Effect of bread containing high level of resistant starch on glucose and insulin responses

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1. INTRODUCTION
Resistant starch (RS) is defined as the sum of starch and products of starch degradation not absorbed in the small intestine of healthy individuals. RS appears to confer considerable health benefits related to inflammatory bowel disease and bowel cancer, reduction of postprandial glycaemia/insulinemia, improvement of insulin sensitivity and fat oxidation, increase satiety as well as play a prebiotic role.

The aim of this study was to evaluate the postprandial glucose and insulin responses in vivo to bread with high amount of RS. Common bread with lower RS level was used as control. We also determined the glycaemic index (GI) of the bread containing high level of RS.

2. METHODOLOGY
37 non-diabetic adults were recruited (26 females and 11 males; 16 with BMI ≤ 24.9 and 21 with BMI > 24.9 kg/m²; aged 22-59 years). This was a single-blind, single-ingestion crossover study.

Two breads were tested: REF (reference bread) – 80g conventionally baked bread from white wheat flour (RS1=1.18% dwb); HRS (bread with high level of RS) – 10g bread with 80% white wheat flour and 20% maize flour baked at long time/low temperature conditions (RS4=3.33% dwb). This bread was developed in previous studies. Broth breads were provided corresponding to 50g of available carbohydrates and served with 250ml of water.

The tested breads were given after an overnight fast on different days. Test meals were finished in 12-15 mins. Postprandial glucose was measured by finger prick capillary blood sampling, prior to intake (0) and 15, 30, 45, 60, 90 and 120 min. after the bread intake. Glucose values were measured directly using a glucose oxidase method (LifeScan One Touch Verio, Johnson & Johnson). The insulin response was measured in capillary-blood samples taken immediately before (0) and 30 mins. after the meal.

Blood samples for insulin analysis were centrifuged and serum was separated and frozen. The insulin level was determined in serum with an enzyme immunoassay kit (Insulin ELSA ME E-0090, LDN Labor Diagnostika Nord GmbH, Germany).

The procedures for the determination of the Glycaemic Index (GI) in broods were based on the ISO/DIS 26642:2010. Two more sessions were considered to the volunteers with BMI ≤ 24.9, in order to obtain the IAUC (Incremental Area Under the Curve) for the reference food (50g of andispy glucose).

Statistical analyses were carried out using SPSS 23.0 for Windows. Significant differences (p<0.05) were evaluated by paired Student’s t test. Incremental IAUC was calculated using the trapezoidal rule for 0-120 min. Any area under the baseline (fasting point) was ignored (Brouns et al., 2005).

3. RESULTS
These results suggest a lower postprandial glucose response after ingestion of HRS relative to REF. HRS showed significantly lower IAUC (106.6 mmol·min⁻¹) compared to REF (137.9 mmol·min⁻¹) (p<0.05).

Similar data where observed for this group. It is evident that the mean IAUC for the REF (165.9 mmol·min⁻¹) is significantly higher (p<0.05) than the mean IAUC for the HRS (142.8 mmol·min⁻¹).

The statistical comparison of blood glucose and incremental IAUC data across the two groups, showed no significant differences between them (p>0.05).

HRS induced lower postprandial glucose response than REF. HRS also showed significantly lower mean IAUC (127.1 mmol·min⁻¹) compared to REF (153.8 mmol·min⁻¹).

Our results seem to confirm that production of RS can also influence the rate of digestion of the available starch fraction. These results are in good agreement with those reported by Hallstrom et al. (2011) and Klosterbuer et al. (2012) for research studies with the same type of RS (R3).

The insulin response was not significantly different (p>0.05) between two groups, whereby the data were handled together.

<table>
<thead>
<tr>
<th>Fasting concentrations</th>
<th>REF</th>
<th>HRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min after ingestion</td>
<td>51.4</td>
<td>54.4</td>
</tr>
<tr>
<td>Δ insulin</td>
<td>18.8</td>
<td>41.9</td>
</tr>
</tbody>
</table>

Values are mean, n=26
Values in each row sharing the same letters were significantly different, p<0.05.

30 min after ingestion of the meal, mean insulin response did not differ significantly (p>0.05) between the REF and the HRS and also there were no significant differences (p>0.05) in the mean incremental insulin response.

According to ISO/DIS 26642:2010 the HRS has a GI of 60 whereas the REF has a GI of 82. The correlation between increased RS content and reduced GI suggests that presence of RS can influence the glycaemic response to the available carbohydrates.

4. CONCLUSIONS
HRS bread seems to elicit a significantly lower postprandial glucose response than REF bread.

Insulin response up to 30 min. appears to have the same behaviour in both breads.

The decrease of the glycaemic response is expressed on the Glycaemic Index of the HRS bread which is lower than the REF bread.

HRS bread has a Glycaemic Index of 60, considered a medium GI food and, because of this, it can be a good choice in the context of a healthy diet.

BIBLIOGRAPHY: