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# Comparative Physiochemical and Microbiological Analysis of Potato Powder Produce from Two Potato Cultivar (*Solanum tuberosum* L.) Grown in Peshawar Valley, Pakistan

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**Abstract:** Two potato cultivar Desiree and Cardinal was procured from Agriculture Research Institute Tarnab Farm Peshawar, Pakistan to use for the preparation of potato powder. The process involves sorting, washing, peeling, slicing, blanching, sulfitation, dehydration, grinding and packing. All these parameters used in process were standardized. Physiochemical analysis of fresh potato and potato powder were carried out. Microbiological examination, functional properties and storage life studies of the potato powder were also performed. The product prepared by drying in cabinet dryer at 55°C for 7 hours was found off white colour potatoes chips which were grinded to make off white potato powder. The potato powder possessed good taste and texture.

**Key words:** Potato Powder · Physiochemical Analysis · Microbiological Analysis · Storage Stability

## INTRODUCTION

Potato is native to South America and was introduced to the Indo-Pak subcontinent by the British right in the 19th century. It is expected that annually about 320.67 million tons of potatoes are produced world over, China being the major producer of this crop with an annual yield of 72 million tons. In Pakistan, the total area under potato farming is 149.1 thousand hectares with the total production of 2.5 million tons [1]. The potato is the world's fourth largest food crop and is a staple in many diets around the world. In addition to being a source of highly digestible carbohydrate and nutritionally complete protein, the potato is also an excellent source of other essential nutrients [2]. The potato is one of the most important vegetable and a part of daily food utilization of almost all the world population. It is a balanced food containing high energy, nutritional quality protein, essential vitamins and minerals [3]. Nowadays, potato has become high yielding carbohydrate enrich vegetable containing phytochemicals and minerals contents throughout the world. Furthermore, it is rich in antioxidants such as vitamin C, polyphenols (phenolcarboxylic acids), carotenoids and selenium and α-tocopherol. It is fourth most important food crop worldwide after maize, wheat and rice, with production of more than 323 million tons [4]. The International Potato Centre (CIP) holds the largest Sweet potato gene bank in the world with more than 6,500 wild, traditional and improved varieties. Sweet potato serves as a staple food vegetable (fleshy roots and tender leaves), snack food, weaning food, animal feed, as well as a raw material for industrial starch and alcohol. It is processed into diverse products [5].

The main objective of the report is to develop a process of potato powder on village level to reduce post-harvest losses and to generate extra income for the farmer. Preparation of potato powder during peak season is one way to overcome the problem of its consumption throughout year. Powder also assists to reduce bulk for storage and transportation with few physiological and biochemical changes.

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## MATERIALS AND METHODS

**Procurement of Raw Material:** The two potato variety Desiree and Cardinal were collected from Agriculture Research Institute Tarnab Farm Peshawar, Pakistan.

**Production of Potato Powder:** Potato powder was prepared by using cabinet dryer. The potato was washed with water to remove adhering soil and to reduce the number of contaminating microorganisms on the raw material. Washed potatoes were peeled to remove their outer layer using peeler machine. Peeled potatoes were again washed to remove the adhering peels. Hand trimming of washed peeled potatoes were carried out to remove any residual peel, eyes, discolored area, black spore, disease, insect injury and sun borne or green material. After trimming potatoes were sliced in an Automatic Electric Slicer Machine. Sliced potatoes were blanched for 5 minutes in a boiling water to inactivate the enzymes and also reduce microbiological contamination. The slices were sulphited in 0.1 – 0.3 %, meta bisulphate solution immediately after blanching. Sulphite protects the product from non-enzymatic browning or scorching during dehydration and increase the storage life of the product under adverse temperature. After sulfiting the potato pieces were dried in a cabinet dryer at 55°C for 7 hours. The dried slices were ground in a cutting mill into powder form. The ground potato powder was packed in polyethylene bags.

**Physiochemical Analysis:** Fresh potatoes and potato powder were analyzed for moisture, protein, fat, carbohydrate, crude fiber and total ash using standard procedures [6].

**Microbiological Analysis:** Potato powder prepared was analyzed microbiologically for Total Plate Count, Coli MPN, Fecal Coli MPN, Yeast & Mould, Salmonella and *E. coli* (FAO 1992) [7].

**Storage Life Studies:** Potato powder was packed in glass bottles and kept at two temperature 25°C and 37°C. Two samples from each lot were examined at monthly intervals for moisture and protein content, up to a period of 08 months.

**Water Absorption Capacity:** The water absorption capacity of the potato powder was evaluated by taking 5 g samples in a centrifuge tube. Add 50 ml distilled water and the resulted slurry was allowed to stand for one hour before centrifugation at 1700 X g for 20 minutes. The supernatant was decanted and the amount of water in grams gained by a 100 g sample was determined.

**Gelatinization Temperature Range:** The temperature at which the potato flours became gelatinized was measured by placing 2-g sample in a wide mouthed test tube. Slurry of 10 % concentration was prepared by adding distilled water and mixing thoroughly. The slurry was then heated in a boiling water bath with continuous monitoring of temperature. The temperature at which the slurry started to loss birefringence (i.e.) appearance of transparency was recorded. Similarly, the temperature at which the maximum transparency appeared was reported as the gelatinization temperature range.

## RESULT AND DISCUSSION

Preliminary studies were undertaken to prepare potato powder. Desiree and Sardinal variety was used and potato powder off white colour was prepared. Physiochemical analysis of fresh potato and the product was presented in Table-1. It was observed that fresh Desirre variety contains moisture 77.0 %, protein 2.0 %, fat 0.1 %, carbohydrate 19.44 %, Fiber 19.4 % and ash 1.0 % while potato powder contain moisture 8.5 %, protein 8.2 %, fat 0.7 %, carbohydrate 76.0 %, fiber 3.1% and ash 4.1 %. The Cardinal fresh cultivar contains74.5 %, protein 2.5 %, fat 0.2 %, carbohydrate 22.0 %, Fiber 0.25 % and

Table 1: Chemical analysis of fresh potatoes and potatoes powder

| | Potato Cultivar | | | |
|---|---|---|---|---|
| | Desiree | | Cardinal | |
| Parameters | Fresh Potato | Potato powder | Fresh Potato | Potato powder |
| Moisture% | 77.00 | 8.50 | 74.5 | 6.04 |
| Protein% | 2.00 | 8.20 | 2.5 | 7.0 |
| Fat% | 0.1 | 0.7 | 0.2 | 0.46 |
| Carbohydrate% | 19.4 | 76.0 | 22 | 78 |
| Fiber% | 0.6 | 3.1 | 0.25 | 3.5 |
| Ash% | 1.0 | 4.1 | 0.6 | 5.0 |

Table 2: Microbiological analysis of potatoes powder

| Tests Parameters | Potato Cultivar Variety | |
|---|---|---|
| | Desiree | Cardinal |
| Total Plate Count (**CFU/g) | 5000 | 6500 |
| Total coliform Bacteria ***MPN/ml | <3 | <3 |
| Total Fecal coliform Bacteria MPN/ml | <3 | <3 |
| *Escherichia Coli* | Nil | Nil |
| Salmonella | Nil | Nil |
| Yeast and Mould | <10 | <10 |

**CFU= Colony Forming Unit, ***MPN= Most Probable Number.

Table 3: Storage Life Studies of potato powder

| | Desiree (37 ° C) | | Cardinal (37 ° C) | | Desiree (25 ° C) | | Cardinal (25 ° C) | |
|---|---|---|---|---|---|---|---|---|
| Storage Time (month) | Moisture | Protein | Moisture | Protein | Moisture | Protein | Moisture | Protein |
| 0 | 8.50 | 8.20 | 6.04 | 7.0 | 8.50 | 8.20 | 6.04 | 7.0 |
| 1 | 8.59 | 8.10 | 6.2 | 7.0 | 8.50 | 8.20 | 6.20 | 7.0 |
| 2 | 8.62 | 8.00 | 6.20 | 6.8 | 8.51 | 8.20 | 6.25 | 6.88 |
| 3 | 8.70 | 8.00 | 6.80 | 6.8 | 8.53 | 8.19 | 6.27 | 6.78 |
| 4 | 8.79 | 8.00 | 6.80 | 6.8 | 8.53 | 8.18 | 6.50 | 6.57 |
| 5 | 8.85 | 8.00 | 7.00 | 6.5 | 8.56 | 8.17 | 6.50 | 6.50 |
| 6 | 9.90 | 7.50 | 7.00 | 6.5 | 8.59 | 8.16 | 6.80 | 6.50 |
| 7 | 11.40 | 7.41 | 7.1 | 6.5 | 8.82 | 8.00 | 7.10 | 6.42 |
| 8 | 13.60 | 6.21 | 7.1 | 6.5 | 9.81 | 7.9 | 7.10 | 6.42 |

Table 4: Functional Property of Potato flour

| Sample | Particle size | Water absorption g/100g | GTR (° C) | Color |
|---|---|---|---|---|
| Desiree | Fine | 380 | 61 | Off-white |
| Cardinal | Fine | 378 | 63 | Off- White |

ash 0.6 % while potato powder contain moisture 6.04%, protein 7.0%, fat 0.46%, carbohydrate 78%, fiber 3.5% and ash 5.0 %.

The product was analyzed microbiologically for Total Plate Count, total Coliform bacteria, Fecal Coliform bacteria, Salmonella, *Escherichia coli*, Yeast and Mould. The overall microbiological results of the product were observed to be satisfactory. Total bacterial count of product was 5000 cfu/g, while coli MPN, Fecal Coli MPN were less than 3 which mean there are no coliform bacteria in the product prepared. Salmonella and *Escherichia coli* were also found to be absent in the final product. Low total count indicates that suitable sanitary conditions were maintained throughout the process. Yeast and mould were also found to be less than 10 cfu/g (Table 2). The bacteriological standards of coliform, 10/gram, *Escherichia coli*, negative, standards plate count, 10,000/gram and negative for salmonella [8]. Storage life studies of the potato powder prepared was also carried out (Table 3). It was observed that Desiree cultivar powder moisture content increased from 0.09 to 1.4 % after 06 months storage while the protein content decreased from 0.04 to 0.4 which indicate that rate of absorption of water was insignificant at 06 months storage time. After 06 months the moisture content was increased and the protein content was decreased. The study of Pinto *et al*. [9] showed the protein content of stored potato tubers evaluated and concluded that at 8°C and 20°C the protein content was greater than at 1°C and tuber reconditioning at 20°C increased the protein level. Average protein values from harvest to the end of six months of storage at 1°C and 8°C showed no significance decrease. It was evaluated that potato powder was acceptable up to the one year storage period. The Cardinal variety powder after one year storage it starts to deteriorate water absorption, particle size, gelatinization temperature range and color of the potato powder [Table 4]. Water absorption of the prepared powder was 380 g/100g. Water absorption is important in the preparation of potato mash, snack foods, extruded products and bakery products, water absorption depend on particle size. Fine particle size was associated with higher water absorption than coarse particle size regardless of variety. The temperature range for gelatinized of potato powder was 61. The colour of the powder was off white. The effect of colour on the

acceptability of the potato powder based product depends on the product itself and on the consumer preference.

## CONCLUSION

The above mentioned lines were high content of protein and carbohydrate values. Farmers can get utmost return by growing such genotypes that will eventually get better their socio economic situation. Furthermore, it will assist in business and growth of processing trade by providing raw substance. This study also proposed that these two varieties may be measured as candidate cultivars for future commercial production.

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**Conflicts of Interest:** The authors declare that they have no competing interests.

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