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Screening of Sorghum Varieties for Papad Preparation

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ABSTRACT

Keywords

Sorghum varieties, papad, Physico- chemical and
Sensory characteristics.

Article Info

Accepted: 17 June 2017 Available Online: 10 July 2017 result revealed that moisture, protein, fat, ash and total carbohydrate content in the Sorghum papad prepared from Parbhani Moti sorghum variety were found in the range of 9 to 9.25 %, 8.39 to 12.64%, 0.88 to 1.05 %, 0.54 to 1.27% and 76.77 to 80.21% respectively. Parbhani Moti sorghum variety was selected among five sorghum varities based on organoleptic evaluation of papads.

The study was conducted in the laboratory of the Department of Food

Trade and Business Management, College of Food Technology, VNMKV Parbhani, to screening of sorghum varieties for papad preparation. Papads were prepared from different sorghum varieties and analyzed for proximate composition, physico-chemical analysis and organoleptic evaluation. The

Introduction

Sorghum [Sorghum bicolor (L.) Moench] popularly called as jowar, is the "king of millets" and is the fifth in importance among the world's cereals after wheat, rice, maize and barley (Anglani, 1998; Awika and Rooney, 2004). Great advantage of sorghum is that it can become dormant under adverse conditions and can resume growth after relatively severe drought. The future promise of sorghum in the developed world is for wheat substitution for people with celiac disease or allergies to gluten (Bogue and 2008). U.S. Department Sorenson, of Agriculture Foreign Agricultural Service USDA states world sorghum production is forecasted to reach to 65.2 million tons in 2016/17 season.

Papad is indigenous traditional snack item with thin wafer like product prepared from variety of ingredients.

Apart from value addition by processing to traditional products from these grains, development of newer products offers variety, convenience, quality, cost- efficiency and scope for increasing the nutritional value (Veena *et al.*, 2012).

Generally, cereal papads are prepared from gelatinized flour prepared of soaked grains. In addition to legume based products, papads are also made from tapioca, sago, jackfruit, gelatinized rice flour and wheat flour (Arya, 1990).

Materials and Methods

Raw materials

Sorghum [Sorghum bicolor (L.) Moench] varieties like Parbhani Moti, Parbhani Jyoti, Akola Kranti, Phule Revati and Phule Vasuda were procured from Sorghum Research Station Parbhani, Maharashtra. Refined vegetable oil, papad khar and spice mix were procured from local market for preparation of sorghum papad. Chemicals (analytical grade) and glass wares required during experiments were used from laboratory. Equipments and machineries like domestic mixer (for grinding of sorghum), texturometer (Stable Micro System TAXT2 plus), colour measuring instrument - Colorflex EZ, cabinet drier, microwave oven required in the present investigation were used, these equipments available in College of Food were Technology, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani.

Physico-chemical analysis

Physical Characteristics of Sorghum varieties like geometric mean diameter (GMD) (Gürsoy and Güzel, 2010), 1000 kernel weight of sorghum grains (W1000), bulkd density (BD) (AOAC, International 1990), true density (ρ t), porosity (ϵ) were determined with the help of different formulae for respective parameter.

Preparation of papad

Sorghum batter and water were used for preparing sorghum papad. Papadkhar was added to sorghum batter before batter was added to boiling water. Water was allowed to boil in a aluminium vessel and the batter was added to the boiling water coupled with stirring. The cooking process continues for 10 min with continuous stirring; the vessel was removed from the fire. Cooked slurry was poured onto a moist cotton cloth and spread it to 10 cm diameter with 2 mm thickness and allowed for drying.

Physical quality attributes of raw and fried sorghum papad

Total yield and number of sorghum papad

The total number of sorghum papad obtained from 100 g of different sorghum (*Sorghum vulgare*) varieties soaked for different durations were weighed and the total yield and number of sorghum papad were recorded. The raw sorghum papad prepared from different types of Sorghum varieties soaked for different durations were deep fried in refined sunflower oil at $180^{\circ}C \pm 5^{\circ}C$ were investigated to different quality attributes.

Unit weight of raw and fried sorghum papad

The unit weight of raw and fried sorghum papad of different sorghum varieties soaked for different durations were recorded by taking the weight of 10 sorghum papad.

Diameter of raw and fried sorghum papad

The diameter of raw and fried sorghum papad of different sorghum varieties and soaked for different durations were measured on opposite ends with the help of thread and recorded.

Expansion percentage of fried sorghum papad

The expansion percentage of fried sorghum papad was calculated according to the procedure of Vidyavati *et al.*, (2004).

Expansion (%) =
$$\frac{DF - DR}{DR} \times 100$$

Where, DF = diameter of fried papad; DR = diameter of raw papad;

Major chemical characteristics of sorghum varieties and papad such as moisture (AOAC, International 1990), ash (AOAC, International 1990), fat (AOAC, International 1990), protein (AOAC, International 1990) and total carbohydrate (Pearson, 1976) were determined along with minerals like calcium and iron (Raghuramulu *et al.*, 2003).

Statistical analysis

The data were analyzed for difference of significance by ANOVA used CRD and CD values are presented.

Results and Discussion

Visual parameters of sorghum cultivars

The samples were compared with Munsell colour chart and colour was represented in the values of hue, value and chroma. Colour of Parbhani Moti, Parbhani Jyoti, Phule Vasuda, Akola Kranti, Phule Revati were pearly white(5Y 8/2), creamy white(5Y 7/2), dull white(10YR 8/2), pale yellow(10YR 7/2) and pearly white(10YR 6/2) respectively. In sorghum phenolic compounds, particularly anthocyanins and condensed tannins are major contributors of colour of the grains (Awika and Rooney 2004). Results were nearer to the results physico-chemical properties of sorghum genotypes reported by Jambamma *et al.*, (2011) (Table 1).

Physical properties of sorghum cultivars

The highest thousand kernel weight (34.30g) and thousand kernel volume (28.5 ml) was observed for Parbhani Moti. Whereas the lowest thousand kernel weight (33.1g) and thousand kernel volume (18.5 ml) was observed in Parbhani Jyoti and Akola Kranti

respectively. This variation may be due to genotypic differences. The weight of thousand kernals is influenced by meteorological factors, methods of farming and genotypic differences (Liman et al., 2012). True density is an index of floury and corneous endosperm ratio inside the kernels. Higher the density indicates hardness of the grain (Rooney and Miller, 1982). The true density of Akola Kranti (as 1.8 g/ml) was found to be highest while Parbhani Moti reported lowest one (1.2 g/ml). Akola Kranti had recorded highest bulk density (0.9 g/ml) while Parbhani Moti reported lowest one (0.6 g/ml). No significant difference in the value of angle of repose was observed among the cultivars. The obtained values for physical properties recorded in the present study are in line with findings of Vannalli et al., (2008) (Table 2).

Nutritional composition of sorghum varieties

Moisture content was range from 12 to 13.9 per cent, fat (3.8 to 4.71 per cent), protein (9.8 to 15.08 per cent), carbohydrate (65.8 to 70.52 per cent) and ash content was ranged from 1.89 to 2.06 per cent.

The variation in per cent chemical composition might be due to variation in recipe. Statistically results were found to be significant at CD at 5 per cent. Similar range of per cent chemical composition was reported by Chavan *et al.*, (2009) and Jambamma *et al.*, (2011) (Table 3).

Physical quality attributes of raw sorghum papad

Total yield of sorghum papad

The highest yield of papad was observed for Phule Revati soaked for three days (80.5 g) and lowest for Parbhani Jyoti papad soaked for five days (72.4 g). This is mainly due to the separation of bran along with the adhered residual starch during preparation of batter from soaked whole cereal and millets grains. Similar results were good accordance with results reported by Manan *et al.*, (1993) (Table 4).

Number of sorghum papad

The number of papad obtained was highest in one day soaked grains (17.8) followed by three days (17) and five days soaked grains (16.1). In the interaction effect the number of papad obtained from different varieties of sorghum grains soaked for different duration was significant at five per cent level.

Unit weight of raw sorghum papad

The highest weight (5.5 g) was observed in Phule Revati papad prepared by five days soaked grains lowest was in Phule Vasuda papad prepared from one day soaked grains (3.92 g). Increase water uptake by the severely damaged starch granules of five days soaked grains may be the reason for increased diameter. Soaked grains of one day were slightly hard to grind so the internal damage was less (Manan *et al.*, 1993).

Diameter of raw sorghum papad

The diameter of raw papad ranged from 8.1 to 8.2 cm with a mean of 8.1 cm. The diameter

of the Parbhani Jyoti papad was significantly highest (8.2 cm) followed by Phule Revati (8.13 cm). Similarly the increase in the diameter of papad prepared from cereals soaked for five days may be due to the increased water uptake by the ruptured granules of starch during steaming (Srilakshmi, 2006).

The wide variation in the total yield, number of papads, unit weight and diameter of raw and fried papad among the sorghum varieties may be attributed to the variation in chemical composition, nature of starch. their characteristic shape, size and cooking behavior of the starch present in them depending upon the plant from which they are derived (Hadimani and Malleshi, 1993 and Srilakshmi, 2006).

Physical quality attributes of fried sorghum papad

Weight of fried papad

The weight of fried papad ranged from 5.24 to 6.29 g with mean value of 5.76 g. Among the sorghum varieties, significantly highest weight of fried papad was observed in Phule Revati (6.29 g) and lowest was in Phule Vasuda papad (5.24 g) (Table 5).



Fig.1 Mean sensory score values for the sorghum papad prepared from 3 days soaked grains

Sr.	Cultivars	Visual parameters of grain						
No.		Colour	Muncell notation for colour	Shape				
1.	Parbhani Moti	Pearly white	5Y 8/2	Very bold				
2.	Parbhani Jyoti	Creamy white	5Y 7/2	Bold				
3.	Phule Vasuda	Dull white	10YR 8/2	Round				
4.	Akola Kranti	Pale yellow	10YR 7/2	Bold				
5.	Phule Revati	Pearly white	10YR 6/2	Round				

Table.1 Visual properties of sorghum

Table.2 Physical properties of sorghum

	Physical properties of grains									
Grains	Thousand Kernels Weight (g)	Kernel Size G.M.D (mm)	Thousand Kernel volume (ml)	True Density (g/ml)	Bulk Density (g/ml)	Angle of Repose (Degrees)				
Parbhani Moti	34.3	3.81	28.5	1.2	0.60	32° 42′				
Parbhani Jyoti	33.1	4.08	23	1.4	0.70	32° 11′				
Phule Vasuda	34.1	3.91	26	1.3	0.65	30° 15′				
Akola Kranti	34.2	4.02	18.5	1.8	0.90	31° 12′				
Phule Revati	34.2	3.73	24	1.3	0.65	30°12′				
SE ±	0.1105	0.0270	0.129	0.0577	0.0624	-				
CD at 5 %	0.3331	0.08161	0.3890	0.1739	0.1882	-				

Note: Each value is a mean of three determinations

Table.3 Nutritional composition of sorghum varieties

Particulars	Moisture Per cent	Fat Per cent	Protein Per cent	Carbohydra te Per cent	Ash Per cent
Parbhani Moti	12	4.04	15.08	66.77	2.06
Parbhani Jyoti	13.5	3.9	14.7	65.8	2
Phule Vasuda	13.8	4.71	9.95	69.54	1.9
Akola Kranti	13.03	3.8	13.9	67.33	1.94
Phule Revati	13.9	3.89	9.8	70.52	1.89
SE ±	0.3631	0.0410	0.0472	0.0411	0.2396
CD at 5 %	1.0943	0.1236	0.1424	0.1241	0.7222

Note: Each value is a mean of three determinations

Sanahum	Total yield of papad (g)			Number of papad				Unit weight (g)				Diameter (cm)				
Vorioty						Duration of soaking (days)										
variety	1	3	5	Μ	1	3	5	Μ	1	3	5	Μ	1	3	5	Μ
Parbhani Moti	79	79.5	72.5	77	18.5	17.4	16.6	17.5	4.01	4.45	5	4.4	8.05	8.18	8.35	8.1
Parbhani Jyoti	78.9	79.4	72.4	76.9	18	17.1	16.3	17.1	4.1	4.5	4.9	4.5	8.1	8.2	8.3	8.2
Phule Vasuda	79.8	80.2	75.5	78.5	18.6	17.5	16.1	17.4	3.92	4.2	4.7	4.2	8.02	8.12	8.3	8.1
Akola Kranti	79	79.5	74.3	77.6	17.4	16.9	16.1	16.8	4.8	4.9	5.3	5	8.04	8.14	8.35	8.1
Phule Revati	80	80.5	75	78.5	16.9	16.1	15.8	16.2	4.85	4.99	5.5	5.1	8	8.1	8.29	8.13
Mean	79.3	79.8	73.9	77.7	17.8	17	16.1	17	4.3	4.6	5	4.6	8	8.1	8.3	8.1
SE ±	0.3679	0.0577	0.2670	-	0.2633	0.05 77	0.05 77	-	0.0367	0.0448	0.26 33	-	0.25 95	0.03 67	0.03 67	
CD at 5%	1.1336	0.1779	0.823	-	0.8114			-	0.1133	0.1382	0.81 14	-	0.79 97	0.11 33	0.11 33	

Table.4 Physical characteristics of raw papad prepared from different Sorghum varieties soaked for different durations

Note: Each value is a mean of three determinations

Table.5 Physical characteristics of fried papad prepared from different Sorghum varieties soaked for different durations

	Unit weight (g)				Diameter (cm)				Expansion per cent (%)			
Sorghum Variety	Duration of soaking of grains (days)											
, arreey	1	3	5	Μ	1	3	5	Μ	1	3	5	Μ
Parbhani Moti	4.82	5.51	6.17	5.5	9.52	10.42	10.51	10.15	18.26	27.38	25.86	23.83
Parbhani Jyoti	5.35	5.58	6.04	5.65	9.48	10.29	10.4	10.06	17.03	25.48	25.3	22.6
Phule Vasuda	4.74	5.2	5.8	5.24	9.34	10.05	10.25	9.88	16.45	23.76	23.49	21.23
Akola Kranti	5.82	6.07	6.54	6.14	9.37	10.15	10.28	9.93	16.54	24.69	23.11	21.45
Phule Revati	5.93	6.18	6.78	6.29	9.32	10.1	10.2	9.87	16.5	24.69	23.03	23.86
Mean	5.18	5.71	6.27	5.76	9.41	10.2	10.33	9.98	17.07	25.2	24.16	22.94
$SE \pm$	0.01	0.02	0.03	-	.005	0.02	0.05	-	0.02	.005	0.02	-
CD at 5 %	0.03	0.08	0.12	-	0.01	0.08	0.17	-	0.08	0.01	0.08	-

Note: Each value is a mean of three determinations

Table.6 Nutritional composition of raw sorghum papad

Sr No.	Papad prepared from sorghum variety	Moisture Per cent	Fat Percent	Protein Per cent	Carbohydrate Per cent	Ash Per cent
1	Parbhani Moti	9	1.05	12.64	76.77	0.54
2	Parbhani Jyoti	9.6	0.93	11.93	76.95	0.59
3	Phule Vasuda	9.3	1.12	8.09	80.93	0.56
4	Akola Kranti	9.5	0.9	11.3	77.73	0.57
5	Phule Revati	9.05	0.92	7.97	81.5	0.56
	Mean	9.29	0.98	10.38	78.77	0.56
	SE ±	0.0517	0.0263	0.0269	0.0628	.005
	CD at 5 %	0.1593	0.0811	0.0831	0.1936	.017

Note: Each value is a mean of three determinations

Sorghum variety	Appearance	Colour	Flavour	Taste	Texture	Overall Acceptability
Parbhani Moti	8.3	9	8.3	8.4	8.1	8.3
Parbhani Jyoti	8.1	8.6	7.8	8.1	7.8	7.3
Phule Vasuda	8.2	7.9	7.1	7.2	7.1	7.5
Akola Kranti	7.6	7.8	7.5	7.2	7.2	7.5
Phule Revati	7.8	6.3	7.2	7.5	6.8	7.2
Mean	8	7.92	7.58	7.68	7.4	7.56
$SE \pm$	0.0577	0.2633	0.0576	0.057	0.0714	0.0577
CD at 5 %	0.1779	0.8114	0.1878	0.178	0.2203	0.1779

Table.7 Mean sensory score values for the sorghum papadPrepared from three days soaked grains

Note: Each value is a mean of three determinations

Diameter of fried papad

The highest diameter was observed in Parbhani Moti papad soaked for five days (10.51 cm) and lowest was in Phule Revati papad soaked for one day (9.32 cm). A definite pattern of total amylose and hot water insoluble amylose contents may be related to better expansion of cereals and millets (Kotagi, 2002).

Expansion per cent of fried papad

The highest expansion per cent was observed in Parbhani Moti soaked for three days (27.38) and lowest was in Phule Revati papad soaked for one day (16.5).

The expansion per cent increase in papad during frying may be due to the replacement of moisture by oil due to the higher content of water insoluble amylase (Chinnaswamy and Bhattarcharya, 1986).

Nutritional composition of raw sorghum papads

The data pertaining to the chemical composition of sorghum papad prepared

samples from different sorghum varieties was as follows, moisture content was range from 9 to 9.6 per cent, fat (0.9 to 1.12 per cent), protein (7.97 to 12.64 per cent), carbohydrate (76.77 to 81.5 per cent) and ash (0.54 to 0.59 per cent) (Table 6).

Organoleptic evaluation of sorghum papads

Mean appearance scores ranged from 7.6 to 8.3 with a mean of 8. Parbhani Moti papad scored highest (8.3) followed by Phule Vasuda (8.2) and Parbhani Jyoti papad (8.1). Mean colour scores ranged from 6.3 to 9.0 with a mean of 7.92. Parbhani Moti papad scored highest (8.3) followed by Parbhani Jyoti papad (8.6). The least score was obtained for Phule Revati (6.3).

The Parbhani Moti papad scored highest (8.1) followed by Parbhani Jyoti (7.80). The lowest was in Phule Revati papad (6.8). The overall acceptability score ranged from 7.2 to 8.3 with a mean of 7.56. Parbhani Moti papad scored highest (8.3) followed by Phule Vasuda (7.5) and Akola Kranti (7.5). The least was in Phule Revati papad (7.2). The result of present study was in good

accordance with results reported by Nazni and Pradheepa 2010.

Changes in sensory attributes of fried sorghum papads

As the duration of soaking of grains increased there was development of off flavour in the fried papad. Papad prepared from five days soaked grains developed very mild off flavour. The result of changes in sensory attributes of fried Sorghum papads was in good accordance with results reported by Venkatesh *et al.*, (1970). The textural changes in papad were attributed to the increased surface area by carbon dioxide liberated from Papad Khar during frying (Chowdhury *et al.*, 2009). The result of comparison of sorghum papad with black gram & finger millet papads was in good accordance with Shwetha *et al.*, (2009) (Table 7 and Fig. 1).

It can be concluded from above discussion that three days soaking period for sorghum grains is suitable for papad making. Out of five cultivars of sorghum on the basis of physical parameters, sensory characteristics and yield of papad Parbhani Moti cultivar found most suitable for papad preparation by conventional method.

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