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

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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.

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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 sucrase activity determination during the 2-yr study, were used in the present context. The baseline sucrase activity values were excluded as there was no previous dietary history.

The comparison between sucrase activity and sucrose consumption (Table 1) showed that the nonlinear, Spearman correlation coefficient values (R) varied between 0.194 and 0.419. When the extreme sucrase values, i.e. values over 50 μmol min^{-1} mg^{-1} ($\times 10^{-3}$) 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 sucrose-containing products free of charge during the entire study period. Presumably the subjects reverted from increased use to their earlier sucrose consumption habits. The coefficient values between salivary sucrase activity and sucrose consumption shown in Table 1 were higher than those between salivary lactobacillus counts and sucrose intake reported recently by Stecksén-Blicks (6) in children.

The subjects whose data were available ($n=32$) were divided into two subgroups according to the sucrase activity values. The values ≥10 μmol min^{-1} and mg^{-1} ($\times 10^{-3}$) were considered high ($n=14$; $\bar{x}=26.2$, SD 22.5), while the values below this level were considered low or moderate ($n=18$; $\bar{x}=4.7$, SD 1.9). Between these two subgroups there were significant differences in the sucrose consumption ($\bar{x}=63.3$, SD 26.1 vs $\bar{x}=44.2$, SD 18.6 kg/2 yr; $P<0.02$), in the sucrose intake frequency ($\bar{x}=5.6$, SD 1.5 vs $\bar{x}=4.1$, SD 1.5 times/day; $P<0.01$) and in the sucrase activity ($P<0.001$).

Earlier (1) it has been suggested that sucrase 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 individuals 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 identify subjects who used more (high-scale consumers) 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) varied between 0.69 and 0.86. The proportion of correct estimation of sucrose consumption obtained by the sucrase test (accuracy) var-

Table 1

Pairwise coefficients of correlation (Spearman, R) at five determinations of salivary sucrase activity and sucrose consumption (kg/month). The values are means ± SD (n = 33)

Date	Sucrase activity Mean	(SD)	Sucrose consumption Mean	(SD)	Correlation coefficient R	(R′)
Jan 1973	16.5	(22.0)	2.6	(1.3)	0.419	(0.386)
May 1973	19.7	(32.9)	2.5	(1.3)	0.261	(0.222)
Oct 1973	11.3	(14.9)	2.2	(1.2)	0.194	(0.372)
May 1974	11.8	(17.1)	1.8	(1.2)	0.330	(0.551)
Oct 1974	13.4	(21.3)	1.7	(1.1)	0.362	(0.411)

R′ correspond to coefficients of linear correlation calculated after excluding the extreme sucrase activity values ≥50 μmol min^{-1} mg^{-1} ($\times 10^{-3}$).

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)*

Date	Sucrase activity	Sucrose consumption			Sn	Sp	A	Ppv	Npv
Jan 1973		>2.2	≤2.2						
	≥10.0	13	4	17	0.65	0.69	0.67	0.76	0.56
	<10.0	7	9	16					
		20	13						
May 1973		>2.2	≤2.2						
	≥10.0	7	5	12	0.44	0.71	0.58	0.58	0.57
	<10.0	9	12	21					
		16	17						
Oct 1973		>2.2	≤2.2						
	≥10.0	5	5	10	0.38	0.75	0.61	0.50	0.65
	<10.0	8	15	23					
		13	20						
May 1974		>2.2	≤2.2						
	≥10.0	5	3	8	0.45	0.86	0.73	0.63	0.76
	<10.0	6	19	25					
		11	22						
Oct 1974		>2.2	≤2.2						
	≥10.0	4	6	10	0.44	0.75	0.67	0.40	0.78
	<10.0	5	18	23					
		9	24						

* Sucrase activity is expressed as μmol min^{-1} mg^{-1} ($\times 10^{-3}$).

ied between 0.58 and 0.73. The prevalence of high-scale consumers decreased from 61% to 27% during the study (Table 2). The predictive value of a positive sucrase test decreased from 0.76 to 0.40 while that of a negative test increased from 0.56 to 0.78 (Table 2).

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.

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