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## Utilization of Deoiled soya Meal for Development of Traditional Products

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Dipali Sangekar<sup>1</sup> Eknath Langote<sup>2</sup>

Department of Food Science & Nutrition, College of Community Science, VNMKV, Parbhani,

**Corresponding Author- Dipali Sangekar**

Email:- [dipalisangekar01@gmail.com](mailto:dipalisangekar01@gmail.com)

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### Abstract

Deoiled soya meal has a great potential to be used as an ingredient for value addition by virtue of its nutrient richness and health benefits. There are several products which are empty calorie foods and they are deficient in protein, and micronutrients. The nutritional value of such products both quantitatively and qualitatively can be increased by using soyabean meal. Different types of traditional snacks are prepared by incorporation of deoiled soya meal i.e., *chakali*, *kharapara* and *shev* are most popular products because of their convenience, ready to eat food and long shelf life. A study was conducted to elicit the information on consumption pattern and utilization of deoiled soya meal (DOSM) for value addition of traditional products. Commonly consumed traditional snack products *chakali*, *kharapara* and *shev* were prepared without incorporation of deoiled soya meal (basic) and with (experimental) at the level of 5 to 20 per cent. The *chakali*, *kharapara* and *shev* were evaluated organoleptically. The highly organoleptically accepted variations were analysed for nutrient composition. To study the shelf-life of the products, were stored at room temperature in an airtight container for 60 days. The findings indicated that among all the variations of *chakali*, *kharapara* and *shev* 15 to 20 per cent of DOSM was highly acceptable. An amount of 100gm developed *chakali* contained 20.06gm protein, 3.15 gm total minerals, 212 mg calcium, 4.27 mg iron and g 3.75 m fibre. While *Kharapara* contained protein 15.73 gm, total minerals gm, 1.2 calcium mg, 115 iron mg 3.0 and fibre 0.54gm per 100gm. *Shev* contained 26.85 gm protein, 3.22 gm total minerals, 360mg calcium, 1.70mg iron and 2.41gm fibre. The amounts of nutrients were more in both experimental samples as compared to basic products. The storage study indicated that three types of the snacks were well accepted at the end of storage period. Hence, it is concluded that the nutritional profile of traditional snacks products can be increased by incorporation of deoiled soya meal at the level of 15 to 20 percent. Deoiled soya meal is helpful to elevate the level of protein, total minerals, fibre, calcium and iron in food products.

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### Introduction

In recent year there has been a considerable shift in the consumer's perception of food due to changing lifestyle, modernization, increased women employment, increased per capita income and newer marketing strategies employed by major food manufacturers. Most consumers demand convenience food, ready to eat snacks or food which add bulk and satisfy appetites without taking up

preparation time (Peter *et al.*, 2012). Besides recently consumer awareness is increased and people feel that there is need to eat nutritionally superior and healthy foods. There has also been renewed interest in micronutrients such as those with antioxidant activity, with recommendations for intakes beyond the traditionally officially recommended dietary allowances. Such interests have led the food industry to introduce a

number of value added products that are claimed to be beneficial for specific physiological functions, including physical and mental performance, or to have an added nutritional value (NRLO , 2010). These products, which are known as value added foods may contain either nutrient and bioactive constituents in a higher quantity than present in corresponding conventional foods such as for antioxidant vitamins.

Deoiled soya meal has a great potential to be used as an ingredient for value addition by virtue of its nutrient richness and health benefits. There are several products which are empty calorie foods and they are deficient in protein, and micronutrients. The nutritional value of such products both quantitatively and qualitatively can be increased by using soyabean meal. If the utilization of this nutrient rich ingredient in the country for human consumption is increased then it may be help to tackle the widely spread problem of Protein Energy Malnutrition.

Apart from this, being rich in protein and low content of carbohydrates the products prepared by incorporation of deoiled soya meal are good for diabetics. Very less oil content makes this food supplement suitable for people with hypercholesterolemia, hypertension and persons with liver diseases where the oil restriction is necessary. Hence deoiled soya meal can be considered for supplementation of food products to provide a more balanced nutritional profile at low cost.

Defatted soya flour can be used in variety of forms such as incorporation in bakery products such as biscuits, pasta, cookies etc. or even in snacks for improving nutritional properties. It can be used for preparation of baby foods or the food supplements specially designed for school children, pregnant women, lactating mothers or elderly people. Therefore, the present study was under taken for development of the value added products with following objectives.

1. To standardize value added food products by incorporating defatted soyabean meal

2. To find out the acceptability of developed value added food products
3. To assess the nutritional quality of the most accepted value added food products
4. To determine the keeping quality of highly accepted value added food products.

#### **Materials and Methods**

The present study was designed to evaluate the acceptability of different food products prepared by incorporating deoiled soya meal.

#### **Procurement of Deoiled Soya meal**

Good quality deoiled soya meal was procured from a soya oil mill located in MIDC area of Parbhani. Meal was cleaned to remove impurities. The selected deoiled meal in raw form was sterilised to make powder. After sterilization it was ground to fine powder & sieved through 40 mesh sieve. Deoiled soya meal powder was stored in air tight container in the refrigerator for development of food products.

#### **Selection of Recipes**

Three recipes that are commonly prepared at household level in Maharashtraian families such as *chakali*, *kharapara* and *shev*, were selected for incorporation of DSM. Among the selected products *Chakli*, *kharapara* and *shev* are used as snack items where The selected products are very popular and are consumed by all the age groups.

#### **Sensory evaluation of prepared value added products**

The deoiled soya meal incorporated product was evaluated for acceptability by selected semi-trained panel members using 5-point hedonic rating test and highly accepted variation will be treated as standardized prepared value added product with incorporation of deoiled soya meal (DOSM). Most accepted variation will be subjected for nutrient analysis.

#### **Nutrient analysis**

The highly accepted variation of each value added product was analyzed for nutritional quality. The proximate nutrient content that is moisture, fat, protein, total mineral and crude fiber was estimated by AOAC (2007) method.

Calcium content estimated by EDTA method, iron content by  $\alpha$ - $\alpha$  dipyridyl method and carbohydrate content by difference method (Raghuramala *et al.* 2003).

#### Shelf life of prepared products

The shelf life of prepared value added products was evaluated by keeping the prepared food product in air tight plastic pouches at room temperature. The product was periodically examined by sensory evaluation for its wholesomeness till it is accepted by panel members (N=20). The highly accepted

nutritionally rich deoiled soya meal incorporated single value added product

#### Statistical Analysis

The collected data was consolidated, tabulated and analyzed statistically. Suitable statistical tests were used to find out the difference between different variables. The analysis of variance was followed for interpreting the differences between different variations for individual sensory characters. The statistical difference with regard to nutrient content of developed products prepared with and without incorporation of deoiled soya meal was tested by 't' test (Panse and Sukhatme, 1985).

### Results and Discussion

Table 1. Sensory evaluation scores of *chakali*

Variations	Level of incorporation of deoiled soya meal (%)	Mean sensory scores				
		Colour	Taste	Texture	Flavour	Overall acceptability
I	0	4.7	4.7	4.6	4.7	4.8
II	5	4.5	4.5	4.4	4.8	4.4
III	10	4.6	4.7	4.6	4.5	4.6
IV	15	4.8	4.7	4.7	4.8	4.8
V	20	4.1	4.2	4.1	4.3	4.3
<b>CD</b>		0.44	0.35	0.38	0.3	0.35
<b>SE <math>\pm</math></b>		0.15	0.15	0.16	0.15	0.15
<b>F-value</b>		2.8*	1.7 <sup>NS</sup>	2.02 <sup>NS</sup>	1.75 <sup>NS</sup>	2.10 <sup>NS</sup>

\* Significant at 5 per cent

NS – Non significant

From the Table 1, it can be noticed that the sensory parameters got the score above 4 for colour and texture (4.1), flavour and over all acceptability (4.3) and taste (4.2) at the level of 15 per cent incorporation of deoiled soya meal. Statistical analysis showed non significant difference in all sensory parameters except colour when different variations were compared. There was a significant decrease in scores of all sensory characters for variation V from the rest of the variations. There seems to be numerical significant increase in the scores for colour, texture and flavour and from variation I to variation IV.

On the whole, it can be inferred that *chakali* prepared with 15 per cent incorporation of deoiled soya meal obtained slightly higher scores than basic

for all parameters except over all acceptability and hence, it can be the best level to incorporate deoiled soya meal in *chakali* without any change.

#### Nutrient Content of *Chakali*

The data pertaining to nutrient content of *chakali* with and without value addition that the moisture content was 7.9 and 8.4 per cent in basic and value added *chakali* respectively. The protein content of basic *chakali* was 12.88 per cent which was increased in value added *chakali* to 20.06 per cent. Other nutrients under study viz. fiber, calcium, iron, copper and magnease were significantly increased with incorporation of deoiled soya meal. On the contrary carbohydrates content of value added *chakali* was decreased non significantly.

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Table 2. Nutrient content of *chakali* (per 100g)

Nutrients	Basic <i>chakali</i>	Value added <i>chakali</i>	't' value	Increase/ decrease in nutrient content
	Mean $\pm$ SD	Mean $\pm$ SD		
Moisture (g)	7.9 $\pm$ 1.01	8.4 $\pm$ 0.77	0.68 <sup>NS</sup>	+0.5
Protein (g)	12.88 $\pm$ 0.5	20.06 $\pm$ 0.04	20.86 <sup>**</sup>	+7.4
Fat (g)	12.6 $\pm$ 0.3	12.43 $\pm$ 0.37	0.50 <sup>Ns</sup>	+0.17
Total minerals (g)	0.47 $\pm$ 0.02	3.15 $\pm$ 1.35	2.80 <sup>Ns</sup>	+2.68
Fiber (g)	2.47 $\pm$ 0.04	3.75 $\pm$ 0.0	4.50 <sup>*</sup>	+1.28
Carbohydrates (g)	64.69 $\pm$ 0.5	44.85 $\pm$ 0.5	39.68 <sup>**</sup>	-19.84
Calcium (mg)	185 $\pm$ 5	212 $\pm$ 2.5	3.11 <sup>Ns</sup>	+27
Iron (mg)	1.45 $\pm$ 0.05	4.27 $\pm$ 0.25	7.9 <sup>**</sup>	-2.82
Copper (mg)	1.705 $\pm$ 0.05	2.535 $\pm$ 0.2	5.69 <sup>*</sup>	+0.83
Zinc (mg)	0.3 $\pm$ 0.05	0.36 $\pm$ 0.048	0.16 <sup>Ns</sup>	+0.06
Manganese (mg)	0.155 $\pm$ 0.05	0.44 $\pm$ 0.05	8.16 <sup>**</sup>	+0.29

\*\* Significant at 1 per cent \* Significant at 5 per cent NS- Non significant

### Shelf Life Study of *Chakali*

mean sensory scores of *chakali* before and after storage. *Chakali* was prepared with 15 per cent incorporation of deoiled soya meal and stored in an air tight container at room temperature. The scores for colour were decreased from 4.8 to 3.2, taste from 4.7 to 3.0, texture from 4.7 to 3.4, flavour from 4.8 to 3.5 and overall acceptability from 4.8 to 3.3 (were decreased) at the end of the storage period

and showed significant decrease in all parameters. The reduction in scores showed gradual decrease with increasing period. The score for the organoleptic parameter of *chakali* did not decrease significantly up to 7 days after that it reduced significantly. The 21<sup>st</sup> day's scores further reduced to the range of 3.9, 3.4, 3.8, 3.7, 3.8 for colour, taste, texture, flavour and over all acceptability.

Table 3. Mean sensory scores of *chakali* before and after storage

Storage period (Days)	Mean sensory scores				
	Colour	Taste	Texture	Flavour	Overall acceptability
1	4.8	4.7	4.7	4.8	4.8
7	4.7	4.3	4.5	4.6	4.6
14	4.4	4.1	4.0	4.4	4.1
21	3.9	3.4	3.8	3.7	3.8
28	3.2	3.0	3.4	3.5	3.3
CD	0.46	0.59	0.4	0.39	0.43
SE $\pm$	0.16	0.21	0.17	0.13	0.15
F-value	16.48 <sup>**</sup>	10.17 <sup>**</sup>	8.7 <sup>**</sup>	15.8 <sup>**</sup>	15.3 <sup>**</sup>

\*\* Significant at 1 per cent

Though the scores for all sensory characters showed significant difference as the storage period was extended, the sensory scores indicated that *chakali* was well acceptable for the entire storage period. It may be because of the less oil content of the deoiled soya meal which replaced 15 per cent of bengal gram flour

from the basic recipe. Hence, it can be concluded that developed *chakali* can be stored for about 28 days.

### Sensory Evaluation of *Kharapara*

sensory parameters of *kharapara* prepared without and with incorporation

of deoiled soya meal at varying levels such as 5, 10, 15 and 20 per cent.

**Table 4. Mean Sensory evaluation scores of *kharapara***

Variations	Level of incorporation of deoiled soya meal (%)	Mean sensory scores				
		Colour	Taste	Texture	Flavour	Overall acceptability
I	0	4.7	4.7	4.8	4.6	4.7
II	5	4.4	4.5	4.6	4.5	4.6
III	10	4.6	4.6	4.7	4.6	4.6
IV	15	4.8	4.8	4.7	4.7	4.8
V	20	4.0	4.1	4.2	4.1	4.3
<b>CD</b>		0.4	0.41	0.4	0.39	0.30
<b>SE ±</b>		0.14	0.14	0.15	0.17	0.13
<b>F-value</b>		3.9**	3.3*	2.9*	1.8 <sup>NS</sup>	2.0 <sup>NS</sup>

\* Significant at 5 per cent

NS-Non Significant

The *kharapara* prepared with 15 per cent incorporation of deoiled soya meal obtained maximum score for colour, taste, flavour and overall acceptability which were slightly higher than even basic *kharapara*. The score for texture was higher (4.8) for control sample while it was low for flavour (4.6) than the variation IV (15% incorporation of deoiled soya meal). The statistical comparison among the variations with regard to all the sensory parameters indicated that there is significant difference in the

scores. However, the comparison between the variations depicted that the scores of variation I to IV did not vary significantly. Hence, it can be concluded that deoiled soya meal can be utilised up to 15 per cent for preparation of well accepted *kharapara*.

#### Nutrient Content of *Kharapara*

*Kharapara* was prepared without and with incorporation of deoiled soya meal at 15 per cent level of incorporation and analysed in lab for nutrient content.

**Table 5. Nutrient content of *kharapara* (per 100 g)**

Nutrients	Basic <i>kharapara</i>	Value added <i>kharapara</i>	't' value	Increase/decrease in nutrient content
	Mean ± SD	Mean ± SD		
Moisture (g)	5.42 ± 0.01	6.64 ± 0.03	0.77 <sup>NS</sup>	+0.29
Protein (g)	7.84 ± 0.28	15.73 ± 0.33	25.55**	+7.89
Fat (g)	10 ± 0.07	10.11 ± 0.01	0.01 <sup>NS</sup>	+0.11
Total minerals (g)	0.8 ± 0.08	1.2 ± 0.01	0.002 <sup>NS</sup>	+0.67
Fiber (g)	0.51 ± 0.04	0.54 ± 0.03	0.42 <sup>NS</sup>	+0.27
Carbohydrates (g)	69 ± 0.5	59.28 ± 0.5	25.4**	-9.72
Calcium (mg)	100 ± 2.5	115 ± 5	0.09 <sup>NS</sup>	+10
Iron (mg)	2.9 ± 0.012	3.0 ± 0.04	0.09 <sup>NS</sup>	+0.1
Copper (mg)	0.20 ± 0.081	0.22 ± 0.04	0.002 <sup>NS</sup>	+0.2
Zinc (mg)	0.64 ± 0.63	0.69 ± 0.004	0.01 <sup>NS</sup>	+0.1
Manganese (mg)	0.60 ± 0.40	0.62 ± 0.04	0.008 <sup>NS</sup>	- 0.02

\*\* Significant at 1 per cent

\* Significant at 5 per cent

NS- Non significant

The moisture content of value added *kharapara* was 6.64 per cent and basic *kharapara* was 5.42 per cent. The higher amount of moisture in value added *kharapara* may be because of higher moisture content of deoiled soya meal than refined wheat flour. The protein content of basic and value added *kharapara* was  $7.84 \pm 0.28$  and  $15.73 \pm 0.33$  g/100g respectively. The protein content was increased by 7.89 g due to value addition. The similar observation was made with regard to fat, total minerals, fiber, calcium and iron, where in the values of deoiled soya meal incorporated *kharapara* were increased than the samples prepared without incorporation of deoiled soya meal. The fat content was increased from 10 to 10.11 per cent, total minerals from 0.8 to 0.82 per

cent, fiber from 0.51 to 0.54 per cent, calcium from 100 to 115 mg/100g and iron from 2.9 to 3 mg/100g. There was significant reduction in carbohydrate content from 69 to 59.28 per cent. The content of copper and zinc did not change significantly because of incorporation of deoiled soya meal though there was slight numerical increase. Hence, it can be concluded that *kharapara* with 15 per cent incorporation of deoiled soya meal would be a best alternative to the basic *kharapara* to enrich nutrients with particular reference to protein.

#### Shelf Life Study of *Kharapara*

*Kharapara* prepared with 15 per cent incorporation of deoiled soya meal was stored in an air tight container at room temperature.

**Table 6. Mean sensory scores of *kharapara* before and after storage**

Storage period (Days)	Mean sensory scores				
	Colour	Taste	Texture	Flavour	Overall acceptability
1	4.8	4.8	4.7	4.7	4.8
7	4.6	4.4	4.4	4.5	4.6
14	4.0	4.1	4.1	4.2	3.9
21	3.8	3.6	3.9	4.0	3.7
28	3.5	3.6	3.6	3.4	3.2
<b>CD</b>	0.389	0.35	0.46	0.49	0.46
<b>SE <math>\pm</math></b>	0.13	0.12	0.16	0.17	0.16
<b>F-value</b>	16.04**	16.01**	7.14**	8.74**	16.66**

\*\* Significant at 1 per cent

The score for the colour of *kharapara* decreased from 4.8 to 3.5 during storage. There was no significant difference in the score of colour up to 7 days (4.8 to 4.6). After that, it decreased significantly. Even the score of texture and flavour did not decrease significantly up to 7 days (from 4.7 to 4.4 and from 4.7 to 4.5 respectively) storage period. There after there was slide down in scores of all organoleptic characters during storage. Though scores even on 28<sup>th</sup> day the

*kharapara* scored greater than 3 indicating 'good' that means it was still in acceptable state. Hence, from the findings it can be inferred that *kharapara* with 15 per cent incorporation of deoiled soya meal.

#### Sensory Evaluation of *Shev*

*Shev* was prepared without and with incorporation of deoiled soya meal at varying levels such as 5, 10, 15 and 20 per cent.

**Table 7. Mean Sensory evaluation scores of *shev***

Variations	Level of incorporation of deoiled soya meal (%)	Mean sensory scores				
		Colour	Taste	Texture	Flavour	Overall acceptability
I	0	4.8	4.7	4.6	4.8	4.7

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II	5	4.1	4.5	4.5	4.5	4.5
III	10	4.6	4.5	4.4	4.6	4.6
IV	15	4.7	4.6	4.5	4.6	4.7
V	20	4.8	4.7	4.8	4.8	4.7
<b>CD</b>		0.45	0.35	0.39	0.29	0.32
<b>SE ±</b>		0.16	0.15	0.17	0.12	0.14
<b>F-value</b>		3.0*	1.5 <sup>NS</sup>	1.6 <sup>NS</sup>	0.99 <sup>NS</sup>	1.4 <sup>NS</sup>

\* Significant at 5 per cent      NS- Non significant

The mean sensory scores of colour of *Shev* ranged from 4.1 to 4.8. The *shev* prepared without incorporation of deoiled soya meal and *shev* prepared with incorporation of 20 per cent of deoiled soya meal obtained a score of 4.8 for colour. The lowest score was obtained by *shev* prepared with 5 per cent incorporation of deoiled soya meal. The statistical analysis showed significant difference in the colour of *shev*. In case of texture and flavour, the highest score (4.8) was obtained by *shev* prepared with 20 per cent incorporation of deoiled soya meal. The lowest score for taste was obtained by *shev* prepared with 5 and 10 per cent incorporation of deoiled soya meal. The *shev* prepared with 20

percent deoiled soya meal obtained maximum score for taste (4.7). over all acceptability of *shev* was highest in the samples with 20 percent incorporation while it was least in 5 percent incorporation. The statistical analysis of sensory parameters indicated that except for colour there was no significant difference in the remaining sensory attributes. From the above findings, it can be inferred that *shev* prepared with 20 per cent incorporation of deoiled soya meal was accepted well than other variations.

#### Nutrient Content of *Shev*

The proximate composition and minerals were analysed for basic

and value added *shev* and the results obtained are tabulated and presented in Table

**Table 8. Nutrient Content of *Shev***

Nutrients	Basic <i>Shev</i>	Value added <i>Shev</i>	't' value	Increase/ decrease in nutrient content
	Mean ± SD	Mean ± SD		
Moisture (g)	7.8±1.13	7.86 ± 1.13	0.065 <sup>NS</sup>	+0.06
Protein (g)	17.78 ± 0.42	26.85± 0.28	14.63**	+9.2
Fat (g)	10.75 ± 1.25	10.025 ± 0.72	0.7 <sup>NS</sup>	-0.73
Total minerals (g)	2.00± 0.15	3.22± 1.33	0.66 <sup>NS</sup>	+1.22
Fiber (g)	1.34±0.1	2.41± 0.27	0.42 <sup>NS</sup>	- 0.71
Carbohydrates (g)	61.24 ± 0.5	55± 0.5	11.36**	-11.06
Calcium (mg)	325±25	360 ± 10	1.83 <sup>NS</sup>	+35
Iron (mg)	1.24±0.025	1.70±0.005	25.5**	+0.46
Copper (mg)	0.17±0.05	0.38± 0.01	0.21 <sup>NS</sup>	+0.2
Zinc (mg)	0.23±0.05	0.24±0.05	0.2 <sup>NS</sup>	+0.01
Manganese (mg)	0.17 ± 0.025	0.33 ± 0.004	8.77**	+0.7

\*\* Significant at 1 per cent      \* Significant at 5 per cent      NS- Non significant

The moisture, protein, fiber and mineral content of value added *shev* were increased from 7.8 to 7.86 per cent; from 17.78 to 20.70 per cent; from 1.34 to 2.41 per cent and from 2.00 to 3.22 per cent respectively after value addition. The carbohydrate content of value added *shev*

was decreased from 61.24 per cent to 55 per cent. The increase in values of protein and iron was statistically significant. Calcium content of basic *shev* was lower (325 ± 2.5 mg/100g) than the value added *shev* (360 ± 10 mg/100g). Hence, the value got decreased in the experimental samples

of shev as the Bengal gram was replaced with deoiled soya meal at 20 per cent level. The iron content of value added shev was increased from 1.24 to 1.7 mg/100g. There was no significant increase in copper, zinc and manganese in deoiled soya meal incorporated shev.

### Shelf Life Study of Shev

**Table 9. Mean sensory scores of shev before and after storage**

Storage period (Days)	Mean sensory scores				
	Colour	Taste	Texture	Flavour	Overall acceptability
1	4.8	4.7	4.8	4.7	4.7
7	4.7	4.4	4.5	4.6	4.6
14	4.5	4.1	4.1	4.4	4.2
21	4.6	3.4	3.8	3.7	3.7
28	4.5	3.0	3.0	3.1	3.3
<b>CD</b>	0.32	0.59	0.49	0.30	0.30
<b>SE ±</b>	0.11	0.21	0.17	0.10	0.11
<b>F-value</b>	1.58 <sup>NS</sup>	10.42 <sup>**</sup>	16.09 <sup>**</sup>	20.81 <sup>**</sup>	25.46 <sup>**</sup>

\*\* Significant at 1 per cent

The mean scores given by judges to shev during the storage period are presented in Table . The data revealed that all sensory parameters except colour (from 4.8 to 4.5), taste (from 4.7 to 3.0), texture (from 4.8 to 3.0), flavour (from 4.8 to 3.1) and overall acceptability (from 4.7 to 3.3) showed a significant reduction on 28<sup>th</sup> day of storage. When compared with the initial score, the final day scores were decreased significantly but the product was well accepted by the Judges until the end of storage period. The scores of the shev remained above 3 even on the 28<sup>th</sup> day of storage which is referred as good on five point ranking scale. Hence, even though the changes are statistically significant, the shev can be stored up to 28 days with very well acceptance.

The overall scrutiny of data generated under the study inferred that though in some of the products statistically significant difference was noticed for some organoleptic parameters it was between highest and lowest observation. The scores of basic variation and the most accepted variation did not differ significantly.

### Conclusion

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From the above findings, it can be suggested that 20 per cent incorporation of deoiled soya meal would increase the protein, fiber and minerals of shev.

1. Very well accepted products viz. *chakali*, *kharapara*, and *shev*, can be prepared by utilizing deoiled soya meal.
2. The nutritional value of products can be increased by incorporation of deoiled soya meal at the level of 10 to 30 per cent.
3. Deoiled soya meal can be very well utilized for value addition.

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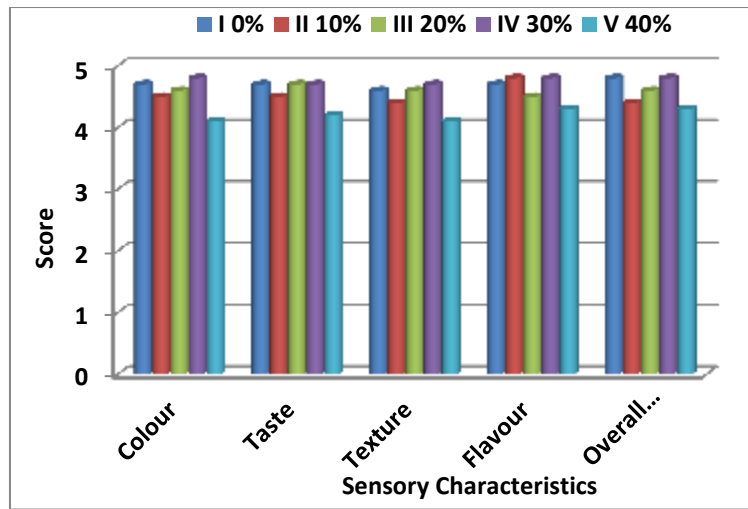


Fig. 1. Sensory evaluation scores of *chakali*

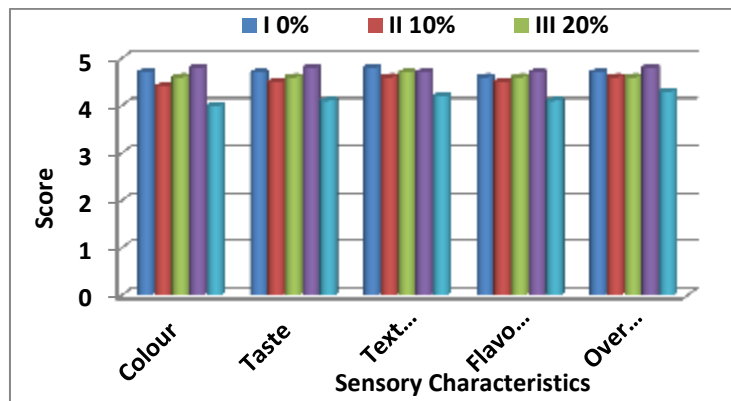


Fig. 2. Sensory evaluation scores of *Kharapara*

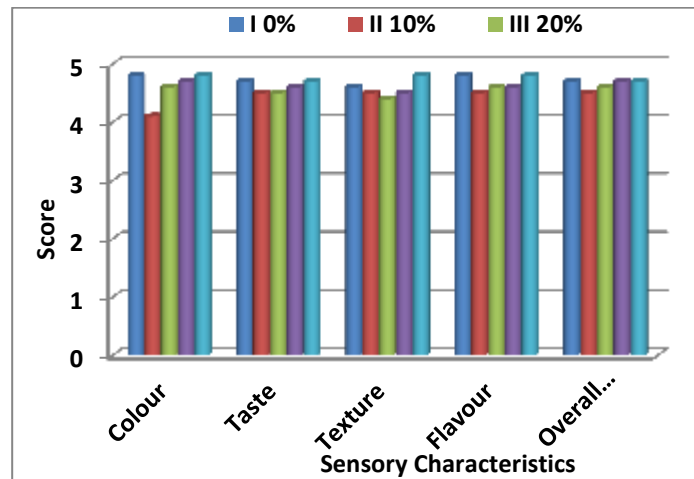


Fig. 3. Sensory evaluation scores of *Shev*

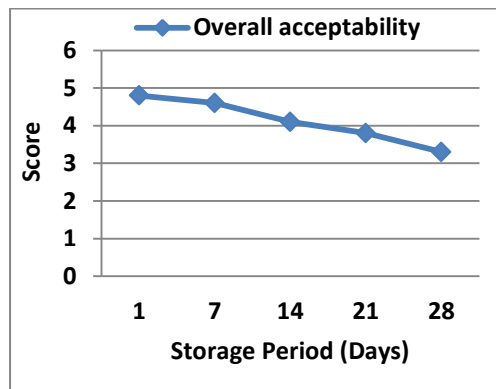
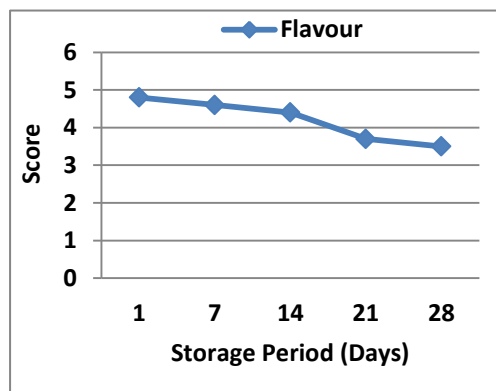
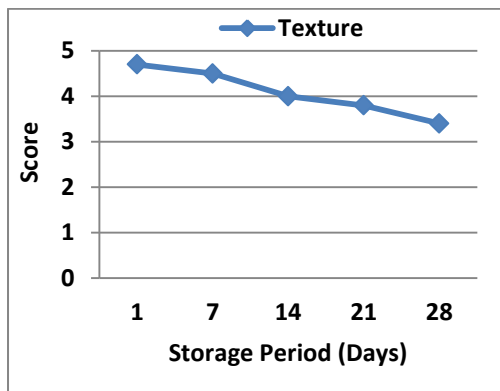
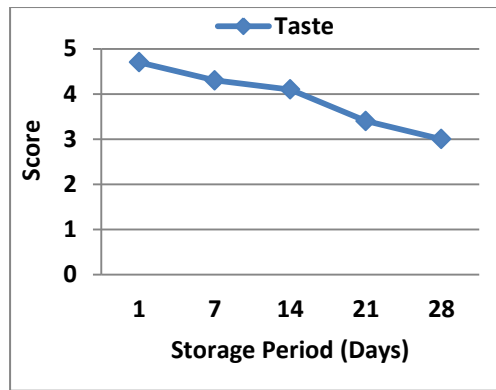
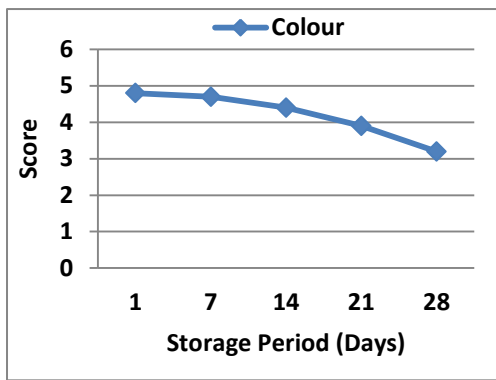
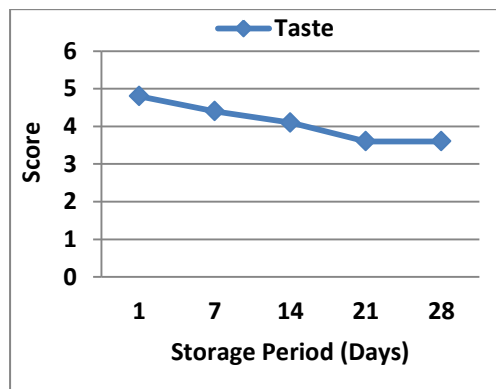
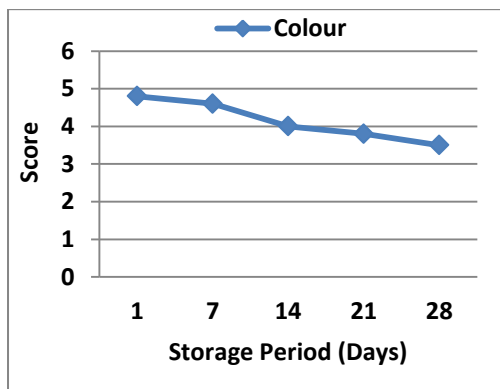


Fig. 4. Mean sensory scores of *chakali* before and after storage



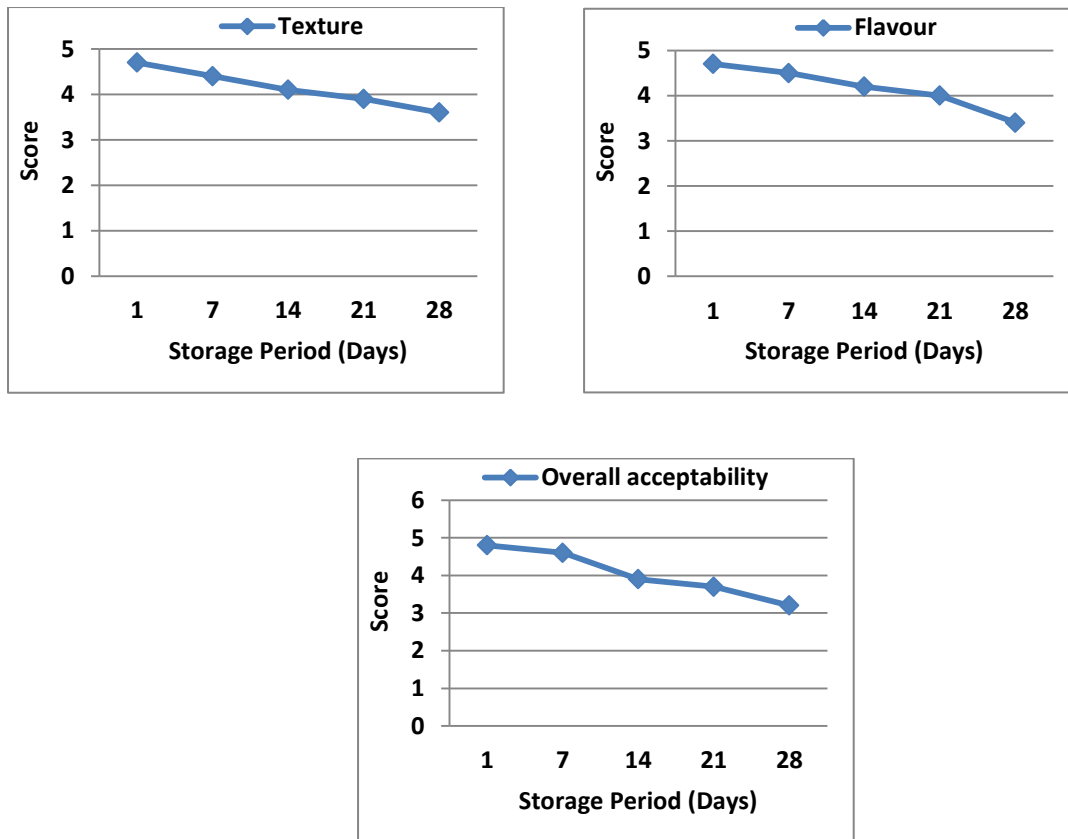
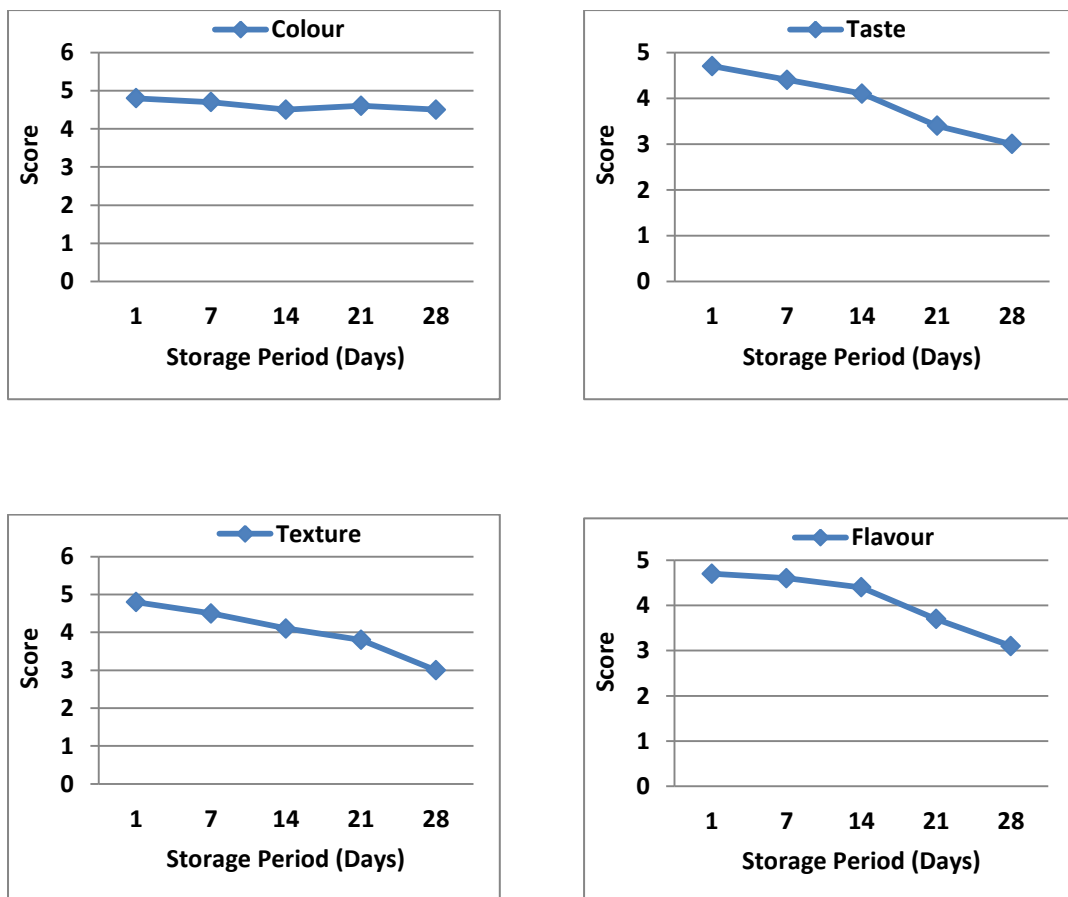


Fig. 5. Mean sensory scores of *kharapara* before and after storage



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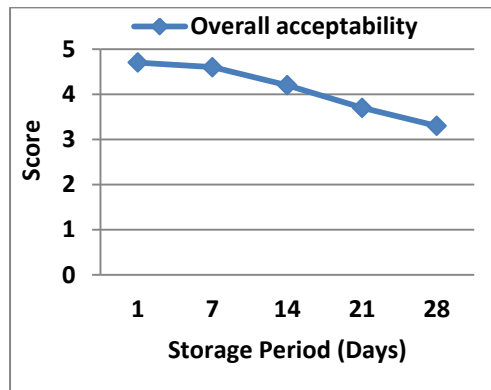


Fig. 6. Mean sensory scores of *Shev* before and after storage