Application Note NS002: GI Analysis of Rice using the NutriScan GI20

Introduction:

Glycemic Index, GI, is most relevant for carbohydrate based foods. Rice is one of the most widely consumed grains throughout the world. Rice is composed mostly of carbohydrate and the GI of rice is important in the understanding of the nutritional value of different varieties and types of rice.

This application note shows the results from measuring the Predictive Glycemic Index of various rice samples.

Procedure:

The GI20 simulates the enzymatic digestion of foods in the human gut and measures the amount of glucose released from the food samples over a 5 hour digestion process.

Enzymatic digestion of 4 rice samples and 2 breakfast cereals were performed under gentle agitation and incubation at 37C for five hours using the NutriScan GI20 Glycemic Index Analyser. Each sample was run in duplicate. The glucose concentration of a 1ml sample extracted from the digests at 15, 30, 60, 120, 180, 240 and 300 minutes were analysed using the Analox GM9 Glucose Analyser. The glucose concentrations are plotted to generate the Glucose Response for each sample. The Glycemic Index was calcualted as the ratio of the Glucose Response to the total available carbohydrates available in the food multiplied by 100.

GI   =   (Glucose Response for the Sample/% Available Carbohydrates) * 100

2 breakfast cereals, Cornflakes and Albran, have well established GI values and were used as low and high standards in order to scale the glucose responses for the rice samples.

Sample Preparation:

1. Bring 57.5 mL of water to the boil in a beaker (covered)
2. Add 6.4g of rice to the boiling water.
3. The power is reduced to ¾ and the rice gently boiled (uncovered) for 16 minutes.
4. Remove beaker from hot plate and drain rice using a standard domestic sieve.
5. Allow rice to cool. Measure the moisture content of 2 grams of boiled rice using an infrared balance.
6. Weigh sufficient of the boiled rice samples to the equivalence of 50mg of available carbohydrate in the rice on a dry basis.

Results:

Table 1. show Glucose Response, mg/dl, for each sample over a five hour digestion process.

	15min GR	30min GR	60min GR	120min GR	180min GR	240min GR	300min GR
Cornflakes	9.5	13.3	13.0	15.0	14.4	15.7	16.6
Albran	7.0	9.7	9.9	10.6	11.4	11.4	11.2
Rice 1	11.2	8.5	9.5	10.6	10.8	11.4	11.7
Rice 1	7.6	8.6	9.9	10.4	11.7	9.2	12.4
Rice 2	5.2	6.3	7.6	9.5	10.1	11.4	12.4

Rice 2	4.3	5.4	7.2	9.4	10.1	11.4	12.1
Rice 3	3.2	4.1	7.6	6.8	8.3	9.9	11.9
Rice 3	2.9	3.6	5.0	6.7	8.8	9.5	10.6
Rice 4	3.4	4.3	6.7	9.7	10.8	12.6	13.5
Rice 4	4.7	6.1	8.5	11.4	10.8	14.1	13.9

These data are then corrected for the drop in sample volume since 2ml of sample is extracted for each analysis and then the GI is determined by dividing the corrected figure by the % Available Carbohydrates. Table 2. shows the corrected Predicted GI Values.

	15min GI	30min GI	60min GI	120min GI	180min GI	240min GI	300min GI	Predicted GI
Cornflakes	34.8	51.0	52.2	63.6	64.9	75.0	84.6	85
Albran	25.6	37.2	39.9	45.2	51.1	54.3	57.0	57
PS Rice	40.7	32.4	38.5	45.2	48.7	54.3	59.7	60
PS Rice	27.6	33.1	39.9	44.4	52.7	43.9	63.4	63
SP	19.0	24.1	30.5	40.6	45.4	54.3	63.4	63
SP	15.8	20.7	29.0	39.8	45.4	54.3	61.6	62
MR220	11.8	15.9	30.5	29.1	37.3	47.4	60.7	61
MR220	10.5	13.8	20.3	28.3	39.7	45.7	54.2	54
PR	12.5	16.5	26.8	41.4	48.7	60.3	68.9	69
PR	17.1	23.4	34.1	48.3	48.7	67.2	70.8	71

Figure 1 shows the plot of the Glucose Responses and figure 2 shows the plot of the Predicted GI va

Figure 1. Glucose Response mg/dl

Figure 2, Predicted GI Values
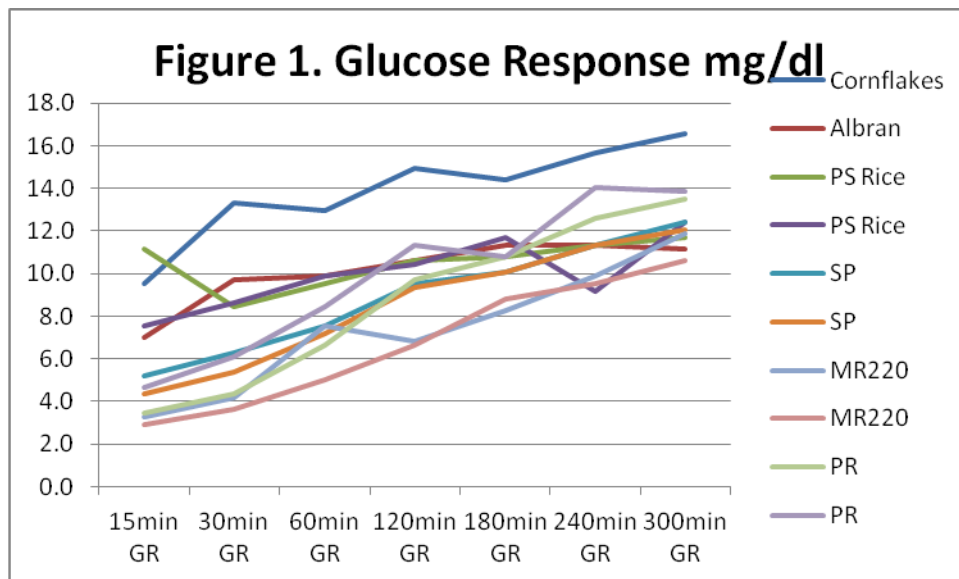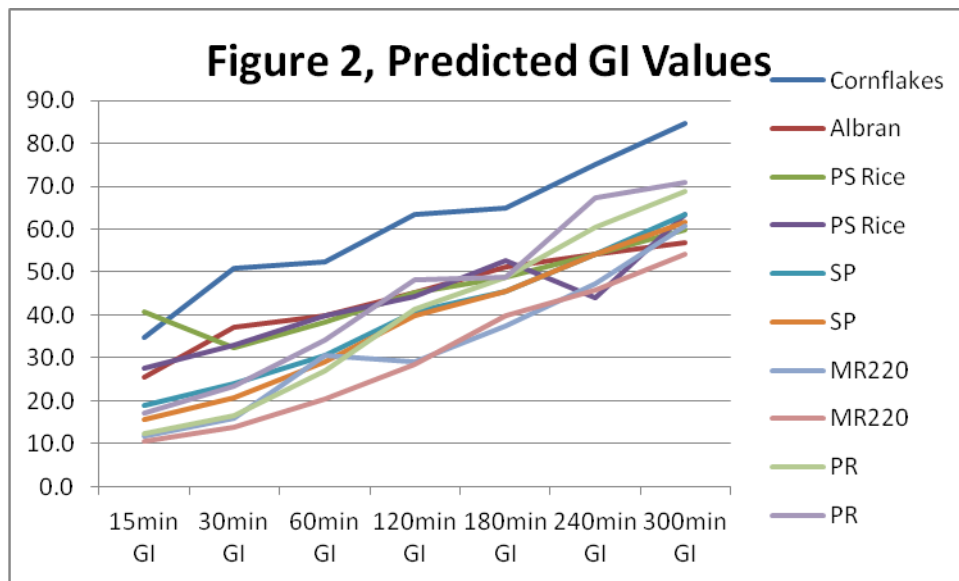
Based on these plots the Glycemic Index has been predicted for each sample. Table 1 shows the predicted GI values.

Table 1. Predicted Glycemic Index for each sample.

	Repeat 1	Repeat 2	Average
Cornflakes	85		85
All Bran	57		57
Rice 1	60	63	61.5
Rice 2	63	62	62.5
Rice 3	61	54	57.6
Rice 4	69	71	70

Based on data provided by CSIRO, Cornflakes should have a GI value of 86 and All Bran a GI value of 54. Using the predicted GI values for the Cornflakes and All Bran samples, a XY plot was drawn and the slope and bias corrections calculated as shown in Figure 6.

The slope and bias were applied to the predicted GI values for each sample.

Table 2. Corrected Glycemic Index for each sample.

	Repeat 1	Repeat 2	Average
Cornflakes	82	91	85.5
All Bran	60	52	56
Grain Flakes	72	77	74
Muesli	59	50	54.5
Extruded	56	59	57.5

Discussion:
The NutriScan GI20 Glycemic Index Analyser provides a means of predicting Glycemic Index in food samples by simulating the enzymatic digestion of the foods and the measurement of the release of glucose from the food during digestion.

The sources of error in this technology include instrumental errors and sampling errors. It is important to perform at least duplicate tests for each sample. Since the sample used for this test is the equivalent of 50mg of available carbohydrates, then weighing the sample is a significant source of error. A 4 decimal place balance is required in order to accurately prepare each test sample. Also the nature of the samples will affect the reproducibility of the tests. Samples that contain large chunks or pieces, eg, fruit or nuts, are very difficult to obtain a representative 50-100mg sub sample. If the food is ground to

a fine powder then it will not react the same as the raw or unground food. As such samples were chopped using a Zylsis Food Processor but the Muesli sample could not be reduced to a point where the two samples used in the analysis were consistent.

Instrumental errors include the addition of the reagents using peristaltic pumps which have a precision of approximately 10%. However the major source of error is probably the precision of the injection of the sample into the GM9 Glucose Analyser and the subsequent precision of the analyser itself.

The GI20 needs to be calibrated against standard samples. Unfortunately the only standards available to us were the Cornflakes and All Bran samples provided by CSIRO. As such, the correction of the Predicted GI values to align them with these standards is considered an acceptable practise.