AN *IN VITRO* ASSAY FOR MEASURING THE AMOUNT OF STARCH ESCAPING DIGESTION *IN VIVO*.

J.G. MUIR, P. MOON and K.O'DEA

Many carbohydrate-rich foods contain variable amounts of starch that escape digestion in the small intestine and pass into the colon (Englyst and Cummings 1985). This fraction of starch escaping digestion has been called resistant starch. Starch in food may resist digestion for a number of reasons including the physical form of the food, the crystalline characteristics of the starch granules and the extent of retrogradation of the starch polymers (Cummings and Englyst 1987). In escaping digestion, resistant starch (RS) behaves like dietary fibre and may therefore share some of the characteristics and health benefits currently attributed to dietary fibre. Before it is possible to establish the physiological significance of RS in the diet a reliable *in vitro* method for measuring the levels of starch which escapes digestion *in vivo* must be developed.

We have recently developed an *in vitro* assay which we believe can be used to predict the amount of starch which escapes digestion *in vivo*. This *in vitro* assay attempts to mimic the physiological conditions for starch digestion from the mouth to the colon. Hence the starch-containing food is chewed, incubated with pepsin (pH 2) at 37°C , followed by incubation with porcine pancreatic amylase (pH 5) at 37°C. The total amount of starch escaping digestion in this system is termed RS.

The aim of the study was to validate this *in vitro* RS assay with an *in vivo* model system for starch digestion using human ileostomates (people who have had their large bowel removed leaving their small bowel intact). Ileostomates make an ideal model in which to study the extent of starch digestion in the small intestine. In these studies subjects were fed the test food containing a known amount of starch for breakfast (eg. boiled whole rice and ground rice, baked beans or cornflakes). Effluent was collected two-hourly for the next 12 hours and frozen immediately. The amount of starch escaping digestion (ie. recovered in the effluent) was analysed for starch content. The results were compared with the amount of starch escaping digestion as predicted by the *in vitro* RS assay.

The results revealed that there was no significant difference between the predicted RS levels using the *in vitro* assay and the results of the ileostomy study. Results shown in the table are expressed as mean ± standard deviation.

	% Undigested starch				
Food	*In vitro* RS assay	n	Ileostomy study	n	P*
Boiled whole rice	3.23±0.9	15	3.90±3.2	9	0.51
Boiled ground rice	0.50±0.2	10	0.71±0.6	7	0.35
Cornflakes	2.90±0.4	11	3.10±0.8	8	0.63
Baked beans	6.50±3.3	13	6.10±2.8	7	0.78

*using t -test, no significant difference between *in vitro* and *in vivo* model systems.

These results suggest that this *in vitro* RS assay may be useful in predicting the amount of starch which escapes digestion and absorption in the small intestine of humans.

ENGLYST, H.N. and CUMMINGS, J.H. (1985). Am J Clin Nutr. 42: 778.
CUMMINGS, J.H. and ENGLYST, H.N. (1987). Am J Clin Nutr. 45: 1243.

Department of Human Nutrition, Deakin University, Geelong, Victoria 3217.