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RESEARCH PAPER

Nutritive value and organoleptic qualities of roti prepared from traditional sorghum landraces

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Abstract: Landraces or traditional varieties are the basic material for developing any variety or hybrid.The study on nutritive value and roti quality helps in identifying superior cultivars which then can be used as parents to develop newer varieties. The twenty traditional sorghum landraces and one high yielding variety were procured from AICRP Sorghum, UAS, Dharwad. The nutritive valuesand sensory properties of twenty sorghum landraces were studied and compared with high yielding variety (M35-1). The proximate composition *viz.*, moisture, fat and carbohydrate content of landraces were on par with M35-1. The crude protein and crude fiber content were significantly higher and the ash content of most of the landraces was significantly lower compared to M35-1. The acceptability of roti prepared from twelve traditional sorghum landraces were on par with M35-1.

Key words: Crude fiber, Landraces, Physico-chemical properties, Roti, Sorghum

Introduction

Sorghum is the important staple food for people living in arid and semi-arid areas of Asia and Africa. It is the fifth mostwidely produced cereal crop after wheat, rice, maize and barley.It has the potential to grow in harsh environments, due to its highly efficient photosynthetic pathway and in utilization of soil nutrients. Sorghum requires less water and is tolerant to drought and flooding. Usually sorghum is utilized in various forms; Sorghum grains are rich in nutrients and used for human consumption whereas, leaf and stalk are used for animal feed. Sorghum is the gluten-free cereal, rich in fiber, protein and essential minerals. The sorghum produced in India is consumed in the form of roti (unleavened flat bread) other food products can be prepared by processing the grain by pearling, milling, flaking, extrusion and popping.Sorghum landraces are traditional varieties generally less productive than commercial cultivars, although in recent years, they have become important as sources of genetic variability in search for genes for tolerance or resistance to biotic and abiotic factors of interest in agriculture. Landraces have large proportion of the dietary intake of nutrients and energy and special attention must be paid to its nutritional characteristics. Thestudies related to nutritional status and roti quality of these landraces are very scares. Hence, the present study was undertaken to studynutritive valueand roti qualitiesof traditional sorghum landraces and compared with high yielding variety M35-1.

Material and methods

Sample procurement

The twenty traditional sorghum landraces and one high yielding variety M35-1 were procured from AICRP on Sorghum, University of Agricultural Sciences, Dharwad. The experiment was conducted in department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences, Dharwad.

Proximate composition of sorghum landraces

Moisture: Moisture content of the sample was expressed in per cent (Anon., 2005).

$$\text{Moisture (\%)} = \frac{\text{Initial weight of the sample (g)} \times \text{Final weight of sample (g)}}{\text{Weight of fresh sample (g)}} \times 100$$

Fat: Soxhlet apparatus was used to determined crude fat content of the samples. The percent of crude fat was expressed as follows.

$$\text{(\%) Crude fat} = \frac{\text{Final weight of flask} - \text{Empty weight of flask}}{\text{Weight of sample}} \times 100$$

Protein: Protein content was determined using Anon., 2005 method. Per cent nitrogen and protein was calculated by the following equation.

$$\text{Nitrogen (\%)} = \frac{14 \times \text{normality of the acid} \times (\text{titrant value burette reading})}{\text{Sample weight} \times 1000} \times 100$$

$$\text{Protein (\%)} = \text{\% N} \times 6.25$$

Ash: Ash was determined using muffle furnace (Anon., 2005). The percent ash was calculated using following formula.

$$\text{Ash content (g \%)} = \frac{\text{Weight of the ash}}{\text{Weight of the sample}} \text{ x } 100$$

Crude fiber: The crude fiber content of sorghum determined by Anon., 2005 method.

$$\text{(\%) Crude fiber} = \frac{\text{Weight of residue} - \text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Total carbohydrate: Total carbohydrate was determined by difference that is by subtracting the measured protein, fat, ash and moisture from 100.

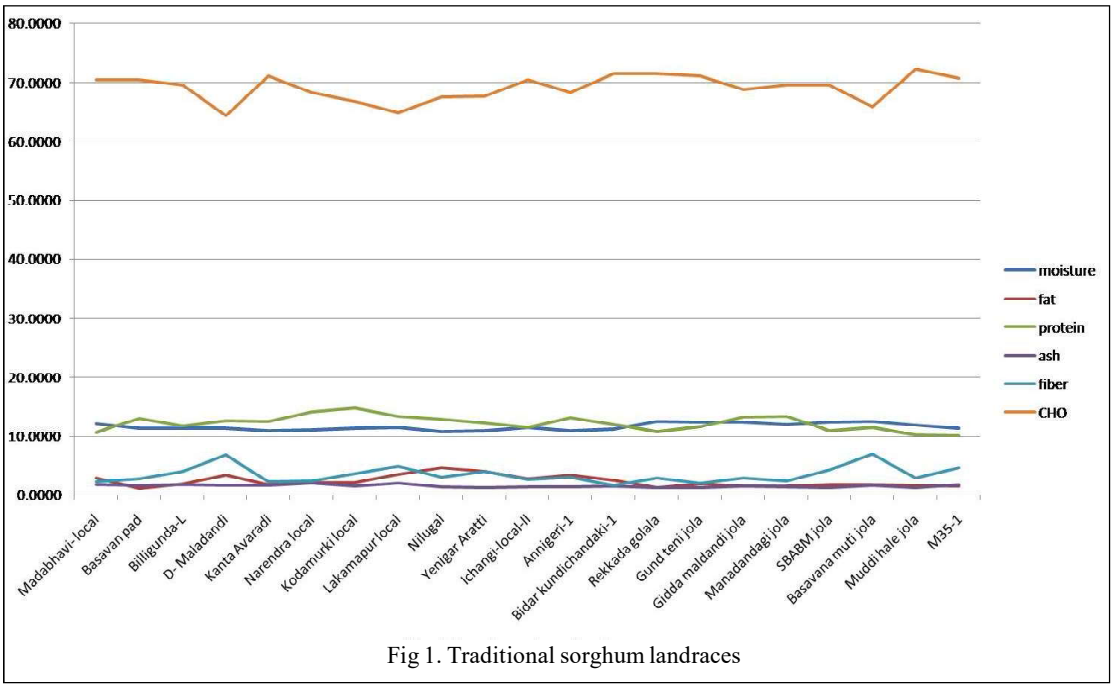

Fig 1. Traditional sorghum landraces

Preparation of roti

Roti was prepared from sorghum flour with the addition of boiled water and kneaded into dough with proper proportion of gelatinized mass and dry flour. The dough was normally flattened on a hard wooden or metal surface sprinkled with a small quantity of flour to facilitate the rolling action when the roti was transferred to a hot pan, the dry surface was brushed with water to make moist and baked.

Table 1. Organoleptic scores of roti prepared from sorghum genotypes

Sorghum landraces	Appearance	Colour	Flavour	Taste	Texture	Overall acceptability	Ranking
Annigeri-1	6.9±0.88^{*cdef}	6.2±1.01^{*defgh}	7.1±0.32^{*bcdef}	7.5±0.53^{abcd}	5.9±0.61^{*abcde}	7.2±0.79^{bcdefg}	7
Basavanapada	7.7±1.25^{abcd}	6.6±0.84^{*abcd}	7.1±0.99^{*bcdef}	7.1±1.1^{abcdef}	7.2±0.79^{abcde}	7.2±1.03^{bcdefg}	7
Basavanamuti jola	7.15±1.06^{bcde}	7.05±1.01^{*defgh}	7.4±0.7^{abcde}	7.3±0.67^{abcde}	7.5±0.53^{abcd}	7.1±0.74^{cdefgh}	9
Bidar kudichandaki-1	7.3±0.82^{bcde}	7.3±0.82^{*cdefg}	7.1±0.74^{*bcdef}	7.1±0.57^{abcdef}	6.4±0.7^{*abcde}	7.1±0.57^{cdefgh}	9
Billigunda-local	6.1±0.74^{*f}	7.2±0.25^{*i}	6.6±0.52^{*ef}	6.3±1.16^{*f}	6.6±0.52^{de}	6.5±0.53^{*gh}	18
Doddamaladandi	6.5±1.23^{*cdef}	6.7±0.82^{*efghi}	7.0±0.94^{*bcdef}	7.0±0.82^{bcdef}	7.0±0.67^{bcde}	6.7±0.82^{*efgh}	16
Giddamaldandi	7.3±0.67^{f}	6.2±0.63^{*hi}	4.9±0.57^{*bcdef}	5.55±0.5^{*cdef}	6.4±0.52^{*e}	5.3±0.82^{*h}	21
Gundteni jola	8.08±0.53^{ef}	6.6±0.52^{*fghi}	8.25±0.63^{abcde}	7.6±0.97^{abc}	7.2±0.63^{abcde}	7.1±0.88^{cdefgh}	9
Ichangi-local-2	7.8±0.79^{abc}	7.8±0.79^{abcd}	7.9±0.57^{ab}	7.9±0.57^{ab}	6.2±0.59^{*ab}	7.05±0.64^{*ab}	12
Kantaavaradi	6.6±1.07^{ef}	5.7±0.48^{*fghi}	6.4±1.07^{*f}	6.4±1.07^{*ef}	6.26±0.63^{*de}	6.6±0.97^{*fgh}	17
Kodamurki-local	7.7±0.95^{abcd}	6.5±0.75^{*abcd}	7.6±0.7^{abcd}	7.5±0.71^{abcd}	7.4±1.07^{abcd}	7.5±0.71^{abcde}	4
Lakamapur-local	6.7±0.95^{*def}	6.2±0.92^{*defgh}	6.7±1.16^{*def}	6.6±1.07^{*def}	6.3±0.95^{*e}	6.5±0.85^{*gh}	18
Madabhavi- local	7.3±0.95^{bcde}	6.52±0.51^{*cdefg}	7.1±0.74^{*bcdef}	7.1±0.57^{abcdef}	6±0.62^{*bcde}	6.9±0.74^{*defgh}	14
Manadandagi jola	7.5±0.97^{abcde}	7.6±0.97^{*bcde}	7.6±0.52^{abcd}	7.8±0.79^{ab}	8.0±0.47^{a}	7.8±0.63^{abc}	3
Muddi hale jola	6.8±0.48^{*ab}	7.0±0.47^{*abc}	6.65±0.41^{*abcd}	7.5±0.97^{abcd}	6.8±0.59^{*abc}	6.8±0.59^{*abcd}	12
Narendra-local	7.3±1.16^{bcde}	6.25±0.62^{*cdef}	7.1±1.2^{*bcdef}	7.1±1.2^{abcdef}	5.89±0.5^{*abcde}	6.9±1.29^{*defgh}	14
Nilugal	8.0±0.94^{ab}	7.15±0.75^{*ab}	8.2±0.59^{abcde}	7.95±0.76^{abcd}	8.0±0.78^{cde}	8.15±0.24^{abcdefg}	2
Rekkada jola	6.9±0.74^{*cdef}	6.85±0.75^{*efgh}	7.8±0.79^{abc}	7.8±0.79^{ab}	7.8±0.79^{ab}	7.45±0.6^{abcdef}	5
SBABM jola	7.3±1.06^{bcde}	6.1±0.52^{*cdefg}	7.6±0.7^{abcd}	7.5±0.71^{abcd}	7.6±0.84^{abc}	7.35±0.75^{abcdefg}	6
Yenigararati	6.6±1.07^{*ef}	6.4±1.07^{*ghi}	6.15±0.63^{*cdef}	6.6±0.97^{*def}	6.4±0.84^{*e}	6.4±0.84^{*h}	20
M35-1	8.3±0.48^{a}	8.6±0.52^{a}	8.2±0.79^{a}	8±0.82^{a}	7.8±0.92^{ab}	8.1±0.74^{a}	1
Mean SD	7.24±1.03	6.79±0.97	7.16±1.06	7.2±1.02	6.89±0.97	7.03±0.96	-
F-value	3.679*	8.082717*	10.74404*	5.46161*	10.11969*	6.52874*	-
S.Em.±	0.53	0.43	0.34	0.39	0.41	0.45	-
C.D.	1.49	1.2	1.23	1.37	1.15	1.25	-

Means followed by asterisk (*) differed from the control group by the Dunnett test ($p<0.05$).

Means followed by different letters in the same column are statistically different by the Duncan test ($p<0.05$)

Sensory score: Like extremely (Excellent) - 9, Like very much (Very good) - 8, Like moderately - 7, Like slightly-6, Neither like nor dislike - 5, Dislikes lightly - 4, Dislike moderately - 3, Dislike very much - 2, Dislike extremely-1

Organoleptic evaluation

Nine point hedonic scale was used for evaluation of sorghum roti for various organoleptic parameters *i.e.*, in terms of general appearance, colour, texture, taste, flavour and overall acceptability by 15 semi-trained panel members**.**

Statistical analysis

The SPSS version of 16.0 package was used to carry out statistical analysis. One way ANOVA andDunnet's test was applied to study variation among twenty traditional sorghum landraces with high yielding variety.

Results and discussion

Proximate composition of sorghum genotypes is presented in Fig 1. There was significant variation in moisture, crude fat, crude protein, ash, crude fiber and carbohydrate content among the sorghum genotypes (Pd≤0.001). The moisture ranged from 10.76 to 12.47 per cent. Basavanamutti and Nilugal landraces showed highest and lowest moisture content respectively. The crude protein content ranged from 10.21 to 14.75 per cent. Kodamurki-local and Mudi hale jola had highest and lowest crude protein content, respectively. The highest value for crude fat was observed in Nilugal variety (4.62 %) and the lowest value was observed in Basavanapada variety (1.10 %). The ash content of sorghum genotypes ranged from 1.22 to 2.00 per cent. Highest ash content was observed in Narendra-local variety and the lowest in Rekkada jola variety. The crude fiber content of sorghum genotypes ranged from 1.53 to 6.99 per cent. Basavanamutti jola and Bidar kudichandaki-1 had highest and lowest crude fibre content respectively. The carbohydrate content ranged from 64.28 to 72.27 per cent. Muddi hale jola and Doddamaldandi varieties showed the highest and the lowest carbohydrate content. The moisture, fat and carbohydrate content of traditional sorghum landraces were on par with M35-1. The ash content of traditional sorghum landraces was lower compared to M35-1. This might be due to genetic variability and difference in mineral content. The crude protein and crude fiber content in most of the traditional sorghum landraces were higher compared to M35-1 variety. The presence of total nitrogen content in the soil and minerals such as molybdenum and total chlorine tend to increase the grain protein content. Higher crude fiber levels can be attributed to higher bran portion of grain. Different researchers reported various range for moisture, crude protein, fat, ash, fiber and carbohydrate content of sorghum genotypes. Jimoh and Abdullahi, 2017 showed the moisture, protein, fat, ash and total carbohydrate content in the Sorghum varieties were found in the range of 9.75 to 16.32 per cent, 6.23 to 13.81 per cent, 3.6 to 10.54 per cent, 1.12 to 1.68 per cent and 65.32 to 76.28 per cent, respectively.Salinas*et al.*, 2021, moisture, ash, crude fat, crude protein, and CHO varied from 8.69 to 9.13, 1.35 to 1.67, 2.60 to 4.14, 10.06 to 12.93, and 63.99 to 69.59, respectively.

Results of organoleptic evaluation of roti prepared from sorghum genotypes are presented in Table 1. There was a significant ($p<0.001$) variation among sensory properties *viz.*, appearance, colour, flavour, taste, texture, overall acceptability of sorghum roti.The Dunnet's test showed that the overall acceptability of twelve traditional sorghum landraces were on par with M35-1. The remaining eight landraces *viz.*, Billigunda-local (p=0.000), DoddaMaladandi (p=0.001), Giddamaldandi (p=0.000), Kanta Avaradi (p=0.000), Lakamapur-local (p=0.000), Madabhavi-local (p=0.011), Narendra local (p=0.011) and YenigarAratti (p=0.000) had significantly lower overall acceptability in comparison to M35-1.The acceptability of sorghum roti was affected by dark and red colour of rotis, hard texture and bitter flavour of roti. Chavan *et al*., 2017 found that the overall acceptability of three improved cultivars RSV 423, CSV 22 and SPV 1546 were on par with M35-1 variety. Vannalli *et al.,* 2008 found that nine landraces had significantly lower colour, appearance, texture, taste, aroma and overall acceptability scores than M35-1.

Conclusion

The most of the traditional sorghum landraces had significant higher crude protein and crude fiber content than M35-1. The overall acceptability of twelve traditional sorghum landraces was on par with M35-1. The ash content ranged from 1.22 to 2.00 per cent and was significantly lower compared to M35-1. Hence, it was found that the studied traditional sorghum landraces are better in nutritional and organoleptic qualities which can be used as parents to develop or improve the sorghum genotypes.

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