Effect of a dairy and calcium rich diet on weight loss and appetite during energy restriction in overweight and obese adults: a randomized trial

Kim Wagner Jones MSc, RD, Lindsay Eller PhD, Jill Parnell PhD,P.K. Doyle-Baker DrPH, Alun Edwards MD, FRCPC, Raylene Reimer PhD, RD

Faculty of Kinesiology
University of Calgary

Conflict of Interest

- KWJ, JAP, ALE, PKDB, LKE declare no conflict of interest.
- Dr. Reimer was previously funded by Dairy Farmers of Canada for work distinct from this study.

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OBESITY AND DIABETES EXPLOSION!

- In 2010, 52% of adult Canadians were classified as obese or overweight. (Canadian Community Health Survey)

- In 2008, 60.9% of adult Albertans were classified as obese or overweight. (Alberta Health Services Cancer Prevention Program)

- 177 million cases of Type 2 diabetes in 2000.
- 300 million cases of Type 2 diabetes in 2025.
  (World Health Organization)

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Bioactive or "Quality-Enhanced" Foods

Do they have the potential to help prevent or treat lifestyle related disease?

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Dairy and the Diabesity Epidemic

Calcium and even more so dairy foods may help with weight loss or weight maintenance, plus healthy blood sugar levels, when included in weight control diets.

- Pereira et al 2002
- Choi et al 2005
- Liu et al 2005, 2006
- Zemel et al 2005, 2006
- Gilbert et al 2010
- Chen et al 2012
- Abargouei et al 2012

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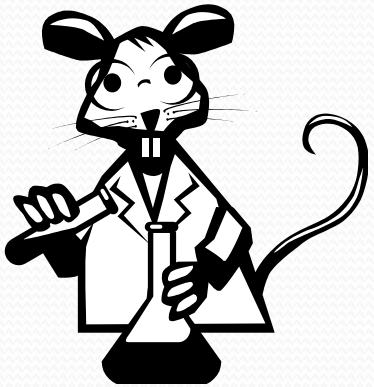
Research Goals



- Previous work in our lab with rats showed that dairy, especially skim milk powder, is a powerful agent for:
  - Preventing weight gain
  - Improving body composition
  - Maintaining healthy blood sugar levels

- Hypothesis and aims of this study were designed to translate this work into a human trial.

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Aim 1

To determine the effect of low-fat milk products as part of calorie-restricted diets on body weight and body composition in insulin resistant, overweight and obese human subjects.

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Aim 2

To measure the impact of skim milk products in weight reducing diets on levels of plasma insulin and glucose as they relate to glucose utilization in overweight and obese, insulin resistant subjects.

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Aim 3

To examine the mechanisms by which low-fat milk products improve components of the metabolic syndrome, including inflammatory markers and satiety hormones.

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Methods and Materials

- Randomized, controlled 12 week study
- Individually prescribed meal plans
- Participants randomized to one of 2 weight loss diets:

1. CONTROL: Usual intake (low dairy and calcium intake).
2. DAIRY/CA: Dairy and calcium supplemented (prescribed high dairy and calcium intake).

- **Both designed to produce weight loss with 500 kcal/d deficit.**

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- Recruitment
- Participant Characteristics
- Information Sessions

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- Anthropometrics
- Biomarkers
- Blood Plasma Analysis
- Dietary Intake
- Visual Analogue Scales

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RESULTS

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Study Participants

•49 people recruited, 38 completed the study for a retention rate of 78%.

•Physical activity was kept consistent (Godin Leisure Time Exercise Questionnaire)

•Weight loss:

- -2.2 ± 0.5kg CONTROL
- -3.3 ± 0.6kg DAIRY/CA

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Baseline and post-intervention characteristics

	Baseline		Week 12	
Characteristic	Control	Calcium	Control	Calcium
Body wt (kg)	84.0 +/- 4.3	93.8 +/- 3.6	81.8 +/- 4.5	90.5 +/- 3.5
LBM (kg)	55.6 +/- 3.7	61.7 +/- 3.0	55.2 +/- 3.8	60.0 +/- 2.9
Body fat (kg)	28.4 +/- 2.0	32.1 +/- 1.7	26.6 +/- 1.9	30.5 +/- 1.6
Body fat (%)	34.2 +/- 1.9	34.5 +/- 1.4	32.9 +/- 1.8	33.9 +/- 1.4
BMI (kg/m2)	31.7 +/- 0.9	32.9 +/- 0.8	30.6 +/- 0.9	31.7 +/- 0.8
WC (cm)	103.9 +/- 2.8	110.4 +/- 1.9	98.4 +/- 2.9	105.5 +/- 2.1

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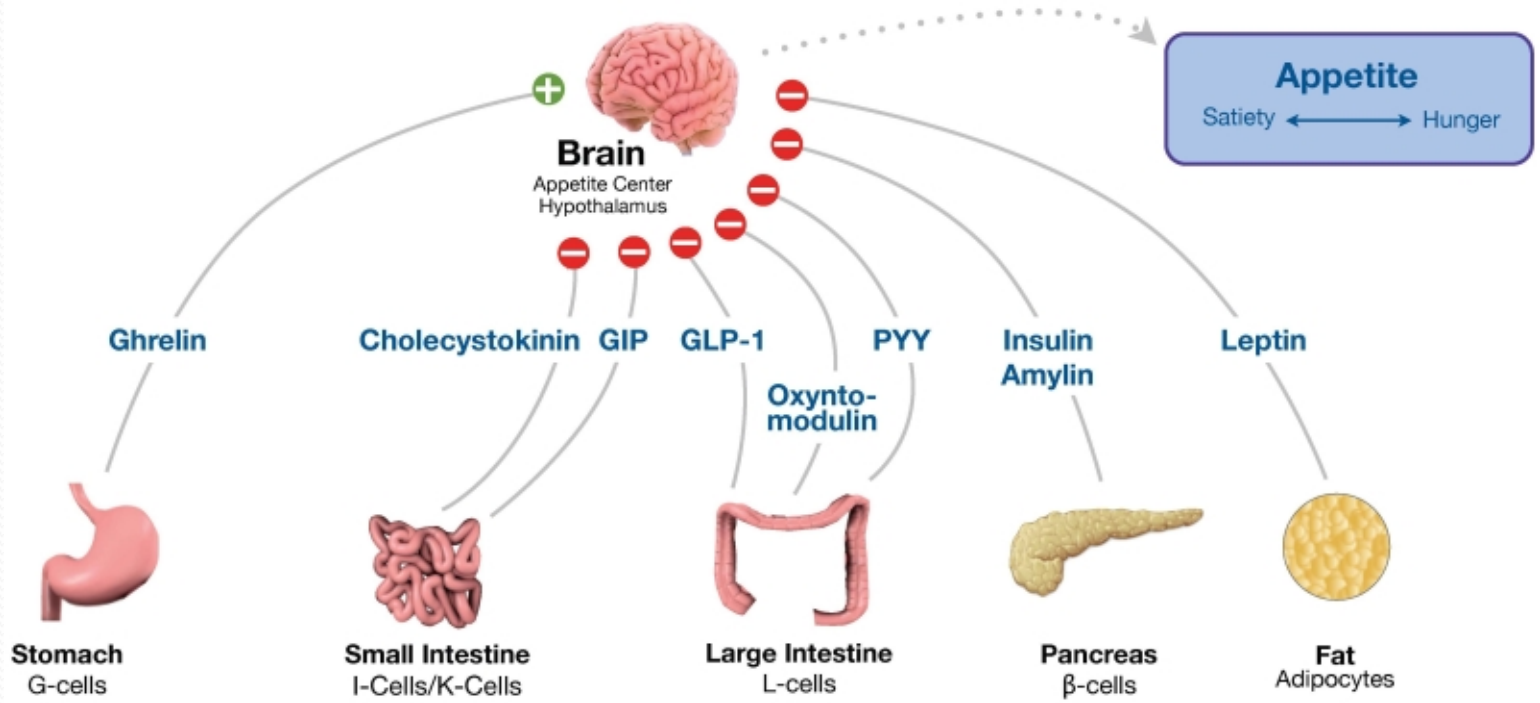
Satiety hormones

Peptide YY (PYY) and glucagon-like peptide-1 (GLP-1)

- higher levels in the blood help us feel full after a meal



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Satiety hormones

PYY

- Groups had the same levels of PYY at baseline.
- At the end of 12 weeks, blood levels of PYY were significantly greater for DAIRY/CA vs. CONTROL group.
    - Fasting
    - 30 minutes
    - 240 minutes

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Satiety hormones

GLP-1

- Groups had the same levels of GLP-1 at baseline.

- Increase in GLP-1 from Week 0 to Week 12 significantly greater for CALCIUM group at 240 min.

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Subjective Appetite

WEEKLY:

- DAIRY/CA group reported feeling "more satisfied" in the weekly assessment of appetite.
- Over 12 weeks, CONTROL felt less comfortable.
- DAIRY/CA felt more comfortable at Week 12 vs. Week 0.

MTT (Test Day):

Trend for greater reported fullness in CALCIUM vs. CONTROL .

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Food Intake

- Total energy (calorie) intake did not differ between groups.
- Both groups reduced their calorie intake significantly.
- However, DAIRY/CA group consumed significantly less energy as fat during 12 weeks, even though both groups prescribed a meal plan with 30% calories from fat.

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Relationship between energy intake and calcium

- Significant relationship between delta energy intake from week 1 to week 12 (kcal) and calcium intake (mg)

  (r^2=0.1635, df=28, p=0.027).

- Suggests that participants who consumed more Ca also consumed more energy, but did not gain weight relative to the increased energy.

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Other Biomarkers Examined

- There were no significant effects of diet on the change in total cholesterol, LDL, HDL and TG and blood pressure between the initial and final visits.

- No significant differences in blood sugar or insulin levels were observed between the 2 groups.

- No significant differences in the markers of inflammation when subjects were fasting (IL-6, TNF α, MCP-1, and IL-1β). But, significant reduction in baseline-adjusted MCP-1 secretion at 30 min. of the MTT for DAIRY/CA vs. CONTROL group.

Key Findings

- DAIRY/CA group experienced an improvement in satiety hormones PYY and GLP-1.
- DAIRY/CA group reported feeling “more satisfied” , “more comfortable”, and showed a trend toward greater fullness.
- DAIRY/CA group chose a lower fat diet, but consumed more calories (than the control group) without gaining weight.

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Take home messages:

- Higher levels of blood hormones (PYY and GLP-1) that help reduce food intake.
- Greater feelings of satisfaction, which may help individuals adhere to a diet.
- Less energy as fat was consumed and less weight gained relative to energy consumed (ie. participants who consumed more calcium also consumed more energy but still lost weight).

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