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NUTRITIONAL VALUE OF PULSES AND THEIR IMPORTANCE IN HUMAN LIFE

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ABSTRACT
Pulses are among the most extensively used foods in the world. A wide variety of pulses can be grown globally, making them important both economically as well as nutritionally. In terms of nutritional aspects, pulses have been an important source of plant-based protein in developing countries, where animal-based protein is lacking. Pulse crop is a rich source of carbohydrate, protein, fat, vitamins and micronutrient such as iron, zinc. Consumption of half a cup of beans or peas per day can enhance diet quality by increasing intakes of these nutrients. In conclusion, including pulses in the diet is a healthy way to meet dietary recommendations and is associated with reduced risk of several chronic diseases.

Introduction

Pulse belongs to the family Leguminosae. The family Leguminosae is made up of many species which are cultivated all over the world. Legumes are power house of nutrients. They are rich source of dietary fibre, complex carbohydrates, starch, minerals such as potassium, iron, zinc etc. They are low in fat and being a plant food, contain low cholesterol. Pulse crop can significantly improve global nutrition, help to eradicate hunger and tackle many chronic health conditions, such as obesity and diabetes. In addition, the phytochemicals and tannins found in pulses possess antioxidant and anti-carcinogenic effects, indicating that pulses may have significant anti-cancer effects. The United Nation has declared 2016 the International Year of Pulses in order to demonstrate the integral role of these nutrient dense food have in global food security and nutrition and to promote how and why pulses will help developing and developed countries alike improve their populations health and well being every day.

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. 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 comes from pulses in the developing countries. In the world pulses are grown by 171 countries. The total area under pulses was 723 lakh ha. This area provided about 644.08 lakh tones of pulses with productivity 890 kg/ha. (Source: FAO statistics, 2013).

Pulses scenario in India

India is the largest producer and consumer of pulses in the world accounting for about 32 % of the world's area and 26 % of the world's production. Even more importantly India is also the largest importer and processor of pulses in the world. In 2013-14, the world total production of pulses is around 72 MT and India produced record 19.5 MT of total pulses which was highest all over the world. Due to the deficient rainfall as well as unseasonal rains and hailstorms, agricultural

production in 2014-15 is estimated to be lower than that in 2013-14, a year of record production. In 2014-15 total production of pulses estimated at 17.20 MT which is lower by 2.3 MT than their production levels during 2013-14.

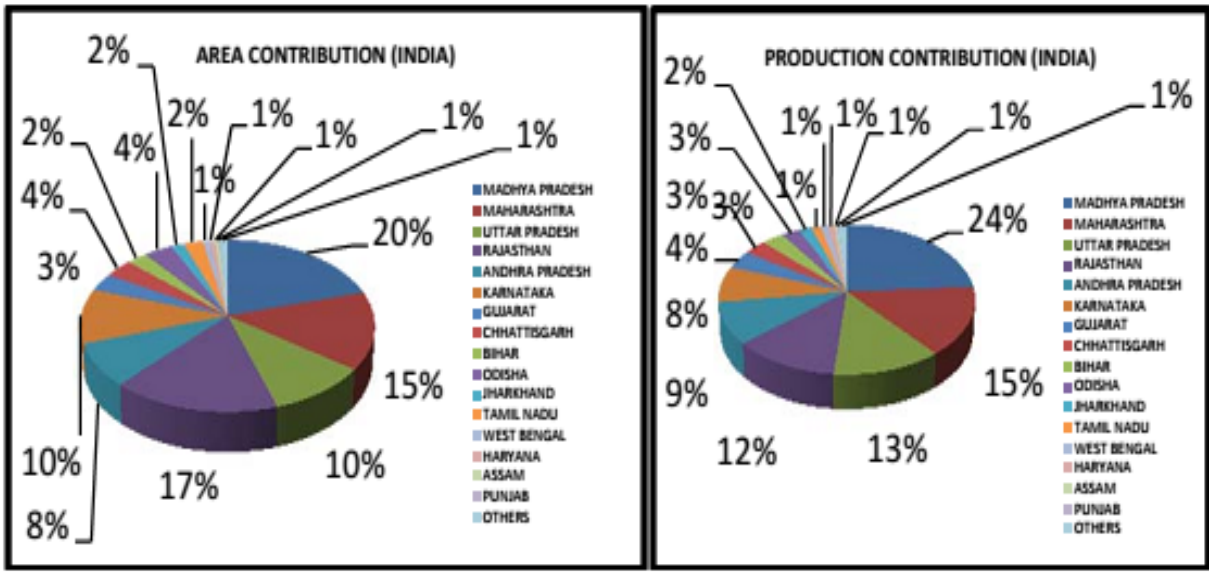

Fig. 1. State wise distribution in terms of pulse cultivated area and production in India

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 has been found to be between 300 and 540 kcal/100 g. The energy of pulse comes from the nutrient supply of protein, fat, carbohydrate and vitamins.

Carbohydrate supply: The carbohydrate content of pulse is high which contributes a great deal to the energy supply of pulses. A large percentage of pulse occurs as starch, about 1.8-18% occurs as oligosaccharides, and while 4.3-25% occurs as dietary fibre. Although the oligosaccharides, which are made up of raffinose, stachynose, verbascose cause gas production in man, they are presently believed to have some beneficial effects. They are hypothesized to improve longevity and reduce colon cancer risk. The high dietary fibre content of pulses is postulated to have some important physiological effects such as reducing the transit time in the mammalian gut. It's also capable of lowering blood cholesterol levels due to its ability to bind with cholesterol in human gut.

Protein supply: Pulses have high protein content. The value is about twice that in cereal and several times that in root tuber. 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). In man, protein helps in the repair of body tissue, synthesis of enzymes and hormones and also in supply of energy. In children, 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.

Fat supply: The fat content of pulse varies in different species. Most species contain about 1% fat, while ground nut and soybeans, have very high fat content, about 30% for soybeans and 49% for peanut. The fat content besides contributing to the energy needs provides the needed essential fatty acids for man. The pulse like soybean, contains linolenic acids, 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.

Vitamin supply: The vitamin present in appreciable quantities in pulses is thiamine, riboflavin, pyridoxine and folic acid. Vitamin E and K are also found in pulses. The B - vitamin acts as co-enzymes in biological process. Vitamin E is known to play a role as an anti-oxidant inhibiting the oxidation of vitamin A in the GIT and of polyunsaturated in the tissues. Vitamin K functions primarily in the liver where it is necessary for the formation of blood clothing factors.

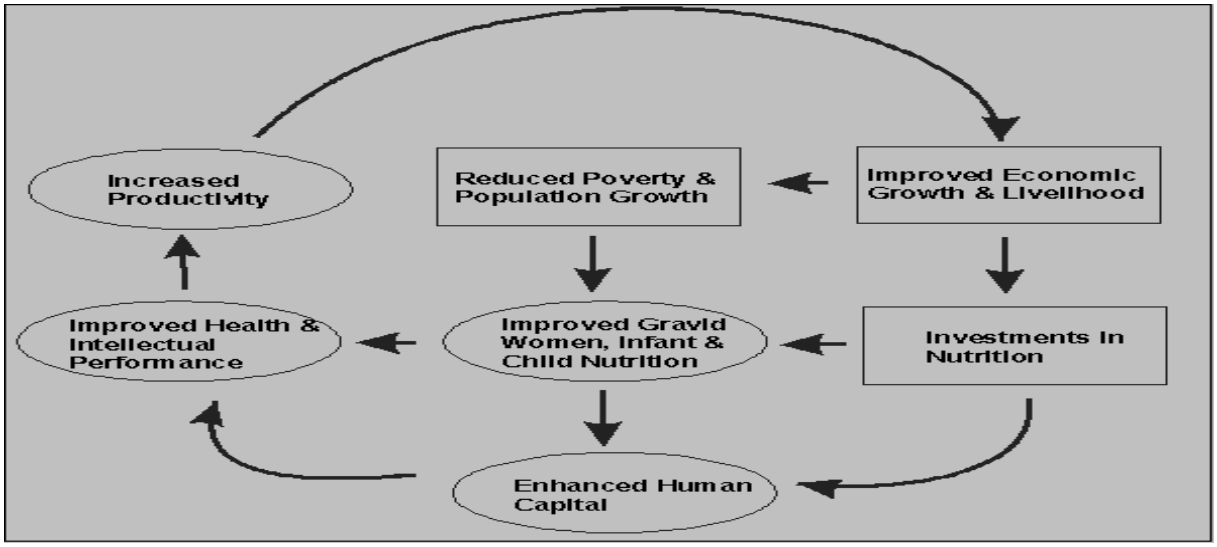

Fig. 2. Layout of overall benefits on pulse crop cultivation

Table 1. Nutritional analysis of selected pulses compared with a reference diet

Nutrient (Unit)	**Reference diet (used on food labels)**	**Chickpeas/Garbanzo Beans (per cup**, cooked, without added salt)**	**Lentils (per cup**, cooked, without added salt)**	**Split Peas (per cup**, cooked, without added salt)**
Calories (kcal)	2000	269	230	231
Total fat (g)	Less than 65	4.3	0.8	0.8
Saturated fat (g)	Less than 20	0.4	0.1	0.1
Trans fat (g)	No value set; minimize in diet	0	0	0
Cholesterol (mg)	Less than 300	0	0	0
Sodium (mg)	Less than 2400	11	4	4
Total carbohydrate (g)	300	45	39.9	41.3
Fibre (g)	25	12.5	15.6	16.3
Protein (g)	50	14.5	17.9	16.4
Vitamin A (IU)	5000	44	16	14
Vitamin C (mg)	60	2.1	3.0	0.8
Calcium (mg)	1000	80	38	27
Iron (mg)	18	4.7	6.6	2.5
*Source: U.S. Department of Agriculture, Agriculture Research Service, National Nutrient Database for Standard Reference, available at www.nal.usda.gov/fnic/foodcomp				
** 1 cup of cooked pulses counts as 4 ounce equivalents from the Protein Food Group or 1cup of vegetables from the Vegetable Group of www.myplate.gov				

Use of pulses in special diet:

As a result of their nutrient content and other properties, pulses can play a role in several special diets:

Gluten free diet: If a person with celiac disease consumes gluten (a protein found in wheat and some other cereal grains), an immune reaction is triggered in small intestine, which can cause damage and poor adsorption of nutrients. Pulses contain no gluten;

therefore, people with celiac disease can use chickpea, lentil or peas as an ingredient in recipes.

Diabetic diet: For people with diabetes, consuming lentils, peas & beans may help with blood glucose management. Compared with some other carbohydrate sources, pulses are high in fibre and have a low glycemic index, making them particularly beneficial to people with diabetes by assisting in maintaining healthy blood glucose and insulin levels. Some studies have shown that consuming pulses may result in more stable blood glucose levels after meals.

Vegetarian diet: Pulse are good source of protein, vitamins and minerals (especially zinc and iron), which makes them an excellent food choice for vegetarians. They contain eight essential amino acids. Consuming lentils with rice provides the full complement of amino acids needed for growth.

Weight management diet: Although more studies are needed, consuming pulses may help with weight management. For people trying to lose weight, pulses are high in fibre and protein, low in fat and moderate in calories. One cup of cooked lentils or dry peas contains about half of the daily fibre recommendation for adults.

Why grow pulses; pulses in the farming system

Pulses fit very well into faming systems and crop rotations because of their disease control, weed control, soil fertility timelineness and financial benefits. They are a cash crop with important additional rotational and whole farm system benefits including fitting into grazing systems. Pulse fit well into modern farming system, particularly where minimal or no tillage farming is practised and where a cereal stubble retention system is in place. Erosion risks are minimal in pulse grown with no tillage and standing stubble situation. When pulse grown in rotation with cereals, they have advantage of providing an alternative income.

Fig. 3. Sowing of lentils between rows of cereal stubble helps to prevent lodging and improves harvest efficiency

Pulse; "A nutrient powerhouse" for the developing world

Pulses are complementary to cereals, with respect to protein quality, when eaten together due to each providing amino acids the other is low in. The micronutrient content of pulses may reduce anaemia levels of the very poor that often rely primarily on starchy foods as the staples of their diet. Pulse consumption also improves serum lipid profiles and positively affects several other cardiovascular disease risk factors, such as blood pressure, platelet activity, and inflammation.

Major challenges for pulse crop cultivation:

Farmer's face the major challenges in the production of pulse crop are listed below

Soil texture: The first major challenge that comes to the farmer is the soil texture, structure and fertility. Many pulse crops are grown in low quality soil in terms of fertility, moisture content and nutrition and under unpredictable weather condition which affects very much for pulses cultivation.

Climate change: The change in climate is also influence the production in different ways. For example, the temporal and spatial variations in precipitation including rainfall may result in deficit moisture stress,

i.e., drought or excess moisture stress condition, i.e., flooding. Similarly, extreme high or low temperature results in variations in the length of crop growing season. This factor also affects the crop productivity.

Biotic and abiotic stresses: Biotic and abiotic stress include pod borers (*Helicoverpa armigera*), fusarium wilt, root rots etc. are the major biotic constraints in chickpea production. The major problems faced in pigeon pea production are pod borer, pod fly, fusarium wilt, sterility mosaic disease etc. while lentil production too faces problems of biotic stresses like aphids, cutworm, rust, mildew etc. Besides, poor drainage facilities leads to water logging which destroys the standing crops like pigeon pea, which grow closer to the ground. This phenomenon also increases the chances of diseases like phytophthora blight.

Economic challenges: Pulses in rotation with cereals can improve the income of economically deprived area of India. Though India is the largest consumer of pulses, but the government subsidies and price control in agricultural sector created distortion that affected distortion. Introduction of pulses in the rabi season could have significant economic and poverty alleviation benefits. But due to economic challenges, there has been a progressive decline in per capita availability of pulses in India. The requirement was estimated to be 21.3 million tonnes by 2012. The Economic Survey 2012-2013 reports the estimated production of pulses in 2011-2012 as 17.09 million tonnes, indicating a wide gap in demand and supply (Swaminathan and Bhavani, 2013).

Particulate matters and its effect on cultivation: Particulate matter such as cement dust, magnesium-lime dust affects the plant by preventing normal respiration and photosynthesis mechanism within the leaves. The dust coating also may affect the normal action of pesticides and other agricultural chemicals applied as sprays to foliage. In addition, accumulation of alkaline dusts in the soil can increase soil pH to levels adverse to crop growth.

Future strategies to improve productivity of pulses: To see the challenges in cultivation, the government has taken several steps to improve the yield as well as motivate the farmers to cultivate pulses farming.

Production of high yielding varieties: The poor harvest index of pulses remains a challenge to the plant breeding programmes. In some of the problematic soils, the varieties with full yield potential in normal situation cannot fit well resulting in poor crop productivity. This situation has to be corrected by employing modern biotechnology techniques. In many parts of India farmers are not able to get information's about the availability of new and improved varieties, resulting in lesser yields. This situation has to be corrected by monitoring and coordinate the activities with the various State Government and Central Government functionaries working in the area of crop production.

Financial crisis mitigation: Maximum percentage of lentil seed in India comes from the informal sector. The situation with respect to other pulses in India is similar. Though we have developed a long list hybrid seeds in modern days, but their adoptability to the farmer's remains constrained due to lack of proper knowledge, resources, inadequate demand and limited supply. So, in that situation, public and private partnership would be the best approach to increase the availability of foundation seed need.

Market linkage and cropping insurance: The farmers in India face severe problem in marketing their crop after harvest due to lack of remunerative prices for the end-products. The situation is alarming in case of pulses like black gram, green gram etc. Globalization has brought openness in trade, but it could not ensure better market prices. There is a need to regulate the agricultural marketing policy for the better marketization of the farming community, which in turn would facilitate food security in India. Besides, natural hazards like floods and droughts occur frequently in India challenging crop productivity and food security. Hence the farmers must be provided with comprehensive crop insurance policy so that in climatic hazards like cyclones and floods, they would be provided with compensation.

New trends in globalization: Undoubtedly globalization for a national economy in India is quite remarkable. It brought several positive changes like technology development and transfer, faster communication and transport and higher growth in the services sector. But, it also faces many challenges in the financial market. So its need to be focused and find the way to improve this condition by adopting new policies which can helps the overall economic development.

Conclusion

The consumption of pulse crop should be encouraged in both adults and children because of their high dietary fibre content. The use of pulses in combination with cereals is also recommended, as this would give cheaper cereals with more complete protein. Pulses are more often grown in regions without access to irrigation or

poor access to inputs (seeds, fertilizers, crop protection products, machinery), which means they can provide nutritional benefits to those who may not be able to grow other crops with similar benefits.

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