Sucrose consumption and salivary sucrase activity in a 2-year longitudinal study

S. KARJALAINEN1, P. HANNULA1, E. SÖDERLING1, M. HÄMÄLÄINEN1, K. MÄKINEN2
AND A. SCHEININ1

1Institute of Dentistry, University of Turku, Turku, Finland; 2School of Dentistry, University of Michigan, Ann Arbor, Michigan, USA

Abstract – Sucrose consumption data of the sucrose group (n = 33) of a 2-yr longitudinal study was plotted against salivary sucrase activity values obtained during this 2-yr period. The correlation coefficients varied between 0.194 and 0.551. The subjects were divided into high (> 10 μmol × min⁻¹ × 10⁻³) and low (< 10) sucrase activity subgroups. There were significant differences in the sucrose consumption and in intake frequency between these two subgroups. These findings give further support for the possibility of using sucrase activity for the estimation of the level of individual sugar consumption.

Key words: dietary carbohydrates; microbial enzymes; salivary test.

S. Karjalainen, Institute of Dentistry, University of Turku, SF-20520 Turku, Finland.
Accepted for publication 11 February 1989.

In a recent study we observed that strict restriction of dietary sucrose over a 2-wk period effectively reduced high salivary sucrase, i.e. invertase-like activity (1). We have now examined whether less profound alterations in sucrose consumption can be detected through sucrase activity of whole saliva and whether there is a relationship between sucrose consumption, frequency of intake and salivary sucrase activity. For these purposes the sucrose consumption and the salivary sucrase activity values of the sucrose group subjects of the Turku sugar studies (2, 3) were reanalyzed.

In the Turku studies, the sucrose group (n = 33) comprised 13 men and 20 women, aged 27.2 yr in average. The salivary sucrase activity was determined six times during the 2-yr study at 4-6-month intervals as described in Table 1. The supernatant fluid of centrifuged (12 000 g, 10 min at 4°C) paraffin wax-stimulated whole saliva was used for the sucrase assay (3-5).

The subjects recorded their sucrose consumption daily over the entire 2-yr study using a specially designed dietary diary (2). A total of 24-monthly sucrose consumption values were thus calculated. Out of these
values, those five which preceded each su- 
crase activity determination during the 2-yr 
study, were used in the present context. The 
baseline sucrase activity values were ex-
cluded as there was no previous dietary his-
tory.

The comparison between sucrase activity 
and sucrose consumption (Table 1) showed 
that the nonlinear, Spearman correlation co-
efficient values (R) varied between 0.194 and 
0.419. When the extreme sucrase values, i.e. 
values over 50 μmol min⁻¹ mg⁻¹ (× 10⁻⁵) 
were excluded, the linear coefficient values 
(R') ranged between 0.222 and 0.551 (Table 
1). The average sucrose consumption showed 
a decreasing trend during the course of the 
study (Tables 1 and 2). The high values 
during the early phases of the study were 
thought to be due to the availability of sucro-
se-containing products free of charge during 
the entire study period. Presumably the sub-
jects reverted from increased use to their 
earlier sucrose consumption habits. The coef-
ficient values between salivary sucrase activi-
ity and sucrose consumption shown in Table 
1 were higher than those between salivary 
lactobacillus counts and sucrose intake re-
ported recently by Stecksen-Blicks (6) in 
children.

The subjects whose data were available 
(χ=32) were divided into two subgroups ac-
cording to the sucrase activity values. The 
values ≥10 μmol min⁻¹ and mg⁻¹ (× 10⁻⁵) 
were considered high (n=14; δ=26.2, SD 
22.5), while the values below this level were 
considered low or moderate (n=18; δ=4.7, 
SD 1.9). Between these two subgroups there 
were significant differences in the sucrose 
consumption (δ=63.3, SD 26.1 vs δ=44.2, 
SD 18.6 kg/2 yr; P<0.02), in the sucrose 
intake frequency (δ=5.6, SD 1.5 vs δ=4.1, 
SD 1.5 times/day; P<0.01) and in the su-
crase activity (P<0.001).

Earlier (1) it has been suggested that su-
crase activity could be used as a diagnostic 
test to reveal the level of individual sucrose 
consumption. Therefore the ability of the 
present sucrase activity values to identify in-
dividuals using excessive amounts of sucrose 
from those who use moderate or scarce 
amounts was tested. The ability of a sucrase 
activity measurement (sucrase test) to iden-
tify subjects who used more (high-scale con-
sumers) or less (low-scale consumers) sucrose 
than on the average (2.2 kg/month) is shown 
in Table 2. The probability of a high sucrase 
activity (positive sucrase test) among high-
scale consumers (sensitivity) varied between 
0.38 and 0.65, while the probability of a 
low sucrase activity (negative sucrase test) 
among low-scale consumers (specificity) var-
ied between 0.69 and 0.86. The proportion 
of correct estimation of sucrose consumption 
obtained by the sucrase test (accuracy) var-

---

Table 1

<table>
<thead>
<tr>
<th>Date</th>
<th>Sucrase activity</th>
<th>Succrose consumption</th>
<th>Correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 1973</td>
<td>16.5 (22.0)</td>
<td>2.6 (1.3)</td>
<td>0.419 (0.366)</td>
</tr>
<tr>
<td>May 1973</td>
<td>19.7 (32.9)</td>
<td>2.5 (1.3)</td>
<td>0.261 (0.222)</td>
</tr>
<tr>
<td>Oct 1973</td>
<td>11.3 (14.9)</td>
<td>2.2 (1.2)</td>
<td>0.194 (0.372)</td>
</tr>
<tr>
<td>May 1974</td>
<td>11.8 (17.1)</td>
<td>1.8 (1.2)</td>
<td>0.330 (0.551)</td>
</tr>
<tr>
<td>Oct 1974</td>
<td>13.4 (21.3)</td>
<td>1.7 (1.1)</td>
<td>0.362 (0.411)</td>
</tr>
</tbody>
</table>

R' correspond to coefficients of linear correlation calculated after excluding the extreme sucrase activity values ≥50 μmol min⁻¹ mg⁻¹ (× 10⁻⁵).
Table 2

Distribution of subjects into two sucrose consumption and two sucrase activity* categories at five determinations carried out during the 2-yr longitudinal study. The ability of the sucrase test to identify individuals consuming more or less sucrose (kg/mo) than on the average is indicated in terms of sensitivity (Sn), specificity (Sp), accuracy (A), positive (Ppv), and negative predictive values (Npv).

<table>
<thead>
<tr>
<th>Date</th>
<th>Date</th>
<th>Sucrase activity</th>
<th>Sucrose consumption</th>
<th>Sn</th>
<th>Sp</th>
<th>A</th>
<th>Ppv</th>
<th>Npv</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan 1973</td>
<td>&gt; 2.2</td>
<td>≤ 2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 10.0</td>
<td>13</td>
<td>4</td>
<td>17</td>
<td>0.65</td>
<td>0.69</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 10.0</td>
<td>7</td>
<td>9</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>May 1973</td>
<td>&gt; 2.2</td>
<td>≤ 2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 10.0</td>
<td>7</td>
<td>5</td>
<td>12</td>
<td>0.44</td>
<td>0.71</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 10.0</td>
<td>9</td>
<td>12</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oct 1973</td>
<td>&gt; 2.2</td>
<td>≤ 2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 10.0</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>0.38</td>
<td>0.75</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 10.0</td>
<td>8</td>
<td>15</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>May 1974</td>
<td>&gt; 2.2</td>
<td>≤ 2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 10.0</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>0.45</td>
<td>0.86</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 10.0</td>
<td>6</td>
<td>19</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oct 1974</td>
<td>&gt; 2.2</td>
<td>≤ 2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 10.0</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>0.44</td>
<td>0.75</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 10.0</td>
<td>5</td>
<td>18</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Sucrase activity is expressed as μmol min⁻¹ mg⁻¹ (× 10⁻³).

Thus, the determination of salivary sucrase activity reflected the amount, variation, and intake frequency of sucrose consumption at a group level. The correlation between sucrose consumption and sucrase activity was relatively high at the beginning of the study when the majority of the subjects used more sucrose than on the average, and again after 24 months when the proportion of high consumers was considerably reduced. However, changes in individual sucrose consumption were not always detectable in the sucrase activities.

References

1. Karjalainen S, Hämaläinen M, Karhuvaara L, Söderling E. Effect of variations in sucrose consumption on salivary lactobacillus...


This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.