Reduction of obesity-associated intestinal inflammation by low-fat dairy yogurt

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Teaching

Previous (Nutritional Sciences)

– Undergraduate
  • Introductory Nutrition
  • Writing in Nutrition
  • Dietary Supplements and Nutraceuticals
– Graduate: Phytochemicals and Health

Future (Food Science)

– Graduate: Dietary Bioactives
– Undergraduate: Food Chemistry
Ongoing research

• Improving quantitative methods for bioactives
Interindividual variation in polyphenol metabolism

Lipid profiles, oxidative stress, inflammation

- Initial Screening (PE, diet, blood, urine)
- Assessment 1 (PE, diet, blood, urine)
- Assessment 2 (PE, diet, blood, urine)
- Assessment 3 (PE, diet, blood, urine)

- Week 0
- Equilibrium period (4 wks)
- Dietary intervention period (12 wks)

- Eligible Volunteers (n = 60)
- Randomization

- Control Group (n = 30) → Placebo
- Treatment Group (n = 30) → Chokeberry Polyphenols
Significant variability in colonic polyphenol metabolism

Mean cumulative urine hippuric acid

Plasma hippuric acid

Individual “A”

Individual “B”
Polyphenols for improving intestinal immune function

Inflammation
DRI-Funded Project

• Role of yogurt consumption in preventing obesity-associated intestinal barrier dysfunction.

Metabolic consequences
- Insulin resistance
- High cholesterol
- Hypertension
- Chronic, unresolved inflammation

Intestinal barrier
- Immune function
- Segregates microbiota
- Blocks proinflammatory signals from gut
Dairy Consumption and Chronic Inflammation

Low-fat dairy & inflammation, chronic disease

– Epidemiological
  • NHANES: Metabolic disorders in obesity
    +1 serving yogurt: OR 0.40 (95%CI: 0.18, 0.89)
  • WHI: Type 2 Diabetes
    ≥2 servings yogurt/wk: RR 0.46 (95%CI: 0.31, 0.68) to <1/mo

– Intervention studies in overweight & obese
  • High dairy reduced biomarkers of chronic inflammation

Yogurt consumption & intestinal inflammation

– Intervention: Reduced endotoxin, LBP, sCD14
– Animal studies: Increase IL10, decrease TLR-4, CC

Hypothesis: Short and long-term consumption of low-fat dairy yogurt will reduce inflammation to a greater extent in obese individuals by improving intestinal barrier function.

Outcomes:
• sCD14 (marker of endotoxin exposure)
• LBP (marker of endotoxin exposure)
• TNF (proinflammatory cytokine)
• CRP (marker of inflammation)
• IL-6 (proinflammatory cytokine)
• IL-10 (anti-inflammatory cytokine)
• LPS (endotoxin molecule)
• Monocyte gene expression
**Study Design**

- **Visit 1:** screening
  - wash in participants avoid yogurt

- **Visit 2:** Start Intervention, Acute Meal
  - n = 66, control snack, 2x daily
  - n = 66, low-fat yogurt, 2x daily

- **Visit 5:** End Intervention, Acute Meal

- **Week 0:**
  - health screening, informed consent, anthropometrics

- **Week 2:**
  - anthropometrics, collect fasting blood, high-fat meal + control or yogurt, blood @ 1, 2, 3, 4 hours following meal, collect dietary records

- **Week 5:**
  - Visit 3 and 4: anthropometrics, collect fasting blood

- **Week 8:**
  - anthropometrics, collect fasting blood, high-fat meal + control or yogurt, collect blood @ 1, 2, 3, 4 hours following meal, collect dietary records
# Study Design

**Chronic intervention**

- 9 weeks
- 12 oz. per day of low-fat yogurt or soy pudding
- ≤ 4 servings of dairy/day
- No probiotics
- Alcohol OK in moderation
- All other dietary and exercise habits remain the same

<table>
<thead>
<tr>
<th></th>
<th>Low-fat yogurt</th>
<th>Soy pudding (initial)</th>
<th>Soy pudding (final)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Serving size</strong></td>
<td>4 oz</td>
<td>4 oz</td>
<td>4 oz</td>
</tr>
<tr>
<td><strong>Calories</strong></td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td><strong>Calories from fat</strong></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Fat (g)</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Saturated fat (g)</strong></td>
<td>0.5</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Cholesterol (mg)</strong></td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td><strong>(g)</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Sugars (g)</strong></td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td><strong>Protein (g)</strong></td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Potassium (mg)</strong></td>
<td>0</td>
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<td>150</td>
</tr>
<tr>
<td><strong>Calcium (mg)</strong></td>
<td>150</td>
<td>150</td>
<td>60</td>
</tr>
<tr>
<td><strong>Vitamin D (mcg)</strong></td>
<td>2.25</td>
<td>2.25</td>
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</tbody>
</table>
Calories: 920
- Fat (g): 54
- Carbohydrate (g): 18
- Protein (g): 82
- Sodium (mg): 2000

Postprandial Triglycerides

<table>
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<tr>
<th>Time (h)</th>
<th>TG mg/dL</th>
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<tr>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>10</td>
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<tr>
<td>2</td>
<td>20</td>
</tr>
<tr>
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<td>30</td>
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<tr>
<td>4</td>
<td>40</td>
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Graph showing the increase in triglycerides over time for two different test groups, V2 and V5.

Progress:
• Methods of biomarker analysis established/developed
• Preliminary data collected
• Dietary records analyzed
• Small study of oxidative stress in obese individuals completed at UCONN
• ~30-40 individuals needed to complete study at UW-Madison