Production and utility of chickpea in Pakistan

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Food legumes, being economical sources of protein, calories, certain vitamins and minerals, are an essential component of the diet of 700 million people of the world. However, the significant role they play in the diets of many developing countries appears to be limited by their scarcity, caused mainly by their present low yield, consequent cost and certain defects in their nutritional and food use qualities.

Food legumes have several indirect beneficial effects on agriculture. They improve soil fertility and rotation of grain legumes. Some medicinal properties of chickpea have been reported. Seeds are astringent and antibilious. When roasted, the grain is considered to be aphrodisiac. Fried seeds are diuretic. Hypocholestrolaemic effects and diabetic management have also been associated with chickpea.

In Pakistan, cereals constitute the bulk of average diet and are known to be limited by lysine. On the other hand, legumes are rich source of lysine but are limited by sulphur amino acids. Legumes are mostly consumed together with cereals, so that surplus of one amino acid in one food makes up the deficiency of the limiting amino acid in the other food. Such combinations of cereal and legume have been reported to meet the protein requirement of various age groups.

The situation in Pakistan with regard to the production of legumes in general and chickpea in particular, is not happy at present. As a result of the emphasis laid on improving the crop yield of cereals, legume production has not only remained stagnant but actually suffered a setback in terms of per capita availability. Recently, however, more attention has been paid to develop high-yielding, disease and insect-resistant legume cultivars and to improve the economy of their cultivation.

The present paper deals with the production and utilization of chickpea in Pakistan and to identify areas for further research and development to improve their utilization in the diets.

AREA AND PRODUCTION TRENDS

Ecologically, Pakistan can be divided into three legume-producing regions. The northern region has a high rainfall where both rainfed conditions and surface irrigation facilities are available. The central region has highly fertile soils but the climate is mostly semi-arid where crop production is mostly aided by surface irrigation. Legumes are also grown under rainfed conditions in some areas of this region. In the southern region, rainfall is scanty and agriculture is totally under irrigated conditions.

Area and production of chickpea are presented in Table 1. The area sown and production remained static except in 1980-81 to 1982-83 and 1987-88. Blight and weather conditions were the major causes of these fluctuations and planted areas and

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production declined by 33 and 21 percent, respectively, during the last ten years.

Table 1. Area and production of chickpea in Pakistan (1978-79 to 1987-88)

Year	Chickpea	
	Area ('000' ha)	Production ('000' t)
1978-79	1224.4	537.8
1979-80	1128.5	313.4
1980-81	842.9	336.9
1981-82	901.6	293.7
1982-83	892.9	491.0
1983-84	919.6	521.9
1984-85	1013.7	523.7
1985-86	1033.3	586.2
1986-87	1082.1	583.3
1987-88	820.6	371.5

Source: Govt. of Pakistan. MINFA, Food and Agriculture Division, (Planning Unit) All-Pakistan Final Estimates for Chickpea (1987-88)

Table 2 compares the total area under chickpea, total production and yield of 1970 with the figures of 1986 for the major chickpea producing countries of the world. Out of some 50 countries that grow chickpea, only eight produce nearly 95 percent of the total. In 1986, Pakistan and India alone accounted for 85 percent of the total area and 80% of total world production. Over 16 years, the world area under this crop increased by only 2.6% and gains in production and yield were 11 and 8%, respectively. In Pakistan, the average yield has declined (2%) and the marginal improvement (1.6%) in production is surely due to increased area.

AVAILABILITY OF PULSES

According to the National Nutrition Survey (1988), the per capita consumption of pulses in Pakistan is 15.7 kg/annum. Legumes contribute on national basis 8% of protein, 8% of calories and 7% of iron intake in the average Pakistani diet. These figures seem to be on higher side and may be due to some error in the survey methodology. However, the per capita availability of chickpea during 1987-88 was 3.04 kg/annum.

Table 2. Area, production and yield in major chickpea-producing countries

Country	Area ('000' ha)		Production ('000' t)		Yield (kg ha-1)
	1970	1986	1970	1986	
Burma	100	265*	58	234*	580	883
Ethiopia	294	180*	185	135*	629	750
India	7,752	7,854	5,546	5,683	715	724
Morocco	158	70*	137	47*	867	671*
Pakistan	1,006	1,041	569	578	566	555
Spain	164	88	97	57	591	648
Syria	25	38	15	28	600	737
Turkey	100	500	109	600	1,090	1,200
World	10,189	10,456	7,073	7,842	694	750

**Estimates only*
Source: FAO Production Yearbook (1971 & 1986).

PROCESSING OF CHICKPEA

Chickpea is subjected to primary processes such as dehulling, splitting, grinding, puffing, parching and toasting before consumption. The main effects of processing on chickpea are to improve their appearance, texture, culinary properties and palatability and to decrease dry matter content and alter the bio-availability of nutrients.

Dehulling

Chickpea seeds are dehulled to prepare *dal.* This process involves the following three steps:

* Pre-treatment to loosen the seed coat from cotyledons,
* splitting, and
* dehusking

Dehulled seeds are easily digested and efficiently utilized

by the body. The traditional household and commercial milling techniques are inefficient, and yield 63 and 70% *dal*, respectively. Household processing of chickpea into *dal* reduced protein, calcium, iron, phosphorus, thiamine, riboflavin and niacin by 11-14, 40-50, 46, 5, 19-28, 26 and 30%, respectively. To improve milling output and quality and to reduce processing cost, there is an urgent need to develop loose-husked chickpea varieties and to improve the milling technology.

Puffing

Puffing of chickpea improves the flavour, modifies the texture and helps in dry or wet grinding. For puffing, the seeds are soaked in water and then toasted with heated sand at 200-500°C for one to two minutes. The roasted chickpea is generally rubbed against a coarse surface to break the husk which is removed by winnowing. Not all chickpea cultivars are used for puffing and the processors prefer those grown in specified agro-climatic tracts which are known to give superior products with good aroma.

Puffing is also influenced by husk content and grains with 12-14% husk contents were found to be good for puffing. There is a need to study the factors affecting puffing of chickpea and to develop methods of increasing puffing expansion.

Grinding

Whole chickpea or dehusked seeds are ground dry to a flour, known as *baysen*. The eating quality of many chickpea flour-based products depends on flour composition, degree of fineness of grinding, mesh grades and cooking conditions.

The traditional processing methods need further improvement to provide improved nutrition and better consumer appeal to the products.

TRADITIONAL USES OF CHICKPEA

Chickpea is used in many forms, from the fresh green seeds to the dried whole, *dal* and flour. Traditional methods of processing chickpea-based products include boiling, roasting, frying and puffing.

Green immature chickpeas are used as vegetable. They are puffing, the seed becomes light due to shrinkage of the endosperm and loss of water. The starch is also dextrinized.

CHICKPEA-BASED PRODUCTS' NUTRITIVE VALUE

From the standpoint of practical dietetics, nutritive value of foods eaten by man and the availability of dietary constituents in the cooked state is more important than the evaluation of food in the raw state.

The nutrient contents of Pakistani cooked chickpea products are presented in Table 3. The protein content (Nx6.25) of the chickpea products was found to vary between 8.9 and 21.1 percent. Roasted chickpea, *desi dal* curry and *chaat* contained more protein than the other products. The energy values ranged between 333 Kcals/100 g for *missi roti* and 614 Kcal/100 g for *halwa*. *Pakora* and roasted chickpea were very high in crude fibre content (11.1 and 10.6% respectively). The calcium content of these products varied from 226 mg/100g for *desi dal* curry to 360 mg/100g for whole *Kabuli* curry and 100 g of the dry products provides about 50-75 percent of the calcium requirement of adult male and female. The iron content of these products ranged from 3.9 mg/100g for *desi dal* curry to 8.2 mg/100g for roasted chickpeas. *Missi roti, pakoras* and roasted chickpeas were found better sources of iron than the other chickpea products. As iron deficiency anaemia is a public health problem in Pakistan. The use of these recipes can help in ameliorat-

Table 3. Chemical composition (dry basis) of some Pakistani chickpea products

Products	g per 100 g					Calories	mg per 100 g					
	Protein (Nx6.25)	Fat	Carbo-hydrate	Crude Fibre	Ash	(Kcal/ 100 g)	Ca	P	Fe	Zn	Mn	Cu
Curry												
Whole *Kabuli*	17.7	12.6	60.9	4.4	4.4	402	360	315	5.3	3.9	2.6	1.1
dal desi	20.3	12.8	60.9	1.6	4.4	393	226	273	3.9	3.3	2.6	0.7
Missi roti	14.6	3.1	75.9	4.1	2.3	333	239	284	6.9	4.6	5.4	0.9
Pakora	17.2	12.4	53.4	11.1	5.9	453	239	243	7.2	2.5	2.9	0.8
Chaat	19.3	5.3	68.2	3.9	3.3	371	328	279	5.8	3.6	1.6	0.9
Halwa	8.9	21.8	63.7	4.4	1.2	614	247	126	3.8	1.8	1.5	0.6
Roasted chickpea	21.1	5.0	60.3	10.6	3.0	361	268	264	8.2	5.4	2.6	1.1

Khan, M.A. (1989).

ing iron deficiency in the local population. A 100g of roasted chickpea and *missi roti* on dry weight basis can meet 50-100 percent of the daily iron requirements of an adult male. The zinc content of these recipes ranged between 1.8-5.4 mg/100g. The copper content of these products varied between 0.6-1.1 mg/100g and whole Kabuli curry and roasted chickpea had the highest amount of copper (1.1 mg/100g) among these products.

Nutritive value of chickpea-based meals

Since chickpea is mostly used in the form of common dishes, the nutritive value of the composite dishes is of great importance. Also, the nutritional significance of these dishes lies in the frequency with which these dishes are consumed.

The results of the chemical composition of these meals are given in Table 4. The protein content of wheat bread based meal (14.3%) was higher than *khhichri,* rice-based meal (11.4%), *halwa (suji+baysen)* provided lowest protein content (7.0%). The crude fibre content of the meals is low and varies from 0.9 to 1.5%. The calcium, phosphorus and iron contents were highest in meal consisting of wheat bread and chickpea *dal.*

In well-balanced diet, 10-15% of the total energy is usually derived from protein, 55-70% from carbohydrate and 20-30% from fat. According to chemical analysis (Table 4), meal containing wheat bread and chickpea *dal* contributes 12% of the total calories from protein, 55% from carbohydrate and 18% from fat. Similarly, 10, 48 and 32% of the total energy of *khhichri* are derived from protein, carbohydrate and fat, respectively. *Halwa* provides 6% of the total calories from protein, 57% from carbohydrate and 32% from fat. It is evident that the first two meals compare favourably with the characteristics of a well-balanced diet.

The true protein digestibility (TD), biological value (BV), net protein utilization (NPU) and net dietary protein calorie percent (NDpCal%) of chickpea-based meals are presented in Table 5. The NPU was the highest (74%) in *halwa* whereas it was the lowest (60%) in meal containing wheat bread and chickpea *dal.* The NDpCal% of meals lie between 4.3 and 7.3. According to FAO (1965), the protein allowances for different age groups in terms of NDpCal% are 8.0, 7.8, 5.9, 8.4, 4.6 and 9.5 for infants, toddler, child (4-9 years), adolescent,

Table 4. Chemical composition (dry basis) of chickpea-based Pakistani meals

Meals	g per 100 g					Calories	mg per 100 g		
	Protein (Nx6.25)	Fat	carbo-hydrate	Crude fibre	Ash	(Kcal/ 100 g)	Ca	P	Fe
Wheat bread + Chickpea dal	14.3	9.3	65.0	1.2	2.3	472	392.0	196.0	7.6
Khichri	11.4	18.6	60.7	1.5	1.7	510	51.3	184.7	3.5
Halwa suji + Baysen	*7.0*	*18.2*	*71.7*	*0.9*	*0.7*	*507*	*32.9*	*81.1*	*2.1*

Khan and Eggum. 1978, 1979.

Table 5. Protein quality of chickpea-based Pakistani meals

Meals	True digesti-bility (%)	Biological value (%)	Net protein utilisa-tion (%)	Net dietary protein calories (%)
Wheat bread + Chickpea *dal*	92.0	66.0	60.0	7.3
Khhichri	92.0	71.0	65.0	6.1
Halwa suji + Baysen	99.0	75.0	74.0	4.3

Khan and Eggum. 1978, 1979.

adult and lactating mothers, respectively. When adjudged in terms of NDpCal%, the protein value of wheat bread and chickpea *dal* meal and *khhichri* is adequate to meet the protein requirements of child (4-9 years) and adult only. The NDpCal% of *halwa* is 4.3 and is inadequate for all different age groups to meet their protein requirements. However, *halwa* can be used as a source of energy.

The cereals and legumes continue to be the major sources of protein and calories in Pakistan and protein needs can be met provided the legumes are made available at the level required to maintain the quality of protein in the diet.

FUTURE RESEARCH AREAS

Larger and more stable yield should be the primary objective of chickpea improvement programmes. The increase in yield should not be at the expense of acceptability in marketing system and protein or lysine content. The most important factors to breed for are sulfur amino acids, tryptophan, lysine, protein, large seed size, regular seed shape, low decortication loss, low gasogen content and resistance to post-harvest infestation. Economic studies should be carried out on cultural practices, including utilization of fertilizers, pesticides and other direct inputs, relative to returns obtained from different legume genotypes grown in different environments and locales. Reassessments will need to be made for new varieties as these are developed.

The effect of improved agronomic practices should be more carefully studied particularly with reference to the vitamin and mineral contents of chickpea seed. Studies concerning interaction between

cultivars and such factors on the nutritional composition would be desirable. It is particularly pertinent to study the biochemical changes in proteins and carbohydrates induced by cooking because digestibility of protein and availability of amino acids are low even after cooking. The losses and bio-availability of minerals and vitamins should also be studied. The presence or otherwise of haemagglutinins, cyanogenic glucosides, anti-vitamins, estrogenic factors, metal binding constituents and toxic amino acids in chickpea also needs investigation. The effect of chemical treatments for control of insect infestation and microbial growth should be examined from nutritional aspects. Research is needed on storage stability, post-harvest technology, including processing, food product development, cooking quality and consumer acceptance. The processing technologies which are largely traditional, partially mechanized versions of age-old home scale techniques, need further improvement with a proper understanding of the principles involved.

Charcoal rot : an important disease of sunflower and its control

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Sunflower (*Helianthus annus*) is a valuable economic as well as an ornamental plant. It ranks second to soybean in world oil production with its 40-42 percent oil content and 17-20 percent protiens. The oil is palatable and contains vitamins A,D,E and K. Besides being used in *ghee,* sunflower oil is utilised in varnishes, soaps, margarine and wool industries. Its leaves are used as fodder, flowers produce a yellow dye, and oil cakes are utilised as poultry and cattle feed. The Soviet Union leads in sunflower production.

Sunflower as an oilseed crop was introduced in Pakistan during 1960s with the realisation that it had the maximum potential for bridging the gap between production and consumption of edible oil in the country.

The acreage under sunflower in Pakistan is on the increase. This expansion has led to problems as regards the occurrence of diseases and their control. Some of the more important diseases of sunflower recorded in Pakistan are charcoal rot (*Macrophomina phaseolina*) (Tassi) Goid, leaf spots (*Alternaria helianthi*), head rot (*Rhizopus* spp), rusts(*Puccinia helianthi*), wilt (*Verticillium dahliae*), black stem rot (*Phoma oleracae* var.*helianthi tuberosi*), Phomopsis (*Phomopsis* spp), powdery mildew (*Erysiphe cichoracearum*), stalk rot and head rot (*Sclerotinia sclerotiorum* and *Botrytis cinerea*), collar rot (*Sclerotium rolfsii*) and anthracnose (*Colletotricum* spp).

Charcoal rot is the disease which is most frequently observed in *barani* areas of Pakistan, and is followed by *Rhizopus* (head rot) and *Alternaria* (leaf spot). Charcoal rot was first observed in Pakistan in 1984. It causes a greyish black discoloration of the stem. The disease is of economic importance as its average incidence ranges from 25 to 30 percent, resulting in 20-60 and 5-8 percent loss in yield and oil content, respectively.

Charcoal rot is found in all sunflower growing areas of the world. The disease incidence is greater in the semi-arid areas where the temperatures are high and moisture low. Its causal organism has a very wide host range as it affects about 400 plant species. The hosts liable to attack in Pakistan other than sunflower are cotton, members of the families Brassicaceae and Cucurbitaceae, okra, sesame, tobacco, corn, mash, mung, garlic, jute, soybean, gram, eggplant, potato, citrus, castor oil and many other cultivated as well as wild plants.

SYMPTOMS

Superficially, the symptoms of charcoal rot resemble those resulting from patchy soils. The most common symptoms of charcoal rot are shredding of tissue at the base of stem. This shredding also extends into the tape root. Consequently, the affected stem becomes hollow and starts rotting due to which the stalk crushes easily under

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