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Development and storage study of instant potato custard

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Abstract
Potato are considered a functionally food with significant health-promoting properties, even as by product i.e. potato starch and grid could be utilized for the product development. The study therefore was conducted to develop instant products from potato starch and grid. The freshly harvested potatoes were taken and washed under running water. and after cleanly peeled using mechanical potato peeler. After washing the potatoes are dipped as per standard method in solution of 0.5% ascorbic acid and 2% salt to prevent them from browning. Potatoes are then converted into chips and blanching was done for 2 minutes. After blanching the potatoes are grinding in mechanical mixer and made into slurry. The slurry was then treated with different solution. The slurry was sieved with muslin clothes. The residue was washed and dried in the mechanical dehydrator. The excellent quality dried product which could further be utilized for the preparation of instant potato custard mix. It was also found that prepared instant potato custard mix could be successfully stored at ambient and refrigerated temperature for the period of 6 months without significant changes in physicochemical quality profile.

Keywords: Potato starch, grid, use of turmeric for colour

Introduction
Potato (*Solanum tuberosum* L.) is the starchy, tuberous crop belongs to the family Solanaceae. It is one of the wide grown and consumed crop worlds. Potatoes are served for either table consumption or as processed products. In addition to being a source of carbohydrates, potatoes also contain high content of protein, vitamin C, fiber, minerals and have a low fat content (Navarre *et al*., 2009) [1]. It also plays multiple and important roles in local food systems and for food security. As it represent an important source of energy, with a high delivery of energy per unit land, water and time and are a valuable source of the diet (Anderson *et al*., 2010) [2].
Potato production has significantly increased in recent years in India, making it the second largest potato producing country in the world (Yadav *et al*., 2006) [3]. Increased potato production with inadequate storage facilities have resulted in frequent gluts in the market leading to wastage of this nutritious crop (Marahwa *et al*., 1997) [4]. Potatoes can be processed into dehydrated flour which has a longer shelf life than fresh tubers. Dehydrated potato flour is a highly versatile and inexpensive raw material that can be added as an ingredient to a variety of products such as bakery products, extruded products and soup mixes (Singh *et al*., 2005) [5]. Processing of potato into value added product such as flour would not only reduce post-harvest loss but also generate income to produces (Kulkarni *et al*., 1997) [6]. The requirement of people for high quality, ready-to-eat foods of traditional nature with modem technological application has become a necessity; both from the economy point of view and to reduce the losses of seasonal agricultural produce. Preservation of traditional food either in ready-to-eat form or by canning of the products has achieved considerable success (Ghosh *et al*., 2001) [8].

Materials and Methods
Procurement of raw Materials
The ingredients and raw materials like Malta fruit, honey, preservatives and 500 mL bottles were procured from local market to Pauri Garhwal Uttarakhand. This research project was conducted in the Department of Food Science and Technology, College of Horticulture, VCSGUUHF, Bharsar (Pauri Garhwal).

Physicochemical characteristics

Total soluble solids (°B)

TSS was determined with the help of hand refractometer of range 0-32°B, (Model ERMA).

Titratable acidity (%)

Titratable acidity was estimated by titrating a known volume of the sample against standard 0.1 N NaOH solution using phenolphthalein as an indicator up to the end point (pink colour). The titratable acidity was expressed as per cent citric acid (AOAC, 2004).

Ascorbic acid (mg/100mL)

Ascorbic acid content was determined as per AOAC (2004) method using 2, 6- dichlorophenol indophenol dye. A known volume of the sample extracted in 3% meta phosphoric acid was titrated with dye to pink colour as end point.

Sugars (%)

Reducing sugars and Total sugars were determined by Lane and Eynon method.

Determination of pH

Measurement of pH indicates the acidity/alkalinity in the food sample. The glass electrode pH meter is widely used. Ten grams of the sample was weighed and 40 ml of distilled water was added to the sample. Transfer it to 100 ml volumetric flask and make up to 100 ml with distilled water. pH was determined by dipping the electrode into the solution and allows stabilizing. The pH reading was recorded. (C.Prakash et al 2018) [9]

3.5- Moisture Content

Moisture content (%) of the bread was determined gravimetrically by the standard procedures of AOAC [7]. Five grams of sample (denoted as W) were taken in a pre-weighed in a petri plate (W1) that was placed in a hot air oven (model NSW 144) maintained at 105 oC until a constant weight for the sample was achieved. The sample was removed from the oven, cooled in a desiccator and weighed (W2), and the moisture content (%) was calculated by the following formula (C.Prakash *et al*. 2018) [9]

$$Moisture\ \% = \frac{W1 - W2}{W} X100$$

3.6-Crude Protein

Crude protein was determined by Kjeldhal's method [8]. A known amount (700 g) of sample was placed in Kjeldhal's digestion tube and added with 5 g K2SO4, 0.5 g CuSO4 and25 ml concentrated sulphuric acid. The sample was digested for 1 hr followed by the addition of 20 ml of deionized water and allowing it to cool. After adding 25 ml NaOH (40%), the sample was then distilled and the ammonia liberated was collected in boric acid and titrated with 0.1N hydrochloric acid. A blank was prepared without any sample and treated in the same manner. Protein content in terms of percentage was calculated by the following formula

$$Crude\ protein\ \% = \frac{(sample\ titre - blank\ titre) x 14 x 6.25}{sample\ weight} X100$$

*molecular weight of nitrogen; #nitrogen factor for plant foods (C.Prakash et al. 2018) [9]

Sensory evaluations

Sensory evaluation of malta juice products were conducted before storage on the basis of colour, flavour, mouth feel and overall acceptability on a 9 point hedonic scale (Appendix-I) according to the method of Amerine *et al.* (1965) [7].

Taste panel (7-9 members at a time) comprised of faculty members and PG students of department of Food Science and Technology, VCSG College of Horticulture Bharsar (Pauri Garhwal), Efforts were made to keep the same panel for sensory analysis throughout the entire period of study. Plain water was provided to the panelists for mouth rinsing in between the sensory evaluation.

Result and Discussion

Table 1: Physico-chemical characteristics of fresh potato

Parameter	Mean ± S.D.
Physical parameters	
Weight(g)	49.4±0.08
Length (cm)	3.88±0.17
Width (cm)	46.66±0.02
T.S.S (°B)	0.30±0.46
pH	7.33±0.06
Bio-chemical parameters	
Titratabe acidity (%)	0.52±0.13
Antioxidant parameters	
Total phenols (mg/100g)	0.92±0.19
Ascorbic acids (mg/100g)	1.86±1.22

Physical characteristics pertaining the potato had an average fruit length and width of 5.48±0.60 cm, 3.88± 0.17cm, respectively. The average volume of the potato fruits was observed to be 46.66±0.02 cm^3 and weight of potatoes was 49.40 ±0.08 g. pH was recorded in the range of 7.33±0.06. Chemical properties of potatoes showed that fruit contained an average titratable acidity (as citric acid) served to be 0.52±0.13 %. Antioxidant properties viz. ascorbic acids and total phenols showed that average ascorbic acid 1.86±1.22 mg/100g. The total phenols content on fresh potato was recorded to be 0.92±0.1 9 mg/100g.

Physico-chemical properties of instant potato custard

Total Soluble Solids (°B)

There was a significant decrease in TSS was observed in all treatments with increasing the storage periods up to six months, the maximum increase in TSS was recorded at two month storage in ambient condition than refrigerated condition.

Table 2: Effect of different treatments, storage durations and storage conditions on total soluble solids (°B) instant potato custard mix

Storage conditions (S)	Storage intervals (I)			Mean
	2 Months	4 Months	6 Months	
Ambient	34.86	34.03	33.76	34.21
Refrigerated	35.01	34.86	34.42	34.76
Mean	34.93	34.44	34.09	
$CD_{0.05}$				
	I	0.29		
	S	0.23		
	I×S	0.41		

Titratable acidity (%)

Table 3: Effect of storage duration and condition on titratable acidity (%) of instant potato custard mix

Storage conditions (S)	Storage intervals (I)			Mean
	2 Months	4 Months	6 Months	
Ambient	0.91	0.87	0.83	0.87
Refrigerated	0.93	0.90	0.88	0.90
Mean	0.92	0.88	0.85	
$CD_{0.05}$				
	I	0.011		
	S	0.009		
	I×S	0.015		

The data on titratable acidity of the instant potato custard during storage duration and storage conditions has been presented in the table 4.6. Under ambient storage the significantly decrease in titratable acidity in instant potato custard from 0.91 % to 0.83% was recorded. While the similar but slight decreasing trend was observed under refrigerated conditions and the decrease is from 0.91% to 0.83% with advancement of storage period up to six months. In overall, the values were higher at two month refrigerated condition and lowest at six months ambient condition.

Ascorbic acid (mg/100g)

The effect of storage duration and conditions on ascorbic acid is presented in Table 4.7. The data depicted in table showed that there was decrease in ascorbic acid with advancement of storage duration, irrespective of storage conditions. The minimum value of ascorbic acid was observed 2.9 (mg/100g) at six month of storage under ambient conditions and the maximum value obtained 3.9 (mg/100g) at two month of storage under refrigerated conditions. The decrease in ascorbic acid content was higher under ambient conditions compared to refrigerated conditions.

Table 4: Effect of storage duration and condition on ascorbic acid (mg/100g) of instant potato custard mix

Storage conditions (S)	Storage intervals (I)			Mean
	2 Months	4 Months	6 Months	
Ambient	3.6	3.2	2.9	3.2
Refrigerated	3.9	3.6	3.2	3.6
Mean	3.7	3.4	3.0	
$CD_{0.05}$				
	I	0.15		
	S	0.12		
	I×S	0.21		

Sugars (%)

Reducing sugars (%)

There was a decreasing trend in reducing sugars content of all treatments throughout the storage intervals, however the maximum reducing sugars was recorded 9.6% of two months storage under refrigerated condition minimum reducing sugars was recorded 8.1% six months ambient condition..

Table 5: Effect of different treatments, storage durations and storage conditions on reducing sugars (%) of instant potato custard

Storage conditions	Storage intervals			Mean
	2 Months	4 Months	6 Months	
Ambient	9.4	8.5	8.1	8.6
Refrigerated	9.6	8.7	8.3	8.8
Mean	9.5	8.6	8.2	
$CD_{0.05}$				
	I	0.09		
	S	0.07		
	I×S	0.13		

Total Sugars (%)

The total sugar decreased with the increased in storage durations as evident from data. The data reveals that the total sugars content maximum in 30.61% at two months refrigerated condition 30.19% which was followed by four months refrigerated condition. While, the minimum 28.38% total sugar was at six month ambient storage conditions. In overall with advancement of storage period the decline in total sugars was higher under ambient condition than refrigerated conditions.

Table 6: Effect of different treatments, storage durations and storage conditions on total sugars (%) of honey enriched malta sweetened juice

Storage conditions (S)	Storage intervals (I)			Mean
	2 Months	4 Months	6 Months	
Ambient	30.16	29.05	28.38	29.19
Refrigerated	30.61	30.19	29.76	30.18
Mean	30.38	29.62	29.07	
$CD_{0.05}$				
	I	0.55		
	S	0.45		
	I×S	0.78		

Moisture content (%)

The data on moisture content of the potato custard mix was significantly higher increase moisture content in storage duration. The maximum moisture content recorded at refrigerated condition during six months whereas the minimum moisture content was recorded at ambient temperature during two months storage.

Table 7: Effect of storage duration and condition in moisture content (%) of instant potato custard mix protein content

Storage conditions (S)	Storage intervals (I)			Mean
	2 Months	4 Months	6 Months	
Ambient	4.1	4.5	4.9	4.5
Refrigerated	4.3	4.7	5.0	4.7
Mean	4.2	4.6	4.9	
$CD_{0.05}$				
	I	0.09		
	S	0.07		
	I×S	0.13		

Table 8: Effect of storage duration and condition in protein (g) content of instant potato custard mix

Storage conditions (S)	2 Months	4 Months	6 Months	Mean
Ambient	1.9	1.4	1.0	1.4
Refrigerated	2.1	1.6	1.1	1.6
Mean	2.0	1.5	1.0	
$CD_{0.05}$				
	I	0.127		
	S	0.104		
	IXS	NS		

The data on protein content of the potato custard mix was significantly higher decrease protein content in storage duration. The maximum protein content was recorded at refrigerated condition during six months whereas the minimum protein content was recorded at ambient temperature during two months storage. There interaction was stastically non- significant.

Effect of different treatments, storage duration and condition on sensory parameters of instant potato custard mix

The sensory evaluation of instant potato custard mix graphically represented in fig 1. The sensory evaluation for colour, flavour, taste and overall acceptability of instant potato custard mix reveals that highest mean were after two, four and six months of storage, among different treatments, the sensory scores.

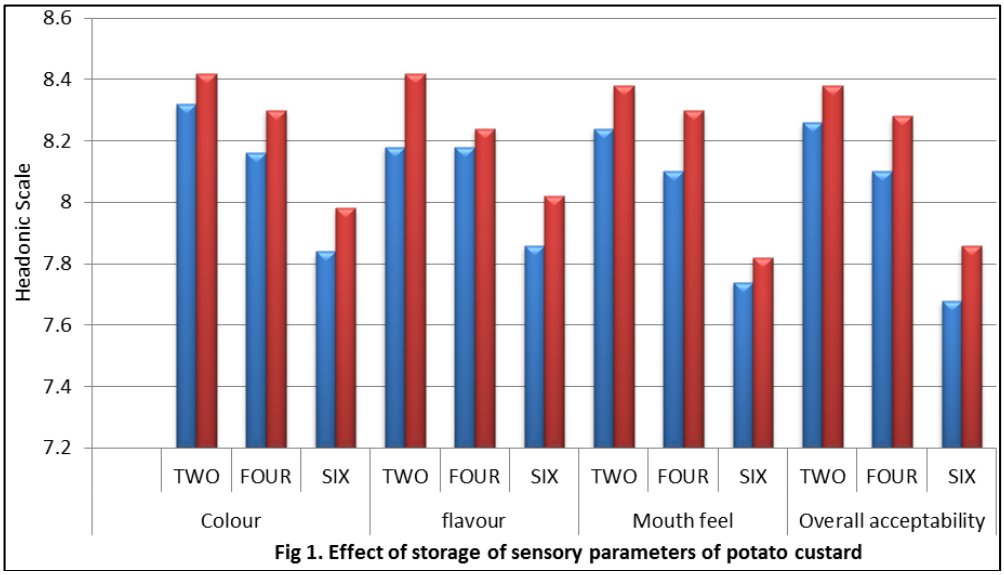

Fig 1: Effect of different treatments, storage durations and conditions on sensory parameters of instant potato custard mix

Conclusion

The challenge for future researchers is to understand the consumer's preferences of

Potato including its products and work in this direction. Popularizing potato in form of RTE snacks or health mixes can be further worked on. These convenience foods can be marketed and taken up for commercialization to make them reach more people and become more popular and also give economic and health benefits to people.

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