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Characterization of sorghum flour and nutrient analysis of different sorghum varieties [*Sorghum bicolor* (L.) Moench]

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Abstract

Sorghum is major cereal in semi-arid region of the world it is an important food crop but in India it is majorly used as a feed crop grown in both rainy and post rainy season. Sorghum is a gluten free cereal and forms the staple diet of a majority of populations. Flour property of sorghum varieties M-35-1, KMJ-1 and SMJ-1 had white colour, whereas AKJ-1 had red colour, dough consistency of M-35-1 and AKJ-1 varieties was rough and non-stretchable whereas KMJ-1 and SMJ-1 was slight smooth KMJ-1 had highest water absorption index (2.76 g). Among the four varieties of sorghum SMJ-1 had highest ash content, KMJ-1 had highest protein content. The zinc content of sorghum varieties varied between 2.61 to 2.76 mg, highest content was found in SMJ-1 (*hurda*) (2.76 mg).

Keywords: Sorghum, varieties, flour properties, nutrients

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] belongs to the Poacea family, tribe of Andropogoneae, genus of Sorghum and species of bicolor. Sorghum is major cereal in semi-arid region of the world it is an important food crop but in India it is majorly used as a feed crop grown in both rainy and post rainy season. It is a staple food in Africa and used as traditional foods and bakery product, most of the grains are for human consumption which are consumed in different forms like porridge, bread, gruel, tortillas, steam cooked products, alcoholic and non-alcoholic beverages. It is also a gluten free cereal important in the recent increased scenario of increase in the celiac disease, immunological response to gluten intolerance

Nowadays consumers are more conscious of their food selection owing to growing awareness about nutritional dependent ailments. Sorghum grain largest part, endosperm is comparatively poor in oil and mineral content. Sorghum is generally low in ash and rich in fiber as well as carbohydrates that are released slowly hence it is beneficial for diabetics.

Material and Methods

The current investigation was carried out in the academic year 2016–17. The many sorghum varieties, including M-35 1 (*Bilijola*), AKJ-1 (*Atharga kempu jola*), SMJ-1 (*Sakkari mukkari jola*), and KMJ-1 (*Kagi moti jola*) or pop sorghum, were gathered from farmer farms between Vijayapur and the Regional Agricultural Research Station. Other ingredients were purchased from the nearby Dharwad market to make cookies with sorghum and refined wheat flour. Sorghum flour's physico-chemical characteristics were investigated.

Visual observation was used to record the color of the flour. In a 5 ml pre-weighed centrifuge tube, various sorghum variety flours were suspended, and the tube was centrifuged for 10 minutes at 3000 rpm. In a dish, the supernatant was placed. Weighing the remaining gel, we calculated its capacity to absorb water. Visual observation was used to determine dough consistency.

Chemical composition of flours such as sorghum varieties *Bilijola*, *Sakkari mukkari jola*, *kempu jola* and *Kagi moti jola* flours were analyzed for moisture, crude fat, crude protein, crude fibre and ash on moisture free basis in triplicates using standard procedures. Further the mineral such as iron (AAS) was analyzed.

Experimental Results

Physical characteristics of sorghum varieties are described in Table 1. M-35-1 (white

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sorghum) had more weight than AKJ-1 (red sorghum) (58 g), according to the grain weight of the two sorghum types. M-35-1 (white sorghum) had the maximum grain volume (34 g), whereas AKJ-1 (red sorghum) and SMJ-1 (*hurda*) had the lowest volume (19 g). The bulk density (3.2w/v) of the M-35-1 (white sorghum), KMJ-1 (pop sorghum), and SMJ-1 (*hurda*) genotypes was comparable. For both weight and volume, there were noticeable variances. Similar observations were made by (Subramanian and Jambunath 1980) [5] (Table 1).

Table 2 shows the flour qualities of various sorghum cultivars. Visual examination revealed that M-35-1, KMJ-1, and SMJ-1 were white, and AKJ-1 was red colour. M-35-1 and AKJ-1 doughs were rough and non-stretchable, whereas KMJ-1 and SMJ-1 doughs were slightly smooth. KMJ-1 had the highest water absorption index (2.76 g), followed by AKJ-1 (2.45 g), and SMJ-1 had the lowest (2.04 g). There was no significant variation in water absorption index amongst the selected sorghum varieties.

The flour nutrient composition of different types of sorghum varieties are depicted in Table 3. The moisture content of sorghum varieties was ranging from 9.83 to 10.93 percentage, AKJ-1 (red sorghum) (9.8%) had lower moisture while KMJ-1 (pop sorghum) (10.93%) had higher moisture content.

Ash content ranged from 1.37 percent to 1.91 percent in various sorghum varieties, with SMJ-1 (*Hurda*) having the highest ash content (1.91%), followed by (M-35-1) white sorghum (1.37%). Protein content ranged from 11.90 percent to 16.73 percent among the varieties, with higher content

observed in Pop Sorghum (16.73%) and lower in (AKJ-1) red sorghum (11.90%). Carbohydrate content ranged from 66.23 percent to 72.01 percent in various varieties, with the highest concentration (AKJ1 red sorghum) at 72.01 percent and the lowest concentration (KMJ1) pop sorghum (66.01%). Crude fiber content ranged from high (SMJ-1 (*hurda*)) to low (1.31%). Fat content ranged from 4.73 percent to low (KMJ 1). Pop Sorghum had the highest fat content (3.21%). All sorghum varieties showed significant differences in fat content.

The trace mineral composition of sorghum varieties is given in Table 4. Iron content of sorghum varieties was ranging from 10.14 to 14.23 mg. Among all selected varieties, KMJ 1 (pop sorghum) (14.23 mg) recorded high iron content followed by SMJ-1 (*Hurda*) (11.67 mg), (AKJ-1) red sorghum (10.14 mg) and M-35-1 (white sorghum) (10.12 mg). Highly significant differences were noticed among varieties for iron content. The zinc content of sorghum varieties varied between 2.61 to 2.76 mg, highest content was found in SMJ-1 (*hurda*) (2.76 mg) followed by M-35-1 (white sorghum) (2.67 mg) and KMJ-1 (pop sorghum) (2.64 mg) and lowest content was found in AKJ-1 (red sorghum) (2.61 mg). Non significant differences were observed among the sorghum varieties for zinc content. Chemical composition of sorghum varieties varied significantly for all parameters within the varieties the variation could be due to genetic and environmental condition (Chaitanya Itagi and Hemalatha 2017) [6].

Table 1: Physical characteristics of sorghum grains

Characteristics	M-35-1	KMJ-1	SMJ-1	AKJ-1	t value	C. D.
Colour	White	White	White	Red		
Weight (1000 grains)	113.1±0.57	84±0.10	64±0.00	58±0.00	2.3060*	1.0870
Volume (ml) (1000 grains)	34±0.57	25±0.57	19±0.57	19±0.57	2.3060*	1.0870
Bulk density	3.2±0.04b	3.2±0.04a	3.2±0.09a	3.0±0.08a	2.3060*	0.4494

*Significant at 5% level

NS- Non Significant

Table 2: Flour properties of different sorghum varieties

Characteristics	M-35-1	KMJ-1	SMJ-1	AKJ-1	S.Em.	C. D.
Flour colour	White colour	White colour	White colour	Red colour	-	-
Dough consistency	Rough and less stretchable	Little smooth	Smooth	Rough and less stretchable	-	-
Water absorption Index (g/g)	2.05±0.0	2.76±0.00	2.04±0.0	2.45±0.0	0.698	1.139082

NS- Non Significant

Table 3: Nutrient composition of different sorghum variety flours (g%)

Sorghum varieties	Moisture	Ash	Protein	Fat	Crude fiber	CHO	Energy (kcal)
M35-1 (white sorghum)	10.87±0.01	1.37±0.0	14.11±0.39	4.73±0.0	1.55±0.01	67.37±0.43	368±0.06
KMJ-1 (pop sorghum)	10.93±0.01	1.58±0.05	16.73±0.20	3.21±0.05	1.31±0.02	66.23±0.19	360±0.13
SMJ-1 (<i>hurda</i>)	10.05±0.03	1.91±0.01	15.04±0.0	3.89±0.0	1.83±0.0	67.28±0.03	364±0.10
AKJ-1 (Red sorghum)	9.83±0.07	1.55±0.03	11.90±0.0	3.24±0.01	1.49±0.0	72.01±0.04	364±0.25
S.Em.±	0.052	0.037	0.261	0.037	00	0.27	0.566
C. D. @ 5%	0.124*	0.867*	0.619*	0.087*	00	0.65*	0.922*

RWF- Refined wheat flour

* Significant at 5% level

Table 4: Mineral composition of different sorghum varieties (mg/100 g)

Varieties	Fe	Zn
M35-1	10.12±0.10	2.67±0.11
KMJ-1	14.23±0.60	2.64±0.10
SMJ-1	11.67±0.51	2.76±0.07
AKJ-1	10.14±0.22	2.61±0.04
CD@1%	0.7783**	NS
S.Em±	0.4773	0.1045

** Significant at 1% level

Conclusion

The M 35-1 had highest weight and volume among the varieties varied significantly. The dough consistency of M-35-1 and AKJ-1 varieties was rough and non stretchable whereas KMJ-1 and SMJ-1 was slight smooth. The ash content highest was found in SMJ-1 (*Hurda*) (1.91%), KMJ-1 (pop sorghum) (16.73 g) had higher protein content, M-35-1 (white sorghum) (4.73%) had higher fat content, Smj-1(1.83%) had highest crude fiber content significant differences were observed between the all sorghum varieties. Trace mineral content KMJ 1 (pop sorghum) (14.23 mg) recorded high iron content varied significantly among the varieties.

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