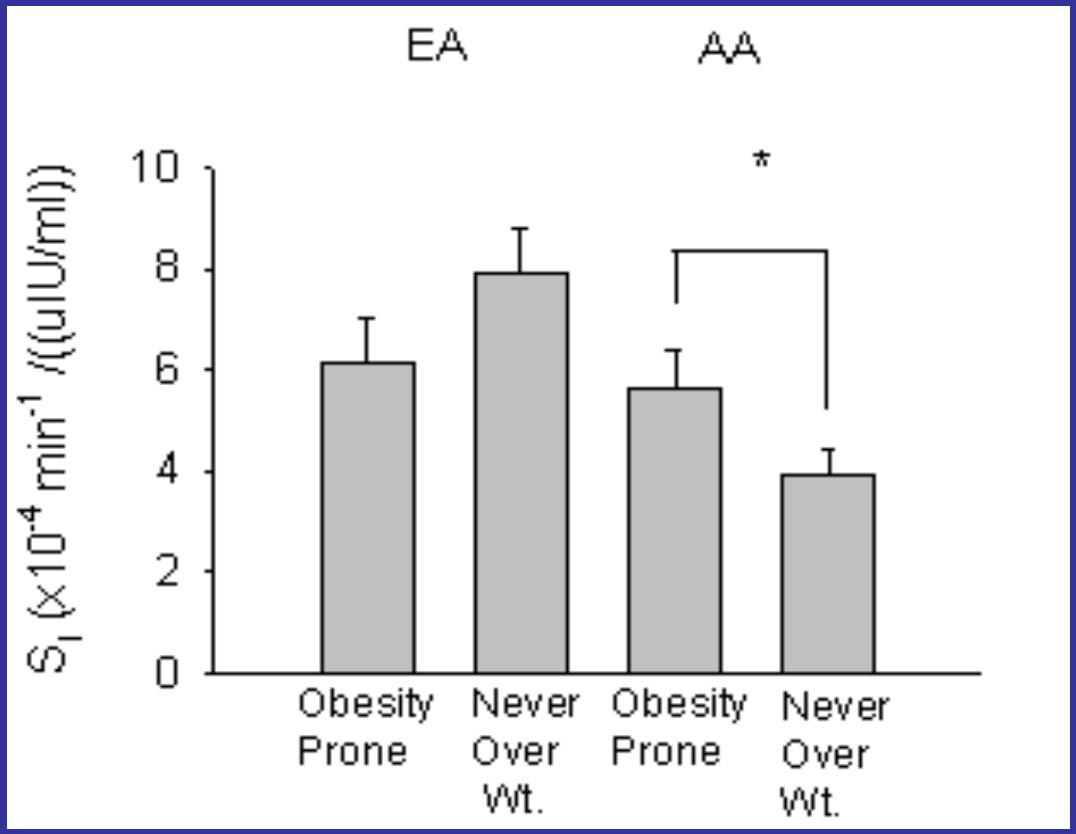
Thank you!

What about constitutionally lean individuals?

Insulin sensitivity is lower in constitutionally lean AA women



Gower et al. 2013 *Nutr. Metab.* 10:3

All women BMI <25 kg/m^2
*Race x obesity status