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Acute Effects of Decaffeinated Coffee and the Major Coffee Components Chlorogenic Acid and Trigonelline on Glucose Tolerance

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OBJECTIVE — Coffee consumption has been associated with lower risk of type 2 diabetes. We evaluated the acute effects of decaffeinated coffee and the major coffee components chlorogenic acid and trigonelline on glucose tolerance.

RESEARCH DESIGN AND METHODS — We conducted a randomized crossover trial of the effects of 12 g decaffeinated coffee, 1 g chlorogenic acid, 500 mg trigonelline, and placebo (1 g mannitol) on glucose and insulin concentrations during a 2-h oral glucose tolerance test (OGTT) in 15 overweight men.

RESULTS — Chlorogenic acid and trigonelline ingestion significantly reduced glucose (−0.7 mmol/l, \( P = 0.007 \), and −0.5 mmol/l, \( P = 0.024 \), respectively) and insulin (−73 pmol/l, \( P = 0.038 \), and −117 pmol/l, \( P = 0.007 \)) concentrations 15 min following an OGTT compared with placebo. None of the treatments affected insulin or glucose area under the curve values during the OGTT compared with placebo.

CONCLUSIONS — Chlorogenic acid and trigonelline reduced early glucose and insulin responses during an OGTT.

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In prospective cohort studies, higher coffee consumption has been associated with a lower risk of type 2 diabetes (1,2). Associations have been similar for caffeinated and decaffeinated coffee (1,3–5), suggesting that coffee components other than caffeine have beneficial effects on glucose homeostasis. Coffee is a major source of the phenolic compound chlorogenic acid (6) and the vitamin B3 precursor trigonelline (7), which have been shown to reduce blood glucose concentrations in animal studies (5–8). This is the first study to investigate the acute effects of chlorogenic acid and trigonelline on glucose tolerance in humans.

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Coffee components and glucose tolerance

Table 1—Glucose and insulin concentrations during an OGTT following ingestion of chlorogenic acid, decaffeinated coffee, trigonelline, or placebo in 15 healthy overweight men

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Placebo</th>
<th>Decaffeinated</th>
<th>Trigonelline</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.7</td>
<td>5.5</td>
<td>5.6</td>
</tr>
<tr>
<td>15</td>
<td>5.1</td>
<td>5.0</td>
<td>5.2</td>
</tr>
<tr>
<td>30</td>
<td>5.0</td>
<td>4.9</td>
<td>5.0</td>
</tr>
<tr>
<td>60</td>
<td>4.9</td>
<td>4.8</td>
<td>4.9</td>
</tr>
</tbody>
</table>

In conclusion, chlorogenic acid and trigonelline also resulted in significantly lower glucose at 15 min after the start of the OGTT compared with placebo. Decaffeinated coffee did not significantly change mean glucose or insulin concentrations at any of the time points following the OGTT, although the insulin concentration tended to be lower at 15 min. None of the treatments significantly changed the insulin or glucose area under the curve values (Table 1).

CONCLUSIONS—In this randomized crossover trial in healthy men, chlorogenic acid and trigonelline ingestion led to significantly lower glucose and insulin concentrations 15 min after an oral glucose load than the doses administered in isolation, complicating the comparison of the treatment effects.

In conclusion, chlorogenic acid and trigonelline reduced early glucose and insulin responses during the OGTT. This finding is consistent with the hypothesis that these compounds contribute to the putative beneficial effect of coffee on development of type 2 diabetes.

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