Effects of Dietary Glycemic Properties on Markers of Inflammation, Insulin Resistance and Body Composition in Postmenopausal Women

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BACKGROUND

- It is currently thought that chronic low-grade inflammation is a major contributor to many chronic diseases states, such as cardiovascular diseases, diabetes, and cancer.
- Inflammation is thought to increase with age, which may in part be responsible for the decline in lean mass and increase in adipose tissue that occurs with aging.
- In this context, low-grade inflammation refers to a variety of mechanisms, including oxidative stress that results in the release of inflammatory cytokines and leads to insulin resistance.
- Factors that contribute to chronic low-grade inflammation are incompletely understood, but recent attention has focused on the Western diet. In particular, there has been considerable interest in the contribution of glycemic index (GI) and glycemic load (GL) to chronic low-grade inflammation.

STUDY OBJECTIVES

Primary Objective:

- To determine the 18-month impact of a calibrated increase in GI/GL on markers of inflammation in community-dwelling, healthy, postmenopausal women.

Secondary Objective:

- To evaluate the long-term effect of increases in dietary GI/GL on inflammation-related health outcomes, insulin resistance and undesirable alterations in body composition.

STUDY DESIGN/ METHODS

A secondary analysis of an 18-month, randomized, double-blind study comparing the effects of a whey protein (PRO) supplement and an isocaloric maltodextrin supplement (CHO) on bone density and body composition in older adults.

Visit Number	1	2	3	4	5	6	7	8	9
Time (months)	-1	0	1.5	3	6	9	12	15	18
• Screening biochemistries • Physical exam	X								
Fasting fingerstick glucose		X	X	X	X	X	X	X	X
Fasting blood draw: • Interleukin-6 • Insulin • C-reactive protein		X							X
Insulin resistance estimated using the HOMA2 calculator		X							X
Body composition by DXA	X								X
Collect diet records for nutritional counseling	X	X	X	X	X	X	X	X	X
Food Processor analysis of diet records		X							X
Calculation of daily GI and GL		X							X
Supplementation (45 g): • Whey or • Maltodextrin		X	X	X	X	X	X	X	X

Inclusion:

- post-menopausal women at least 60 years of age
- minimum daily consumption of at least 20g of either PRO or CHO supplement
- **naturally** consume a diet containing low to normal protein (0.6-1.0 g/kg)

Exclusion:

- a protein intake < 0.6 g/kg or > 1.0 g/kg
- BMI > 32 or < 19
- skeletal disease of any kind
- active gastrointestinal diseases
- Hx of renal disease or kidney stones

Calculation of daily GI and GL:

- GL of individual food items was assigned using the Sydney University Glycemic Index Research Service website and the International Tables of Glycemic index and Glycemic load values (2008) with glucose as a reference.
- **Daily GL =** ∑GL values for all food items/day.
- **Daily GI =** $\frac{\text{Daily GL}}{\text{Total available CHO}} \times 100$

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EXPERIMENTAL INTERVENTIONS

	Maltodextrin Control Supplement	Protein Supplement
Kcal/ 45 g powder	160	160
Sodium (mg)	73	81
Potassium (mg)	183	182
Phosphorus (mg)	112	113
Calcium (mg)	236	239

RESULTS

- The two study groups were closely matched for age, body composition and energy intake (Table).
- By 18 months daily GL in the CHO group increased by 34% and did not change in the PRO group; mean change between the groups differed significantly (P<0.0001; Table; Figure 1).
- At 18 months there were no differences in markers of inflammation between the CHO and PRO groups (Table).
- When the PRO and CHO groups were pooled and analyzed by quartile of daily GL there was no difference in markers of inflammation when the highest quartile was compared to the lowest at 18 months.
- However when the highest GL quartile was compared to the lowest at 18 months, we did observe an increase in BMI (P=0.03) and total fat mass (P=0.005), and a decrease in the lean mass/fat mass ratio (P=0.0008; Figure 2).

	CHO			PRO		
	Baseline	18-months	Δ	Baseline	18-months	Δ
Age	69.3 ± 0.9	----------N/A----------		68.9 ± 0.9	----------N/A----------	
Weight (kg)	66.5 ± 1.5	66.8 ± 1.6	0.3 ± 0.6	68.1 ± 1.7	68.0 ± 1.6	-0.2 ± 0.4
BMI (kg/m²)	25.8 ± 0.6	26.0 ± 0.6	0.2 ± 0.2	26.0 ± 0.6	26.0 ± 0.6	0.009 ± 0.1
Lean mass (kg)	39.0 ± 0.6	38.4 ± 0.6[a]	-0.6 ± 0.3[a]	40.1 ± 0.7	40.3 ± 0.7[a]	0.2 ± 0.2[a]
Fat mass (kg)	25.5 ± 1.1	26.7 ± 1.2	1.2 ± 0.5	25.9 ± 1.3	25.9 ± 1.2	-0.009 ± 0.4
Total Calories	1661 ± 51.6	1729 ± 55.5	68.2 ± 54.5	1627 ± 45.6	1678 ± 58.0	56.5 ± 54.2
Supplemental CHO (g)	N/A	29.5 ± 0.9	N/A	----------N/A----------		
Total CHO (g)	201.2 ± 6.9	232.3 ± 8.7[a,b]	31.1 ± 7.4[a]	207.2 ± 9.0	198.9 ± 8.9[a]	-8.6 ± 8.4[a]
Supplemental PRO (g)	----------N/A----------			N/A	30.4 ± 0.9	N/A
Total PRO (g)	71.5 ± 2.2	69.8 ± 2.5[a]	-1.7 ± 2.3[a]	73.5 ± 2.7	98.5 ± 2.8[a,b]	25.1 ± 3.1[a]
GI	48.5 ± 2.0	55.7 ± 1.2[a,b]	7.2 ± 2.1[a]	45.7 ± 1.4	46.6 ± 1.1[a]	0.9 ± 1.7[a]
GL	88.4 ± 5.2	118.5 ± 4.9[a,b]	30.0 ± 5.1[a]	86.5 ± 4.1	82.0 ± 3.6[a]	-4.5 ± 3.9[a]
IL-6 (pg/mL)	1.7 ± 0.2	1.9 ± 0.2	0.2 ± 0.2	1.5 ± 0.1	1.8 ± 0.1	0.3 ± 0.1
CRP (mg/L)	1.5 ± 0.2	2.0 ± 0.2	0.5 ± 0.2	1.9 ± 0.2	2.5 ± 0.4	0.6 ± 0.3
HOMA:						
% B²	132.8 ± 7.1	117.1 ± 6.2	-15.7 ± 8.4	137.0 ± 8.6	133.3 ± 6.1	-3.7 ± 9.3
% S²	75.0 ± 4.5	75.7 ± 4.5	0.66 ± 4.7	66.9 ± 3.6	64.1 ± 3.3	-2.9 ± 2.6
% IR²	1.6 ± 0.1	1.5 ± 0.1	-0.02 ± 0.08	1.7 ± 0.1	1.7 ± 0.1	0.02 ± 0.07

[1]Values are averages ± SEMs. [2]Values estimated as percentages of a normal reference population.
Values with a superscript letter: [a] significantly different between the two study groups P < 0.05;
[b] significantly different from baseline, P < 0.05.
CHO, *n*=46; PRO, *n*=38.
% B, β-cell function; CRP, C-reactive protein; HOMA, Homeostasis Model Assessment;
IL-6, Interleukin 6; % IR, Insulin resistance; % S, Insulin sensitivity.

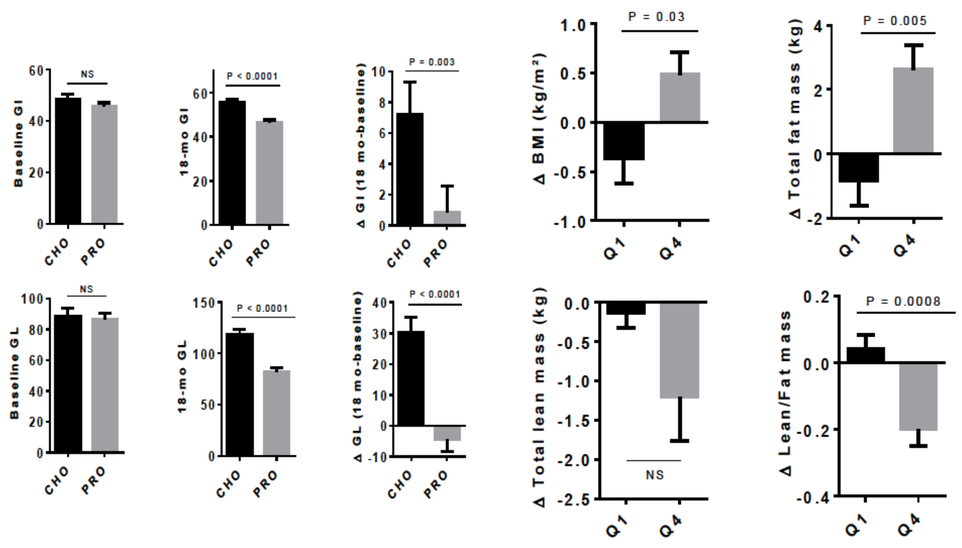

Figure 1. Left two panels baseline GI and GL. Middle two panels GI and GL at 18-mo. Right two panels change from baseline in GI and GL. (CHO, *n*=46; PRO, *n*=38).

Figure 2. Comparison of 18 month changes in BMI and body composition in the lowest and highest quartiles of GL (Q1, *n*=20; Q4, *n*=21).

SUMMARY / CONCLUSION

- Maltodextrin supplementation of at least 20 grams/d for 18 months resulted in an increase in the estimated GI/GL of the diet, but had no effect on markers of inflammation or measures of insulin resistance.
- We did, however, observe significant differences in indices of body composition, with the consumption of a lower GL diet resulting in favorable changes in BMI as well as lean and fat mass.

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Diabetes (to include obesity, pathophysiology & epidemiology)

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