Determination of the Glycemic and Insulinemic Indexes of Raisins in Three Populations

Yeonsoo Kim1, Steven R. Hertzler1, Heidi K Byrne2, Craig O. Mattern2

1 The Ohio State University, Columbus, OH, 2 State University of New York at Brockport, Brockport, NY

Abstract

The eligibility criteria for study participation were as follows:

- Fasting blood glucose of S and A groups = < 100 mg/dL
- Fasting blood glucose of P group = < 125 mg/dL
- BMI of S and A group = 18.5-24.9 kg/m²
- S and P group had not exercised > 3 h/week for the past 6 months
- A group had aerobically trained ≥ 8h/week for the past 6 months

Methods

The study consisted of 10 healthy sedentary persons (S), 11 endurance athletes (A), and 11 pre-diabetic individuals (P). Informed consent was obtained from subjects prior to the screening test.

Statistical analysis

Descriptive statistics and normally tests were obtained for all variables using the NCSS 2000 software package (NCSS Computing, Kayceville, UT). Repeated measures ANOVA was used to determine global significant differences. The event of a significant ANOVA result (P < 0.05) Tukey-Kramer post-hoc tests was used for pairwise comparisons.

Table 1. Subject characteristics.

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>A</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>10</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Age (years)</td>
<td>25.7 ± 1.3</td>
<td>23.1 ± 1.0</td>
<td>50.0 ± 2.6</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>164.4 ± 2.5</td>
<td>175.8 ± 2.4</td>
<td>167.2 ± 2.6</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.8 ± 6.5</td>
<td>74.8 ± 2.9</td>
<td>94.5 ± 6.6</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.3 ± 1.7</td>
<td>24.1 ± 0.3</td>
<td>32.8 ± 1.9</td>
</tr>
</tbody>
</table>

Results

Feeding protocol

The study was a two-treatment, randomized, crossover study with carbohydrates from raisins and from a glucose solution (reference food) on two separate occasions. Serum glucose and insulin concentrations were measured from capillary finger-stick blood samples at baseline and at 15, 30, 45, 60, 90, and 120 min (and 180 min for P) postprandially. The GI of raisins was low (GI = 49.4 ± 7.4) in the S group, and the GI index of the P group was moderate (GI = 62.3 ± 10.5) in the A group. However, there were no differences among the groups (P = 0.237). The insulin index values of raisins were 47.3 ± 9.4, 51.8 ± 6.5, and 54.4 ± 8.9 for the S, A, and P groups, respectively. On average, the A group secreted 2.2-2.5-fold less insulin per gram of carbohydrate compared with the S and P groups, respectively. In summary, raisins are a low to moderate GI food and their insulin index is proportionate to their GI, regardless of the population studied. Athletes were able to normalize postprandial glycemia with lower insulin secretion.

Blood sample analysis

Blood samples were collected via capillary finger-stick at baseline (S, 15, 30, 45, 60, 90, and 120 minutes; A, 150 and 180 minutes for P) postprandially. The GI of raisins was > 3 for the past 6 months. A group had aerobically trained ≥ 8h/week for the past 6 months. Age of S and A groups 18-25 years. Age of P group 18-45 years.

Calculation of GI and insulin index of raisins

GI of raisins = serum glucose IAUC of raisins
Insulin index of raisins = serum insulin IAUC of raisins

Conclusions

Raisins are a low to moderate GI food and their insulin index is proportionate to their GI, regardless of the population studied. Athletes were able to normalize postprandial glycemia with lower insulin secretion.

Acknowledgements

This study was funded by the California Raisins Marketing Board.