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# Nutritional quality evaluation of Rice bean flour based *Boondi*

**S Sharma, YS Dhaliwal and Ranjana Verma**

**Abstract**
Study was conducted on development, nutritional quality evaluation and shelf life of *boondi* prepared from different blending proportions of bengal gram and rice bean flour. The different blending proportions of bengal gram and rice bean flour was 100:00, 75:25, 50:50, 25:75 and 00:100. The product was analyzed for major nutritional constituents viz. moisture, protein, fat, fiber, ash, carbohydrates, mineral contents and sensory evaluation (on the basis of 9 point hedonic scale). The products were evaluated at the beginning and at interval of three and six months for chemical and sensory evaluation in order to study the storage stability of the product. The moisture content of *boondi* were ranged from 6.87 to 4.19, protein content 16.36 to 14.58, fat content 26.80 to 27.61, fiber content 1.84 to 2.90 and carbohydrates content was ranged from 51.65 to 51.17 per cent, respectively. The overall acceptability of the product was ranged between liked moderately to liked very much.

**Keywords:** Rice bean and Bengal gram flours, *Boondi*, development, nutritional and sensory quality evaluation.

## Introduction
Food legumes, commonly known as pulses find a place in Indian diets because of good source of protein and other nutrients which are essential for supplementation of cereal based diets. Large segment of the human population in developing countries suffer from protein malnutrition and the production of pulse is unable to meet the requirements of the expanding population of the country. Among the different pulses, rice bean is one of the underutilized and orphan pulse crops. Rice bean *[Vigna umbellata* (Thunb.) Ohwi and Ohashi] is also known as climbing mountain bean, mambi bean, oriental bean and red bean. In India, it is known by different vernacular names such as moth, *rajmoong* and *satrangi* mash.
Rice bean (*Vigna umbellata)* is one of best food legume, rich in protein (21-25%) and amino acid composition, especially the more limiting amino acids namely, methionine and tryptophan are considerably high. It contains high quality of vitamins as well as minerals (Singh *et al*. 1980). Promotion of this crop could play an important role in improving diet and food security of people. Several food items are prepared locally from rice bean. The seeds, which are the primary products, are usually taken as a soup or as a pulse (*dhal*) with rice. The grains from young pods are used as vegetable. Bengal gram (*Cicer arietinum*) also called by several names viz chickpea, *chana*, *chole*, *basen* or gram, has been classified in the family Fabaceae. Bengal gram seeds are rich source of protein. It is widely consumed throughout the world. *Boondi*, a fried product made from chickpea batter is a common snack known all over India. The present studies were undertaken to find out the nutritive quality of *Boondi* prepared from different blends of bengal gram and rice bean flours.

## Material and Methods
### Procurement of raw materials
Rice bean seeds were procured from the Department of Organic Agriculture, College of Agriculture, CSKHPKV, Palampur. Dry mature seeds of rice bean were converted into flour and were kept in airtight containers at room temperature for further use. Bengal gram flour, chemicals and other ingredients were procured from local market.
Moisture, protein, fat, fiber, ash and minerals contents of the *boondi* were determined according to standard AOAC 2000 [2] methods. Crude protein content was calculated by multiplying Kjeldahl nitrogen by a factor of 6.25. Carbohydrates content was determined by NIN 1983 [6] method.

***Boondi***

**Ingredients**

| Bengal gram : Rice bean | Blends (Quantity for 1 Kg flour) | | | | |
|---|---|---|---|---|---|
| | **100:00** | **75:25** | **50:50** | **25:75** | **00:100** |
| Water (ml) | 1550 | 1600 | 1650 | 1950 | 1550 |
| Baking powder (gm) | 2 | 2 | 2 | 2 | 2 |
| Salt (gm) | 55 | 55 | 55 | 55 | 55 |
| *Garam masala* (gm) | 18 | 18 | 18 | 18 | 18 |
| Chilly powder (gm) | 9 | 9 | 9 | 9 | 9 |

**Method**

Take a bowl, put flour as well as all ingredients in it and mix well. Then add water to the mixture for making batter and whisk it thoroughly to avoid lumps. Heat oil in a frying pan. Take *boondi* batter and pour it over slotted spoon and allow the batter to fall gently into oil in the form of small pearl like balls. Allow *boondi* to fry for some time then turn it over, fry *boondi* till it turns light brown. Take it out and place on a plate covered with paper napkin. Figure 1 indicates the steps involved in preparation of *Boondi*.

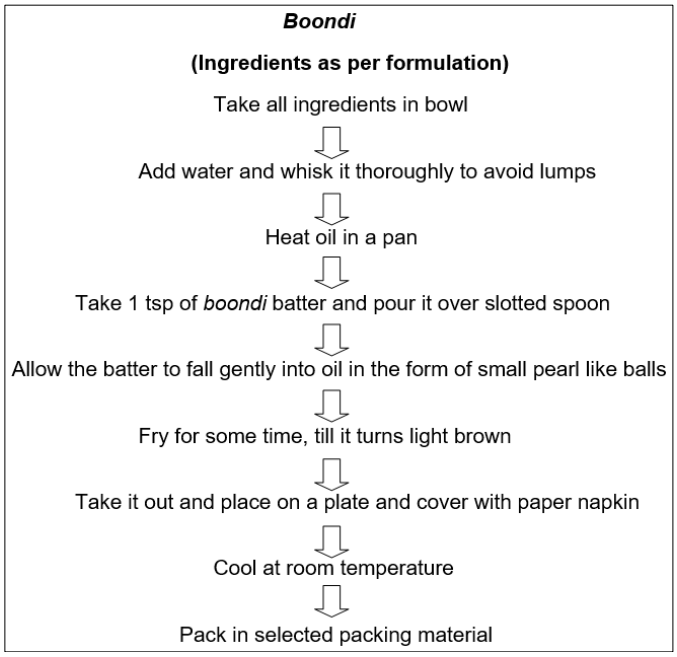


**Fig 1:** Steps involved in the preparation of *Boondi*

**Result and discussion**

Table 1 illustrates the mean values of the moisture content of *boondi* prepared from different blends of bengal gram flour and rice bean flour and stored for 6 months of storage interval. The maximum moisture content (6.87%) was recorded as in *boondi* prepared from 100 parts of bengal gram flour followed by 6.55, 5.93, 4.66 and 4.19 per cent in 75:25, 50:50, 25:75 and 00:100 blending proportions of bengal gram and rice bean flours, respectively. The mean moisture content of *boondi* was 4.87 per cent which increased significantly to 5.69 and 6.37 per cent after 3 and 6 months of storage intervals, respectively.

Kalra *et al*. (1998a) [3] found that the value of moisture content of *mongra* prepared by chickpea flour was ranged as 0.18 to 6.90 per cent. The value is in close agreement with the present results. The moisture content slight increased during storage which may be due to the fact that at a higher humidity the vapour pressure may have increased which aids water absorption into the samples. A similar finding has been reported by Akindahunsi and Oboh (2000) [1].

The mean protein content of the pure bengal gram *boondi* was 16.36 per cent which decreased significantly to 15.97, 15.63, 15.04 and 14.58 per cent in *boondi* prepared from 75:25, 50:50, 25:75 and 00:100 blending proportions of bengal gram: rice bean flours, respectively. With storage, the mean protein content was recorded as 15.59 per cent which decreased to 15.52 and 15.44 per cent after 3 and 6 months of storage intervals, respectively.

The results obtained are in close agreement with Kalra *et al*. (1998a) [3] as they observed that the values of protein content of *boondi* prepared with chickpea flour were presented in the range of 15.16 to 21.15 per cent. The slight decrease in the protein content may be due to the absorption of moisture from the atmosphere that further accelerated the proteolytic activity. Similar results have been reported by Leelavathi *et al*. (1984) [5].

**Table 1:** Nutritional quality of *Boondi* as affected by addition of Rice bean flour and storage intervals

| Parameters/Blending | Storage Intervals | | | Mean |
|---|---|---|---|---|
| **Bengal gram : Rice bean** | **Fresh** | **3 Months** | **6 Months** | |
| Moisture | | | | |
| 100 : 00 | 6.02 | 6.95 | 7.65 | 6.87 |
| 75 : 25 | 5.81 | 6.73 | 7.12 | 6.55 |
| 50 : 50 | 5.24 | 5.92 | 6.62 | 5.93 |
| 25 : 75 | 3.97 | 4.56 | 5.46 | 4.66 |
| 00 : 100 | 3.32 | 4.27 | 4.99 | 4.19 |
| Mean | 4.87 | 5.69 | 6.37 | 5.64 |
| **Protein** | | | | |
| 100 : 00 | 16.42 | 16.39 | 16.28 | 16.36 |
| 75 : 25 | 16.05 | 16.00 | 15.86 | 15.97 |
| 50 : 50 | 15.69 | 15.60 | 15.60 | 15.63 |
| 25 : 75 | 15.13 | 15.01 | 14.97 | 15.04 |
| 00 : 100 | 14.64 | 14.62 | 14.47 | 14.58 |
| Mean | 15.59 | 15.52 | 15.44 | 15.52 |
| **Fat** | | | | |
| 100 : 00 | 28.59 | 26.75 | 25.06 | 26.80 |
| 75 : 25 | 28.76 | 27.16 | 25.43 | 27.12 |
| 50 : 50 | 29.02 | 27.33 | 25.65 | 27.33 |
| 25 : 75 | 29.07 | 27.39 | 25.85 | 27.44 |
| 00 : 100 | 29.07 | 27.76 | 26.00 | 27.61 |
| Mean | 28.90 | 27.28 | 25.60 | 27.26 |
| **Fiber** | | | | |
| 100 : 00 | 1.90 | 1.85 | 1.78 | 1.84 |
| 75 : 25 | 2.17 | 2.06 | 1.99 | 2.07 |
| 50 : 50 | 2.50 | 2.36 | 2.29 | 2.39 |
| 25 : 75 | 2.71 | 2.70 | 2.57 | 2.66 |
| 00 : 100 | 2.96 | 2.88 | 2.85 | 2.90 |
| Mean | 2.45 | 2.37 | 2.30 | 2.37 |
| **CD (P ≤ 0.05)** | **Moisture** | **Protein** | **Fat** | **Fiber** |
| Blends (A) | 0.02 | 0.03 | 0.03 | 0.05 |
| Storage intervals (B) | 0.02 | 0.02 | 0.03 | 0.04 |
| AXB | 0.04 | 0.05 | 0.06 | 0.08 |

The values pertaining to the fat content of the *boondi* prepared from different blends of bengal gram and rice bean flours are presented in Table 1. The mean fat content of *boondi* was 26.80 per cent (100:00) which significantly increased to 27.12, 27.33, 27.44 and 27.61 per cent in 75:25, 50:50, 25:75 and 00:100 blending proportion of bengal gram: rice bean flour in *boondi*, respectively. The initial value of fat content in *boondi* prepared from 100 parts of rice bean flour was 29.07 per cent which decreased to 27.76 per cent after 3 months of storage and further decreased to 26.00 per cent after 6 months of storage duration, respectively.

The results of the study are in conformity with the results reported by Kalra *et al*. (1998a) [3]. As Kalra (1998a) [3]

reported that the value of fat content of *mongra* prepared by chickpea flour was recorded as 37.13 to 61.33 per cent. The storage of *boondi* decease the fat content which might be due to the development of rancidity as reported by Leelavathi *et al*. (1984) [5].

Table 1 indicates the effect of blending levels and storage intervals on the fiber content of the *boondi*. The mean values of fiber content in pure bengal gram *boondi* was 1.84 per cent which increased to 2.07, 2.39, 2.66 and 2.90 per cent in 75:25, 50:50, 25:75 and 00:100 blending proportions of bengal gram and rice bean flours in *boondi*, respectively. With storage, the mean fiber content was recorded as 2.45 per cent which decreased to 2.30 per cent after 6 months of storage interval.

Data presented in Table 2 indicates the mean values of the ash content of *boondi* prepared from different blending proportions of bengal gram and rice bean flours. The maximum ash content was observed in pure rice bean *boondi* was (3.75%) followed by 3.68, 3.62, 3.55 and 3.34 per cent in the *boondi* prepared from 25, 50, 75 and 100 parts of bengal gram flour, respectively. The mean ash content of *boondi* was 3.71 per cent which decreased significantly to 3.63 and 3.43 per cent after storage interval of 3 and 6 months, respectively.

Kalra *et al*. (1998a) [3] studying on 'Preparation, packaging and quality standards of *Mongra*– A traditional savoury product' analyzed that the values of ash content in *Mongra* prepared by chickpea flour were in the range of 1.71 to 5.11 per cent, close to the values of present study.

**Table 2:** Ash and Total Carbohydrates contents of *Boondi* as affected by addition of Rice bean flour and storage intervals

| Parameters/Blending Bengal gram : Rice bean | Storage Intervals | | | Mean |
|---|---|---|---|---|
| | Fresh | 3 Months | 6 Months | |
| **Ash** | | | | |
| 100 : 00 | 3.39 | 3.32 | 3.31 | 3.34 |
| 75 : 25 | 3.69 | 3.57 | 3.39 | 3.55 |
| 50 : 50 | 3.74 | 3.70 | 3.43 | 3.62 |
| 25 : 75 | 3.87 | 3.72 | 3.44 | 3.68 |
| 00 : 100 | 3.85 | 3.82 | 3.57 | 3.75 |
| Mean | 3.71 | 3.63 | 3.43 | 3.59 |
| **Total Carbohydrates** | | | | |
| 100 : 00 | 49.70 | 51.68 | 53.58 | 51.65 |
| 75 : 25 | 49.34 | 51.21 | 53.33 | 51.29 |
| 50 : 50 | 49.05 | 51.19 | 53.17 | 51.19 |
| 25 : 75 | 49.22 | 51.19 | 53.17 | 51.19 |
| 00 : 100 | 49.48 | 50.92 | 53.10 | 51.17 |
| Mean | 49.36 | 51.20 | 53.24 | 51.27 |
| **CD (P ≤ 0.05)** | **Blends (A)** | **Storage intervals (B)** | **AXB** | |
| Ash | 0.03 | 0.02 | 0.05 | |
| Carbohydrates | 0.08 | 0.06 | 0.13 | |

Table 2 represents the total carbohydrates content of the *boondi* as affected by different blending proportions and storage intervals. The maximum total carbohydrates content in *boondi* with respect to blending was observed in pure bengal gram flour *boondi* (51.65%) and minimum in 50:50 proportion of bengal gram and rice bean flour based *boondi* (51.03%). The mean values of total carbohydrates content in fresh *boondi* was 49.36 per cent which increased significantly to 51.20 and 53.24 per cent with increased in storage interval of 3 and 6 months, respectively.

**Mineral contents**

Table 3 illustrates the effect of blending on the mineral contents of *boondi*. The mean values of calcium, iron and zinc content in *boondi* was 181.16, 2.96 and 1.50 mg/100gm, respectively. The maximum calcium content was observed in 100 part of rice bean flour in *boondi* (289.01 mg/100gm) and minimum zinc content in pure bengal gram flour *boondi* was 1.17 mg/100gm. The iron content of *boondi* prepared with equal proportions of bengal gram and rice bean flour was 2.95 mg/100gm.

**Table 3:** Minerals content (mg/100g) of *Boondi* as affected by addition of Rice bean flour and storage intervals

| Blending Bengal gram : Rice bean | Minerals | | |
|---|---|---|---|
| | Calcium | Iron | Zinc |
| 100 : 00 | 73.20 | 3.58 | 1.17 |
| 75 : 25 | 127.14 | 3.26 | 1.35 |
| 50 : 50 | 181.37 | 2.95 | 1.49 |
| 25 : 75 | 235.06 | 2.67 | 1.67 |
| 00 : 100 | 289.01 | 2.36 | 1.82 |
| Mean | 181.16 | 2.96 | 1.50 |
| CD (P ≤ 0.05)` | 3.86 | 0.04 | 0.04 |

**Sensory quality**

Table 4 represent the sensory quality of the *boondi* prepared from different blends of bengal gram and rice bean flours evaluated by using 9 point hedonic scale at different storage intervals. The mean colour scores of pure bengal gram flour *boondi* was 7.37 which decreased significantly to 6.93, 6.47, 6.18 and 5.79 after addition of 25, 50, 75 and 100 parts of rice bean flour in *boondi*. In respect of storage interval, the mean colour score for all the blends was 7.20 which slightly decreased to 6.43 and 6.02 after 3 and 6 months of storage intervals, respectively.

Decreased in colour scores might be due to solidification of fat over them during storage period. Kalra *et al*. (1998a) [3] reported that *mongra* prepared with chickpea flour was found to be acceptable up to 4 months of storage period.

The flavor scores of *boondi* were higher in pure bengal gram flour *boondi* (7.20) followed by *boondi* prepared by using 25, 50 and 75 parts of rice bean flour with recorded scores as 7.01, 6.64 and 6.28 (on the hedonic scale of 9.0), respectively.

**Table 4:** Sensory scores (on the basis of 9.0) of *Boondi* as affected by addition of Rice bean flour and storage intervals

| Parameters/Blending Bengal gram : Rice bean | Storage Intervals | | | Mean |
|---|---|---|---|---|
| | Fresh | 3 Months | 6 Months | |
| **Colour** | | | | |
| 100 : 00 | 8.40 | 7.10 | 6.60 | 7.37 |
| 75 : 25 | 7.75 | 6.75 | 6.30 | 6.93 |
| 50 : 50 | 7.03 | 6.38 | 6.00 | 6.47 |
| 25 : 75 | 6.45 | 6.30 | 5.80 | 6.18 |
| 00 : 100 | 6.38 | 5.60 | 5.40 | 5.79 |
| Mean | 7.20 | 6.43 | 6.02 | 6.55 |
| **Flavor** | | | | |
| 100 : 00 | 7.65 | 7.33 | 6.63 | 7.20 |
| 75 : 25 | 7.60 | 7.05 | 6.38 | 7.01 |
| 50 : 50 | 7.00 | 6.63 | 6.30 | 6.64 |
| 25 : 75 | 6.65 | 6.50 | 5.68 | 6.28 |
| 00 : 100 | 6.50 | 6.55 | 6.33 | 6.46 |
| Mean | 7.08 | 6.81 | 6.26 | 6.72 |
| **Taste** | | | | |
| 100 : 00 | 8.20 | 7.57 | 6.90 | 7.56 |
| 75 : 25 | 7.80 | 7.43 | 6.70 | 7.31 |
| 50 : 50 | 7.33 | 7.10 | 5.63 | 6.68 |
| 25 : 75 | 6.75 | 6.25 | 6.10 | 6.37 |
| 00 : 100 | 6.40 | 6.25 | 5.73 | 6.13 |
| Mean | 7.30 | 6.92 | 6.21 | 6.81 |
| **Texture** | | | | |
| 100 : 00 | 7.95 | 7.18 | 6.43 | 7.18 |
| 75 : 25 | 7.65 | 7.08 | 6.45 | 7.06 |
| 50 : 50 | 7.18 | 7.00 | 6.13 | 6.77 |
| 25 : 75 | 6.85 | 6.74 | 6.15 | 6.58 |
| 00 : 100 | 6.60 | 6.18 | 5.79 | 6.19 |
| Mean | 7.25 | 6.83 | 6.19 | 6.76 |
| **CD (P ≤ 0.05)** | **Colour** | **Flavor** | **Taste** | **Texture** |
| Blends (A) | 0.40 | 0.32 | 0.34 | 0.41 |
| Storage intervals (B) | 0.31 | 0.25 | 0.26 | 0.32 |
| AXB | 0.69 | 0.56 | 0.59 | 0.71 |

The least flavor scores were observed in *boondi* prepared by using 25 parts of bengal gram flour and 75 parts of rice bean flour was (6.28). Irrespective of the blends, the mean flavor scores of freshly prepared *boondi* was 7.08 which decreased to 6.81 and 6.26 after 3 and 6 months of storage intervals, respectively.

The decreased in the mean flavor scores might be due to development of rancid flavor in *boondi* with increased in storage interval. Similar observations have been reported by Kalra *et al*. (1998b) [4] but in *mathi*.

The scores for taste, recorded highest in *boondi* prepared from pure bengal gram flour based *boondi* (7.56) whereas least scores for taste were observed in pure rice bean flour based *boondi* (6.13) (on the hedonic scale of 9.0). On a whole, the scores of taste decreases with the addition of rice bean flour. With storage, the mean taste scores was observed as 7.30 in freshly prepared *boondi* which decreased to 6.21 after 6 months of storage interval. However, the value of taste score of *boondi* prepared from proportion of '00:100 and 25:75 and 75:25 and 100:00' were varied critically non-significant.

It is clear from the data that the storage of *boondi* had significant effect on the taste scores of the *boondi* and decreased with increase in storage interval. Similar results have been reported by Kalra *et al*. (1998b) [4].

The texture scores of *boondi* prepared by using 100 parts of bengal gram flour was recorded maximum (7.18) (on the hedonic scale of 9.0). The texture scores of *boondi* prepared with bengal gram flour was 7.18 which significantly decreased to 7.06, 6.77, 6.58 and 6.19 with addition of 25, 50, 75 and 100 parts of rice bean flour, respectively. With storage, the mean texture scores of freshly analyzed *boondi* decreased significantly from 7.25 to 6.19 after 6 months of storage interval.

The declining trend in the mean texture scores might be due to increase in moisture with increasing storage period which reduced crispness of the product. The results are in agreement with Kalra *et al*. (1998b) [4].

Fig 2 represents the overall acceptability scores of *boondi*, the mean values for all the blends ranged between 7.33 to 6.14 for 100:00 to 00:100 proportions of bengal gram and rice bean flours. However, with storage, the mean overall acceptability scores of the product was 7.21 which decreased to 6.75 and 6.17 after 3 and 6 months of storage intervals, respectively.

Although, the acceptability scores decreased with storage but the values ranged between liked moderately to liked very much. The results are in agreement with those reported by Kalra *et al*. (1998b) [4] but in *mathi*.

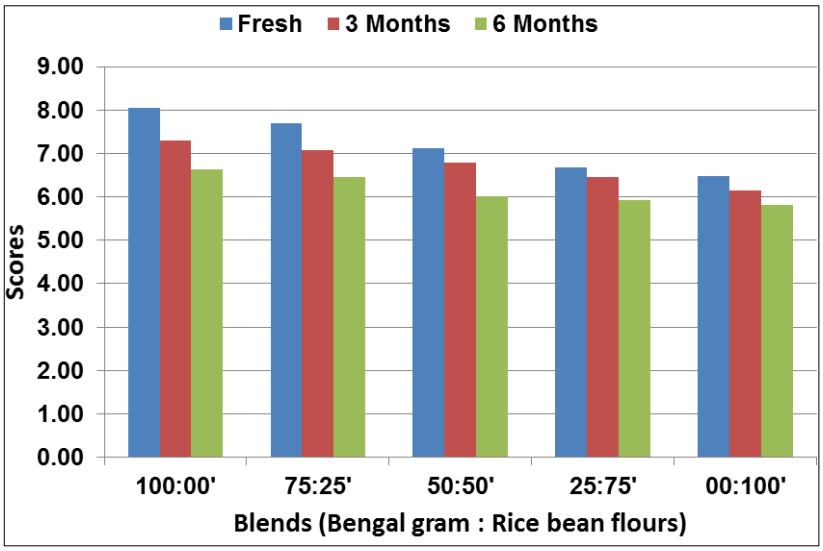


**Fig 2:** Effect of blending and storage on the overall acceptability scores (on the basis of 9.0) of *Boondi* prepared from blends of Bengal gram: Rice bean flours

## Conclusion

The rice bean based *boondi* prepared in the present study have improved nutritional profile and acceptable storage stability in relation to overall acceptability of the products. Storage studies revealed that *boondi* can be stored safely for six months, at ambient temperature without much change in chemical and sensory characteristics. The standardized/ developed rice bean based product has great potential for household food security and add variety to diet for better nutrition. The improved/ developed formulations can be popularized for preparation of products with added advantages and meaningful utilization of rice bean in specialty products at cottage industry.

## References


1. Akindahunsi AA, Oboh G. Effect of changes in relative humidity on the storage stability of microfungi fermented Gari. In: Proceedings of 24th Annual conference of Nigerian Institute of Food Science and Technology, 2000, 47-49.
2. AOAC. Approved methods of Association of Official Analytical Chemists. 7th Edition Saint Paul, Minnesotea, U.S.A, 2000, 345p.
3. Kalra CL, Sehgal RC, Nagender A, Berry SK. Preparation, packaging and quality standards of mongra - A traditional savoury product. Journal of Food Science and Technology. 1998a; 35(5):414-418.
4. Kalra CL, Sehgal RC, Nagender A, Berry SK. Preparation, quality standards and storage of *mathi* - A traditional savoury product. Journal of Food Science and Technology. 1998b; 35(1):25-29.
5. Leelavathi KP, Haridas RD, Indrani, Shurpalekar SR. Physico-chemical changes in whole wheat flour (*Atta*) and resultant *atta* during storage. Journal of Food Science and Technology. 1984; 21:68-71.
6. NIN. A manual of laboratory techniques, National Institute of Nutrition, Hyderabad, 1983.
7. Singh SP, Misra BK, Chandel KPS, Pant KC. Major food constituents of rice bean. Journal of Food Sciences and Technology. 1980; 17:238-240.