Simpler Method to Compare Starch Hydrolysis Rate and In Vitro Expected Glycemic Index of Flours

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ABSTRACT

In vitro expected glycemic index (eGI) is a reliable tool to predict postprandial blood glucose concentrations. Evaluating foods for eGI is important particularly for diabetes patients who must manage their health condition by consuming products with more slowly digestible carbohydrates. In this study, flour samples were digested with continuous agitation for 3 hours with the help of alpha-amylase enzyme. Digestion was monitored by measuring brix every 20 minutes using a refractometer. Brix was plotted to produce a hydrolysis curve for each flour sample. Measuring brix eliminated the need for glucose oxidase/peroxidase (GOPOD) reagent and spectrophotometer steps required by current methods used to determine eGI. Results indicate significant differences in hydrolysis index (HI) and eGI among flour samples ranging from 44.9 (pinto bean flour) to 87.6 (green split peas). With the exception of split green peas which had a much higher eGI than previously reported, all other values were in close proximity to values obtained using GOPOD.

METHOD

Buffer Preparation
Maleate Buffer (pH 6, 100 mM) was prepared following method described in Megazyme Resistant Starch Kit (Megazyme, UK).

Digestion
Twenty grams of flour sample was collected in a 400 ml beaker and 250 ml of maleate buffer added. The mixture was homogenized for 30 s at 10,000 rpm using a Polytron 2500E homogenizer to remove clumps (Kinematica Inc., NY). Beakers were then placed in a water bath at 60 °C and mixed continuously with a 20 rpm rotating blade. Exactly 500 μl of Amylyx ST enzyme (DuPont Nutrition and Health, New Century, KS) was added when the internal temperature in the beakers reached 60 °C. A refractometer was used to measure brix at 20 minutes intervals over 3 hours.

Determination of eGI
The eGI was determined by first calculating the hydrolysis index (HI) and then applying the eGI equation below (Granfeldt, et al. 1992).

\[ HI = \frac{\text{Area Under Curve Representing Sample}}{\text{Area Under Curve Representing White Bread}} \times 100 \]

\[ eGI = 8.198 + 0.862(\text{HI}) \]

Statistical Analysis
SPSS Software (IBM SPSS Statistics for Windows, Version 24.0) was used to conduct analysis of variance (ANOVA) followed by Tukey’s multiple comparison test to determine differences in eGI. Differences were considered to be significant at p < 0.05.

RESULTS

<table>
<thead>
<tr>
<th>Flour Type</th>
<th>Brix (%)</th>
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</thead>
<tbody>
<tr>
<td>Corn starch</td>
<td>56.9b</td>
</tr>
<tr>
<td>Pinto bean flour</td>
<td>44.9a</td>
</tr>
<tr>
<td>Pinto bean starch</td>
<td>60bc</td>
</tr>
<tr>
<td>Tapioca flour</td>
<td>66.2c</td>
</tr>
<tr>
<td>White rice</td>
<td>74.5d</td>
</tr>
<tr>
<td>Green split peas</td>
<td>87.6e</td>
</tr>
</tbody>
</table>

CONCLUSIONS