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Effect of storage period on nutritional qualities of *sev* prepared from different cultivars of sorghum

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Abstract
The varieties Phule Panchami, Phule Rohini, Phule Anuradha, Phule Suchitra, Phule Vasudha, Phule Revati and M 35-1 (Maldandi) procured from AICRP, on Sorghum, MPKV, Rahuri were used for study. Factorial Randomized Design was used to perform the experiment. The organoleptic properties were judged on the basis of colour and appearance, texture, flavour, taste and overall acceptability by using 9-point hedonic scale. Treatment T_2 *sev* was found to be superior to other combinations in a preliminary study i.e. (50% sorghum flour and 50% Bengal gram flour). *Sev* prepared from 7 varieties shows moisture content ranges from 2.60% to 2.79%, highest in Phule Panchami. The fat level of the varieties ranged from 16.69% to 21.01%, with Phule Rohini having the high. The protein content of the varieties ranged from 11.61% to 13.38%, with the Phule Rohini having the high. The crude fibre content ranged from 3.86% to 4.21%, with the highest in the Phule Suchitra. The total carbohydrates content ranged from 59.61% to 65.21%, with the highest in M 35-1. The calcium content ranged from 31.39mg/100g to 35.43 mg/100g, with Phule Rohini containing the highest. The iron content ranged from 5.27mg/100g to 8.44 mg/100g, with Phule Panchami having the highest. The chemical composition of control *sev* showed 4.28% moisture, 23.49% fat, 16.27% protein, 3.29% crude fiber and 52.56% carbohydrate. Calcium and iron content were 50.72 and 8.51mg/100g respectively. During the storage study chemical parameter such as moisture content of *sev* increases but other parameters such as protein, fat, carbohydrate, crude fibre and calcium, iron are decreases. Chemical evaluation results into *sev* prepared from Phule Revati variety stored in LDPE packaging material show good quality and remained in excellent condition even up to 28 days.

Keywords: Sorghum, *sev*, nutritional, sensory, storage period, LDPE

Introduction
Sorghum (*Sorghum bicolor* (L.) Moench), often known as *jowar*, is a member of the *Graminae* family and has a diploid chromosome number of $2n = 20$. After wheat, rice, maize and barley, sorghum is the world's fifth most important cereal (Anglani, 1998; Awika and Rooney, 2004) [4, 5]. Sorghum (*Sorghum bicolor* L. Moench) and maize (*Zea mays*) are members of the *Panicoideae* subfamily of the *Gramineae* family. *Sorghum vulgare* and *Sorghum bicolor* are grasses species. Sorghum is said to have originated in Central Africa, according to several ideas. It expanded over Asia and India somewhere between 4500 and 1000 BC (Kimber, 2000) [9]. In North America, it is commonly known as milo or milo-maize. It grows in dry and semi-arid climates across the world (Murty and Kumar, 1995) [12]. Sorghum has a higher protein level than maize; however it has a lower fat content and the same quantity of carbohydrates. Sorghum is gluten-free and has more fibre and minerals than wheat. High yielding cultivars and hybrids with enhanced agronomic characteristics have been developed, resulting in surplus output. Sorghum has 348 calories per 100g, 10.3g of protein, 1.9g of fat 72.5g of carbohydrates, 24 milligram of calcium, 4.1 milligram of iron, 0.37 milligram of thiamine and 0.14 milligram of riboflavin. Sorghum contains phenolic and several types of tannins, which give energy and antioxidants (Chavan and Salunkhe, 1984) [7]. The moisture content of Indian sorghum grain was determined to be 11.9 percent, 10.4 percent protein, 1.9 percent fat, 72.6 percent carbohydrates and 1.6 percent minerals (Shakuntala and Shadaksharaswamy, 2001) [21]. In the grain, starch is the most abundant carbohydrate. Simple sugar, cellulose and hemicelluloses are some of the other substances found.

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The amount of amylose in starch fluctuates between 21 and 28 percent. Amylose is rare in waxy forms of starch. Free sugar may be found in both waxy and normal starches, ranging from 1 to 2%. Sucrose (0.85%), glucose (0.09%), fructose (0.09%) and maltose (0.09%) are the most common sugars. Albumin (5%) globulin (6.3%), prolamin (46.4%) and glut Elin (30.4%) are the various protein fractions found in Indian sorghum (Salunkhe et al., 1977) [20].

In Maharashtra, there are native sorghum types. The following are the most essential: The All India Coordinated Sorghum Improvement Project has published a number of new sorghum genotypes, including Phule Revati, Phule Vasudha, Phule Anuradha, Phule Rohini, Phule Panchami, Phule Madhur, Phule Chitra, Phule Suchitra, Phule Yashoda, Akola kranti, Parbhani Moti and Parbhani Jyothi. In many parts of our nation, sev is a well-known deep-fat fried snacks dish (Pruthi et al., 1983) [17]. It is typically served using Bengal gram flour (Besan) and numerous additions like as salt, spices and sodium bicarbonate; many additional ingredients are also used to impart a crisp and crunchy quality, as well as improve the physical state of the fried food (Berry et al.; 1986) [6].

Materials and Methods
Varieties of sorghum
The grains of seven sorghum varieties viz., Phule Anuradha, Phule Panchami, Phule Rohini, Phule Vasudha, Phule Revati, Phule Suchitra and M 35-1 (Maldandi) for this study were obtained from the All India Co-ordinated Sorghum Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri.

Ingredients for Sev
Ingredients as shown in table such as Bengal gram flour, cumin seeds, again seeds, chilli powder, oil, salt, turmeric powder purchased from local market of Rahuri.

Packaging material
The packaging material viz., LDPE bags were procured from local market and used for packaging of sev for storage study.

Chemical properties of sorghum sev
The A.O.A.C. (2000) [2] technique was used to calculate the moisture content. The total protein content of the samples was determined by standard Micro-kjeldhal method to determine total nitrogen content (A.A.C.C., 2000) [2]. The predicted total nitrogen content was multiplied by a factor of 6.25 to get the total protein content. The fat content was calculated using the A.O.A.C. Soxhlet technique (2000). The A.O.A.C. technique was utilized to determine the crude fibre content (2000). The content of carbohydrate in the selected samples were obtained by subtracting from 100, the sum of values of moisture, protein, fat and ash content per 100 g of the sample (Raghuramulu, et al., 1993) [18]. The calcium content of the samples was measured using the technique (A.O.A.C., 2000) [2]. The iron concentration was determined using the colorimetric technique and the Spectronic-20 (AACC 2000) [2].

Preparation of dough / composite flour
The suitable combination was selected for all other varieties to prepare sev. This composite flour was utilized in the preparation of sev. All other ingredients were kept constant in all composite flours.

Table 1: Best recipe for preparation of sorghum sev

No.	Ingredient	Quantity
1	Sorghum flour + Chickpea flour (g)	100
2	Cumin seed powder (g)	2
3	Ajwain seed powder (g)	2
4	Chilli powder (g)	2
5	Oil (ml)	250
6	Salt (g)	2
7	Colour (Turmeric powder) (g)	0.2
8	Boiled water	As per requirement

Table 2: Various combinations of sorghum flour and Bengal gram flour for sev

Treatment	Sorghum flour (%)	Bengal gram flour (%)
T_0(Control)	00	100
T_1	25	75
T_2	50	50
T_3	75	25
T_4	100	00

The preliminary trials were done and best combinations identified for sev by organoleptic evaluation. The best combinations were utilized for final production of sev.
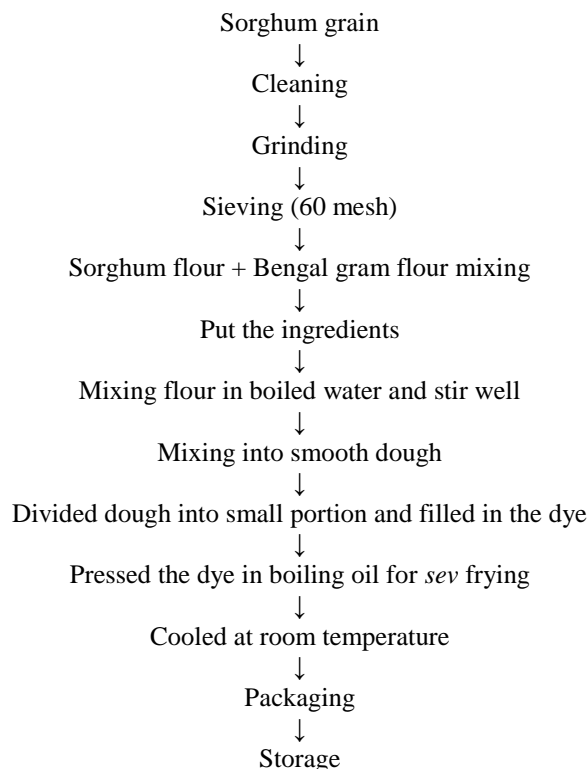
Procedure of *sev*

Sorghum grain
↓
Cleaning
↓
Grinding
↓
Sieving (60 mesh)
↓
Sorghum flour + Bengal gram flour mixing
↓
Put the ingredients
↓
Mixing flour in boiled water and stir well
↓
Mixing into smooth dough
↓
Divided dough into small portion and filled in the dye
↓
Pressed the dye in boiling oil for *sev* frying
↓
Cooled at room temperature
↓
Packaging
↓
Storage

Fig 1: Flow chart for preparation of sorghum s*ev*

Sensory / organoleptic evaluation of *sev*
The sensory / organoleptic evaluation of *sev* was carried out using the standard technique for colour and appearance, flavour, texture, taste and overall acceptability Amerine *et al.* (1980) [3]. Semi-trained judges were used and the quality of the sorghum *sev* was rated on a 1 to 9 point hedonic scale. The quality was assessed using the average of 10 judges.

Storage studies of *sev*
The *sev* were packaged in LDPE and kept at room temperature for 28 days. After interval of 0, 7, 14, 21 and 28 days, all samples were taken and analysed for chemical characteristics.

Statistical analysis
All studies were conducted with three to ten replications using Factorial Completely Randomized Design (FCRD) and

Completely Randomized Design (CRD). According to Rangaswamy's method, the results collected in this research were evaluated for statistical significance (2010).

Results and Discussion
Sensory evaluation of sorghum *sev* prepared with different combination of Bengal gram flour (Treatment selection)
A 9-point hedonic scale of sensory features such as colour, flavour, texture, taste, and overall acceptability was used to evaluate *sev* made from the Phule Revati cultivar. The treatment T_2 received the highest marks for colour and appearance, texture, flavour, taste, and overall acceptance. As a result, T_2 and T_0 were chosen for storage research. For a period of 28 days, products were stored in LDPE packaging material at room temperature.

Table 3: Sensory evaluation of sorghum *sev* prepared with Phule Revati variety with different combination of Bengal gram flour (Treatment selection)

Treatments	Colour and appearance	Texture (Crispiness)	Flavour	Taste	Overall acceptability	Rank
T_0	8.48	8.21	8.18	8.49	8.34	3
T_1	8.45	8.37	8.31	8.51	8.41	2
T_2	8.45	8.42	8.52	8.69	8.52	1
T_3	8.19	8.31	8.15	7.98	8.10	4
T_4	7.88	7.93	8.07	7.76	7.91	5
Mean	8.29	8.24	8.24	8.28	8.25	-
S.E(m)	0.0086	0.0097	0.0097	0.0106	0.0139	-
C.D at 5%	0.0270	0.0304	0.0304	0.0335	0.0438	-

All results are mean of ten replications. 9 points are the greatest value.
Whereas;
T_0: *Sev* prepared from 100% Bengal gram flour,
T_1: *Sev* prepared from 25% sorghum flour (Phule Revati) and 75% Bengal gram flour,
T_2: *Sev* prepared from 50% sorghum flour (Phule Revati) and 50% Bengal gram flour,
T_3: *Sev* prepared from 75% sorghum flour (Phule Revati) and 25% Bengal gram flour,
T_4: *Sev* prepared from 100% sorghum flour (Phule Revati) and 0% Bengal gram flour,

Chemical composition of sorghum *sev* and Bengal gram *sev* at 0 days
According to Mallick *et al*. (2014) [11], unripe banana *sev* has a moisture content of 2.54% to 2.96% and a fat content of 30.23% to 36.88%. The current values are consistent with those found in the literature. These results of chemical composition of fortified sorghum *sev* are comparable to Patekar *et al*., (2017) [16].

Table 4: Chemical composition of sorghum *sev* and Bengal gram *sev* at 0 days

Bengal gram: Sorghum (ratio)	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Bengal gram (100%)	4.28	16.27	23.49	3.29	52.56	50.72	8.51
M 35-1 (50:50)	2.75	11.65	16.69	3.99	65.51	32.57	6.82
Phule Revati (50:50)	2.72	12.43	17.49	3.94	63.96	33.39	5.36
Phule Anuradha (50:50)	2.68	12.80	20.24	4.05	60.88	31.39	7.75
Phule Vasudha (50:50)	2.64	12.25	18.61	3.99	63.10	34.50	5.43
Phule Suchitra (50:50)	2.62	11.61	19.19	4.21	63.18	33.96	5.27
Phule Rohini (50:50)	2.60	13.38	21.01	3.86	59.61	35.44	7.08
Phule Panchami (50:50)	2.79	13.07	19.32	4.18	61.42	32.93	8.44
Mean	2.88	12.93	19.50	3.93	61.27	35.61	6.833
S.E. +	0.0058	0.0058	0.0068	0.0082	0.0068	0.0115	0.0134
C.D. at 5%	0.0173	0.0173	0.0203	0.0245	0.0203	0.0346	0.0401

All results are mean of three replications.

5.3 Effect of storage period on chemical composition of *sev* prepared from different varieties of sorghum packaged in LDPE during storage
The current result indicates that the chemical composition of all varieties *sev* during storage does not alter significantly. Because the product is hygroscopic and absorbs moisture readily when exposed to the environment, there is a modest rise in moisture content. Singson *et al*. (2014) [23], Namitha *et al.* (2019) [14] and Pandey *et al*., (2018) [15] reported considerable increase in moisture content of value-added composite flour *sev* and reduction in protein, fat, and fibre content with increase in storage period. Sorghum contains a lot of crude fibre. As a result, sorghum-based goods have a greater crude fibre content than the control sample. Sorghum is a high-carbohydrate grain. As a result, when compared to the control in the current study, its product provides a higher level of total carbohydrates than the other items. Mallick *et al*. (2014) [11] unripe banana *sev* yielded similar findings. Because sorghum variety *sev* only contains 50% Bengal gram flour, its crude protein level is lower than the control sample.

M 35-1

Table 5: Effect of storage period on chemical composition of *sev* prepared from M 35-1

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_1	2.80	11.61	16.67	3.96	65.51	32.52	6.78
S.E. +	0.004	0.005	0.006	0.004	0.003	0.002	0.003
CD at 5%	0.013	0.014	0.019	0.012	0.010	0.007	0.009
Storage period							
S_1: 0 days	3.52	13.96	20.09	3.64	59.04	41.65	7.67
S_2: 7 days	3.52	13.94	20.09	3.63	59.04	41.63	7.66
S_3: 14 days	3.56	13.91	20.06	3.61	59.07	41.58	7.63
S_4: 21 days	3.61	13.90	20.03	3.61	59.06	41.57	7.59
S_5: 28 days	3.65	13.87	20.04	3.59	59.05	41.55	7.57
S.E. +	0.007	0.008	0.010	0.006	0.005	0.004	0.005
CD at 5%	0.020	0.022	0.030	0.019	0.015	0.012	0.014
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46
T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_1S_1	2.75	11.65	16.69	3.99	65.51	32.57	6.82
T_1S_2	2.75	11.63	16.69	3.97	65.51	32.53	6.81
T_1S_3	2.79	11.61	16.66	3.96	65.53	32.51	6.79
T_1S_4	2.84	11.60	16.64	3.96	65.51	32.49	6.75
T_1S_5	2.88	11.58	16.65	3.94	65.51	32.48	6.73
S.E. +	0.009	0.011	0.014	0.009	0.007	0.005	0.007
CD at 5%	NS	NS	NS	NS	0.022	0.016	NS

All results are mean of three replications
Whereas;
T_0: Control *sev* (100% Bengal gram)
T_1: Sorghum *sev* prepared from M 35-1 variety (50% sorghum flour + 50% Bengal gram flour)
S_1 to S_5: Storage period

Phule Revati

Table 6: Effect of storage period on chemical composition of *sev* prepared from Phule Revati

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_2	2.77	12.39	17.47	3.91	63.96	33.34	5.32
S.E. +	0.005	0.005	0.006	0.004	0.004	0.003	0.003
CD at 5%	0.014	0.014	0.016	0.012	0.011	0.008	0.008
Storage period							
S_1: 0 days	3.50	14.35	20.49	3.62	58.26	42.06	6.94
S_2: 7 days	3.50	14.33	20.49	3.61	58.27	42.04	6.93
S_3: 14 days	3.55	14.30	20.46	3.59	58.29	41.99	6.90
S_4: 21 days	3.59	14.29	20.43	3.58	58.29	41.98	6.86
S_5: 28 days	3.64	14.26	20.44	3.56	58.28	41.96	6.84
S.E. +	0.007	0.007	0.009	0.007	0.006	0.004	0.004
CD at 5%	0.022	0.021	0.026	0.020	0.017	0.012	0.012
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46
T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_2S_1	2.72	12.43	17.49	3.94	63.96	33.39	5.36
T_2S_2	2.72	12.41	17.49	3.92	63.96	33.35	5.35
T_2S_3	2.76	12.39	17.46	3.91	63.98	33.33	5.33
T_2S_4	2.81	12.38	17.44	3.91	63.96	33.31	5.29
T_2S_5	2.85	12.36	17.45	3.89	63.96	33.30	5.27
S.E. +	0.010	0.010	0.012	0.009	0.008	0.006	0.006
CD at 5%	NS	NS	NS	NS	0.024	0.017	NS

All results are mean of three replications
Whereas;
T_0: Control *sev* (100% Bengal gram)
T_2: Sorghum *sev* prepared from Phule Revati variety (50% sorghum flour + 50% Bengal gram flour)
S_1 to S_5: Storage period

Phule Anuradha

Table 7: Effect of storage period on chemical composition of *sev* prepared from Phule Anuradha

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_3	2.73	12.76	20.22	4.02	60.88	31.34	7.71
S.E. +	0.004	0.004	0.005	0.004	0.003	0.003	0.003
CD at 5%	0.013	0.013	0.015	0.013	0.009	0.008	0.008
Storage period							
S_1: 0 days	3.48	14.54	21.87	3.67	56.72	41.06	8.13
S_2: 7 days	3.48	14.51	21.87	3.66	56.73	41.04	8.12
S_3: 14 days	3.53	14.49	21.83	3.64	56.75	40.99	8.09
S_4: 21 days	3.57	14.47	21.81	3.64	56.75	40.98	8.06
S_5: 28 days	3.62	14.45	21.81	3.62	56.74	40.96	8.03
S.E. +	0.007	0.007	0.008	0.007	0.005	0.004	0.004
CD at 5%	0.021	0.020	0.023	0.021	0.014	0.013	0.012
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46
T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_3S_1	2.68	12.80	20.24	4.05	60.88	31.39	7.75
T_3S_2	2.68	12.78	20.24	4.03	60.88	31.35	7.74
T_3S_3	2.72	12.76	20.21	4.02	60.90	31.33	7.72

T_3S_4	2.77	12.75	20.19	4.02	60.88	31.31	7.68
T_3S_5	2.81	12.73	20.20	4.00	60.88	31.30	7.64
S.E. +	0.010	0.010	0.011	0.010	0.007	0.006	0.006
CD at 5%	NS	NS	NS	NS	0.020	0.018	NS

All results are mean of three replications
Whereas;
T_0: Control *sev* (100% Bengal gram)
T_3: Sorghum *sev* prepared from Phule Anuradha variety (50% sorghum flour + 50% Bengal gram flour)
S_1 to S_5: Storage period

Phule Vasudha

Table 8: Effect of storage period on chemical composition of *sev* prepared from Phule Vasudha

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_4	2.69	12.21	19.17	3.96	63.10	34.45	5.39
S.E. +	0.005	0.005	0.005	0.004	0.003	0.003	0.003
CD at 5%	0.014	0.014	0.015	0.012	0.008	0.008	0.008
Storage period							
S_1: 0 days	3.46	14.26	21.34	3.64	57.83	42.61	6.97
S_2: 7 days	3.46	14.24	21.34	3.63	57.84	42.59	6.96
S_3: 14 days	3.51	14.21	21.31	3.61	57.86	42.55	6.93
S_4: 21 days	3.55	14.20	21.28	3.61	57.86	42.54	6.90
S_5: 28 days	3.60	14.17	21.29	3.59	57.85	42.52	6.88
S.E. +	0.007	0.007	0.008	0.006	0.004	0.004	0.004
CD at 5%	0.022	0.021	0.023	0.019	0.012	0.013	0.012
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46
T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_4S_1	2.64	12.25	19.19	3.99	63.10	34.50	5.43
T_4S_2	2.64	12.23	19.19	3.97	63.10	34.46	5.42
T_4S_3	2.68	12.21	19.16	3.96	63.12	34.44	5.40
T_4S_4	2.73	12.20	19.14	3.96	63.10	34.42	5.36
T_4S_5	2.78	12.18	19.15	3.94	63.10	34.41	5.34
S.E. +	0.010	0.010	0.011	0.009	0.006	0.006	0.006
CD at 5%	NS	NS	NS	NS	0.017	0.018	NS

All results are mean of three replications
Whereas;
T_0: Control *sev* (100% Bengal gram)
T_4: Sorghum *sev* prepared from Phule Vasudha variety (50% sorghum flour + 50% Bengal gram flour)
S_1 to S_5: Storage period

Phule Suchitra

Table 9: Effect of storage period on chemical composition of *sev* prepared from Phule Suchitra

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_5	2.67	11.57	19.17	4.18	63.18	33.93	5.23
S.E. +	0.005	0.005	0.005	0.004	0.003	0.003	0.003
CD at 5%	0.015	0.014	0.015	0.012	0.008	0.008	0.008
Storage period							
S_1: 0 days	3.45	13.94	21.34	3.75	57.87	42.34	6.89
S_2: 7 days	3.45	13.92	21.34	3.74	57.88	42.34	6.88
S_3: 14 days	3.50	13.89	21.31	3.72	57.90	42.29	6.85
S_4: 21 days	3.54	13.88	21.28	3.72	57.90	42.28	6.82
S_5: 28 days	3.59	13.85	21.29	3.70	57.89	42.26	6.80
S.E. +	0.008	0.008	0.008	0.007	0.004	0.004	0.004
CD at 5%	0.024	0.022	0.023	0.020	0.013	0.013	0.012
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46

T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_5S_1	2.62	11.61	19.19	4.21	63.18	33.96	5.27
T_5S_2	2.62	11.59	19.19	4.19	63.18	33.95	5.26
T_5S_3	2.66	11.57	19.16	4.18	63.20	33.93	5.24
T_5S_4	2.71	11.56	19.14	4.18	63.18	33.91	5.20
T_5S_5	2.76	11.54	19.15	4.16	63.18	33.90	5.18
S.E. +	0.011	0.011	0.011	0.009	0.006	0.006	0.006
CD at 5%	NS	NS	NS	NS	0.018	0.018	NS

All results are mean of three replications.

Whereas;

T_0: Control *sev* (100% Bengal gram)

T_5: Sorghum *sev* prepared from Phule Suchitra variety (50% sorghum flour + 50% Bengal gram flour)

S_1 to S_5: Storage period

Phule Rohini

Table 10: Effect of storage period on chemical composition of *sev* prepared from Phule Rohini

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_6	2.65	13.34	20.99	3.83	59.61	35.38	7.04
S.E. +	0.004	0.005	0.005	0.012	0.003	0.003	0.003
CD at 5%	0.011	0.015	0.015	0.036	0.008	0.009	0.008
Storage period							
S_1: 0 days	3.44	14.83	22.25	3.58	56.09	43.08	7.80
S_2: 7 days	3.44	14.80	22.25	3.57	56.09	43.06	7.79
S_3: 14 days	3.49	14.78	22.22	3.55	56.12	43.01	7.76
S_4: 21 days	3.53	14.76	22.19	3.54	56.11	43.00	7.73
S_5: 28 days	3.58	14.74	22.20	3.52	56.10	42.98	7.70
S.E. +	0.006	0.008	0.008	0.019	0.004	0.005	0.004
CD at 5%	0.018	0.024	0.023	NS	0.013	0.014	0.012
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46
T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_6S_1	2.60	13.38	21.01	3.86	59.61	35.43	7.08
T_6S_2	2.60	13.36	21.01	3.84	59.61	35.39	7.07
T_6S_3	2.64	13.34	20.98	3.83	59.63	35.37	7.05
T_6S_4	2.69	13.33	20.96	3.83	59.61	35.35	7.02
T_6S_5	2.74	13.31	20.97	3.81	59.61	35.34	6.99
S.E. +	0.008	0.011	0.011	0.027	0.006	0.007	0.006
CD at 5%	NS	NS	NS	NS	0.018	0.020	NS

All results are mean of three replications.

Whereas;

T_0: Control *sev* (100% Bengal gram)

T_6: Sorghum *sev* prepared from Phule Rohini variety (50% sorghum flour + 50% Bengal gram flour)

S_1 to S_5: Storage period

Phule Panchami

Table 11: Effect of storage period on chemical composition of *sev* prepared from Phule Panchami

Parameter	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
Treatment							
T_0	4.34	16.21	23.45	3.26	52.59	50.67	8.46
T_7	2.84	13.03	19.30	4.15	61.42	32.88	8.40
S.E. +	0.005	0.005	0.005	0.004	0.003	0.003	0.003
CD at 5%	0.015	0.015	0.015	0.012	0.008	0.008	0.009
Storage period							
S_1: 0 days	3.54	14.67	21.41	3.74	56.99	41.83	8.48
S_2: 7 days	3.54	14.65	21.41	3.73	57.00	41.81	8.47
S_3: 14 days	3.58	14.62	21.37	3.71	57.02	41.76	8.44
S_4: 21 days	3.63	14.61	21.35	3.70	57.02	41.75	8.40
S_5: 28 days	3.68	14.58	21.35	3.68	57.01	41.73	8.38
S.E. +	0.008	0.008	0.008	0.006	0.004	0.004	0.005

CD at 5%	0.023	0.023	0.023	0.019	0.013	0.012	0.014
Interaction							
T_0S_1	4.28	16.27	23.49	3.29	52.56	50.72	8.51
T_0S_2	4.28	16.24	23.49	3.29	52.57	50.72	8.50
T_0S_3	4.33	16.21	23.45	3.26	52.60	50.65	8.46
T_0S_4	4.37	16.19	23.42	3.25	52.61	50.65	8.43
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_7S_1	2.79	13.07	19.32	4.18	61.42	32.93	8.44
T_7S_2	2.79	13.05	19.32	4.16	61.42	32.89	8.43
T_7S_3	2.83	13.03	19.29	4.15	61.44	32.87	8.41
T_7S_4	2.88	13.02	19.27	4.15	61.42	32.85	8.37
T_7S_5	2.93	13.00	19.28	4.13	61.42	32.84	8.35
S.E. +	0.011	0.011	0.011	0.009	0.006	0.006	0.007
CD at 5%	NS	NS	NS	NS	0.018	0.017	NS

All results are mean of three replications.
Whereas;
T_0: Control *sev* (100% Bengal gram)
T_7: Sorghum *sev* prepared from Phule Panchami variety (50% sorghum flour + 50% Bengal gram flour)
S_1 to S_5: Storage period

Chemical composition of sorghum *sev* at 28 days
From the chemical composition observed in all seven varieties at all over storage period and at 28 days it was found that Phule Revati sorghum variety at 50:50 proportion with Bengal gram is best suited for preparation of sorghum *sev*.

Table 12: Chemical composition of sorghum *sev* at 28 days

Bengal gram: Sorghum (50:50)	Moisture (%)	Protein (%)	Fat (%)	Crude fibre (%)	Carbohydrate (%)	Calcium (mg/100g)	Iron (mg/100g)
T_0S_5	4.42	16.16	23.42	3.23	52.59	50.62	8.41
T_1S_5	2.88	11.58	16.65	3.94	65.51	32.48	6.73
T_2S_5	2.85	12.36	17.45	3.89	63.96	33.30	5.27
T_3S_5	2.81	12.73	20.20	4.00	60.88	31.30	7.64
T_4S_5	2.78	12.18	19.15	3.94	63.10	34.41	5.34
T_5S_5	2.76	11.54	19.15	4.16	63.18	33.90	5.18
T_6S_5	2.74	13.31	20.97	3.81	59.61	35.34	6.99
T_7S_5	2.93	13.00	19.28	4.13	61.42	32.84	8.35
Mean	3.02	12.85	19.53	3.82	61.28	35.52	6.73
S.E. +	0.0068	0.0098	0.0101	0.0098	0.0091	0.0098	0.0084
C.D. at 5%	0.0203	0.0293	0.0302	0.0293	0.0274	0.0293	0.0252

All results are mean of three replications.
Whereas;
T_0: Bengal gram T_4: Phule Vasudha
T_1: M 35-1 T_5: Phule Suchitra
T_2: Phule Revati T_6: Phule Rohini
T_3: Phule Anuradha T_7: Phule Panchami
S_5: Storage period at 28 days

Conclusion
The present investigation showed that the *sev* prepared from 50% sorghum flour and 50% Bengal gram flour had better acceptability as compared to other combinations. These products can be kept for up to 28 days in LDPE packaging material in good condition. The control as well as sev prepared from different combination of sorghum flour and Bengal gram flour showed good chemical properties. It is concluded from all the chemical properties that Phule Revati variety of MPKV, Rahuri are best suited for *sev* preparation. Hence such sorts of value-added production have the potential to improve economic conditions and human health while requiring minimal investment.

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