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EVALUATION OF FINGER MILLET GENOTYPES FOR PROXIMATE COMPOSITION AND ANTINUTRIENTS CONTENT

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Abstract: Finger millet is mainly grown as a grain crop and is a favorite food of hard toiling class and also preferred to persons suffering from diabetes. It plays an important role in the nutrition of millions of people in semi-arid tropics, particularly of India and East Africa. Finger millet is a source of carbohydrates, proteins, minerals, sugars, starch and dietary fiber. In the present investigation 28 finger millet genotypes were evaluated for proximate composition based on size and colour of the grains. The nutritional composition of genotypes were: crude protein, 3.85 to 7.86; crude fat, 1.46 to 2.18; ash, 1.80 to 3.20; crude fibre, 1.30 to 2.70; carbohydrates, 73.37 to 78.61 per cent and iron, 3.42 to 6.32 mg per 100g. The cultivars IPGFM-8 and IPGFM-2 were found to be high in protein content (7.86 and 7.48% protein, respectively). The genotypes IPGFM-15, IPGFM-16, IPGFM-20 and IPGFM-26 were comparatively high in starch content and the genotypes IPGFM-27 and IPGFM-28 showed the highest mineral content.
Keywords: Finger millets, composition, anti nutrients, genotypes, nutrition.

Introduction

Finger millet (*Eleusine coracana* Gaertn.) known in the literature by various names like '*ragi*' or '*nagli*' or '*nachani*' in Maharashtra is one of the most important food crops of the poor farmers and especially of the tribal people in India. It belongs to family Graminae and is a polymorphic and self-pollinated crop. Africa is considered to be the centre of origin of this crop (De Wet *et al*., 1984). Finger millet is mainly grown as a grain crop and is a favorite food of hard toiling class and also preferred to persons suffering from diabetes. The grains are malted and fed to infants. It plays an important role in the nutrition of millions of people in semi-arid tropics, particularly of India and East Africa. In India, the crop is extensively grown in the states of Karnataka, Andhra Pradesh, Orissa, Bihar, Gujrat, Tamil Nadu and Maharashtra. The area under finger millet in Maharashtra for the year 2007-2008 was 136 thousand ha, while the yield was 123 thousand tones with the productivity of 904 kg per ha (Anonymous, 2008).

Finger millet is a source of carbohydrates, proteins, minerals, sugars, starch and dietary fibre. The proximate composition of finger millet grains has been studied by several workers (Wadikar *et al*., 2007). Antinutrients generally reduce the bioavailability of minerals.

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In finger millet, phytic acid and polyphenols are the main antinutritional factors. Phytic acid is a strong chelating agent which binds with the essential minerals to from phytate-mineral complexes (Oberleas *et al*., 1966). A wide variation in the chemical composition of finger millet grains projects further scope for improving its nutritional quality. The scientific information on the proximate composition, antinutritional factors and the influence of processing on the nutritional functionality of finger millet grains appears to be inadequate. Hence, the information generated in the present investigation will be useful to the plant breeders to further expedite the breeding of finger millet genotypes for better grain quality attributes.

Material and Methods

The genetically pure seeds of twenty eight promising germplasm of finger millet were obtained from the Associate Director of Research, Zonal Agricultural Research Station, Igatpuri, Nashik (MS). The seeds were cleaned and stored at 4°C until used for various experiments.

For proximate composition analysis viz., moisture, ash, crude fat, crude protein (N%×6.25), crude fibre and iron were estimated according to the standard procedures of AOAC (1990). Total carbohydrate content was calculated by difference. Reducing sugars were determined by Nelson-Somogyi method (Nelson, 1944). The starch content was determined by the method of Mc Gready *et al.* (1950). Antinutritional factors such as polyphenols and phytate phosphorus were determined by the procedure described by Swain and Hillis (1959) and Wheeler and Ferrel (1971), respectively.

Results and discussion

The promising genotypes of finger millet differing in seed size and colour were examined for their grain characteristics, chemical compositions including polyphenols and phytate phosphorus, minerals, limiting amino acid i.e. lysine and the correlations between various chemical constituents were also worked out.

The results in Table 1 reveal that the grain moisture content varied from 11.35 to 13.89 per cent with a mean value of 12.46 per cent. The genotypes IPGFM-18 and IPGFM-9 contained the highest moisture (13.89 and 13.22 %, respectively), while the genotypes IPGFM-20 contained the lowest (11.35 %). The earlier reported values of moisture content in finger millet grains are 10.9 to 12.17 per cent (Singh *et al*., 2005). The total ash content in the grains of finger millet genotypes varied from 1.8 to 3.2 per cent with a mean value of 2.49 per cent (Table 1). The genotype IPGFM-27 contained the highest minerals content of 3.2 per

cent, followed by IPGFM-28 with 3.1 per cent. The crude fat content in the grains of finger millet genotypes varied from 1.46 to 2.18 with a mean value of 1.81 per cent (Table 1). The total lipids in finger millet have been reported to range between 1.1 and 2.1 per cent (Wadikar *et al*., 2007). The grain protein content also ranged between 3.85 and 7.86 per cent with a mean value of 5.87 per cent (Table 1). The genotypes IPGFM-8, IPGFM-2 and IPGFM-7 contained the highest protein content of 7.86, 7.48 and 7.41 per cent, respectively.

The reducing sugars also varied from 0.23 to 0.42 per cent with a mean value of 0.32 per cent, while non reducing sugars varied from 0.65 to 0.89 per cent with a mean value of 0.80 per cent and total sugars from 1.02 to 1.20 per cent with a mean value of 1.11 per cent (Table 2). The starch content of finger millet genotypes varied from 57.6 to 67.5 per cent with a mean value of 61.85 per cent (Table 2). The genotypes IPGFM-27, IPGFM-28 and IPGFM-24 contained the highest iron content of 6.32, 6.19 and 6.02 mg per 100g, respectively as compared to other genotypes.

The polyphenols content of whole grains varied from 0.22 to 0.46 per cent with a mean value of 0.34 per cent (Table 3). The genotypes IPGFM-5 and IPGFM-14 were found to contain the highest amount of polyphenols (0.46 %). The phytate phosphorus content in grains ranged from 0.22 to 0.35 per cent with a mean value of 0.27 per cent (Table 4). The genotypes IPGFM-12 and IPGFM-21 exhibited the highest phytate phosphorus content of 0.35 and 0.31 per cent, respectively, while the genotypes IPGFM-9, IPGFM-16 and IPGFM-22 exhibited the lowest of 0.22 per cent (Table 3). The values of polyphenols and phytate phosphorus observed in the present studies are in agreement with the literature values of Shanthala *et al*., 2004 and Wadikar *et al*., 2006.

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Table 1: Proximate composition of grains of finger millet genotypes

Sr. No.	Genotypes (%)	Moisture (%)	Ash (%)	Crude fat (%)	Crude protein (%)	Crude fibre (%)	Carbohydrates (%)
1	IPGFM-1	13.03	2.50	1.78	5.21	2.40	75.08
2	IPGFM-2	12.26	2.30	1.70	7.48	1.30	74.96
3	IPGFM-3	12.63	2.20	1.84	4.84	1.70	76.79
4	IPGFM-4	12.94	2.80	1.50	6.50	2.70	73.57
5	IPGFM-5	12.53	2.80	1.86	6.26	2.30	74.25
6	IPGFM-6	12.99	1.80	1.80	6.37	1.90	75.14
7	IPGFM-7	12.16	1.90	1.46	7.41	1.70	75.37
8	IPGFM-8	11.84	2.40	1.68	7.86	2.10	74.13
9	IPGFM-9	13.22	3.00	1.88	6.81	1.50	73.60
10	IPGFM-10	11.65	2.40	1.94	5.49	2.60	75.92
11	IPGFM-11	12.57	1.80	1.70	6.78	2.20	74.95
12	IPGFM-12	12.45	1.90	1.84	5.17	1.70	76.95
13	IPGFM-13	13.00	2.50	1.56	5.78	1.80	73.37

14	IPGFM-14	12.80	2.50	1.76	6.77	2.30	73.87
15	IPGFM-15	12.18	2.70	2.04	5.80	2.40	74.88
16	IPGFM-16	12.43	2.40	1.94	5.78	1.60	75.86
17	IPGFM-17	12.09	2.60	1.68	5.16	1.70	76.77
18	IPGFM-18	13.89	2.60	2.18	5.49	1.90	73.94
19	IPGFM-19	12.24	2.40	1.58	6.77	2.10	74.91
20	IPGFM-20	11.35	2.60	1.84	4.20	1.40	78.61
21	IPGFM-21	11.72	2.40	1.92	5.16	1.60	77.20
22	IPGFM-22	12.96	2.40	2.08	5.17	2.00	75.40
23	IPGFM-23	11.67	2.40	1.98	3.85	1.50	78.60
24	IPGFM-24	12.72	2.90	1.90	4.52	2.30	75.66
25	IPGFM-25	12.39	2.50	1.58	5.78	2.60	75.16
26	IPGFM-26	12.59	2.80	2.12	5.78	1.60	75.12
27	IPGFM-27	12.66	3.20	1.90	5.78	2.40	74.07
28	IPGFM-28	11.80	3.10	1.64	6.45	1.70	75.31
Range		**11.35-13.89**	**1.80-3.20**	**1.46-2.18**	**3.85-7.86**	**1.30-2.70**	**73.37-78.61**
Mean		**12.46**	**2.49**	**1.81**	**5.87**	**1.96**	**75.34**
SE±		**1.82**	**0.16**	**3.65**	**1.86**	**0.18**	**6.54**
CD at 5 %		**5.17**	**0.46**	**0.10**	**5.28**	**0.51**	**0.19**

Table 2: Sugars, starch, lysine and iron contents in grains of finger millet genotypes

Sr. No.	Genotypes	Sugars (%)			Starch (%)	Lysine (mg per 16 g N)	Iron (mg per 100 g)
		Reducing	Non-reducing	Total			
1	IPGFM-1	0.37	0.71	1.08	63.00	3.26	5.27
2	IPGFM-2	0.31	0.79	1.10	59.40	2.59	5.19
3	IPGFM-3	0.23	0.83	1.06	61.20	3.36	4.87
4	IPGFM-4	0.37	0.65	1.02	63.00	2.21	5.32
5	IPGFM-5	0.30	0.88	1.18	63.90	2.98	5.43
6	IPGFM-6	0.30	0.84	1.14	63.00	2.92	3.49
7	IPGFM-7	0.42	0.66	1.08	61.20	2.59	3.68
8	IPGFM-8	0.35	0.75	1.10	57.60	2.56	5.13

9	IPGFM-9	0.28	0.84	1.12	60.30	2.82	5.91
10	IPGFM-10	0.29	0.81	1.10	61.20	3.17	5.55
11	IPGFM-11	0.35	0.79	1.14	57.60	2.80	3.42
12	IPGFM-12	0.31	0.77	1.08	58.50	3.23	3.70
13	IPGFM-13	0.31	0.89	1.20	61.20	3.04	5.34
14	IPGFM-14	0.29	0.85	1.14	64.80	2.82	5.33
15	IPGFM-15	0.30	0.86	1.16	65.80	3.01	5.48
16	IPGFM-16	0.33	0.75	1.08	67.50	3.05	5.30
17	IPGFM-17	0.29	0.75	1.04	61.20	3.25	5.40
18	IPGFM-18	0.33	0.81	1.14	63.90	3.08	5.40
19	IPGFM-19	0.38	0.68	1.06	59.40	2.70	5.25
20	IPGFM-20	0.29	0.87	1.16	65.80	3.93	5.42
21	IPGFM-21	0.30	0.88	1.18	57.60	3.31	5.26
22	IPGFM-22	0.31	0.85	1.16	61.20	3.19	5.19
23	IPGFM-23	0.31	0.87	1.18	61.20	4.39	5.25
24	IPGFM-24	0.33	0.69	1.02	59.40	3.69	6.02
25	IPGFM-25	0.28	0.76	1.04	63.00	2.99	5.32
26	IPGFM-26	0.28	0.82	1.10	65.80	3.04	5.87
27	IPGFM-27	0.30	0.84	1.14	61.20	3.03	6.32
28	IPGFM-28	0.29	0.89	1.18	63.00	2.82	6.19
Range		**0.23- 0.42**	**0.65-0.89**	**1.02-1.20**	**57.60-67.50**	**2.21-4.39**	**3.42-6.32**
Mean		**0.32**	**0.80**	**1.11**	**61.85**	**3.07**	**5.19**
SE±		**9.38**	**1.07**	**1.84**	**0.14**	**5.65**	**6.49**
CD at 5 %		**2.67**	**0.03**	**5.23**	**0.38**	**0.16**	**1.85**

Table 3: Anti nutritional factors in grains of finger millet genotypes

Sr. No.	Genotype	Polyphenols (%)	Phytate phosphorus (%)
1	IPGFM-1	0.28	0.24
2	IPGFM-2	0.26	0.23
3	IPGFM-3	0.22	0.26
4	IPGFM-4	0.34	0.27

5	IPGFM-5	0.46	0.30
6	IPGFM-6	0.42	0.30
7	IPGFM-7	0.24	0.26
8	IPGFM-8	0.32	0.27
9	IPGFM-9	0.26	0.22
10	IPGFM-10	0.38	0.28
11	IPGFM-11	0.42	0.30
12	IPGFM-12	0.40	0.35
13	IPGFM-13	0.42	0.28
14	IPGFM-14	0.46	0.28
15	IPGFM-15	0.44	0.27
16	IPGFM-16	0.28	0.22
17	IPGFM-17	0.34	0.30
18	IPGFM-18	0.34	0.27
19	IPGFM-19	0.30	0.27
20	IPGFM-20	0.28	0.28
21	IPGFM-21	0.40	0.31
22	IPGFM-22	0.42	0.22
23	IPGFM-23	0.36	0.23
24	IPGFM-24	0.32	0.26
25	IPGFM-25	0.28	0.27
26	IPGFM-26	0.24	0.30
27	IPGFM-27	0.30	0.29
28	IPGFM-28	0.30	0.28
Range		**0.22-0.46**	**0.22-0.35**
Mean		**0.34**	**0.27**
SE±		**2.21**	**4.32**
CD at 5 %		**6.28**	**1.23**