

Utilization of Banana and Pomogranate Peel Flour in Fortification of Bread

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Abstract--The banana peel reported to have excellent nutritional health benefits against diarrhoea, dysentery, diabetes, cardiac disease, and hypertension, while pomegranate peel was reported to possess antimicrobial activities. The peel powder (60 mesh size) from banana and pomegranate were prepared from their dried peel. Due to their pharmaceutical use an attempt is made to prepare the bread by incorporating the peel powder of each from 5%, 10% and 15%. The bread were prepared by replacing 10%, 15%, 20%, and 30% of wheat flour by incorporating wheat flour with Banana Peel Flour and Pomogranate Peel flour in ratio of 5:5; 10:10; 15:15 and 5:10. The bread prepared was designated as B1, B2, B3 and B4 respectively. They were tested for moisture, ash, protein, fat, crude fibre, ascorbic acid and total polyphenols as per the standard methods. The calorific value of bread was determined by the bomb calorimeter. The Physico-chemical and sensory parameters of these four test bread were compared with a control bread prepared from 100% wheat flour designated as B0. Result showed the bread prepared by replacing 10% of flour by incorporating 5% each of banana and pomegranate peel flour (B1) is found to be sensory acceptable. The B1 bread was analyzed for above mentioned parameter. On comparing B1 bread with B0 bread the protein and fat content is increased from (6.7% to 9.4%) and (6.2% to 10.12%) respectively. Also the calorific value per 100 gm of bread is increased from (183.6 Kcal to 276.1 Kcal). The value of Phenolic and moisture content of B1 bread was found to be (0.201µg/GAE) and (33.74%) which was higher than the B0 bread. Results suggest that B1 bread was rich in antioxidant and stable to staling, owing to higher moisture content (33%) compared with control bread (27%). It is also found that B1 bread contain 10 fold higher dietary fibers than the B0 bread. Study showed that the nutritionally and sensory accepted bread can be prepared by replacing at most 10% of flour.

Keywords: Pomegranate Peel Flour, Banana Peels Fibre, Polyphenolic Compound, and WHC.

I. INTRODUCTION

Banana and pomogranate is an important fruit of many tropical and subtropical regions of India. Banana is cultivated in area near about 830.5 thousand ha and total production is around 29,779.91 thousand tons. Total area under pomogranate cultivation India is 107 thousand ha and production is about 743 thousand ton. ^[1]

Banana especially peels provide excellent nutritional status to contribute various health benefits it comprises diarrhoea, dysentery, intestinal lesion, in ulcerative colitis, diabetes, nephritis, gout, cardiac disease, hypertension ^[2, 3, 4, 5] it is richest source of dietary fibre as well as pectin (9-23%), however, The banana peel is major waste of banana processing industry it contribute near about 40% of fresh banana fruit ^[6]. Pomegranate (*Punica grantum*) is a popular owing to both its functional and nutritional properties can be used as the pharmaceutical agent such as antimicrobial, antiviral, anticancer, potent antioxidant and Antimutagenic activities ^[7, 8]. Diet abundant with Phytochemicals is correlate to the wide variety of disease like cancers, inflammation, cardiovascular and neurodegenerative problems ^[9, 10]. The pomegranate peel having good antioxidant activity as compared to the pulp and seed portion of fruit ^[11]. The noodles prepared from banana peel flour showed lower glycemic index and short digestibility as they having a higher content of resistant starch ^[11, 12]. The release of glucose in blood is lowered by the low glycemic index food as compared to the high glycemic index food, have ability to lower the starch hydrolysis rate. The flour of fruit and vegetable residue gives high fibre, protein minerals and good water holding capacity (WHC) and oil holding capacity (OHC), in this connection it can be the best cost effective and functional ingredient as an ultimate option to wheat flour in bakery product like bread, in order to preparation of new low-calorie products ^[14].

II. MATERIALS AND METHOD

Plant material:

Fresh Banana and pomogranate are obtained from local market of Jalgaon, Maharashtra, India. All other Chemicals used were of analytical grade with highest purity.

Powder Preparation method:

Banana Peel Powder:

The banana fruit was washed and separated into peel. To avoid browning reaction, peels were dipped in 0.5% w/v citric acid solution for 20 min., drained and dried the

banana peel in hot air oven at 60⁰ C for 24 hrs. Dried peels were grinded in mixer and passes through 60 mesh screen to obtain banana peel flour. All dried powder was stored in airtight bottle and kept in cool place for further analysis.

Pomogranate Peel Powder:

The pomogranate fruit was washed and separated into peels. Then the peels are cut into small pieces and dried in hot air oven at 45⁰C for 48 hrs. The dried peels were grind in the laboratory mixer and stored in airtight bottle for further analysis.

Analysis of Nutritional Content:

The proximate composition of banana powder, pomogranate powder and bread were analyzed. Moisture, Ash, Fat, Protein, Total Sugar, and Fibre were determined according to method of ^[15]. Total sugar content was determined by the use of Fehling's reagent method of ^[15].

Water Holding and Oil Holding Capacity:

The 25 ml of distilled water or oil and 1 gm of sample was taken in tubes of 30 ml and allow standing for room temperature for 15 min at ambient temperature. Then the tubes were centrifuged at 4000 x g for 20 min, and then the supernatant was allowed to drain. The residue remains after draining of excess water was weighed and WHC and OHC of sample were determined as gm of water or oil /gm sample ^[16]

Total Polyphenol Content:

Determination of TPC was carried out according to method described by the ^[17].

Sensory Evaluation:

The sensory evaluation of bread carried out by faculty staff and Non-staff members of institute. All samples were provided in plates having white colour at ambient temperature. The samples were evaluated for the overall acceptability colour, taste and crumb firmness. The samples rated on nine –point hedonic scale to find the liking and disliking of sample (9-like extremely, 5- neutral not like or not dislike 1- dislike extremely).

Bread Preparation:

Bread was prepared according to the straight dough method ^[18].

III. RESULTS AND DISCUSSION

Formulation of Bread:

Formulation of bread was carried out according to formulation of HUL, (Modern Food), Mumbai. Recipe used for the brown bread preparation was used.

Table no.1: Formulation of Bread.

	B0	B1 (Gm)	B2 (Gm)	B3 (Gm)	B4 (Gm)
Maida	100	90	80	70	85
Sugar	20	20	20	20	20
Salt	0.600	0.600	0.600	0.600	0.600
Shortening	7.5	7.5	7.5	7.5	7.5
Yeast	2.5	2.5	2.5	2.5	2.5
Water	50ml	60ml	70ml	85ml	75ml
BPP	----	5	10	15	5
PPP	----	5	10	15	10

B0- normal bread/ control bread; B1- Bread substituted with 5 % BPF and 5 % PPF. B2- Bread substituted with 10 % BPF and 10 % PPF.

B3- Bread substituted with 15 % BPF and 15 % PPF. B4- Bread substituted with 5 % BPF and 10 % PPF.

The water required for the bread preparation shows that the as concentration of substitution increase the water required for bread preparation also increases.

Proximate composition of Banana Powder and pomogranate powder:

The BPF having a highest content of ash as compared to the PPF which was higher than the result obtained by ^[19] i.e.8.50. The ascorbic acid content of pomogranate peel was 12.65 % which was higher as compared to banana peel flour as shown in **Table no.2**. The colour of banana peel was slightly darker than the pomogranate peel flour. Total sugar content of banana peel flour was higher than the pomogranate peel flour. Banana peel also having a higher content of fibre (21.51) than the pomogranate peel flour but lower than the result obtained by ^[19] (31.70 %).

Table no.2: Banana and Pomogranate Peel Flour composition

Parameter	Banana peel	Pomogranate peel
Moisture	6.72	5.32
Ash	12.93	3.05
Fat	6.44	10.23
Protein	2.14	4.45
Fibre	21.51	15.14
Total sugar	43.06	32.68
Reducing sugar	10.44	9.07
Non reducing	32.62	23.61
Ascorbic acid mg/100gm	4.21	12.65

WATER HOLDING AND OIL HOLDING CAPACITY:

Table no.3: Water Holding & Oil Holding Capacity

	Water Holding Capacity	Oil Holding capacity
Wheat Flour	1.04	0.8
Banana Flour	3.48	0.9
Pomogranate Flour	2.35	0.9

The WHC of banana peel flour was higher as compared to the wheat and pomogranate flour as the banana having higher fibre content. Result shows that the water required for the bread dough preparations are found to increase from 50 ml to 85 ml as the concentration of banana and pomogranate peel flour increased in bread. The bread shows highest water absorption at the B3 concentration as shown in Table no.1. The water holding capacity of banana flour (3.48 ml/gm) was higher than the wheat and pomogranate flour.

Physiochemical Properties of Bread:

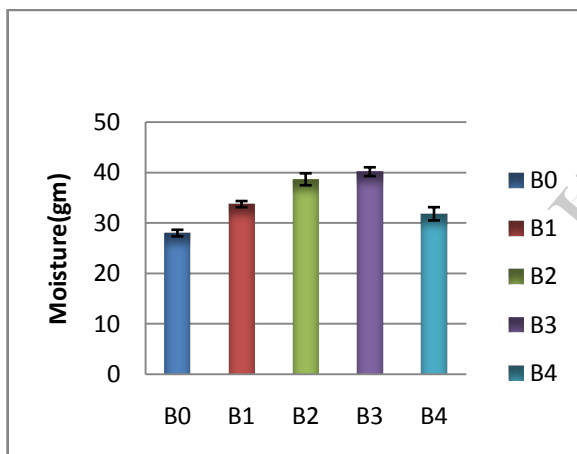


Figure 1 Effect on Moisture Content

The addition of banana peel powder and pomogranate peel powder leads to the increase in moisture content of bread. The B3 bread shows the highest moisture content as compared to control. ^[20] Shows that addition of apple fiber to bread leads to the increase in water absorption of bread as apple fiber was consider as good water binder, so there is increase in moisture content of bread. The results are same as there is increase in water absorption as concentration of banana powder increase in bread as shown in **Table no.1**. The control bread shows the lower moisture content than the other concentration the flour substituted bread. The moisture content of B1 bread was 33.74 % which was increased from 27.99 % in control bread. The same results are obtained by ^[21] that moisture content of soy flour composite bread (28.5 %) was increased (39.5 %) as the level of soy flour increased in bread.

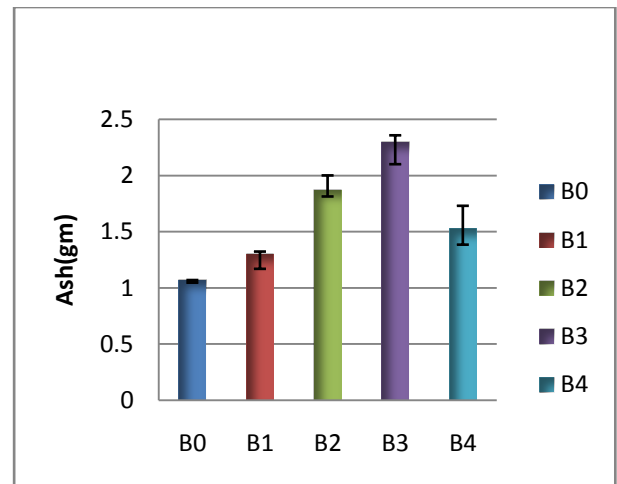


Figure 2 Effect on ash Content

The addition of pomogranate and banana peel flour to bread leads to increase in ash content of bread **Fig no.2**. There is increase in ash (from 1.07 gm to 2.3 gm) content as the increase in level of banana peel flour and pomogranate peel flour. The same result were obtained by ^[21], ash content was increased from (1.82 % to 2.65 %) as the concentration of soy flour increased in bread. The ash content of control sample was lower than B1, B2 and B3 bread. As the ash content of banana peel is 12.93 % and pomogranate peel was 3.05 % according to ^[19] high ash content was analogous to good sources of minerals.

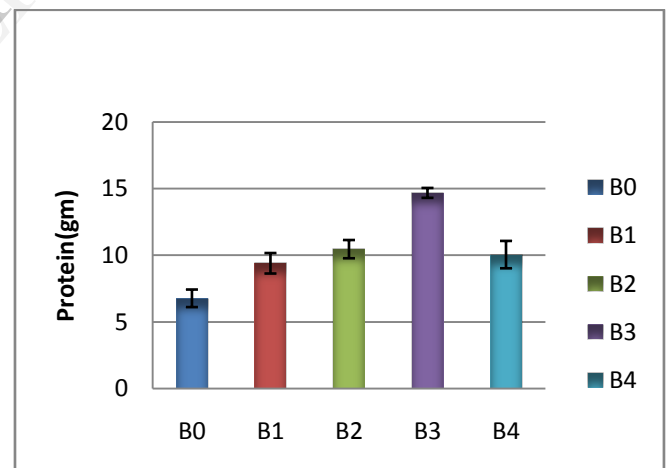


Figure 3 Effects on Protein Content of Bread

The addition of BPF and PPF affect the protein content of bread. The protein content of B1 bread was higher (9.4 %) as compare to the control bread (6.77) (control bread <B1). The same result was obtained by ^[21] that protein content of bread was increased from (8.13% to 12.5 %) as the concentration of soy flour increased in bread.

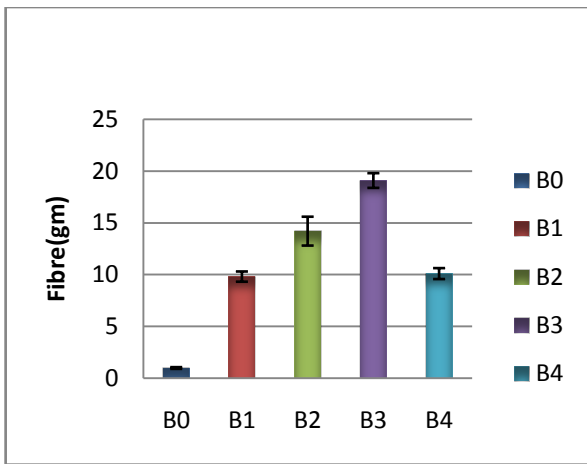


Figure 4 Effect on fibre content of Bread

The fibre content of bread increased with the increase in banana and pomogranate flour. The increase in fibre content leads to an increase in water requirement for the bread preparation (Table 1). Also the moisture content of bread increased with increase in the substitution of banana and pomogranate flour (Fig. 1). Lack of adequate dietary fibre in the diet is associated with constipation, diverticulosis, cardiovascular disease and cancer [22]. Fibre in general may cause firmer crumb structure by a thickening effect on the area that surround the air bubbles in fibre added dough [23]. The fibre content of B1 bread (9.8 gm) which was accepted in sensory evaluation (Fig.9e) which was increased as compared to the control bread (0.97 gm). The same result obtained by [21] shows that the fibre content of bread increased from (3.30% to 5.60%) when concentration of soy flour increased in bread.

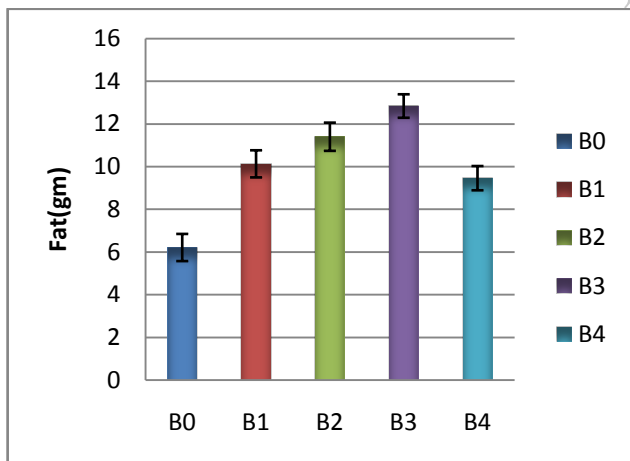


Figure 5 Effect on Fat content of Bread

The addition of banana peel powder and pomogranate peel powder leads to small amount of increase in fat content of bread. The increase in fat content may be due to the externally added fat. The increased fat content of bread leads improved in structure of bread. The fat content of B1 bread was 10.12 gm which was higher than the control bread (6.2). The result so obtained are same with result

obtained by [21] that fat content of bread substituted with soy flour increased from (4.0 % to 6.4 %) as level of soy flour increased in bread.

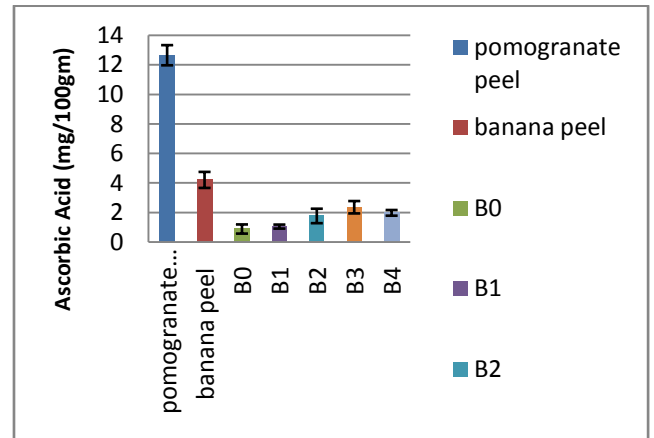


Figure 6 Effect on Ascorbic acid content of Bread

The ascorbic acid content of pomogranate peel was higher than the final product. The ascorbic acid content of bread decreased as the heating of bread was increased. The Vit.C content of B1 substituted bread was 1.05 mg which was higher as compared to the control bread (0.886 mg).

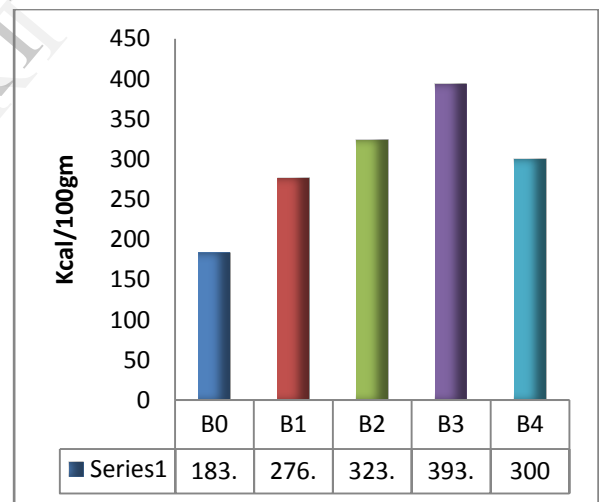


Figure 7 Effect on the calorific value of bread.

The calorific value of bread was increasing as the level of flour substitution was increasing in bread formulation. The increased calorific indicates that the addition of banana and pomogranate flour to the bread affects the nutritional value of bread as compared to the control bread. The protein, carbohydrate and some amount of fat content of flour substituted bread was increased, so there was increase in calorific value of bread. The calorific value of B1 bread was 276.1 Kcal/100 gm which was higher than the control bread (183.6 Kcal/100gm).

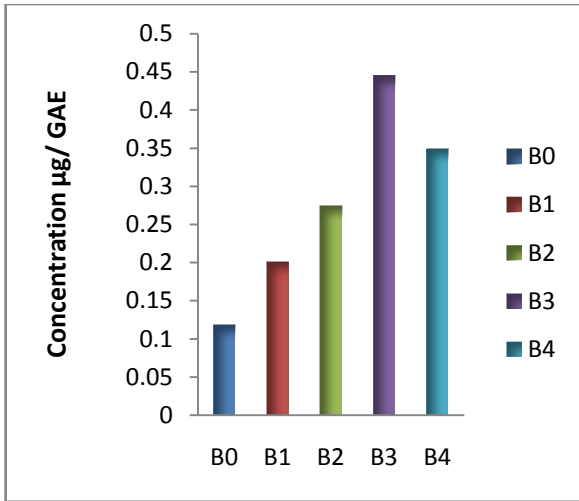


Figure 8 Effect on total phenolic content of Bread

The total phenol content of bread substituted with banana and pomogranate peel flour was higher as compared to the control bread. The heat treatment might induce the changes in extractabilities of the phenolics and flavonoids due to the disruption of the plant cell wall. The phenol content of control bread (0.118µg/GAE) which was lower than the B1 bread (0.201µg/GAE).

Sensory Evaluation of Bread:

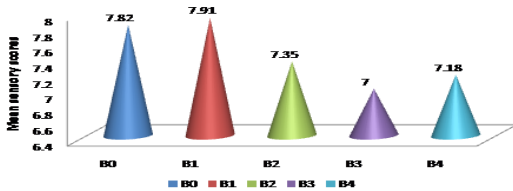


Fig.No.9a: Sensory scores for color

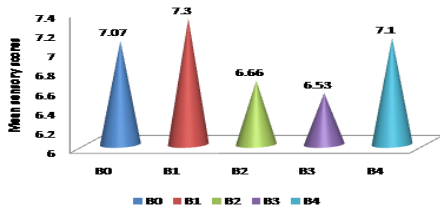


Fig.No9b:Sensory scores for taste

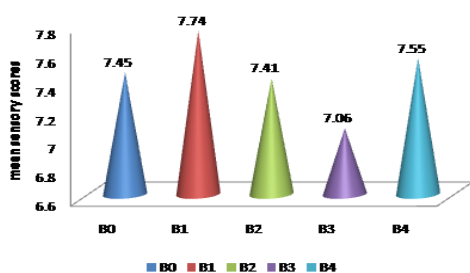


Fig.No.9e:Sesory scores for overall acceptability

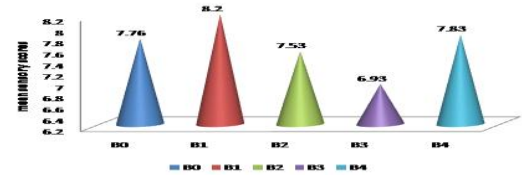


Fig.No9c: Sensory scores for crumb texture

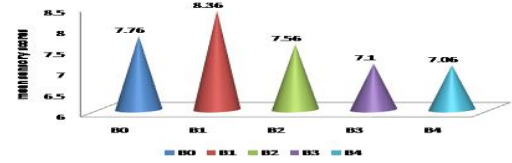


Fig.No.9d: Sensory Scores for Flavour

The sensory evaluation of bread carried out at department shows that B1 bread shows the good in taste (Fig.9 a) as compared to the other bread. As the concentration of peel flour was increased in bread there is slightly increase in bitterness of bread, these results may be due to the increased tannin content of pomogranate peel flour, so the taste evaluation shows lower in sensory scores. The highest mean score was obtained by the B1 bread for taste (7.3). The colour scores for B1 bread were much good as compared to other bread and also control bread (Fig.9b). The crumb texture of B1 bread was good as compared to the other bread (Fig.9c). The increase in fibre content of bread leads to deterioration of gluten structure, so the disturbed gluten structure shows its effect on crumb structure of bread. The addition of fibre shows its effect on firmness of crumb [23]. The flavour of bread was affected if level of flour is increased above the B1 bread. The B1 bread shows highest score for the flavour (Fig. 9d).

IV CONCLUSION

The B1 bread shows the good result for moisture, ash, protein, fat, fibre, calorific value and total phenolic content as compared to control. Also the B1 bread is acceptable on sensory evaluation. Higher dietary fibre content in B1 bread contributes to crumb firmness due to increased water holding capacity. The nutritional better bread can be prepared by the addition of banana and pomogranate peel flour at 5 % level of each.

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