Short Communication

Effects of Dietary Sucrose on the Metabolism *in vitro* of Liver from Rats of Different Strains

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There are several reports in the literature of strain differences in response to dietary sucrose, e.g. extent of kidney damage, concentrations of serum cholesterol and effect on the life span of rats (Marshall & Hildebrand, 1963; Durand, Fisher & Adams, 1968).

Bender & Thadani (1970) have shown that different strains of rats differ in their response to dietary sucrose as measured by the oxidation of glucose *in vitro* and lipogenesis by liver and by adipose tissue. Bender & Thadani (1970) suggested, since dietary sucrose caused an elevation of liver glucose 6-phosphatase activity (Freedland & Harper, 1957), that this was the cause of the depression of oxidation of glucose in liver slices.

The purpose of the present work was to compare the effects of dietary sucrose on the liver metabolism *in vitro* of five strains of rats, and to correlate the findings with the glucose 6-phosphatase activities, with dietary starch as the control.

The strains used were (a) hooded rats from Animal Suppliers (London) Ltd., Welwyn, Herts., U.K. (ASL Hooded), (b) Sprague–Dawley rats from the Medical Research Council colony (MRC Sprague–Dawley), (c) Lister rats of the Queen Elizabeth College colony (QEC Lister), (d) Wistar rats from Animal Suppliers (London) Ltd. (ASL Wistar) and (e) hooded rats of the Medical Research Council colony (MRC Hooded).

Male rats 28 days of age were fed for 25 days on diets in which the carbohydrate was 60% sucrose or 60% starch, with 24% casein, 8% arachis oil and an adequate supply of vitamins and minerals (Bender & Thadani, 1970). Liver slices were incubated with radioactive glucose as described by Bender & Thadani (1970). Oxidation of glucose was measured by the radioactivity of the recovered CO_2 , and fat synthesis was measured by the

radioactivity of the extracted fat, in both instances expressed as c.p.m./mg dry wt. of liver. Glucose 6-phosphatase activity was assayed by the method of Harper (1963) and expressed as μmol of P_i /min per g of liver.

Table 1 shows that fat synthesis from glucose was significantly depressed by dietary sucrose in three strains, MRS Sprague–Dawley, QEC Lister and ASL Wistar, but not in the other two strains. Glucose oxidation was depressed by dietary sucrose in three strains (QEC Lister, ASL Wistar and MRC Hooded) and these strains had significantly higher glucose 6-phosphatase activities. The remaining two strains (ASL Hooded and MRC Sprague–Dawley) showed no change either in glucose oxidation or in glucose 6-phosphatase activity. The suggestion (Bender & Thadani, 1970) that the depression of glucose oxidation by liver slices *in vitro* is due to increased glucose 6-phosphatase activity would appear to be verified.

This difference between strains may explain some of the conflicting reports from different laboratories on the effects of dietary sucrose in the rat.

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Table 1. *Metabolism in vitro of liver of rats fed on 60% starch or sucrose for 25 days*

Experimental details are given in the text. The non-parametric Mann & Whitney (1947) test was used to determine the statistical significance of the results (N.S., not significant).

Strain	Diet	No. of rats	Fat synthesis (c.p.m./mg dry wt.)			Glucose oxidation (c.p.m./mg dry wt.)			Glucose 6-phosphatase (μ mol of P _i /min per g of liver)		
			Mean (range)	Ratio sucrose/starch	P value	Mean (range)	Ratio sucrose/starch	P value	Mean (range)	Ratio sucrose/starch	P value
ASL Hooded	Starch	6	15.6 (11.4-18.6)			149 (49-242)			8.8 (7.4-9.7)		
	Sucrose	6	14.7 (7.7-25.0)	0.9	N.S.	123 (67-160)	0.8	N.S.	9.6 (7.8-13.4)	1.1	—
MRC Sprague-Dawley	Starch	5	27.4 (17.1-41.0)			235 (200-271)			8.1 (7.4-8.9)		
	Sucrose	5	13.1 (11.7-15.4)	0.5	0.004	244 (137-392)	1	—	8.6 (6.7-10.7)	1.1	—
QEC Lister	Starch	4	20.0 (17.6-22.7)			305 (266-360)			8.8 (8.2-9.6)		
	Sucrose	5	10.5 (7.1-14.4)	0.5	0.004	147 (125-165)	0.5	0.008	11.9 (10.9-12.5)	1.4	0.004
ASL Wistar	Starch	5	17.7 (15.7-20.7)			157* (152-162)			8.4 (7.4-9.6)		
	Sucrose	3	10.0 (7.3-11.3)	0.6	0.004	62 (38-88)	0.4	0.1	11.9 (10.2-13.9)	1.4	0.004
MRC Hooded	Starch	6	21.2 (17.9-32.1)			130 (104-165)			6.9 (5.6-8.4)		
	Sucrose	6	14.2 (12.9-23.9)	0.9	N.S.	105 (89-130)	0.8	0.048	9.5 (8.9-11.1)	1.4	0.004

* Mean of two values.