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Proximate composition of 92 little millet landraces whole grains, rice and bran by using near infrared radiation (NIR) based on locality, colour, size and shape

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ABSTRACT

Millet is one of the oldest cultivated foods known to humans and possibly the first cereal grain used for the domestic purposes. The present study was undertaken to evaluate the little millet landraces for chemical composition. Proximate principles such as moisture, crude protein, crude fat, total mineral matter were analyzed according to standard AOAC procedures. The highest moisture content was found in whole grain millets collected from SS Koppa (5.73%) and least from Karadikoppa (4.37%). Significant difference was found in case of moisture content of bran with maximum creamish brown (5.63%) and minimum in blackish (3.61%) colour and in fibre content having maximum in blackish (30.15%) and minimum in blackish brown (23.08%) colour grains. The significant difference was found only in case of moisture content of whole grain with maximum moisture content in small flattened (5.71%) and minimum in small round (4.87%) grains; in case of fibre content of bran with maximum fibre content in big round (31.86%) and minimum in small round (24.48%) grains and in case of ash content of whole grain with maximum in small lengthy (5.29%) and minimum in small oval shaped grains.

Keywords: Millet; proximate principle; moisture; fibre; protein; total mineral matter

INTRODUCTION

Today millet is the world's sixth most important grain. India is the world's largest producer of millet with eight African countries and China making up the rest of the top ten producers. Depending on variety millets can grow anywhere from one to 15 feet tall and usually have a very hard, indigestible hull that must be removed before the grain is eaten. Most millets do best in dry and warm climates.

Little millet (*Panicum sumatrense*) is one of the important minor cereals grown extensively in the tropics and a staple food for the low income groups in some countries of the world. Little millet is comparable with other cereals such as rice and wheat as a source of protein, fat,

carbohydrates and crude fibre apart from minerals and vitamins. Kodo millet (*Paspalum scrobiculatum*) and little millet (*Panicum miliare*) have 37–38 per cent of dietary fibre which is the highest among the cereals; the fat has higher PUFA (Malleshi and Hadimani 1993); the mineral content is also higher than decorticated grain or wheat. It also contains phytochemicals such as phenolic acids, flavonoids, tannins and phytate. Phenolic acids are known to act as antioxidants by donating hydrogen or electrons. In addition their stable radical intermediates prevent the oxidation of various food ingredients particularly fatty acids and oils (Maillard et al 1996). The wide range of protective components in whole grains potential mechanism for protection and linkage to the reduced risk of cardiovascular diseases like cancer, diabetes and obesity have been described by many scientists. Over the years the cultivated area under millets has decreased. The decline in production may be due to reduced cultivated area which is shifted to other crops like rice, wheat, maize etc (Anon 2009). The present investigation was carried out to evaluate the effect of preliminary processing on proximate composition of little millet landraces.

MATERIAL and METHODS

In total 92 little millet landraces grown in the year 2007-09 were procured from the farmers of three districts of Karnataka namely Dharwad, Haveri and Chitradurga. All the samples were collected in one lot, cleaned and stored in polythene covers and used for entire study. Based on chemical composition top 12 landraces were selected for further study.

Proximate principles such as moisture, crude protein, crude fat and total mineral matter were analyzed according to standard AOAC procedures (Anon 1990).

Moisture: About 10 g of sample was weighed into previously weighed moisture cup and dried in an oven at 100-105°C till a constant weight was attained. The moisture (%) was calculated using the following formula:

$$\text{Moisture (\%)} = \frac{\text{Initial weight (g)} - \text{final weight (g)}}{\text{Sample weight (g)}} \times 100$$

Crude protein: The nitrogen content of the grain was assessed by Kjeldahl method using Pelican Kelplus equipment and crude protein was calculated by multiplying with a factor 6.25 as below:

$$\text{Protein (\%)} = \frac{\text{Titre value - Blank x N of HCl x 14.007 x 6.25}}{\text{Sample weight (g)}} \times 100$$

Crude fat: Moisture free sample was weighed in moisture free thimble and crude fat was extracted by refluxing in soxplus apparatus using petroleum ether as solvent. Per cent crude fat was calculated using the formula given as under:

$$\text{Crude fat (\%)} = \frac{\text{Initial weight (g)} - \text{weight after extraction (g)}}{\text{Sample weight (g)}} \times 100$$

Crude fibre: Crude fibre was estimated from the moisture and fat free sample. The residue obtained after digestion with acid and alkali was dried in crucible and weighed. The difference in weight of the crucible before and after ashing of the digested residues was taken as weight of the crude fibre.

$$\text{Fibre (\%)} = \frac{\text{Weight of residue before ashing (g)} - \text{weight of residue after ashing (g)}}{\text{Weight of fat free sample}} \times 100$$

Ash: Moisture free sample (5 g) was analyzed for ash content by charring and igniting the known weight of sample in silica crucible at 600°C for 3-5 hours and thereby ash percentage was calculated by difference in the weight of crucible.

$$\text{Ash (\%)} = \frac{\text{Weight of the ash}}{\text{Sample weight (g)}} \times 100$$

RESULTS and DISCUSSION

Effect of locality on moisture, fat, protein, fibre and ash content of whole grain millets and its milled fractions (Table 1) : The highest moisture content was found in whole grain millets collected from SS Koppa (5.73%) and least from Karadikoppa (4.37%). Moisture content in the grains collected from other localities was at par with that of SS Kopa. The fat, protein, fibre and ash content percentage in whole grain ranged from 2.93 to 4.79, 7.39 to 7.68, 2.68 to 2.80 and 1.52 to 4.88 per cent respectively. The moisture, fat, protein, fibre and ash content percentage in decorticated grain ranged from 2.57 to 2.90, 3.11 to 3.39, 5.40 to 5.82, 1.42 to 1.66 and 2.55 to 2.67 respectively and in bran from 3.83 to 5.71, 3.16 to 3.32, 9.37 to 9.60, 24.48 to 32.86 and 7.61 to 8.66 respectively but there were no statistical differences in these values wrt localities.

Table 1. Moisture, fat, protein, fibre and ash content percentagee of whole grain millets and milled fractions based on locality

Locality	Moisture (%)			Fat (%)			Protein (%)			Fibre (%)			Ash (%)		
	WG	DG	B	WG	DG	B	WG	DG	B	WG	DG	B	WG	DG	B
L_1	5.59	2.80	5.02	4.52	3.39	3.32	7.63	5.54	9.59	2.80	1.47	29.48	4.53	2.67	8.66
L_2	4.87	2.80	4.32	4.79	3.21	3.26	7.55	5.63	9.60	2.80	1.42	28.45	1.52	2.66	7.80
L_3	5.30	2.67	5.42	4.62	3.22	3.27	7.39	5.71	9.55	2.73	1.46	32.86	3.19	2.66	8.14
L_4	5.50	2.81	3.83	3.15	3.25	3.20	7.52	5.51	9.55	2.68	1.51	29.74	3.53	2.56	8.24
L_5	5.59	2.90	5.63	4.53	3.18	3.20	7.65	5.60	9.45	2.65	1.47	28.08	3.00	2.62	7.81
L_6	4.90	2.80	5.60	3.04	3.15	3.31	7.68	5.44	9.43	2.71	1.48	24.48	4.67	2.55	8.56
L_7	5.57	2.79	5.09	2.93	3.15	3.17	7.64	5.58	9.57	2.73	1.54	29.18	4.88	2.60	7.61
L_8	5.36	2.80	4.90	4.49	3.19	3.21	7.52	5.82	9.47	2.69	1.47	28.33	3.15	2.62	8.58
L_9	4.37	2.64	5.67	4.26	3.11	3.27	7.57	5.54	9.56	2.76	1.46	30.38	4.63	2.59	8.31
L_{10}	5.55	2.57	5.71	4.52	3.28	3.27	7.52	5.40	9.37	2.70	1.53	29.06	3.65	2.62	8.59
L_{11}	5.73	2.74	4.75	4.37	3.27	3.20	7.61	5.52	9.40	2.76	1.66	29.18	3.30	2.65	8.21
L_{12}	5.52	2.81	4.41	4.59	3.19	3.16	7.64	5.58	9.57	2.69	1.47	28.33	3.15	2.62	8.58
SEm±	0.302	0.090	0.551	0.768	0.071	0.054	0.119	0.164	0.108	0.068	0.056	2.778	1.343	0.038	0.549
$CD_{0.05}$	0.882	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Values are mean of three replications; L_1: Chikkayagatti, L_2: Jekinkatti, L_3: Chadaval, L_4: Ganjigatti, L_5: Palikoppa, L_6: Tirumallakoppa, L_7: Shishunal, L_8: BN Koppa, L_9: Karadikoppa, L_{10}: Kamplikoppa, L_{11}: SS Koppa, L_{12}: Mantrodi, WG: whole grain, DG: decorticated grain, B: bran

Table 2. Moisture, fat, protein, fibre and ash content of whole grain millets and its milled fractions based on colour

Colour	Moisture (%)			Fat (%)			Protein (%)			Fibre (%)			Ash (%)		
	WG	DG	B	WG	DG	B	WG	DG	B	WG	DG	B	WG	DG	B
C_1	5.60	2.90	5.63	4.55	3.17	3.25	7.51	5.65	9.55	2.79	1.47	23.30	4.67	2.55	8.56
C_2	3.66	2.74	3.61	4.38	3.23	3.20	7.40	3.87	9.57	2.70	1.45	30.15	5.26	2.62	8.02
C_3	5.59	2.56	5.02	4.46	3.31	3.14	7.56	5.71	9.44	2.72	1.46	23.08	5.45	2.58	8.22
C_4	5.71	2.81	5.04	3.04	3.16	3.20	7.64	5.58	9.57	2.79	1.47	23.30	3.01	2.64	7.61
SEm±	0.076	0.122	0.506	0.769	0.036	0.043	0.112	0.971	0.058	0.044	0.030	1.260	0.786	0.029	0.486
$CD_{0.05}$	NS	NS	1.651	NS	NS	NS	NS	NS	NS	NS	NS	4.108	NS	NS	NS

Values are mean of three replications; C_1: creamish brown, C_2: blackish, C_3: blackish brown C_4: creamish, WG: whole grain, DG: decorticated grain, B: bran, WG: whole grain, DG: decorticated grain, B: bran

Table 3. Moisture, fat, protein, fibre and ash content of whole grain millets and its milled fractions based on size and shape

Shape	Moisture (%)			Fat (%)			Protein (%)			Fibre (%)			Ash (%)		
/size	WG	DG	B	WG	DG	B	WG	DG	B	WG	DG	B	WG	DG	B
SS_1	4.87	2.72	4.32	4.61	3.22	3.30	7.68	5.44	9.43	2.71	1.48	24.48	4.67	2.55	8.56
SS_2	5.59	2.82	5.63	4.60	3.20	3.26	7.66	3.68	9.49	2.61	1.47	31.86	4.63	2.58	7.96
SS_3	5.71	2.80	5.00	4.12	3.23	3.22	7.57	5.54	9.56	2.77	1.46	30.38	4.79	2.62	8.35
SS_4	5.40	2.74	5.64	3.64	3.19	3.22	7.56	5.71	9.44	2.70	1.47	26.67	5.29	2.58	7.54
SS_5	5.62	2.81	4.95	4.55	3.18	3.26	7.48	5.84	9.49	2.56	1.57	30.82	4.48	2.47	7.82
SEm±	0.25	0.05	0.53	0.512	0.029	0.061	0.136	0.101	0.831	0.123	0.091	2.333	0.159	0.086	0.461
$CD_{0.05}$	0.79	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	7.359	0.502	NS	NS

Values are mean of three replications; SS_1: small, round, SS_2: big ,round, SS_3: small flattened, SS_4: small Lengthy, SS_5: small oval shaped, WG: whole grain, DG: decorticated grain, B: bran

Effect of colour on moisture, fat, protein, fibre and ash content of whole grain millets and its milled fractions (Table 2): The moisture, fat, protein, fibre and ash content percentage in whole grain having different colours ranged from 5.59 to 5.71, 3.04 to 4.55, 7.40 to 7.64, 2.70 to 2.79 and 3.01 to 5.45 respectively; in decorticated grain from 2.56 to 2.90, 3.16 to 3.31, 3.87 to 5.71, 1.45 to 1.47 and 2.55 to 2.64 respectively and in bran from 3.61 to 5.63, 3.14 to 3.25, 9.44 to 9.57, 23.08 to 30.15 and 7.61 to 8.56 respectively. However the signicicant difference was found in case of moisture content of bran with maximum creamish brown (5.63%) and minimum in blackish (3.61%) and in fibre content having maximum in blackish (30.15%) and minimum in blackish brown (23.08%).

Effect of size and shape on moisture, fat, protein, fibre and ash content of whole grain millets and its milled fractions (Table 3) : The moisture, fat, protein, fibre and ash content percentage in whole grain having different size/shape ranged from 4.87 to 5.71, 3.64 to 4.61, 7.48 to 7.68, 2.56 to 2.77 and 4.48 to to 5.29 respectively; in decorticated grain from 2.72 to 2.84, 3.18 to 3.23, 3.68 to 5.84, 1.46 to 1.57 and 2.47 to 2.62 respectively and in bran from 4.32 to 5.64, 3.22 to 3.30, 9.43 to 9.56, 24.48 to 31.86 and 7.54 to 8.56 respectively. The significant difference was found only in case of moisture content of whole grain with maximum moisture content in small flattened (5.71%) and minimum in small, round (4.87%) grains; in case of fibre content of bran with maximum fibre content in big, round (31.86%) and minimum in small round (24.48%) grains and in case of ash content of whole grain with maximum in small lengthy (5.29%) and minimum in small oval shaped grains.

Shimelis and Mulugeta (2009) reported that moisture content was maximum in local PBL-3 and minimum in finger millet variety Boneya among three varieties Tadesse, Padet and Boneya tested with local varieties PBR (pawe brown)-1, PBR-2, PBR-3, PBL (pawe black)-1, PBL-2 and PBL-3.

Similarly Sanaa et al (2005) analyzed 4 cereals including barley, pearl millet, rye and sorghum and found that barley and rye contained lower fat compared to sorghum and millet.

Sanaa et al (2005) also reported that barley whole grain had the highest total ash content (2.9%) among cereals followed by rye, millet and sorghum (1.96%,1.82% and 1.87% respectively).

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