*Intl. J. Food . Ferment. Technol. 5(1), 83-90, June, 2015*



**DOI Number:** 10.5958/2277-9396.2015.00012.4

RESEARCH PAPER

# Preparation and Evaluation of "*Aloo wari*"- a novel nutritious traditional fermented product

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Paper No. 85 Received: 22 October 2014 Accepted: 21 July 2015

## Abstract

*Aloo waris* were prepared by blending dehydrated potato flour with black gram flour. The developed product was analyzed for sensory, physico-chemical, phyto-chemical and shelf-life quality and the results have been compared with *dhal waris* (control). Protein content was significantly higher in control *waris* compared to the potato supplemented *waris*. Bioactive compounds including ascorbic acid, total phenolics and total antioxidant activity measured as DPPH radical scavenging activity increased significantly on incorporation of potato flour. Between the cultivars, *waris* enriched with Kufri Pukhraj flour (a table variety which is considered unfit for processing), displayed the highest phyto-chemical content and total antioxidant activity. Sensory evaluation indicated higher overall acceptability scores of *aloo waris* compared to *dhal waris*. Storage studies showed that the potato *waris* can be stored safely for 12 months with its nutrient constituents intact.

**Keywords:** Potato, potato flour, *wari*, phytochemicals, antioxidants

Potato (*Solanum tuberosum L.)* popularly known as "The king of vegetables" has emerged as the fourth most important food crop in the world after rice, wheat and maize (Misra and Kulshrestha, 2003). Potato contains carbohydrates (16%), proteins (2%), minerals (1%), dietary fiber (0.6%) and negligible amount of fat (Brown, 2005; Kaur *et al.,* 2012). Besides being a rich source of carbohydrates, potato also has some health promoting compounds such as phenolic acids, ascorbic acid and carotenoids; commonly described as antioxidants (Ezekiel *et al.,* 2013, Kasper *et al.,* 2013).

Potato production has significantly increased in recent years in many developing countries, particularly India, making it to the position of second largest potato producing country in the world. Despite the increasing production, bulk of the crop incurs heavy post-harvest losses due to its perishable nature and inadequate storage facilities in our country. Conversion of potato to potato flour extends the shelf-life of potatoes and lowers storage cost (Lakra and Sehgal, 2011). Their incorporation into traditional foods will enhance their utilization.

*Waris* are legume based fermented food made from black gram flour blended with Mung bean flour along with seasonings. These are sun-dried dumplings, spicy, hollow and brittle which are manufactured on cottage scale in rural areas of Northern India and is used as adjunct in curries (Singh *et al.,* 2013). Fermentation and drying of the batter takes place simultaneously and the drying cause case hardening that result in a cavity or porous texture (Kulkarni *et al.,* 1997). Dehydrated *waris* are easy to prepare, require no costly machinery for manufacture and have a longer shelf-life.

Since production of potato is abundant, there is a need to find diversified uses of potatoes and to develop new processed products with improved nutritional quality that can be made available for consumption throughout the year. Potato flour can be added to an indigenous dehydrated product called *wari*, which has a promising future due to its long shelf-life and diverse uses. The aim of this work was to develop *waris* enriched with potato flour from different cultivars and to evaluate the quality characteristics of the developed product in order to assess its physico-chemical characteristics and shelf-life.

## Materials and Methods

### Materials

Two potato cultivars known for better quality characteristics (Kufri Chipsona-1, Kufri Chandramukhi) and one commonly cultivated variety (Kufri Pukhraj) were procured from Vegetable Crops Department of Punjab Agricultural University Ludhiana (PB) India and were used for production of *waris*. Split black gram *dhal* (*Phaseolu smungo* Roxb.) and whole spices (dried fenugreek leaves, coriander seeds, cumin, cinnamon, black pepper, red pepper, cloves, nutmeg, asafoetida) were purchased locally.

### Preparation of Raw Materials

**Dehydrated potato flour:** The tubers of K. Chipsona-1, K. Chandramukhi and K. Pukhraj were peeled and cut into 2-3 mm thick slices with a rotary hand slicer. The slices were cooked in boiling water containing 0.25% potassium metabisulphite for 10 min to prevent enzymatic darkening (Marwaha and Pandey, 2006). Immediately after cooking, potato slices were cooled under running tap water. The sulphited slices were drained, loaded in trays and dried in hot air cabinet drier at 60$^{O}$C±5$^{O}$C for 5 to 6 hr. The dried potato slices were ground in an electric grinder and then, powdered in a cyclotec mill.

**Wet pulse paste**: Black gram *dhal* or *Urad dhal* (450 g) was washed thoroughly and soaked in about 550 ml of water overnight. The drained pulses were then, ground in an electric grinder with small addition of water, till it became a thick paste.

**Spice mix:**Whole spices were coarsely ground in a grinder and used for the preparation of *waris*.

### Processing Method

Standardized recipe of *waris* had the various ingredients as potato flour 66g, water 249g, pulse paste 135g, dried fenugreek leaves 3.5g, coriander and cumin seeds 7.5g, cinnamon 1.5g, black and red pepper 3.0g, cloves 0.8g, nutmeg 0.25g, asafoetida 0.1g. *Waris* were prepared from thick batter obtained by mixing standardized quantities of above described ingredients. The resultant thick wet paste was whisked continuously with hand till it became light and fluffy due to incorporation of air. The resultant fluffy batter was divided manually into small balls weighing about 50-60 g. The prepared balls were spread on stainless steel trays smeared with oil, maintaining a distance of 1-2 inches between the balls. The trays were then, loaded in a hot air cabinet drier and dried at 60±5$^{O}$C for 14-16 h. The control (without potato) *wari* samples were used for physico-chemical, phytochemical and sensorial comparisons.

## Analysis

### Physico-chemical and phyto-chemical Analysis

The moisture, ash, acid insoluble ash, acidity and protein contents of raw materials and prepared products were estimated by the official methods (AOAC, 2005). The ascorbic acid content was determined by visual titration method using 2, 4-Dichlorophenol-Indophenol dye method (Ranganna, 2004). The results have been expressed as milligram of ascorbic acid/100 g dw.

The color of *waris* was measured using a Minolta Chroma colorimeter model CR 200 (Minolta Co., Osaka, Japan) against a white reference standard. The measurements were displayed in *L**: lightness, *a*:* redness and *b*:* yellowness.

### Sensory Quality Evaluation

For sensory evaluation, the prepared *waris* were shallow-fried at 150$^{O}$C for 30 sec and then cooked in a vegetable curry preparation. Curry was prepared using onion, garlic and tomato paste along with various spices (cumin, red pepper, coriander powder, salt). *Waris* were pressured cooked for 10 minutes and then, served hot to the panelists.

The cooked hot *wari* samples were evaluated by a panel of 10 judges using 9-point Hedonic scale for their sensory characteristics like appearance, flavor, texture and overall acceptability. The scores were assigned from extremely liked (9) to disliked extremely (1) on hedonic scale (Joshi, 2006).

### Storage Studies

*Waris* were packed in 200 gauge polythene bags and sealed in tight air containers. The packed *waris* were exposed to room temperature (26-38$^{O}$C/RH 35-87%) for a period of 12 months. Storage stability of the product was assessed by determining the changes in moisture and color attributes. Sensorial analysis of the stored *waris* was done by a semi-trained panel of 10 judges using 9-point Hedonic scale.

### Statistical Analysis

All the experiments were carried out in triplicate. One-way analysis of variance was performed using the SPSS version 20.0 (Statistical Package for Social Sciences). Significant differences ($p<0.05$) were determined by Tukey's.

## Results and Discussion

### Proximate Composition of Raw Ingredients

Composition of physico-chemical parameters (Table 1) indicated varietal difference in moisture contents among different potato cultivars. K. Pukhraj had a higher percentage of moisture content (84.69%) which is indicative of its lower dry matter content as compared to K. Chipsona-1 and K. Chandramukhi which contained a lower percentage of moisture. However, there were no significant ($p<0.05$) differences observed among moisture content of potato flours of all the varieties (Table 1). Protein and ash contents of potato flours were similar to those noted in raw potatoes, indicating a non-significant ($p < 0.05$) effect of processing on the micronutrients of potatoes (Table 1). Data for protein and ash content is in line with those reported by Gahlawat and Sehgal, (1998) and Sandhu and Parhawk, (2002). *Urad dhal* and spice mix contained 9.80 and 3.10 per cent moisture, 26.38 and 0.21 per cent protein and 3.63 and 3.58 per cent ash, respectively (Table 1).

As depicted in Table 1, fresh potato cultivars contained the highest level of ascorbic acid (75.76-107.83 mg/100 g) total phenolics (165.4-419.9 mg GAE/100g) and antioxidant capacity (38.10-63.50%) as measured by DPPH radical scavenging method. Processing of raw tubers in flour resulted in a significant ($p < 0.05$) reduction in these phytochemicals (Table 1). Potatoes

**Table 1: Physicochemical and phytochemical traits of raw ingredients used in development of potato *waris***

| Raw ingredients | Treatments | Moisture* (%) | Protein (%)** | Ash (%) | Ascorbic acid (mg/100g) | Total phenols (mg GAE/100 g) | Scavenging activity* (%) |
|---|---|---|---|---|---|---|---|
| ***Cultivars*** | | | | | | | |
| K.Chipsona-1 | Fresh potatoes | 75.69±0.10$^{b}$ | 21.40±0.62$^{d}$ | 4.03±0.15$^{d}$ | 75.76±0.30$^{d}$ | 165.4±0.21$^{f}$ | 38.10±0.25$^{d}$ |
| | Dehydrated flour | 6.02±0.09$^{d}$ | 20.98±0.54$^{e}$ | 3.86±0.08$^{e}$ | 62.84±0.21$^{f}$ | 132.3±0.20$^{h}$ | 20.90±0.28$^{f}$ |
| K.Chandramukhi | Fresh potatoes | 75.70±0.50$^{b}$ | 18.75±0.55$^{f}$ | 4.92±0.12$^{b}$ | 80.92±0.30$^{b}$ | 224.2±0.60$^{d}$ | 53.20±0.50$^{c}$ |
| | Dehydrated flour | 6.05±0.20$^{d}$ | 18.04±0.40$^{g}$ | 4.62±0.09$^{c}$ | 67.54±0.22$^{e}$ | 167.8±0.31$^{e}$ | 25.86±0.50$^{e}$ |
| K.Pukhraj | Fresh potatoes | 84.69±0.51$^{a}$ | 23.05±0.60$^{b}$ | 6.85±0.18$^{a}$ | 107.83±0.55$^{a}$ | 419.9±0.65$^{b}$ | 63.50±0.30$^{b}$ |
| | Dehydrated flour | 6.15±0.12$^{d}$ | 22.86±0.52$^{c}$ | 6.92±0.20$^{a}$ | 80.86±0.21$^{c}$ | 318.6±0.42$^{c}$ | 20.90±0.25$^{f}$ |
| *Urad dhal* | Fresh | 9.80±0.28$^{c}$ | 26.38±0.70$^{a}$ | 3.63±0.21$^{f}$ | 9.06±0.10$^{h}$ | 155.2±0.25$^{g}$ | 20.10±0.30$^{g}$ |
| Spice mix | Fresh | 3.10±0.18$^{e}$ | 0.21±0.05$^{h}$ | 3.58±0.18$^{f}$ | nd | nd | 98.10±0.55$^{a}$ |

*g/100g wet basis; *nd* – not detected. ** Day weight basis.

Values within a column with different letters are significantly ($p < 0.05$) different.

Mean values ± SD ($n = 3$)

are considered as significant source of bioactive compounds such as ascorbic acid and total phenolics that help reduce the risk of chronic diseases (Ezekiel *et al.,* 2013). It has been reported that these bioactive compounds are relatively unstable to heat and get easily oxidized (Ahmed and Ali, 2013). So the reduction in ascorbic acid and total phenolics in the present study might be related to water blanching operations. Similar losses during processing of raw tubers into flour were reported earlier by Marwaha and Pandey, (2006). Out of the studied cultivars, Kufri Pukhraj, a table variety which is considered unfit for processing, showed the higher ascorbic acid and total phenolic content than the other two cultivars (Table 1). Also, the free radical, 1, 1-diphenyl-2-picrylhydrazyl (DPPH) scavenging activity was the highest in cultivar Kufri Pukhraj for both potato mash and flour (Table 1).

*Urad dhal* used in the preparation of *wari* contained 9.06 mg/100 g (dw) ascorbic acid, 155.2 mg GAE/100g (dw) total phenolics and 20.10% radical scavenging activity, respectively (Table 1). The present findings for total phenolic content of *urad dhal* were lower than those reported by Sreeramulu *et al.,* (2009). These differences might be due to variations in botanical origin. Spice mix used in the making of *waris* had 98.10% radical scavenging activity (Table 1). These results are in line with those documented by Shan *et al.* (2005).

## Quality characteristics of fresh *waris*

Quality attributes i.e. physico-chemical, phytochemical and colour characteristics of control *waris* and potato incorporated *waris* are summarized in Table 2.

### Physico-chemical Characteristics

The control and potato supplemented *waris* did not differ significantly ($p< 0.05$) in their moisture content. The ash content of control *waris* was 4.02% and it ranged from 3.33 to 4.02% in potato supplemented *waris* (Table 2). The ash content of *waris* conformed well to the proposed standards (Max. 4.50%) for *dhal waris* (Kulkarni et al. 1997). Acid insoluble ash ranged 0.18-0.26% and was within the prescribed limits (Max. 0.40%) (Kulkarni *et al.,* 1997). The variations (1.31-1.41%) in acidity (as oleic acid) of *waris* were also within the proposed standards (Max. 1.70%) (Kulkarni *et al.,* 1997). In control *waris*, protein content was 22.56% that was found to be significantly ($p<0.05$) higher than that of potato supplemented *waris* (14.58-16.82%) (Table 2). The protein content of the control *waris* also conformed to the proposed specifications (Min. 16%) (Kulkarni *et al.,* 1997), while *waris* incorporated with potato showed significantly lower values.

### Physico-chemical characteristics

Phytochemical characteristics i.e., ascorbic acid, total phenolic content and radical scavenging activities of fresh *wari* samples significantly ($p<0.05$) increased on supplementation with potato as compared to the control *waris* (Table 2). It might be due to a larger amount of phyto-chemical content in potato in comparison to *urad dhal* (Table 1). Between the cultivars studied, *waris* supplemented with K. Pukhraj had the highest bioactive content and radical scavenging activity while the lowest was observed in K.Chipsona-1 *waris* (Table 2). The higher concentration of these phytochemicals in K. Pukhraj at initial level (Table 1) might have contributed towards their higher retention in the prepared product.

### Colour characteristics

Color characteristics (*L*, a* and b**) of control and potato supplemented *waris* were significantly ($p<0.05$) different from each other (Table 2). K. Chipsona-1 supplemented *waris* had the maximum *L** (lightness) value while the lowest was noticed for *waris* supplemented with K. Pukhraj. *Waris* incorporated with K. Pukhraj were darker in color which might be due to higher phenolic content in this cultivar. Besides providing antioxidant properties, phenolic compounds are also associated with enzymatic browning which occurs due to their oxidation by polyphenol oxidase enzyme (Marwaha and Pandey, 2006; Marwaha *et al.,*2010; Mehta *et al.*, 2011).

## Effect of Storage

Moisture Content

Moisture is perhaps the most important factor, determining the shelf-life of *waris* and has to be maintained within 11 per cent to prevent them from fungal attack (Kulkarni *et al.,* 1997). *Waris* supplemented with potato flour did not show any significant ($p<0.05$) difference in moisture content (Fig. 1). However, there was a gradual increase ($p< 0.05$) in the moisture content of *waris*, irrespective of cultivars. As can be seen in Fig. 1, the average moisture content of *waris* increased from 5.15 to 8.56% during 12 months of storage. It might be due to variation in atmospheric relative humidity, which ranged from 35-85% during the storage period. Similar behavior was also observed in Mung Bean *waris* stored at room temperature (12-37$^{O}$C) for 12 months (Singh *et*

**Table 2: Quality characteristics of fresh *waris**

| Products | Moisture (%) | Ash (%) | Acid insoluble ash (%) | Acidity (%) | Protein (%) | Ascorbic acid (mg/100g) | Total phenols (mg GAE/100g) | Scavenging activity (%) | Color attributes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | *L** | *a** | *b** |
| *Waris* without potato flour | | | | | | | | | | | |
| Control (without potato) | 5.82±0.20$^{a}$ | 4.02±0.15$^{a}$ | 0.26±0.05$^{a}$ | 1.33±0.02$^{b}$ | 22.56±0.50$^{a}$ | 23.48±0.21$^{d}$ | 360.7±1.40$^{d}$ | 82.64±0.48$^{d}$ | 52.48±0.23$^{a}$ | 3.76±0.22$^{b}$ | 13.11±0.11$^{a}$ |
| *Waris* supplemented with dehydrated potato flour | | | | | | | | | | | |
| K.Chipsona-1 | 5.98±0.20$^{a}$ | 4.00±0.20$^{a}$ | 0.20±0.01$^{b}$ | 1.31±0.01$^{b}$ | 16.74±0.12$^{b}$ | 28.78±0.10$^{c}$ | 387.0±1.80$^{c}$ | 90.26±0.54$^{c}$ | 49.89±0.19$^{b}$ | 3.85±0.05$^{a}$ | 10.52±0.25$^{b}$ |
| K. Chandramukhi | 5.63±0.18$^{a}$ | 3.36±0.10$^{b}$ | 0.18±0.01$^{c}$ | 1.41±0.03$^{a}$ | 14.58±0.80$^{c}$ | 31.54±0.30$^{b}$ | 509.4±1.48$^{b}$ | 92.91±0.80$^{b}$ | 49.86±0.28$^{b}$ | 3.44±0.09$^{c}$ | 10.60±0.15$^{b}$ |
| K.Pukhraj | 5.81±0.20$^{a}$ | 3.80±0.21$^{a}$ | 0.21±0.02$^{b}$ | 1.33±0.01$^{b}$ | 16.77±0.054$^{b}$ | 35.55±0.25$^{a}$ | 763.5±0.30$^{a}$ | 93.96±0.88$^{ab}$ | 47.60±0.20$^{c}$ | 3.24±0.14$^{d}$ | 10.41±0.12$^{b}$ |

*Results expressed on dry weight basis

Values within a column with different letters are significantly ($p < 0.05$) different.

Mean values ± SD ($n = 3$)

*al.*, 2013) and in dehydrated jackfruit *papads* stored for 180 days (Jagadeesh *et al.,* 2007).

During storage, none of the *waris* exceeded the prescribed limits (Max. 11%) for moisture content and all the samples were free from havy insect infestation up to 12 months of stage.

Color Attributes

Storage exerted a significant ($p < 0.05$) effect on the color changes in potato added *waris,* regardless of cultivars. The $L^*$,$a^*$ and $b^*$ values decreased ($p < 0.05$) consistently during storage of *waris* for 12 months (Table 2). The change in color might be due to increase in

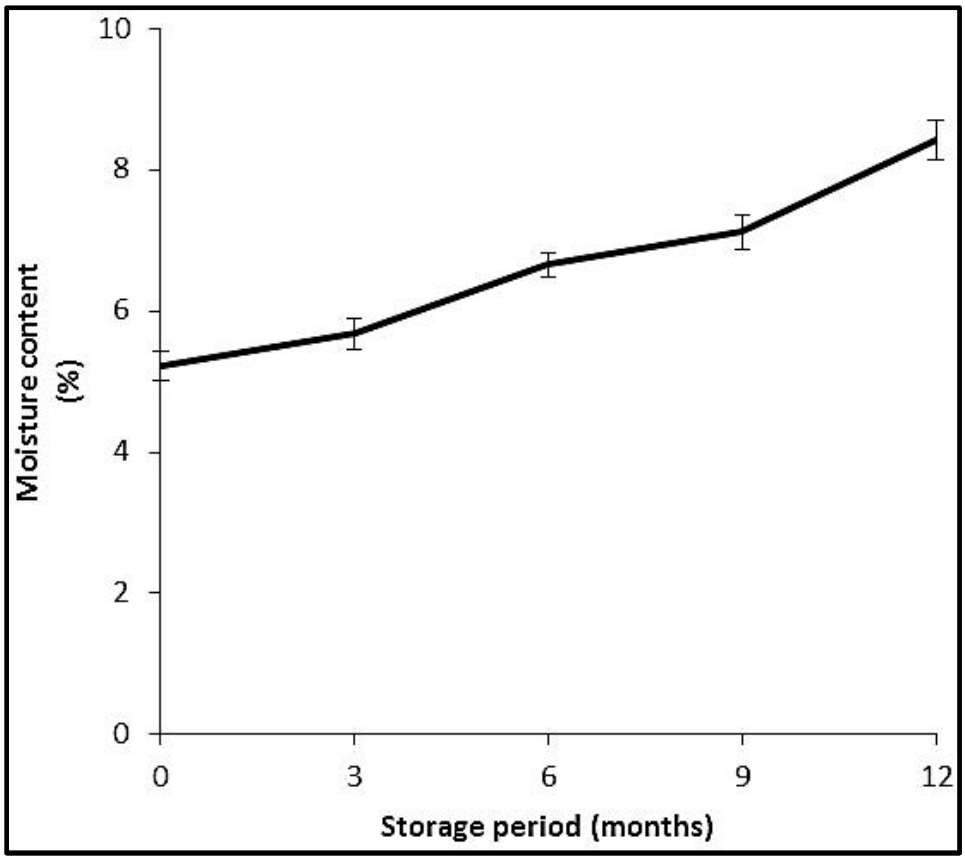


**Fig. 1: Effect of storage on moisture content of *waris*. Mean values ± SD ($n$ = 3). Error bars represents SD of the mean**

**Table 3: Effect of storage on overall acceptability of control and potato supplemented *waris***

| Product | Duration of storage (months) | | | | |
|---|---|---|---|---|---|
| | 0 | 3 | 6 | 9 | 12 |
| Control (without potato) | $7.20 \pm 0.05^{dA}$ | $7.20 \pm 0.03^{cA}$ | $7.00 \pm 0.06^{dB}$ | $6.80 \pm 0.04^{dC}$ | $6.52 \pm 0.02^{dD}$ |
| *Waris* supplemented with dehydrated potato flour | | | | | |
| K.Chipsona-1 | $8.80 \pm 0.02^{aA}$ | $8.54 \pm 0.02^{aB}$ | $8.23 \pm 0.03^{aC}$ | $8.00 \pm 0.05^{aD}$ | $7.80 \pm 0.04^{aE}$ |
| K. Chandramukhi | $8.52 \pm 0.04^{bA}$ | $8.30 \pm 0.05^{bB}$ | $8.10 \pm 0.05^{bC}$ | $7.90 \pm 0.03^{bD}$ | $7.50 \pm 0.01^{bE}$ |
| K.Pukhraj | $8.30 \pm 0.04^{cA}$ | $8.26 \pm 0.05^{bA}$ | $7.94 \pm 0.05^{CB}$ | $7.42 \pm 0.05^{cC}$ | $7.04 \pm 0.03^{cD}$ |

Values within a column with different superscript lower case letters are significantly ($p < 0.05$) different between treatments (with and without potato).

Value within a row with different superscript capital letters are significantly ($p < 0.05$) different within the storage duration. Mean values ± SD ($n$=3)

moisture content and temperature during storage (Hamed *et al.,* 1973).

Sensory Quality

The effect of storage on the overall acceptability of *waris* stored at room temperature (26-38$^{o}$C/RH 35-87%) is represented in Table 3. Potato flour supplemented *waris* had better acceptability scores as compared to control (without potato) *waris*. Both control and potato incorporated *waris* were free from fungal infestation and were found to be highly desirable up to 12 months of storage. In the present study, visual color appearance of the *waris* enriched dehydrated potato flour was highly acceptable even after 12 months of storage despite changes in color characteristics (*L*, a**and *b**values).

## Conclusion

It can be concluded that nutritionally enriched *waris* can be developed using dehydrated potato flour which provides significantly more bioactive compounds including ascorbic acid, total phenolics and antioxidant activity and high acceptability ratings than traditional *dhal wari*.

## References


Ahmed, F.A. and Ali, A.F.M. 2013. Bioactive compounds and antioxidant activity of fresh and processed white cauliflower. *Bio. Med. Res. Int.* 1-9.

AOAC. 2005. Official Methods of Analysis of the Association of the Official Analytical Chemists. 18th ed. Gaithersburg, Md.

Brown, C.R. 2005. Antioxidants in Potato. *Am. J. Potato Res.* **82**: 163-172.

Ezekiel, R., Singh, N., Sharma, S. and Kaur A. 2013. Beneficial phytochemicals in potato – a Review. *Food Res. Int.* **50**: 487-496.

Gahlawat, P. and Sehgal, S. 1998. Protein and starch digestibilities and mineral availability of products developed from potato, soy and corn flour. *Plant Foods Hum.Nutr.* **52**: 151-160.

Jagadeesh, S.L., Hegde, L., Kotimani, S., Gorbal, K., Reddy, B.S., Swamy, G.S.K., Basavaraj, N. and Raghavan, G.S.V. 2007. Influence of packaging on storage behaviour of jackfruit papads. *Bev. Food World.* **34**: 15-19.

Joshi, V.K. 2006. *Sensory Science: Principles and application in food science.* Agro-tech Publishing Academy, Udaipur, India.

Kasper, K.L., Park, J.S., Brown, C.R., Weller, K., Ross, C.F., Mathison, B.D. and Chew, B.P. 2013. Sensory evaluation of pigmented flesh potatoes (*Solanum tuberosum L.*). *Food Nutr. Sci.,* **4**: 77-81.

Kaur, S., Sandhu, K.S. and Aggarwal, P. 2012. Chlorpropham affects processing quality of potato during storage. *Int. J. Veg. Sci.,* **18**: 328-345.

Kulkarni, S.G., Manan, J.K., Agarwal, M.D. and Shukla, I.C. 1997. Studies on physicochemical composition, packaging and storage of blackgram and greengram *wari* prepared in Uttar Pradesh. *J Food Sci. Technol.,* **34**: 119-122.

Lakra, P. and Sehgal, S. 2011. Influence of processing on total and extractable mineral content of products prepared from potato flour. *J. Food Sci. Technol.,* **48**: 735-739.

Marwaha, R.S. and Pandey, S.K. 2006. Suitability of cultivars and methods for the production of dehydrated chips. *Potato J.,* **33**: 110-117.

Marwaha, R.S., Pandey, S.K., Kumar, D., Singh, S.V. and Kumar, P. 2010. Potato processing scenario in India: Industrial constraints, future projections, challenges ahead and remedies – A review. *J. Food Sci. Technol.,* **47**: 137-156.

Mehta, A., Charaya, P. and Singh, B.P. 2011. French fry quality of potato varieties: Effect of tuber maturity and skin curing. *Potato J.* **38**: 130-136.

Misra, A. and Kulshrestha, K. 2003. Effect of storage on nutritional value of potato flour made from three potato varieties. *Plant Foods Hum. Nutr.* **58**: 1-10.

Ranganna, S. 2004. *Handbook of Analysis and Quality Control for Fruit and Vegetable product.* Tata McGraw Hill Publishing Company Limited, New Delhi, p. 105.

Sandhu, K.S. and Parhawk, B. 2002. Studies on the preparation of dehydrated potato cubes. *J. Food Sci. Technol.* **39**: 594-602.

Shan, B., Cai, Y.Z., Sun, M. and Corke, H. (2005). Antioxidant capacity of 26 spice extracts and characterization of their phenolic content. *J. Agric. Food Chem.* **53**: 7749-7759.

Singh, M., Kaur, G., Singh, S. and Singh, S. 2013. Effect of packaging material and storage conditions on biochemical and microbial profile of Mung Bean *Warrian* (Indigenous Fermented Food). *Int. J. Food Ferment. Technol.* **23**: 65-69.

Sreeramulu, D., Reddy, C.V. and Raghunath, M. 2009. Antioxidant activity of commonly consumed

cereals, millets, pulses and legumes. *J. Biochem. Biophy.,* **46**: 112-115.

Velioglu, Y.S., Mazza, G., Gho, L. And Onmah, B.D. 1998. Antioxidant activity and total phenolics in selected fruits and vegetables and grain products. *J. Agric. Food Chem.,* **46**: 4113-1117.

Yamaguchi, T., Takamura, H., Mataoba, T. and Terao, J. 1998. HPLC method for evaluation of the free radical scavenging activity of foods by using 1, 1-diphenyl-picrylhydrazyl. *Biosci. Biotechnol. Biochem.,* **62**: 1201-1220.