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Review Article

The Role of Pulses in Human Nutrition: *A Review*

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Pulses belong to the family leguminosae (COPR, 1981). The family leguminosae is made up of many species which are cultivated all over the world (Rubatzky and Yamaguchi, 1997). Legumes have a wide range of usage, some are used as fodder or green manure, some are used as silage, while others are extracted for their oil, notably soyabean and groundnut (COPR, 1981). Such oil contributes a great deal to the energy intake of people all over the world. Majority of legumes are grown for their green pods, green seeds, or dried seeds (COPR, 1981). The term pulses cover all those grown for their dried seeds (COPR, 1981). Pulses have a variety of functions. The use of pulses range from their forming a staple diet to their being used as condiments, milk, cheese and snacks (Reddy *et al*., 1986; Uzogara and Ofuya, 1992). They play a very important role in human nutrition. The present paper reviews the work that has been done on the nutritional value of pulses.

Production: Pulses are grown all over the world (Reddy *et al*., 1986). Production as per continent is shown in the table below.

Table 1 Production of Pulses by Continent in 10^3 Mt*

PLS	SCIENTIFIC NAME	N & C AMERICA	S. AMERICA	AFRICA	EUROPE	ASIA	USSR
[1]Dry Beans	Phaseolus vulgaris	2627	2839	1911	830	6366	170
Broad beans	Vicia faba	88	109	1124	551	2408	-
Peas (dry)	Pisum sativum	435	98	334	2727	2377	7800
Chickpeas	Ciser arietinum	180	26	290	90	7257	-
Lentils	Lens culinaris	288	-	136	74	1714	-
Cowpea	Vigna unguiculata	57	-	1003	6	27	-

[1] *Haricot bean (also common bean)* **MT – Metrric Tonnes, Data obtained from FAO Year Book (1975 & 1986)*

Asia is the largest producer of the pulses listed above, followed by the USSR, where most of the pulses produced are in the form of dry Peas (Pisum sativum). The next largest producing continent for all pulses is Africa and the types of beans majorly produced are dry beans (Phaseolus vulgaris), broad beans (Vicia faba) and cowpeas (Vigna unguiculata). The continent that produces next to Africa is Europe, where most of the pulses produced are dry Peas (Pisum sativum). The least producing continents are North America, Central and South America. In these continents the dry beans (Phaseolus vulgaris) constitutes the pulse produced most.

Consumption of Pulses: Pulses are consumed all over the world. Consumption is higher in those parts of the world, where animal proteins are scarce and expensive for example, South East Asia and Africa (COPR, 1981). In this part of the world, they provide a large proportion of the protein required for adults and children. About 20% of the protein presently available to man, come from pulses in the developing countries (Reddy *et al*., 1986).

The nutritional value of pulses: The nutritional importance of pulses are numerous, they can be a valuable source of energy. The energy content of most pulses have been found to be between 300 and 540 Kcal / 100g (Table 2). Energy is required for all metabolic processes. The energy of Pulses come from the nutrient supply of protein, fat and carbohydrate.

Table 2. The Energy Content Of Some Pulses Commonly Consumed By Man

Pulses	Scientific name	Energy (kcal/100g)
Cowpeas	Vigna unguiculata	340
Chickpeas	Cicer arietinum	347
Broad bean	Vicia faba	320
Cluster bean		307
Lentil	Lens culinaris	302
Mung bean	Vigna radiata	310
Peanut	Arachis hypogea	570
Pigeon pea	Cajamis cajan	301
Soya bean	Glycine max	403

Source: Woleung et al (1968); Gopalan et al (1980)

The carbohydrate supply: The carbohydrate content of pulses is high (Table 3) (Reddy *et al*., 1985; Oke *et al*., 1995). The high carbohydrate content contributes a great deal to the energy supply of pulses. A large percentage of pulses occurs as starch (Table 3), about 1.8 - 18% occurs as oligossacharide while 4.3 - 25% occurs as dietary fibre (Table 4). Although the oligossacharides, which are made up of raffinose, stachyose, verbascose, cause gas production in man, they are presently believed to have some beneficial effects. They can shorten transit time and promote the growth of bifido bacteria in man. Infact researchers in Japan have actually suggested that oligossacharides from soyabeans could be used as substitute for common table sugar. They are also hypothesized to improve longevity and reduce colon cancer risk (Hayakawa *et al*., 1990; Koo and Rao, 1991). The high dietary fibre content of pulses (Table 4), are postulated to have some important physiological effects, such as reducing the transit time in the mammalian gut (Sathe *et al*., 1984). This would help to relieve gastrointestinal conditions such as constipation and diverticular disease. It is also capable of lowering the blood cholesterol level due to its ability to bind with cholesterol in the human gut (Burkitt and Trowell, 1985). This feature is being suspected as being capable of reducing colonic cancer in man (Davis and Stewart, 1987; Hangen and Bennink, 2002). Pulses also have low glyceamic indices (Hatford, 1985; Björek *et al*., 2000), which makes them valuable foods for diabetics. The cotyledon of legumes like locust bean and guar (guar gum) reduces postprandial glucose and insulin concentrations in man (Fairchild *et al*., 1996; Gatenby, 1991; Feldman *et al*., 1995).

PROTEIN SUPPLY

Pulses have a high protein content (Table 5), the value is about twice that in cereal and several times that in root tuber (FAO, 1968), so they can help to improve the protein intake of meals in which cereals and root tubers in combination with pulses are eaten (Kushwah *et al.*, 2002). Pulse when eaten with cereals, can also help to increase the protein quality of the meal (Table 6). In man, protein helps in the repair of body tissue, synthesis of enzymes and hormones and also in the supply of energy. In children, the consumption of pulses should be encouraged, particularly where animal protein is scarce and expensive, as this would help to furnish the child with the necessary amino acids required for growth.

Table 3. Starch and Total Carbohydrate Content of Pulses

Common name	Scientific name	Total carbohydrates %	Starch %	Amylose content of starch %
Winged bean	Psophocarpus tatragonubulus	24.0 – 42.2	–	–
Smooth peas	Pisum sativum	56.6	36.9 – 48.6	23.5 – 33.1
Wrinkled pea	Pisum sativum	–	24.0 – 36.6	62.8 –65.8
Great Northern beans		61.2 – 61.5	44.0	10.2 – 30.3
California small white beans		–	57.8	29.1 – 32.6
Broad beans	Vicia faba	57.3	41.2 – 52.7	20.7 – 45.5
Lentil	Lens culinaris	59.7	34.7 – 52.8	20.7 – 45.5
Cowpea	Vigna unguiculata	56.0 – 68.0	31.5 – 48.0	–
Lupine seed	Lupinus spp	–	0.3 – 3.5	–
Black gram	Vigna mungo	56.5 – 63.7	32.2 – 47.9	43.9
Common name	Scientific name	Total carbohydrates %	Starch %	Amylose content of starch %
Bengal gram	Cicer arietinum	60.1 – 61.2	37.0 – 50.	31.8 – 45.8
Mung gram	Vugna radiata	53.3 – 61.2	37.0 – 53.6	13.8 – 35.0
Red gram	Cajanus cajan	57.3 – 58.7	40.4 – 48.2	39.6
Red kidney bean	Phaseolus vulgaris	56.3 – 60.5	31.9 – 47.0	17.5 – 37.2
Navy bean	Phaseolus vulgaris	58.4	27.0 – 52.7	22.1 – 36.0
Pinto beans	Phaseolus vulgaris	54.6 – 63.7	51.0 – 56.5	25.8
Pink beans	Phaseolus vulgaris	–	42.3	14.9 – 35.3
Black eye beans	Vigna unguiculata	–	41.2	15.8 – 38.3
African yam bean	Strepnostylis stenocarpa	40.8	–	–

Source: Reddy et al. (1985); Frank-Peterside, Dosumu, and Njoku (2002); Ofuya (2002); Oke, Tewe, and Fetuga (1995).

Table 4. Dietary Fibre Content of Pulses (Per 100g of Whole Mature Seeds)

Legume	Dietary fibre	References
Chickpea	25.6	1
Groundnut	6.1	2
Kidney bean	25.4	2
Mung bean	15.2	1
Pea	16.7	1
Soya bean	11.9	2
Cluster bean	4.3	2
Lentils	11.7	2
Pigeon pea	15.0	2

Kamath and Belvady (1980) By Paul and Southgate (1978)

Table 5. Protein Content Of Pulses

Common name	Scientific name	Protein content g/100g DM	
		Mean	Range
Broad bean	Vicia faba	24.0	22.0 – 38.2
Chick pea	Cicer arietinum	22.2	19.1 – 31.2
Common bean	Phaseolus vulgaris	23.9	15.2 – 36.0
Common pea	Pistum sativum	23.1	14.2 – 36.1
Cowpea	Vigna unguiculata	24.0	20 – 34.2
Pigeon pea	Cajanus cajan	21.0	17.9 – 31.0
Groundnut	Arachis hypogaea	26.2	17.1 – 31.0
Soya bean	Glycine max	40.3	28.7 – 50.1
African yam bean	Streptpstylis stenocarpa	18.4	18 – 22

Source: FAO (1981); Ofuya (2002); Frank-Peterside, Dosumu and Njoku (2002); Oke, Tewe and Fetuga (2002); Amartiefo *et al.* (2002)

Table 6 Protein Quality of Cereal Grain and of Cereal Grain / Bean Diets Fed at Equal Levels of Dietary Protein

Protein source	Average weight gain (g)	PER
100% rice	43	2.15
90% rice + 10% beans	56	2.32
100% maize	13	0.87
90% maize + 10% beans	32	1.40
100% sorghum	12	0.88
90% sorghum + 10% beans	30	1.39
100% wheat	19	1.05
90% wheat + 10% beans	41	1.73
100% oats	34	1.60
90% oats + 10% beans	75	2.37
Casein	75	2.71

Source: Bressani (1972)

FAT SUPPLY: The fat content of pulse varies in different species. Most species contain about 1% fat, while groundnut and soyabean, have very high fat content, about 30% for soyabean and 49% for peanut (FAO, 1968). The fat content besides contributing to the energy needs, provides the needed essential fatty acids for man. A pulse like soyabean, contains linolenic acid, which is an omega–3–fatty acid. This fatty acid is currently being studied for its ability to reduce the risk of heart disease and cancer.

MICRONUTRIENT SUPPLY

VITAMIN SUPPLY: The vitamins present in appreciably quantities in pulses are thiamin, riboflavin, pyridoxine and folic acid; vitamin E and K are also found in pulses. The B-vitamins act as co-enzymes in biological processes Vitamin E is known to play a role as an antioxidant inhibiting the oxidation of vitamin A in the GIT and of polyunsaturates in the tissues. It is also believed to maintain the stability of cell membranes (Davies and Stewart, 1987). Vitamin K functions primarily in the liver where it is necessary for the formation of blood clothing factors.

Conclusion: Thus far, the many important functions of pulses have been highlighted. Their consumption should be encouraged in both adults and children. Because of their high dietary fibre content, I will advice more usage among the affluents who can afford lots of animal protein. Their use should also be encouraged among malnourished children because of their high protein content. The use of pulses as components of weaning foods in combination with cereals is also recommended, as this would give cheaper cereals with more complete protein. Finally, the use of oil from pulses should be encouraged because of the high polyunsaturated fatty acid content. Polyunsaturated fatty acids are suspected of being capable of reducing the risk of heart diseases.

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