

## **Glycaemic index and the athlete**

You can significantly improve your performance by eating the right mix of complex and simple carbohydrates. Getting the right balance will give you an energy boost just when you need it and it is not as hard to achieve as it might sound. All you have to know is a food's glycaemic index.

### **What is the glycaemic index (GI)?**

Glycaemic index (GI) is a numerical system that tells you how fast a particular food triggers a rise in your blood sugar levels. A food with a high GI will cause a fast rise in blood sugar while a food with a low GI will bring about a slower rise.

### **Why is this important?**

From a health point of view, sharp increases in blood sugar are thought to be undesirable because of the effect this has on insulin levels. Diets high in simple carbohydrates and low in starch have been shown to significantly increase the risk of developing diabetes, high blood fat levels, high blood pressure and heart disease.

### **Why is this important for the athlete?**

For the athlete, knowing the GI of different foods is important for reasons other than just health. Getting the balance between complex and simple carbohydrates right can significantly influence performance.

Many experts recommend a low glycaemic index meal one to two hours before an exercise session.<sup>5</sup> It is thought that the slower, more consistent, release of energy will improve performance by delaying fatigue. It has also been found that low GI meals produce higher blood sugar and fatty acid levels during the latter stages of exercise.<sup>6,7</sup> For endurance sports, this is very advantageous.

During exercise, when blood sugar levels need to be maintained, one way to achieve this is to drink an isotonic sports drink. This will provide glucose, which is quickly absorbed, fluid and also sodium.

After exercise, however, when muscles' stores of sugar (glycogen) need to be quickly restored, a high GI food is a good choice. This is because the simple sugars contained in a high GI food are rapidly absorbed into the blood stream. In turn, this rapid absorption stimulates insulin release and that results in increased uptake by the muscle cells of glucose and their manufacture of glycogen.

So, knowing the GI of various foods can clearly help you plan your diet in a way that will help to optimise your performance.

### **How is glycaemic index for a food worked out?**

The glycaemic index of any particular food is worked out by comparing it with a "reference food" for which a GI has already been established. In other words, the effect

of the food being tested on blood sugar levels is monitored at set intervals over a two-hour period and the results compared with the reference food.

Glucose is the reference food normally used or, occasionally, white bread. It is possible that you may see the same food with two different glycaemic index figures. If glucose has been used as the reference food, the GI figure is lower than if white bread has been used. The reason for the difference is that pure glucose is absorbed into the blood stream much more quickly than the complex carbohydrates in white bread. However, both figures mean the same.

So, for example, baked potato has a GI of 85 (when glucose is used as the reference food) which means that its effect on blood sugar levels is 85 per cent that of glucose. Therefore, baked potato has less of an effect on blood sugar levels. The GI of glucose has been set at 100 and nearly all foods will fall below this figure.

If white bread was used as the "reference food" the figure for the GI of baked potato would be 128. This is because baked potato has a greater effect on blood sugar levels than white bread. White bread, when used as the reference food, is given the notional GI figure of 100 and quite a number of foods will have a higher GI figure than this.

[Click here to view the GI of a range of foods](#)

### **Which component in food increases blood sugar?**

It is the carbohydrate in food which influences blood sugar levels. Carbohydrate is made up of various simple carbohydrates and starch. Starch is referred to as a complex carbohydrate because it is a large molecule made up of many different sugar units all joined together. While simple carbohydrates are small molecules made up of just one or two sugar units.

Because of their small size and simple construction, simple carbohydrates are easily absorbed into the blood stream. The result is a rapid rise in blood sugar levels.

In contrast, complex carbohydrates (such as starch) need to be broken down into their individual sugar units before they can be absorbed. For this reason, they take some time to be absorbed into the blood stream. The result is a much slower rise in blood sugar levels.

### **What about meals and glycaemic index?**

We often eat meals made up of various foods, rather than just one food on its own, so how can you work out the GI of the meal?

Various factors such as the fat, protein and fibre content of meals together with cooking methods can influence the GI of the entire meal as these will influence how quickly absorption takes place from the gut into the blood stream.

The following method for working out the GI of a whole meal has been suggested.<sup>8</sup> Calculate the total carbohydrate content of the meal, then work out the contribution each

individual food makes to the total carbohydrate content. For example, the GI of an average breakfast is calculated below:

Food	Carbohydrate (g)	% of total carbohydrate	GI	Contribution to meal GI
Orange Juice (150 ml)	12.5	26%	46	26% X 46 = 12
Weetabix (30g)	21	43%	69	43% X 69 = 30
Milk (150 ml)	7	15%	27	15% X 27 = 4
1 slice of toast	13	27%	70	27% X 70 = 19
<b>Total</b>	<b>53.5</b>		<b>100%</b>	<b>Meal GI = 65</b>

### Key points

A high GI food has a more dramatic effect on blood sugar levels than a low GI food  
 Rapid rises in blood sugar levels are undesirable and are linked to various health problems (particularly diabetes)  
 Low GI foods/meals should be eaten one to two hours before exercise  
 During exercise blood sugar levels can be maintained with isotonic sports drinks  
 A high GI food is a good choice immediately after an exercise session

Source: [www.bupa.co.uk](http://www.bupa.co.uk)

### References:

1. Salmeron J et al. Dietary fiber, glycemic load, and risk of non-insulin-dependent diabetes mellitus in women. *JAMA* 1997; 277: 472-77.
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5. Thomas DE. et al. Carbohydrate feeding before exercise; effect of glycaemic index. *Int. J. Sports Med.* 1991; 12; 180-6.
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8. Leeds, A, Brand Miller J, Foster-Powell K, Colagiuri S. *The Glucose Revolution* (2000) (London: Hodder & Stoughton) p29.

9. MAFF/RSC (1991). McCance & Widdowson's The Composition of Foods, 5th ed. (Cambridge: MAFF/RSC)

## Glycaemic index and carbohydrate content of some common foods

Glycaemic index (GI) is a numerical system that tells you how fast a particular food triggers a rise in your blood sugar levels. A food with a high GI will cause a fast rise in blood sugar while a food with a low GI will bring about a slower rise.

Below the three tables (divided into high, moderate and low GI foods) give the GI values for a range of common foods.

### High GI foods (GI=60-100)

Food	Portion size	Glycaemic index (GI)	Carbohydrate (g) per portion	kcal per portion
<b>Breakfast cereals</b>				
Cornflakes	1 small bowl (30g)	84	26	108
Rice Crispies	1 small bowl (30g)	82	27	111
Cheerios	1 small bowl (30g)	74	23	111
Shredded Wheat	2 (45g)	67	31	146
Weetabix	2 (40g)	69	30	141
<b>Grains/pasta</b>				
Couscous	5 tbsp (150g)	65	77	341
Brown rice	6 tbsp (180g)	76	58	254
White rice	6 tbsp (180g)	87	56	248
<b>Breads</b>				
Bagel	1 (90g)	72	46	241
Croissant	1 (60g)	67	23	216
Baguette	3 inches long (40g)	95	22	108
White bread	1 large slice (38g)	70	18	85
Wholemeal bread	1 large slice (38g)	69	16	82
Pizza	1 large slice (115g)	60	38	288
<b>Crackers and biscuits</b>				
Puffed crispbread	1 slice (10g)	81	7	32
Ryvita	1 slice (10g)	69	7	32
Water biscuit	1 (8g)	78	6	35

Rice cakes	1 (8g)	85	6	28
Shortbread	1 (13g)	64	8	65
<b>Vegetables</b>				
Parsnip	2 tbsp (65g)	97	8	43
Baked potato	1 medium (180g)	85	22	94
Boiled new potato	7 small (175g)	62	27	116
Mashed potato	4 tbsp (180g)	70	28	188
Chips	average (165g)	75	59	450
Swede	2 tbsp (60g)	72	1	7
Broad beans	2 tbsp (120g)	79	7	58
<b>Fruit</b>				
Cantaloupe melon	1 slice (200g)	65	6	26
Pineapple	1 slice (80g)	66	8	33
Raisins	1 tbsp (30g)	64	21	82
Watermelon	1 slice (200g)	72	14	62
<b>Dairy products</b>				
Ice cream	1 scoop (60g)	61	14	62
<b>Drinks</b>				
Fanta	375 ml can	68	51	191
Lucozade	250 ml bottle	95	40	150
Isostar	250 ml can	70	18	68
Gatorade	250 ml bottle	78	15	56
Squash (diluted)	250ml glass	66	14	54
<b>Snacks and sweets</b>				
Tortilla/Corn chips	1 bag (50g)	72	30	230
Mars bar	1 standard (65g)	68	43	287
Muesli bar	1 (33g)	61	20	154
<b>Sugars</b>				
Glucose	1 tsp (5g)	100	5	19
Sucrose	1 tsp (5g)	65	5	19
Maltodextrin	1 tsp (5g)	105	5	19

### Moderate GI foods (GI=40-59)

Food	Portion size	Glycaemic index (GI)	Carbohydrate (g) per portion	kcal per portion
<b>Breakfast cereals</b>				
All Bran	1 small bowl (40g)	42	19	104
Sultana Bran	1 small bowl (30g)	52	20	91
Porridge (with water)	1 small bowl (160g)	42	14	78
Muesli	1 small bowl (50g)	56	34	183
<b>Grains/pasta</b>				
Buckwheat	4 tbsp (80g)	54	68	292
Bulgar wheat	4 tbsp (56g)	48	44	196
Basmati rice	4 tbsp (60g)	58	48	215
Noodles	4 tbsp 230g cooked	46	30	143
Macaroni	4 tbsp 230g cooked	45	43	198
Spaghetti	4 tbsp 220g cooked	41	49	229
<b>Breads</b>				
Pitta bread	1 large (75g)	57	43	199
Rye bread	1 slice (25g)	41	11	55
<b>Biscuits and cakes</b>				
Digestive	1 (15g)	59	10	71
Oatmeal	1 (13g)	55	8	57
Rich Tea	1 (10g)	55	8	40
Muffin	1 (68g)	44	34	192
Sponge cake	1 slice (60g)	46	39	181
<b>Vegetables</b>				
Carrots	2 tbsp (60g)	49	3	14
Boiled potato	2 medium (175g)	56	30	126
Peas	2 tbsp (70g)	48	7	48
Sweetcorn	2 tbsp (85g)	55	17	94
Sweet potato	1 medium (130g)	54	27	109
Yam	1 medium (130g)	51	43	173
<b>Pulses</b>				

Baked beans	1 small tin (205g)	48	31	166
<b>Fruit</b>				
Apricots	1 (40g)	57	3	12
Banana	1 (100g)	55	23	95
Grapes	1 small bunch (100g)	46	15	57
Kiwi	1 (68g)	52	6	29
Mango	half (75g)	55	11	43
Orange	1 (208g)	44	12	54
Papaya	half (175g)	58	12	47
Peach	1 (121g)	42	8	36
Plum	1 (58g)	39	5	20
Sultanas	1 tbsp (18g)	56	12	50
<b>Dairy products</b>				
Custard	2 tbsp (120g)	43	20	140
<b>Drinks</b>				
Apple juice	1 glass (160ml)	40	16	61
Orange juice	1 glass (160ml)	46	14	58
<b>Snacks and sweets</b>				
Crisps	1 packet (30g)	54	16	159
Milk chocolate	1 bar (54g)	49	31	281
<b>Sugars</b>				
Honey	1 heaped tsp (17g)	58	13	49

#### Low GI foods (GI=1-39)

Food	Portion size	Glycaemic index (GI)	Carbohydrate (g) per portion	kcal per portion
<b>Breakfast cereals</b>				
<b>Pulses</b>				
Butter beans	4 tbsp (120g)	31	22	124
Chick peas	4 tbsp (140g)	33	24	168
Red kidney beans	4 tbsp (120g)	27	20	124

Green/brown lentils	4 tbsp (160g)	30	28	164
Red lentils	4 tbsp (160g)	26	28	160
Soya beans	4 tbsp (120g)	18	6	169
<b>Fruit</b>				
Apples	1 (100g)	38	12	47
Dried apricots	5 (40g)	31	15	63
Cherries	1 small handful (100g)	22	10	39
Grapefruit	half (80g)	25	5	24
Peaches tinned	half tin (120g)	30	12	47
Pear	1 (160g)	38	16	64
Plum	1 (55g)	39	5	20
<b>Dairy products</b>				
Full cream milk	half pint (300ml)	27	14	198
Skimmed milk	half pint (300ml)	32	15	99
Yoghurt (low fat fruit)	1 carton (150g)	33	27	135
<b>Snacks and sweets</b>				
Peanuts	1 small handful (50g)	14	4	301
<b>Sugars</b>				
Fructose	1 tsp (5g)	23	5	19

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#### References:

1. Leeds, A, Brand Miller J, Foster-Powell K, Colagiuri S. The Glucose Revolution (2000) (London: Hodder & Stoughton) p29.
2. MAFF/RSC (1991). McCance & Widdowson's The Composition of Foods, 5th ed. (Cambridge: MAFF/RSC)