Prunes and the glycemic index

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Efficacy of low GI foods and their application

OUTLINE

- Definitions and methodology
- Examples of high and low GI foods
- Food factors that influence the GI
- What's so good about the GI?
- Is it a useful clinical tool?
- How do put a low GI diet into practice

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Carbohydrates are the only food constituents that directly raise blood glucose

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Carbohydrates vary in their glycemic 'potency'

Pounding waves
"Gushers"

Gentle trickle
"Tricklers"

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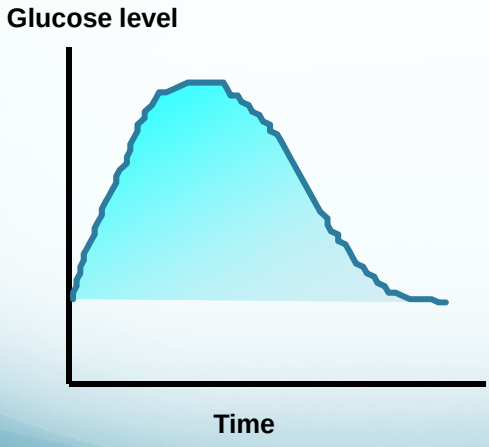
Glycemic potential depends on

- Speed of stomach emptying
- Speed of digestion
- Speed of absorption

Glycemic potency is a property of the food, not the person

Postprandial glycemia

in a given individual



Determined by:

- The quantity of CHO
- The quality of CHO

= Glycemic index

GI = ranks individual foods according to their impact on blood glucose

CHO = carbohydrate

The glycemic index (GI)

- It allows the 'glycemic' comparison of CHO exchanges or servings of food that contain equal amounts of CHO
- The GI of a food is determined by a standardized in vivo testing protocol
- Glycemic load (GL) is a measure of both CHO quantity and quality
- = GI x grams of CHO per serving (divided by 100)

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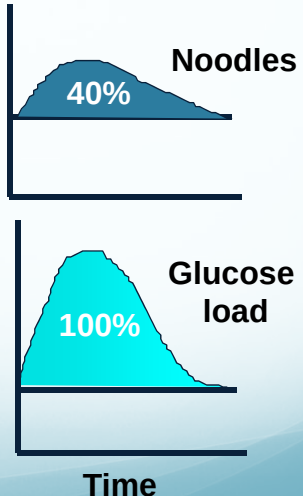
CHO = carbohydrate

GI methodology

- Compares glucose AUC over 120 min
- Gram for gram of carbohydrate
- Relative to the reference food (=100)
  - 50 g glucose load (or 25 g)
  - Assessed 2 or 3 times
- Published GI is the mean of 10 subjects (640 datapoints)
- Reproducible in different groups of subjects



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Examples of high and low GI carbs

Searchable database at www.glycemicindex.com

High GI (>70)

- Potatoes
- White bread
- Wheatmeal bread
- Most rices
- Most breakfast cereals
- Most low-fat snacks

Low GI (<55)

- Pasta and noodles
- Legumes
- Dairy foods
- Most fruit & vegetables
- Basmati rice
- Some breads
- Some breakfast cereals

NB Wholegrain products are often high GI

GI of dried prunes

Dried prunes GI = 40 ± 6

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Factors that influence the GI

- Type of starch
  - Amylose, amylopectin, degree of gelatinisation
- Cooking and processing
  - Water, temperature, pressure, time
- Protein and fat content of food
- Acidity (vinegar in particular)
- Fibre (viscous fibre, not insoluble fibre)
- Phtyo-nutrients (polyphenols, amylase inhibitors…)

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How well does the GI reflect postprandial glycemia and insulinemia?

The **peak**?
Insulin responses?

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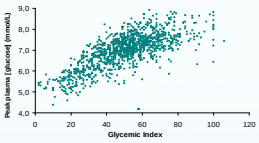

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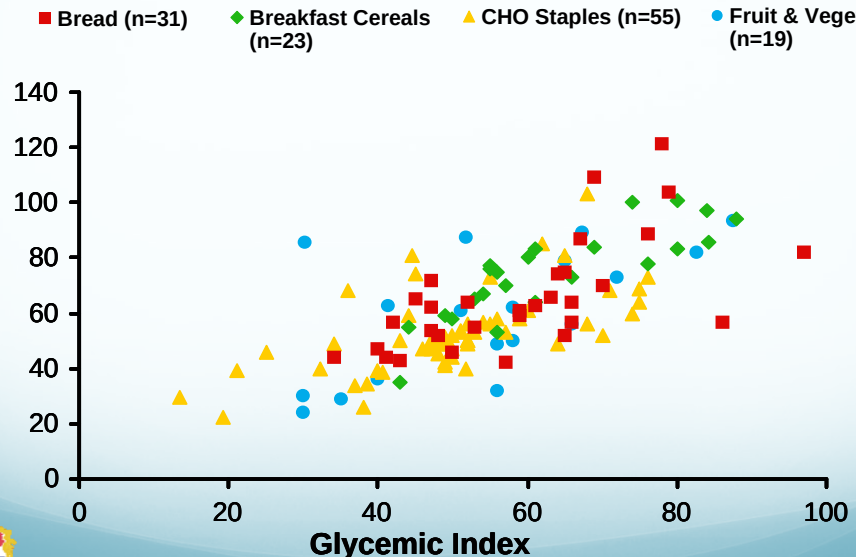
GI and insulin are closely correlated



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What about mixed meals?

Does the GI predict the glucose and insulin response to realistic meals?

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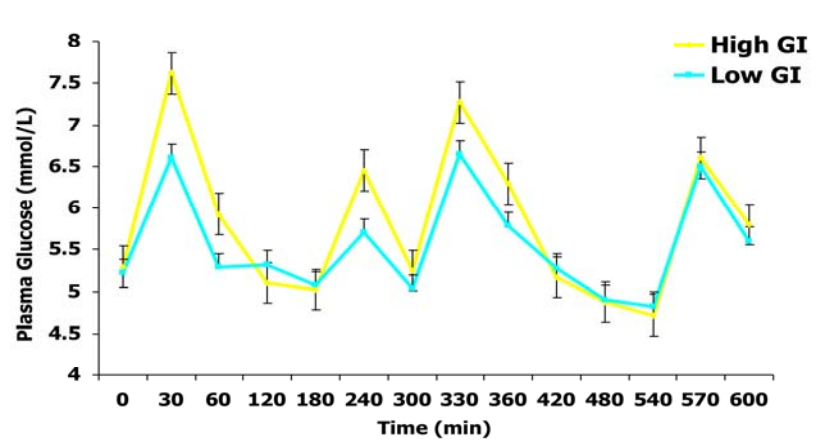
Glucose profiles for 4 mixed meals over 10 h

n = 11 overweight subjects



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McMillan-Price et al. Arch Intern Med 2006

Insulin profiles for 4 mixed meals over 10 hr

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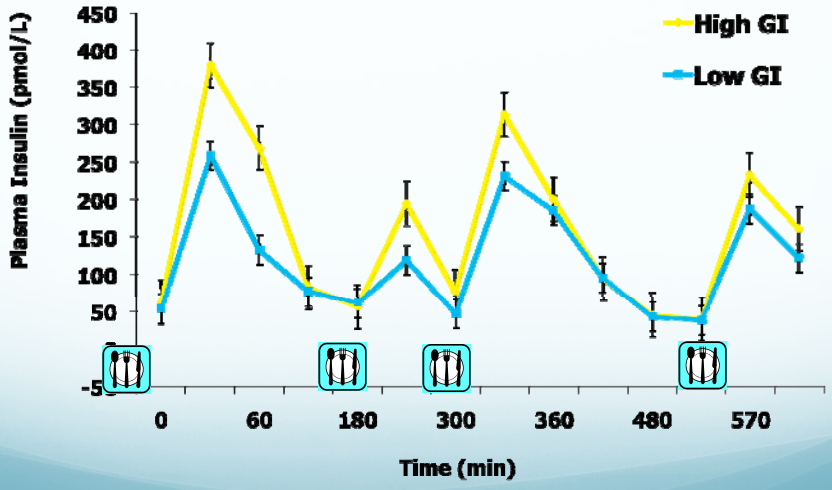

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McMillan-Price et al. Arch Intern Med 2006

What's so good about the glycemic index?

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The GI is a useful clinical tool

Low GI diets have been shown to…..

- improve glucose control in diabetes
- improve insulin sensitivity
- reduce risk of type 2 diabetes
- improve cardiovascular risk factors
- improve weight control

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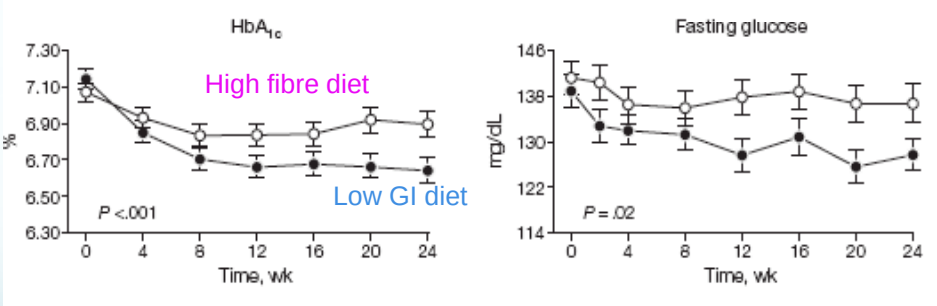
Low GI diet vs high fibre diet

RCT in type 2 diabetes over 24 wks (n = 210)



HDL also increased more in the low GI arm and more subjects required reductions in medication

Jenkins et al. JAMA 2008

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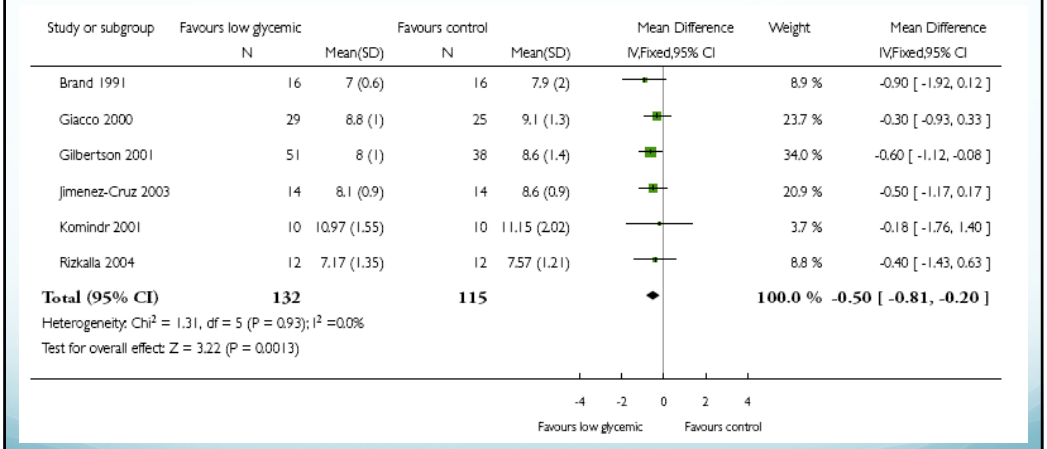
Low GI improves diabetes control

Meta-analysis of glycated hemoglobin (mean Δ = -0.5%)



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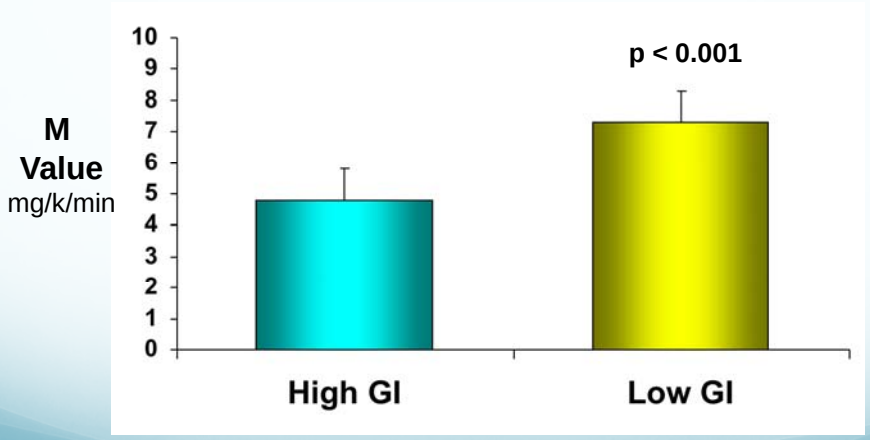
Thomas et al. Cochrane Library 2009

Low GI diet improves insulin sensitivity

4 week crossover, 12 diabetic subjects, weight maintenance



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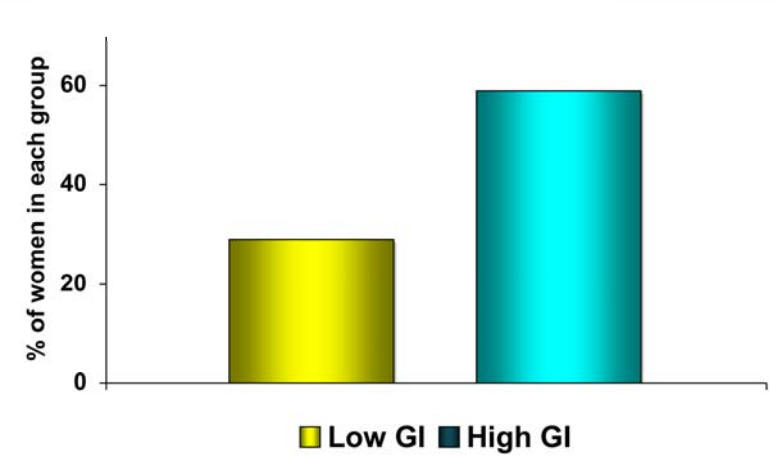
Rizkalla et al. Diabetes Care 2004

Low GI diets reduce need for insulin in GDM

Gestational diabete, low GI vs high fibre diet, n = 62



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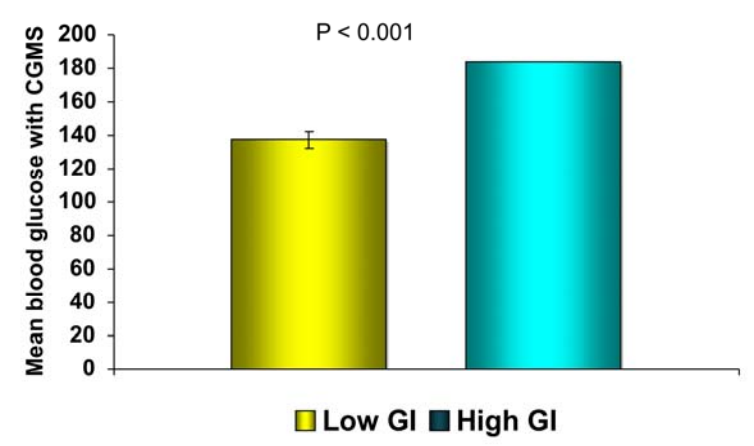
Moses et al. Diabetes Care, in press

Low GI meals reduce mean BGL

CGMS in 20 children with type 1 diabetes over 24 h



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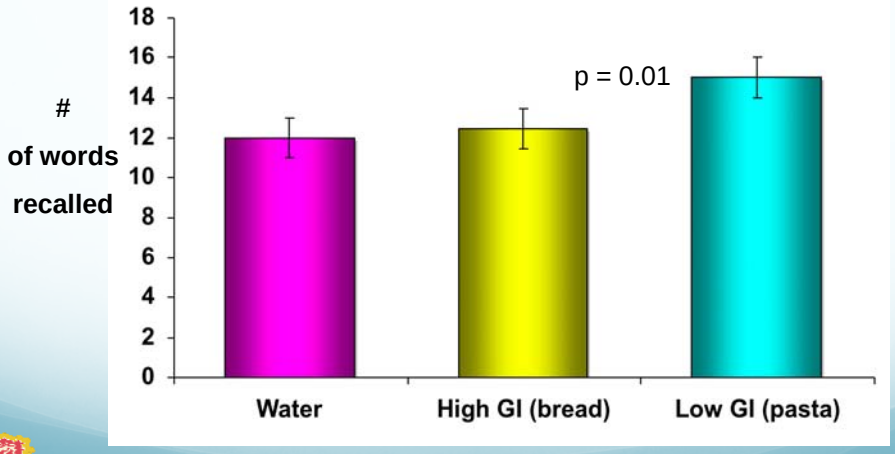
Nansel et al. Diabetes Care, 2008

Low GI improves memory recall

Delayed memory recall, Type 2 diabetes, n = 21



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Papanikolaou et al. Diabetologia 2006

GI and GL predict the risk of developing type 2 diabetes

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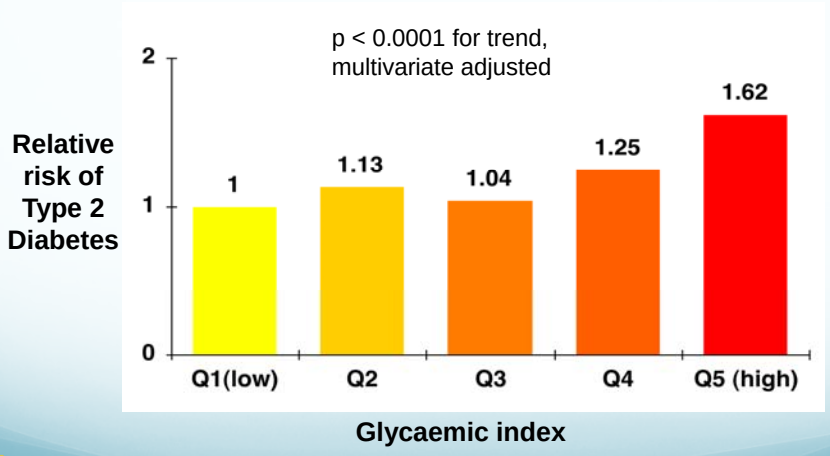
High GI increases risk of T2DM

Nurses Health Study II, 8 years of follow-up in 91,000 women



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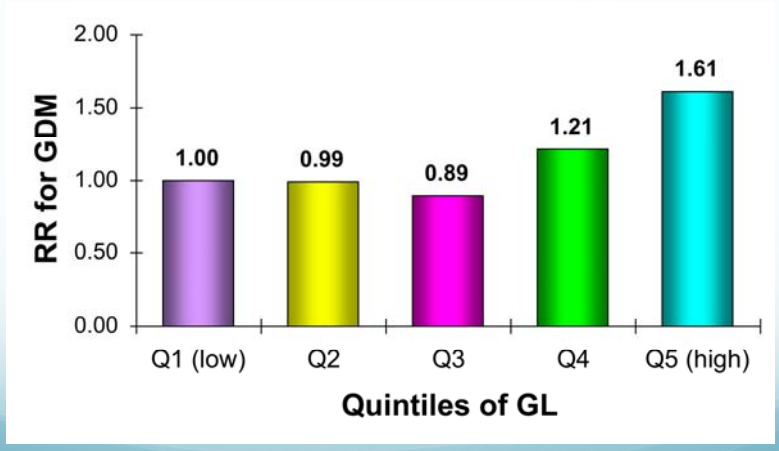
Schultz et al, Am J Clin Nutr, 2004

High GL diets increase risk of diabetes in pregnancy

Gestational diabetes over 8 y of follow up in 13,110 women



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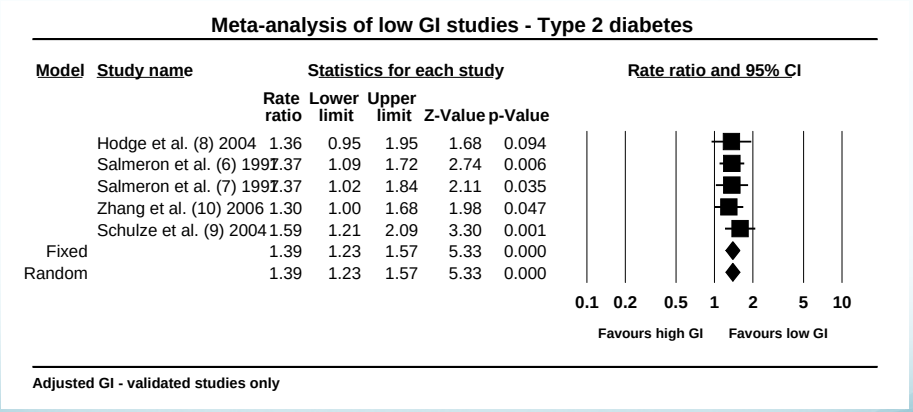
Zhang et al. Diabetes Care 2006

Meta-analysis of observational studies

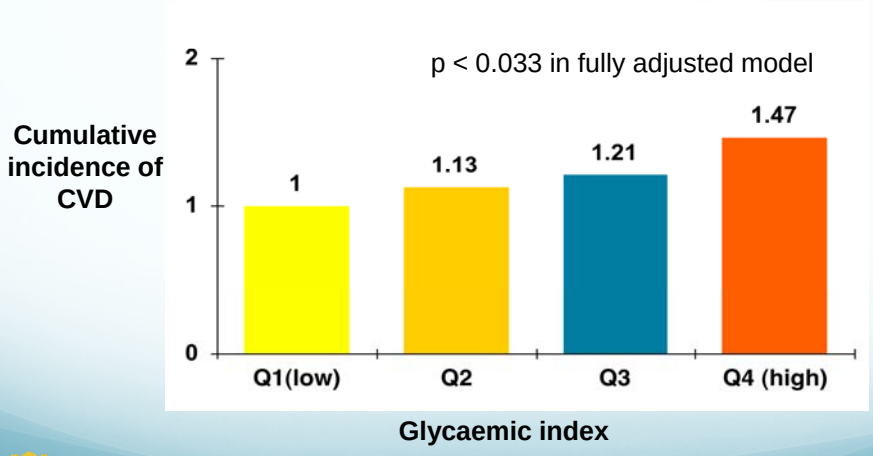
GI and diabetes risk (RR = 1.4)



Barclay et al. Am J Clin Nutr 2008

High GI diets increase CVD risk

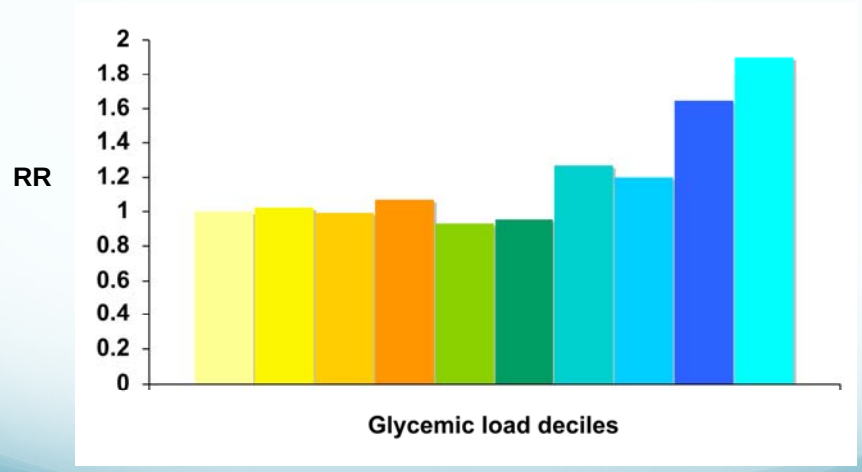
Prospect-EPIC Dutch cohort, n = 15,714 women, 9 y of followup



Beulens et al. J Am Coll Cardiol 2007

Diet glycemic load and risk of CVD

Nurses' Health Study 20 years of follow-up in 82,000 women



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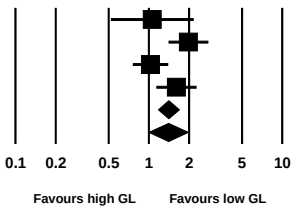
Halton et al. New Engl J Med, 2006

Meta-analysis of observational studies

GL and CVD (RR = 1.4)

Meta-analysis of low GI studies - CVI

Model	Study name	Statistics for each study					Rate ratio and 95% CI
		Rate ratio	Lower limit	Upper limit	Z-Value	p-Value	
	van Dam et al. (17) 2000	1.06	0.52	2.15	0.16	0.872	
	Liu et al. (14) 2000	1.98	1.41	2.78	3.97	0.000	
	Oh et al. (15) 2005*	1.03	0.76	1.39	0.19	0.846	
	Oh et al. (15) 2005+	1.61	1.15	2.26	2.75	0.006	
Fixed		1.41	1.18	1.69	3.74	0.000	
Random		1.41	1.00	1.97	1.97	0.048	



Adjusted GL - validated studies only

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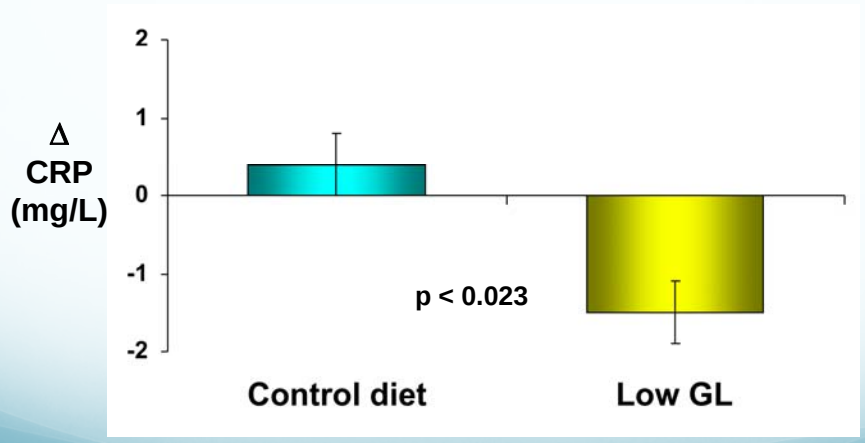
Barclay et al. Am J Clin Nutr 2008

Low GI improves inflammation

CRP is a measure of oxidative stress, n = 34, 26 wk study



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Pittas et al. Obesity 2006

GI and obesity

Vigorously debated in recent issues of AJCN, Lancet and JAMA

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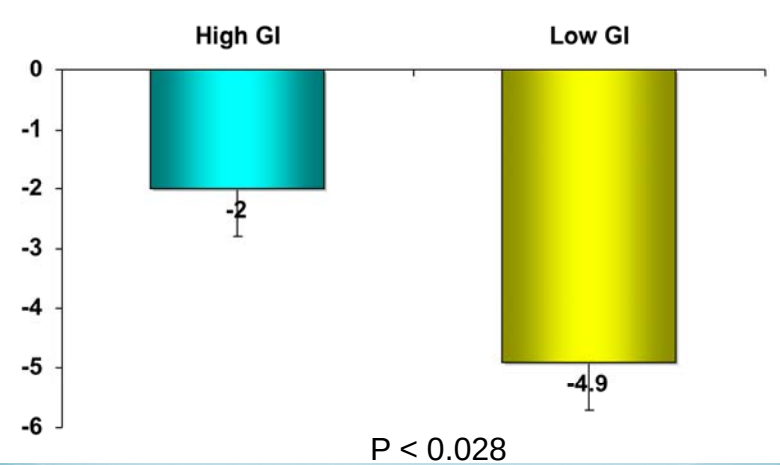
Low GI diet increases body fat loss

Fat mass changes in overweight young adults



P < 0.028

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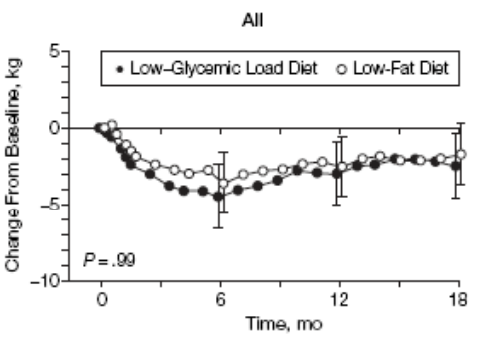
McMillan-Price et al. Arch Intern Med 2006

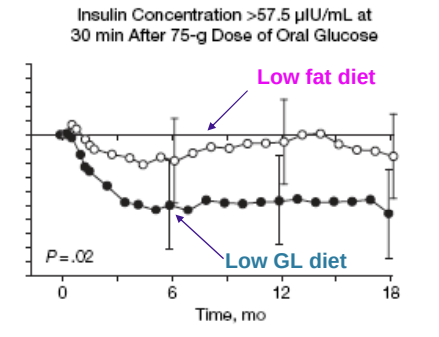
Long term effects of a low GL diet

Changes in weight over 18 months in overweight subjects (n = 73)

All subjects



Subjects with high insulin-30



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Ebbeling et al. JAMA 2007

Proven clinical benefits of low GI diets

- lower average glucose levels
- improve diabetes control
- reduced risk of developing diabetes
- reduced risk of developing heart disease
- improved insulin sensitivity
- improved weight control

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Duality of interest

Jennie Brand-Miller is….

Director of Sydney University Glycemic Index Research Service www.glycemicindex.com

President of Glycemic Index Ltd, a non-for-profit food endorsement program in Australia www.gisymbol.com

Co-author of “The New Glucose Revolution” and “The Low GI Diet” and other books

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