

RESEARCH PAPER

DOI: 10.15740/HAS/IJPPHT/6.1/109-113

Preparation and evaluation of biscuit supplemented with potato flour

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■ **Research chronicle** : Received : 31.12.2014; Revised : 11.05.2015; Accepted : 26.05.2015

SUMMARY :

Preparation and evaluation of biscuit supplemented with potato flour was carried out with the objectives to formulate biscuit using potato flour in different proportions and to evaluate the sensory and physical characteristics of biscuits. Biscuits were prepared with partial replacement of wheat flour by potato flour at 10 per cent, 20 per cent, and 30 per cent supplemented with wheat flour. Physical characteristics of biscuit were done. Results of physical analysis showed that the weight, diameter, density spread factor of biscuits were decreased significantly with the increasing level of potato flour replacement up to 30 per cent biscuit. Thickness of biscuit increased slightly with the increasing level of potato flour replacement upto 20 per cent. On the other hand diameter of biscuits and spread ratio are decreased as substitution level of potato flour increased in the baked samples and this may be due to the higher water holding capacity of potato flour. Moisture content of biscuits decreased with increasing the incorporation level of potato flour. Sensory evaluations of biscuit samples were evaluated. Sensory evaluation revealed that 10 per cent potato flour incorporation with wheat flour was found to be the most acceptable combination in biscuit making with respect to organoleptic qualities of biscuits.

KEY WORDS : Potato flour, Biscuit, Physical characteristics, Sensory evaluation

How to cite this paper : Sonone, Vidya S., Powar, Dilip A. and Surpam, Tukesh B. (2015). Preparation and evaluation of biscuit supplemented with potato flour. *Internat. J. Proc. & Post Harvest Technol.*, **6** (1) : 109-113.

Bakery industry is the one of the largest food industries in India. The biscuit industry has been growing at an average rate of 15 per cent during the past three years and this is expected to be maintained in coming years. A biscuit is major product accounting

for 80 per cent of the total bakery products in India. The contributing factor about this is urbanization resulting in increased demand for ready to eat convenient product like biscuits. Among convenience foods biscuits are very convenient and inexpensive but have only about 6 to 7

per cent protein (Agarwal, 1990). Its popularity is due to availability of varieties of products having different taste and texture profiles at reasonable cost with longer shelf-life. Now days there are an ever-growing demand for high protein biscuit.

Potato (*Solanum tuberosum* L.) popularly known as 'The king of vegetables', has emerged as fourth most important food crop in India after rice, wheat and maize. Indian vegetable basket is incomplete without potato. Because, the dry matter, edible energy and edible protein content of potato makes it nutritionally superior vegetable as well as staple food not only in our country but also throughout the world. Among several processed products, potato flour is the oldest commercial potato product, which can be stored safely and incorporated into various recipes. Potato flour has diversified uses in the home as well as in the food industry, especially, in the baking industry in preparation of bread and biscuits. Potato flour with negligible fat content, high dietary fibre, high vitamins, a good amount of minerals and 6-12 per cent protein content (Gahlawat and Sehgal, 1998) can be substituted for wheat flour in the preparation of biscuits. This also helps in lowering the gluten level and prevent from Coeliac disease (Tilman *et al.*, 2003). Addition of potato flour also enhances the sensory characteristics of biscuits and industries also find it economical to use in biscuit manufacture. Potato flour can be prepared by drying the peeled slices in a hot air drier or by drying the cooked mash with a drum drier into flakes followed by grinding and sieving (Yadav *et al.*, 2006). Hence, potato may prove to be a useful tool to achieve the nutritional security of the nation. Keeping all these facts in view, the present project work was planned with the objectives- to formulate biscuits using potato flour in different proportions, to evaluate the physical and sensory quality characteristics of biscuits.

EXPERIMENTAL METHODS

The present study was conducted in the Department of Agricultural Process Engineering, Dr. Ulhas Patil College of Agricultural Engineering and Technology, Jalgaon, Maharashtra, India. Raw materials such as potatoes and wheat required for conducting the experiment was procured from local market of Jalgaon.

Preparation of potato flour :

Uniform sized potatoes having no signs of infection or infestation were thoroughly washed in running tap water to remove any adhering soil, dirt and dust. Then the tubers were dipped in 3 per cent salt solution for 30 minutes. After draining the water the tubers were surface dried at room temperature (30-32°C) and their weight was taken using an electronic balance. Then the potatoes were sliced into thin slices of 2-3 mm thickness and steam blanched for five minutes. The blanched potatoes were dried in a cabinet drier at 50°C for two hours and at 60°C for six hours. After complete drying, the slices were milled, passed through 80 mesh sieve to obtain fine flour of uniform size. After measuring the final weight the flour was packed in airtight plastic containers until further use (Misra and Kulshrestha, 2003).

Preparation of potato biscuits :

Potato flour was incorporated in the traditional recipe to replace refined wheat flour at levels of 10, 20 and 30 per cent in preparation of biscuits as per method given by (Whitley, 1970). The raw ingredients such as wheat flour, potato flour with different concentration was mixed by adding salt and baking powder as shown Table 1. Biscuits were produced by cutting it into uniform size and baking at a temperature of 220°C for 15 min. The biscuits were allowed to cool for 30 minutes and stored in airtight plastic container before further analysis.

Evaluation of physical characteristics of biscuits :

The moisture content of potato flour, wheat flour and prepared biscuit supplemented with potato flour were determined by method given in (AOAC, 2000).

The (AACC, 1995) method was used to determine biscuits diameter, thickness and spread factor. Biscuits diameter was measured by placing 6 biscuits edge-to-edge to get the average diameter in millimeters. Biscuit thickness was measured by stacking 6 biscuits on top of each other and gets the average thickness. Diameter divided by thickness gave the spread factor. Bulk density (g/cm^3) was determined as described by (Singh *et al.*, 2003).

Sensory evaluation :

Sensory characteristics of biscuits were evaluated for the different sensory attributes by a panel of ten judges in the Dr. Ulhas Patil College of Agricultural

Engineering and Technology Jalgaon. The nine point hedonic scale was used for evaluation for assigning the numerical values for different quality attributes of biscuits *viz.*, appearance and colour, flavour, texture, taste and overall acceptability. In the 9 point hedonic scale 9 represents 'extremely like' and 1 represents 'extremely dislike'. Sensory attributes like appearance, colour, flavour, texture, taste and overall acceptability, were assessed using nine point hedonic scale (Amerine *et al.*, 1965).

EXPERIMENTAL FINDINGS AND ANALYSIS

The findings of the present study as well as relevant discussion have been presented under following heads :

Preparation of potato flour :

Potato flour prepared by the cabinet drier method after steam blanching produce good quality flour and can be used as partial replacements for wheat flour in preparation of various bakery products. According to (Khaliduzzaman *et al.*, 2010) potato flour prepared by blanching the potato slices in water at 90°C for 08 minutes and cooled quickly in cool water gave better quality flour when compared to other treatments. Nazni and Pradeepa (2010) developed good quality potato flour by following some pretreatments like immersing the potato slices in 0.05 per cent ascorbic acid solution and 0.2 per cent KMS solution before blanching. This potato flour was used in the preparation of biscuits as a partial replacement for wheat flour (Nazni and Pradeepa, 2010 and Khaliduzzaman *et al.*, 2010).

Preparation of biscuit :

Samples of a standard biscuit (with no substitution) and biscuit with 10 per cent, 20 per cent and 30 per cent potato flour replaced by the wheat flour were produced following steps of creaming, mixing, kneading, cutting, baking and cooling. Composite flour, salt and baking powder were added to the creamed mixture and dough was prepared by proper kneading with hands. When dough was ready, it was kept for 5-7 min. as it is and then used for sheeting. Sheets were made by rolling balls of dough on wooden platform. These sheets were cut by hand operated metal dye. Then these were kept for baking. The biscuits were baked at 220°C for 13-15 minutes in the oven. Then they were cooled at room temperature for few minutes.

Evaluation of physical characteristics of biscuits :

The Table 2 shows the weight, diameter, bulk density and spread factor of biscuit were decreased significantly with the increase of potato flour replacement up to 30 per cent. But the volume of biscuit increased significantly and thickness of biscuit increases slightly as substitution level of potato flour increased. According to (Khaliduzzaman *et al.*, 2010) thickness of biscuit increased slightly with the increasing level of potato flour replacement up to 25 per cent. On the other hand diameter of biscuits and spread ratio are decreased as substitution level of potato flour increased in the baked samples and this may be due to the higher water holding capacity of potato flour. Singh *et al.* (2003) reported higher extensibility of dough made by the addition of potato flours from different Indian potato cultivars. The differences in

Table 1 : Basic formula for preparation of biscuit

Ingredients (g)	Standard biscuits T ₁	Biscuit T ₂	Biscuit T ₃	Biscuit T ₄
Wheat flour	100	90	80	70
Potato flour	-	10	20	30
Sugar	50	50	50	50
Salt	0.5	0.5	0.5	0.5
Baking powder	2	2	2	2
Vanilla essence	0.5	0.5	0.5	0.5

Table 2 : Physical properties of biscuits

Treatments	Weight (g)	Volume (cm ³)	Density (g/cm ³)	Width (mm)	Thickness (mm)	Spread ratio
T ₁	14	12.82	1.09	49	6.8	7.2
T ₂	11	14.44	0.76	52	6.8	7.6
T ₃	10	13.20	0.75	49	7.0	7
T ₄	12	15.11	0.79	51	7.4	6.8

spread factors of cookies containing flours of different potato cultivars may be attributed to the differences in swelling patterns and rheological properties.

The weight and density of biscuit decreased with increased in level of potato flour. Minimum value was obtained for sample T₃ (10 g and 0.75 g/cm³). The volume increased with increased in level of potato flour (Fig. 1).

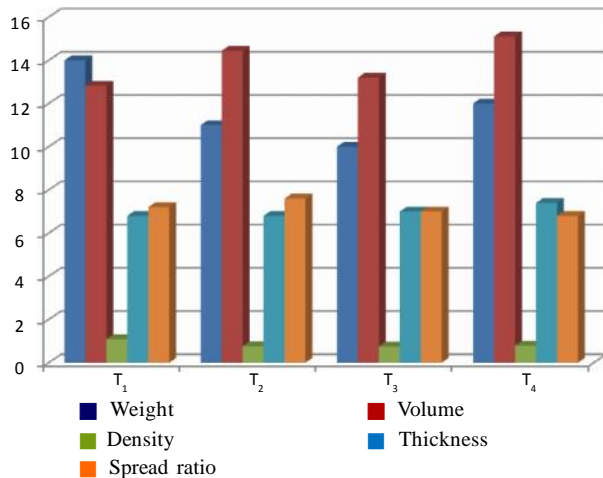


Fig. 1 : Physical properties of biscuits supplemented with potato flour

The thickness of biscuit decreased with increased in level of potato flour. Minimum thickness was obtained for biscuit samples T₁ and T₂ (6.8 mm). The best spread ratio was obtained for biscuit sample T₂ (7.6).

Sensory quality score of potato supplemented biscuit :

The biscuits were prepared by partial replacement of wheat flour by potato flour. Table 3 indicates the score assigned to biscuits by judges in sensory evaluation. Control biscuits (0 % potato flour) had the highest score for all the characteristics; however, scores at 20 per cent potato flour levels was found good that of the control for all the sensory characteristics. But there is a significant drop in acceptable level was observed between 20 per cent and 30 per cent incorporation level for all the sensory

attributes. Scores of the other sensory attributes like flavour, texture and taste also revealed that acceptability level of the respondent was higher for the 20 per cent incorporation level when compared to 10 per cent and 30 per cent level. According to (Khaliduzzaman *et al.*, 2010) biscuits made from five different proportions of composite flour of wheat and potato (0, 15, 20, 25 and 30 % potato flour) revealed that biscuits containing 25 per cent potato flour as a supplement secured the highest score in terms of all sensory attributes among others, though all samples are acceptable. Misra and Kulshrestha (2003) formulated biscuits by incorporating potato flour in 6 different proportions to replace wheat flour at levels of 0, 10, 20, 30, 40 and 50 per cent. Results of the sensory evaluation revealed that until the 20 per cent level, there was no significant difference observed in acceptability of the product and all three levels had similar sensory scores, being judged as good for appearance, taste and colour and fair for flavour, texture and overall acceptability.

The maximum overall acceptability was obtained for the biscuit sample with 10 per cent potato flour T₂ (8.1). Hence, from Table 3 the best result obtained for the biscuit with 10 per cent potato flour T₂. According to a study conducted by (Nazni *et al.*, 2009) potato flour incorporated biscuits have obtained highest scores for overall acceptability when compared to maize and green gram flour incorporated biscuits.

Moisture content of the biscuit :

Moisture content of potato was found to 76 per cent that of potato flour 5.6 per cent (dry basis) whereas, Vasantharuba Seevaratnam *et al.* (2012) found that moisture content of potato flour was 4.9 per cent. The moisture content of biscuit supplemented with potato flour was found to 4.5 per cent in control (T₁), 4.12 per cent (T₂), 3.82 per cent (T₃) and 3.46 per cent (T₄). The moisture content of biscuit was below 4 per cent hence, shelf-life of prepared product was more. The least moisture content was obtained for T₄ (3.65 %) as shown in Fig. 2.

Sample code	Appearance	Flavour	Texture	Taste	Overall acceptability
T ₁	8.0	8.0	8.2	7.9	8.0
T ₂	8.0	7.9	7.9	8.6	8.1
T ₃	7.8	7.9	7.5	8.0	7.8
T ₄	7.8	7.5	7	7.6	7.4
Mean	7.9	7.8	7.6	8	7.8

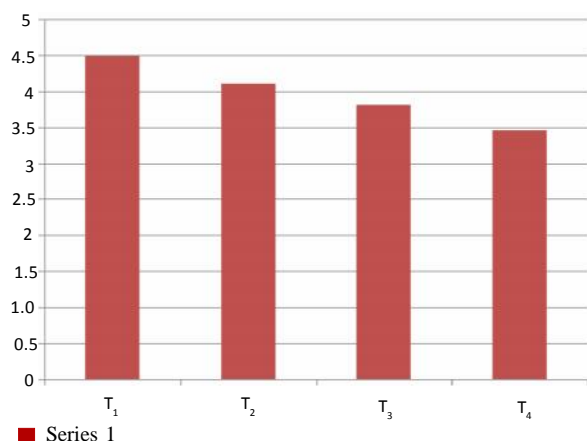


Fig. 2 : Moisture content of biscuit supplemented with potato flour at different concentration

Conclusion :

Biscuits were prepared with partial replacement of wheat flour by potato flour at 10, 20, and 30 per cent levels while other ingredients were kept constant. Results

of physical analysis showed that the weight, diameter, density spread factor of biscuits were decreased significantly with the increasing level of potato flour replacement up to 30 per cent biscuit increased slightly as substitution level of potato flour increased. On the other hand diameter of biscuits and spread ratio are decreased as substitution level of potato flour increased in the baked samples and this may be due to the higher water holding capacity of potato flour. A result of sensory evaluation shows that appearance and colour of biscuit samples was found to be acceptable with increasing the incorporation level of potato flour. Flavour of biscuit samples with 20 and 30 per cent potato flour incorporation were found to be more acceptable as compared to biscuits with 30 per cent potato flour incorporation. 10 per cent potato flour incorporation with wheat flour was found to be the most acceptable combination in biscuit making with respect to organoleptic and physical qualities of biscuits.

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