

Original Research Article

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Development of Value Added Bhakari and Chapati by Incorporating Horse Gram (*Macrotyloma uniflorum*) Powder

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ABSTRACT

Horse gram is a potential grain legume having excellent nutritional and remedial properties. It is less expensive source of protein and is also rich in minerals. An attempt was made to develop bhakari and chapati by incorporating horse gram flour at different levels. Control products were prepared without incorporating horse gram flour whereas experimental products were developed with varying levels of horse gram flour. Sensory evaluation, nutritional analysis and storage study was carried out for the value added products. Results showed that bhakari and chapati were well acceptable at 20 per cent level. Incorporation of 20 per cent of horse gram flour helped to increase protein, total minerals, calcium and iron in the developed products. Bhakari and chapati can be stored up to 24 hours in air tight steel container at room temperature. It can be concluded that horse gram flour can be utilized for development of value added *bhakari* and *chapati*. It can serve as a vehicle to enhance the nutrients such as protein, iron, total minerals, calcium and especially fiber content of the products.

Keywords

Horse gram,
Value added,
Bhakari, Chapati

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Introduction

The horse gram is a traditional unexploited tropical grain legume well known for its hardiness, adaptability to poor soil and adverse climatic conditions (Bhokre *et al.*, 2012). Horsegram has great significance in the nutritional security of rural, tribal and underprivileged masses (Bhartiya *et al.*, 2015). Horse gram is gaining more attention as legume food due to its high protein content

and other nutrients as well. Horse gram is popularly called “Madras Bean” due to the principal cultivation and production of this legume, especially in rural areas, in the erstwhile Madras Presidency State, India, before the states were separated. It is also known as the “poor man’s pulse crop” (Vandarkuzhali and Narayanasamy, 2016). This neglected and under valorised crop has great untapped potential to support smallholder rural farming communities by

providing income, food and nutritional security as well as sustaining the genetic resources needed to address present and future environmental challenges (Bhartiya *et al.*, 2015).

Horse gram is a potential grain legume having excellent nutritional and remedial properties. It is less expensive source of protein and is also rich in minerals such as calcium, phosphorus, iron and vitamins such as carotenes, thiamine, riboflavin, niacin and L-ascorbic acid. Like other legumes, it is deficient in methionine and tryptophan (Thirukkumar and Sindumathi, 2014).

Hence, a study was conducted to formulate value added Bhakari and Chapati by utilizing horse gram due to its dense nutritional and functional profile to serve as therapeutic as well as supplementary foods for the nutritionally vulnerable communities.

Materials and Methods

Good quality horse gram was procured from local market of Parbhani City. The procured horse gram was cleaned and ground in a flour mill to make powder. Horse gram powder was stored in air tight container at room temperature for development of food products. Two commonly prepared regular meal product viz. Bhakari and *chapatti* were selected for incorporation of horse gram. The composition of the recipes has been mentioned in Table 1 and 2. In the pilot experiment the trials were taken for feasibility of incorporation of horse gram at different levels in selected products.. The selected levels were 10, 15, 20 and 25 per cent. After preparation of products the sensory evaluation was carried out by following five-point ranking test. Basic and the best accepted variations of the products under study were bio-chemically analysed for assessing their nutrient content.

The developed value added Bhakari (*roti*) and *chapatti* were stored in air tight steel container at room temperature for evaluation of shelf life. The stored products were assessed for acceptability. The collected data was consolidated, tabulated and analysed statistically.

Results and Discussion

Sensory evaluation of Bhakari (*Roti*)

A brief picture of mean scores of various organoleptic parameters of Bhakari without and with incorporation of horse gram flour is presented in Table 3.

The incorporation of horse gram flour was at the levels of 10, 15, 20 and 25 percent. Addition of horse gram flour at 20 percent level increased the sensory scores of all organoleptic parameters. The score of colour of Bhakari of basic sample and sample with 20 percent incorporation of horse gram flour was observed to be same (4.7). Other parameters such as texture was given scores of 4.2 for basic and 4.4 for variation IV, taste was given score of 4.6 for basic and 4.7 for variation IV, flavour was given score of 4.4 for basic and 4.7 for variation IV, overall acceptability was given score of 4.5 for basic and 4.8 for variation IV, by the judges. Above data indicates that the Bhakari can be very well prepared with incorporation of 20 percent horse gram flour. The statistical analysis of the data indicated that there was significant difference in the scores of colour, taste, flavour and overall acceptability of the samples. When it was compared between basic and variation V (25% horse gram flour). However, there was no significant difference in any of the sensory parameters of variation I to IV. These results suggest that horse gram can be successfully incorporated up to 20 percent in jowar flour for preparation of Bhakari.

Shelf life study of Bhakari

The mean sensory scores of Bhakari during storage are given in Table 4. Bhakari prepared with 20 percent incorporation of horse gram flour was selected for storage study. It was stored in an air tight container at room temperature. The organoleptic scores for colour decreased from 4.4 to 3.9, texture, taste and flavour from 4.7 to 4.4 and overall acceptability from 4.8 to 4.5 which were non-significantly reduced after 24 hours of storage. Bhakari was well accepted by the judges after 24 hours also. Hence, it can be concluded that Bhakari prepared with horse gram flour can be stored for about 24 hours.

Nutrient content of Bhakari

Table 5 denotes the proximate nutrient content of Bhakari. The moisture content of basic Bhakari was 7.66 percent whereas for value added Bhakari it was 8.2 percent. The protein content of basic and value added Bhakari was 8.31 and 12.25 percent respectively. The protein content of horse gram flour incorporated Bhakari was increased by 3.94 g. The fat content of value added Bhakari was decreased by 0.07 g. The fiber and total mineral content of experimental variation sample was increased by 0.75 g (from 1.16 to 1.91 g/100g) and 0.62 g (from 1.21 to 1.83 g/100g) respectively. The increase in the fiber and total minerals content was statistically significant. The carbohydrate content of basic sample was higher (80.38 %) than value added sample (74.06 %). The calcium content of value added Bhakari was increased from 26.5mg/100g to 60 mg/100g. About, 4.4 mg/100g of iron was noticed in value added Bhakari, whereas the iron content of basic Bhakari was 3.83 mg/100g. The increase in iron was significant. Addition of horse gram to Bhakari did not increase the values of micro mineral content i.e. zinc and manganese significantly.

With reduced fat content and increased protein, calcium and iron content, horse gram flour incorporated Bhakari could be used instead of traditional Bhakari by the people who have dietary restriction of carbohydrates and fat and want to have more protein, calcium & iron from same amount of Bhakari.

Sensory evaluation of chapatti

The mean sensory scores of *chapatti* revealed that there was slight higher shift in the scores of organoleptic parameters such as colour (from 4.4 to 4.7), taste (from 4.3 to 4.7) and overall acceptability (from 4.3 to 4.6) due to incorporation of horse gram. While the organoleptic scores of texture and flavour remained unchanged up to 20 percent level of incorporation of horse gram flour in Chapati. The further increase in the incorporation level of horse gram flour resulted in decrease in the sensory scores with respect to all sensory parameters. Hence, 20 percent incorporation of horse gram flour proved to be good for preparing Chapati (Table 6).

Thirukkumar and Sindhumathi (2014) noticed that *chapatti* prepared from wheat flour incorporated with 10 percent soaked and dried or 15 percent roasted horse gram flour was highly acceptable.

Shelf life study of chapatti

The mean sensory scores of Chapati before and after storage are given in Table 7. Chapati prepared with 20 percent incorporation of horse gram flour was selected for storage study. It was stored in an air tight steel container at room temperature. Scores of texture and taste showed a significant reduction in 24 hours of storage but colour, flavour and overall acceptability were non-significantly reduced. Though there was significant reduction in the organoleptic scores, the Chapati was well accepted by the

judges after 24 hours also. Hence, it can be said that *chapatti* prepared with 20 percent horse gram flour can be stored for about 24 hours.

Nutrient content of *chapatti*

Chapati was prepared with 20 percent incorporation of horse gram flour and without incorporation of horse gram flour. The nutrient composition of both variations of *chapatti* was estimated in laboratory and the results are given in Table 8. The nutrient content of basic *chapatti* and value added

Chapati revealed that the moisture content of the value added *chapatti* was increased by 2.2 percent (from 6.6 to 8.8 %). The protein content of value added Chapati showed non-significant increase in value. The basic sample contained 9.97 percent protein and value added sample contained 10.5 percent of protein. The fat content was decreased due to addition of horse gram from 1.13 g to 1.07 g/100g in Chapati. Fiber content of value added Chapati increased from 1.61 to 2.21 g/100g while total mineral content was increased from 2.03 to 2.71 g/100g.

Table.1 Composition of Bhakari and its variants

Ingredients (g)	Variation I	Variation II	Variation III	Variation IV	Variation V
Jowar flour	100	90	85	80	75
Horse gram flour	0	10	15	20	25

Table.2 Composition of Chapati and its variants

Ingredients (g)	Variation I	Variation II	Variation III	Variation IV	Variation V
Wheat flour	96	86	81	76	71
Oil	2	2	2	2	2
Salt	2	2	2	2	2
Horse gram flour	0	10	15	20	25

Table.3 Mean sensory evaluation scores of Bhakari (*roti*)

Variations	Level of incorporation of Horse gram flour (%)	Mean sensory scores				
		Colour	Texture	Taste	Flavour	Overall acceptability
I	0	4.7	4.2	4.6	4.4	4.5
II	10	4.4	4.2	4.5	4.2	4.1
III	15	4.2	4.3	4.4	4.2	4.3
IV	20	4.7	4.4	4.7	4.7	4.8
V	25	3.9	3.8	3.8	4.0	3.9
CD		0.38	0.38	0.42	0.41	0.36
SE ±		0.13	0.15	0.14	0.14	0.12
F-value		6.7 **	2.3 ^{NS}	5.3**	3.3*	7.8**

** Significant at 1 percent

* Significant at 5 percent NS- Non-significant

Table.4 Mean sensory scores of Bhakari (*roti*) during storage

Storage period (hours)	Mean sensory scores				
	Colour	Texture	Taste	Flavour	Overall acceptability
0	4.4	4.7	4.7	4.7	4.8
6	4.3	4.6	4.6	4.7	4.7
12	4.3	4.6	4.5	4.6	4.6
18	4.3	4.5	4.4	4.4	4.6
24	3.9	4.4	4.4	4.4	4.5
CD	0.35	0.37	0.38	0.34	0.44
SE ±	0.14	0.13	0.15	0.12	0.15
F-value	1.6 ^{NS}	1.36 ^{NS}	2.3 ^{NS}	1.73 ^{NS}	1.84 ^{NS}

NS- Non-significant

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

Nutrients	Basic Bhakari	Value added Bhakari	't' value	Increase/decrease in nutrient content
	Mean ± SD	Mean ± SD		
Moisture (g)	7.66 ± 0.11	8.2 ± 0.09	5.4*	+0.54
Protein (g)	8.31 ± 0.62	12.25 ± 2.47	1.79 ^{NS}	+3.94
Fat (g)	1.76 ± 0.021	1.69 ± 0.028	15.0**	-0.07
Total minerals (g)	1.21 ± 0.029	1.83 ± 0.021	18.5**	+0.62
Fiber (g)	1.16 ± 0.029	1.91 ± 0.058	25.98**	+0.75
Carbohydrates (g)	80.38 ± 1.29	74.06 ± 2.44	2.39 ^{NS}	-6.32
Calcium (mg)	26.5 ± 1.8	60 ± 0.5	26.62**	+ 33.5
Iron (mg)	3.83 ± 0.10	4.4 ± 0.085	6.19*	+0.57
Copper (mg)	0.27 ± 0.014	0.46 ± 0.021	7.8*	+0.19
Zinc (mg)	0.93 ± 0.10	1.21 ± 0.02	3.88 ^{NS}	+0.28
Manganese (mg)	0.83 ± 0.035	0.92 ± 0.007	3.0 ^{NS}	+0.09

** Significant at 1 percent * Significant at 5 percent NS- Non-significant

Table.6 Mean sensory evaluation scores of *chapatti*

Variations	Level of incorporation of Horse gramflour (%)	Mean sensory scores				
		Colour	Texture	Taste	Flavour	Overall acceptability
I	0	4.4	4.4	4.3	4.3	4.3
II	10	4.4	4.1	4.1	4.2	4.1
III	15	4.2	4.2	4.0	4.0	4.0
IV	20	4.7	4.4	4.7	4.2	4.6
V	25	3.6	3.4	3.6	3.5	3.4
	CD	0.42	0.36	0.35	0.41	0.38
	SE ±	0.15	0.12	0.12	0.14	0.13
	F-value	6.7*	9.0*	10.8*	5.0*	10.8*

** Significant at 1 percent

Table.7 Mean sensory scores of Chapati during storage

Storage period (hours)	Mean sensory scores				
	Colour	Texture	Taste	Flavour	Overall acceptability
0	4.4	4.7	4.7	4.2	4.6
6	4.4	4.7	4.7	4.2	4.6
12	4.3	4.6	4.6	4.1	4.4
18	4.3	4.6	4.6	4.0	4.4
24	4.2	4.0	4.2	4.0	4.4
CD	0.35	0.34	0.36	0.40	0.37
SE ±	0.14	0.12	0.13	0.16	0.13
F-value	0.3 ^{NS}	5.01 ^{**}	6.5 ^{**}	1.9 ^{NS}	1.53 ^{NS}

** Significant at 1 percent NS- Non-significant

Table.8 Nutrient content of Chapati (per 100g)

Nutrients	Basic Chapati	Value added <i>chapatti</i>	't' value	Increase/decrease in nutrient content
	Mean ± SD	Mean ± SD		
Moisture (g)	6.6 ± 0.20	8.8 ± 0.19	8.14*	+2.2
Protein (g)	9.97 ± 0.24	10.5 ± 2.47	0.27 ^{NS}	+0.53
Fat (g)	1.13 ± 0.021	1.07 ± 0.007	3.0 ^{NS}	-0.06
Total minerals (g)	2.03 ± 0.029	2.71 ± 0.058	41 ^{**}	+0.68
Fiber (g)	1.61 ± 0.029	2.21 ± 0.058	20.78 ^{**}	+0.6
Carbohydrates (g)	78.54 ± 0.085	74.67 ± 2.39	2.20 ^{NS}	-3.87
Calcium (mg)	47.5 ± 2.17	97 ± 1.8	99 ^{**}	+49.5
Iron (mg)	4.61 ± 0.071	5.09 ± 0.078	6.48*	+0.48
Copper (mg)	0.22 ± 0.021	0.44 ± 0.014	43 ^{**}	+0.22
Zinc (mg)	1.26 ± 0.078	1.38 ± 0.011	2.55 ^{NS}	+0.12
Manganese (mg)	0.39 ± 0.01	0.8 ± 0.012	41 ^{**}	+0.41

** Significant at 1 percent * Significant at 5 percent NS- Non-significant

Bhakari and *chapatti* can be prepared by utilizing horse gram flour. Horse gram flour can be incorporated up to 20 per cent level in Bhakari and *chapatti*. The nutritional value of products can be increased by incorporation of horse gram flour at the level of 20 per cent with special reference to protein, total minerals, fiber, calcium and iron. The developed value added products have good shelf life.

Carbohydrate content of horse gram flour incorporated Chapati was 74.67g/100g which was significantly less than basic (78.54 g/100g). The calcium content of basic *chapatti* was significantly lower (47.5 mg/100g) than value added Chapati (97 mg/100g). Further, it was noticed that the iron content of value added *chapatti* was significantly increased from 4.61 to 5.09 mg/100g.

Other minerals content such as copper and manganese were significantly increased in value added Chapati but zinc was significantly decreased. From these findings, it can be suggested that value added Chapati would be better than basic Chapati, as it was a rich source of calcium and iron and contained higher amount of proximate nutrients than basic Chapati.

References

- Bhartiya A., J. P. Aditya and L. Kant (2015). Nutritional and remedial potential of an underutilized food legume horse gram (*Macrotyloma uniflorum*): a review. *The Journal of Animal & Plant Sciences*, 25(4): 908-920.
- Bhokre Chandralekha, Pravin Udhavrao Ghatge, Girish Machewad and Ashok Rodge (2012). Studies on preparation of buns fortified with germinated horse gram flour. *Open Access Scientific Reports*, 2:228.
- Thirukkumar.S and Sindumathi.G (2014). Studies on preparation of processed horse gram (*Macrotyloma uniflorum*) flour incorporated chappathi. *International Journal of Scientific Research*, 3(3):110-111.
- Vandarkuzhali, Narayanasamy Sangeetha (2016). Effect of germination, dehydration on physical properties of horse gram (*Macrotyloma uniflorum*) flour. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)*.10(6:1):59-66.

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