

# Studies on Preparation of Processed Horse Gram (Macrotyloma Uniflorum) Flour Incorporated Chappathi



## Engineering

**KEYWORDS :** anti-nutritional factors; soaking and drying; roasting; nutritional characteristics; sensory quality

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### ABSTRACT

Horse gram is one of the inexpensive sources of protein, calcium and iron. Simple processing such as soaking and roasting of horse gram were used to reduce the anti-nutritional factors. One portion of horse gram was washed, soaked in sufficient water for 12 hours with periodical change of water every four hours. It was dried in hot air oven and then powdered. In another processing method the horse gram was roasted for 10 minutes on low flame, cooled and powdered. While anti-nutritional factors such as tannins and phytates reduced on processing, nutrients namely protein, calcium, iron and phosphorus did not change when compared to that contained in raw horse gram. Further wheat based common food product chappathi was incorporated with processed horse gram flour to improve the nutrient content of the product. The sensory evaluation of food product was carried out by a panel of 10 trained member using 9-point hedonic scale. Chappathi prepared from wheat flour incorporated with 10 percent soaked and dried or 15 percent roasted horse gram flour was highly acceptable.

### Introduction

Horse gram is largely cultivated, especially in dry areas of Australia, Burma, India and Sri Lanka, mainly for animal feed. It is also used as a vegetable in India and is known as the poor man's pulse crop in southern India. Horse gram is an inexpensive 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 (Sodani, et.al.2004). The high content of dietary fibre in horse gram flour might be helpful in terms of maintaining positive effects on intestine and colon, besides other homeostatic and therapeutic functions in human nutrition (Sreerama, et. al.2012). Conventional processing methods, such as soaking, boiling, germination and fermentation are widely used to decrease the content of undesirable components, which results in enhanced acceptability and nutritional quality in addition to optimal utilization of horse gram as human food (Kadam and Salunkhe,1985).

The processed horse gram flour incorporated into wheat based food product dal pitha, had high protein, low glycemic index and low anti-nutritional factors (Archana and Sharma, 2012). Chappathi made from whole wheat flour is an unleavened one (single) layered Indian flat bread. Almost 80 percent of the wheat produced in India is consumed in the form of chappathi (Shalini and Laxmi, 2007). Hence this study was undertaken to compare the effect of two different processing on the content of anti-nutritional factors in horse gram and to standardize processed horse gram flour incorporated chappathi.

### Materials and Methods

Horse gram was procured from Departmental store in Madurai, Tamil Nadu. It was thoroughly cleaned to remove extraneous matters.

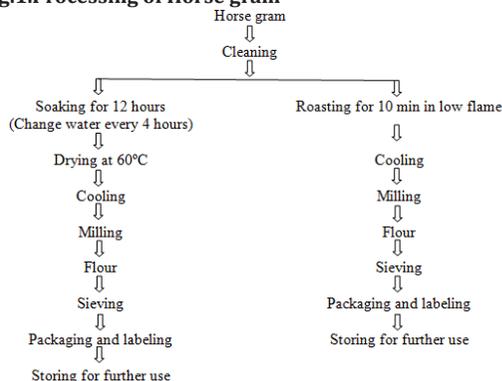
#### Soaking

Horse gram was soaked in sufficient water for 12 hours with periodical change of water every four hours. The soaked horse gram was spread evenly on aluminium trays and dried in a cabinet drier at 60°C for two to three hours. The dried horse gram was milled into flour.

#### Roasting

Horse gram was roasted on low flame for 10 minutes till it changed to light brown color and developed roasted flavor. The roasted horse gram was ground into flour.

**Fig.1.Processing of Horse gram**



### Standardization of chappathi mix incorporated with processed horse gram flour

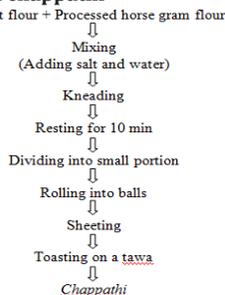
**Table 1.Composition of chappathi mix incorporated with processed horse gram flour**

Ingredients	Control (g/100g)	Variant A (g/100g)	Variant B (g/100g)	Variant C (g/100g)	Variant D (g/100g)	
Wheat flour	100	95	90	85	80	
Processed horse gram flour	Soaked and dried	-	5	10	15	20
	Roasted	-	5	10	15	20
Salt	3	3	3	3	3	

Control chappathi were prepared using only wheat flour. Each variation of chappathi namely variant A, B, C, D were tried incorporating horse gram, processed in two different ways, into wheat flour.

### Method for preparation of Chappathi

**Fig. 2.Preparation of processed horse gram flour incorporated chappathi**



**Determination of chemical characteristics of unprocessed (raw) and processed horse gram flour**

The chemical characteristics such as moisture content, protein, calcium, iron, phosphorus, ash, were determined as per the procedures of AOAC (2000). Tannin was determined as per the procedure of Schanderl (1970) and phytate was determined as per the procedure of Wheeler and Ferrel (1971) in raw and processed horse gram flour.

Processed horse gram flour was incorporated into wheat flour at 5, 10, 15 and 20 percent. Chappathi were prepared and compared with control by organoleptic evaluation.

**Organoleptic evaluation**

The organoleptic evaluation of chappathi incorporated with different levels of processed horse gram flour was carried out by trained panel of ten judges on a 9.0 point hedonic scale (Amerine, et. al, 1965).

**Statistical analysis**

The data obtained in the experiments were recorded and subjected to statistical analysis using standard procedures. The standard errors (SE) and critical differences (CD) at 5% level of significance were worked out for comparison of treatments and presented in the respective tables. Factorial Completely Randomized Design (FCRD) as per the method described by Gomez and Gomez (1984) was employed for the analysis with triplicate number of samples involving single factor.

**Results and Discussion**

The nutrient and anti nutritional factors content of raw, soaked and dried and roasted horse gram flours is shown in Table 2.

**Table 2. Nutrient and anti nutritional factors content of raw, soaked and dried and roasted horse gram flour**

Parameters	Horse gram flour				
	Raw (Unprocessed)	Soaked and dried	Roasted	SED	CD (0.05)
Moisture(g/100g)	10.60	11.30	6.40	0.0822	0.2615**
Protein(g/100g)	21.40	15.20	20.60	0.0100	0.0318**
Calcium(mg/100g)	232.00	230.00	234.00	0.0122	0.0390**
Iron(mg/100g)	14.20	14.20	15.60	0.0168	0.0536**
Phosphorus (mg/100g)	315.00	312.00	318.00	0.0220	0.0700**
Ash (g/100g)	3.30	3.10	3.40	0.0379	0.1205**
Phytate (mg/g)	10.20	4.38	1.49	0.0071	0.0225**
Tannin (mg/g)	16.12	10.30	8.38	0.0141	0.0450*

\*Significant

\*\*Highly significant SED-Standard Error Deviation

The soaked and dried horse gram flour was found to have higher moisture content than raw and roasted horse gram flour, which had the lowest moisture content of 6.40 g/100g. After soaking and drying a decrease in the protein content of horse gram flour was observed. There was a slight decrease in the protein content of horse gram flour after roasting. The iron content of horse gram was 15.60 mg/100g in roasted horse gram flour, which was more than found in unprocessed and soaked and

dried horse gram flour. Other nutrients such as phosphorus and calcium did not change much in processed horse gram flours when compared to raw horse gram flour. Unprocessed (raw) horse gram contained 10.20 mg/g phytate and 16.12 mg/g tannin. It was found that on roasting or soaking and drying, the phytate and tannin content reduced considerably. Phytate content reduced to 4.38mg/g on soaking and drying and after roasting it was only 1.49 mg/g. Similarly tannins reduced from 16.12 mg/g to 10.30 mg/g on soaking and drying and to 8.38 mg/g on for roasting. The results of this study reveals a reduction of anti-nutritional factors, Nwosu (2010) reported a time dependent reduction in phytate, tannins and trypsin inhibitor contents following cooking.

The organoleptic evaluation of the Chappathi incorporated with processed horse gram flours is shown in table 3.

**Table 3. Organoleptic evaluation of chappathi incorporated processed horse gram flour**

Parameters	Chappathi								
	Control	Percentage of soaked and dried horse gram flour incorporation				Percentage of roasted horse gram flour incorporation			
		5	10	15	20	5	10	15	20
Colour	8.8	8.6	8.7	8.4	8.2	8.4	8.5	8.8	8.5
Flavor	8.9	8.5	8.8	8.2	8.5	8.2	8.4	8.8	8.0
Texture	8.8	8.5	8.7	8.3	8.0	8.6	8.2	8.8	8.3
Taste	8.9	8.4	8.7	8.3	7.8	8.5	8.6	8.7	7.8
Overall acceptability	8.9	8.5	8.7	8.3	8.3	8.4	8.4	8.8	8.1

It was found that sensory quality of chappathi incorporated with processed horse gram flour for appearance, colour, flavor, texture, taste and overall acceptability by using a 9 point hedonic scale were found to be different when comparison to control. The overall acceptability for 10 percent soaked and dried horse gram flour incorporated chappathi got highest score of 8.8 compared to 5, 15 and 20 percent of soaked and dried horse gram flour incorporated chappathi. Roasted horse gram flour incorporated at 15 percent level obtained with the highest score of 8.8. Bhokre et al., (2012) reported that the sensory evaluation of buns fortified with germinated horse gram flour (5%, 10% and 15%) were acceptable than the buns fortified with germinated horse gram flour (20%).

**Conclusion**

The result of this study indicates that horse gram flour is rich in protein, calcium and dietary fibre. Hence suitably processed horse gram flour could be used in the preparation of various food products. Of the different processes employed, roasting was effective in reducing anti-nutritional factors. The results obtained from this study indicate that the processes of soaking and drying or roasting are simple methods to eliminate the anti-nutrients content of horse gram. Horse gram, being a locally available pulse, can be thus used after simple processing to improve the fibre, protein and mineral content of chappathi.

**REFERENCE**

- Amerine MA, Pangborn RM and Roessler EB (1965) Principles of sensory evaluation of food. Academic press, New York. | 2. AOAC (2000) Official Methods of Analysis (17th Edn.), Official Methods of Analysis of Association of Official Agricultural Chemists International, Gaithersburg, MD.
- Archana and Sharma S (2012). Development of augmented Dal Pitha: A protein rich Horse gram (*Macrotyloma uniflorum*) incorporating food product. Int. J. of Food Science, Technology & Nutrition, 6(1), 41-50 | 4. Bhokre C, Ghatge PU, Machewad G, Rodge A (2012) Studies on Preparation of Buns Fortified with Germinated Horse Gram Flour. 2:228. doi.org/10.4172/scientificreports.228 | 5. Borade VP, Kadam SS, Salunkhe DK (1984) Changes in phytates phosphorus and minerals during germination and cooking of horse gram and moth bean. Plant Foods Human Nutr 34: 151-157. | 6. Gomez, K. H. and Gomez, A. A. 1984. Statistical procedures for Agricultural Research 2nd Edn. John Wiley and Sons. New York. P. 381. | 7. Kadam SS and Salunkhe DK (1985) Nutritional composition, processing, and utilization of horse gram and moth bean. Crit Rev Food Sci Nutr 22: 1-26. | 8. Nwosu JN (2010). Effect of soaking, blanching and cooking on the anti-nutritional properties of asparagus bean (*Vigna Sesquipedalis*) flour. Nature and Science 8(8):163-167. | 9. Schanderl, S.H. 1970. In: Method in food analysis, Academic press, New York. P.709. | 10. Sodani, S.N.; Paliwal, R.V. and Jain, L.K (2004, Nov 5-7). Phenotypic stability for seed yield in rain fed horse gram (*Macrotyloma uniflorum*). Proceedings of the National Symposium on Arid legumes for sustainable Agriculture and Trade, Central Arid Zone Research institute, Jodhpur, Rajasthan, India. | 11. Shalini, K. G. and Laxmi, A. 2007. Influence of additives on rheological characteristics of whole-wheat dough and quality of Chapatti. (Indian unleavened flat bread) part I-hydrocolloids. Food Hydrocolloids, 21: 110-117. | 12. Sreerama Y.N, Sashikala V.B, Pratapa V.M and Singh V. (2012). Nutrients and anti nutrients in cowpea and horse gram flours in comparison to chickpea flour: Evaluation of their flour functionality. doi.org/10.1016/j.foodchem.2011.09.008 | 13. Wheeler, EL and Ferrel, R.E, 1971, Cereal chemistry, P.312. |