

RICE: NUTRITIONAL PROFILE AND GI IMPLICATIONS

Summary

- Rice is an excellent food source, low in fat and high in starchy carbohydrate
- Rice is packed full of vitamins and minerals and provides an excellent source of vitamin E, B vitamins (thiamin, niacin) and potassium
- Brown rice and basmati rice have medium or low GI values, and are not associated with increasing risk factors for weight gain and diabetes. Other white rice is categorised as a high GI food. However, since rice is normally eaten in combination with other foods, the overall GI value of a meal that includes white rice is normally lower.

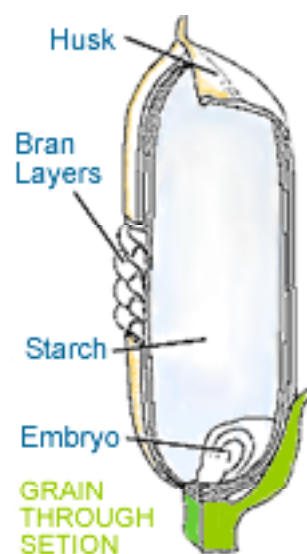
Background

Rice is one of the oldest cultivated crops, first mentioned in history as far back as 2800 BC in China. Rice is a staple crop and forms the foundation of the diet for many of the world's population, especially those living in Southern and Eastern Asia. There are a huge number of rice varieties – such as long-grain, basmati and Arborio - but only a few are grown widely.

Structure of Rice Grain

Freshly harvested rice is called paddy grain or rough rice. The pearly white starch grain used for cooking is the centre of the rice seed and is covered and protected by the hull.

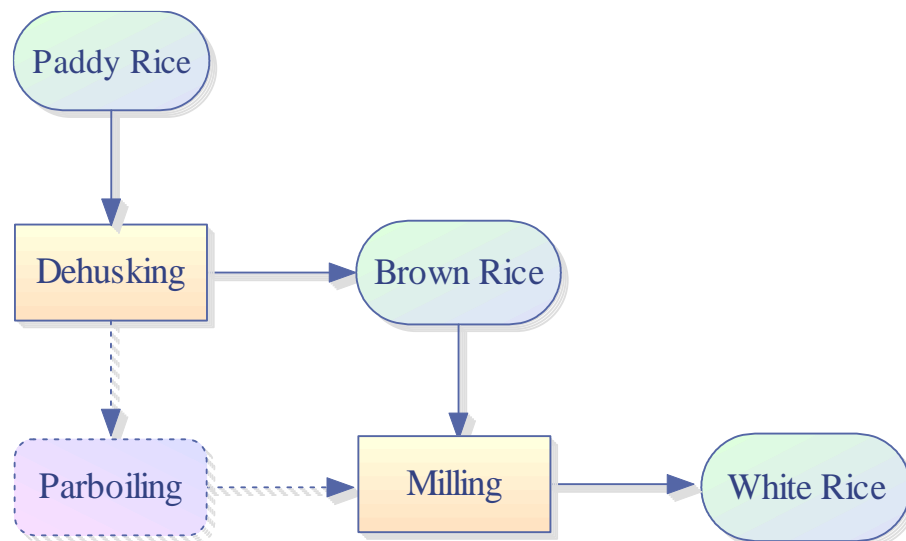
Inside the hull, the familiar white grain is covered by a layer called bran. The embryo, a small structure at the base of the grain, is also contained within the bran layer. Together, the grain, embryo and bran are called brown rice.



Processing

The process begins as the rice arrives from the growing areas. Firstly whole or paddy rice is dehusked or dehulled by a rubber roll sheller to produce brown rice. The outer tough protective coating is removed because it is indigestible. This has no effect on the nutritional composition of the grain that lies within the husk.

The resultant brown rice can be further milled to produce white rice. Milling of brown rice involves removal of the outer bran layers of the grain (the pericarp) which are darker in colour and are rich in nutrients such as B vitamins.



Before milling, unhusked rice may be parboiled (steamed or boiled after soaking) to soften the husk. Rice is soaked in warm water (56°C) for 4-5 hours before being steamed under pressure, dried and milled. The process increases the total and head yield of the rice and decreases the loss of nutrients during processing. During this process, some of the water soluble B vitamins located in the bran move into the endosperm, along with the oil. Although cooking and parboiling rice reduces its protein digestibility by 10-15%, there is a corresponding increase in the biological value, leading to an unchanged net protein utilisation value.

Allergies

Allergic reactions to rice are rare in the western world, and rice can be an invaluable alternative source of carbohydrate and energy for anyone allergic to gluten or wheat.

Nutritional benefits of rice

Rice has been found to be very easy to digest. It is low in fat, low in cholesterol, high in starch, and has a high nutritional content.

Rice is also an excellent source of energy. It is comprised of 77.5% carbohydrate. Carbohydrate is one of the human body's two main sources of energy, the second being fat. Like other cereals, the carbohydrate in rice is mainly in the form of starch – a complex carbohydrate, and like other cereals the starches occur in granules in the endosperm. Starch exists as either amylose or amylopectin and comprises units of glucose (a simple sugar) linked together in very large numbers.

During digestion, these links are broken and the resulting glucose is absorbed into the body. Amylopectin contains branches and is less resistant to digestion whereas amylose is a straight chain molecule and harder for the digestive system to break up. This means that rice varieties with a greater proportion of starch in the form of amylose tend to have a lower glycaemic index (see below).

Rice also contains a range of important nutrients, including B and E vitamins; protein; and minerals – especially potassium which helps the body reduce toxins. Rice can contribute significantly to vitamin and mineral intake, although the contribution to micronutrient intake will depend on the proportion of germ, bran and endosperm consumed (ie the balance between brown and white rice).

Comparison of selected nutrients in brown and white rice (per 100g) ¹

Nutrient	Brown rice, raw	White rice (easy cook), raw
Energy (kcal/kJ)	357 / 1518	383 / 1630
Fat (g)	2.8	3.6
Protein (g)	6.7	7.3
Carbohydrate (g)	76	78
Fibre (as NSP ²) (g)	1.9	0.4
Thiamin (mg)	0.59	0.41
Riboflavin (mg)	0.07	0.02
Niacin equivalents (mg)	6.8	5.8
Folate (ug)	49	2

Vitamin content of selected cereals (mg/per 100g, unless specified) ¹

Vitamin	Vit E	Thiamin	Riboflavin	Niacin equivalent (µg)	Vit B ₆ (µg)	Folate (µg)
Wheat flour, white, plain (fortified)	0.30	0.31*	0.03	3.6*	0.15	22
Wheat flour, wholemeal	1.40	0.47	0.09	8.20	0.50	57
Rice, easy cook white, raw	(0.10)	0.41	0.02	5.8	0.31	20
Rice, brown, raw	0.80	0.59	0.07	6.80	-	49
Popcorn, plain	11.03	0.18	0.11	1.7	0.20	3
Oatmeal, quick cook raw	1.50	0.90	0.09	3.4	0.33	60
Barley, pearl raw	0.40	0.12	0.05	4.8	0.22	20
Rye flour, whole	1.60	0.40	0.22	2.6	0.35	78
Millet flour	Trace	0.68	0.19	2.8	N	N

Mineral content of selected cereals (mg/per 100g, unless specified) ¹

Mineral	Na (mg)	K (mg)	Ca (mg)	Mg (mg)	Fe (mg)	Zn (mg)	Se (µg)
Wheat flour, white, plain	3	150	140*	20	2.0*	0.6	2
Wheat flour, wholemeal	3	340	38	120	3.9	2.9	6
Rice, easy cook white, raw	4	150	51	32	0.5	1.8	13
Rice, brown, raw	3	250	10	110	1.4	1.8	10
Popcorn, plain	4	220	10	81	1.1	1.7	N
Oatmeal, quick cook raw	9	350	52	110	3.8	3.3	3
Barley, pearl raw	3	270	20	65	3.0	2.1	(1)
Rye flour, whole	(1)	410	32	92	2.7	3.0	N
Millet flour	21	370	40	N	N	N	N

¹ Source: Food Standards Agency and Institute of Food Research 2002.

² NSP: non-starch polysaccharides

Rice as part of a healthy balanced diet.

According to the Food Standard Agency Balance of Good Health food model cereal products including rice, alongside potatoes, bread and cereals, should form the major part of a meal. These guidelines recommend that one-third, or 33%, of meals are based on carbohydrate rich food such as rice, bread, pasta and potatoes. In terms of calories, carbohydrate rich foods should make up around 50% of our total calorific intake.



The glycaemic index (GI)

Led by the diet industry, retailers and the media, the GI has undoubtedly been given a boost by the 'carb conscious' climate. There is currently developing interest in classifying foods according to their glycaemic index. The GI is intended to measure how quickly a carbohydrate food is absorbed into the blood stream. Foods with a higher GI are, in principle, more quickly digested than those with a lower GI value. However, the rate of digestion and absorption is influenced by a number of factors:

1. Cooking method and amount of chewing (the more food is chewed, the higher the GI value)
2. Cooking or processing (milling increases the GI)
3. The nature and amount of carbohydrate
4. Other food components (presence of fat and protein tends to lower GI values)
5. The nature of the starch (eg: ratio of amylose to amylopectin)
6. Individual variation. Given the same food, there can be a 50% variation in GI value between individuals.

GI Classification

Foods tend to be classified as high, medium or low GI.

Low-GI foods (<55) All-Bran (42) Apple, raw (38) Baked beans (48) Carrots, Uncooked (49) Peanuts (14) Rye bread (41) Skimmed milk (32) Spaghetti (41)

Medium-GI foods (55-70)

Alpen muesli (55) Apricots, raw (57) Banana, raw (58) **Basmati rice (58)** Croissant (67) Crumpets (69) Frosties (55) Kiwi fruit, raw (58) Mango (60) Peach (58) Pita bread (57) Shredded wheat (67) Sweetcorn, cooked (62)

High-GI foods (>70) Bagel (72) Broad beans (79) Cornflakes (84) French fries (75) Lucozade (95) Parsnip (97) Rice Krispies (82) **White rice (87)**

There are still doubts about the usefulness of the GI as a means of discriminating between foods, not least because of the confounding issues mentioned above and also because of the lack of science. The GI system also implies that foods with a high GI have no other nutritional benefits and can discriminate against certain fruits and vegetables which directly counters the DoH's 5 a day fruit and vegetable initiative. Nevertheless, there is an increasing amount of research in this area. A brief summary of the research position is set out below:

GI summary

- The methodology for measuring GI is flawed and GI values differ between laboratories
- The GI of individual foods is variable and can be changed by other nutrients (eg: adding fat and protein to rice can lower the GI of the meal, adding milk to cornflakes lowers the GI)
- Low GI foods may favour endurance exercise but high GI foods favour recovery from exercise
- The evidence for beneficial effects of low GI diets on body weight is strengthening
- The evidence for beneficial effects of low GI foods on the metabolic syndrome is strengthening
- The evidence for beneficial effects of low GI diets on diabetes management is good but on diabetes prevention is weak. The evidence for beneficial effects of low GI diets on cardiovascular disease and its risk factors remains weak
- There is no evidence for beneficial effects of low GI diets on cancer
- The WHO / FAO report lists low GI foods as a possible factor for decreasing the risk of developing type 2 diabetes and reducing risk of weight gain (WHO / FOA, 2003)