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Nutritional and functional variability of Nutri cereals

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Abstract

The millet varieties were procured from Peraiyur Block of Madurai District, Jamunamarathoor Block of Thiruvannamalai District and Anjetty Block of Krishnagiri District in Tamil Nadu with the support of DHAN Foundation and study their nutritional characteristics. The little millet variety from Jamunamarathoor Block was rich in carbohydrate content. The kodo millet grain variety from Coimbatore was found to be high in crude fibre (11.88g). Finger millet was found to contain the maximum calcium content of 134.63mg. The nutritionally rich small millet varieties were selected for the standardization of therapeutic foods and traditional foods commonly consumed by the farmers.

Keywords: Millets, hulled, dehulled, nutritional characteristics

Introduction

Small millets are small seeded annual coarse cereals grown throughout the world. Small millets are rich in vitamins, minerals, sulphur containing amino acids and phyto-chemicals and hence are termed as “nutri-cereals”. The World’s millet production is shared by South and East Asia (about 60%), Eurasia and Central Asia (14%), Africa (16%) and rest of the World (10%). Millet grains account for about one sixth of the total food grain production hold an important place in the food grain economy of India. (Pradhan *et al.*, 2010)^[11]. Small millets have great potential for being utilized in different food systems by virtue of their nutritional quality and economic importance. They are also considered to have therapeutic value against illnesses like diabetes. Value added products from millet have the potential to add value to business and has a large potential for growth as consumers believe that millets and millet based foods contribute directly to their health. In recent years, millets have been recognized as important substitutes for major cereal crops to hope up with the world foods storage and to meet the demands of increasing population of both developing and developed countries (Shree *et al.*, 2008)^[19].

Materials and Methods

The different small millet varieties were procured from the three project sites namely Peraiyur Block of Madurai District, Jamunamarathoor Block of Thiruvannamalai District and Anjetty Block of Krishnagiri District in Tamil Nadu with the support of DHAN Foundation. The small millet varieties were analyzed for moisture (Ranganna, 1995)^[12], carbohydrate (Dubois *et al.*, 1956)^[2], Protein (Micro Kjeldahal, Nx6.25), Fat (solvent extraction), Ash (muffle furnace-dry ash), Calcium (titration), Iron (calorimetric) were determined by AOAC method (1980)^[1]. Crude fibre (acid and alkali), Tannin (calorimetric) were determined by the method of Sadasivam and Manickam (1996)^[13].

Results and Discussion

The nutrient content of millet varieties presented in Table 1 and Fig. 1, 2, 3, 4. The little millet variety from Jamunamarathoor Block was rich in carbohydrate content. The protein content of the barnyard millet variety obtained from Peraiyur Block was found to be 8.52g per 100g of the grains, which is essential for the enzyme formation. The kodo millet grain variety from Coimbatore was found to be high in crude fibre (11.88g), which is best suited for diabetics and in iron content (62.31mg), which helps in heme formation. Finger millet was found to contain the maximum calcium content of 134.63mg, which is essential for healthy bones and also reduces the onset of osteoporosis. Small millet grains were found to have promising quantity

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of essential amino acids such as tryptophan, cystine, methionine with high biological value of crucial to health and growth.

Review of literature

The nutritive value of millets is comparable to other staple cereals like wheat and rice, some of them are even better with regard to average protein, fat and mineral contents (Gopalan *et al.*, 1997) [5]. They are particularly low in phytic acid and rich in dietary fibre, iron, calcium and B-vitamins. Among the minor millets, little millet or samai and kodo millet or varagu is highly nutritious (Seetharama and Rao, 2004) [14]. In little millet, the fat, iron and niacin content are higher than other cereals (FAO, 1995) [3] the iron content of little millet is reported to be 9.30mg per 100g compared to 0.7mg per 100g in raw rice (Gopalan *et al.*, 2002) [4].

Paramahans and Tharanathan, (1980) [10] revealed that the millet starches contain nearly 25 to 35 per cent amylase and 65 to 75 per cent amylopectin. Lorenz (1980) [7] determined phytate content of 24 varieties of proso millets as 0.17 to 0.47 per cent. Further, it was reported that the process of dehulling reduced phytate and tannin levels by 27 to 53 and 65 to 80 per cent among the different varieties.

The minor millets are good store houses of nutrients with varietal differences evident within the species. Foxtail millet of 21 varieties recorded a fat content ranging from 2.3 to 5.9 per cent, followed by Proso (2.1 to 5.2 per cent), little (3.10 to 3.7 per cent) and Kodo millet (1.10 to 3.30 per cent) as reported by several investigators (Malleshi and Desikachar, 1985) [8].

The calcium content of five minor millets (Proso millet, kodo millet, Italian millet, little millet and barnyard millet) was recorded with values ranging from 12.36 to 29.17 mg per 100 g. The crude fibre content in kodo millet was 6.3 per cent followed by little millet (5.73 per cent) and Proso millet with 5.51 per cent. The tannin content of five minor millets *viz.*, Proso, Kodo, Italian, Little and Barnyard millet. Lowest level was recorded in Barnyard millet (102.96 mg) followed by Italian millet (129.29 mg), little millet (147.76 mg), Proso millet (156.65 mg) and Kodo millet (167.10 mg) (Kulkarni *et al.*, 1992) [6].

Navitha and Sumathi (1992) [9] studied the effect of primary processing on dietary fibre profile of sorghum, pearl millet, finger millet and wheat. Highest dietary fibre was found in finger millet and lowest in pearl millet. The insoluble fibre content of unprocessed finger millet flour samples was found to be high. Conversely soluble dietary fibre content was found to be high in bajra, its total dietary fibre content was low. The total dietary fibre content of sorghum bran was found to be low and wheat bran was high. A significant decrease in total dietary fibre and its components on processing was noted. The total dietary fibre content of unprocessed and processed pearl millet flour was found to be 8.9 and 6.5 g per cent respectively.

FAO, (1995) [3] reported that millet grain contains about 65 per cent carbohydrate, a good proportion of which is in the form of non-starchy polysaccharides. Starch is the major carbohydrate and ranges from 60 to 70 per cent of seeds, the non-starchy carbohydrate forming about 15 per cent of the grain are mostly unavailable to the body because of dietary fibre.

Kumar and Parameshwaran (1998) reported that among the millets barnyard millet recorded highest protein content (15.07 per cent) and lowest was in Proso millet (8.5 per cent).

The average protein content in little, kodo and foxtail millet were reported to be about 9.5, 8.8 and 11.07 g respectively, with varietal differences within species. Srivastava *et al.*, (2001) [16] stated that the nutritive value of millets is comparable with other staple cereals like wheat and rice and some have higher proportion of protein, fat, vitamins, minerals and fibre.

Barnyard millet was reported to contain crude fibre in the range of 5.35 to 7.90 per cent in nine different varieties. The ionisable iron content was 1.47, 1.50, 0.55, 10.76 and 1.38 mg in proso, kodo, italian, little and barnyard millet respectively. Similar range of values for iron and calcium in barnyard millet *viz.*, 1.27 to 1.50 mg and 20.31 to 32.78 mg per 100 g respectively (Veena *et al.*, 2003) [17].

Shashi (2005) [15] conducted a study on fibre content, anti-nutrients and bioavailability of iron in new Indo-African finger millet genotypes. The neutral detergent fibre showed the highest score in check varieties- Indaf-5 (31.73) and GPU-365 (26.99) followed by ML-322 (26.25) and ML-553 (22.77). The acid detergent fibre was highest in Indaf-5 (12.38) and GPU-28 (12.09) followed by ML-31 (11.41) and least in ML-553 (8.88). The highest tannin content was found in ML-197 (0.54 per cent) followed by ML-31 (0.44 per cent), ML-553 (0.44 per cent) and the check Indaf- 5 (0.40 per cent). The maximum phytate content was found in ML-197 (320.00 mg/g) followed by ML-31 (301.50 mg/g) and then the two checks GPU-28 (275.00mg/g) and Indaf-5 (242.00 mg/g). The highest bioavailability of iron was found in ML-426 (12.10) followed by ML-322 (12.06) then the check followed by GPU-28 (12.02) and least bioavailability of iron was found in the genotype ML-197 (9.28). Pearl millet is rich source of carbohydrate (67per cent), protein, (11.6per cent), fat (5.6 – 7.1per cent) and energy (360 k cal/100 g).

Nutritional importance of small millets

Small millets are considered as functional foods and nutraceuticals because they provide dietary fibre, protein, energy, minerals, vitamins and antioxidants required for human health. Small millets contain a high proportion of carbohydrates and dietary fibre which helps in prevention of constipation, lowering cholesterol and slow release of glucose into the blood stream during digestion. Small millets protein contains amino acids in balanced proportions especially rich in methionine, cysteine and lysine. They are rich sources of iron, calcium, magnesium and phosphorous which help in reducing the early onset of cardiovascular disease and diabetes etc. Magnesium lowers high blood pressure and reduces the risk of heart attack, especially in people with atherosclerosis and diabetic heart disease (Vijayalakshmi and Radha, 2006) [18].

Conclusion

The nutritionally rich small millet varieties were selected for the standardization of therapeutic foods (for diabetic, cardiovascular disease and obesity etc) and traditional foods commonly consumed by the farmers.

Acknowledgement

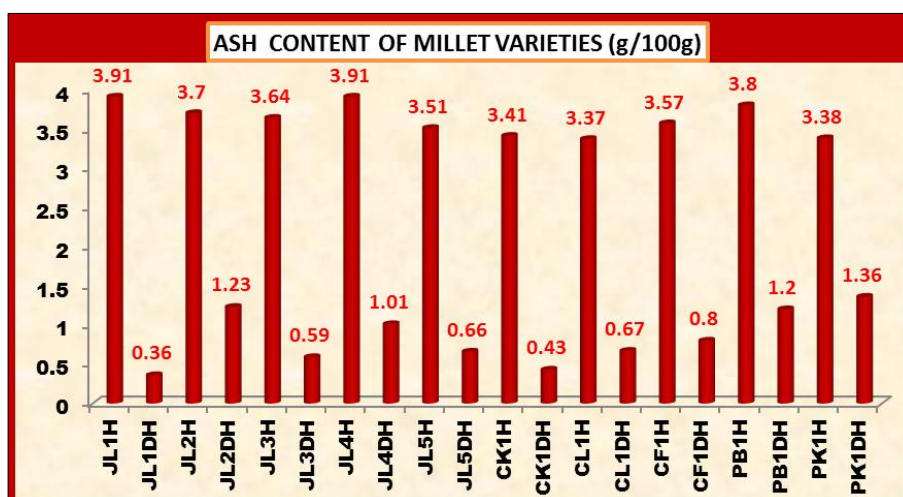
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Table 1: Nutrient content of millet varieties (per 100g)

Sl. No.	Varieties	Moisture (g)	Ash (g)	Carbohydrate (g)	Protein (g)	Fat (g)	Crude fibre (g)	Calcium (mg)	Iron (mg)	β -carotene (μ g)
1.	JL1H	6.86	3.91	68.84	5.68	4.36	10.35	53.66	33.47	0.12
2.	JL1DH	7.54	0.36	85.22	5.68	0.89	0.31	32.80	17.43	Nil
3.	JL2H	8.81	3.70	66.57	5.68	4.40	10.84	48.01	21.01	0.15
4.	JL2DH	6.62	1.23	82.82	5.68	3.03	0.62	36.53	16.90	Nil
5.	JL3H	6.65	3.64	69.31	5.68	4.79	9.93	47.48	25.40	0.15
6.	JL3DH	7.26	0.59	84.72	5.68	1.21	0.54	29.10	20.35	Nil
7.	JL4H	5.59	3.91	69.72	5.68	4.80	10.30	46.10	22.63	0.14
8.	JL4DH	7.21	1.01	82.89	5.68	2.79	0.42	34.57	29.70	Nil
9.	JL5H	7.26	3.51	68.50	5.68	5.24	9.81	49.73	43.85	0.17
10.	JL5DH	6.99	0.66	84.85	5.68	1.46	0.36	34.93	44.95	Nil
11.	CK1H	5.46	3.41	72.25	3.98	3.02	11.88	47.74	62.31	0.17
12.	CK1DH	6.62	0.43	86.12	5.11	1.16	0.56	33.88	24.06	Nil
13.	CL1H	6.52	3.37	69.16	7.39	4.78	8.78	93.25	16.70	0.13
14.	CL1DH	7.29	0.67	82.39	7.39	1.56	0.70	93.13	9.63	Nil
15.	CF1H	6.37	3.57	68.21	6.82	5.93	9.10	134.63	14.63	0.15
16.	CF1DH	6.59	0.80	81.19	7.95	2.71	0.70	81.25	26.05	Nil
17.	PB1H	5.32	3.80	67.94	8.52	4.88	9.54	102.88	16.63	0.15
18.	PB1DH	5.76	1.20	80.76	8.52	3.09	0.67	20.50	10.05	Nil
19.	PK1H	4.58	3.38	73.67	5.68	2.59	10.10	76.75	32.70	0.34
20.	PK1DH	4.89	1.36	84.41	6.82	2.11	0.41	17.13	14.79	Nil

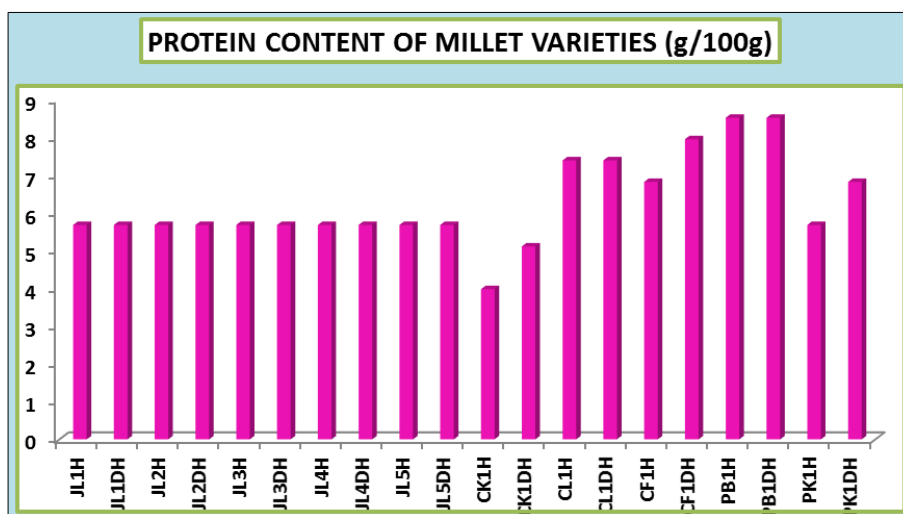
C- Coimbatore, J- Jamunamarathoor, P-Peraiyur,

F- Finger Millet, K-Kodo Millet, L- Little Millet, B- Barnyard Millet, H- Whole DH- Dehulled



C- Coimbatore, J- Jamunamarathoor, P-Peraiyur,

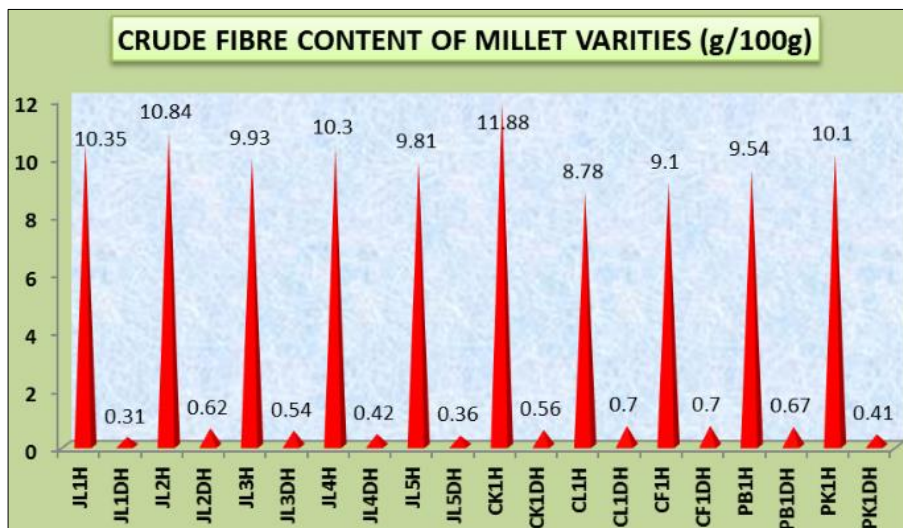
F- Finger Millet, K-Kodo Millet, L- Little Millet, B- Barnyard Millet, H- Whole DH- Dehulled

Fig 1: Ash content of millet varieties (g / 100g)

C- Coimbatore, J- Jamunamarathoor, P-Peraiyur,

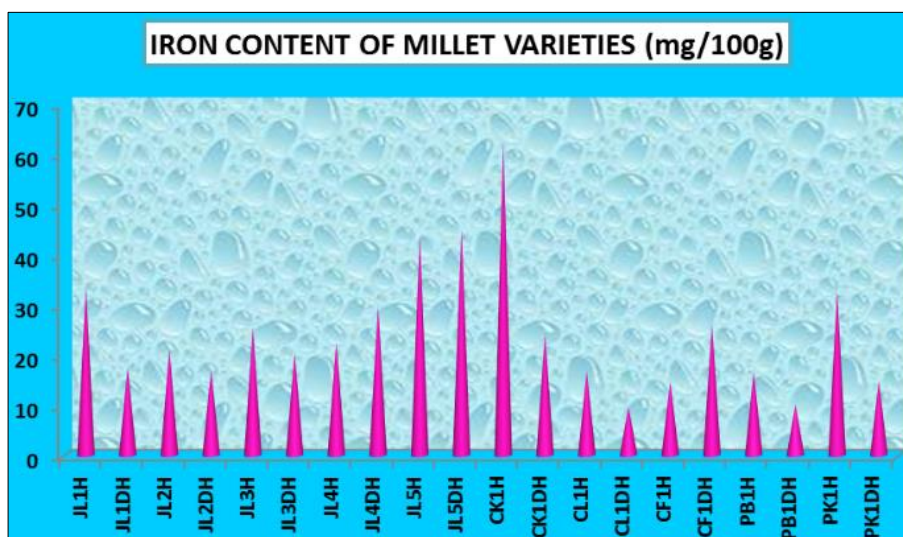
F- Finger Millet, K-Kodo Millet, L- Little Millet, B- Barnyard Millet, H- Whole DH- Dehulled

Fig 2: Protein content of millet varieties (g / 100g)



C- Coimbatore, J- Jamunamarathoor, P-Peraiyur,
F- Finger Millet, K-Kodo Millet, L- Little Millet, B- Barnyard Millet, H- Whole DH- Dehulled

Fig 3: Crude fibre content of millet varieties (g / 100g)



C- Coimbatore, J- Jamunamarathoor, P-Peraiyur,
F- Finger Millet, K-Kodo Millet, L- Little Millet, B- Barnyard Millet, H- Whole DH- Dehulled

Fig 4: Iron content of millet varieties (mg / 100g)

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